



The Spiritual Genome

Networked Intelligence In DNA

By Bradley York Bartholomew

TIMELINE PUBLISHING INC.,
North Hollywood, CA



Published by
Timeline Publishing Inc.

ALL RIGHTS RESERVED

No part of this book may be reproduced without
written request for authorization. Please forward your request to:

Timeline Publishing Inc., 12439 Magnolia Blvd # 199,
North Hollywood, Ca 91607

To inquire about special discount rates on bulk purchases, please contact
Timeline Publishing Inc., 949-249-3825 or 818-763-7063

info@timelinepublishinginc.com

Timeline Publishing Inc.,
12439 Magnolia Blvd. Suite 199
North Hollywood, Ca 91607

Email: [**info@timelinepublishing.com**](mailto:info@timelinepublishing.com)

Website: [**spiritualgenome.com**](http://spiritualgenome.com)

ISBN 978-0-9913457-2-4

Library of Congress Control Number:
2014931773

Contents

Introduction	4
Chapter One – Networked Intelligence and Morphogenic Resonance	8
Chapter Two – Past Lives	47
Chapter Three – Memristors in the DNA	66
Chapter Four – DNA as a Quantum Computer	81
Chapter Five - Biophotons	94
Chapter Six – Inner Self Located	120
Chapter Seven – The Five Senses	134
Chapter Eight – The Meaning of Maya	149
Chapter Nine – Is the Universe Real?	160
Chapter Ten – Are we living in a computer simulation?	177
Chapter Eleven – Bishop Berkeley and Networked Intelligence	221
Chapter Twelve – The Web of the Spider and Networked Intelligence	231
Chapter Thirteen – <i>VALIS</i> and Networked Intelligence	242
Chapter Fourteen – East meets West	252
Notes	27

Introduction

To prepare the reader for what he/she will encounter in this book, I have decided simply to relate how the 'discoveries' herein contained where introduced to me. For the fact is this book has come together in increments over a period of almost thirty years. It really started in the mid-1980s when I had a day job as a lawyer and I was trying to write a novel in my spare time. I forget the plot of the novel, I don't think I even finished it, but the story called for a protagonist who had knowledge of psychology. So I had to do some research into this vast area of study. Where better to start than Sigmund Freud, I thought, so I went to the public library in my hometown of Sydney, and I came across the complete works of Sigmund Freud in twenty-three volumes. I recall I estimated this opus at about 3 million words. So I started reading from page 1 of Volume 1 and in next to no time I had read through his complete works twice from beginning to end. I was hooked. My career as a novelist was ended.

I had been practicing hatha yoga since my early twenties, but I had never had any contact with the spiritual side of Hinduism. Around the same time that I got hooked on Sigmund Freud, a girlfriend at the time introduced me to a Hindu sect that had an ashram in Sydney. I started going to regular chanting sessions at this ashram, and at some point I experienced an epiphany. It became very clear to me that Freud's unconscious mind and the Hindu inner self were one and the same. I then experienced a compulsion to start researching neuroscience in an effort to locate the inner self in the brain. My inspiration for this research was the conviction that the inner self must be the embryo brain region. After all, every species has an embryo brain region, and given the fact that every living creature has an unconscious mind, or inner self, it seemed to follow as a matter of pure logic that the inner self must be located in the embryo brain region.

I identified the embryo brain region to consist of the midbrain, thalamus, hypothalamus and brainstem, and from that point it was a

relatively easy matter for me to wade into the vast discipline of neuroscience, and extract all the evidence I could find indicating the pivotal role of this area, both for our sleeping and waking consciousness, as well as it being the master control area for the operation of our five senses. This was in the latter half of the 1980s, and you will see that all the references to works of neuroscience listed in the notes section of this book date from that period or earlier. However you need not be concerned that my work has become outdated, because since that time the most widely accepted theory of consciousness in the brain, the 'global neuronal workspace', attributes the thalamus as having the pivotal role, just like in my theory.

At this point I had sufficient neuroscience research data to back up my claim that our consciousness is generated from the embryo brain region, and that our sensory input can be initiated from that region of the brain, but I had virtually no knowledge of the Hindu sacred texts. I remember in the late 1980s, I had just finished a session of hatha yoga at an Iyenagar yoga center in Sydney, and I said to our instructor: "You won't see me anymore, I have to go off and tell people about the inner self." I then went to Mumbai, or Bombay as it was known in those days, and I went to a leading Hindu bookstore and purchased all the books on Hinduism that I could cram into a medium sized suitcase. I then went to an ashram two hours out of Mumbai in a little town called Ganeshpuri, and that's where I remained for three months while I read all those books. When I came back to Australia, I wrote three articles which are now Chapters 6-8 of this book. All three articles were published in various philosophical journals in India, but Chapter 6 *Inner Self Located* was actually published by the *Indian Philosophical Quarterly*, of the University of Poona, the most prestigious philosophical journal in India. It was not even properly formatted when I sent it to them, also I had no formal qualifications as a Hindu scholar, yet they evidently saw the merit in the article and went to the trouble of reformatting it for publication. So, no matter how this book is ultimately received, I am in fact an accredited Hindu philosopher, and that can never be taken away from me.

At the turn of the new millennium, all I had was my theory that the inner self was located in the embryo brain region at the base of the brain, and a rock solid conviction that we are all somehow linked so that we are living in a virtual reality. By this time I had done a great deal of research into what the founders of quantum mechanics had been saying about the nature of life, and I was convinced that the new physics was saying exactly what the Hindu texts have been saying for thousands of years, namely that the external world is an illusion. It was my gut feeling that the embryo brain region in all our brains was connected in an information network that was responsible for generating the illusory external world that we think is so real. This led me in particular into a search for the data. It was one thing to say that the world is an illusion, but this is telling us nothing unless we can locate the data. Once we locate the data, we can assert that the world actually is 'real' but it is just not composed of physical matter like we thought, it is a virtual reality.

Then around about 2004, a friend told me about a theory by some German authors, Grazyna Fosar and Franz Bludorf, that was circulating on the internet. Their book *Vernetzte Intelligenz* [Networked Intelligence] was not even published in English, but their theory about a networked intelligence in the DNA had become widely disseminated in the English speaking world thanks to the internet. The instant I heard about this theory, I knew that this was the answer. I immediately ordered a copy of the book from amazon.de and once it was received, I set to and translated the entire book with the aid of my school boy German and a good German-English dictionary.

The rest of my odyssey to obtain enlightenment was relatively straight forward. I knew nothing about genetics and even less about quantum computing. So I enrolled in a Bachelor of Science degree at Griffith University, in Brisbane, Australia, and I proceeded to bone up on these two essential disciplines, hoping this would enable me to get some insights into how this networked intelligence actually operated, and most importantly how the data is processed and stored. In Chapter 3, I discuss the architecture of the DNA, and demonstrate that there are actually millions and millions of memristors in the DNA which enable the storing

and processing of data. In Chapter 4, I demonstrate the quantum computing process which takes place in the DNA, which results in an output to the neurons of our brain as well as to our bodily organs by means of biophotons. In chapter 5, I tell you about the new science of optogenetics where it is found that these biophotons coming from the DNA are capable of triggering and inhibiting action potentials in the neurons of the brain, which means that ultimately they are the explanation for all our neural activity. Finally, and I hope you will believe me when I say that I came to this most important realization only at the very end of my enquiry after almost thirty years, the networked intelligence in the DNA is just another way of saying that the DNA acts as a global or universal quantum computer. All the valence electrons in the DNA are the qubits, and the DNA of all creatures is networked in terms of standard quantum computing theory; the valence electrons (the qubits) are all entangled. It's just that simple. The valence electrons in my DNA are entangled with the valence electrons in your DNA. You and I are linked in a networked intelligence.

The embryo brain region in our respective brains is indeed our inner self. It is in the nature of an individual workstation on the networked intelligence. The embryo brain region is responsible for giving us a unique personality, and a unique perspective on the external world. But the essential information linkup and the essential processing and storing of data takes place in the DNA.



1

Networked Intelligence and Morphogenic Resonance

In their book *Vernetzte Intelligenz* [Networked Intelligence], Grazyna Fosar and Franz Bludorf argue that there is a networked intelligence in the DNA that sets up the consciousness of all living creatures (including plants). Essentially, the networked intelligence is a hypercommunication of information in the DNA that constitutes a substratum beneath the physical world. This networked intelligence cannot be detected through the five senses. It is completely unconscious to us and can be likened to the collective unconscious as postulated by Carl Gustav Jung. We all believe ourselves to be independent beings with our own free will, but in fact we are all connected in the substratum. At the level of the DNA all life is unity. All this diversity that we see around us is in the nature of an illusion.

Fosar & Bludorf have drawn together some diverse threads in order to come up with this theory about the networked intelligence. Principally they rely on the groundbreaking discoveries of the Russian molecular biologist, Pjotr P. Garjajev, and quantum physicist, Dr. Vladimir Poponin, also Russian. In the early 1990s a team of researchers headed up by these two gentlemen discovered the DNA Phantom Effect. They found that when you beam laser light through a DNA sample, a certain wave pattern appears on the back of the screen. However, if you then remove the DNA

sample from the experiment, the wave pattern remains on the screen behind, as if the sample was still there. The nature of the wave pattern actually changes, but it changes in such a way that it appears as if the laser light is still passing through some sort of material or an energy field. Some sort of resonating force field remains in the spot where the DNA sample was located. Garjajev & Poponin termed this phenomenon the DNA Phantom Effect. We are dealing here with a force field that cannot be detected via the five senses, nor can it be explained by any of the known laws of nature or Physics. The DNA Phantom Effect is a supernatural phenomenon. It is an indication that there are forces at work in the DNA that are not subject to the normal constraints of time and space in the external world.

This same group of Russian scientists made some other very significant findings about the DNA. Fosar & Bludorf explain that, although these days we take for granted that the DNA is a 'genetic code' (it encodes information), contemporary genetics attempts to unravel its mysteries exclusively by means of chemistry. However the Moscow group thought this was more an area for speech experts, and they attempted to examine the DNA from the point of view of linguistics. They came up with some remarkable results.

Linguistics is the scientific study of the structure of speech. In linguistics they not only explore natural speech patterns that have been developed in different countries and cultural settings, but they also examine artificial speech; for instance the language of computer programming. This is the means by which people can talk to computers and computers can talk to each other.

Language involves natural laws about syntax (rules about the construction of words from letters) and semantics (information about the inherent meaning of words); together these two aspects make up the body of rules that is known as 'grammar'. When the genetic code is examined from this point of view, it also follows the same rules of human speech. Admittedly, not the rules of a particular language (in this case the Russian language), but rather the ground rules that are the foundation of all human speech. There is a connection between the structure of the genetic

code, and the structure of every existing human language. In other words, Dr. Pjotr Garjajev in his linguistic studies of the genetic code, believes he has found the prototype for all human speech.

It becomes necessary to reverse the normal conception of this relation. The structure of the DNA does not correspond to the structure of human speech; but rather, they found that human language, in its construction, follows the rules of the genetic code. This seems perfectly natural when you think about it. After all, the genetic code was around for many billions of years before humans ever uttered their first words. So, evidently the existing human languages must follow the fundamental patterns that were already in place in the structure of the genetic code. What is reversed is the orthodox-materialistic world view whereby human language capacity is only a secondary effect of the operation of proteins that have been synthesized from the genetic code. As a result of the findings of the Moscow group, we now know that the origin of the bases in the genetic code actually follows grammatical rules; that is to say, an immaterial or spiritual plan that is analogous to our human speech patterns. The fact that we are not just dealing here with physical or chemical processes is underscored by the truly significant discovery of the Moscow group. The analogy between the structure of the DNA and human language was found to be evident in that part of the DNA molecules that are not involved in protein synthesis. Conventional genetics dismisses the bulk of the DNA that is not involved in protein synthesis as 'junk DNA' or dumb DNA. And yet the Moscow group was able to establish that it is precisely this dumb DNA that has the potential for speech.

In extended experiments, the Moscow group was able to prove that these extensive codes laid out in the DNA were in no way connected with the synthesis of some unknown building blocks for the body; which is the case for the synthesis of proteins from the genes. The purpose of this code seems to be for communication; that is to say 'hypercommunication', as per the theory of Fosar & Bludorf. They mention that there is actually a data exchange at the DNA level by means of these inbuilt communication codes. The fact that this code has a structure, which is the basis for all human speech, indicates that it is a means for transmitting higher

information that ultimately becomes incorporated into human consciousness.

The Moscow group found that by modulating the frequency pattern in the laser beam, they were actually able to influence the genetic information encoded in the DNA. The DNA substance in vivo reacts to speech-modulated laser light just like it does to radio waves, provided the precise resonance frequency is found. This opens up the possibility of formulating artificial genetic information simply by talking to the DNA through the medium of laser light, and thus doing away with the current laborious methods of cutting and splicing the actual chemical genes. Ultimately, many uses will be found for this technique in medicine for repairing genetic defects more easily and efficiently, without the risks and side effects of the classic biochemical genetic techniques.

But the really important discovery of the Moscow group was that it is possible to actually transfer information patterns in the DNA using these techniques. Their work advances the groundbreaking discoveries of Fritz-Albert Popp that the DNA emits natural light photons, and can therefore act as a transmitter of information. The Moscow group found that they could encapsulate in laser light the complete genetic information in a salamander embryo, and transcribe it into a frog embryo, thus creating a completely different creature without transposing any of the chemical genes. What has been transmitted is the information patterns in the genes without cutting and splicing the genes themselves. The fact that the DNA-chromosomal continuum in living systems has wave attributes indicates that it incorporates a computer-like program for the construction of organisms that goes way beyond the chemical synthesis of proteins from base pairs in the genes. Dr. Garjajev states that the chromosomes in vivo act as a solitonic-holographic computer by means of the endogenous DNA laser light emissions. In the DNA, information is being stored, processed and transmitted.

In support of this argument, that there is hyper-communication of information in the DNA, Fosar & Bludorf refer to the theory of Finnish physicist, Matti Pitkänen, about magnetic wormholes in the DNA. In quantum physics, the existence of wormholes has been theorized for a

long time. Fosar & Bludorf relate the findings of Russian physicists Professor Vjatcheslav L. Djatlov and Alexej N. Dimitrijevič who, in 1995, published a physical explanation for the numerous reports of strange light effects that regularly occur in the Russian skies, particularly in Siberia. These strange lights that appear in the skies are often taken to be UFOs. There are many reports that the lights exhibit intelligent behavior, and sometimes the observers even feel that the lights are somehow attuned to their psyche. Practically all UFO sightings involve the appearance of strange lights that can travel at incredible speeds, and somehow interact with the people observing them. Djatlov and Dimitrijevič set about to find a physical explanation for this phenomenon.

They based their findings on the existence of negative mass in space. Negative mass is said to act as a balance against normal positive mass so that, in a vacuum, no mass can actually be measured. However, they posed the heretical question of what would happen over a long period of time if this balance became violated; a question that Einstein had gone to great pains to avoid. They came up with the sensational conclusion that in a vacuum domain where there exists an imbalance between positive and negative mass, it is possible for the normal electrical and gravitational energies to become coupled to each other. In other words, in a vacuum domain it is possible for gravitational energy to change into electrical energy and vice versa. Although their theory sounds far-fetched, it actually follows quite clearly the known and accepted equations of classical physics.

According to the theories of Dimitrijevič and Djatlov, heightened activity of the Sun in outer space can actually cause such a vacuum domain. Earth, as it revolves around the Sun, can cross one of those vacuum domains and thus, it can get caught up in its own gravitational pull. At the intersection between the Earth's atmosphere and the vacuum domain, the gravitational force can become a strong electrical field that can result in atmospheric luminous phenomena, so-called *energophoren*. Smaller examples of *energophoren* have also been known in the past as ball lightning.

These Russian physicists also found that prominent breaklines in the Earth's crust can also contribute to the formation of these vacuum domains. This explains why these anomalous luminous phenomena are so prevalent in Siberia, in the vicinity of the border between Russia and China. *Energophoren* are also capable of appearing on radar screens even though they are obviously not composed of solid material. Furthermore, they emit electromagnetic frequency in the ELF range, which means that they are in the region of those longish waves beneath 10 Hertz that the human brain is also capable of producing. This possibly explains why these luminous phenomena are often taken to be UFO sightings by observers who have the impression that it is, in some way, interacting with their psyche. These mysterious, self-radiating light bodies can appear to be made out of solid material, and they can, in some cases, react with our thoughts. From time to time an illuminated vacuum domain could follow in its movements the intellectual anticipations of the observers. Alexej Dimitrijevic actually observed this phenomenon first hand.

Fosar & Bludorf state that this is perfectly understandable. If the illuminated apparition is sending out low frequency waves similar to those actually produced in the brain, then obviously what is occurring is an intellectual or mental 'contact' between human beings and the luminous phenomena. These peculiar characteristics of the vacuum domain have meant in the past that the observer can have no other conclusion to draw, except that it is a case of an intelligently piloted flying object. Also, because of the breakneck speed and haphazard movements of some of these apparitions, the observers can obviously rule out any possibility that it can be any sort of conventional manmade aircraft. It must be a spacecraft of extraterrestrial origin.

So it turns out that these vacuum domains are a perfectly natural occurrence. According to the Russian theory, they are just a secondary effect of a prior primary phenomenon that admittedly is quite exotic, and about which we still know very little. For these self-radiating lights to appear somewhere else in the universe, there must arise an imbalance between positive and negative mass. This is where the theory about wormholes in space reappears. The fact that wormholes can occur is

known from the theory of the famous American quantum physicist, John Wheeler. Wheeler's student, Kip Thorne, who is the present incumbent of the Feynman chair of physics at Caltech Institute in California, has been working intensively on the question: "Under what conditions can such wormholes become sufficiently large and stable to enable spacecraft to travel through them to distant parts of the Universe?" For a long while it was believed that this was not possible at all. According to conventional theory these wormholes are influenced by gravitational forces and, after a relatively short period of time, they begin to break up so that there can be no extended tunnel in any normal sense of the word. In recent times however, David Hochberg from the Spanish Institute for Air and Space Technology, and Matt Visser from Washington University in St. Louis, have argued that stable wormhole connections are actually conceivable, but only when it has at its disposal a considerable amount of exotic material with negative mass.

Fosar & Bludorf argue that a stable wormhole could then be responsible for those pronounced vacuum domains in the theory of Dimitrijevic and Djatlov; vacuum domains that can create anomalous luminous phenomena in our atmosphere by converting gravitational force into electricity. It is conceivable that one day it will be possible to construct a spacecraft that can safely travel through these stable wormholes utilizing the electromagnetic forces that are generated when gravitational force is converted into electricity.

So then we come to the theory of the Finnish physicist, Matti Pitkänen, who appears to have bridged the gap between physics and biology. Pitkänen has put forward a brilliant theory about the construction of the Universe that is based on a very complex eight-dimensional space geometry. His theory is called Topological Geometrical Dynamics (TGD). In this theory magnetic wormholes play an important role. Not in space, however, but in the DNA. Pitkänen has found a much wider role for DNA than simply its known involvement in the synthesis of proteins as a chemical process based on the precise genetic sequences of the base pairs. Also in these coded sequences of base pairs in the DNA is to be found magnetic wormholes that act as communication channels.

Pitkänen comes to a completely new way of looking at things for, in his theory, the concepts of consciousness and perception are specifically introduced into a physical theory about matter and the structure of the Universe. According to Pitkänen: "Wormhole magnetic fields that are encapsulated in space-time sheets, and represent what is customarily known as Biomatter, are also excellent candidates for the physical explanation of perception. Wormhole magnetism can actually be considered the quintessential living system." Pitkänen's theory puts us on the threshold of a completely new understanding of the whole Universe. The Cosmos can no longer be seen like a mechanical clockwork mechanism, but rather a system that is permeated with conscious energy. The conclusion to be drawn from this is that the Universe is actually a byproduct of consciousness. The Universe exists because it is being perceived.

Fosar & Bludorf state that even before Pitkänen's theory, there have been scientists who have seen the Universe as much more than a physical or mechanical system. For instance, the Nobel Prize winner Charles Townes is quoted as saying: "There is an intelligent being involved in the laws of the Universe." It matters not whether we refer to this intelligent being as God or soul. However, as a result of Fosar & Bludorf's theory about the networked intelligence, we can also know that this intelligence appears to be located in the DNA.

Matti Pitkänen's new cosmology opens up for the first time a link between physics and consciousness, and can produce a substantial physical explanation for the operation of hyper-communication via these magnetic wormholes in the DNA. According to Fosar & Bludorf the DNA Phantom Effect is a byproduct of this hyper-communication. There is at work in the DNA an energy that operates in the substratum beneath the physical world. This energy allows hyper-communication of information in the DNA of all living creatures (including plants), and sets up a networked intelligence that is responsible for our consciousness. As conscious beings we are then able to perceive a universe that is external to us, but this universe depends precisely on the networked intelligence in the DNA for its existence.

Pitkänen says that there are flux tubes in the DNA that are cylindrical 3-dimensional surfaces with an outer boundary, and that there are wormhole magnetic fields (charged wormholes) situated at the boundaries of the flux tubes. The essence of Pitkänen's theory is that those magnetic wormholes enable the energy in the DNA to be directed into the external world. It is known that the DNA emits light and in Pitkänen's model dark photons decaying via decoherence to ordinary photons facilitate interactions between ordinary and dark matter. That is to say that dark matter is the quantum controller of ordinary matter, and dark matter is itself generated as magnetic body from the magnetic flux quanta in the DNA.

Not only is the DNA emitting energy but it is also storing information. The DNA has memory capacity. The TGD "model suggests that organic molecules are able to store memories into integer-valued vacuum quantum numbers associated with supra current loops, and that perhaps through the interaction with coherent light, biophotons provide a mechanism for memory storage. The enzyme substrate interactions in turn code this information in chemical form." What this means is that biosystems use the twisted and untwisted configurations of closed flux tubes to store binary data. A twisted magnetic flux tube resembles a Möbius strip, and so this basic dichotomy between twisted and untwisted magnetic flux tubes becomes a classical binary format for the storage of data. Needless to say, data that is stored in that fashion is also capable of being transmitted via the magnetic wormholes. This is the networked intelligence, as identified by Fosar & Bludorf.

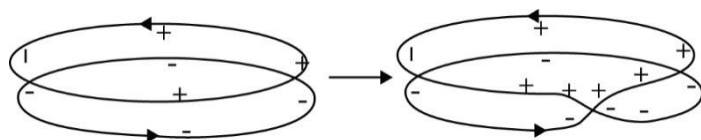


Figure 1. The twisted and untwisted flux tubes in the DNA that, according to Matti Pitkänen, are the means by which binary data is stored.

In Chapter 3, I set out and fully explain my own theory as to how data can be stored in the DNA. It will be seen that Pitkänen's twisted and

untwisted flux tubes are actually electrons in the covalent bonds in the DNA that have flipped or not flipped. Pitkänen says that the flux tubes in the DNA are cylindrical 3-dimensional surfaces with outer boundary. We will see in Chapter 3 that this seems to be the orbitals of the valence electrons he is talking about, which do indeed have an associated magnetic field. In which case his magnetic wormholes actually permeate the solenoid fiber, which itself has electromagnetic properties enabling it to read the data, and transmit the energy in the DNA into the external world as electromagnetic waves. Also, Pitkänen says that dark matter is the quantum controller of ordinary matter, and dark matter is itself generated as magnetic body from the magnetic flux quanta in the DNA. What Pitkänen calls dark matter we can normally associate with data. It is the data in the DNA that controls physical matter, although to call data 'dark matter' in this context makes for a very nice analogy.

Since Matti Pitkänen was writing about wormholes in the DNA we have come to know a great deal more about the nature of wormholes in general. In an article in *New Scientist*, 27 July 2013 edition, called *The Great Quantum space-time Tangle*, it is stated that wormholes emerge from entanglement. Entanglement is the buzz-word in quantum computing where particles 'know' what other particles are doing even at such great distances that it would require signals passing at speeds faster than the speed of light. This is also known as non-locality. Einstein famously said of non-locality that it was 'spooky'.

What it means is that a wormhole exists between every entangled particle in the universe. And as every particle in the universe is entangled it means that wormholes exist between every particle in the universe. Which means that at the quantum level the universe is NOTHING but wormholes. Now that we know that wormholes are responsible for entanglement we are in a better position to judge what a wormhole is, or at least what it is not.

For starters it obviously has no dimensions such as length, diameter, beginning, end, top bottom etc. It seems to me that a wormhole is synonymous with non-locality, it is an absence in space-time, such that the same event can occur simultaneously at two different points in space-time.

The article describes the universe as filled with ‘a thicket of cosmic tunnels’ but I think this should be read as tunneling in the context of quantum mechanics, and we may say that a wormhole emerges where there is some probability of a signal passing between two particles faster than the speed of light to trigger a non-local event.

In later chapters I will demonstrate to you that the valence electrons in the DNA molecule act as memristors and it is now clear that the networked intelligence in the DNA simply means that the valence electrons in the genome of all living creatures are in fact entangled via these wormholes for the purpose of processing and storing data. Essentially the networked intelligence in the DNA is the quantum computer.

In his book *The Presence of the Past*, Rupert Sheldrake argues that memory is inherent in nature. All species and natural systems of all kinds have evolved the way they are because of a collective memory. The characteristics of all living creatures are really in the nature of habits that have become entrenched as a result of this cumulative memory. The way they were before determines the way they are now, and the way they are now will determine the way they will be in the future. Sheldrake suggests that memory may also be inherent in matter at all levels. In atoms and molecules, in crystals, and indeed in the entire cosmos there may be some sort of collective memory at work.

Sheldrake explains: “A beech seedling, for example, as it grows into a tree takes up the characteristic shape, structure, and habits of a beech. It is able to do so because it inherits its nature from previous beeches; but this inheritance is not just a matter of chemical genes. It depends also on the transmission of habits of growth and development from countless beech trees that existed in the past. Likewise, as a swallow grows up, it flies, feeds, preens, migrates, mates, and nests as swallows habitually do. It inherits the instincts of its species through invisible influences, acting at a distance, that make the behavior of past swallows in some sense present within it. It draws on and is shaped by the collective memory of its species. All humans too draw upon a collective memory, to which all in turn contribute.”

In relation to humans, Sheldrake also suggests that our day to day personal habits have come about as a result of being 'tuned in' to our past behavior. If this is the case, there is no need for our personal habits to be actually stored in our nervous system. The same considerations also apply to our conscious memories. They also may form part of a cumulative memory to which we can have direct access. There is now a great deal of memory research that indicates that our conscious memories are not stored in the brain at all. Sheldrake's suggestion that the past may, in some sense, become present to us directly, may be an explanation for this.

Sheldrake argues for the existence of morphic fields as being the primary principle of formative causation. Every kind of natural system has its own specific morphic field. These morphic fields have an effect at every level. They determine the shape of atoms and molecules through to the actual state of the Universe. Our past behavior, our societies, our customs, and mental processes are all encapsulated in these morphic fields which make them available to determine the nature of life in the future.

These morphic fields are described as being non-material regions of influence extending into space and continuing in time. Interestingly Sheldrake does not actually make the claim that these morphic fields are located in the DNA or in our chromosomes, although this is the obvious place for them to be. Indeed the only place that they can be is in the genome. It is suggested that the DNA Phantom Effect described earlier is just such a morphic field. Sheldrake simply says that these morphic fields are localized within and around the systems they organize. When any particular organized system ceases to exist (for instance, when a snowflake melts or an animal dies) its organizing field disappears from that place only to reappear again somewhere else where the conditions are appropriate. It can be seen then that Sheldrake sees these morphic fields as having the ability to reincarnate. They contain within themselves a memory of their previous physical existences, and they are potential organizing patterns of influence that will be able to generate another organized system (material object) based on the object's stored memory of its previous incarnations.

Maybe the reason why Sheldrake did not make the claim that these morphic fields are in the DNA is that he is adamant that they are the organizing principle behind inorganic matter (atoms, molecules and crystals) as well as organic matter (living beings including plants that have DNA in each living cell). He says, however, that the way the information stored in memory is passed on to future morphic fields is through morphic resonance, and this seems to mirror the findings of the Russian molecular biologists, as well as the theory by Matti Pitkänen about the resonating magnetic flux tubes in the DNA.

Bear in mind that when Sheldrake is talking about cumulative memory being passed on to future generations, he is talking about the transmission of information. Sheldrake says: "The process by which the past becomes present within morphic fields is called morphic resonance. Morphic resonance involves the transmission of formative causal influences through space and time. The memory within the morphic fields is cumulative, and that is why all sorts of things become increasingly habitual through repetition. When such repetition has occurred on an astronomical scale over billions of years, as it has in the case of many kinds of atoms, molecules, and crystals, the nature of these things has become so deeply habitual that it is effectively changeless, or seemingly eternal."

Sheldrake's notion of morphic resonance is vague, and he seems to assume that all the characteristics of organic and inorganic matter can be effectively classified as 'habits', but there can be little doubt that he is really talking about a networked intelligence that has a creative and an organizing role in everything that we see around us, including ourselves. He also sees these morphic fields as 'evolving' which is another striking similarity with what is known about the DNA. He says: "All this obviously contrasts with currently orthodox theories. There is no such thing in contemporary physics, chemistry, or biology as morphic resonance; and the known fields of physics are generally assumed to be governed by eternal laws of nature. By contrast, morphic fields arise and evolve in time and space, and are influenced by what has actually happened in the world. Morphic fields are conceived of in an evolutionary

spirit, but the known fields of physics are not; or at least until quite recently, they were not.”

We know that the DNA is resonating; we know that it is emitting a mysterious energy field, and we know that it is the organizing principle behind all living systems (organisms). The DNA also seems to be evolving. New species are being created, other species are becoming extinct, the DNA as a morphic field seems to have an eternal quality about it. All that is required is the knowledge that there is hypercommunication in the DNA of all living creatures (including plants), and we can understand that the cumulative memory for all life that has ever existed is stored in it, and this is what gives it the capacity to go on creating forever. There is an infinite quality about the DNA. It always was there, it is there now, and it always will be there. The morphic field for every object (organic or inorganic) is contained therein. As Sheldrake says: “Now, in the 1980s, theoretical physics is in ferment. Theories are reaching back into the first moments of creation. Entirely new, evolutionary conceptions of matter and of fields are coming into being. The cosmos now seems more like a growing and developing organism than like an eternal machine. In this context, habits may be more natural than immutable laws.”

The whole universe is now seen as a cosmic system of fields and energy. At every level of matter from the subatomic level through to star galaxies, there are force fields operating as the guiding principle. This has come about as a result of the joint influence of Einstein’s theory of relativity as well as the New Physics (Quantum Mechanics). Einstein found in his theory that it was impossible for the universe to be a static clockwork mechanism that would exist eternally within the universal field of gravitation. His own equations were demonstrating that the universe is actually a non-static organizational system, so it was necessary for him to artificially introduce the so-called cosmological constant into his equation to give the universe the appearance of being static. This is the so-called ‘Einstein static universe’ which, in fact, has the universe expanding ever so slightly. Take the cosmological constant out of this gravitational equation and the universe would implode on itself. The cosmological constant was the solution to make Einstein’s equation work, but at the

same time he had destroyed the notion of a changeless background universe, and he knew it. And what's more, he was very worried about it. When you have got non-static force fields as the guiding principle behind the universe, the equations for which can be adjusted to show the universe as either expanding or contracting, then quite obviously there must be some sort of creative intelligence behind it all. It doesn't seem likely that the 'Big Bang' is capable of formulating a cosmological constant to make the universe work.

In his book's section on the growth of habits, Sheldrake quotes Samuel Butler who, writing in the 19th century, had concluded that memory was the fundamental characteristic of life. According to Butler: "Life is that property of matter whereby it can remember - matter which can remember is living. Matter which cannot remember is dead." And sometime later Butler said: "I can conceive of no matter which is not able to remember a little, and which is not living in respect of what it can remember. I do not see how action of any kind is conceivable without the supposition that every atom retains a memory of certain antecedents." Butler said this in the 19th century. As you will see in Chapter 3 of this book, at the subatomic level an electron in an atom can remember whether its spin state has flipped or not. All of life does seem to be patterned on memory. Embryos seem to develop as a repetition of their ancestors. The habits and instincts of all animals are based precisely on what was done by their ancestors. Quite clearly this involves some sort of memory at the base of all matter, living and non-living.

Butler was writing before the development of genetics. As this new science developed, it was demonstrated that our physical characteristics, our habits and our instincts, could be explained in terms of chemical genes. Butler's theories about memory in biology fell into disfavor before geneticists were able to show that the complex molecules of the DNA contained a sort of memory that was inherited from generation to generation, and could account for our physical characteristics and our behavior. This appeared to demonstrate that our acquired characteristics are transmitted mechanically via the genes. There did not appear to be any need to inquire more deeply into the matter, and ask precisely how this

‘information’ can be stored in the complex molecules of the DNA. This question has now been answered by Matti Pitkänen, who confirms that the information is indeed stored in the complex molecules of the DNA as binary data in the twisted and untwisted magnetic flux tubes. Or in Chapter 3, you will see that it can be stored in binary form by electrons that have flipped or not flipped. Pitkänen is not contradicting conventional genetics. He is merely taking genetics one stage further and demonstrating that heredity is not a chemical/mechanical process but is actually about information technology – the storage and transmission of data.

The concept of morphogenesis is not new. Morphogenesis concerns the coming into being of form, and it is derived from the Greek *morphe*, form, and *genesis*, coming into being. All living creatures develop from a single cell into a multi-celled complex organism. The cells divide and multiply in such a way that they appear to be carrying out some sort of master plan, and yet the precise workings of this remain a mystery. One school of thought, the preformationist theory, maintains that a miniature version of the adult organism is contained, already formed, in the egg. This tiny form simply grows and unfolds into the adult organism. This theory was revitalized in the 20th century with the development of genetics, and has become the central dogma of modern molecular biology. However, pre-formationists these days would argue that the genetic material contains a template or ‘code’ for the synthesis of proteins. These proteins cause the cells to divide and multiply in precise ways according to a preordained template.

Others have argued for purposeful organizing principles that are non-material in nature. In the 1990s a vitalist theory was put forward that developed a notion of entelechy: physical processes were directed in a purposeful or teleological manner toward goals contained within the living system. Ironically, although mainstream geneticists and molecular biologists believe that entelechy has been discredited, in fact the same argument appears in a different guise, precisely in the notion of genetic material acting as a template or code for morphogenesis. As Sheldrake explains: “Programs contain within themselves information about the end

to which they are leading. Thus, organisms can develop purposively toward these ends that are contained in their programs; likewise, embryos can regulate and organisms regenerate because of the purposive and holistic properties of these hereditary organizing principles. Finally, the idea of the genetic program seems to fit well with the jargon of information theory; and with the linguistic metaphors in general usage within modern biology. DNA 'codes information', which can be 'transcribed' into RNA molecules, and then 'translated' into a sequence of amino acids as protein molecules are synthesized. The metaphor of the genetic program can hardly fail to suggest that development is organized by a pre-existing purposive principle that is either mind-like itself or designed by a mind."

Since the 1920s several biologists have suggested that morphogenesis is organized by fields. The field becomes the causal factor for the typical organization and specific activities of a living system. It was argued that each specific organism has its own morphogenetic field. These were also known as 'individuation fields.' Again, these attempts by biologists to explain morphogenesis in terms of fields was merely a rehashing of the entelechy theory in disguised form. Quite clearly these fields were also purposeful or teleological, and they were non-material in nature. We are back with the notion that there is some sort of mind-like or spiritual plan for morphogenesis.

Sheldrake maintains that the novelty of his own theory about morphogenetic fields is that he sees them as having memory. The precise form of any particular morphogenetic field is determined by the cumulative memory of similar organisms that have lived in the past. "Thus, for example, the morphogenetic fields of the foxglove species are shaped by influences from previously existing foxgloves. They represent a kind of pooled or collective memory of the species. Each member of the species is molded by these species fields, and in turn contributes to them, influencing future members of the species."

When it comes, however, to describing how this memory actually works, Sheldrake merely states that it depends upon a kind of resonance, called morphic resonance. This morphic resonance is determined by its

similarity to previous organisms. “And the more such organisms there have been, the more powerful their cumulative influence. Thus, a developing foxglove seedling, for example, is subject to morphic resonance from countless foxgloves that came before, and this resonance shapes and stabilizes its morphogenetic fields.”

Sheldrake distinguishes morphic resonance from other types of resonance known in nature or in physics, such as acoustic resonance, electromagnetic resonance, electron spin resonance and nuclear-magnetic resonance. These other types of resonance simply involve a transfer of energy from one system to another, whereas morphic resonance involves ‘a non-energetic transfer of information.’ Here we find the essential similarity between Sheldrake’s theory and the networked intelligence of Fosar & Bludorf. A morphogenetic field is not determined by the morphogenetic fields of previous organisms, nor is it determined by the morphic resonance of previous organisms. A morphogenetic field is determined by stored information about previous organisms. In Matti Pitkänen’s theory this data is stored in binary format in twisted and untwisted magnetic flux tubes. These magnetic flux tubes have a specific resonance and it may be assumed that the precise resonance is determined by the actual data that is stored; the same with my memristor theory where the data is stored in electrons in the covalent bonds in the DNA. The electrons that flip and the electrons that don’t flip create a specific electron spin resonance which can store data. The morphic resonance is stored data about previous organisms. When a new creature is created, this stored information is transferred to create a new morphogenetic field based on what has gone before. This is the networked intelligence in operation.

The networked intelligence enables us to fully understand another claim by Sheldrake. “The hypothesis of formative causation postulates a two-way flow of influence: from fields to organisms and from organisms to fields.” Not only does stored information determine new morphogenetic fields, but these new morphogenetic fields will result in a change or an updating of the stored information. When a creature dies, its

whole life trajectory will have become stored as information, which will determine the morphogenetic fields of future generations.

Sheldrake talks about the problem of the medium of transmission. Morphic resonance does not involve the movement of quanta of energy through any of the known fields of physics. So how is it achieved? How does morphic resonance take place through or across time and space when it is not actually a material energy that can be detected in earthly time and space? "In answer to this question, we might imagine a 'morphogenetic aether,' or another 'dimension,' or influences passing 'beyond' space-time and then re-entering. But a more satisfactory approach may be to think of the past as pressed up, as it were, against the present, and as potentially present everywhere. The morphic influences of past organisms may simply be *present* to subsequent similar organisms." Foss & Bludorf would explain this with the notion of hypercommunication. This is described as instant communication, zero time lag, even if the information is transferred from one end of the universe to the other. It is actually illogical to talk about communication or the transferring of information in these circumstances. Hypercommunication means that the information is available in both places simultaneously. Even the notion of both places is illogical. Hypercommunication ultimately means a unified field of information. This is what Sheldrake means when he states that morphic influences of past organisms may simply be *present* to subsequent similar organisms. It is all there in a unified field at the genetic level. The unified field is the networked intelligence.

Sheldrake actually talks about *fields of information*. "Morphic fields play a role comparable to information and programs in conventional biological thought, and can indeed be regarded as *fields of information*. Thinking of information as contained in morphic fields helps to demystify this concept, which otherwise seems to be referring to something that is essentially abstract, mental or mathematical; or, at any rate, nonphysical in nature. It also draws attention to the evolutionary nature of biological information, for these fields contain a built-in memory sustained by morphic resonance." It can be seen that Matti Pitkänen's notion of information stored in binary format in the twisted and untwisted flux

tubes, or my theory about the information stored in the electrons that have flipped or not flipped, does not change Sheldrake's theory at all. Pitkänen and I are simply describing in more detail how the information is stored.

Sheldrake refers to the pioneering work by Michael Faraday about field theory and magnetism. By so doing, he more or less implies that his morphic resonance is magnetic in nature. Matti Pitkänen's theory about the storage of data in twisted and untwisted magnetic flux tubes is likewise based on the properties of magnetism, as is my memristor theory. The nucleosomal fiber is stored in chromatin as a classic solenoid coil, and could not help but have electromagnetic properties enabling it to read the data. So too is the hypercommunication of information via the magnetic wormholes in the DNA based on the properties of magnetism. It is not hard to envisage that the storage of data in twisted and untwisted flux tubes, or in memristors, and the hypercommunication of information via the magnetic wormholes in the DNA is indeed going to set up a specific magnetic resonance in the DNA, which Sheldrake describes as morphic resonance.

Faraday's remarks about the nature of magnetism, therefore, become relevant to the networked intelligence. He felt that magnetism was essentially 'lines of force' that extended around a magnet. He did not see them as being made of ordinary matter; although he also saw them as states of strain that are physically real. He offered alternative explanations as to this reality. On the one hand he felt that they were a material medium: the Aether; and on the other hand, he felt that they have a material existence as 'mere space.' The latter explanation was preferred by Faraday because it fitted in with his other theories about material particles being point centers of converging lines of force. Ultimately, Faraday felt that all physical substance was in the nature of space, where each point in the force field had a certain amount of force. The interaction of these points in the force field set up a vibration that created patterns of force which we take to be material bodies.

Matti Pitkänen's Quantum TGD model postulates the notion of magnetic body. Everything that we perceive (everything that becomes conscious to us) is in the nature of magnetic body and therefore has a

unique space-time sheet. Essentially, therefore, Pitkänen's theory is merely a way of describing the workings of a magnetic force field that can explain the existence of external matter in a space-time context. In his space-time sheets he is joining up those points in Faraday's magnetic force field in order to create a space filled with matter. His space-time sheets are depicting the patterns that Faraday spoke of. Essentially therefore, they are also depicting Sheldrake's morphic resonance.

The extraordinarily complex and symmetrically beautiful shapes that are found in crystals suggest that morphic resonance is at work determining their development. Sheldrake tells us that it is not possible to predict from first principles the way the molecules will pack together to form a crystal lattice. It is simply not possible to explain why any particular crystal chose that particular pattern rather than another. It is also impossible to explain the way these crystalline structures grow to a symmetrical whole. Snowflakes, for instance, normally have a six-fold symmetry, but every snowflake is actually unique. However, the basic structure of the six arms of all snowflakes is very similar, and all six arms are normally perfectly symmetrical. What is puzzling about this is the question of how one face of a growing crystal knows what is happening on the other side, so that the crystal can continue to grow as a symmetrical whole. The explanation offered by Sheldrake is as follows: "From the point of view of the hypothesis of formative causation, the lattice structure is organized by a lattice morphic field, and a higher level field organizes the structure of the crystal as a whole. The same lattice structure - for example, that of water - can be organized into different types of crystal, as in sheets of ice, in snowflakes, and in various kinds of frost. The morphic field of the crystal as a whole is associated with the 'lattice vibrations which are exquisitely sensitive to the structure in which they occur' and organizes the pattern in which the crystal grows."

Matti Pitkänen would offer a more precise explanation for crystallization in terms of dark matter. Dark matter is actually invisible because it is made up of dark photons that may be thought of as the antibody of normal light photons. The magnetic resonance in the DNA is capable of being channeled into inanimate objects in the external world by

means of the dark matter. Water, ice, glass and crystals are all partially composed of dark matter. Conformally confined blocks of atoms in these substances interact with the dark photons emanating from the DNA, and this is what creates the unique resonance patterns in snowflakes and other crystals. In Pitkänen's theory, these crystalline structures would also be described as magnetic body produced from the resonance of the magnetic flux tubes in the DNA. Crystalline structures are therefore a perfect example of how the magnetic resonance in the DNA, the morphic resonance in Sheldrake's theory, can actually interact with and control the matter that we perceive to be real in the external world.

Sheldrake also claims to explain the 'Lamarckian inheritance' of acquired characteristics through morphic resonance. 'Lamarckian inheritance' is named after the 19th century zoologist Jean-Baptiste Lamarck who was of the opinion that acquired characteristics could be passed on from generation to generation. Acquired characteristics normally come about due to a change in the environment or through learning, and it is strongly disputed by mainstream geneticists that such acquired characteristics can actually modify the genetic makeup of the organism, which would be necessary for the new characteristic to be passed on through the genes to the next generation.

For example, camels have thick calluses on their knees supposedly caused because of the way they kneel down. The Lamarckian explanation would be that the abrasions to the skin caused these thick calluses to appear, and that this characteristic became inherited so that baby camels are actually born with thick pads that protect their knees when they kneel. Although the Lamarckian viewpoint assumes that this is an acquired characteristic that can be inherited, they can offer no feasible explanation as to how the genetic makeup of camels actually became modified, so that camels are actually born with these knee pads in place. It seems that Darwin himself also accepted that acquired characteristics could be inherited, but neo-Darwinists, who are mainstream geneticists, flatly deny that our genes can become modified because of changes in the environment, or because of what we have learned. According to them, baby camels are born with protective knee pads because of chance genetic

mutations that just happened to cause these knee pads to occur exactly in the right spot to protect the camel's knees while kneeling.

Sheldrake suggests that acquired characteristics can be inherited because of morphic resonance. This does not involve the transfer of modified genes from one generation to the next. As more and more members of the species acquire the characteristic, the morphic resonance will cause the members born with that characteristic to progressively increase. He even suggests that the morphic resonance can cause other members of the species that are geographically separate to acquire the characteristic as well; where there is no possibility at all of any conventional form of communication between the gene pools. In other words, he is suggesting that this morphic resonance can result in a hypercommunication of information in the DNA such that an acquired characteristic can spread throughout a species via the networked intelligence in the magnetic wormholes.

From the point of view of Matti Pitkänen's theory, acquired characteristics are virtually proof positive that the life of every sentient being (including plants) is recorded as information or data in the DNA. The life of the being (the phenotype) does change the DNA (the genotype) inasmuch as new data is stored, and will be available for subsequent generations. This can be the only possible explanation for inheritance of acquired characteristics; and furthermore, it offers a more reasonable and comprehensible explanation for Sheldrake's morphic resonance. As we have seen previously, the only explanation Sheldrake gives for the transmission of information through morphic resonance is this suggestion that the past is in some way 'pressed up' against the present. The morphic influences of past organisms is simply *present* to subsequent similar organisms. This explanation is so vague that it is no explanation at all. However, we may now take it that the morphic resonance is stored as binary data. Because of hypercommunication of information in the DNA, this data is available for all sentient beings (including plants) present and future. These new beings that are being created are themselves changing the data that is stored as a never-ending, ongoing process. When we think of evolution, we should think only of the data stored in the DNA, for in

the last resort it is only that data pool that is continually evolving. Hence, the morphic resonance is changing.

Sheldrake says: "The hypothesis of formative causation provides a radical reinterpretation of the nature of memory. It proposes that memory is inherent in all organisms in two related ways. First, all organisms inherit a collective memory of their species by morphic resonance from previous organisms of the same kind. Second, individual organisms are subject to morphic resonance from themselves in the past, and this self-resonance provides the basis for their own individual memories and habits." He is suggesting that all memory is somehow stored in this morphic resonance. Each individual has its own personal memories available to it while it is living; and in addition, these memories also form part of a collective memory that may be conceived of as a universal database common to all DNA. This is precisely the model developed by Pitkänen. Our individual memories are stored in our DNA, and through hypercommunication of information via magnetic wormholes, the information stored in our DNA is accessible by all creatures present and future.

We can immediately see here an explanation for the 'past lives' phenomenon which will be the subject of the next chapter. With a universal database in the DNA, it is understandable that from time to time we can have the impression not only that we have lived past lives as human beings, but that also in past lives we have been a member of a different species, maybe even a plant. The information about all past lives is capable of hypercommunication in the DNA, and therefore can become present to us in our waking or dream consciousness.

Sheldrake dismisses the so-called 'mechanistic' theories of memory, according to which our memories depend upon physic-chemical modifications of the nervous system; that is to say 'traces' of past experience stored in the brain. A memory trace in the brain occurs when we learn something new about the world around us, and at some later date we will be able to recall or remember that thing by somehow having access to that memory trace. Sheldrake notes that, so far, all attempts to locate such traces within the brain, and to analyze them have been unsuccessful: "By contrast, through formative causation, memory

depends on morphic resonance between patterns of activity within the nervous system now, and similar patterns of activity in the past. It need not depend on physic-chemical modifications of the nerves. Memory need not be stored in material memory traces if it results from morphic resonance; the past can exert a direct influence on the present.”

Here again we find that Pitkänen offers the ultimate explanation for memory – both personal and collective. The DNA is capable of storing information as binary data in the twisted and untwisted magnetic flux tubes. This data is capable of transmission via the magnetic wormholes. So, evidently we can access this data when we are seeking to recall our own personal memories, and in addition, in group consciousness situations, it is possible for other individual creatures to access this data as a kind of collective memory for all species. The hypercommunication of information in the DNA can explain how the memory ‘traces’ of any sentient being that has ever lived, or is currently living, can indeed surface in our own consciousness. This information is evidently processed in our brain in order to become conscious to us, but the essential memory storage, the trace, is in the DNA, or as Sheldrake would say, it is in the morphic resonance.

In computer parlance they talk about Read Only Memory (ROM) that is fixed and cannot be changed. There is also Random Access Memory (RAM) that is volatile memory, and is constantly being updated. The memory storage in the DNA would be a kind of volatile memory that is continually augmenting as life in the universe evolves. At any moment in time data for the entire universe is stored therein, reflecting the stage to which the universe has evolved. As the world and the universe change, so too does this data. Hypercommunication of information amongst all sentient beings allows all creatures to perceive a universe in its current state, right down to the minutest detail. When a leaf falls from a tree, the data changes, and the change can be observed by all. If a pebble in the street is moved, the data changes, and the universe has to that extent evolved. Ultimately, this means that the only reality is that data storage in the DNA. The whole universe is right there as stored data, including all

that has gone before, as well as everything that can currently be perceived through the senses.

As regards the learning of language, Sheldrake says: "Human babies have an inherited disposition to learn languages; the young of other mammalian species do not. In conventional terms, this is thought of as a kind of programming in the DNA. From the present point of view, it is due to morphic resonance from innumerable people in the past. This resonance underlies the general tendency to acquire language, and also facilitates the acquisition of particular languages, such as Swedish and Swahili, by resonance from previous speakers of these languages." Sheldrake refers with approval to the language theories of Noam Chomsky, who has strenuously argued that it is impossible to explain a human child's ability to acquire language in terms of stimuli and conditioned responses. There seems to be an element of 'creativity' at work with the way children can pick up their maternal tongue. By the age of 5 or 6 they have the ability to understand an indefinitely large number of utterances that they could never have actually heard. In other words, their language ability seems to grow in their mind just like their physical limbs and organs are growing. This suggests that their basic organizing structures of language are innate. Children must inherit their language abilities from their predecessors in their genes.

This is consistent with what Sheldrake has to say: "A general morphic resonance from all of past humanity would indeed reinforce any organizing fields and chreodes that are in fact common to most if not all languages, and this would be in harmony with Chomsky's proposal. However, it is not necessary from this point of view to suppose that the grammatical structure of all languages depends on a single universal grammar. The general morphic resonance gives young children a general tendency to learn language, but as they begin to speak a particular language, such as Swedish, they enter into morphic resonance with the people they hear speaking it; their learning of its particular grammar and vocabulary is facilitated by this resonance. Speaking this language tunes them in, on the basis of similarity, to speakers of the same language, including many millions of speakers in the past."

The networked intelligence theory of Fosar and Bludorf, based on the findings of the Russian scientists about the grammatical structure of the DNA, serves to reinforce and clarify Sheldrake's morphic resonance. According to the Russian scientists, the DNA itself is structured as a language. What's more, voice-modulated laser light will actually interact with the resonance of the DNA, provided the correct frequency is found. They have come to the conclusion that the DNA itself is the prototype for all languages, and from that point of view, no doubt the DNA would not only interact with laser light modulated with every human language, but also with the sounds uttered by other creatures such as monkeys, birds, dolphins, or the roar of the lion or the hiss of the snake. It seems that any living being capable of uttering sounds may be able to communicate with its own DNA. These creatures all come into existence by virtue of the resonance in the DNA (or as Sheldrake would say, "the morphic resonance"), and the DNA is demonstrating its ability to store data about all these creatures through its sensitivity to laser light modulated with their sounds. Effectively it is demonstrating not only that it is creating, but also that it is recording. Human language is based on fundamental communication techniques that are established and utilized in the DNA.

The Book of Genesis in the Old Testament starts with the statement: "In the beginning there was the Word." Somehow God proceeded to create the Universe with the Word. Now that we know that the DNA contains data, we may reinterpret this statement, which really has remained mysterious since the beginning of human civilization. The Word means data. In the beginning there was data, and it is by means of data (information) that the world and all its inhabitants are created. What else could this statement mean? Surely it is not intended that God used a Hebrew word or a Greek word, or even less, an English word, to create the world. But the fact is that all these words can ultimately be written or spoken by a byte of data, so this is the ultimate source of all words. It is commonplace to all of us who use word processing programs to type words knowing that the words we see on the screen are actually written by means of the binary computer code. Words come out of data, and not vice versa.

Sheldrake says that morphic fields are also to be thought of as existing in the external world. "According to the hypothesis of formative causation, the morphic fields that organize our behavior are not confined to the brain, or even to the body, but extend beyond it into the environment, linking the body to the surroundings in which it acts. They coordinate sensation and action, bridge the sensory and motor regions of the brain, and coordinate a nested hierarchy of morphic fields, right down to those that organize the activity of particular nerve and muscle cells." Likewise in the networked intelligence theory, the magnetic resonance in the DNA can interact with conventional electromagnetic forces in the external world to orchestrate and control a whole host of natural phenomena, such as tornados, ball lightning, thunderstorms and even crop circles. In Pitkänen's theory, the magnetic resonance in the DNA can create plasmoids in the external world. Plasmoids are themselves rotating magnetic fields. As all objects in the external world are in the last resort merely magnetic body, then obviously a nested hierarchy of magnetic fields is the only rational explanation for what we perceive, and the events that take place as the universe evolves. Sheldrake is merely saying the same thing with his morphic fields, although the physical explanation that he gives is not as precise.

Sheldrake asks the question: "If morphic resonance underlies the phenomena of memory, and if the effects of such resonance do not fall off with time, then why is anything forgotten?" By the same token we may ask the question: "If everything about our life, as we live it, is being stored as binary data in the DNA, such that it becomes our own personal memory storage, as well as augmenting the collective memory of all living beings, why can we not recall anything that we want to recall?" To answer this question, we must have regard to the overall concept of life as we know it. The universe that has been created by the DNA obviously has the appearance of being composed or populated by an infinite number of beings that have a unique and separate existence. The limitations on our memory are put in place precisely to enhance the impression that we are individuals leading an independent mortal existence. It simply would not be appropriate for us to have access to all the material that is stored in the

DNA, for that would negate the apparent scenario of a real world peopled by an infinite number of unique individuals. It is one thing for us to be created by the intelligence in the DNA, but in order for us to lead our normal existence, the great bulk of the information must remain unconscious to us.

The exception, however, proves the rule for there are many documented instances of people who are capable of remembering an extraordinary amount of material, even in situations where they have never actually had physical real-time access to that material; which demonstrates that they have more access to the intelligence and memory storage in the DNA than is normal. We, all of us, could have that ability, if that was what was intended. The limited access that we have at this point in our evolution would appear to be artificially imposed. In the DNA there is an infinite intelligence at work, but it is creating beings with finite intelligence, so evidently it only allows those creatures a limited access.

Once we appreciate the overall concept that access to the infinite intelligence in the DNA is arbitrarily restricted, then all the various ways that we may forget things are merely the means by which the restrictions are put into effect. Sheldrake lists several different causes for forgetting. For instance, we forget all the mundane, repetitive things that we do as a matter of course every day. The explanation for this is that they immediately pass out of our short-term memory, and are not stored as long-term memory. The real explanation is, however, that our own brain acts as a short-term memory filter. Such repetitive functions are in fact stored, for all of us, forever in the DNA; but because we can no longer access them, it appears to us to have passed out of short-term memory. Essentially, limited access to the infinite intelligence in the DNA means that we have a limited ability to retrieve information. This limited access to retrieve can be brought about by natural causes such as passing out of short-term memory, or limited IQ, or disease or brain damage or whatever. There are many reasons that appear to explain why we have a limited ability to retrieve memory data stored in the DNA.

Sheldrake says: "On the hypothesis of formative causation, the reason we have our *own* memories is that we are more similar to ourselves in the

past than we are to anyone else; we are subject to a highly specific self-resonance from our own previous states. But we are also similar to members of our own family, to members of social groups to which we belong, to people who share our language and culture; and indeed, to some extent, we are similar to all other human beings past and present. If we are influenced by morphic resonance from particular individuals to whom we are in some way linked or connected, then it is conceivable that we might pick up images, thoughts, impressions, or feelings from them, either during waking life or while dreaming, in a way that would go beyond the means of communication recognized by contemporary science." This is precisely the networked intelligence at work, brought about by hypercommunication of information in the DNA.

As evidence that this sort of communication is occurring, Sheldrake cites the phenomenon of mental telepathy. There are many documented instances of mental telepathy, and all of us experience from time to time a situation that can only be explained as non-conventional mental communication, and yet from a strictly scientific point of view mental telepathy is physically impossible, and cannot occur. Similarly, Sheldrake cites the well-documented phenomenon of experiencing past lives. Sheldrake says: "Some young children spontaneously claim to remember a previous life, and sometimes give details about the life and death of the previous person whom they claim to be. Careful research has shown that some of the details they give could not have been known to them by normal means. Dozens of case studies of this type have now been documented in detail. (Descriptions of previous lives have also been given by adults under hypnosis, but many seem to contain a large element of fantasy and the evidence for 'paranormal' memory is much less impressive than in the spontaneous cases in young children)".

The Hindu doctrine of reincarnation is often cited as an explanation for memory of past lives, however Sheldrake seeks to explain it with his doctrine of morphic resonance as formative causation. He says that a person may, for some reason, tune in by morphic resonance to a person who lived in the past. In this way the person who experiences the memory of a past life does not logically have to have been the other person in a past

life. In Sheldrake's view, it is more likely a transfer of memories from a person who has lived in the past. In other words, the morphic resonance from other people acts as a kind of pooled memory. Here now is the precise theory of Matti Pitkänen that memory is stored as binary data in the DNA. If the memories of all creatures that have ever existed are stored in the DNA, then this explains how any of us could from time to time experience a memory trace that we do not recognize as our own. It is not that we have lived that life in the past. However that memory of a person who has lived in the past is still currently stored in the DNA memory bank. Much of our dream imagery that we do not recognize may simply be the memories of other people stored in the DNA. Indeed it is conceivable that we actually retrieve the memories of non-human creatures as well, but because it is actually a non-human memory trace we can't relate to it at all and simply don't know what to make of it. There are as well instances of people who claim to have memory traces of a past life as a member of some other species. It is all there in the pooled memory in the DNA, and is accessible by anyone.

Sheldrake advances his theory of morphic resonance in order to explain how many insect communities seem to have a common mind. Termite nests, for example, that can contain millions of individual insects, are constructed and operate as if there is only one mind at work. Termites are particularly interesting because they are actually blind, and yet they can construct a nest, each insect playing its own part and starting from different points, where the final outcome displays remarkable symmetry with all the diverse components lining up exactly. Biologists can provide no plausible explanation for this, although there are many theories. Sheldrake says: "According to the hypothesis of formative causation, the organization of social systems depends on nested hierarchies of morphic fields, with the overall field of the society organizing the individual animals within it through their morphic fields, which in turn organize their component organs, and so on down to the cellular and subcellular levels."

By means of these morphic fields, Sheldrake seeks to explain not only the organization of termite colonies, but also beehives and a wider variety

of colonial invertebrates, such as the Portuguese man-of-war and the *Nanomia*. "These specialized individuals within the colony are effectively like organs in an organism, and some are even connected together and coordinated through nerves. Such forms of life seem to be both colonies *and* organisms. Other colonial invertebrates, such as the corals, can likewise be regarded as both at the same time."

Sheldrake quotes the work of South African naturalist Eugene Marais who studied the termite nests, and came to the conclusion that the queen was like the 'brain' of the community; and that she was somehow directly connected with all the other members of the community through means over and above conventional chemical or physical explanations. There is here some sort of psychic connection between the queen and all her followers, and Sheldrake suggests that this linkage should be thought of in terms of a morphic resonance. Again, Sheldrake quotes the findings of the naturalist Edmund Selous who studied the behavior of flocks of birds while in flight. The way a vast flock of starlings, for instance, turned, wheeled and reversed the order of their flight, suggested to Selous that all the individual starlings were merely component parts of a larger organism. Selous was convinced that their behavior admitted of no normal sensory explanation, and could only explain it on the basis that some sort of thought transference was at work, so rapid that it was actually simultaneous collective thinking on the part of the entire flock. According to Sheldrake these flocks of birds all form part of a unified morphic field, which is the only way to explain how they can all act in concert with such harmony and split-second precision.

Fosar and Bludorf take Sheldrake's explanation further and argue that the morphic field is actually brought about by hypercommunication of information in the DNA. Rather than a morphic field, which is too vague a concept, it should actually be thought of as a networked intelligence, which means literally that these birds and the other insects as well, do act as a group with a collective mind. The whole group is connected at the level of the DNA, so it is not a case of all the individuals independently making the same decision simultaneously, but rather all the individuals

are part of a larger network that is making the one decision in which they all share and participate.

The same considerations apply to the habits, customs and traditions of many animal and insect species. "There is in effect a kind of social memory. Spectacular examples of such traditional behavior are provided by many migratory animals. Herds of reindeer, for instance, follow traditional migration pathways and return annually to the same calving grounds; various species of ducks, geese and swans migrate in flocks of mixed ages along traditional routes year after year; and some of the breeding grounds of colonial birds are known to have been used for centuries." So their social behavior is shaped by the morphic fields of the group that is built up generation after generation through morphic resonance that will allow past patterns of activity to shape the current behavior of the species. This forms some sort of self-perpetuating group memory.

According to Matti Pitkänen there is indeed such a group memory in our genes, but it is much more than a vague morphic resonance built up from patterns of behavior in the past. The DNA of all species has the capacity to store and transfer information as binary data, and effectively there is a pooled memory for all species in the DNA which allows each species to draw upon the behavior of its own in the past in order to determine its behavior in the present; but in addition can allow the hypercommunication of information amongst all species (including plants), which actually means that there is a collective memory for the entire universe.

Theories abound that our genes are responsible for our cultural heritage and our social behavior (including our altruism). Sheldrake also seeks to explain this in terms of morphic resonance. He takes the view that human societies, just like termite nests and bee hives, can be regarded as organisms. "Despite this great diversity, all human societies have certain fundamental features in common. All involve the incorporation of individuals into social groups; all have language; all have structures of kinship and social organization; all have myths and rituals which are in some way related to the origin of the social group and its continuation; all

have customs, traditions, and manners; all impose upon the people within them a variety of expectations, obligations, rules, and laws; all have systems of morality; and all function as more or less cohesive, self-organizing wholes."

"Moreover, all societies and social groups involve an awareness of the group as a unit. People not only belong to families, tribes, clans, communities, nations, teams, schools, regiments, colleges, companies, corporations, clubs, or associations, but they *know* that they are members of the group and have some conception of it as an entity. They are likewise aware of the existence of other such social entities to which they do not belong."

"The idea that societies are wholes that are greater than the sum of their individual parts seems to be taken for granted almost universally. All of us have grown up with it. The parallel between societies and organisms is so pervasive that it is built into conventional phrases such as the *body politic*, the *arm of the law*, and the *head of state*. Economies too are thought of as if they are living organisms: they develop and grow, create demands, consume resources, can be healthy or sick, and so on. Political discourse is replete with phrases that take for granted the reality of collective entities such as parties, pressure groups, social classes, trade unions, companies, corporations, governing bodies. Such vaguely defined concepts as the will of the people, the national interest, spheres of influence, and the defense of the realm are not mere abstractions: they play a major role in shaping political actions and have come to have enormous effects on the world."

This is undoubtedly the most significant issue of all. And Sheldrake expressed it all beautifully. Where do our values, our social characteristics, our ethics, our morals come from? Some people say they come from our environment and upbringing, others would say they are determined by our genes, Sheldrake says that they are determined by morphic fields built up from generation to generation. Fosar & Bludorf would say that the networked intelligence, which sets up the consciousness of all living beings (including plants) is responsible for our social behavior, our altruism and our morals. Still others would say that these aspects are

ordained by God, without enquiring too deeply about the logical implications of there being so many gods, if that is the case.

As Sheldrake points out, there are so many similarities in the social behavior of human beings all over the world, and he can logically explain their differences as well on the basis that each culture or ethnic group can build up its own morphic field based on the customs and habits of preceding generations. The morphic field explanation is consistent with the networked intelligence explanation inasmuch as the memories of all sentient beings (including plants) are stored as binary data in the DNA. So when the genes are passed on, the stored memories are also available to shape the habits and morals of future generations, no matter what ethnic or cultural group they may belong to.

From this point of view the morphic fields are not only responsible for our altruistic behavior and our morals, but they are also responsible for our evil tendencies and our immoral behavior. According to Sheldrake, we can have bad or immoral tendencies now because we have had bad or immoral tendencies in the past, and this is what has shaped our morphic field. The same applies for the networked intelligence though. The countless memories of previous generations are stored in the DNA as binary data, and it is this data that is responsible for our consciousness. Therefore, it is logical to assume that our consciousness in the here-and-now can have access to bad or evil thoughts, and carry those evil tendencies through into actions, which will in turn be stored in the DNA to shape the conduct of future generations. What you have then is a self-perpetuating process where both good and bad tendencies are stored in the DNA as a result of the generations that have preceded us.

That explanation would appear to be logically complete and consistent. What it does not explain however is motivation (i.e. desire). There is more to life than simply generation after generation acting out what they have done in the past. With each new generation there is obviously much that can be explained in terms of what has gone before, but there is something else as well. The motivation to live is there as fresh and vibrant as ever. There is a fundamental desire component that drives us on, and then for most of us, the way we seek to satisfy or satiate that

desire will push us along the well-trodden and conventional paths. Sheldrake's morphic fields, or Fosar & Bludorf's networked intelligence, can explain the various ways we adapt to fulfill our desire, based upon the ways this has been done in the past. But the desire itself is always fresh and new, and with every succeeding generation new ways will be added in attempts to fulfill that desire.

This desire is actually a fundamental lack that is instilled into us at the moment of birth. It is the trauma of birth that creates in us anew the desire which will drive us throughout our life. At the moment of birth we lose the conditions that we enjoyed in the womb, and try as we might, we will never find that ideal state again. That is the lack which can never be fulfilled. We will go to our grave always seeking to satiate it, but we never can. From the point of view of the networked intelligence, the paradise lost is actually programmed into us.

In the last resort it is not satisfactory to explain bad or evil conduct on the basis that we have behaved that way in the past, and it is therefore part of our morphic field. Desire as a sense of lack explains the motivation for everything that we do. All our social behavior and our habits ultimately depend upon desire, where we seek compensation for what is lost at birth. Our initial reaction to being born is a total sense of loss and annihilation. The primary motivations that arise from this as our personality develops is hatred for the world and *will to power*, as per Friedrich Nietzsche. Aspects of this can be identified as sadomasochism, but the fact is that this hatred for the world and will to power permeates everything that we do. What we actually refer to as 'good' or 'right' behavior are merely terms given to conduct that furthers our hatred for the world and will to power. Good is what is in our interest. Effectively all conduct has as its base this desire to obtain compensation for what was lost at birth, and the morphic field that arises from our conduct through the generations merely contains the infinite number of ways we have grappled with this desire for compensation in the past.

The morphic field does not explain our social behavior and values; it merely records, or memorizes, our previous attempts to regain what was lost. Essentially, the morphic field explains what we consider to be 'good'

or 'bad.' It does not explain the nature of desire or the will to power that arises out of it. At the basic level there is no such thing as 'good.' There is only this need for compensation for what was lost. What we come to consider as 'good' and 'bad' is all based on this flawed motivation. Something is 'good' if it in some way furthers our own ends.

According to Sheldrake, structures of thought and experience of past generations comprise the morphic fields that determine our own thought and conduct at the present time. Carl Gustav Jung expressed a similar concept with the notion of archetypes as innate psychic structures that make up a collective unconscious mind. Jung wrote as follows: "The collective unconscious is a part of the psyche which can be negatively distinguished from a personal unconscious by the fact that it does not, like the latter, owe its existence to personal experience, and consequently is not a personal acquisition. While the personal unconscious is made up eventually of contents which have at one time been conscious, but which have disappeared from consciousness through having been forgotten or repressed, the contents of the collective unconscious have never been in consciousness, and therefore have never been individually acquired, but owe their existence exclusively to heredity. Whereas the personal unconscious consists for the most part of complexes, the content of the collective unconscious is made up essentially of archetypes."

Those archetypes surface in the dreams and myths of all people, and for this to happen they must be somehow stored in the DNA, although as Sheldrake points out, Jung was unable to explain how such inheritance could occur; and his idea is clearly incompatible with the conventional mechanistic assumptions that our genes simply have a chemical role in the synthesis of proteins. If, however, Matti Pitkänen is correct - that our memories are actually stored in the DNA as binary data, and this data is capable of transmission in the DNA of all sentient beings via magnetic wormholes - then this provides a complete and specific explanation for Jung's collective unconscious. These archetypes surface in the dreams of people of different races, cultures and linguistic backgrounds because of the networked intelligence.

So what exactly is recorded in the DNA? According to Matti Pitkänen, our consciousness is made up of space-time sheets. We should think of them as the individual slides that make up a motion picture, only with these time sheets, they include not only an image and sound, but also input for the other senses as well. Each individual space-time sheet contains what we become conscious of through the senses. These are what is generated by the DNA, and these are what is recorded in the DNA. And this is for every sentient being (including plants) that is currently alive or has ever lived. This is an impossible amount of information to store, you may think. But we must consider the amount of storage space that is available. Every living cell contains the full complement of chromosomes for that species, and any single chromosome has a vast storage capacity. The number of chromosomes existing at any time is simply a vastly infinite number and there is more than enough storage capacity there to contain the space-time sheets for all creatures living or that have ever lived. What it means is that the Universe is actually a vast data storage system of volatile memory (i.e. data that is constantly being changed and updated).

Also, the essential feature is that space-time sheets are only generated when something is perceived. Anything that is not perceived simply doesn't exist. So it's not a case that space-time sheets are being generated for everything in the universe all the time. This would be an impossible amount of information to store. And in any event, this is not what memory is about. Memory is the recorded space-time sheets that create the consciousness of living creatures. It is this data that is recorded, and it is this data that we can access when we recall our own personal memories; and exceptionally, it is this data that is accessed by certain individuals who have a past-life experience or a déjà vu experience, or other paranormal experiences of that nature. In the next chapter, we look at the evidence for past life experiences.



2

Past lives

Past life experiences are a positive indication that there is a communal data pool that records the lives of all creatures that have ever existed. Much of the past lives literature seems to approach this phenomenon from the point of view of reincarnation: that is, each individual lives a series of

lives, and in some cases an individual may remember certain aspects of a previous life. This approach is not quite correct. It is based on a fallacy about what is meant by reincarnation. For a start, it is not individuals that reincarnate. The divine inner self is what incarnates in all living creatures, and when a creature dies, the inner self will then reincarnate into another creature. The inner self is common to all creatures, and it is the inner self that is doing the incarnating and the reincarnating. It is a widely held belief that in Hindu philosophy a person can come back in the next life as a member of a different species, for example a dog, or a rat or a snake. This is not the case. The inner self incarnates all creatures. So when a person dies, the inner self leaves that body and can reincarnate into any creature. But there is no such thing as a certain individual leading a series of lives, as humans or as other creatures or plants. The common thread is simply that the space-time sheets for all creatures, human or otherwise, are recorded in the DNA and from time to time living creatures can access this pooled memory data. This is what gives them the impression that they have lived before.

It is undeniable that people can have past life impressions. There is a lot of literature on it. The mere fact that they are having these impressions is proof positive that pooled memory data exists. It seems that not everyone could or would agree that this pooled memory data must be in our DNA, but it is really very difficult to envisage where else the pooled memory data might be, if not in our DNA. In the last chapter I set out the argument for the pooled memory data being in our DNA, and in the next chapter I will look specifically at how the data is stored and accessed. In this chapter it is proposed to review the literature on past lives to see how strong the evidence is for people being able to access pooled memory data. I personally have never had a past life experience. Many times in my dreams I have viewed scenes that seem vaguely familiar to me, or that I have the impression of having seen or visited before. I have never specifically had the impression that I have seen that, or done that, in a past life. I am therefore totally reliant on what other writers have had to say about this.

Carol Bowman, in her book *Children's Past Lives*, tells us about the past lives memories of her two children, Chase and Sarah. Her young son, Chase, burst into uncontrollable crying at a children's 4th July party where there were loud fireworks. She had no idea what could have caused his anguish because normally he was a very active happy child. Sometime later Chase was regressed by a past-lives therapist during which he related in a mature, manly voice, that he was a black-skinned soldier.

"I'm standing behind a rock. I'm carrying a long gun with a kind of sword at the end."

"I have dirty, ripped clothes, brown boots, a belt. I'm hiding behind a rock, crouching on my knees and shooting at the enemy. I'm at the edge of a valley. The battle is going on all around me."

"I'm behind a rock. I don't want to look, but I have to when I shoot. Smoke and flashes are everywhere. And loud noises: yelling, screaming, loud booms. I'm not sure who I'm shooting at – there's so much smoke, so much going on. I'm scared. I shoot at anything that moves. I really don't want to be here and shoot other people."

"I'm crouching on my knees behind the rock. I'm hit in the right wrist by a bullet someone shot from above the valley. I slide down behind the rock, holding my wrist where I was shot. It's bleeding – I feel dizzy."

"Someone I know drags me out of the battle, and takes me to a place where they took soldiers that are hurt – not like a regular hospital, just big poles, like an open tent, covered with material. There are beds there, but they're like wooden benches. They're very hard and uncomfortable."

"I'm walking back to battle. There are chickens on the road. I see a wagon pulling a cannon on it. The cannon is tied onto the wagon with ropes. The wagon has big wheels."

Carol Bowman relates that her son Chase actually had severe eczema on his wrist in the spot where he was shot in the past life. Soon after that regression where he related his past life, this eczema cleared up and never returned. Also, Chase never had any further fear of loud noises.

Some years later, the Gulf War broke out. Carol picked Chase up from school and he said to his mother: "They'll never make me fight again." Carol was astonished to hear this, and so she tried another regression with

Chase to see if he had more to relate. By this time Chase was eight years old.

“Can’t hear sounds, but can see it. I see horses coming in the valley. Men with guns with spears on the end. I see myself crouching behind a rock, looking up at them. I’m feeling sad, scared, proud. There are soldiers on horses on my side. I’m now kneeling behind a rock. Waiting.”

“There’s a battle going on. Smoke everywhere. I’m not shooting. I’m waiting. I start to shoot at the enemy – I don’t have any choice. I want to protect myself. The people on the horses are white, I’m black. White soldiers are on my side. There’s too much going on. Confusion everywhere. I’m scared half to death. Oh – he gets my wrist with a shot. It hardly hurts. Everything goes black.”

“Now I’m going back to fight with a bandage on my wrist. I see horses pulling a cannon, making a lot of dust. The cannon is on a wagon with big wheels – it’s tied down with heavy ropes. There’s chickens walking along the road. It’s a time between fighting. I’m thinking about how unhappy I am about going to war. I didn’t know what I was getting into.”

“I’m back in battle. I’m shooting a cannon from the top of the valley. I pull a string, the cannon fires. I’m not loading it, though. I can’t shoot a gun because of my arm. I’m scared shooting the cannon. Now I know how the others feel to be shot at. They’re scared too.”

“I’m at a house. It’s mine. Sort of a cabin made of rough wood. The house has a front porch with a railing – a place to hitch horses. There’s a rocking chair on the porch, and a door in the middle. I have two kids. I think I have a wife – I do. I’m happy. It’s before the war. I was where the blacks are free. I see my wife – I see her from behind. She’s in the house. She’s wearing a blue dress with petticoats and black boots. She has straight hair she wears pulled back in a rag.”

“I see a black man on the porch smoking a pipe – it’s me. I’m not young – about thirty or something. I’m very happy in the town. I wasn’t born there, but I was brought there as a baby in a covered wagon. I’m a painter and a carpenter, and I make pots and sell them and make models out of wood for a hobby. There’s a green area behind my house with bushes around. That’s my favorite place – that’s where I make my pots.”

"There's a dirt road in front of my house that goes to town. My town is a friendly town with wagons and farms. Chickens walk free. There are other black people who get along pretty well. The name of our town is something like Colosso. It's eighteen-sixty-something, at the beginning of the war."

"People are standing around a post where the roads meet – it's the center of the town. There's a lot of excitement; they're talking about the war. I'm reading a notice attached to the post. The notice says 'WAR' and has little print. I'm not sure that I can read, but I know the notice is asking for volunteers. I get excited too, and I volunteer. I sign a paper. I don't know what the paper says. I can't read."

"I'm leaving my family. This is a sad time for me and my family, especially my kids. They're crying. I'm very sad. This is the saddest time of my life."

At this point Chase stopped talking, as he felt the sadness. After a long pause, Carole asked him: "And then what happens?"

"We're meeting with someone important, a general or something, after I join. He's talking about strategy. It's for my own good to listen. But I'm not paying attention – I'm thinking about my family. I feel totally pushed around, and I don't like it. People around me are more sad than scared."

Chase paused, then jumped back to the scene in the field hospital.

"I'm hurt in the wrist. I'm under a big cloth held up by poles – it looks like a teepee or a covered wagon – wide open on the sides. It's very crowded. A lot of noise – war in the background, gunshots. Someone is putting bandages around my wrist. Others are screaming because they're in so much pain. I'm thankful I don't have as much pain as the others. I guess my wrist isn't that bad. I'm sad to go back to battle. I miss my family. I'm behind the cannon. I'm hit!"

After a pause, Chase continued on his own:

"I'm floating above the battlefield. I feel good that I'm done. I see the battle and smoke below. As I look down on the battlefield, everything is still and smoky – nothing is moving down there. I feel happy that I'm done. I get to go to a happier life. I float over my house. I see my wife and

kids. I say goodbye to my family. They don't see me because I'm in spirit, but they know that I'm dead."

After a short pause, Carole asked Chase what he had learned from his lifetime as a soldier. She states she was amazed by his reply.

"Everyone has to be in a war. It balances everything out. Not necessarily die in war, but experience it. It teaches you about feelings. It gives you a sense of how other people feel. It's a bad place. I skipped World War II. I was up. I was waiting for my turn to go back to a more peaceful time. I had a short life in between."

Carole says she listened in wonder as her young son talked about universal balance and compassion. He spoke with a wisdom far beyond his eight years. His words and his tone of voice sounded as though they were coming from an old soul.

Carole Bowman tells us that her nine-year-old daughter Sarah had a terrible fear of house fires. This was perplexing because Sarah had not had any actual experience that could explain this fear. Carole took her daughter to a therapist experienced in past-life regressions, by the name of Norman. Carole relates what they came up with:

"Sarah described a simple two-story wooden house, shaped 'like a barn' and surrounded by woods and farmland. A wagon road, overgrown with grass, passed in front of the house. She saw herself as a girl, about eleven or twelve years old (older than she was in her current life). She said she spent most of her time working around the house helping her mother, and sometimes helping her father with the animals. She didn't go to school because 'they don't believe girls need education.' She saw a younger brother who couldn't help with the work. Squeezing her closed eyes to see more details, she added that her brother may have been handicapped in some way."

"Up to this point, Sarah told her story as an observer, objectively reporting what she saw, without any involvement or emotion. Then Norman suggested she 'move ahead to the time when your fear of fire started.' Sarah's perspective shifted. Now she spoke as a young girl, in the present tense, totally absorbed in the terror of her predicament."

"I wake up suddenly and smell smoke – I know the house is on fire. I'm scared. Panicked. Can't think. I jump out of bed. Flames and smoke everywhere. I run across the hall looking for my parents. Big flames cover the stairs and banister. Small flames shoot up through the cracks in the floor. The bottom of my nightgown is on fire! I'm running into my parents' room. They're not there. Their beds are made. Where are they? I keep running until I'm trapped in the far corner of the room. I'm shaking as I stand in the corner. Why don't they save me? Why don't they get me out?"

"A beam covered with big flames falls down right in front of me, and breaks a hole in the floor. Fire is everywhere. There's no way out. Oh, it really hurts to breathe. I know I'm going to die!"

Sarah sat silently for a while. Norman waited, then softly asked Sarah, "What are you experiencing now?"

"I feel myself floating high over the treetops. I feel light, like air. I guess I'm dead. I don't feel any pain. I'm relieved that it's over. That was awful."

Norman asked Sarah if she could see her family now.

"There's my house – it's totally covered with flames. The roof is gone. I can see my family in the yard. My brother is sitting on the ground, and my father is holding on to my mother, who's crying and waving her arms at the house."

Sarah began to cry deeply as she described her family.

In his book, *Twenty Cases Suggestive of Reincarnation*, Dr. Ian Stevenson sets out the strongest evidence he could find for reincarnation during a lifetime of research. Dr. Stevenson devoted his life to investigating any incident that was reported to him that may shed light on this question, and in total built up a research portfolio of several thousand cases. We may be assured that the evidence presented by Dr. Stevenson is the best evidence available.

Case 1 presents an Indian boy named Prakash who, at the age of five, began to report vivid memories of a previous life as a boy named Nirmal, who had lived in a neighboring town approximately six miles away. It seems at that early age, he was able to name Nirmal's relatives and friends. "At that time he began waking up in the middle of the night, and running

out of the house to the street. When stopped, he would say he 'belonged in' Kosi Kalan, that his name was Nirmal, and that he wanted to go to his old home. He said his father was Bholanath. He woke up and started to run away like this four or five nights in a row; and then somewhat less frequently, but continuing to do so for a month altogether. He so strongly importuned his family to take him to Kosi Kalan that one day in 1956 (in the hope of quieting him), his paternal uncle took him on a bus to Kosi Kalan." At that stage Prakash did not recognize anything in Kosi Kalan, although he actually went to a shop that turned out to be the shop of Sri Bholanath Jain, who was the father of a child called Nirmal who had died of smallpox in April, 1950.

Dr. Stevenson states that Case 2 was unusual in that the past life recalled was of a boy that did not actually die until about three and half years after the birth of the 'physical body of the present personality.' Strictly speaking this cannot be a case of reincarnation, but if we are able to retrieve memories from a common pool in the DNA, then there is no logical impediment to be able to retrieve the memories of a person who was still alive at the time of the present personality's birth, but has subsequently died. That is to say, it is not a case of reincarnation; but it is a case of memory retrieval of a person who lived previously.

The relevant facts of this case are as follows: "In the spring of 1954, Jasbir, three-and-a-half year old son of Sri Jat of Rasulpur, District Muzaffarnagar, Uttar Pradesh, was thought to have died of smallpox. Jasbir's father went to his brother and other men of the village proposing that they assist him in burying his 'dead' son. As it was then late at night, they advised postponing burial until the morning. Some hours later Sri Girdhari Lal Jat happened to notice some stirring in the body of his son which then gradually revived completely. Some days passed before the boy could speak again, and some weeks before he could express himself clearly. When he recovered the ability to speak, he showed a remarkable transformation of behavior. He then stated that he was the son of Shankar of Vehedi village and wished to go there. He would eat no food at the home of the Jats on the grounds that he belonged to a higher caste, being a Brahmin. This obstinate refusal to eat would surely have led to a second

death if a kindly Brahmin lady, a neighbor of Sri Girdhari Lal Jat, had not undertaken to cook food for Jasbir in the Brahmin manner.”

In case 3, an infant of one and a half years of age, called Sukla, who was barely able to talk was often observed cradling a block of wood or a pillow and addressing it as ‘Minu’. When asked who Minu was, Sukla said it was ‘her daughter’. For the next three years Sukla revealed more information about Minu, her daughter, as well as her husband in a previous life, and the names of the two younger brothers of her husband, Khetu and Karuna. She said that she and her husband and daughter lived in the district of Rathtala in Bhatpara. This village of Bhatpara was approximately eleven miles away from where Sukla’s family lived. Sukla’s family had heard of the village of Bhatpara, but they knew nothing of this district of Rathtala. Sukla’s father made some inquiries, which revealed that there actually lived in Rathtala a person called Khetu who had had a sister-in-law named Manu, and this sister-in-law had died leaving an infant girl child, named Minu. We are told that when Sukla was five years of age her family actually took her to Rathtala, and she met and correctly named and recognized several of her family members in her previous life.

Case 4 presents a three-and-a-half year old girl, called Swarnlata, who went with her father on a trip of some 170 miles to another city. “On the return journey, as they passed through the city of Katni (57 miles north of Jabalpur), Swarnlata unexpectedly asked the driver of the truck they were in to turn down a road toward ‘my house’. A little later, when the group was taking tea in Katni, Swarnlata proposed that they could obtain much better tea at ‘her’ house nearby.” When Swarnlata and her father returned home, she told other children about her previous life in Katni as a member of a family named Pathak. About two years later, Swarnlata performed some unusual dances and songs which she would have had no opportunity to learn. Some ten years after the initial incident, Swarnlata met a woman from Katni whom she claimed to recognize from her previous life in that city. Subsequent investigations turned up the Pathak family living in a house described by Swarnlata. All indications were that

Swarnlata in her previous life was a woman named Biya, a member of the Pathak family, who had died some twenty years before.

In Case 5 a boy named Ravi Shankar born in the Chipatti District of Kannauj, near the city of Kanpur, who was between two and three years old, began to describe himself as the son of Jageshwar, a barber in the same district. Ravi Shankar also gave details of 'his' murder, and named the murderers, the place of the crime, and other circumstances of the life and death of Munna, his name in the previous life. As it turned out there really was such a boy named Munna who was the son of Sri Jageshwar Prasad, a barber in the district, who was brutally murdered when he was six years old. Apparently the alleged murderers of Munna were arrested, and one of them gave a confession which he later retracted. Owing to lack of substantial evidence they were subsequently released and went free. The statements made by Ravi Shankar was further evidence tending to identify these murderers, but this evidence was found to be inadmissible at law. Notwithstanding this further evidence identifying the murderers of Munna, the authorities were not able to reopen the criminal prosecution against them.

Munna's head was cut off, and Ravi Shankar had a linear mark resembling a scar on his neck. This scar was congenital although it resembled closely the scar of a long knife wound across the neck. His mother first noticed the mark when he was three to four months old. "When Ravi Shankar talked about the murder of the previous life, he would say that the mark on his neck derived from the wounds of the murder. As Ravi Shankar grew, the mark gradually changed position until in 1964 it was high on his neck just below his chin."

Case 6 concerned a young girl, named Mallika, who at four years of age visited the upstairs apartment of the owner of the apartment where her family was living. "There she noticed some embroidered cushions lying on some chairs in the apartment. She immediately pointed to them and said: 'I made those.' The cushions had in fact been made by Srimati's deceased sister Devi, and when Srimati told Mallika that the cushions had been made by a woman who had died more than ten years earlier, Mallika shook her head and replied: 'That was me.' Devi was actually Srimati's

sister and Mallika, right from the start, likewise addressed Srimati as 'sister', although Srimati was a middle-aged woman. And subsequently when Mallika was introduced to Srimati's family, she addressed Srimati's (and Devi's) brother as 'brother', although he was at that stage a fifty-five year old man. Mallika also spontaneously recounted an anecdote about a cow that the family had owned many years before that Devi would have known about, but which was impossible for Mallika to know about without the benefit of the past life memory.

Case 7 tells of a boy named Parmod Sharma. "When he was about two-and-a-half, he began to tell his mother not to cook because he had a wife in Moradabad who could cook. Later, between the ages of three and four, he began to refer to a large soda and biscuit shop which he said he had in Moradabad. He asked to go to Moradabad. He said he was one of the 'Mohan Brothers.' He claimed to be well to do and to have had another shop in Saharanpur. He showed an extraordinary interest in biscuits and shops. He related how in the previous life he had become ill after eating too much curd and said he 'had died in a bathtub.'" It turned out that there were some people in Moradabad known as the Mohan Brothers who owned a soda and biscuit shop as well as another shop in Saharanpur. There was a third brother, Parmanand Mehra who had died shortly before the birth of Parmod Sharma. This third brother had indeed developed a chronic gastrointestinal illness after gorging himself on curd, although the actual cause of death was given as appendicitis and peritonitis. It was also verified that Parmanand had been given a bath just prior to his death, although there was nothing to suggest that he had actually died in the bathtub.

Case 8 refers to a very young girl born in Hedunawewa in central Ceylon, named Gnanatilleka. "When she was one year old she began talking about another mother and father, but she was two before she made her first clear references to a previous life. She then said she had a mother and father in another place, and also two brothers and many sisters. At first she did not give the place of her previous life a specific location, but did so after a visit to her home by some villagers who had been to a town called Talawakele. Hearing about this visit, Gnanatilleka stated that her

mother and father were at Talawakele. She then said she wanted to visit her former parents, and gave further details of the location of her former home and names of members of her family." It was later confirmed that there was such a house in Talawakele, and the people who lived in that house had lost a son called Tillekeratne some two years before Gnanatilleka was born. Gnanatilleka subsequently correctly identified seven members of Tillekeratne's family, as well as two other persons living in this community.

Case 9 is also in Ceylon. This was a young boy born with a marked deformity of his right breast and arm, named Wijeratne, who at the age of two and a half years began to recount his previous life as his own dead uncle. "When Wijeratne was between two and two and a half years old, he began to walk around his house in a solitary way talking to himself. His behavior attracted the attention of his mother, who listened to his talk. She overheard him saying that his arm was deformed because he had murdered his wife in his previous life. He mentioned a number of details connected with a crime of which she, until that time, had heard nothing. She asked her husband about the boy's statements, and he confirmed the accuracy of what the boy was saying, for in fact his younger brother, Ratran Hami, had been executed in 1928 for the murder of his wife." Wijeratne was later able to recount details of the crime, arrest and execution of his uncle in great vividness, much of which Dr. Stevenson was able to verify from the court transcript of the trial. It was impossible for Wijeratne to know anything about his uncle's crime from family discussions; indeed, his father had never even told his mother about his brother's crime.

Case 10 is about a young boy born in Ceylon, who from the very beginning comported himself like an English infant and not like his brothers and sisters. When Ranjith was between three-and-a-half and four years old, his father heard him telling his mother, brother and sisters: 'You are not my mother, brothers, and sisters. My mother, father, and others are in England.' Ranjith's father, Mr de Silva, was very concerned that his son seemed to have no filial affection for himself and his wife, so he decided to question Ranjith further. "He took Ranjith aside and first asked

him where he was from. Ranjith replied that he was from England. When asked the names of his parents, he could not remember, but he gave the names of two brothers as Tom and Jim and one sister as Margaret. He could not remember his own name. But when Mr. de Silva asked about his father's occupation, Ranjith seemed to have additional memories. He said his father worked on big steamers. He brought home pineapples. He worked in the ship and Ranjith took his lunches to him at work where there was a place to keep the lunch. His house was on top of a hill without other houses close by, but with another at the bottom of the hill. Ranjith then added spontaneously that at the time, he put on a jersey and an overcoat and moved near a fire in the morning, because there was ice in the garden and on the roads. Wagons came to pick up the ice on the roads. When Mr. de Silva asked Ranjith whether the wagons were motor wagons, he said they were horse wagons. Ranjith further stated quite spontaneously that he was not a Buddhist, but a Christian. He said he took his brothers and sister to church every Sunday on the pillion of his motorcycle. He then added, again spontaneously, that he himself and his mother were very fair; and when asked how fair, he said much fairer than a Burgher (mixed-Dutch descent) lady who was a neighbor of the de Silvas. When asked by his father what his other mother wore, Ranjith said she wore a skirt and jacket. This contrasted with the saris worn by most Sinhalese women. When asked about fruits he ate in England, Ranjith said 'grapes and apples.'" Ranjith's father was mystified by many of the above details given by his son. For instance, in Ceylon he had never seen ice or snow, nor had he ever seen horse-drawn carriages or wagons. As Ranjith grew up, he showed a definite propensity to speak English in the manner as spoken in Great Britain, and not like his brothers and sisters. Ranjith also showed a remarkable aptitude for automobile mechanics and how to drive automobiles and motorcycles.

Case 11 comes from Brazil. This was a case of a woman, named Sinhá, who on her death bed confided to her friend, Ida Lorenz, that she intended to come back as her friend's daughter. Sinhá had been very unhappy in life and she confided to Ida that she had intended to die. She had tuberculosis and had deliberately exposed herself to the cold weather

without adequate clothing. "Then she promised her good friend that she would return again and be born as her daughter. Sinhá further predicted that 'when reborn and at an age when I can speak on the mystery of rebirth in the body of the little girl who will be your daughter, I shall relate many things of my present life, and thus you will recognize the truth.'" Ten months later Ida gave birth to a daughter named Marta. When Marta was just two-and-a-half years old, she began to speak spontaneously about her previous life as Sinhá. Her first of many such statements was to her older sister Lola. She, as little sister Marta, told Lola that when she (as Sinhá) was big and Lola (her older sister) was small, she used to carry Lola often. She went on to describe to Lola the farm of dead Sinhá's parents. Lola told her father (now Ida's husband), F.V. Lorenz, about this. He questioned her further, and Marta related to him another incident in the life of Sinhá. Marta also said in her previous life her name was Maria, and she also had another name that she couldn't remember. In fact, Sinhá's real name was Maria Januaria de Oliveiro, and she was known familiarly as Sinhá or Sinházinha.

F.V. Lorenz relates that he recorded no fewer than 120 instances where Marta spoke of her previous life. Unfortunately his original notes were lost, but in 1946 he published a book in which he detailed many of these instances from memory. Dr. Stevenson himself interviewed Marta when she was an adult. He reports: "In 1962 she was living in Porto Alegre, where I spent some hours with her. She has forgotten much of the life of Sinhá, but by no means all; and said she still retained certain vivid memories of events which happened to Sinhá, most particularly the last scenes of Sinhá's life, and her death from tuberculosis."

Case 12 listed by Dr. Stevenson actually comes from the same family as Case 11 related above. It seems that the Lorenz family had thirteen children. Emilia, the eldest daughter of Ida and F.V. Lorenz was a very unhappy child, and as a young adult she committed suicide. During her lifetime she told several of her brothers and sisters that she wanted to come back as a man. About two years after her death, Ida Lorenz had her thirteenth child, a boy that they named Paulo. "For the first four or five years of his life, Paulo resolutely refused to wear boy's clothes. He wore

girl's clothes or none at all. He played with girls and with dolls. He made several remarks asserting his identity with Emilia. He exhibited an unusual skill for sewing, and also had in common with Emilia a number of other traits or interests. When Paulo was about four or five, a pair of trousers was made for him out of a skirt formerly worn by Emilia. This seems to have appealed to him, and he permitted himself to wear boys' clothes. Gradually his sexual orientation shifted toward the masculine side, but important elements of femininity were obvious into his teens, and a strong feminine identification (for a man) persisted to the time of my investigation of the case in 1962." Dr. Stevenson states that he interviewed separately all the older sisters of Paulo, and he was satisfied that they were all giving their own spontaneous account of Paulo's memories of his past life as Emilia.

Case 13 comes from Alaska and concerns a very young Tlingit Indian named Jimmy Svenson. His father, Olaf Svenson, was actually half Tlingit and half Norwegian. His mother, Millie Svenson, was a full-blooded Tlingit. "When Jimmy was about two years old he began to talk of a previous life, claiming that he had been his mother's brother, and had lived in the village of Klukwan. Klukwan is a village one hundred miles away. He made a number of statements concerning matters that this uncle could have known about, but which it seems unlikely that Jimmy could have learned by normal means. Often, and especially when angry, he would ask to go to the village of Klukwan to stay with his maternal grandmother. Jimmy talked considerably of his previous life for about two or three years, and thereafter his references diminished."

Bearing in mind that Jimmy was aged two when he started talking about his past life, some of the statements he made sound incredibly mature. For instance he said that his name was John, not Jimmy. His uncle's name was John Cisko. He said he used to live in Klukwan, the village that his deceased uncle lived in. He said he was shot to death in his former life. It was not known how John Cisko died, but one theory was that he was shot to death by the jealous husband of a woman he was having an affair with. He said he used to drink wine which was his uncle's preferred drink. His uncle used to drink wine to excess, whereas his father

used to drink only beer; and his parents never had wine in their home. He gave an accurate description of a lake near Klukwan, and when taken there at age 6 he showed a marked familiarity with people and places in the area.

Case 14 also comes from the Tlingit Indians in Alaska. I mention it only for completeness, for the Tlingits have a strong belief in reincarnation, and the case as set out by Dr. Stevenson does not seem to have material concerning actual memories of the subject in his current life. It seems the parents of the subject thought or believed that their young son was a reincarnation of a deceased relative. Likewise, in Case 15, the principal informant as an adult stated that he no longer had any actual memories of a past life. All he could remember was what he heard from his mother when he was a child. So too, in Case 16, the subject had no memories of his past life. All he knew was what his father had extrapolated from a particular statement he was alleged to have said when he was about three or four years old.

Case 17 deals with specific memories of past lives by a Mr. Henry Elkin of the Tlingit Indians in Alaska. Dr. Stevenson says he examined him 'carefully' in 1962. At that stage Henry would have been 63 years of age. "When Mr. Elkin was a child his mother took him to the old community house in Angoon. When looking around in it, he said he 'saw his grandmother there'. His mother said that such an event had occurred before he was born, but would not discuss that matter further with him. When the Tlingits engaged in their tribal wars (which ceased between 1850 and 1880), their womenfolk would sit in the community houses until the surviving husbands returned from battle. Henry Elkin's grandmother had in fact waited in the community house at Angoon for her husband (and other male relatives) to return from their battles. He was therefore seemingly recalling events that had taken place twenty-five or more years earlier."

"When Henry Elkin was eight, he suddenly 'remembered' an occasion when his father with a companion out in a boat had saved the lives of two other men who, while cutting kelp, had encountered some misfortune and were about to drown. The details of his recollection of this episode were

acknowledged as correct by his parents when he told them. However, once again they told him this had happened before he was born and would not permit him to talk about the subject any more. The memory of his father's rescue of these two men remained clear in Mr. Elkin's mind in 1962."

In Case 18 the informant had a birthmark that others associated with the death of an ancestor, so it is not really relevant to our inquiry about memories of past lives. So too in Case 19 the parents seemed to be associating their child with a deceased ancestor on account of a birthmark.

The final case, number 20, comes from Lebanon. Dr. Stevenson states: "At the first interview with the family of Imad, I learned that he was born on December 21, 1958. He was thus a little over five years of age at the time of my first visit. When he was between a year and a half and two years old he had begun to make references to a previous life. He had mentioned a considerable number of names of people and some events in this life, as well as various items of property he claimed to have owned. Sometimes he talked to himself about the people whose names he mentioned, asking himself out loud how these people were getting along. Apart from such musing to himself, his statements about the previous life came out at odd moments here and there when something seemed to stimulate such a statement. He also seemed to speak about these matters in his sleep. He was still making statements about the previous life at the time of my visits. Imad had given the name of the village (Khirby) where he claimed to have lived and of the family (Bouhamzy) he claimed to belong to; he had importuned his family to take him to Khirby."

Imad's family originally did not take his statements seriously. However, at a later stage Imad spontaneously recognized a person in the street who actually came from Khirby. Sometime after that it was confirmed to Imad's family, by someone who lived not far from Khirby, that there was in fact a family in Khirby that bore the name of Bouhamzy, as Imad had specified. At this point Imad's family actually took steps to verify Imad's claims, with mixed success.

"Since Imad had mentioned a considerable number of names, his family had tried to fit these names into a pattern of family relationships.

The first words he had ever spoken were 'Jamileh' and 'Mahmoud'; and he had repeatedly mentioned Jamileh, and compared her beauty to the lesser attractiveness of his own mother. He also spoke of an accident in which a truck had driven over a man, breaking both his legs and causing other injuries, which led to his death shortly after the accident. Imad had spoken of a quarrel between the driver of the truck and the injured man; and he was thought to believe that the driver had meant to kill the injured man by deliberately running over him with his truck. Imad had also spoken of a bus accident. He said he belonged to the Bouhamzy family of Khirby. And he had further expressed a most unusual joy in being able to walk, saying over and over how happy he was that he could now walk."

Dr. Stevenson states that much of this information had been altered by Imad's parents in an effort to fit it to an actual member of the Bouhamzy family who had lived previously in Khirby. He concludes: "As it turned out, however, the errors of inference made by Imad's family add considerably to the evidence of their honesty, and also to the improbability that they themselves could have provided a source or channel for the information given by Imad."

What has been presented here are excerpts from the literature about past lives. We have all heard of this phenomenon, and none of us doubt that some people really do have the feeling that they have lived a life in the past. What comes to their mind as apparent memories of that past life must, of necessity, be related to their current life and circumstances. In any event, the vast majority of us get no such feelings of having specific memories of what we did in a past life. For most of us, we probably get a *déjà vu* sensation from time to time from perhaps certain images that we have seen in our dreams. We feel that we have seen this image before, but have no idea of where or when.

Matti Pitkänen says that data is stored in the DNA as space-time sheets. In other words, it is not stored in the form of a specific and coherent individual memory of the type that we as individuals may recall as something that we did or saw a long time ago. For an individual to access data of a past life, it is more likely to be simply inexplicable images of the *déjà vu* type, with absolutely no recall about how it relates to them. It must

be remembered that human DNA has simply infinite data storage capacity. Human DNA is in the nucleus of practically every cell of every human being; and all living creatures (including plants) have their own DNA as well. It is suggested that there is enough storage capacity here for the space-time sheets of the lives of every single creature that has ever lived. So when an individual does access an 'image' of something that has occurred in the past, it means that it has come out of the common data storage pool for all of humanity; and it is most certainly not a precise memory of something done or seen by that individual in a 'previous' life.



3

Memristors in the DNA

Our DNA is, of course, located in the nucleus of all human cells with one notable exception: red blood cells. These cells actually amount to about a quarter of the cells in the human body, and they start out with a nucleus and then become enucleated. The blood stream is, however, a primary communication channel throughout the body, and these enucleated cells remain within the DNA information network by virtue of other cell-signaling mechanisms such as hormones and enzymes.

Is the DNA capable of memory storage? We know that more than 95% of the human genome has no known function, and it is dismissed by most scientists as ‘junk’ DNA. In the human genome there are 46 chromosomes, that is to say, 23 pairs of chromosomes. Each person has two copies of each chromosome numbered 1 through 23. The genes on these chromosomes can work in conjunction, which means that both the paternal and maternal allele are expressed, or in many cases one allele is dominant and the complementary allele is not expressed. The DNA itself is a double helix and when the genes are transcribed into RNA, only one strand of the DNA is read; so, in effect the complementary strand has no known function or purpose. Everywhere we look in the genome we see duplication. The double strand of DNA winds around a histone core, which is said to be an

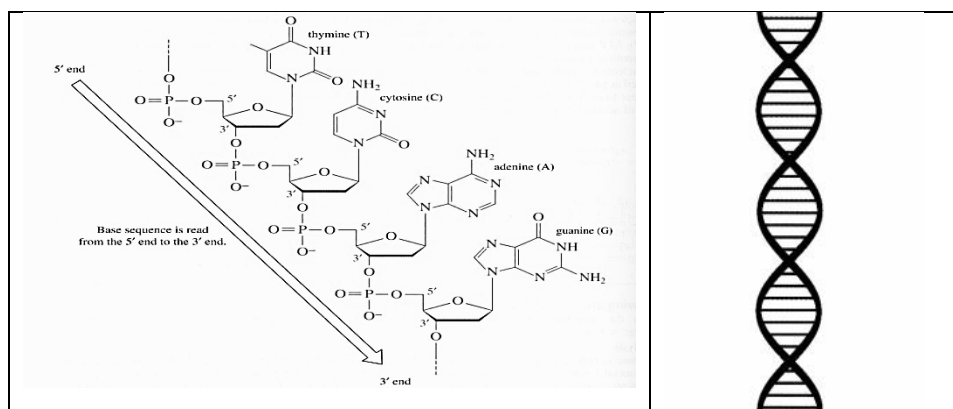
octamer because it is a duplication of the four core histones: H2A, H2B, H3 and H4. There is also a fifth core histone known as H1, and this also is duplicated between each nucleosomal unit. The nucleosome which consists of the double helix of DNA wound almost two times around the histone core (like thread around a spool) is the basic unit of chromatin, the packaging of DNA. In any one chromosome there can be anywhere between several hundred thousand to a million of these nucleosomes, depending on the length of the chromosome. At this level the nucleosomes are said to resemble 'beads on a string'.

As if this staggering amount of duplication were not enough, we now come to the base pairs themselves. These constitute the steps or rungs in the double helix spiral. They are said to be nitrogenous because they contain the element Nitrogen. There are four essential bases: Adenine (A), Guanine (G), Thymine (T) and Cytosine (C). Adenine is always paired with Thymine and constitutes an AT base pair, and likewise Guanine and Cytosine go together as the CG base pair. There are approximately 3 billion of these base pairs AT or GC in a haploid set of 23 chromosomes in the human genome. The entire 23 chromosomes are duplicated to make 46 chromosomes in all, so that makes 6 billion base pairs. Now this is what is in every human cell, and there is somewhere between 50 and 75 trillion cells in the body; and there are around 6.7 billion human beings on this planet; so, in all we are looking at approximately 6 billion \times 60 trillion \times 6.7 billion, which in scientific notation comes to 2.4×10^{33} base pairs of DNA currently in the world. And let us say 3% of these are actually involved in gene expression; that is 7.2×10^{31} .

Now this is only the amount of surplus DNA currently floating around in the human species. I have heard it estimated that there are 1 million species on this planet. Admittedly, not all the other species have as much DNA as humans, but we can safely say that there are, in fact, more base pairs of DNA currently in the world than there are stars in the sky, and grains of sand on the beach put together. That is a rather large amount of something with no known purpose. We are told that there are about 25,000 genes in the human genome. Genes are sequences of DNA that code for proteins. A codon of 3 base pairs (e.g. AGC) codes for a

specific amino acid, and the protein is then fabricated in the cell into long strings (polymers) of these amino acids. I gave a rough estimate of 3% for the percentage of the base pairs that code for proteins because, in fact, the final codon sequence from the DNA that is translated into amino acids has actually undergone a splicing procedure, where non-coding sequences (introns) are removed from the RNA. So even within the gene sequences themselves, there are considerable amounts of supposedly redundant and useless DNA.

Below we see two different models of the double helix DNA strand. On the left is the chemical structure of the single strand of DNA, and on the right is the double helix DNA where the bridges represent the base pairs A-T or G-C.



Let us pose the question on whether a possible use for all of this surplus DNA is in fact data storage. This would at once explain all this seemingly, totally wasteful and inefficient surplus of DNA. Surely it makes more sense to assume that the DNA does have a memory capacity, than to make the current assumption that 97% of the most miraculous and extraordinary substance in the universe is just junk.

We now come to the way the DNA is packaged in chromatin. The first thing to note is that chromatin is actually made up of proteins; so, we will have to consider not only the constituents of the amino acid chains in the chromatin, but also the secondary and tertiary structure of the chromatin,

which may shed some clue as to its purpose. Although geneticists do not know the functions of chromatin (what it does, how it works, why it is there), they do at least admit that the chromatin may serve some purpose in gene expression. So little is actually known about gene expression: what starts transcription, what stops it, why certain regions are spliced out, why certain regions seem to code for multiple genes, and how these multiple genes work in conjunction with each other, etc.; but at least geneticists do not dismiss the chromatin as junk. Overall, they view chromatin as essentially packaging for the DNA. They have documented how the chromatin condenses during mitosis and meiosis. These are the processes of cell division when the entire 46 chromosomes are duplicated, and then the duplicated sets pass into the nuclei of dividing cells. That is mitosis. Then, with meiosis (which occurs only in cells in the ovary or testis line for the creation of gametes) where again the entire 46 chromosomes are duplicated, but then are randomly assorted into (haploid) gametes for procreation. It is well documented that when these processes are going on, the chromatin does seem to play a very substantial role; but it is mainly assumed that this role is simply supportive to enable the process of cell division to occur. It is not conceded that the chromatin plays any role whatsoever in anything that could be involved in the storage or retrieval of information.

Cells that are not dividing, whether during mitosis or meiosis, are said to be in 'interphase'. This is the period when the chromosomes are not condensed. The chromosomes are completely extended, and it is estimated that during interphase, they are 10,000 times longer than when they are at metaphase in meiosis or mitosis. The condensation that occurs is therefore extraordinary. At metaphase chromosome 1, the longest chromosome, has condensed to 50 μm and becomes visible under a light microscope. The karyotype of the human genome, which will be familiar to most people, occurs at metaphase, when it is possible to actually photograph all 46 chromosomes and arrange them in an ordered array pair-wise, according to their size. When the chromosomes are at this most condensed stage, they can be stained with certain dyes which reveal very specific bands. Approximately 1,000 of these light and dark bands have

been identified and counted, and they allow for a reasonably precise description for the region on a chromosome where a particular gene is located. The actual significance of these bands in terms of gene expression or information processing is not known, and it is generally assumed that there is no significance. The chromosomes just happen to stain in that way and no other; and this notwithstanding the fact that they always stain in exactly the same way at exactly the same positions.

The molecular structure of DNA is essentially cylindrical or tunnel shaped with a double helix architecture, which bears some similarities to carbon nanotubes that are used as semiconductors in so much of modern electronics, including transistors, quantum dots and digital and analog integrated circuits. Nucleosomal fiber consists of millions of discreet solenoid coils where the DNA string is tightly looped around a protein (histone) core. The DNA coil is negatively charged due to the phosphate groups in its backbone. Also, DNA has many polar molecules, which are molecules that have charges that are unevenly distributed. The histone core is positively charged. There are therefore myriads of localized potential differences (voltage) in chromatin, which will enable currents to flow in very complex ways. DNA is actually used as an electronic circuit in nanoparticles. In fact, it is said to be 'the best known nanowire in existence'. Measurements of DNA viruses have revealed that high currents flow through DNA molecules.

To my mind, this network of millions of mini coils in the nucleosomal fiber would act as an incredibly complex and intricate circuit of inductors (electromagnetic force (EMF) generated in coils). In a string of mini coils like that, you are going to get self-inductance and mutual inductance as well as back EMF on a scale quite unimaginable. The plethora of localized voltage differences would seem to indicate millions of intertwined RL (Resistor-Inductor) circuits. These mini solenoid coils would all have a precise magnetic moment, and their histone core has a relative permeability that enables 'histone H1-conjugated superparamagnetic nanoparticles' to be used as magnetic tracers to detect concentrations of DNA. A superparamagnetic core of histones will have the effect of substantially increasing the magnetic field within the solenoid. The

electromagnetic properties of chromatin are indisputable. It is likewise indisputable that the chromatin would be a most suitable milieu for memristors to operate in storing data.

In a recent study, *Electric oscillation and coupling of chromatin regulate chromosome packaging and transcription in eukaryotic cells*, which appears in Theoretical Biology and Medical Modelling, are to be found some very curious facts about the electromagnetic properties of DNA. For example, link DNA is said to zigzag back and forth between 'stacks' of these mini coils as well as the histone cores of the mini coils linking with each other. There is said to be a 'permanent dipole moment' between each mini coil which is said to generate 'electric dipolar oscillation' between them. The capacity for mutual induction of emf in the nucleosomal fiber would be virtually infinite. In addition the current that has been detected in the nucleosomal fiber is 'oscillating'; that is to say, it is an alternating current with frequencies between 2 and 50MHz. The frequencies are said to vary from region to region in the chromatin depending on the 'DNA-protein complexes in that region'. As this is essentially an alternating current, it is suggested that the mere fact of the DNA synthesizing the superparamagnetic histone core, and then coiling itself around the core, and then all these coils 'clustering' into 'stacks' in the nucleosomal fiber, would be sufficient to generate a self-perpetuating current.

Another most curious item that emerges in that study is that when the chromatin is not in M-phase - that is, when the chromosomes are not tightly compacted for the purpose of cell division - the chromosomes appear to relax or unwind in the nucleus, and it is during this phase that the non-coding sections of the DNA (the 'junk DNA') adopt the quaint custom of 'chromosome kissing' where these 'introns' on several different chromosomes will be seen to cozy up to each other based on their oscillating natural frequencies. What sort of electrical forces and emf are being generated during these chromosome kissing sessions is anybody's guess. Given, however, the electromagnetic complexity of nucleosomal fiber, it is my guess that the forces would be mind-blowing. At the very least the mere proximity to each other of several chromosomes, with their

respective potent 'junk' electromagnetic fields, would be sufficient to generate a current.

We might then be led to inquire why indeed chromatin should have any electromagnetic properties, when the sole function of DNA is to encode for amino acids. At that point we, like all geneticists, will probably simply dismiss the possible electromagnetic properties as something totally coincidental, with no possible significance for anything remotely resembling information storage or retrieval. They say the histone core is positively charged and the DNA is negatively charged, simply as a packaging device for the DNA; and yet they know that there are oscillating frequencies of electric current within specific regions of the chromatin in all that so-called 'junk DNA'. This is like building a high performance superconducting network to every apartment block, house, railway siding, log cabin and teepee in America, with a central power house in Minneapolis, and then actually using it only as far as Saint Paul, with all that electricity to the rest of the country going to waste.

Just because the genome is an exquisitely complex labyrinth of electromagnetic fields, you may say it doesn't prove that the chromatin is acting as a quantum computer. To which I reply: "Ah, but it does." The fact is the valence electrons in the DNA as they pass through these magnetic fields will have to 'decide' whether to flip their spin, or whether to remain \uparrow (spin-up) or \downarrow (spin-down). And there you have the potential both to store as well as to process data.

We have to look at the quantum mechanical properties of these valence electrons that are the conductors for all this wasted current (electrical current these days is completely explained in terms of quantum mechanics), and we should look at the new types of memory being developed in the computer industry *for memory storage and processing*, which they say are actually to be found in biological computers, notably our own brains.

'Memristors' are four decades in the making, but it turns out that this fourth kind of circuit element (beyond the inductor, capacitor, and resistor) might have more potential to change computing than even its creators first believed, says *Discovery Magazine*.

In a study announced in the prestigious science journal *Nature*, researchers with Hewlett-Packard reported that they have built a memristor capable of performing Boolean algebra operations. Boolean algebra is the essence of computer processing. The computer will know what to write depending on whether a current is flowing in one circuit AND/OR another. Essentially a memristor is a circuit that can remember the resistance it encountered previously before the current was turned off. The Hewlett-Packard team have built a device that can perform logic operations based on the resistance it encountered previously. The name memristor has been coined from 'memory' and 'resistor.' In addition, the Hewlett-Packard team claim that their device has achieved 'stateful logic' which means that the 'state' of the memristor acts as both the computer and the memory. This is most significant because it is a radical advance on current computers, which typically load data from memory, perform operations on it, and then send it back. These memristors have the capacity to store and process information in the absence of an electrical current.

The possibility of creating memristors was first put forward by Leon O. Chua back in 1971. Before this announcement by the Hewlett-Packard team, it was thought that they could be just another kind of memory; in other words, simply passive storage of data. However, it is now evident that memristors have the capacity to perform logic, which means that they have the capacity to process information and not simply store it. This opens up the prospect of building chips that can both perform calculations and hold data; in other words, a chip that will act as both CPU (Central Processing Unit) and memory storage. For conventional computers, processing and memory storage are separate operations.

The H.P. technology is based on the ability to use an electrical current to move atoms within an ultrathin film of titanium dioxide. After the location of an atom has been shifted, even by as little as a nanometer, the result can be read as a change in the resistance of the material. That change persists even after the current is switched off, making it possible to build an extremely low-power device which is exceptionally fast.

This prospect of a chip that can both perform processing and store data is thought to be what occurs in a biological supercomputer such as the human brain. These are obviously the sort of capacities one would expect to find in a biological supercomputer, and indeed Chua is reported as saying, "Our brains are made of memristors. We have the right stuff now to build real brains." What he didn't seem to realize is that potentially the DNA, not just of human beings, but of all living creatures (including plants) is made of memristors. And here is the explanation for the networked intelligence theory of Fosar & Bludorf as well as the capacity for memory storage advanced by Matti Pitkänen.

So with this notion of memristors in mind, let's look at the Pauli Exclusion Principle in quantum mechanics, specifically in relation to the spin of electrons. From the figure above of the base pairs of the DNA molecule it will be seen that they are comprised of four elements: Hydrogen (H), Oxygen (O), Carbon (C), and Nitrogen (N). Hydrogen occupies Level 1 on the Periodic Table which means that in bonding with other elements, it only has one electron in its outer shell, and that it will therefore share the electron with the element it bonds with. Carbon, Nitrogen and Oxygen have two electrons in their inner shell; and four, five and six electrons respectively in their outer shell. So, all these elements bond in such a way that their outer shell is fully occupied with electrons 'shared' with the other elements. Prior to combining in a DNA molecule, the 'spin' state of the electrons in all these elements can be randomly Up (+1/2) or Down (-1/2).

According to the Pauli Exclusion Principle, any orbital in an atom can contain a maximum of two electrons (an orbital containing two electrons is said to be full), and the two electrons in a full orbital must be of opposite spin. So for Oxygen, Carbon and Nitrogen that have an outer shell capable of holding eight electrons, there will of necessity be four orbitals containing two electrons. These are the covalent chemical bonds which usually consist of one, two or three pairs of electrons shared between atoms, each pair containing electrons of opposite spin. This is what happens when a base pair in a DNA molecule is formed. But prior to combining into these covalent bonds, the electrons in the valence shell of

the individual elements can be randomly in a state of spin $+1/2$ or spin $-1/2$. In standard theory there is equal probability that the electrons will be spin $+1/2$ or spin $-1/2$. In entering into an orbital forming a covalent bond with another element, the electron will 'know' whether the other electron is spin $+1/2$ or spin $-1/2$, and it can only enter into that orbital if it has the opposite spin polarization. In some cases the electron will be in a spin state that is the opposite polarization so it can enter into the orbital, and in other cases the electron will have to 'flip' its polarization so it can enter into the orbital. In a nutshell, the outer shell of Oxygen, Nitrogen and Carbon making up the base pair in the DNA molecule will consist of eight electrons in four orbitals, some of which will have flipped their polarization and some will have not. It is this dichotomy therefore, between electrons that have flipped and electrons that have not flipped, which can potentially contain an 8-bit binary code, identical to the 8-bit binary code of 0 or 1 in conventional computing. Simply read 0 for 'not flipped' and 1 for 'flipped'.

When an electron flips its spin from spin-up to spin-down, this is actually a change in magnetic flux. We saw that in the computer industry they are currently developing a new form of processing systems based on memristors. Essentially a memristor is an electrical circuit that has the capacity to 'remember' the change in magnetic flux in that circuit. Even after the current has been switched off, the memristor will remember the previous change in magnetic flux when the circuit is switched on again. This is leading to the development of new forms of logic gates for processing of data.

There are several different types of memristive systems that are either being developed or have been proposed as theoretically possible. In particular there is the 'spintronic memristor', which is based on the spin of electrons in one section of the device pointing in a different direction from the spin of electrons in another section of the device, which creates a boundary between the two states known as a 'domain wall.' Electrons flowing into the device with a certain spin will then alter the magnetization state of the device. Changing the magnetization of the device in turn moves the domain wall, and this will be remembered as a

change in resistance. There is absolutely no doubt that an electron has the capacity to remember a change in magnetic flux, that is to say whether it has flipped its spin or not.

Since quantum mechanics was first developed there has been much debate about the ability of electrons to 'remember' their previous states. David Bohm, for instance, argued, following the 'pilot wave' theory proposed by Louis de Broglie in 1927, that a single electron is a member of a whole of many electrons, joined in a common wave. This hypothesis follows from Schrödinger's equation, which although it is used to calculate the probability that the electron is doing certain things, also describes a relationship between electron and wave. According to Bohm, each electron on a given wavelength has the wave function encoded into it. It 'remembers' where it came from, and thus remains linked to other electrons sharing the wave, even when they are physically far distant. It follows from this that an electron will remember its spin state if, for any reason, it is forced to flip that state.

Electrons also 'remember' their more proximate relationship to their neighbors. In a single atom each electron has its own distinct set of quantum numbers (the size of its orbit, the shape of its orbit, the direction in which the orbit is pointing, as well as its spin). It 'knows the address' of all the others and knows not to enter their territory, for if it did the atom would implode. This is due to the Pauli Exclusion Principle. The electrons of an atom in the ground state are not permitted to have the same quantum number. The quantum number is based on the level of the orbital, the orbital itself and whether the electron has magnetic spin $+1/2$ or $-1/2$. A pair of electrons sharing one orbital will have the same quantum number if both electrons have the same magnetic spin. The electrons therefore know their own magnetic spin state as well as the magnetic spin state of their neighbors, and they will remember if they have had to flip their magnetic spin in order to satisfy the Pauli Exclusion Principle. The magnetic spin of each electron in the atom is an integral part of the wave function for the entire atom.

It is also known that electrons have the ability to communicate their spin to electrons with which they have been paired, even if this involves a

form of communication that is faster than the speed of light. This, of course, is a paradox because according to Einstein nothing can travel faster than the speed of light. An experiment was actually devised by Einstein, Boris Podolsky, and Nathan Rosen to try and test this. This became the issue of non-locality: "How does it come about that an electron can communicate its magnetic spin to an electron with which it was paired, even if that other electron is now somewhere else in the universe?" It contradicts everything that is known about electromagnetism and relativity. A particle should only be influenced by force fields in its immediate vicinity, or at least close enough to allow communication at speeds not exceeding the speed of light.

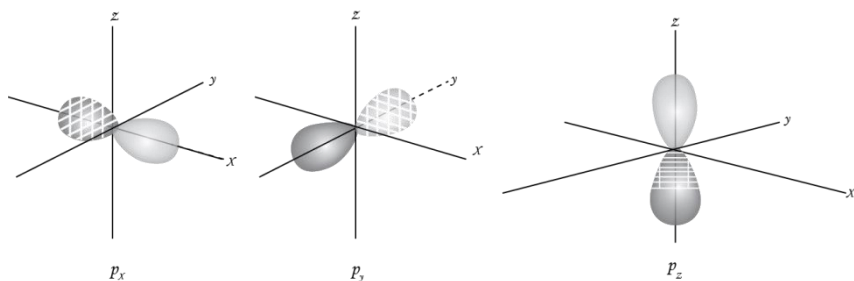
David Bohm, however, was able to conduct experiments which showed that a pair of particles could be affected by a magnetic field that was physically close to only one of them. He did experiments with charged paired particles that are separated and sent off to devices which will record their spin state. Because they were paired together, their spin state will be correlated. If one of them is spin-up then the other will be spin-down. By sending one particle through a magnetic field, he was able to change the spin of only one of them. He found, however, that the spin of the other particle was also changed even though the other particle could not have been affected by the magnetic field.

The particles continue to behave as though they are related. The experiment suggests that each particle 'knows' what the other is doing. The spin polarization of either particle cannot be known until it is measured; that is, until the wave function has collapsed. In effect one particle must 'wait' until the other particle is measured, and then take the opposite value accordingly. A classical explanation would require some local hidden variable to 'tell' each particle what state to assume when it was measured, and then to communicate it to the other, which would then assume the opposite state. This is impossible because the particles would have to communicate at faster than the speed of light. Einstein declared this to be 'spooky' because it seems to involve forces for which there is no physical explanation.

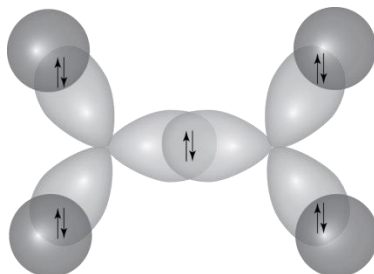
Bohm argued that electrons are connected by invisible forces. They are like corks bobbing on waves in the sea. If one electron moves, the paths of other electrons entangled with it on a shared wave will be modified. The fact that these particles can be described as waves means that they have the ability to affect each other through constructive and destructive interference. Matter, then, is composed of waves that are thoroughly and intimately interrelated, and the fact that electrons have knowledge of these interrelations implies that they have the capacity to remember their previous states. The point is that these electrons are not just randomly spin-up or spin-down. They are determined by forces that not even Einstein could understand, and they have the capacity to store data. *Electromagnetism is memory.*

So not only do the electrons composing a DNA molecule have the ability to 'remember' whether or not their spin polarization has flipped when they occupied the valence orbitals of the constituent atoms of Hydrogen, Oxygen, Nitrogen and Carbon; but, in addition, they 'know' whether or not all the other electrons have flipped. In the language of quantum mechanics, an electron will enter into a valence orbital either in the spin state of $+1/2$ or $-1/2$. Depending on the spin state of the other electron occupying that orbital, it can either remain in its original state of spin, or it will have to flip its polarization to the opposite state. This means that the atoms of Hydrogen, Oxygen, Carbon and Nitrogen comprising each base pair in the DNA molecule, encapsulates an 8-bit binary code.

The explanation above of the valence orbitals for elements in the base pairs of DNA has been as simplistic as possible. Below we see the p orbitals for the outer shell of Oxygen, Carbon and Nitrogen.



In fact, when elements combine to form molecules, these orbitals overlap or 'hybridize'; and below, we see the orbital pictures for the bonding of four C-H bonds, which is a simplified illustration of the more complex covalent bonds that exist in the DNA.



These orbitals are actually electron density pictures; in other words, they only depict where electrons are most likely to be found. So, let us say that the above orbitals are simply an indication of where these valence electrons are most of the time. In addition to their spin quantum number of $+1/2$ or $-1/2$, they also have a magnetic quantum number of $+1$, 0 or -1 . These electrons only have one preferred axis in terms of their angular momentum, and the magnetic quantum number relates to the orientation of that axis. Without getting too complicated we can say that each of these orbitals also has a magnetic field attached to it, and we can therefore think of these orbitals in the nature of magnetic flux tubes in the theory of Matti Pitkänen. He says that data is stored in the DNA in binary format with twisted and untwisted magnetic flux tubes. So it can be seen that the two theories are actually relating to the same process. When an electron in its valence orbital flips its spin state in order to satisfy the Pauli Exclusion Principle, this must also put a 'twist' in the magnetic flux tube associated with that orbital. Indeed, we may assume that it is the magnetic field that causes the electron to flip its spin state. Presumably, it doesn't do so simply because it 'knows' the spin state of the other electron; so, it is effectively processing data.



4

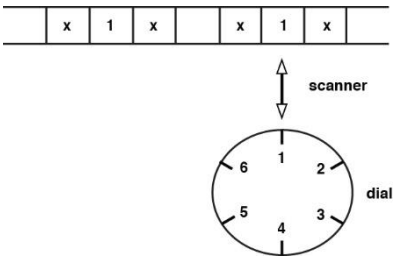
DNA as a quantum computer

In order to understand how the DNA could act as a quantum computer, you will need some elementary information about conventional computing.¹ In the traditional approach the issue is how to squeeze more devices onto a computer chip. This essentially is what nanotechnology is all about. The nanometer scale (10^{-9}m) is used to measure the size of electronic devices. For many years the quest has been to develop single electron devices which operate by moving a single electron in and out of a conducting region. Such single-electron devices can serve as transistors, memory cells, or building blocks for logic gates.

Single-electron transistors operate by applying a voltage to the ‘gate’ which transfers a single electron from a reservoir into a semiconductor island (the so-called “quantum dot”) surrounded by non-conducting material. Once an electron is in the dot it will block the transfer of other electrons due to Coulomb repulsion (like charges repel). The current through a transistor then depends on the number of electrons stored in the dot, which will ‘write’ or ‘erase’ information. There are also molecular devices which are the nanometer-scale structures that also operate pursuant to the laws of quantum physics, although they are obviously much larger than single electrons. Whether single electrons or molecular devices, they are described by conventional (electrical) current-voltage characteristics, and operate in traditional digital computers using the familiar values of a bit, ‘0’ and ‘1’.

In the above description I have tried to be as general and non-technical as possible; and the essential point is simply that already conventional computers can operate using single electron devices, and exploit the rules of quantum mechanics that have evolved to describe the behavior of sub-atomic particles.

Conventional computing started with the Turing Machine which is the simplest “theoretical” digital computer. The Turing Machine has three parts: a tape divided into the squares, a scanner, and a dial. Basically the machine can write a symbol ‘X’ or ‘1’ in a blank square or erase them. Any positive integer can be written as a sequence of 1’s so the number 5, for example, would be ‘11111’. The ‘X’ before and after a number, indicates where it begins and ends. So, in order to add $1 + 1$, the Turing Machine would commence in the following state:



The program incorporates a table with various instructions for the addition process. To start with, the scanner sees the number 1 on the tape and the dial setting “1”. The instruction for the intersection (1,1) is ‘R1’ which means ‘move the tape one square to the right and set the dial to 1.’ Another instruction might be ‘E2’: ‘erase X, and set the dial to 2.’ The whole process for the addition of $1 + 1$ is set out below. The list of all the instructions is in the farthest column to the right. In the bottom row is contained the answer which you will see is ‘x11x’. The whole program works by moving the X on either side of 1 and 1 to the bottom line where now there is ‘11’ between the X’s. The numbers in parentheses, like (6), are instructions for the tape to move that many squares to the right or left. The final exclamation point is an instruction for the machine to stop because an answer has been reached.

instructions							
x	1	x	(2)		1	x	R2
x	1	x(2)			1	x	E3
x	1	(3)			1	x	R3
x	1(3)				1	x	E5
x	(5)				1	x	L5
x		(5)			1	x	L5
x			(5)		1	x	L5
x				(5)	1	x	L5
x					1(5)	x	R1
x				(1)	1	x	D6
x				1(6)	1	x	R3
x			(3)	1	1	x	R3
x		(3)		1	1	x	R3
x	(3)			1	1	x	R3
x(3)				1	1	x	E4
(4)				1	1	x	L4
	(4)			1	1	x	L4
		(4)		1	1	x	L4
			(4)	1	1	x	L4
				1(4)	1	x	R6
			(6)	1	1	x	X6
		x(6)		1	1	x	!

Addition is, of course, the simplest process. Multiplication, requires 15 numbers on the dial instead of five, but it is essentially the same process. Digital computers have obviously become much more sophisticated than this, but the main components have not changed. The writing and erasing elements perform the calculations, with the software or program replacing a simple table of instructions, and the tape and dial being the memory unit.

The Turing Machine operated by taking two input numbers, 1 and 1, and the operation consisted simply of bringing those two numbers together to form an answer: $1 + 1 = 11$. Obviously, as the numbers get bigger it will result in the machine having to read and write a prodigious number of 1s, which will slow down the computational process. Advancement in computing came about from the introduction of the binary code to write large numbers. Any number can be written as a string of 1s and 0s that actually represent the coefficients of the sum of numbers

to the power of 2 that then add up to the number. For example, $59 = (111011)$ is a notation for:

$$59 = 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

So for a simple addition process where the computer has to add the two numbers, 2 and 3, the input will be the two binary numbers (10) and (11), and the process will be to add 0 and 1 (right column) to get 1. Then it will add 1 and 1 (second column from the right) and get 0 for the second column, and a carry-over of 1 for the third column. So the sum is equal to (101) which is 5 in binary code. This addition of the binary digits (bits) is done by means of Boolean algebra. Essentially there is a table of values which tells the computer, depending on the bit in the first number and the corresponding bit in the second number, the value of the carryover from the addition in the column to the right, the value of the bit in the sum, and the value of the carryover to the next column to the left. The Boolean algebra is simply 'OR' and 'AND' operations. Depending on the bit in the first number and the bit in the second number ('if 1 AND 1'; 'if 1 OR 0'), the computer will write the appropriate bits in the carryover column and in the answer.

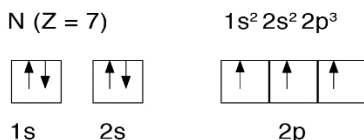
The computer chip consists of microscopic electrical circuits. If the gate is closed, current will flow in the circuit. If the gate is open, the circuit is broken and current will not flow. So each circuit has two current states - "current" or "no current" - and these equate to a 1 or a 0. The process makes use of the fact that an electrical current also has magnetic properties, so when a current is flowing in one circuit, it will open or close a gate in an adjoining circuit. The Boolean algebra tells the computer what to write depending on whether there is a current, for example, in circuit A OR circuit B; or a current or no current in circuit C AND circuit D.

This brief, and very general introduction, to conventional computing was necessary in order for you to understand quantum computing. But before we get into that, there are a few things you must know about the electrons in DNA molecules. We saw in the last chapter that when the atoms of carbon (C), oxygen (O), nitrogen (N), and hydrogen (H) come together to form a base in the DNA molecule, the valence electrons will be

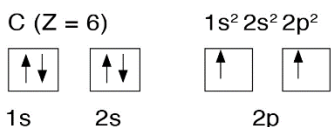
forced, in some cases (but not all), to alter their spin state due to the Pauli Exclusion Principle. No two electrons can have the same atomic number; so when the valence electrons pair up in the orbitals of the combined atoms, the pair of electrons has to have complementary magnetic spin. That is to say that one electron in the orbital must be spin-up and the other spin-down.

The table below shows the state of the valence electrons in nitrogen and carbon before these two atoms combine into a DNA base. You will see that in the valence orbitals, which are not fully occupied, the electron spin in both atoms is spin-up. When these two atoms come together, some of those valence electrons will have to flip their spin orientation in order to occupy an orbital, now as a pair of electrons. Those three valence electrons in the 2p orbitals of nitrogen (N), and the two valence electrons in the 2p orbitals of carbon (C) will have to 'decide' which ones are to flip their spin in order that they might cohabit the same orbital in the molecule of DNA. And we saw in the last chapter that these valence electrons will 'remember' whether or not they have flipped.

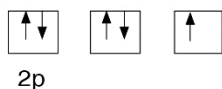
Hund's rule predicts that nitrogen's seventh electron enters the last empty 2p orbital, with its spin parallel to the two other 2p electrons



The fifth and sixth electrons in carbon must enter one of three half-filled 2p orbitals and pair up with (have opposing spin to) the electrons already present



So the combined C-N molecule will have following combined 2p orbitals



Now Pauli's Exclusion Principle only operates when the energy levels of the atoms are in the ground state. In other words, when the DNA molecule is at its lowest energy level, the atoms of nitrogen (N), oxygen (O), carbon (C), and hydrogen (H) will be the closest together; the orbitals of the valence electrons will be at their minimum size; and all the valence electrons will be uniformly paired in 'one spin-up' and 'one spin-down' configurations.

In 1970, Fritz-Albert Popp, a German theoretical biophysicist, found that DNA absorbs and emits light. In fact, what he found was that DNA stores light. This stored light is released as very weak, extremely coherent biophotons. It is said that: "Photons switch on the body's processes like an orchestra conductor launching each individual instrument into the collective sound. At different frequencies they perform different functions." Keep this quote in mind for the next chapter when I talk about Optogenetics.

When an atom absorbs light the electrons jump to a higher energy level, and when it emits light the electrons jump back down to their ground state. So when DNA absorbs light, the electrons actually jump to a higher orbital. Essentially the distance between the atoms increases to accommodate this, the DNA molecule expands, and most importantly, the electrons are no longer bound by the Pauli Exclusion Principle. Each pair of electrons in each orbital no longer has to be uniformly paired with one spin-up and the other spin-down. As soon as the DNA molecule absorbs energy from light, it is no longer possible to tell from the spin state of one electron what the spin state of its paired electron will be. Indeed it is no longer possible to predict whether those two identical electrons are still paired with each other at all.

Once the DNA molecule is in an excited state, it is not possible to say with any certainty that any electron is in its state spin-up or spin-down. Any one electron is actually in a superposition of an infinite number of states; and certain probabilities attach to these superposition states as to what state the electron would be in, if we had the expertise to measure it.

In the case of the individual spins of one electron in one atom in one base of the DNA double helix, the probabilities of whether it would be

spin-up or spin-down would be immensely (infinitely) complex. These probabilities would depend, among other things, on whether it was spin-up or spin-down in its previous ground state, whether it flipped or did not flip in that previous ground state, (and then these same considerations for every previous ground state); and then all these probabilities would be correlated in an immensely complex way with every other electron spin in the entire DNA molecule. But the really interesting thing is no matter how astronomically complex these probabilities become the processing could all come down to a Boolean algebra no more complex than in a conventional computer. For instance, if a single spin was spin-down in its last ground state AND it was spin-down in the ground state before that, then it would have a high probability of being spin-down, if its spin state were to be measured in its current excited state. This is where quantum computing comes in.

Before we get onto that however, recall Popp's finding that light is emitted from the DNA as very weak, extremely coherent biophotons, and that it is surmised that these biophotons switch on the body's processes like an orchestra conductor with his baton directing all the individual instruments. This must therefore involve the DNA acting as a quantum computer to process the probability states of the electrons when the DNA molecule is in an excited state. The light that the DNA emits when the molecule falls back to the ground state (these extremely coherent biophotons), are the output of the quantum computing process. If this light is directing the body and brain's processes like instruments in an orchestra, then it is highly unlikely that these biophotons are the result of a random process of electrons dropping back to the ground state. Quantum processing is taking place and specific instructions are being generated.

In a conventional digital computer information is coded as a string of bits; in quantum computers however, the elements that carry the information are the quantum states. Suppose for example we just consider two quantum states of an atom, namely the ground state and the first excited state. The quantum system can be populated in the ground state $|0\rangle$, or in the excited state $|1\rangle$, or in any linear combination (or

superposition) of these two states. For quantum systems the new term 'qubit' (quantum bit) was introduced instead of the conventional term 'bit'. Qubits allow for a vastly more effective means of processing, known as 'quantum parallelism', which is no longer deterministic in the sense of going linearly from one step to the next like conventional computers. A quantum computer can execute its steps randomly and will reach a result based on probabilistic computation.

There are normally many different ways to arrive at a final (correct) answer, and we may think of each way as having its own probability of being correct. If the probability of the very quick ways is high enough, the answer can be found quickly even by conventional computers most of the time. In those situations probabilistic calculations could be used instead of deterministic ones. For instance, there is a fast algorithm for simple addition which can be used by deterministic computers. However, there is no fast algorithm for factoring. For a conventional deterministic computer to find the factors of a very large number (i.e. the prime numbers that can be multiplied to make up that number), a conventional computer has to start with the number 2 and try sequentially all natural numbers, which quickly becomes an impossible task. However a quantum computer can simply select numbers that have the highest probability of being the right numbers. This is probabilistic computation. Adopting these methods there is no upper limit to the processing tasks a quantum computer can perform.

By using a superposition of quantum states the computation of a quantum computer becomes vastly more effective (quicker) than the simple tasks of probabilistic computation that a conventional computer can perform. There can be an infinite number of ways for a quantum system to attain the final state (final answer), but now every way is defined not by the probability but by the amplitude of the probability. These probability amplitudes are complex numbers and so they can add to zero or cancel each other out. In an efficient quantum computer only the correct answer survives with high probability, meaning that all the incorrect answers have simply cancelled each other out.

If we think now of the DNA in an excited state then all the qubits have been thrown upward to be “processed”; and then when the molecule falls back into the ground state, light is emitted that will interfere with itself in a probabilistic way, thus causing an output of these weak but extremely coherent biophotons that Popp discovered. The fact that it is evidently light interfering with itself during this quantum processing is particularly easy to understand because these probability amplitudes involve precisely this notion of phase angles, which everybody who knows anything about the constructive and destructive interference of light can readily relate to. Destructive interference involves light rays cancelling themselves out altogether. And constructive interference when two rays of light are in phase will bring about a higher probability amplitude. The light that is actually emitted by the DNA is truly the light that has the highest probability amplitude. The DNA is able to carry out this quantum processing through constructive and destructive interference, and at the speed of light! The light that is emitted by the DNA molecule is simply the answer with the highest probability that has “survived” the quantum computing process.

Optical computing is already quite far advanced, and it is said that it will be up to 1,000,000 times faster than today’s silicon machines; it provides an extremely optimized way to store data, and it allows for parallel processing with less heat and less noise. With advantages such as these it is clear that the DNA is an optical quantum computer par excellence.

To give you an idea of how these phase angles work, we will look at the only quantum computing algorithm that has been developed to date. This is Shor’s quantum algorithm of efficient computation. Just the key points of this algorithm will be presented to avoid excessive technical explanations. In this example we have only two strings of qubits whereas in the DNA there would be trillions of strings of qubits. Some functions are periodic which means that at regular intervals of time they execute exactly the same graph. Sine waves and cosine waves are examples of periodic functions that take the same waveform at intervals of 2π . For this example we have a function $f(x) = \cos(\pi x) + 1$, so if x takes the value 0 then

$f(0) = 2$, and if x takes the value 1 then $f(1) = 0$, and if x takes the value 2 then $f(2) = 2$ and so on. The function will periodically equal either 2 or 0. The algorithm that Shor developed is for a quantum computer to find the period of this function, which we can see is 2. Every second function returns the same result.

We have two strings of qubits. There is the X string (register) which holds the values of the argument x , namely 1,2,3,... And there is the Y string (register) which holds the values of $f(x)$. For $x = 5$ for example, $f(x) = 0$, and these values of x and $f(x)$ correspond to the states of the two registers which can be written in binary code thus:

$$\mathbf{X: |000 \dots 101 \rangle; \quad Y: |000 \dots 000 \rangle}$$

You can see that the value of the state of the X register is 5 and the value of the state of the Y register is 0. For the representation of the states X and Y together we have:

$$|x, f(x) \rangle = |000 \dots 101, 000 \dots 000 \rangle$$

or in decimal notation

$$|x, f(x) \rangle = |5, 0 \rangle$$

Now if the register of X consists of three qubits this would mean that it would be in a uniform superposition of $2^3 = 8$ digital states. These are the numbers $x = 0,1,2,3,4,5,6,7$ that can be expressed in binary code with three bits. The X register is a superposition state (all the values are expressed at once) and looks like

$$\mathbf{X: \frac{1}{\sqrt{8}} (|000 \rangle + |100 \rangle + |010 \rangle + |001 \rangle + |011 \rangle + |101 \rangle + |110 \rangle + |111 \rangle)}$$

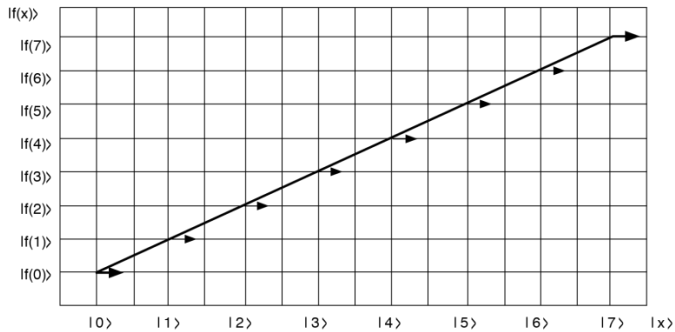
The $1/\sqrt{8}$ just means that this superposition state is normalized. In quantum mechanics this is necessary so that the probabilities for all the qubits can add up to 1.

We do not know the values of $f(x)$ in advance. These have to be computed by means of parallel processing. If a conventional computer were to do this it would take the value of x starting at zero and plug it into the equation for each value of x up to 7. It would then decide that the period of the function must be 2. A quantum computer will take all eight values for x at once and come up instantly with the answer 2 because this

is the answer with the highest probability. The wave function for this superposition of qubits would be (in decimal notation):

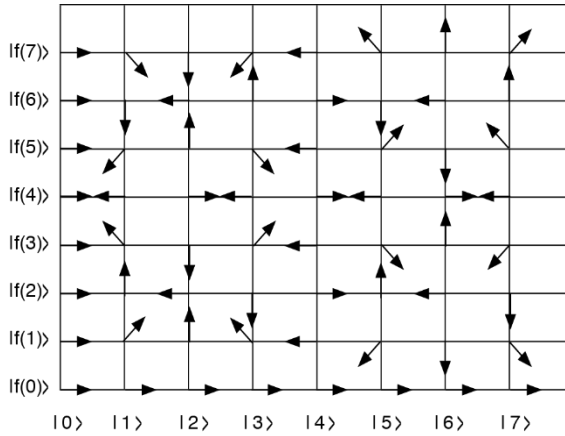
$$\Psi = \frac{1}{\sqrt{8}}(|0,f(0)\rangle + |1,f(1)\rangle + |2,f(2)\rangle + |3,f(3)\rangle + |4,f(4)\rangle + |5,f(5)\rangle + |6,f(6)\rangle + |7,f(7)\rangle)$$

To avoid any further complex mathematics I shall simply set out the vector diagram of first the input superposition above, and then the vector diagram for the transformation of the X register that the quantum computer will perform to solve this problem for $f(x)$ with a period of 2 i.e. $f(0) = f(2) = f(4) = f(6)$, and $f(1) = f(3) = f(5) = f(7)$.



In the vector diagram for the superpositional state, every vector (arrow) on the intersection of $|x\rangle$ and $|f(x)\rangle$ represents the corresponding amplitude of the term $|x, f(x)\rangle$. The angle between the direction of the vector and the horizontal line is the phase, ϕ , of the complex amplitude (0, in this case).

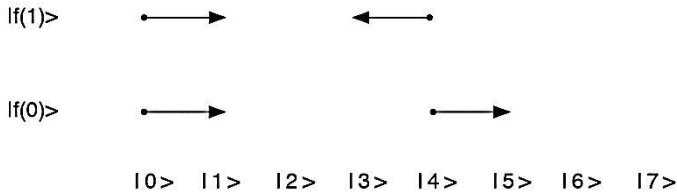
Now below is the transformation vector diagram which represents the instantaneous answer. Each one of those vectors represent the probability amplitudes for the correct answer. In other words beams of light travelling in all those directions would constructively and destructively interfere with each other; and only one wave function will survive.



The wave function that survives is the following:

$$\Psi' = \frac{1}{2} \{ |0, f(0) \rangle + |0, f(1) \rangle + |4, f(0) \rangle + e^{i\pi} |4, f(1) \rangle \}$$

and it is represented schematically as



You will see from the above vector diagram that the qubits $|0\rangle$ and $|4\rangle$ have survived and we started out with the parallel processing of 8 qubits; 8 divided by 0 is an impossible answer so the correct result is 8 divided by 4 = 2.

This example contained a very simple processing task involving only two strings of qubits. The quantum processing in the DNA would involve registers with an infinite string of qubits; and the light emitted by each atom in every base of the DNA molecule would actually be diffracting off an indefinite number of atoms in its immediate vicinity; and the phase angles (probability amplitudes) would actually be too numerous and too

complex for us to even comprehend. But no matter how complex the diffraction patterns actually become, the processing is simply the constructive and destructive interference of light beams, which by definition will be completed with the speed of light. The most complex processing task that you could ever imagine will be completed just as quickly as the task of adding $1 + 1 = 2$.



5

Biophotons

In 1970 Fritz-Albert Popp was a theoretical biophysicist teaching radiology at the University of Marburg in Germany. Radiology involves the interaction of electromagnetic (EM) radiation on biological systems. At that time he was working on two almost identical molecules –

benzo[a]pyrene and benzo[e]pyrene. This is organic matter, and the former is a lethal carcinogen and the latter is not. There is only a very small difference in their molecular makeup and yet the difference in their toxicity is profound. Popp was observing the different effects of UV light on these molecules.

Popp's experiments were motivated by the findings of a Russian biologist, Alexander Gurwitsch, who in 1923 had proposed that onion roots could communicate with each other using UV light. Gurwitsch had found that onion roots could stimulate the roots of a neighboring plant if they were in a quartz glass pot which allowed UV light to pass through, and not if the pots were made of silicon glass which filtered UV light. As this was the only difference between the two forms of pot, it became apparent to Gurwitsch that the plants must be communicating using ultraviolet light.

Ultraviolet light has a wavelength of about 380nm and a frequency of 10^{15} Hz which is just outside the range of visible light. Its wavelength is shorter than visible light and its frequency is faster. Ultraviolet and visible light are electromagnetic waves the same as all the other waves in the electromagnetic spectrum, which ranges at one end from radio waves that have a very long wavelength and a comparatively slow frequency through to gamma rays with a very short wavelength and very fast frequency of 10^{20} Hz. The ultraviolet light that Popp was using is towards the middle of the electromagnetic spectrum as is visible light.

So when Popp was using UV light on these benzopyrenes, he found that the toxic version, which is found in coal tar and cigarette smoke among other things, absorbed the light and then re-emitted it at a completely different frequency. The other molecule which is harmless to humans, benzo[e]pyrene allowed the light to pass through unaltered. The carcinogenic molecule appeared to Popp to be a light 'scrambler.'

So Popp proceeded to perform the same experiment on other compounds, 37 in all, and he got precisely the same result. He found that he was able to predict which substances were carcinogenic from this scrambling effect they had on UV light. In every case they re-emitted the light at a different wavelength. Also, the carcinogenic substances

absorbed the light at a specific wavelength – 380nm in the ultraviolet range.

Popp went in search of an explanation for this and came across the phenomenon called ‘photorepair.’ You can blast a cell with ultraviolet light to the point that it is almost completely destroyed (including the DNA in the nucleus), and then by simply using light of the same frequency but of much weaker intensity the cell can be restored as good as new. In addition to which, Popp knew that this photorepair process is defective in patients with *xeroderma pigmentosum*. These patients actually die of skin cancer as a result of solar damage because their skin has no ability to repair itself.

It was even known that photorepair works most efficiently at a wavelength of 380nm, the same frequency that these carcinogens were absorbing light and then scrambling it. Obviously there had to be some connection, or at least it appeared so to Popp, who proceeded to write a groundbreaking paper that was published in a prestigious scientific journal in Germany, where he argued that there must be some kind of light naturally produced by the body that is responsible for photorepair. Furthermore, external substances must cause cancer by absorbing this natural light and scrambling the frequency so it loses its repair capabilities.

After this initial discovery Popp and his Ph.D student, Bernhard Ruth, set about to prove that light was emanating from the human body. His student was a gifted experimental physicist and he constructed a machine along the lines of an X-ray detector that could count photons one at a time. This machine, called a photomultiplier, had to be highly sensitive in order to accurately capture the extremely weak emissions that they assumed would be emanating from the human body.

There is an old documentary taken in the laboratory at the International Institute of Biophysics. Dr. Popp places a plastic container containing a fresh cutting from a plant and a wooden matchstick inside a dark chamber about the size of a bread box. When he switches on his photomultiplier machine, an image immediately appears on the computer screen. The green, glowing silhouette of the leaves is clearly visible while

the wooden matchstick is black. The image of the leaves in the darkened chamber becomes clearly visible. Dr. Popp exclaims, "We know today that man is essentially a being of light."

By 1976 Popp and his assistants were testing cucumber seedlings, and were surprised by the intensity of the photons, or light waves, that were emanating from these seedlings. To rule out the possibility that the intensity of the light was due to the effect of photosynthesis, they next performed the experiment on potato seedlings that had been sprouted in the dark. Their photomultiplier machine registered light coming from these potato seedlings that was even more intense than what they had found in the cucumbers. In addition, they noticed that this light from living organisms was much more coherent than the light from their earlier experiments. A coherent light is one that retains its precise sinusoidal waveform for longer periods of time. Laser light, for instance, is one of the most coherent forms of light. So when Popp found specifically how coherent this light is, it meant that this light emanating from these living organisms was in the nature of laser light.

Popp developed theories about how light from the food we eat is stored in the body. He knew that when we eat green vegetables like broccoli, it is metabolized into carbon dioxide and water; and he reasoned that the energy from these photons must be distributed over the entire spectrum of electromagnetic frequencies and dissipated in the body. This energy, he reasoned, was the driving force for all molecules. Chemical reactions can occur when electrons are activated by photons of a certain frequency, and therefore provide the appropriate amount of energy. Green vegetables are known to have certain specific beneficial effects on the body, so ultimately it is actually the photons stored by green vegetables that are responsible for triggering these effects. This is the forerunner of much theory that is widely accepted today; that electromagnetic vibrations from these biophotons are specifically directing chemical reactions, and acting as a catalyst to speed up reactions that would be much slower at body temperature of 37°C if unfacilitated by electromagnetic energy.

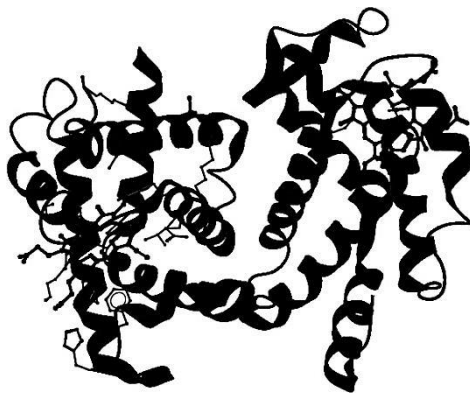
Popp came to the conclusion that photons (light) control everything in the cell. He found that all the molecules that make up the cell responded to individual frequencies, and that these molecules in turn modulated the frequencies of other processes further down the line. The photons have been likened to the conductor of an orchestra directing all the individual instruments (components in the cell) with his baton. Different frequencies signal all the myriad processes and functions.

These findings by Popp have been the forerunner of a sizeable and ever-growing body of research known as biophotonics or bioinformatics; for instance see the article *The Real Bioinformatics Revolution: Proteins and Nucleic Acids Singing to One Another?* co-authored by Irena Cosic, Professor of Biomedical Engineering, RMIT University, Melbourne, Australia and Dr. Veljko Veljkovic of the Institute of Nuclear Sciences, of Belgrade, Serbia. Hundreds of new chemicals are made by the chemical industry, and these researchers developed a method for predicting whether any of these chemicals may be carcinogenic. Their methods were based on certain electronic properties of the molecules along similar lines to what Popp was doing. It all relates to electromagnetic waves. In addition to determining which chemicals were carcinogenic, they were also able to predict which organic chemical may be mutagenic or toxic, and indeed which organic chemicals may be potentially antibiotic or anticancer agents.

There is so much of conventional genetics and biology that remains unexplained. For instance, how enzymes can recognize their substrates, how antibodies in the immune system can grab onto specific foreign invaders and disarm them, how proteins can 'dock' with different partner proteins, or latch onto specific nucleic acids to control gene expression, to mention but a few. The best explanation offered by biologists and geneticists are variations on the so-called 'lock and key' model, where molecules randomly bump into each other and, in so doing, they find other molecules with complementary shapes that they can lock into, and thus allow biochemical reactions to take place. The process has been likened generally to finding a friend in a very big crowded ballroom in the dark. In every cell there can be hundreds of thousands of molecular pair-

wise interactions every second, so the conventional explanation of finding the best fit through random collisions is actually no explanation at all.

Likewise, the explanations of geneticists that segments of DNA are translated and transcribed into proteins is devoid of any specific explanation as to how genetic information actually translates into biological function. The one DNA sequence can encode for several different proteins through multiple splice sites or whatever. Genes and proteins with similar sequences can have totally different functions. Although it is widely accepted that the secondary and tertiary structures of proteins (see image below) are crucial for their functioning, the base sequences of amino acids that make up the proteins are completely silent as to the how and why of these protein structures. All this information and much more besides must come from some source other than the linear sequence of bases of the DNA molecule. As Dr. Mae-Wan Ho states in her book *The Rainbow and the Worm – The Physics of Organisms*, “The conventional account is also too mechanical, and at odds with the fuzzy picture of atoms and molecules as ‘clouds’ of probability density in quantum theory.”



It is obvious that a mechanical explanation for the molecular interactions in cells is inadequate, and Veljkovic and Cosic have argued that the interactions are actually electromagnetic in nature. Each molecule can send out a unique electromagnetic field that can sense the field of a complementary molecule. They envisage the cellular milieu as a kind of

ballroom with all the molecules dancing to the rhythm of these biophotons. The molecules send out specific frequencies of electromagnetic waves which enable them to 'see' and 'hear' each other at a distance. They see each other with optical waves (photons) and hear each other with acoustic waves (phonons). This enables them to interact at a distance and the dance begins. The photons and phonons are capable of exciting the molecules at the atomic level, and this is what is necessary for a chemical reaction to take place.

This molecular resonance is well known in chemistry, and something very similar happens with music. When a piano tuner strikes a tuning fork next to a piano, a string, if correctly tuned to the same frequency, will start to sing back to the vibrating tuning fork. When this happens the energy is a two-way street. The waves cause energy to flow from the tuning fork to the piano string, and *vice versa*, which is why the vibration lasts much longer when they are resonating at the same frequency. It is also known that molecular resonance is extremely selective for fine tuning. This mutual vibration phenomenon will occur only if there is less than a 1/10,000th variation in resonant frequency.

Cosic analyzed more than 1,000 proteins which consisted of more than 30 different functional groups, and the results showed that proteins with the same biological function share a *single* frequency peak and, by the same token, proteins with different functions have no significant peak frequency in common. Generally, she found that the characteristic peak frequency differs for different biological functions. She proposed a Resonant Recognition Model (RRM) of molecular function, and produced a table of specific frequencies for various DNA regulatory sequences and many protein sequences. As a rough estimate she found the maximum and minimum wavelengths of the electromagnetic radiation to be 30,000 and 300 nanometers respectively. In other words, the radiation ranges from the very low infrared through the visible to the ultraviolet.

In an article *Biophotons and Their Role in Growth Regulation and Differentiation*, a mathematical argument is advanced that the regulation of cell growth in the body must be by means of biophotons, and not by chemical processes. The speed and accuracy with which these processes

take place can only be attained by biophotons. When one considers that an adult human has a cell loss of about 10^7 /sec (10 million cells die every second), then it is apparent that in order to keep up with cell loss, every 10 millionth of a second a signal is received from a dying cell as a message to produce a new one, and all these signals are propagating over a distance of a couple of meters for an adult human. It is only signals propagating at the speed of light that could achieve this; certainly, vastly in excess of speeds that can be achieved by chemical diffusion. At the very least, the article points out, a signal has to exceed the distance of two neighboring cells; and therefore achieve a velocity of 10^{-3} cm per 10^{-7} sec, which is approximately the speed of sound. It is well known that sound waves can propagate through matter due to vibrating atoms, and this is still much faster than any signals that can propagate by chemical means. The article therefore argues that if biophotons and/or biophonons are regulating normal cell growth, then it would be natural to expect that decoherence and increased intensity of biophoton emission in malignant tumors should ultimately be the explanation for cancer.

Popp had found these 'biophoton emissions' and had recognized that they would provide an ideal communication system among the many cells in an organism, but the question still remained as to where this light was actually coming from. One of Popp's students actually suggested the answer to him. A certain chemical, ethidium bromide was known to cause DNA to unwind by insinuating itself between the base pairs of the double helix. The suggestion was to measure the light coming from the DNA after it had been unwound in this way. When Popp tried it, he found that there was a direct correlation between the intensity of the light and the more the DNA unraveled. The greater the concentration of ethidium bromide, the more the DNA unraveled, and the stronger the intensity of the light. Conversely, less ethidium bromide meant less unraveling of the DNA and the light was less intense. This light being emitted from the DNA seemed to include a wide range of frequencies, and these frequencies seemed to be linked to specific functions in the cell. Popp reasoned that the DNA must store light, which would explain why more light was emitted the more it was unraveled.

This also suggested an explanation for the way body tissue and particularly skin can repair itself after being cut or scratched. Somehow the cells that are injured can send a signal to nearby healthy cells to start reproducing healthy cells to fill in the gap. Once the cut or abrasion has been mended, then another signal tells the neighboring cells to stop reproducing. It was not known how this mechanism actually works. Popp looked at the problem from a holistic perspective, and reasoned that there must be one central orchestrator for this process. The weak light emissions from the DNA would be sufficient to orchestrate the coordinated response to body repair, and at the same time operate in the very small intracellular space (virtually a quantum space) between cells; more intense light would create too much 'noise' at the quantum level. Cosic analyzed more than 1,000 proteins which consisted of more than 30 different functional groups, and the results showed that proteins with the same biological function share a *single* frequency peak and so would no longer be a candidate for the operations that were going on here.

Popp continued his investigations into this light coming from the DNA. He found that different species produced light of varying intensity and frequency. It appeared that the more complex the organism, the fewer were the photons being emitted. For instance, simple organisms and plants were emitting light with 100 photons/cm²/sec at a wavelength between 200-800nm. This is a very high frequency EMF well within the visible range. Humans on the other hand, at this frequency (namely visible light), emit a light that is 90 per cent less intense.

Popp experimented extensively on the light being emitted from humans. Every day for nine months he took photon readings from the hands and forehead of one of his assistants, a 27-year old woman in good health, and found biological rhythms at 7, 14, 32, 80 and 270 days; and the emissions from both hands were correlated, which suggested that the biophoton emissions were an essential metabolic process. Similarities in biorhythms were also noted by day or night, by week and by month, as though the body was somehow resonating with the external world.

Next, Popp tried to find characteristic differences in photon emission between those who are healthy and those who are ill. He tested a series of

cancer patients and found that, in every case, they no longer had those biological rhythms which his healthy assistant had displayed. He took this to indicate that the lines of internal communication had been scrambled. They had lost their connection with the world almost as if their light was going out. He also found that biophoton emissions from cancer patients lack coherence, and that malignant tumors are emitting photons approximately at about 1,000 percent increase compared to normal skin. Tumors emit on average 300 photons/cm/minute compared to 22 photons/cm/minute for normal skin. Such a marked increase must have a biological significance. Furthermore, it was found that surface tumors as well as tumors excised during surgery will respond to remedies involving reduced photon emissions. A beneficial agent with reduced photon emissions will not kill the cancerous cells; rather it appears to stimulate the normal cells to overcome the cancerous ones.

In a study *A novel method of assessing carcinoma cell proliferation by biophoton emission*, relating to changes of the emission intensities of ultraweak biophoton emission during the cell proliferation of human carcinoma cell culture, not only was it demonstrated that the intensity of this light increased proportional to cell proliferation, but also spectral analysis of the light demonstrated a significant peak around 530nm. Other studies have shown that normal photorepair processes in the skin operate on frequencies of 380nm, so there has evidently been a significant shift in the frequency of this light coming from cells known to be cancerous. The researchers found that the emission intensity mainly depends on the cell population, and that this non-invasive technique has a potential role in cancer diagnosis.

Furthermore, in a study *Ultraweak biophoton emission imaging of transplanted bladder cancer*, the researchers compared biophoton emissions from untreated tumors and normal regions in mice, and found that the photon counts were on average three times higher in the malignant sections. The photon counting method they developed would be applicable for the diagnosis of superficial tumors.

Patients with multiple sclerosis also seemed to be drowning in light. Excessive light prevents the cells from doing their job properly. Earlier he

had found that the emissions had to be very weak, operating as they did within the infinitesimally small intracellular spaces. Light that was excessively intense was too noisy for these spaces, and so the bodily functions were not being regulated correctly. From the point of view of the DNA acting as an optical quantum computer, excessive light being emitted by the DNA would suggest that the light had lost some of its coherence, in which case the probability amplitudes would not cancel out perfectly, and the computing process would go awry. The output would be imprecise and 'scrambled.'

Interestingly, Popp found something similar when he started examining the effects of stress on people. The biophoton emissions go up but he interpreted this as a defense mechanism designed to restore the patient's equilibrium. Logically it seems more reasonable to assume that this would block the healthy biorhythms, and lead to regulatory dysfunction similar to the patients with MS.

At the same time he was developing a theory that these photon emissions were indicating an alternative explanation to Darwinism for the evolution of the species. It wasn't simply a matter of finding a cure for cancer or *Gestaltbildung*. These emissions seemed to be directing the way living organisms function and evolve. The DNA could be using electromagnetic frequencies at different levels to encode and transfer information. Evolution was not occurring as a result of random mutations in the DNA which is the conventional explanation; rather, the DNA is specifically directing the course of evolution by means of the information that it is able to store and transmit to the various products that are synthesized from the DNA, proteins, hormones, enzymes, neurotransmitters, and the like.

As part of this overall process, Popp came to the conclusion that these biophotons held the key not only to illness, but to what is healthy or unhealthy generally. He started experimenting on foodstuffs. In one case he compared the light from the eggs of free-range hens to those from factory farms where the hens are crowded into cages. The photons in the former were found to be significantly more coherent, than those coming from the latter. This notion of coherence is most significant. Coherent light

retains its sinusoidal waveform for much longer periods and is thus able to convey precise information. Light that has lost its coherence has lost its precise shape; and the signal becomes scrambled or even lost altogether. Whatever functions conducive to good health the coherent light from the free-range hens was performing, are simply lost from the eggs from the factory farms.

Popp pioneered the process of using biophoton emissions as a tool for measuring the quality of food. He was able to determine that low intensity and high coherence meant healthy food. Whereas in unhealthy food the electromagnetic waves are out of sync, and there is increased intensity due to overproduction of photons. It seemed that the lower the intensity and the higher the coherence showed how well the organism was communicating at the subatomic level. These days biophoton emission is routinely used in agricultural science to test the quality of foods and it has wide commercial applications. There are many patents for the use of biophoton emissions for quality control in the food industries, cosmetics and health, as well as general environmental applications.

For instance, biophoton therapy is the application of light to particular areas of the skin for healing purposes. We have already seen Popp's initial insight that these biophotons can actually be responsible for the photorepair phenomenon, and that carcinogenic and toxic substances can actually block the natural repair systems in the cells. By applying light to the skin at appropriate frequencies, the light is absorbed by the skin's photoreceptors which then can travel through the body's nervous system to the brain. These therapeutic frequencies can then regulate our so-called bioenergy which presumably is something akin to our natural life force, and determines our wellbeing at a fundamental level. If we are experiencing pain, this can also be relieved simply by stimulating certain areas of the body by light with specific frequencies and intensities. Many doctors practice this biophoton therapy and it is all based on Popp's initial theories; that light can affect the electromagnetic oscillations or waves in the body, which in turn can regulate specific enzyme activity. Enzymes, which are known to have myriad applications in the chemical reactions in the living cell are, of course, synthesized from the DNA; so it would be

natural to expect that the light being emitted from the DNA would be ultimately responsible for all chemical reactions in the functioning of the cell.

Popp wrote extensively about his discoveries and over the years he built up a substantial following from scientists, doctors and others involved in health research. The fundamental premise was that the body's communication system is a complex network of resonance and frequency, which is responsible at a fundamental level for the chemical reactions that are being studied in conventional medicine, genetics and organic chemistry. Mainstream medicine has only come to know about biophotons in recent decades thanks to the discoveries of Popp; whereas the chemical reactions in the body have been studied for centuries and, of course, are much easier to work with experimentally. Many groups of scientists have taken up the challenge to specifically study the bodily processes in terms of electromagnetic waves; and together they make up the International Institute of Biophysics, which has been specifically created to further this research.

Popp is still coming up with groundbreaking new insights into the potential of this research. For instance, he went on to study the light emissions from several organisms of the same species. One such species was a type of water flea of the genus *Daphnia*. These interesting little creatures were found to be literally sucking up the light being emitted from each other. He next turned his photomultiplier machine on certain small species of fish, and they too seemed to be consuming each other's light emissions. The process seems to be akin to that of sunflowers, which act like photon vacuum cleaners seemingly hoovering up as much solar light as they can possibly get. Even the lowly bacteria, the germs of this world, were found to be swallowing the light from whatever media they were put in. We are all absorbing light from each other like the sunflowers absorb light from the sun. For all living creatures, light seems to be the most essential life-giving commodity of all. Popp came to the conclusion that all creatures great and small were 'beings of light.'

This opened up the possibility of communication between organisms. Popp realized that these light emissions must have a purpose outside the

body. It wasn't just a matter of inter-cellular communication, but they were also sending information between organisms. He actually coined the phrase 'photo sucking' for this exchange of light between living beings. Here was the explanation for the way schools of fish or a swarm of bees or a flock of birds seem to act in perfect unison. They are all linked through light waves, which means that communication is instantaneous. Also, the mysterious homing abilities of birds, bees and fish as well as the way termites that cannot even see, unerringly construct a perfectly symmetrical nest, although working from different directions and compartments; for all these phenomena it has been demonstrated that it is not a matter of simply following habitual trails or familiar scents, nor has it anything to do with the magnetic fields of the Earth. It is as if they are all linked by something akin to invisible rubber bands; and in the case of some migrating creatures, they somehow manage to find their way back to some place on the other side of the world. Evidently some unseen energy is guiding them and that can only be electromagnetic waves, which can indeed act like invisible rubber bands linking us all.

So this could actually mean that if our own light goes awry in some way, it may be possible simply by exposing ourselves to the healthy light of others, we could bring about our own return to form. Indeed, there have been experiments that suggest that it is possible to transmit death signals to other organisms by means of this light. These are the experiments of V.P. Kaznacheyev and his team who are really taking us into the realm of the paranormal. They are reminiscent of the very early experiments about onion roots communicating with each other through glass which will not allow UV light to pass, and quartz which will. These researchers used cell cultures instead of onion roots, and they were placed in quartz containers in separate rooms with the dividing wall containing a window that could be of glass or quartz. The cells in one room were killed by a variety of means – virus infection, toxic irradiation, poisons, etc. – and if the window to the adjoining room was made of quartz that allows the transmission of UV and infrared, then their neighbors would likewise sicken and die. If, on the other hand, the window was made of ordinary glass which is

opaque to UV and infrared light, the neighboring cells remained alive and well.

It seems that Kaznacheyev and his colleagues performed over 5,000 experiments of this kind, all in total darkness, and always they found that the induced complementary sickness in the neighboring culture occurred within about two to four hours of the mortal peril of the primary culture. The only difference between window glass and quartz is that the latter will transmit UV and infrared light whereas the former will not. They both are completely transparent to visible light. So it has been suggested that glass is a suppressor of the 'paranormal channel' although there does not seem to be anything paranormal about it. We have seen as far back as the experiments of the Russian biologist Alexander Gurwitsch, that living organisms, in that case onion roots, could stimulate each other by means of UV light.

This general notion that biophoton emission is correlated with cell distress or cell death has been substantiated in many studies. In one such study *Biophoton Imaging: A Nondestructive Method for Assaying R Gene Responses*, it was found the R-Gene in plants is responsible for the synthesis of the (R) proteins that are active in plant disease resistance. When a plant is undergoing some sort of incompatible interaction, the ultraweak photon emission in the DNA increases, which triggers the synthesis of these (R) proteins as a defensive response. The study concludes that 'biophoton generation' is demonstrated to be associated with hypersensitive cell death, and that monitoring biophoton emissions is a noninvasive and non-destructive means of studying plant defensive responses in real time. In addition, it was found that the "assay is robust and applicable to a range of incompatible interactions in various plant species." What this study is saying is that the 'biophoton generation' is directly related to genetic processes of synthesizing and controlling specific proteins designed to perform specific functions in metabolism. "The bioluminescence provides both temporal and spatial information on R-protein elicitation."

Another study *Biophoton distress flares signal the onset of the hypersensitive reaction* confirms this relation between biophotons and the

onset of hypersensitive resistance reaction in *Arabidopsis*, bean and tomato. The burst of biophotons precedes macroscopic symptoms by several hours, and the researchers conclude that the ability to monitor biophoton emission from whole plants in real time should allow detailed dissection of plant defense responses. Similar conclusions were reached in a study, *Functional imaging of biophoton responses to fungal infections*. These researchers present the potential adaption of functional imaging of ultraweak luminescence to monitor time-dependent free radical processes during disease development, and its application, to draw conclusions on plant resistance to pathogens, and possibly also means by which plants may acquire systemic resistance to pathogens.

Also in 1950, Western researchers used ultraviolet radiation to kill cells kept in darkness, after which they kept these dead cells completely shielded from visible light for 24 hours or more. By this time these cells were well and truly clinically dead yet the researchers found that they still could be revived simply by now radiating them with visible light. Certainly the explanation given by Kaznacheyev and his team in relation to their experiments does not rely on the paranormal. They suggest that every cell emits mitogenetic radiation (a term coined by Gurwitsch) in the ultraviolet range only twice in its life, when it is born and when it dies. These ultraviolet photons emitted at death are said to contain a virtual state pattern of the condition of the cell at death. When healthy cells are bombarded with these death messages from the dying cells, the death pattern is diffused throughout the healthy culture, thereby pre-empting the demise of the healthy cells as well. These findings about mitogenetic radiation have been strenuously disputed or denied by mainstream geneticists and biologists, particularly since the time of World War II. According to the conventional approach, there is no such thing as mitogenetic radiation, and even if it does exist, it can have no biological relevance whatsoever. In mainstream biology mitogenetic radiation does indeed come under the heading of the paranormal.

In her book, *The Field: The Quest for the Secret Force of the Universe*, Lynne McTaggart reviews Popp's approach to finding substances that could reintroduce more harmonious communication between these

biophoton emissions and the cells they were influencing. Popp had found that in cancer cells the biophoton emissions had ceased to communicate with the rest of the body, so he went in search of plant extracts that would be capable of re-establishing these blocked lines of communication. He began experimenting with a variety of non-toxic substances that had indicated some efficacy in treating cancer. Mainly he found, however, that these reputed remedies had the effect of increasing the intensity of the biophotons from cancerous cells which were actually scrambling the information even more and making the cells even more deadly; not surprising when one considers that cancer as a general rule is incurable, so the majority of these plant extracts were having some effects, but were not essentially going to the root of the problem.

There was however one plant that helped the body to 'resocialize' the photon emissions of tumor cells back to normal, and that was mistletoe. Popp reports numerous successes with this plant, which is all the more interesting for the fact that mistletoe is a parasitic plant that lives on trees such as oaks, elms, firs and pines, and actually ends up killing its host. The berries of the mistletoe are poisonous to small animals, and there is considerable controversy as to whether it is actually safe to use mistletoe as a remedy. Back in pagan times mistletoe was reputed to inspire passion and increase fertility, which is where the custom of kissing under the mistletoe originated. Over the centuries mistletoe has become something of an all-purpose remedy. In the 17th century, French herbalists prescribed mistletoe for nervous disorders, epilepsy, and the spasms known as the Saint Vitus Dance. It was also used as a folk medicine to treat complaints as diverse as arthritis, asthma, bed-wetting and cancer.

An extract of mistletoe, known as Iscador, is widely used in Europe to stimulate the immune system and kill cancer cells. It is said to reduce the size of tumors and improve the quality of life of cancer patients. One French study reports that Iscador increases the efficiency of the body's natural killer cells in destroying cancer cells. There are German studies that confirm that Iscador is indeed effective as an inhibitor of tumor growth, and can prolong and enhance the quality of life of women with breast cancer which is spreading to other parts of the body.

Popp himself reported numerous successes with mistletoe. One of his cases was a woman in her thirties suffering from breast and vaginal cancer. Applying mistletoe seemed to enhance biophoton coherence in her cancer tissue samples. This particular patient stopped all other treatments apart from the mistletoe extract, and a year later all her laboratory tests had returned to normal.

Popp's notion of 'photon sucking' can be thought of in terms of a 'resonance absorber.' In homeopathy for example, which rests upon the notion that 'like is treated with like', it meant that frequencies which caused a problem may also be the way to cure the problem. If a plant at full extract can cause hives in the body, then a diluted extract of the same plant may be the cure the body needs. Rogue frequencies can cause certain symptoms, so find a plant extract that produces the same symptoms, and use a highly diluted preparation, which should emit the same frequencies that will resonate like a tuning fork with the abnormal oscillations and absorb them. Popp's notion of homeopathy as 'photon sucking' allowed the body to return to normal health by re-tuning the electromagnetic frequencies that were out of phase. The harmful resonances were absorbed by the beneficial ones. This gets us into the area of constructive and destructive interference in photon theory. Light of the same frequency will constructively interfere with itself if the wave peaks are in sync, and will destructively interfere with itself if the wave peaks are out of sync. Essentially the frequency of healthy light could be capable of erasing light of the same frequency that was out of phase.

The acupuncture points as practiced in traditional Chinese medicine are a system of meridians, running deep in the tissues of the human body, which are vortices for the channeling of the life force known to the Chinese as *ch'i*. This life force enters the body through these meridians and then flows on into the vital organs. If these pathways or channels become blocked then illness will be the result. Popp was able to reinterpret this theory which is silent as to the exact nature of the so-called 'life force', in terms of the meridian system representing specific electromagnetic waves (the biophotons) which are transmitted to specific zones in the body.

Popp's theory about acupuncture has been tested by an orthopedic surgeon, Dr. Robert Becker, who developed a special electrode recording device that could roll over the body; and he found that many of these acupuncture points are characterized by a markedly reduced electrical resistance when compared to the surrounding skin. The figures for the reduction in electrical resistance are quite staggering. At the acupuncture meridian points, the resistance was found to be 10 KiloOhms (that's 10,000 Ohms) compared to the resistance in the surrounding skin of 3 MegaOhms (that's 3,000,000 Ohms). Such a dramatically reduced resistance would indeed enable the most subtle electric currents to pass freely, which would be well and truly blocked in the adjacent skin areas.

Other researchers have supported this notion that the electrical and optical properties of meridians are different from surrounding tissue; indeed, meridians have been compared with electrical transmission lines. Methods have been developed to actually visualize the radiation emanating from the body using infrared cameras in the range of between 1 - 5 μm . A micrometer is a millionth of a meter. This radiation has been described as solitons, which are optical waveguides for the propagation of electromagnetic pulses without losing their coherence and form. They do not spread out during propagation, unlike conventional linear waves. In other words, these solitons are capable of transmitting information. It is known that charged solitons propagating along organic molecules, such as DNA, emit electromagnetic radiation of characteristic frequencies, and the existence of coherent electromagnetic fields in living matter is beyond doubt. It is also known that living matter, which has been variously described as nonlinear optical crystals and liquid crystals, specifically supports the propagation of electromagnetic solitons. The electromagnetic field is said to become 'self-focused' which suggests the specific output of the DNA as a result of optical quantum computing.

In an article entitled *Light as a Trigger and a Probe of the Internal Dynamics of Living Organisms*, by a group of researchers at the International Institute of Biophysics, Neuss, Germany, they were attempting to put forward a model of how biomolecules and electromagnetic fields can interact through the quantum mechanical

properties of water. They state that in a biological organism, no water molecule is farther from a surface than a few hundred Ångströms, such that all water in a living organism is interfacial and, therefore, coherent. They go on to describe several quantum and electromagnetic properties of this coherent water in biomolecules, including quantum tunneling and coherent excitation of the ensemble of quasi-free electrons to create vortices, which make it an ideal candidate for the channeling of information by means of biophotons. "The combination of these effects allows vortices having parallel magnetic momenta to add up, so that the energies of these vortices sum up, making it possible to reach high energy values starting as very small energies of elementary excitation." In other words, a very weak but extremely coherent emission of biophotons from the DNA is capable of triggering cellular and body functions that require a lot more energy. "The process of charge and discharge in coherence domains could give rise to a common oscillation capable of inducing coherence among them, so that higher structures can emerge producing hierarchical scales of nested structures, such as coherence domains, then cells, tissues and organs."

These researchers conclude, "In short, there is an interplay between electrodynamics and chemistry which is responsible for the organization of matter. Here, the energy stored in the electromagnetic fields trapped in the coherence domains induces, through a resonance mechanism, a selected set of chemical reactions which, in turn, through their output of chemical energy, change the frequency of the trapped electromagnetic fields, then change the set of possible chemical reactions. In this way we have a biochemical scheme able to evolve with time. The engine of this dynamic is electromagnetic fields whose frequency changes with time, starting with small values and reaching values in the infrared or visible range that, in turn, can activate biomolecules."

The model they put forward is that the human body possesses a set of pathways along which endogenous electromagnetic fields are self-trapped and propagate as solitons. The form of these pathways plays the role of waveguides. In certain areas, these pathways approach the skin, where they constitute special 'nodes' known as biologically active points

or acupuncture points. The meridians, acupuncture points and their *chakras*, in traditional Chinese medicine as well as Eastern medicine, represent those nested levels of electromagnetism in the living organism, and therefore reflect energetic organization of the living system. A recent study done by researchers at University of Pennsylvania *Protein's Secret Water Music in Nanospace* seems to confirm this model where the water molecules immediately surrounding the protein, move in concert with different parts of the protein itself, down to individual amino acids, suggesting that the water molecules are in some way integral to the functioning of the protein. We can understand why this should be so if, in fact, this water is capable of ramping up the energy in the extremely weak biophotons emitted from the DNA to sufficient levels, where it can trigger cellular processes and bodily functions. Quite simply, the water surrounding the proteins acts as a conduit for electromagnetic instructions from the DNA.

There have been many other findings about the significance of water for the transmission of energy and information within the organism; indeed, it has been proposed that molecular signals cannot be transmitted in the body unless you do so in the medium of water. Some researchers in Japan have put forward the notion of the 'superradiance' of water. The water molecules play a role in organizing discordant energy into coherent photons. Water as the natural medium of all cells not only sends the signal but also amplifies it. It is the conductor of a molecule's signature frequency in all biological processes; and furthermore, wave information is imprinted in the way water molecules organize themselves to form a specific pattern during transmission.

Dr. Mae-Wan Ho states, "The precise role of organized biological water in transmitting and perhaps amplifying electromagnetic signals has yet to be defined, but a growing number of us suspect that water may be playing the lead role in living processes. Significantly, water is largely transparent just within the narrow limits of frequencies around the visible range of electromagnetic radiation, where most of the molecular resonance frequencies are to be found, with steep rises in absorption on either side. This does enable resonating molecules to 'see' one another and

transfer energy. At the same time however, there is now little doubt that electromagnetic radiation in the microwave range and far below can have biological effects. As molecules self-assemble into structures on all scales, one would not be surprised to find vibrations and resonance over the entire range of frequencies.”

In another study *Yin/Yang Polarization: Quantitative Diagnostic Evaluation Using Biophoton Measurement from Human Hands and Feet*, the researchers attempted to use the ultraweak biophoton emission from human hands and feet as a diagnostic tool specifically to measure the *yin/yang* balance of a human subject. Although these researchers were primarily concerned with validating procedures used in Traditional Chinese Medicine, they adopted the measure of spin polarization from quantum physics as a means of deriving specific equations for *yin/yang* polarization parameters. In other words, these researchers assumed a direct correlation between spin up and spin down probabilities in the valence electrons in the DNA, and the *yin/yang* balance in metabolism which has been a core feature in Traditional Chinese Medicine for centuries. They were able then to quantify the spin up and spin down probabilities simply by measuring the biophoton emissions from the parts of the human anatomy traditionally associated with the *yin/yang* balance.

We come to the theory by Stuart Hamerhoff and Roger Penrose about microtubules in the brain being perfect candidates for an explanation for consciousness. Neurons in the brain are made up of axons which is like the body of the cell, and dendrites which is the tail. These microtubules are infinitesimally small, hollow tubes that surround the axon. Their function is not known, although generally they are thought to be a scaffold that supports the nerve fiber. In the theory of Hamerhoff and Penrose however, their size and structure appears to be perfectly designed to transmit photons in the UV range. Specifically, they have a crystal-like lattice structure and a hollow inner tube, which would enable optical quantum computing of the kind outlined in the previous chapter through the constructive and destructive interference of light; they merely assert that these structures appear to have the capacity for information processing. If we envisage the quantum computing actually taking place

in the nucleus of the neuron in the DNA, then their theory about the microtubules being perfectly designed to transmit photons in the UV range, does suggest a possible means by which the output of the quantum processing in the DNA is transmitted into the brain proper, and directs brain functioning.

Hamerhoff & Penrose advance quantum computing in these microtubules as being an explanation for consciousness; but with the quantum computing taking place in the DNA, and the microtubules being simply a conduit that allows the output to trigger brain processes, then consciousness must be defined as simply what we 'see' on the screen, namely the cortex of our brain. The brain itself becomes little more than a sophisticated television receiver where we not only see and hear something that appears to be an external world, but can also smell, touch, and taste it.

The observations of Hamerhoff & Penrose about the crystal-like structure of the microtubules making them candidates for quantum computing is very insightful, even though they didn't recognize that it is precisely optical quantum computing, and no other, that could occur here. When scientists talk about the crystal-structure of some material, they do not mean what a layman would normally think of as a crystal. A crystal-like structure merely means a very precise and repetitively consistent structure throughout the entire material, which does enable very precise diffractive patterns as the light scatters off atoms in the material. DNA also has a precise crystal-like structure in this sense, albeit a very complex one. But the more complex the crystal-like structure is, the more complex is the optical quantum computing that can occur. Ultimately, this is what makes the DNA the obvious candidate for quantum computing and not these microtubules in the brain. The microtubules do however have the necessary structure to make themselves candidates for transmitting optically processed information. The microtubules all seem to radiate from the nucleus of the neuron where the DNA is located.

To quote Stuart Hamerhoff: "Traditionally viewed as the cell's 'bone-like' scaffolding, microtubules and other cytoskeletal structures now appear to fill communicative and information-processing roles.

Theoretical models suggest how conformational states of tubulins within microtubule lattices can interact with neighboring tubulins to represent, propagate and process information as in molecular-level ‘cellular automata’ computing systems.” All he is really saying is that they are perfect conduits for biophotons from the DNA.

In a study *Biophotons as neural communication signals demonstrated in situ* which investigated biophotonic activities in rat spinal nerve roots *in vitro*, it was found that different spectral light stimulation (infrared, red, yellow, blue, green, and white) at one end of the spinal sensory or motor nerve roots resulted in a significant increase in the biophotonic activity at the other end. The investigators conclude, “This study may provide a better understanding of the fundamental mechanisms of neural communication, the functions of the nervous system, such as vision, learning and memory, as well as the mechanisms of human neurological disease.”

In another study *Emission of Mitochondrial Biophotons and their Effect on Electrical Activity of Membrane via Microtubules*, it was found that in addition to electrical and chemical signals propagating in the neurons of the brain, signal propagation takes place in the form of biophoton production. The researchers investigated the interaction of mitochondrial biophotons with microtubules from a quantum mechanical point of view. They concluded: “Our theoretical analysis indicates that the interaction of biophotons and microtubules causes transitions/fluctuations of microtubules between coherent and incoherent states.” We have seen in the last chapter that optical quantum computing in the DNA involves the coherent light being spontaneously emitted within the DNA molecule, canceling out the probability amplitudes through constructive and destructive interference. If this is the case, then these microtubules within the essential structure of the neuron are the means by which the output from the DNA is channeled into the brain to trigger neural functions.

Further evidence that these biophotons are actually responsible for sensory perception in the brain comes from a study *Estimation of the number of biophotons involved in the visual perception of a single-object image*. These researchers found that the retina transforms external photon signals

into electrical signals that are carried to the *striate cortex* of the brain. From there the electrical signals can be converted into regulated ultraweak bioluminescent photons (biophotons) that make it possible to create intrinsic biophysical pictures during visual perception and imagery. In other words, the actual biophoton intensity within these neurons in the visual pathway seems to be responsible for the mapping of the image we 'see' in the visual cortex at the back of our brain.

Another study *Biophotons, microtubules and CNS, is our brain a Holographic Computer?* points out that neurons are large colorless cells with wide arborizations (dendritic branches), and have an active metabolism generating photons, contain little pigment, and have a prominent cytoskeleton consisting of hollow microtubules. The brain and spinal cord are protected from environmental light by bone and connective tissue, so the signal to noise ratio should be high for photons acting as signals, and in addition the neurotransmitters most active in the brain - serotonin, dopamine and norepinephrine - demonstrate the 'strongest fluorescence'. All these factors indicate that the brain creates an ideal environment for optical computing, and the researchers argue that it should be looked upon as a 'holographic computer'.

It seems that mainstream geneticists are now finally starting to catch on to the concept that biophotons from the DNA are capable of controlling our brain processes. There is a new field of study known as Optogenetics, which started almost a decade ago with the development of channelrhodopsins, light-activated ion channels that can, with the flick of a switch, instantaneously turn on neurons. These channelrhodopsins were first discovered in unicellular green algae, where they acted as photoreceptors enabling light to guide the movements of these microorganisms. In 2005 these light-sensitive proteins were transplanted into mouse neurons, and the researchers found that by shining a pulse of blue light on these neurons they could reliably trigger action potentials; the ion channel at channelrhodopsin's core opens up allowing positively charged ions to enter the cell.

Subsequently another light-sensitive protein, the halorhodopsins, were found to be selective for the negatively charged ion chloride, which

would enable neurons to be deactivated by the flick of a switch. Initially this process was found to be very inefficient. Halorhodopsin is what is known as an 'ion pump' which means that for every photon of light only one chloride ion crosses the neuron's membrane. Researchers found that it led to only a partial inhibition of neurons in living animals. A breakthrough has recently been announced (April 1914) where researchers were able to develop some genetic mutations of these ion channels, based on their analysis of the molecular structure of the channelrhodopsin, which now gives them a reliable means of silencing the neurons as well. According to *ScienceDaily*: "The new structurally engineered channel at last gives neuroscientists the tools to both activate and inactivate neurons in deep brain structures using dim pulses of externally projected light."

Scientists are now saying that they will soon have the power to activate or deactivate neurons with the flick of a switch. This of course involves light shining on the neurons from an external source, but it would seem that that they have merely hit upon one small aspect of the way that the DNA within the neuron can trigger action potentials by means of biophotons, and thus effectively control and modulate all neural activity.

A summary of all the various fields where biophoton emission has been determined to be a factor can be found in the study *An introduction to human biophoton emission*. The following fields of research are listed: (1) influence of biological rhythms, age, and gender on emission, (2) the intensity of emission and its left-right symmetry in health and disease, (3) emission from the perspectives of Traditional Chinese and Korean Medicines, (4) emission in different consciousness studies, (5) procedures for analysis of the photon signal from hands, and (6) detection of peroxidative processes in the skin. The material the authors present includes aspects like spatial resolution of intensity, its relation to health and disease, the aspect of color, and methods for analysis of the photon signal and they conclude that the study of biophoton emissions, although still in its infancy, has the most significant implications not only for health

and disease generally, but also to mental states, moods, emotions and neural processes.



6

Inner self located

Sufficient data is now known from neurophysiology and electroencephalography to pinpoint the part of the brain that operates in our sleep. It is the purpose of this chapter to review Hindu philosophy (as expounded in the *Upaniṣads*) on the subject of sleep; and to inquire whether the part of the brain that operates during sleep is the part of the brain where the Self resides. It will be shown that the Scriptures abound with clues as to the precise location of the Self; and just a basic knowledge of neurophysiology and electroencephalography is sufficient to interpret these clues, at which stage they become veritable signposts pointing in the right direction.

It can be no exaggeration to say that the state of sleep is the very cornerstone of Hinduism. According to the *Kaṭha Upaniṣad*, *Puruṣa*, “who keeps awake and goes on creating desirable things, even when the senses

fall asleep, is pure; and He is *Brahman* and He is called the Immortal. All the worlds are fixed on Him; none can transcend Him" (II. ii. 8).¹ This *Puruṣa* is called thus because He sleeps in all bodies (*Puriśaya*) (*Bṛhadāraṇyaka Upaniṣad* 2.5.18).² On an individual plane this *Puruṣa* or *Brahman* is known as *Ātman* or the Self.

Two states of sleep are distinguished. There is first the dream consciousness which is evoked and sustained by the Self. "The blissful Self, revived by the impression of joy etc. is perceived in dream..." (Śaṅkarācārya's Commentary on the *Taittirīya Upaniṣad* p. 323)¹ "That radiant infinite Being ... puts the body aside in the dream state." (*Bṛhadāraṇyaka Upaniṣad* IV. 3. 11).² "*Puruṣa* is the Supreme Person, who Himself becomes manifest as the persons in the eye and in dream..." (Śaṅkarācārya's Commentary on the *Chāndogya Upaniṣad* p. 658)³

"When the Self thus stays in the dream state, these are the results of its past work." (*Bṛhadāraṇyaka Upaniṣad* 2. 1. 18)⁴ "Dreams generally correspond to experiences of the waking state. But sometimes one dreams things neither experienced nor to be experienced in this life. And since dreams are not original experiences, the above must be attributed to experiences of another life..." (Commentary on the *Bṛhadāraṇyaka Upaniṣad*, p. 319)⁴ "When it dreams, it takes away a little of this all-sustaining body, itself makes (the body) insensible and self creates (a dream body) and dreams through its own radiance (illumined) by its own light. In this state this entity (the Self) itself becomes the light." (*Bṛhadāraṇyaka Upaniṣad* 4. 3. 9).⁴ The *Praśna Upaniṣad* states, "there in dreaming state, that God experiences His own greatness. He sees all, Himself being all." (IV. 5)

There is secondly the state of deep sleep. "... then the sleeper becomes merged in Existence. He attains his own Self. Therefore, they speak of him as, "he sleeps" for he attains his own Self". (*Chāndogya Upaniṣad* VI. 8. 1)³ "... they reach daily (during sleep) this *Brahman* which is the goal." (*Chāndogya Upaniṣad* VIII. 3. 2)³ "In deep sleep *Puruṣa* remains unmanifest and His organs fully withdrawn." (Śaṅkarācārya p. 660) Krishnananda says, "It is only in the state of deep sleep that the self goes back to its own pristine purity. The energy is withdrawn; consciousness is withdrawn; the

ability to perceive is withdrawn. It appears as if life itself has gone. There is a practical non-existence of the individual for all conceivable purposes. What happens is that the central consciousness, which is the Self, draws forth into itself all the energies of the external vestures, viz. the body, the *Prāṇa*, the senses, the mind, etc. and rests in itself without having the need to communicate with anything outside." (p. 855)⁵

The Self is consistently stated to be the agent that brings about the transition from the sleeping state to the waking state. "...it hastens back in a reverse way just to its previous state, that of waking..." (*Bṛhadāraṇyaka Upaniṣad* 4. 3. 15).⁴ "As a large fish swims alternately to both banks (of a river) eastern and western even so does this infinite entity move alternately to both these states – those of dreaming and waking." (*Bṛhadāraṇyaka Upaniṣad* 4. 3. 18)⁴ "While the Self withdraws itself from all manifestations when it is in deep sleep, it projects itself in waking through the very channels through which it withdrew itself in sleep." (p. 865)⁵

The *Kaivalyopaniṣad* states that "The being who sports in the three cities (viz the states of wakefulness, dream and profound sleep) from Him has sprung up all diversity. He is the substratum, the bliss, the indivisible consciousness, in whom the three cities dissolve themselves." (14)⁶ "Verily the *Ātman* (Self) should be known as being the same in its states of wakefulness, dreaming and dreamless sleep." (*Amṛtabindūpaniṣad* 11).⁶ It should be noted, however, that when the Self has totally withdrawn, It is no longer considered to be contained within the state of deep sleep and the *Upaniṣads* speak of a fourth state. Then it is "devoid of states, positive or negative, and remains in a state of non-separation and oneness, that It is spoken of as *Turiya*, the fourth." (*Sarvopaniṣad* 2)⁶ The Self or *Ātman* is the *Liṅga-Śarīra* (subtle body) and the "heart's knot". In the fourth state the Self transcends the individual altogether and merges with the macrocosmic *Brahman*. "That very mind becomes the fearless *Brahman* possessed of the light of Consciousness all around." (*Māṇḍūkya Kārikā* III. 34)⁷

"Right from the time of the *Āg Veda* the divine texts have consistently maintained that the Self is located in the heart (*hṛdaya*). Because this Resplendent God who is the nourisher of all by His might knows fully the

hidden soul or *Ātman* dwelling in the cave of the heart or intellect doing many noble deeds, He is Omnipotent.” (1. 23. 14) Śaṅkarācārya explains the meaning of the word *anṅuṣṭhamātrah* – “of the size of a thumb, the lotus of the heart is of the size of a thumb; (and) as conditioned by the internal organ existing in the space within the lotus of the heart (the Self) has the size of a thumb.” (p. 181)¹ The *Chāndogya Upaniṣad* states: “This Self of mine within the heart, is smaller than paddy or barley or mustard or a Shyamaka seed, or the kernel of Shyamaka seed. This Self of mine within the heart is greater than the earth, greater than the interminable space, greater than the heaven, greater than the worlds.” (III. 14. 3)³ In particular, the location of the Self in deep sleep is given as the heart. The *Bṛhadāraṇyaka Upaniṣad*, for example, states: “When this Self that is associated with the intellect is thus asleep, it withdraws by its specialized knowledge the functions of the organs, and lies in the Supreme Self that is within the heart.” (2. 1. 17)⁴ “In the ether of the heart situated in the interior of the sheath, the divine soul attains the state of sleep. Then by resorting to the same course he leaps into the waking state.” (Subāla Upaniṣad IV 1)⁸

The Sanskrit word ‘*hṛdaya*’ (heart) is composed of three letters ‘*Hṛ*’ ‘*Da*’ and ‘*Ya*’. Krishnananda explains, “*Hṛ* means to draw. That is the grammatical root meaning of the letter ‘*Hṛ*’. Drawing, to attract, to pull towards oneself, to compel everything to gravitate towards oneself, to bring everything under one’s control, to subjugate everything, to superintend over all things and to be overlord of everything – all these meanings are comprehended in the root meaning of the letter *Hṛ*...that which draws everything towards itself.” (p. 682)⁵ “The other element is *Da*. In the word *Hṛ-da-ya*, *Da* is the second letter. *Da* connotes the meaning ‘to give’ in Sanskrit.” (p. 683)⁵ “The third letter is *Ya* of *Hṛ-da-ya*. In Sanskrit *Ya* means “to go”.” (p. 684)⁵ The obvious etymological significance, then, of the word ‘*Hṛdaya*’ is that it goes by drawing and giving. Monier-Williams lists ‘to withdraw’ as a specific meaning of the root ‘*Hṛ*’. (p. 1302)⁹ He lists ‘giving, granting, offering, effecting, producing as meanings of the letter ‘*Da*’. (p. 464)⁹ “ ‘*Ya*’ in the masculine,” Monier-

Williams says, “is a ‘goer or mover’ and in the feminine ‘Ya’ means the act of going.” (p. 838)⁹

Given the fundamental precept of Hindu philosophy that the Self is responsible for the three states of waking, dreaming and deep sleep; and the equally fundamental precept that the Self is located in the heart (*hr̥daya*), the conclusion is inescapable that the heart (*hr̥daya*) is the part of the brain that is responsible for drawing the individual into sleep, and for waking him or her up again. The heart (*hr̥daya*) goes by drawing and giving; that is to say, withdraws waking consciousness from the individual (draws him or her into sleep); and then it gives consciousness back to the individual at the time that it wakes the individual up (it produces a new waking consciousness). In order to locate the Self, it is simply a matter of pinpointing the part of the brain that operates during our sleep.

There are many indications that the embryo in the womb is in a state of sleep. The state of ‘wakefulness’ comes about after the state of sleep and depends upon the fetus being developed to the point where, at the end of the sixth month, its eyelids actually open. The part of the brain that operates during sleep is the embryo brain region. The adult sleeper must therefore be regarded as having reverted to the primary fetal state (the embryonic state). Mentally, the adult sleeper has returned to his mother’s womb. This is reinforced by the many similarities between an embryo and an adult in the state of sleep that are too obvious to list here.

The specific neurophysiological and electroencephalographical indications that the embryo is in a state of sleep are as follows:

a) We know that growth hormone is released from the pituitary gland specifically during the state of ‘slow-wave’ sleep. The pituitary gland in the embryo brain develops some thirty days after conception and commences to release growth hormone. In other words, ‘slow-wave’ sleep must be occurring for the growth hormone to be released.

b) The electroencephalogram picks up dysrhythmic low-voltage brain wave activity as early as the second month of gestation.¹⁰ This is consistent with ‘slow-wave’ sleep having commenced.

c) Five weeks after conception the embryo will make an 'avoidance' type movement if the trigeminal nerve in its face is touched or stroked. It will even 'sneer' eight weeks after conception or 'scowl' eleven weeks after conception.¹¹ Such responses are consistent with the embryo being disturbed in its sleep.

d) The part of the brain that is responsible for the transition from 'slow-wave' (NREM) sleep to dreaming (REM) sleep is located in the embryo brain region.¹²

e) The neurotransmitter 'noradrenaline' which draws the individual into sleep comes from the embryo brain region.¹³

f) The neurotransmitter 'dopamine' which wakes the brain from sleep comes from the embryo brain region.¹⁸

g) There may also be a peptide neurotransmitter which is responsible for sleep, and although research data is not clear, larger concentrations of this substance have been located in the embryo brain region.¹⁴

h) Another neuropeptide, 'somatostatin', which releases or inhibits growth hormone, and is therefore very relevant to the sleeping process, has been traced to the embryo brain region.¹³

i) Electroencephalography indicates that the 'synchronizing' and 'desynchronizing' brainwaves of the sleep-wakefulness cycle emanate from the embryo brain region.¹²

j) In 1962 Michel Jouvet suggested that the path responsible for sleep desynchronization (dreams) commences in the embryo brain region. Conversely, the pathway responsible for the desynchronization observed during waking hours commences in the embryo brain region.¹²

The embryo brain consists of the thalamus, hypothalamus, midbrain and brainstem. These are the specific areas of the brain that are discernible about five weeks after conception. As the brain grows and expands these areas remain the central core and guiding influence. It is mentioned in passing that the thalamus and hypothalamus comprise a part of the brain known as the diencephalons which also contains the pineal body. A special significance for this pineal body is not ruled out, although there is little neurophysiological evidence as to its functions.

The hypothalamus is responsible for the states of being awake or asleep which are pivotal in our lives. It is said to organize, when electrically stimulated, total acts of aggression, timidity, mating and sexual behavior in animals. As to these last mentioned aspects, compare the content both of our dreams and our thoughts, where themes such as these regularly occur. In terms of human emotion we would talk of hatred, fear, love and desire. The hypothalamus apparently directs our mental processes from the very beginning, and is responsible for all our emotions. The hypothalamus is also considered responsible for the autonomic nervous system which directs all the myriad functions that take place in our body over which we have no conscious control – functions relating to circulation, respiration, digestion, excretion, regulation of body temperature and metabolism, regulation of water content and reproduction. The fact that the hypothalamus remains a relatively small area in the developed adult brain merely attests to its potency, and to the fact that it was performing functions just as complex in the embryo period when it was very small indeed. Hence references in the *Upaniṣads* to the Self being of the size of a thumb or less. The entire embryo brain region in the adult brain is indeed about the ‘size of a thumb.’ The hypothalamus itself has a rostrocaudal extent of about 10 mm.¹⁶

Compare the fact that the hypothalamus controls respiration with the passage in the *Bṛhadāraṇyaka Upaniṣad*, “That which breathes by the breath is thy soul which is within every being.” (3. 4. 1)² It is also known that the fetus in the womb practices breathing movements specifically during REM sleep.¹⁷ Another factor indicating the workings of the Self in the embryo brain region; the source of respiration and dreams: “Now he who, without stopping the respiration, goes upwards, moving about yet unmoving, dispels darkness, he is the Self.” (*Maitreyi Upaniṣad* II. 2)³

The thalamus has extensive connections with the higher regions of the brain and determines what will become conscious to us. Fibers from the thalamus are connected as well to neurons of the central nervous system, gustatory, auditory, visual, and from the skin, the organs of balance, the bladder, the alimentary canal, the muscles and joints. The *Upaniṣads* speak about precisely these nerves emanating from the heart. “Again when (this

person) is fast asleep, when (he) knows nothing whatsoever returning in the body with the seventy-two thousand nerves by name *hita* which proceed from the heart to all parts of the body, he sleeps." (*Bṛhadāraṇyaka Upaniṣad* II. i. 19)¹⁵

By five months of gestation, increased brain wave activity is noted with the onset of activity around the thalamus.¹⁰ This is consistent with the thalamus acting as a mediator or 'go-between' between the embryo brain and the higher regions of the fetus's brain that are by now substantially developed. And it is likewise consistent with the brain wave activity in the adult where there are 10/sec rhythmical brainwaves that are considered to comprise a loop between the cortical regions and the thalamus.¹² There are a number of theories about the precise pathway that the loop takes but the concept of the thalamus as a 'go-between' is reinforced by Baron Edgar Adrian's observation that rhythmic thalamic activity persists even if substantial areas of the cortex are removed – indeed even if the whole cortex is removed! Further reinforcement comes from the theory that the thalamus acts as a central 'pacemaker' for cortical rhythmical activity, which implies that command signals from a small thalamic region are distributed to wide areas of the cortical mantle.¹²

The importance of the brainstem is certainly on a par with the other areas of the embryo brain because a system of projections are in place here by the end of the embryo period (8 weeks) which influence the growth and development of the cortical (higher) regions. It is generally concerned with the states of arousal - sleeping, waking, relaxation, alertness, vigilance etc. Sensory input from the receptors does not reach the anatomical substrate of consciousness while we are asleep because of the operation of the brainstem; if the input is urgent it awakens us.¹³ "The nerve that rises upward from the heart is their passage for moving (from the dream state to the waking state); it is like a hair split into a thousand parts. (Numerous) nerves of this body, called *Hita* are rooted in the heart." (*Bṛhadāraṇyaka Upaniṣad* 4. 2. 3)⁴ "This Self (i.e. the subtle body) is surely in the heart. There are a hundred and one of the (chief) nerves. Each of them has a hundred (division). Each branch is divided into seventy-two

thousand sub-branches. Among them moves the *Vyāna*.” (*Praśna Upaniṣad* III. 6)⁷

Neurons or nerve cells in the brain are a spherical medium enclosed within a surface membrane and containing a salt solution quite different from the surrounding medium. The composition of the external salt medium is similar to that of an ultrafiltrate of blood. Nerve fibers likewise contain an internal aqueous medium and lie in an external aqueous medium which corresponds again to an ultrafiltrate of blood. (p. 20)¹⁸ As the *Chāndogya Upaniṣad* says, ‘Those that are these nerves of the heart are filled with subtle juices...’ (VIII 6. 1)³

There are many clues in the *Upaniṣads* that the Self is located in the embryo brain region in the center of the brain. For instance, very often the Self is simply described as being located in the middle. “After meditating on the Self seated in the middle of the heart like a lamp placed inside a vessel of the size of a thumb and of the form of smokeless flame (the Self manifests himself).” (*Paiṅgala Upaniṣad* III. 3)⁸ “All deities worship that adorable one, the seated in the middle, who pushes the *prāṇa* upward and impels the *apāna* inward” (*Kaṭha Upaniṣad* II. ii. 3)¹ “...in the middle (between the two parts) there comes into being the divine person, the person, with a thousand eyes, a thousand feet and a thousand arms...” (*Subāla Upaniṣad* I. 1)⁸ (“between the two parts” – the two hemispheres of the brain). These would all appear to be clear references to the embryo brain region. “Therein the individual soul who has established himself in the middle of the eyebrows...” (*Paiṅgala Upaniṣad* II. 8)⁸ It so happens that the spot in the middle of the eyebrows, the mystical third eye of Shiva, is directly in line with the embryo brain region in the middle of the brain.

We learn from neurophysiologists that when pieces of midbrain are isolated from the brain, the cells continue to fire spontaneously and in a sustained manner.¹² By ‘firing’ is meant ‘synapses’ – the nerve cells acquire electrical properties. When one considers that by the fifth week after fertilization the embryo cranium is bulging with midbrain, and given the spontaneous nature of midbrain activity independently of the higher regions, it is apparent that we have a mental life from a very early age. This spontaneous firing of the midbrain is what the *Bṛhadāraṇyaka*

Upaniṣad is referring to when it says, “it thinks as it were and quivers, as it were” “as in dream the mind vibrates.” (*Māṇḍūkya Kārikā* III. 30)⁷ Krishnananda says, “Even if there is a blazing sun in dream it is the mind shining.” (p. 519)⁵ The midbrain ‘shines’ in the sense of spontaneous firing of nerve cells. “As from a blazing fire sparks of like form issue forth by the thousands even so many kinds of beings issue forth from the Immutable...” (*Māṇḍūkya Upaniṣad* III. i. 1)⁸

The fact that the midbrain is directly connected with the eyes is the clue that it is the source of dreams. The *Maitreyi Upaniṣad* tells us that “The person who is in the eye, who abides in the right eye, he is Indra and his wife abides in the left eye... There is a channel extending from the heart up to the eye and fairly fixed there. That is the channel which serves both of them, by being divided in two though but one.” (VII. 11) “That is the eye in a man through which one sees in a dream.” (*Vedic text* p. 52)⁷ The visual pathway runs forward from the midbrain to the eyes, and backwards from the midbrain to the visual cortex at the back of the brain. The visual pathway is indeed “divided in two though but one” as the *Maitreyi Upaniṣad* says, in order to serve both eyes. Dreams involve visual image and are therefore inextricably tied in with the visual pathway. Śaṅkarācārya says, “and then a man whose eyes are plucked out should not perceive blue yellow etc. in dream.” (Commentary on *Aitareya Upaniṣad* p. 52)⁷ This is an allusion to the fact that only the color cone receptors in the retinae of the eyes can produce a color image in our dreams. It is apparent then that a dream image originates in the midbrain as an electrical impulse which then travels forward to the eyes where the impulse is converted into a color image – this is why dreams always involve eye movement either rapid or non-rapid – and from the eye back along the visual pathway to the visual cortex where the image is actually registered. It is therefore understandable that brain patterns during REM sleep (desynchronized) are practically identical with those during arousal.¹³ The visual pathway comes into operation in both cases. Krishnananda says, “As in dream, so in waking, as in waking so in dream.” (p. 521)⁵ The midbrain “thinks as it were, and quivers, as it were.

For being one with dreams, it goes beyond this (waking) world.” (*Bṛhadāraṇyaka Upaniṣad* 4. 3. 7)⁴

“This is but the middle-part of the Self.” (*Chāndogya Upaniṣad* V. 15. 2)³ ; “*Madhye āsīnam* – sitting in the middle – sitting in the space inside the lotus of the heart, shining in the intellect as revealed knowledge.” (Śaṅkarācārya’s Commentary on the *Kaṭha Upaniṣad* p. 187)¹ “Abiding in the middle place, man sees both places, this and the place of the other world.” (*Bṛhadāraṇyaka Upaniṣad* 4. 3. 9)² It is submitted that in the midbrain is located the cosmic intelligence, *Brahman* and *Ātman* or the individual Self operates through the hypothalamus and thalamus as well as the brainstem. “The Supreme dwells in close fellowship with the individual Self in the cave of the human intelligence.” (Rangaramanuja – quoted by Radhakrishnan p. 621)³ There are dozens of similar references in the *Upaniṣads* to this ‘*guhā*’, this secret place, this cavity, this cave in the intellect which is *ākāśa*: space. “It is used as a name of the Supreme, because like a space, *Brahman* has no body and is subtle.” (Radhakrishnan, p. 511)⁸ There is literally a cavity or space associated with the midbrain. The fourth ventricle. A broad shallow rhomboid-shaped cavity that extends from the upper cervical spinal cord to the cerebral aqueduct of the midbrain. (p. 35)¹⁶ “The fourth state, *Turiya*” “the ether of the heart?” And it does arguably resemble the broad leaf of a lotus plant. “In addition there is the central grey matter (grey perforating substance) of the midbrain which is also known as perforated space.” (p. 198)¹⁸

That the embryo brain region is the location of the Self is consistent with the many references in the *Upaniṣads* to the Self being the ‘seed’, ‘the source’, ‘the creator’. “In a person, indeed this one first becomes an embryo.” (*Aitareya Upaniṣad* II. i. 1)⁸ “It is the seed of all activity, that is to say, it is the state of deep sleep. That (mental state) is called *jñānam*, knowledge...” (Śaṅkarācārya p. 392)⁷ It is repeated that by the fifth week after fertilization, the embryo cranium is bulging with midbrain that is firing spontaneously. This is the vital force. “It is like that which is known as the flash of lightning, and It is also as though the eye winked.” (*Kena Upaniṣad* IV. 4)¹ “The vital force enters into the womb along with the seed and it develops itself into the embryo and all the other limbs such as the

eye, the ears and the rest manifest themselves subsequently.” (Sivananda p. 534)¹⁵

“The desire is for knowing some special director of the mind.” (Ananda Giri) “Who is that effulgent being who is the director of the mind and other organs towards their own objects and how does he direct?” (Śaṅkarācārya’s Commentary on the *Iśa Upaniṣad* p. 39)¹ “He is all-pervasive, pure, bodiless, without wound, without sinews, taintless, untouched by sin, omniscient, ruler of the mind, transcendent and self-existent.” (*Iśa Upaniṣad* 8)¹ This ‘special director’, this ‘ruler’ of the mind has to be the part of the brain that determines the growth and development of the whole brain, i.e., the embryo brain region.

“As the spider weaves out the web and again withdraws it, so the *Jīva* comes out to and goes back again to the wakeful and dreaming states respectively.” (*Brahmopaniṣad* p. 62)⁵ This reference to the Self being like a spider that casts out and withdraws its web occurs a number of times in the *Upaniṣads*. It is consistent with the Self being located in the *hṛdaya* (heart) that goes by drawing and giving. It would appear to be an illustration of the way the Self, lodged in the embryo brain region by means of the neurotransmitter, noradrenaline, draws the individual into sleep, and by means of the neurotransmitter, dopamine, wakes the individual up again. These neurotransmitters emanate from the embryo brain region in spider web pattern through the network of nerve channels in the brain. “And when a man is about to wake up, they emanate – they proceed to their respective functions – from the mind itself just like the rays radiating from the sun.” (Śaṅkarācārya’s Commentary on the *Praśna Upaniṣad* p. 452)⁷

We perceive an external world and function within it by virtue of the outer regions of the brain, and in particular the cerebral cortex. For instance, the visual cortex acting on messages received from the retina of the eye forms an internal map of what is seen. The parietal lobes are responsible for providing us with ‘body schema’ information about the spatial properties of our own body. It therefore becomes easy to understand references in the *Upaniṣads* to the upside down tree. “With the root above and branches below (stands) this ancient fig tree. That

(indeed) is the pure; that is *Brahman*. That indeed is called immortal. In it all the worlds rest and no one ever goes beyond it.” (*Kaṭha Upaniṣad* II. iii. 1)⁸ The brain truly resembles a tree with the embryo brain region as its root and trunk, and the cerebral hemispheres and cortex where the manifested world is registered as the branches. The root is ‘above’ in the sense that *Brahman* is located in the root. “It is the Self that is below.” (*Chāndogya Upaniṣad* VII. 25. 2)³ “...that One, the omniscient and transcendent – who is both *para*, high, as the cause and *apara*, low, as the effect...” (Śaṅkarācārya’s Commentary on the *Mūṇḍaka Upaniṣad* p. 139)⁷ “The tree branches ‘downwards’ in the sense that the cerebral cortex, where the manifested world is located is the effect and is low, for this world is indeed lower.” (*Bṛhadāraṇyaka Upaniṣad* 3. 18)⁴

“Just as all the spokes are fixed in the nave and the fellow of a chariot wheel, even so are all beings, all gods, all worlds, all organs and all these (individual) selves fixed in the Self.” (*Bṛhadāraṇyaka Upaniṣad* 2. 5. 15)⁴ It doesn’t take much imagination to envisage the brain as a section of a wheel. The embryo brain region in the middle is the hub or nave and the cerebral cortex is the circumference or fellow. “Within that (heart) in which are fixed the nerves like the spokes on the hub of a chariot wheel moves this aforesaid Self by becoming multiformed.” (*Mūṇḍaka Upaniṣad* II. ii. 5)⁷ Note the allusion is simply to the way the spokes are fixed in the hub; not to the Self being the hub of a complete wheel.

There are many references in the *Upaniṣads* to the Self being ‘unborn’. “This great, unborn soul is the same which abides as the intelligent (soul) in all living creatures, the same which abides as ether in the heart; in him it sleeps; it is the subduer of all, the Ruler of all, the sovereign lord of all beings.” (*Bṛhadāraṇyaka Upaniṣad* 4. 4. 22)² It is only when one grasps the significance of the sleeping state that the reference to the Self being unborn can be understood. From conception onwards the embryo is asleep, and the adult sleeper reverts precisely to that embryonic state of mind. The Self is located in the embryo brain region and preserves its embryonic identity. It is in this sense that the Self is ‘unborn’. When an adult goes to sleep he mentally reverts to his mother’s womb. “The talkers vouch indeed for the birth of that very unborn, positive entity. But how can a

positive entity that is unborn and immortal undergo mortality?" (*Māṇḍūkya Kārikā* III. 20)⁷ "(The Self) without being born (appears to be born in various ways), it follows that He is born on account of *Māyā* alone." (*Māṇḍūkya Kārikā* III. 24)⁷ As *Āg Veda* says, "It is the controller of the body, the unborn part, which survives death." (X. 16. 4)

Finally, once one understands the significance of *hṛdaya* as the embryonic region of the brain that draws the individual into sleep and wakes the individual up again, it becomes possible to understand the full meaning of the word '*satya*' truth. "The gods adore even truth. The name of *satya* (truth) consists of three syllables. The first is '*Sa*', the second syllable '*Ti*' and the third syllable '*Ya*'. The first and the last syllables (*Sa* and *Ya*) are truth, the middle falsehood (*anṛta*), falsehood is on either side encompassed by truth." (*Bṛhadāraṇyaka Upaniṣad* 5. 5. 1)² This is an illusion to the sleeping-waking cycle. Truth, the Self, which withdraws into the *hṛdaya* when we are asleep is the reality. When the Self gives us a waking consciousness, that is the falsehood, the untruth. In other words, *māyā*, the illusion of the manifested world. On again being drawn into the state of sleep we return to the reality. The truth is that *Brahman* is in the heart (*hṛdaya*) and *Brahman* is the reality.



7

The five senses

Brain scientists have continued to search for the way in which external stimuli activate the senses, notwithstanding the fundamental message of quantum mechanics - that their efforts are in vain. Quantum mechanics as well as Hindu philosophy are at one in denying the possibility of 'duality', i.e. that both 'subject' and 'object' can have a separate existence, which therefore raises a question as to the true operation of the senses. We shall here examine in some detail the sensory apparatus of the body to see whether it's possible that quantum mechanics and Hindu philosophy are right, and that the senses are actually giving us false information. In particular we shall look at the operation of neurotransmitters that are capable of activating the senses from within the brain.

All along, the *Upaniṣads* have been saying that the senses are directed from within. For example, in relation to the sense of sight, "This person that is seen in the eye, this is the Self." (*Chāndogya Upaniṣad* IV. 15. 1)¹ "For everybody sees... through the mind alone." (*Bṛhadāraṇyaka Upaniṣad* I.

5.3)² This can only be done by neurotransmitters in the retina of the eye which determine the nature of the electrical impulse that is sent down the optic nerve. Neurotransmitters are potent chemical substances which, as their name implies, transmit neural (electrical) signals. And it is precisely electrical stimulation that causes them to be released. Throughout the brain and body there are constant waves of electrical activity emanating from the embryo brain region, and these brainwaves can signal to a neurotransmitter in the retina which excites (or inhibits) a particular neuron or nerve cell.

Blood can also signal the release of neurotransmitters in the retina. The whole brain is bathed in blood; and hormones, which are neurotransmitters carried by blood, are capable of stimulating any neuron in the body. By virtue of blood the whole body becomes a closed circuit. The blood reaches everywhere and the hormones it contains are like radio messages. The program can be picked up by anybody who has a radio to receive it. (p. 530)³ These programmed messages are all released into the bloodstream from the embryo brain region (including the pineal gland and the hypothalamus), and can regulate and stimulate myriad electrical interactions.

The standard explanation from neurophysiologists for what we see is that the retina is sensitive to light; and changes in the chemical composition of the retina activate 'bipolar cells' which in turn activate 'ganglion cells', which fire electrical impulses down the optic nerve. They further tell us that prior to the activation of the ganglion cells, there is stimulation from 'lateral' connections known as the 'horizontal' and 'amacrine' cells, which are internal to the brain. This internal innervation, they do concede, can also determine the nature of the electrical impulses that are sent down the optic nerve to the embryo brain region. From there a dense group of fibers, the optic radiations, relay the impulses to the visual cortex at the back of the brain where the external world is registered. Wave functions in these optic radiations from the embryo brain region to the visual cortex determine what we see.

But this is only one-half of the story. There is also a very dense projection of nerve fibers back from the visual cortex to the embryo brain

region which indicate that the visual system is a circuit – output from the visual cortex to embryo brain region, which in turn determines input to the visual cortex. Neurophysiologists indeed are at a loss to understand why this should be so. It seems to be excessively complex if all the visual system is doing is monitoring objects in an external world. (p. 803)³ But a circuit such as this is precisely what would be required if the brain itself is generating everything that we see. All that remains is to pinpoint the part of the embryo brain region that can signal to the horizontal and amacrine cells in the retina what we will see next.

The retina of the eye is attached to the pineal gland via the retinohypothalamic tract. The pineal gland is said to be sensitive to light, and is the central releasing factor for the neurotransmitters melatonin and serotonin. When light is ‘turned off’, melatonin increases in the retina. When light is ‘turned on’, serotonin increases and melatonin decreases. It is therefore possible for the pineal gland to signal to the retina the degree of brightness of the external light supposedly entering the eye. In addition, the enzyme responsible for converting serotonin to melatonin serves as a highly specific marker for the site of formation of melatonin (p. 355)⁴. It can therefore signal shades of brightness and darkness on the retina.

In lower animals the pineal displays photosensitivity and electrical activity suggestive of a ‘third eye’ (p. 351)⁴. And in those few species that actually have a third eye in the top of the skull, the nerve fibers connecting the pineal with this third eye are very short; the two structures are almost touching (p. 530)³. From these scientific observations we readily see the significance of the mystical third eye of Shiva, situated between the eyebrows, which are on line with the pineal gland in the embryo brain region (*Hṛdaya*) of the brain. “He who dwells in light but is within it, whom light does not know, whose body is light, and who controls light from within, is the Inner Controller – your own Self and immortal.” (*Bṛhadāraṇyaka Upaniṣad* 3. 7. 14)²

Another neurotransmitter found in the retina, principally in the amacrine cells, and in the optic nerve, and at several levels of the visual system, is somatostatin. The amacrine cells, it will be remembered,

represent innervation from within the brain prior to the firing of the ganglion cells that send the visual impulses down the optic nerve. Somatostatin in the amacrine cells excites spontaneous neural activity (p. 573)⁴. In particular, somatostatin is reported to stimulate serotonin release (p. 573)⁴. As already stated, increases in serotonin in the retina signal light being 'turned on'. The embryo brain region is the central releasing area for somatostatin into the blood, as it is indeed for all neurotransmitters-neurohormones that stimulate and regulate the brainwaves on circuit.

It is easy to appreciate then how brainwaves generated from within can also be responsible for our hearing. The basilar membrane in the cochlea of the ear is simply a frequency analyzer, different frequencies producing activity at different places along the basilar membrane. The information contained in the patterns of vibration on the basilar membrane is transmitted in the fibers of the auditory nerve in the form of brief, electrical impulses called spikes or action potentials. Special cells, called hair cells, which rest on the basilar membrane, are said to be responsible for transforming the vibrations into spikes. However, the same neurotransmitter, somatostatin, which is found in the amacrine cells of the retina has also been found in the cochlea; and somatostatin fibers project into the main portions of the auditory nerve (p. 569)⁴. In other words, the same brain wave (electrical) frequency is capable of releasing a neurotransmitter that synchronizes light and hearing.

Another neurotransmitter that appears to play a key role in what we hear is the enkephalin group which has been found in the entrance to and at the back of the cochlea (p. 585)⁴. The enkephalins are also found in the olfactory bulb, and can therefore coordinate the workings of the ear and the nose (p. 585)⁴. Indeed, more than a dozen neuropeptides have been identified within subsets of sensory neurons. Included in this list are substance P, somatostatin, CCK, VIP, dynorphin, vasopressin, galanin, and oxytocin (p. 625)⁴. These can all be innervated by the electrical milieu (wave functions emanating from the embryonic heart of the brain), and so cause sensory receptors to fire as if stimulated by external means. "Within (the heart in) the body, where the vital force has entered in five forms, is the subtle Self to be realized through that intelligence by which is

pervaded the... sensory organs of all creatures." (*Mūṇḍaka Upaniṣad* III. i. 9)⁵

The receptors for smell lie in the mucous membrane at the top or back of the air passages in the nose, but it is not known how smell molecules activate these cells which causes them to fire electrical impulses into the olfactory bulb. As with the other senses, there are many neurotransmitters and neuropeptides in the smell receptors, which can be stimulated by brainwaves, or by electrical activity in the mucous membrane as well as by other neurotransmitters and hormones in the blood. Nasal stimulation increases the blood supply to that portion of the brain serving the sense of smell (p. 349)³. These glands are in turn controlled by the pituitary gland in the embryo brain region. And so we can appreciate the advice in the *Kauṣītaki-Brahmana Upaniṣad*, "Odor is not what one should desire to understand, one should know him who smells... ." (III. 8)⁶

By the same token, "Taste of food is not what one should desire to understand, one should know the discerner of the taste of food." (III. 8)⁶ We must, therefore, find out how receptors in the mouth and throat are activated to give us the sensation of taste. Taste receptors are bathed in saliva, which is secreted from the salivary glands, and contains taste stimuli such as sodium chloride or potassium chloride; these can come from the blood. (p. 768)³ *Changes in salivary concentration of taste stimuli can be 100-fold and highly significant. It can render an otherwise piquant food tasteless.* So, as the *Kauṣītaki-Brahmana Upaniṣad* says, "there is no point in looking to the apparent external substance, food, as an explanation for taste."

The peptide somatostatin has been identified in the salivary gland, and it is also found in the gut and pancreas. It is also found in the olfactory tubercle which explains the co-relation between taste and smell. (p. 569)⁴ There is an extensive list of other neurotransmitters and neuropeptides that will activate somatostatin release. (p. 572)⁴ It will be remembered that the taste stimuli in saliva is sodium chloride and potassium chloride, and it has been found that somatostatin reduces the reaction of taste receptors to calcium, and increases their reaction to potassium. (p. 261)⁴ This brings about the sensation of taste. Somatostatin is released in response to

depolarizing stimuli. (p. 568)⁴ In other words through electrical activity (brainwaves emanating from the embryo brain region), we come “to know the discerner of the taste of food.”

The last of the five senses is that of touch. The skin contains several kinds of touch receptors, and recent experiments have demonstrated that all these receptors can be stimulated electrically. Electrodermal activity (electrical currents in the skin) can therefore be responsible for the sense of touch. Like brainwaves, this electrodermal activity is simply wave functions that emanate from the embryo brain region. And the results of these experiments indicate that external stimuli are both immaterial and unnecessary. For example, the Pacinian corpuscle receptors give a sensation of tickling, or when the electrical stimulation is increased, a sense of vibration. Meissner corpuscles evoke a sense of tapping, fluttering, buzzing, or vibration (related to the frequency of the vibration). The Merkel receptors evoke a sense of sustained pressure or sustained contact. (p. 780)³

All that is required is for neurons in the sensory receptors to be activated, whereupon electrical channels will innervate myriads of cells in the cortex that are actually responsible for telling us what we are seeing, hearing, touching etc. (p. 129)³ The retina, for example, is mapped not once but over and over in the cortex of the brain, where we perceive an external world. And this is not confined to only vision. Multiple brain maps of sensory and motor systems, as well as representations of body schema are now established. (p. 438)³ There are billions of cells in the cortex that have their own specific stimulus requirements, and as a consequence when they are stimulated, they ‘say’ something specific about the world supposedly external to the brain. Cells that will signal colors, different orientations of lines or edges, directions of movement, brightness and texture size; or pressure, and tickling, and particular smells, sounds and tastes. “...The one divine Narayana alone (is the mainstay of all creation), the eye and what is seen... the ear and what is heard... the nose and what is smelt... the tongue and what is tasted... the skin and what is touched... .” (*Subāla Upaniṣad* VI. 1)⁶

The proof, however, that the brain/body is a closed electrical circuit, and that therefore sensory stimuli comes from within, is to be found in the branch of modern physics known as quantum mechanics. Brain scientists have failed to appreciate that the brain they are analyzing is a 'physical' object like any other, and is therefore a creature of the laws of physics. When a brain scientist reports, for instance, that he has examined the workings of a certain nerve cell in the retina of the eye, and has found a certain neurotransmitter substance which caused the appearance of a 'hole' or 'passage' in the membrane of the neuroreceptor, through which only a particularly charged ion can pass, he is really talking the language of quantum mechanics. He may talk about a more complex neuroreceptor response, which involves an enzyme in the membrane as a second messenger, and results in the secondary opening of particular ion channels. Again, he is talking the language of quantum mechanics; the 'two-holes' experiment to be precise.

Feynman, who received the Nobel Prize for Physics in 1965, said that the basis of quantum theory is the experiment with two holes. Why? Because this is a phenomenon which is impossible, absolutely impossible, to explain in any classical way, and which has in it the heart of quantum mechanics. In reality, it contains the only mystery... the basic peculiarities of all quantum mechanics. (p. 164)⁸ This central mystery is that 'particles' and 'waves' behave in the same way. If a scientist in an experiment observes a 'particle' passing through one hole, then the interference pattern on the other side will be consistent with that one particle having passed through that one hole. However, if nobody observes which of two holes that one 'particle' passes through, then the interference pattern on the other side will suggest that waves passed through them both. The strangest thing about the 'two holes' experiment is that it is the act of observing a system that forces it to select one of its options, which then becomes real. In terms of Schrödinger's wave equation, each of the potential 'particles' corresponds to a wave, or rather, a packet of waves. The observation that crystallizes one 'particle' out of the wave of probabilities is called the 'collapse of the wave function.' (p. 173)⁸

The significance then of quantum mechanics for the workings of the brain is obvious. If a brain scientist examines the workings of a certain neuroreceptor, he will collapse a wave function, in which case he will see an actual particle passing through a hole or through one of a number of holes in the membrane. And it is precisely the brain scientist's action in observing the process that causes the particle to select which hole it will pass through. But, if no brain scientist is examining the workings of that neuroreceptor, then the effect is identical to brainwaves having caused the neuron to fire. And what's more, as soon as the brain scientist stops looking at the particle, it immediately reverts to the wave function containing a new array of potential particles. Nothing is real unless we look at it, and it ceases to be real as soon as we stop looking. (p. 173)⁸

This raises the question of how we obtain knowledge of atomic processes through the senses. "Whatever quantity we say we are 'observing', the actual procedure nearly always ends in reading the position of some kind of indicator on a graduated scale or its equivalent." (p. 99)⁹ It is fundamental to quantum theory that all that is real are the results of the experiments. The ions in brain science are true particles within the meaning of atomic physics, and cannot be seen in any normal sense of the word. The most sophisticated atomic recording devices are used to determine whether an ion did, in fact, pass through the hole. And the membranes of the neuroreceptors are themselves practically of atomic dimensions, and can only be pictured in an electron micrograph. It is these pictures that are all that is real. As Sir Arthur Eddington says, "Observable is a very elusive conception, and if we pursue the criticism to the end, we shall have to doubt a lot of things that we do not in the least want to doubt." (p. 54)⁹ Potentially, tens of thousands of holes can open through which ions pass to cause the single firing of one nerve cell, or so the instruments tell us. Yet the whole thrust of quantum mechanics is that to count the number of holes that open up in the membrane, and record the ions that pass through it is erroneous. The wave function on the other side of the membrane, if no instrument records the event, is more complex mathematically speaking than the sum total of interference of the actual particles that passed through it when an instrument records them. Brain

scientists however, although they are working with atomic processes, are not taking the findings of quantum theory into account. They attach no special significance to the mathematically more complex wave function after the 'particles' have passed through the holes, when they are not on hand to observe.

It is misleading, then, to explain brain science in terms of chemical neurotransmitters and particles because they only become 'real' when the wave function collapses. Better to look upon electrical waves stimulating the senses. This is also suggested by the sheer number of neurohormones, neurotransmitters, neuromodulators and neuropeptides that have now been found. In quantum mechanics more than 200 particles have been identified, which caused Dirac to remark, "People are only too willing to postulate a new particle on the slightest evidence, either theoretical or hypothetical." (p. 127)⁸ Sir Arthur Eddington was even more skeptical, "...an illustration may show that a serious practical question is raised. Just now nuclear physicists are writing a great deal about hypothetical particles called neutrinos... I am not much impressed by the neutrino theory. In an ordinary way I might say that I do not believe in neutrinos. But I have to reflect that a physicist may be an artist, and you never know where you are with artists. My old-fashioned kind of disbelief in neutrinos is scarcely enough. Dare I say that experimental physicists will have sufficient ingenuity to make neutrinos?" (p. 112)⁹ Since then - 1939 - neutrinos have been 'discovered'.

In the same vein, there are more than 50 recognized neurotransmitters, which does not take into account subgroups within that 50, to say nothing of the neuropeptide 'explosion'. Peptides are made of amino acids joined together to make a chain; and since eighteen different amino acids are found in animals, there are 306 ways of putting these together to make a dipeptide; and, theoretically, there is an astronomical number of different decapeptides (with ten amino acids). (p. 543)³ They all create potential 'particles' to be observed by brain scientists upon the collapse of a wave function. A leading neurobiologist (artist, according to Eddington) talks of neurotransmitters as "a chorus of informational voices, each adding tonal color or timber to the final output

of the brain and nervous system.” (p. 560)³ But the fact that there are so many also suggests that they are being thrown up to create an illusion; and when not being observed, they are simply electrical waves emanating from the embryo brain region – the heart of the brain where the Self is located.¹⁰

Heisenberg’s ‘uncertainty principle’ would also appear to indicate for brain scientists the futility of observing particles. According to this principle we can never know all that there is to be known about a particle. If we know exactly its position then we can’t know exactly its velocity. Alternatively, if we know precisely its velocity we can’t know exactly where it is. It cannot be disputed that the precise position of particles in the membrane of neuroreceptors, and the actual velocity of the passage of the particles through the holes in the membranes will have effects on the excitation or inhibition of the neurons. Schrödinger specifically says, “All chemical transformations, the velocity of chemical reactions... everything in fact... is governed by laws of this kind... ” (p. 66)¹³ Yet brain scientists go on identifying more and more neurotransmitters and observe the particles pass through the holes, without concerning themselves that the bewildering array of neurotransmitters already identified “... remains subject to the uncertainty principle, of which the only tolerable image is the guiding wave group.” (p. 220)¹³

The exquisitely subtle element in Schrödinger’s wave mechanics is the concept of ‘probability’. If we make an observation of a quantum system and get an answer A to our measurement, then the quantum equations tell us what the probability is of getting answer B (or C, or D, or whatever) if we make the same observation a certain time later. (p. 123)⁸ Sir James Jeans insists that these probability waves do not exist, but are merely waves of knowledge. Indeed, the only positive thing we know about them is that they have an irreversible relation to observation. (p. 94)⁹ We have already learned that quantum theory, on observation, is all about converting atomic processes into a life-size object that the scientists can actually see; the measuring instrument. This measurement at the macroscopic level becomes the reality; in other words, the wave of probabilities collapses to produce this one item of observational

knowledge. But its options remain open for the future. Here again, an insoluble problem for brain scientists; trying to find out through their own senses how the sensory receptors work at a quantum level. Or, at least it would be a problem were they ever to become aware of it!

The probability waves, then, are actually waves of consciousness in the brain of the observing scientist that caused him to see, hear, touch etc. his measuring instrument. Through these waves, the total illusion is effected; conscious scientist, illusory measuring instrument, fictitious quantity measured, even the probability of obtaining a like measurement in the future and the denial of any underlying 'reality'. Waves of consciousness also satisfy all the stipulated conditions for probability waves. For a start, they are wave packets with precise frequencies, vibrations, intensities etc. Secondly, they have an irreversible relation to observation for, by their very nature, it remains undetermined what observational knowledge they will produce in the future. And finally, they conform to Sir James Jeans' description as waves of knowledge that do not exist in external space. They are emitted from the embryonic substratum of the scientist's own brain. In the words of *Māṇḍūkya Kārikā*, "... it is the vibration of Consciousness that appears to be the knower and the known." (IV. 47)⁵

Waves of consciousness, of course, are responsible for all sensory input, and not just for scientists obtaining knowledge of atomic processes through the senses. Recordings have been made from the exposed brains of fully conscious human subjects of the reticular activating system; that dense network of cells that arises in the embryo brain region, and spreads upwards and outwards to infiltrate the cortex. Originally, the subject was touched and could feel nothing. When the touch to the skin was intensified, the recorded waveform became more complex and the subject reported, "I can feel something." According to a leading neurophysiologist, "It seems reasonable to assume that the additions to the waveform reflected those contributions from the reticular system upon which consciousness depends." (p. 753)³ And so we have direct evidence of the co-relation of changing wave functions from the embryo brain region, and what external stimuli becomes conscious to us. "Out of

the totality of the rhythm he created the organs of the sense organs.” (*Pañigala Upaniṣad* I. 10)⁶

Even if all the foregoing is not enough to convince that electrical waves are ‘probably’ responsible for activating the five senses, there are also the findings of quantum mechanics concerning ‘subject’ and ‘object’. We (as subject) have the impression that we can see an object external to us. We may also have the impression that we are touching that object, or tasting that object, or smelling or hearing that object. The *Upaniṣads*, of course, are quite clear that this is an illusion. “On account of false notions the Supreme Being is perceived as manifold, for him are yoked ten organs, nay hundreds of them. He indeed is the organs; He indeed is tens and thousands, numerous and countless.” (*Bṛhadāraṇyaka Upaniṣad* 2. 5. 19)² If however quantum mechanics were to establish that there can be a ‘subject’ and ‘object’, then evidently the *Upaniṣads* would be wrong. The ‘false notion’ would be to deny ‘duality’ as the *Upaniṣads* do.

But this is where quantum mechanics so convincingly supports the *Upaniṣads*. In the words of Schrödinger, “that mysterious boundary between the ‘subject’ and the ‘object’ has broken down.” (p. 50)¹¹ “It is said there is also an unavoidable and uncontrollable impression from the side of the subject onto the object.” (p. 53)¹¹ Brain science, however, is out of step with both the *Upaniṣads* and quantum mechanics. Brain scientists don’t realize that they can never determine how an external stimuli (object) activates a particular sensory receptor (subject). There is no physical boundary between the two. And what of this unavoidable and uncontrollable impression from the side of the sensory receptor onto the external stimuli? An unavoidable and uncontrollable impression from the side of the nose onto the odor! “Then what should one smell and through what?” (*Bṛhadāraṇyaka Upaniṣad* 2. 4. 14)²

Or another example, say, the action of a light on the retina of the eye of an experimental animal. The light would be the object and the animal would be the subject. A brain scientist cannot determine how the one acts upon the other for the light and the retina of the animal are one. And there is an even more complex problem. Now the brain scientist becomes the subject and the light and the retina of the animal is the object. There is no

physical boundary between him and the light/retina object. Not only is he one with what he is observing but there is an unavoidable and uncontrollable impression from him onto what he is observing. To again quote Schrödinger: “We are to understand that we never observe an object without it being modified or tinged by our own activity in observing it.” (p. 50)¹ For a brain scientist to tell us how the light acted upon the retina after he ‘modified’ or ‘tinged’ what he is observing, is to tell us nothing.

The core of the problem is that modern physics has been unable to establish, as a matter of pure mathematics, that an external world exists. If this could be done there would be some objective standard by which the reaction of external stimuli on sensory receptors could be gauged. If it could be proved that the light in the above example really existed in time and space external to the experimental animal, and we knew the mathematical constituents of that light alone, then theoretically it would be possible to determine how that light acts upon the retina of the animal. In theory it would be possible for a physicist to determine this without observing the experiment, and therefore modifying it. But not only can’t it be proved mathematically that the light exists external to the animal, on the contrary, modern physics tells us that the light is not external to the animal. That mysterious boundary between subject and object has broken down. Without a boundary, talk of external stimuli becomes irrational and meaningless. Hence the statement in the *Taittirīya Upaniṣad*, “He that is here in the human person, and he that is there in the sun, are one.” (II. viii. 5)¹²

Also, in the *Bṛhadāraṇyaka Upaniṣad*, “When there is duality, as it were, then... one sees another, one hears another... one knows another.” (2. 4. 14)² This raises the well-known problem of ‘other minds’. It is one thing to say that the whole universe is programmed into my own brain, but how do I explain the apparent fact that other people, and animals as well, are exhibiting thought processes similar to my own and yet these thought processes are not taking place in my brain. The answer is the Self. “There is no other seer than He, there is no other hearer than He, there is no other thinker than He, there is no other knower than He. He is the Inner Controller – your own Self and immortal.” (*Bṛhadāraṇyaka Upaniṣad* 3. 7.

23)² The Self is in the embryo brain region of each and every sentient being. There is no other seer than He in that He causes all sentient beings to see – and smell, and taste etc. There is no other thinker than He in that He causes all sentient beings to think. The embryo brain region of all sentient beings is a microcosm in a macrocosmic intelligence link-up (*Brahman*).

This is the only way to explain the astounding finding of quantum mechanics; that there is no boundary between subject and object. Duality, the apparent existence of other minds, must be an illusion. We have to look to one entity that embraces everything – a macrocosmic mind. Sir Arthur Eddington specifically says the “statement that the universe is of the nature of a thought or sensation in a universal Mind is true in the sense that it is the logical consequence of” quantum theory. (p. 151)⁹ We must picture then a non-physical observing universal ‘subject’ – *Brahman*. There is no other knower than He. Through waves of consciousness, He operates the five senses in all of us, and creates illusory objects. The *Kena Upaniṣad* could not be more definite on the point – “That which man does not see with the eyes, that by which man perceives the activities of the eye, know that alone to be *Brahman* and not what people worship as an object. That which man does not hear with the ear, that by which man knows this ear, know that to be *Brahman* and not this that people worship as an object. That which man does not smell with the organ of smell, that by which the organ of smell is impelled, know that to be *Brahman* and not what people worship as an object.” (I. 7-9)¹²



8

The meaning of maya

Many parallels can be drawn between Hindu philosophy and the branch of modern physics known as quantum mechanics. To this end a general review of Hindu philosophy as well as quantum mechanics will first be undertaken, which will highlight the similarities between the two disciplines. It will be shown that the message of quantum mechanics leads into so-called 'mentalism', which has been a fundamental premise of *Āg Veda* and the *Upaniṣads* all along. In addition, however, to simply confirming the underlying soundness of Hindu philosophy, quantum theory provides detailed insight into the true significance of *Māyā* – the illusion of the manifested world. Taken together, these two disciplines, one ancient and the other recent, provide a comprehensive indication as to the nature of life.

We come across many statements about *Māyā* in the *Upaniṣads*, although we are not actually told how this illusion of duality is effected; and it is precisely this ignorance that has to be overcome in order that we may realize *Brahman*. "Since it is stated (in the *Vedas*), 'There is no diversity here', and 'the Lord, on account of *Māyā*, (is perceived as manifold)', '(the Self) without being born (appears to be born in various ways)', it follows that He is born on account of *Māyā* alone." (*Māṇḍūkya Kārikā* III. 24)¹ "The very word *avidya* (ignorance) suggests that it is removable by *vidya* (knowledge), and *Māyā* (cosmic illusion) suggests that it is unreal." (Śaṅkarācārya's Commentary on the Kaṭha *Upaniṣad* p. 162)² It can be

demonstrated that a knowledge of Quantum Mechanics does disperse ignorance (*avidya*), at which point we can gain insight into the unreality of *Māyā*.

From quantum mechanics, for example, we learn that atomic substances are sometimes considered as particles and are sometimes considered as a wave function. The theory states quite simply that a particle materializes upon the collapse of the wave function during observation. Once we stop looking at it, it immediately reverts to being a 'ghost' particle. "Persist in asking for a physical picture of what is going on, and you find all physical pictures dissolving into a world of ghosts, where particles only seem to be real when we are looking at them." (p. 174)³ To the question, "Do the electrons really exist in their orbits within the atom?" Schrödinger answers a decisive 'no'. (p. 154)⁴

Again, according to Schrödinger, "When you come to the ultimate particles constituting matter, there seems to be no point in thinking of them again as consisting of some material. They are, as it were, pure shape, nothing but shape; what turns up again and again in successive observations is this shape, not an individual speck of material." (p. 21)⁶ This would seem to confirm the many statements in the *Upaniṣads* about 'name and form'. "So even now the universe is manifested only as name and form, it gets such and such a name and such and such a form." (*Bṛhadāraṇyaka Upaniṣad* I. 4. 7)⁵ "Further, the forms are objects of the eye; the latter is their foundation, for from the same all forms spring forth; this is their community; for it is common to all forms." (*Bṛhadāraṇyaka Upaniṣad* I. 6. 2)⁷ Sir Arthur Eddington says that according to quantum theory the 'hard facts of observation' are probability waves that are 'observationally produced'. (p. 93)¹³ So the above message from *Bṛhadāraṇyaka Upaniṣad* is not just stating the obvious when it says all forms spring forth from the eye.

Sir James Jeans tells us that the object is of the nature of an idea; existence consists in being perceived by a mind. (p. 196)⁹ Schrödinger, after talking about an unavoidable and uncontrollable impression from the side of the subject onto the object, goes on to say, "What remains doubtful to me is only this: whether it is adequate to term one of the two

physically interacting systems the 'subject'. For the observing mind is not a physical system, it cannot interact with any physical system. And it might be better to reserve the term 'subject' for the observing mind." (p. 54)⁶ It is apropos, therefore, that the *Bṛhadāraṇyaka Upaniṣad* asks, "Who is seen by whom?" (IV. 5. 15)⁷ For the object owes its existence to the perceiving mind, and the subject is the perceiving mind. Or, as the *Chāndogya Upaniṣad* puts it, "The mind is His divine eye." (VIII. 12. 5)⁸ "There is no other seer than He." (*Bṛhadāraṇyaka Upaniṣad* 3. 7. 23)⁵ "The Witness of Vision..." (*Bṛhadāraṇyaka Upaniṣad* p. 64)²

"All this that there is – together with all that moves or does not move – is perceived by the mind (and therefore all this is but the mind); for when the mind ceases to be the mind, duality is no longer perceived." (*Māṇḍūkya Kārikā* III. 31)¹ 'Duality' of course here means the perception of subject and object as two distinct entities. We are being told what Schrödinger has also ascertained through wave mechanics, namely "that mysterious boundary between the subject and the object has broken down." (p. 50)⁶ In other words, that 'duality' is an illusion. "This is to be attained through the mind. There is no diversity whatsoever." (*Kaṭha Upaniṣad* II. i)² Sir James Jeans explaining the findings of Dirac tells us that, so far as the inanimate world is concerned, "we may picture a substratum below space and time in which the springs of events are already concealed; and it may be that the future already lies hidden, but uniquely and inevitably determined, in this substratum. Such a hypothesis at least fits all the known facts of physics. But as we pass from the phenomenal world of space and time to this substratum, we seem, in some way we do not understand, to be passing from materialism to mentalism, and so possibly also from matter to mind." (p. 215)⁹ "This substratum of reality is in some way richer and more varied than the world of phenomena." (p. 172)⁹ Dirac's theory "requires the idea of an external chooser", according to Bohr. (p. 19)¹⁴ In *Āg Veda* we find, "you tell people about eternal cause and the perishable world (which is its effect)" (5. 62. 8)¹⁰ "...the transcendent Brahman, the underlying support." (*Brahmopaniṣad* p. 48)¹² "who upholds all His subjects well according to the law of cause and effect." (I. LXVII. 5)¹¹

The energy of a light ‘particle’ is measured in terms of its frequency, or wavelength. But the mathematics showed that they couldn’t be real waves in space, like ripples on a pond, but represented a complex form of vibrations in an imaginary mathematical space called phase space. (p. 116)³ The *Bṛhadāraṇyaka Upaniṣad* is in agreement with quantum theory that light does not constitute real waves in space, but instead the source of light is within the brain. “This (infinite) entity which is reflected in the intellect, which is amid the organs, and which is the self-effulgent light within the intellect. Stimulating the intellect, it roams between this and the next life; it thinks as it were, and quivers, as it were...” (4. 3. 7)⁵ By ‘quivers’ is meant the firing of nerve cells, synapses, which take on electrical properties and create brainwaves (stimulating the intellect). Compare then a free quotation from Jeans made by Schrödinger, “ ‘Light waves do not really exist, they are only waves of knowledge.’ ” (p. 42)⁶

Explaining these vibrations that cause waves of knowledge in the form of light, Schrödinger says the emission frequencies appear as deep ‘difference tones’ of the proper vibrations themselves. It is quite conceivable that, on the transition of energy from one to another of the normal vibrations, something – I mean the light wave – with a frequency allied to each frequency difference, should make its appearance. (p. 10)¹⁵ The *Upaniṣads*, of course, completely identify with vibrations in quantum theory. “...it is the vibration of Consciousness that appears to be the knower and the known.” (*Māṇḍūkya Kārikā* IV. 47)¹ “...in the waking state the mind vibrates as though with two facets.” (*Māṇḍūkya Kārikā* III. 29)¹ The two facets spoken of in the Sanskrit text, as well as the ‘knower and the known’, are referring to the illusory subject and object (duality), the illusion being effected by the vibrations within the mind. Specific vibrations incorporating the mathematics of this imaginary phase space will create light (colors) in the eye in the form of subject and object (i.e. the manifested world). “He that is here in the human person, and he that is there in the sun, are one.” (*Taittirīya Upaniṣad* II. viii. 5)²

“The electric power moves the tip of our tongue and activates many forms...” (*Ṛg Veda* 3. 39. 3)¹⁶ “...electricity from the firmament which is like the forehead of the whole world...” (*Ṛg Veda* 6. 16. 13)¹⁰ Once we

understand that it is electricity generated by synapses within the mind that creates the light that manifests name and form, the following quotation from Jeans will not seem surprising: "...electric and magnetic forces are not real at all; they are mere mental constructs of our own, resulting from our rather misguided efforts to understand motions of particles. It is the same with the Newtonian force of gravitation, and with energy, momentum and other concepts, which were introduced to help us understand the activities of the world; all prove to be mere mental constructs, and do not even pass the test of objectivity. The fact that so much of what used to be thought to possess an objective physical existence now proves to consist only of subjective mental constructs, must surely be counted a pronounced step in the direction of mentalism." (p. 200)⁹

Schrödinger speculates on the existence of a sub-brain. As a result of experiments with a flickering light – if it flashed say 60 times per second in both eyes it appeared continuous; but if 30 flashes per second registered in the left eye and the alternate 30 in the right, there remained the flickering sensation (this should not be so if it was simply a case of physical light outside the brain registering at the one place within the brain) – he concluded "it is as if each eye had a separate sensorium of considerable dignity proper to itself, in which mental processes based on that eye were developed up to even full perceptual levels. Such would be two such sub-brains, one for the right eye and one for the left." (p. 60)¹⁷ Admittedly, the *Maître Upaniṣad* does not talk about two sub-brains but it does infer that one sub-brain services both eyes. "There is a channel extending from the heart up to the eye and fairly fixed there. That is the channel that serves both of them, by being divided into two though but one." (VII. II)¹⁸

There are many, many references in *Āg Veda* and the *Upaniṣad* to this 'sub-brain' (heart) and with a basic knowledge of neurophysiology, it is not difficult to locate. "Within that (heart) in which are fixed the nerves like the spokes on the hub of a chariot wheel moves the aforesaid Self by becoming multiformed." (*Mūṇḍaka Upaniṣad* II. ii. 6)¹ The nerve channels of the brain are fixed into the embryo brain region like the spokes in the hub of a chariot wheel, which is as one would expect for the embryo brain

controls the growth and development of the whole brain. These nerve channels emanate from there to the higher regions. Also, within five weeks of conception, the embryo cranium is bulging with midbrain that is firing spontaneously – synapses.¹⁹ The source of electricity that *Āg Veda* speaks of. “The vibrating mass of electricity...” that Schrödinger speaks of. (p. 91)¹⁵ “It thinks as it were, and quivers, as it were.” From electroencephalography we learn that the desynchronized brainwave patterns observed during waking hours emanate from this region.¹⁹

“In quantum physics a wave denotes no more than the probability that a certain state exists.” (Planck p. 62)²⁰ These probability waves, as we have already learned, are not real in the sense of existing in space and time. It would seem therefore that the wave mechanics of Schrödinger are referring to none other than the precise vibrations and frequencies of the brainwaves that emanate from the midbrain. When these waves reach the cortex they ‘collapse’, using the parlance of wave mechanics, and subject and object (duality) is created. In other words, the probability that was the brainwave becomes the reality that we experience, through all the senses.

In conjunction with the brainwaves there is the visual pathway, which appears to be specifically responsible for causing the ‘particle’ to materialize when the wave function magically collapses. Discreet chunks of electricity (quanta) are emitted by synapses in the midbrain which are conveyed to the eyes via the visual pathway. The electrical impulses are converted into light (color images) by the color cones in the retinae of the eyes. These color images are then relayed back to the visual cortex at the back of the retina; so, if light really consisted of physical particles that came from an external world, they would have to pass through the vascular system, a mesh of nerve fibers and three layers of cell bodies in order to get to them.²¹ Also, the color cones operate on the principle of mixing red, green and blue primaries to create all the colors of the spectrum analogous to the way color television transmission is effected.²¹ “Those which are true are the three colors alone.” (*Chāndogya Upaniṣad* VI. 4. 1)⁸

An analogy must also be drawn to motion pictures, because quantum theory tells us that the universe is in some way discontinuous. This discontinuity was discovered by Max Planck who postulated a Quantum of Action, which caused him great concern because it negated the possibility of a physical universe existing in space and time. "...the postulate of continuity of description. It is this postulate of continuity that appears to be unfulfillable! There are as it were gaps in our picture." (Schrödinger p. 26)⁶ Light and therefore color images are composed of unbreakable units (quanta) that are propagated with such rapidity as to give the impression of continuity. In the same vein, motion pictures are possible because we perceive continuous movement in response to a rapid succession of static views. The phenomenon is often called 'apparent movement'.²¹

Once it is realized that the Self in the heart (midbrain) manifests all forms by emitting electrical impulses that are converted into light (colors) by the eye, it is possible to appreciate what Sir Arthur Eddington means when he talks of a 'revolving brain' being necessary to postulate an external universe. He says that the nearest we can get to a non-subjective, but nevertheless, observational view is to have before us the reports of all possible dummy observers, and pass in our minds so rapidly from one to another that we identify ourselves, as it were, with all the dummy observers at once. To achieve this, we seem to need a revolving brain. (p. 86)¹⁴ The Self in the embryo brain region of each being must be seen as a microcosm within a macrocosmic intelligence link-up (*Brahman*). The same form can appear in two or more individual consciousnesses by virtue of the midbrain emitting similar electrical impulses to the eyes of those individual beings that are then converted into a color image manifested on their visual cortex. These synonymous color images will, of course, have slight variations having regard to the subjects' supposed points of view and apparent motion (according to relativity theory). "O *Arjuna*, the Lord, dwells in the heart of all beings, whirling by *māyā* all beings, (as if) on machines mounted." (*Gita Bhaṣya* XVIII. 61)²²

"Jeans view that mathematical conceptions appear in physics because it deals with a universe created by a Pure Mathematician." (Eddington p.

137)¹³ The fact that the manifested universe originates in electrical impulses from the embryo brain region of individuals, synchronized in such a way as to give the 'illusion' of diversity, means that the cause is in the substratum embryo brain region, and the effect is on the visual cortex. The equations of wave mechanics 'invented' by Schrödinger must therefore be seen as the mathematics the Self adopts to manifest the universe. The electrical impulses (quanta) are emitted with mathematical precision so as to create forms on the visual cortex that appear to be real and existing in space and time. This mathematical scheme has been revealed to us through the medium of various geniuses such as Schrödinger and Dirac; but it was the 'Pure Mathematician', *Brahman*, located in the substratum that formulated the mathematical scheme in the first place. "They should preach the Glory of the Great *Brahman* who is the knower of all sciences." (*Āg Veda* 2. 2. 13)²³ "...expert in the science of physics..." (*Āg Veda* 5. 31. 12)¹⁶

Schrödinger devised a hypothetical experiment where a cat was placed in a box along with an explosive device to be detonated by indeterminate radioactive decay. The question was whether it could be ascertained whether the cat was alive or dead other than by opening the box and looking. Einstein in a letter to Schrödinger says, "At a fixed time parts of the (wave) function correspond to the cat being alive, and other parts to the cat being pulverized. If one attempts to interpret the (wave) function as a completed description of a state, independent of whether or not it is observed, then this means that at the time in question, the cat is neither alive nor pulverized. But one or the other situation would be realized by making an observation." (p. 35)²⁴ This state of affairs was very disturbing to Einstein. He asks, "Is the state of the cat to be created only when a physicist investigates the situation some definite time? Nobody really doubts that the presence or absence of the cat is something independent of the act of observation. But then the description by means of the (wave) function is certainly incomplete, and there must be a more complete description." (p. 39)²⁴

However, that the cat is neither alive nor pulverized prior to making the observation is perfectly understandable when one realizes that the cat

is not, and never was, real. It was merely electrical impulses from the midbrain which registered on the visual cortex of an observer in the form of a cat. If it is not being observed it quite simply does not exist. “ ‘It is a well-known fact in the world that a thing exists so long as it is within the range on an instrument of cognition, and the contrary one is non-existent.’ ” (Śaṅkarācārya’s Commentary on the *Kaṭha Upaniṣad* p. 210)² “The creatures... that the experience of the waking state sees forever as existing... are but objects of perception to the consciousness of the man in the waking state, and they do not exist separately from that consciousness.” (*Māṇḍūkya Kārikā* IV. 65)¹ The cat in the box has reverted to the probabilities of wave mechanics in the substratum, and its fate can only be revealed by a wave function collapsing during observation.

Schrödinger explains that in quantum theory there is the liberty of choice between the traditional sacrosanct geometry of Euclid, according to which three-dimensional space is analogous to an infinitely extended plane in two dimensions, or one of the newly invented geometries presenting a definite positively or negatively curved space. “The boldness of this idea will strike you,” he says, “when you remember that with positive curvature the three-dimensional space would find its two-dimensional analog in the surface of a huge ball and, like the ball’s surface, would be finite, though unbounded.” (p. 114)⁴ Eddington flatly admits that “when we introduce spherical space in physics, we refer to something – we know not what – which has this structure.” (p. 146)¹³ It is but a short step to conclude that curved space is a theoretical space adopted by *Brahman* within the substratum, coupled with wave mechanics governing the electrical impulses emitted (quanta), to give the illusion of a manifested world on the rounded cortex of the brain. It is the brain itself that is ‘finite, though unbounded’ in the sense that within it is manifested the whole universe. “The space that is outside the individual... is the same as the space within the individual... (and that again) is the same as the space within the lotus of the heart.” (*Chāndogya Upaniṣad* III. xii. 7-9)²

Quite simply, the mathematics are worked out beforehand in this imaginary space. Compare the statement in the *Chāndogya Upaniṣad*, “That which is indeed called Space, is the manifester of name and form. That in

which they are contained is *Brahman*." (VIII. 14. 1)⁸ to Heisenberg's statement that, "the tensors of quantum theory are in a space of indefinitely many dimensions, and that this space is not real but imaginary." (p. 55)²⁵ This space of indefinitely many dimensions is in the substratum (*Brahman*) which brings about the manifestation of name and form. We then begin to understand such abstruse assertions in the *Upaniṣads* as for example, "By this immutable (*Brahman*), O Gargi, is the (Unmanifested) space (*ākāṣa* i.e. *māyā*) pervaded." (*Bṛhadāraṇyaka Upaniṣad* III. viii. 11)²

We also gain some insight into the nature of 'time', once we realize that light is generated from within the brain, and not from without. "...you should know that twelve-spoked wheel of time (*kala* as it is called) revolves around the sun." (*Ṛg Veda* I. 164. 11)²³ "There are, verily, two forms of *Brahman*, time and the timeless, without parts. But which is prior to the sun is the timeless, without parts. But that which begins with (has a beginning from) the Sun is time, which has parts. Verily, the form of that which has parts is the year." (*Maitri Upaniṣad* VI. 15)¹⁸ Time must be looked upon as an optical illusion. Every time we see a bright light in our consciousness which we call the sun, we count 'one'. When we have seen the bright light 365 times, we say that a year has passed. But the point is that that bright light has its source in electrical impulses that emanate from the midbrain (substratum). So, in agreement with Einstein, we can say that there is no such thing as a universal time in the Newtonian sense, but only a perceptual time (related to individual consciousness) that is an illusory concept introduced from the substratum.

The *Maitri Upaniṣad* says that "Time is formed and formless too." (VI. 14)¹⁸ Quantum theory has a much more complex way of explaining this simple statement. It has to do with the Feynman diagram, which shows the track of a photon (light quantum) with no arrow on it because first, the photon is its own antiparticle; and secondly, because motion through time has no meaning for the photon – and that is why it is its own antiparticle. (p. 190)³ One imagines that a photon that is its own antiparticle truly is 'formed and formless too'. And it is not hard to see that "this mechanism is as yet innocent of any notion of past and future." (p. 85)¹⁷ To quote

Schrödinger, “because the photon does not travel through external (absolute) space”; it simply comes from the substratum (midbrain) in the form of a wave function that collapses in the cortex of the brain in the form of an illusory light ‘particle’. A negligible and, therefore, timeless journey. Once the wave function collapses, the march of time begins for forms (color images) on the cortex of the brain.

‘As if’ is a famous concept in philosophical parlance, a concept that is fundamental to Hindu philosophy in particular. “For when there is duality, as it were, then one sees another... one knows another.” (4. 5. 15)⁵ *Brahman* has created a world ‘as if’ it were real, and peopled it with beings ‘as if’ physical. *Māyā*: the illusion of duality. “He (the Self) wished, ‘Let me be many, let me be born.’ He undertook the deliberation. Having deliberated, He created all this that exists. That (*Brahman*) having created (that), entered into that very thing. And having entered there, It became the formed and the formless, the defined and the undefined, the sustaining and the non-sustaining, the sentient and the insentient, the true and the untrue.” (*Taittirīya Upaniṣad* II. vi. 1)² And now, with the aid of quantum theory, we also know that *Brahman* became ‘the photon and the antiphoton’, which is how *Māyā* is effected.



Is the universe real?

These days physicists are displaying great ingenuity in formulating unbelievable theories about the source and nature of matter. For example, all the matter in the Universe is somehow supposed to support itself by its own 'bootstraps', or the source of matter is a 'void' from which 'virtual' particles appear and into which they disappear, or the Universe is constantly branching into myriads of 'parallel' universes which are all equally 'real'. Sometimes physicists will transcend the unbelievable and enter the realm of the absurd with theories such as the one that God is in the nature of a Big Bang. It seems that the only scenario that physicists are not prepared to contemplate, the one taboo theory as it were, is that the Universe might actually be of mental construction and not 'real' at all.

Practically every book popularizing the New Physics quotes the famous statement by Niels Bohr; that anyone who is not shocked by the New Physics has not understood it. And it is a testament to the emotional maturity of the authors of these books that their writings display no evidence at all that they are in a state of shock. Without exception they seem to calmly go about their business of describing in words what the New Physics means; notwithstanding, that the fundamental message of the New Physics is that words are meaningless to describe the state of affairs at the subatomic level. As a general rule these writers display a profound confidence that matter is actually 'real' and external; but there are just some minor idiosyncrasies which the ultimate Theory of Everything will satisfactorily explain, at which time it will emerge that we didn't have to be shocked at all.

Sir Arthur Eddington, more than a half a century ago, was widely speculating that particle physicists were 'artists' that somehow create the weird and wonderful array of particles they were supposedly discovering; and we find these days that we are being treated to a theory called

Quantum Chromodynamics which paints the sub-atomic world in all sorts of delicious colors and flavors. So it seems that the giants of particle physics can sound warning bells as often as they like; their words are lost in the tumultuous struggle of the rank and file to come up with a new particle, some new theory, a masterpiece which will win them the accolades of their peers as well as the coveted Nobel Prize. Who cares where it is all leading? It's simply 'art for its own sake'.

So much 'creativity', so much 'inventiveness', and yet it will here be argued that the Theory of Everything has already been formulated in mathematical terms, and the very physicists who created it do not know what it all means in relation to the everyday world. The theory is just too weird because it involves the one thing that no 'scientist' can accept; that we are created from 'nothing'. The theory in question that seems to qualify as the Theory of Everything is the wave function of the Universe formulated by John A. Wheeler and Bryce De Witt, coupled with the wormhole connections of Sidney Coleman. But before we go into the theory in detail, we must first become aware of two extremely well-known facts about the brain. The first is that the brain of sentient beings generates a complex array of wave functions that are commonly called 'brainwaves'. And the second is that the external world, including body schema, is mapped on the cortex of the brain of sentient beings.

So what have physicists been telling us about the basis of matter? They have been saying that its basis is probability waves which are not real waves in external space, but are in the nature of waves of knowledge. The only tangible thing that can be said about these waves is that they have an irreversible relation to observation. And therefore a most striking parallel can be drawn immediately with waves of consciousness in the brain, because they too have an irreversible relation to observation for, by their very nature, it remains undetermined what observational knowledge they will produce in the future. Likewise, waves of consciousness do not exist in any external space, and they can most certainly be described as waves of knowledge. If these waves of consciousness actually cause the maps of the external world to be represented on the cortex of the brain,

then we have a complete explanation of waves being the source of matter that is consistent with the New Physics.

The question of 'observation' is of paramount importance in the New Physics. And this seems to be so whether we are concerned with quantum theory or with relativity theory. Physicists in order to postulate an 'external' world find it necessary to have before them the reports of all possible dummy observers; and it is the sum total of all these reports from the dummy observers which gives them a non-subjective representation of the Universe. So, here again a clear parallel can be drawn with the maps of the external world which are represented on the cortex of the brain in sentient beings. If all sentient beings are dummy observers, they will have a certain part of the universe mapped on their cerebral cortex, and the sum total of all those maps will indeed amount to what we know about the external universe. Which brings us to the other important feature about observation according to the New Physics: physicists don't actually see this breathtaking array of particles that they are telling us about. All they see are the results of their experiments. And the results of their experiments, in the last analysis, appear as maps on the cortex of the brain of the observing scientist. It is only the result of the experiment (namely the map on the cortex of the brain of the observing scientist) that is 'real', and the mathematics specifically deny the reality in the particle that was supposedly observed.

We have already seen how Sir James Jeans has suggested that the findings of Dirac indicates that there is a substratum beneath the real physical world; that is the external world out there that looks so real does not consist of matter at all but is in fact of mental construction. Dirac's theory "requires the idea of an external chooser" according to Bohr.² There is no talk amongst physicists as to where this substratum might actually be located, but again, given the known fact that the external world is mapped on the cerebral cortex of the brain, it is a fair bet that the substratum is likewise located in the brains of sentient beings at the lowest level. If the wave functions in the brain have their source in this substratum, then we have a complete explanation for the material

universe which is purely mental, in keeping with what Sir James Jeans has said.

Imagine then the substratum as a kind of mental thermal spa, and all the bubbles that appear on the surface represent the cerebral cortices of all sentient beings, the dummy observers. The external world (including body schema) is manifested on the cerebral cortices of sentient beings in such a way that each 'bubble' has a profound impression that it is a physical being living in a real world. On the cerebral cortex, or bubble, would appear maps of the part of the Universe that the supposed being in question appears to be inhabiting. And on his or her cerebral cortex as well would appear body schema that gives that bubble a notion of 'selfness'. A make-believe world composed of pseudo-physical robots, none of which have the slightest reason to doubt that they are not in fact what they appear to be. At least they had no real reason to doubt their own reality until quantum mechanics came along, and that is why quantum mechanics is, or at least should be, shocking! All that they see, and smell, and touch, and hear and taste are brought about by waves from the substratum.

With the idea of the mental thermal spa in mind, take the diagram given by Professor Paul Davies in his book, *God and the New Physics*.



Figure 1. The elasticity of space suggested by Einstein's General Theory of Relativity permits the growth and separation of a 'daughter universe' (bubble) from the 'parent' universe.³

Professor Davies says that according to this model, these balloons start off as bumps that blow up out of an elastic space-time that represents the 'mother sheet'; and we are to imagine that the neck of the balloon somehow comes together and closes off so the balloon becomes disconnected from the mother sheet. This balloon represents the universe, and there can be an infinite number of them. On the analogy of a thermal spa, each bubble represents the universe that is mapped on the cerebral cortex of each dummy observer. The universe as it appears to an ant, for

example, will be different to the universe as it appears to a human being. This is why the mathematics seem to allow an infinite number of universes. There are as many different universes according to this analogy as there are sentient beings that have ever existed, or that are ever likely to exist. Also, the bubbles appear to be disconnected from the thermal spa that is their source. This is appearance only but is prescribed by the mathematics in order to give the dummy observer in question a notion of selfness.

Here also we see an explanation for the many-worlds interpretation of quantum mechanics proposed by Dr. Hugh Everett III and others, where there are myriads of alternative worlds branching off 'sideways'. This theory has been taken seriously because it is considered to be the only self-consistent explanation of what is meant by quantizing the Universe. According to this theory the observer's mind is also split into countless duplicates by this process. But if we look upon the Universe as being simply maps on the cerebral cortex of every sentient being that has ever existed, or that is ever likely to exist, then the Universe is made up of mental quanta. The many-worlds are the many realities of all the sentient beings. These many realities all exist side by side, and the observer's mind is literally split into countless duplicates of what is supposed to be the Universe common to all. We are the dummy observers!

Einstein's General Theory of Relativity tells us that there is no objective physical fact which can be called 'the distance between two bodies at a given time', since time and distance will both depend on the observer.⁴ Continuity in the universe is established by his Special Theory of Relativity which relies on the velocity of light being the same for all observers, however they may be moving.⁵ Light in vacuo always travels at a certain constant rate, almost exactly 300,000 kilometers a second. Because of his theories space and time become merged, and events now occur in a four-dimensional mathematical medium called 'space-time'.

Likewise, gravitation in Einstein's general theory of relativity is linked to a certain constant. What a body does, it does because of the nature of space-time in its own neighborhood; not because of some mysterious force emanating from a distant body.⁶ Newton's theory on the matter was

overturned. However, the same problem confronted Einstein as had faced Newton – why doesn't the Universe collapse in on itself? He added the so-called cosmological constant to his equations which was said to act as a long-distance repulsive force that kept the universe in a state of equilibrium. This cosmological constant is said to be very close to zero but still it is an artificial concept and is not based on any observational or experimental evidence. It is pure theory. Simply by adjusting the value of the constant, physicists are able to construct models of expanding, contracting or static universes. At present the constant is apparently set at 10^{-32}eV .

We have learned from quantum mechanics that light can be regarded either as particles or waves, and that motion through time has no meaning for the light photon. Light can therefore be regarded as wave functions from the substratum of the brain that can cause light and dark images to occur on the retina in our eyes, and from there become an image on our visual cortex. It is known from neuroendocrinology that the pineal gland releases neurotransmitters that regulate such wave functions. The so-called speed of light that appears in the equations of Einstein therefore becomes an arbitrary figure which is calculated to give the Universe dimensions. The Universe is of purely mental construction, and the stars we see which are supposedly billions of light years away are in fact as close as the visual cortex of our own brain.

The substratum requires the idea of an external chooser, according to Bohr. Centuries ago, Sir Isaac Newton likewise expressed the opinion that such a wonderful uniformity in the planetary system must be allowed the effect of choice. It is only when we can appreciate the nature of the substratum that we can understand just how this 'choice' can be put into effect. From the substratum, the Pure Mathematician can give effect to choice concerning the position of the heavenly bodies because the substratum is actually the source of light. The dimensions of the Universe merely depend upon where the points of light from the 'stars' are positioned on the visual cortex of all sentient beings (the reports of all dummy observers), coupled with the arbitrary figure on the speed of light.

Attempts have been made to unify quantum mechanics and Einstein's general theory of relativity in order to arrive at one ultimate Theory of Everything. As a matter of logic there should be no problem with unifying these two theories, for as we have seen, they are both basically about observation. quantum mechanics deals with observing subatomic particles, and the general theory of relativity is about the observation of the Universe. The former does not state that there are real sub-atomic particles, and the latter does not state that there are real stars existing in absolute time and space in an actual universe. Indeed, both theories specifically deny any ultimate physical reality. They merely set up the rules by which these bodies are seen to be real.

Einstein himself saw the general theory of relativity merely as a step on the way towards the ultimate truth. "...however we select from nature a complex (of phenomena) using the criterion of simplicity, in no case will its theoretical treatment turn out to be forever appropriate... But I do not doubt that the day will come when that description (the general theory of relativity), too, will have to yield to another one, for reasons which at present we do not yet surmise. I believe that this process of deepening the theory has no limits." ⁷

He actually set about to formulate his own Theory of Everything, the so-called 'unified field theory'. His efforts became focused upon coming up with a theory "whose object is the totality of all physical appearances".⁸ To him the problem involved the ambiguities of quantum theory, the question of the beginning of the Universe, which his own general theory of relativity indicated; and also the vexed question of the so-called constants of Nature. He wanted to come up with a theory that did away with these constants whose values were not explained by the theory itself. Constants such as Newton's constant of gravitation, or the constant of the speed of light in his special theory of relativity, or the cosmological constant in his general theory of relativity. Physics has many such constants and there is no satisfactory explanation for them. Einstein says, "I cannot imagine a unified and reasonable theory which explicitly contains a number which the whim of the Creator might just as well have chosen differently, whereby a qualitatively different lawfulness of the

world would have resulted... A theory which, in its fundamental equations explicitly contains a constant (of Nature) would have to be somehow constructed from bits and pieces which are logically independent of each other; but I am confident that this world is not such that so ugly a construction is needed for its theoretical comprehension."⁹

Einstein was actually of the opinion that these constants were, in fact, divinely inserted into the laws of Nature as well as into the starting conditions of the universe in order to create the unique phenomena that we appear to be part of. Certainly, if these constants have not been divinely decreed then they amount to a stupendous coincidence, for it has been estimated that if the constants of Nature were not within one percent or so of their observed values, then the basic building blocks of life would not exist in sufficient profusion in the Universe.¹⁰ In other words, were it not for these arbitrary figures, or so-called 'pure' numbers which permeate physics and chemistry, we simply would not be here making these inquiries.

As stated earlier, physicists actually appear to have formulated the Theory of Everything that explains these constants; but the theory is so strange that the very authors of it simply do not know what it all means. This is the so-called 'wave function of the Universe'. This wave function of the Universe is referred to in equations as " W ", and it is an adaptation of Schrödinger's famous equation governing the wave function of ordinary quantum mechanics, but with the curved space attributes of general relativity incorporated as well. The equation enables them to establish that ours is the most 'probable' of all possible universes. However, the strange consequence of this equation is that time disappears altogether. The equation requires the four-dimensional thing of which it is the boundary to be a four-dimensional space and not a four-dimensional space-time, which is what the real universe has always been assumed to be.¹¹ The most significant thing about this equation is, however, that it does away with the need for the initial conditions of the universe, and is often described as giving a picture of 'creation out of nothing'.

The theory, therefore, attracts widespread skepticism for nobody understands how the universe can be created out of nothing. All of science

is oriented towards searching for the beginning of the universe, the Big Bang for example, or in mathematical parlance, the initial conditions. The wave function of the universe says that the initial conditions are of no significance. Scientists simply do not know what to make of it. But if the universe is to be regarded as emanating from wave functions at the base of the brain of all possible observers, then the wave function of the universe makes perfect sense. There simply is no physical beginning to the universe, and time is a fiction. We do indeed find ourselves in a 'probable' universe which tunnels into existence out of nothing.

The American physicist Sidney Coleman has enlarged this wave function of the universe theory to the point where many physicists are certain that they are encroaching on the province of science fiction. However, this new theory satisfactorily disposes of the cosmological constant and all other constants as well. This new theory is about 'space-time wormholes'. John D. Barrow in his book *Theories of Everything* says that, "wormholes can be viewed as tubes which link otherwise distant parts of space and time." Some of the ramifications of such a structure are illustrated in Figure 2. "They provide new types on non-local connectedness within space and time which could have unpredictable consequences. If particles appear from a wormhole locally, then observers would witness what they would interpret as the violation of certain conservation laws of physics. Mass and energy could appear out of apparently nothing. Electric charge could appear and disappear".¹²

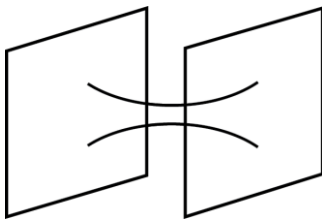


Figure 2. A wormhole joining two flat regions of space-time undistorted by the presence of mass-energy.

The possibility of wormholes emanating from space-time inspires us to imagine the most general type of structure that our Universe could

possess during its earliest stages; to be a complicated ball with many handles and branches emanating from it. Some of these branches would double-back and rejoin the mother universe, while others might end on other smaller ‘baby universes’; or even on regions as large as our Universe. Our mother universe, other mother universes, and the baby universes can all interact through the wormhole connections. Some of the possibilities are shown in the following figure:

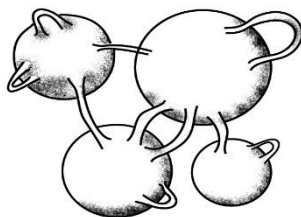


Figure 3. Wormholes connecting different ‘universes’ to themselves by handles and to other universes by wormhole ‘throats’.¹³

Professor Barrow, in a footnote, says that he has indulged in some abuse of language to avoid too great a multiplicity of terms. The entire universe consists now of the sum total of all the pieces, and he refers to our part of the whole system as a mother universe. Smaller emanations, joined by wormholes to the mother universe, are referred to as baby universes. Such a theory can only make sense by going back to the concept of observers in physics. The mother universe for any one dummy observer is the one that is represented on his cerebral cortex. The other universes are precisely the universes represented on the cerebral cortex of all the other dummy observers. There is no one physical universe, only the sum total of all the parts – the sum total of all the piecemeal universes represented on all the cerebral cortices of all dummy observers. And all these universes are connected through wormholes in space-time. That is, the brains of all dummy observers are connected through these ‘wormholes’.

Professor Barrow explains further, “If the collection of paths from the initial state of the Universe to some future state, out of which the optimal action path is to be selected, (and) is assumed to include the possible

wormhole paths, then two remarkable things happen. The first is that they conspire so as to suppress the cosmological constant when the Universe is large. More specifically, if one imagines that a cosmological constant exists to start with, then it induces interactions via the wormholes whose effect is almost equal and opposite to the original cosmological constant. The net result is to cancel out to zero with very, very high probability.” In a universe that becomes large like ours, the cosmological constant is predicted to have a residual value that is very steeply peaked around zero. This is illustrated in Figure 4.

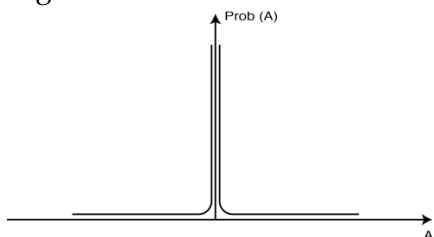


Figure 4. The probability that, when measured in a low-energy world like our own, the cosmological constant will be found to possess a value A as a result of wormhole interactions to neighboring universes. It is very steeply peaked about zero.¹³

This theory of wormhole connections in space-time is in its infancy. Calculations are made on the basis of a ‘dilute wormhole approximation’. The dilute wormhole approximation assumes that wormholes are widely separated, so that we can consider the effect of a wormhole upon its parent universe in isolation from the effects of all the others. Moreover, it is assumed that wormholes only join universes to baby universes, or universes to themselves; there are no wormholes joining different baby universes in this approximation, nor are there allowed to be wormholes which split up into two or more other wormholes (see Figure 5). The dilute wormhole connection allows us to envisage a universe connected to baby universes with changed constants of Nature (see Figure 6).

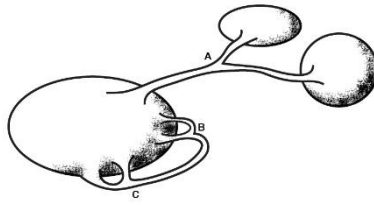


Figure 5. Some conceivable interconnections involving wormholes and baby universes not permitted by the 'dilute wormhole' approximation which is required to make the calculations of the wormhole-induced constants of Nature tractable at present. At A, B, and C we see wormholes dividing, whilst at B and C we see wormholes that do not join large flat regions. By contrast, the configurations shown in Figures 2 and 3 were completely in accord with the dilute wormhole approximation.

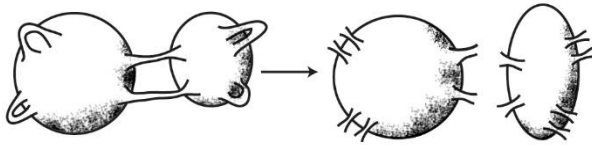


Figure 6. In the dilute wormhole approximation, the effects of the wormhole connections can be represented as a sum of the effects of the connected pieces that result after the wormhole connections are cut.¹⁴

If we think about this for a moment we can see exactly what this all means. The Universe becomes the sum of the effect of the connected pieces after the wormhole connections are cut. All dummy observers, namely all sentient beings, all have the impression of living and interacting in one universe as independent entities. The physics ends up with a result that appears to make us all separated, which is exactly what we experience as living beings. But the wormhole connections are there, nonetheless, coordinating the piece of the universe which is manifested on our cerebral cortex with all the other pieces on the cerebral cortices of other dummy observers.

Professor Barrow goes on to say, "...there is every reason to expect that eventually a technique will be found which will enable some, if not all, of the inhibitions of the dilute wormhole approximation to be cast off. However, in this case, the results of the shifting of constants of Nature are unlikely to be such a clear-cut affair; it will depend on the initial wormhole configuration in some way. Very likely, this will allow simple predictions to be made, but it will have the added consequence that it will link the

previously disjointed concepts of the constants of nature and initial conditions. In the added context of the 'no boundary' condition of the wave function of the Universe, there would then appear an interesting triple union of the laws (of physics), initial conditions, and constants".¹⁵ That is to say, the Theory of Everything!

The 'no boundary' condition for the wave function of the Universe does away with the distinction between space and time. According to the theory time somehow merges into space, or more precisely it becomes a further dimension of space. We end up living in a 'probable' universe only. What all this means is that the universe literally had no physical beginning, there was no Big Bang, which seems to be the most common speculative theory amongst scientists these days. And if there was no physical beginning, then there is no absolute time, just as the wave function of the Universe states.

Time is a fiction introduced into the consciousness of the dummy observer to give the impression of continuity. The wormhole connections appear to be cut and we appear to be living as physical creatures in a real world that has a past history. But that impression comes only from the piece of the universe that any one dummy observer is experiencing at the moment. A dummy observer can have, for example, the representation of an Egyptian pyramid on his visual cortex which looks old. In addition he may have the representation of a book on his visual cortex with words that tell him the pyramid is old, and so on. That is all the past is, mere impressions on the visual cortex of the dummy observer. Other dummy observers, through the wormhole connections in space-time, will have similar representations on the cortex of their brain which will confirm these impressions of an evolving past. The impressions will appear mutual. But the explanation is wave functions emanating from the base of the brain of all dummy observers.

In cosmology the current view of the multiverse is that of a multitude of discreet 'bubble' universes that are constantly inflating. Individual universes will age and die but there is a continual process where these bubbles are budding off new universes. This has led to a very bizarre paradox known as 'Boltzmann brains.' The multiverse comes to resemble

an infinite number of self-aware disembodied brains. This is a real problem for physicists because the starting point for all their theory assumes that we human beings, and not disembodied balls of consciousness, are the typical observers, taking our measurements according to the laws of quantum mechanics on an external universe, which we also happen to inhabit. But their own math is telling them that these disembodied Boltzmann brains would outnumber consciousnesses such as ours, and that the only way to vanquish the Boltzmann brains from the theory is to do away with the notion that our measurement of quantum fluctuations depends upon an observer external to the system who is doing the measuring. In other words these disembodied Boltzmann brains are simultaneously the multiverse as well as the observers taking the measurements.

This leads us into a new burgeoning area of quantum theory based on Bayesian statistics. Essentially quantum physics allows a physicist to make an observation about the state of a particle by calculating the probability of one outcome from many encoded in a multifaceted wave function. This will cause the wave function to 'collapse' and out of all these possible outcomes the observation has solidified into one real outcome. Without the observation there is no collapse of the wave function and it is impossible, indeed meaningless, to determine the state of the particle. This applies not only to atomic and subatomic particles that we can't actually see anyway, but also to larger objects that we can actually see. There is the famous paradox of Schrödinger's cat. If you put a cat in a box with a vial of poison and a radioactive trigger that can break that vile of poison, it is impossible to determine without opening the lid of the box whether the cat is alive or dead. Indeed until the observation is made the cat is neither alive nor dead. It is in a superposition of both states. Einstein famously asked what is so special about human consciousness? Wouldn't the observations of a mouse in the box be sufficient to collapse the wave function. Apart from the obvious answer that the mouse would be sharing the same fate as the cat and so you would have the 'cat and mouse' paradox, the answer is 'no'. A human observer has to calculate the

probability and make the observation. It's only at that point that the state of these creatures becomes real.

Quantum Bayesianism attempts to do away with this problem by asserting that all this quantum weirdness that appears to be happening out there in the external world is actually in our own mind. They attempt to introduce a 'subjective' interpretation of quantum mechanics. In classical Bayesian statistics you might make an observation that there is a 40 percent chance that it's going to rain today. Then you might see some clouds moving in and you would update your prognosis to perhaps 80 percent or even 100 percent chance. To quote an article *State of Mind: It's not quantum theory that's uncertain* in New Scientist: "The actual likelihood of rain has not changed; but your state of knowledge about it has."¹⁶

It is the same with quantum mechanics. When a physicist measures, for example, the spin of an invisible electron, all he is doing is acquiring new knowledge about that particle, and now his assessment of the probabilities have been updated from uncertain to certain. In the quantum world nothing has changed but his state of knowledge has. "Quantum states, wave functions and all the other probabilistic apparatus of quantum mechanics do not represent objective truths about stuff in the real world. Instead, they are subjective tools that we use to organize our uncertainty about a measurement before we perform it. In other words: quantum weirdness is all in the mind."

So according to this quantum Bayesianism the "measurements do not 'cause' thing to happen in the real world, whatever that is; they cause things to happen in our heads... The appearance of a spontaneous change is just the result of two parties independently performing measurements that update their state of knowledge." This theory is great as far as it goes, inasmuch as it appears to be saying that it is these disembodied Boltzmann brains that are ultimately responsible for all this quantum weirdness, and are actually responsible for what we think we are seeing out there in the external world. Unfortunately it is just as vague as telling us that it is 'consciousness' that is doing it. This book remedies that fatal defect however, because we now know the exact location of the quantum computer in our brain that is capable of making all these measurements in

parallel with 7 billion other human beings, and in addition we know how these 7 billion disembodied consciousnesses can have simultaneous parallel access to a common data base via the networked intelligence in the DNA.

The Creationist Science started by Phillip Henry Gosse in the nineteenth century has been vindicated by the wave function of the Universe equation. Gosse was concerned to reconcile the observed fact of fossil remains in rocks which appeared to be millions of years old with his religious conviction that the world had been created only thousands of years ago. He propounded the theory that the rocks came complete with pre-aged fossils to bear false testimony that the world is actually older than it is. A fossil in a rock is no different from a pyramid. A dummy observer can have the representation of a fossil on his visual cortex. Again he can have the representation of a book on his visual cortex which contains words that inform him that the fossil is so many millions of years old. But no matter what way he obtains information about that fossil, it will all come as momentary impressions on the cortex of his brain. Those impressions can just as easily come from wave functions emanating from the base of his brain and, in fact, the wave function of the Universe tells us that this is so. Again, he may have the representation of other dummy observers on his visual cortex who likewise appear to agree that the fossil is millions of years old. These impressions are synchronized as between dummy observers through wormhole connections in space-time so that all dummy observers believe they are living in an evolving world. Finally, a scientist may carry out an experiment on the rock, carbon dating for example, in order to estimate the age of the fossil. But all this involves is a representation of the result of the experiment appearing on his cerebral cortex. We again are faced with the fundamental enigma concerning observation, which is the essence of quantum mechanics. The result of the experiment on the scientist's cerebral cortex can come from wave functions at the base of his own brain.

As Bertrand Russell says, "If there were no reality in the physical world, but only a number of dreams dreamed by different people, we should not expect to find any laws connecting the dreams of one person

with the dreams of another. It is the close connecting between the perceptions of one person and the (roughly) similar perceptions of another that makes us believe in a common external origin of the different related perceptions. Physics accounts both for the likenesses and for the differences between different people's perceptions of what we call the 'same' occurrence."¹⁷ Now, thanks to the wave function of the Universe equation and the wormhole connections theory we can see that the Universe does literally tunnel into the brains of different people and synchronizes their dreams into a common perception, which they then mistakenly interpret to be the 'external' world.



Are we living in a computer simulation?

In the last three decades we have seen some minor encroachment on the solution to the standard philosophical question proposed by philosopher Hilary Putnam: “How do I know that I’m not just a brain in a vat somewhere, being simulated by some mad scientist?” Instead of applying their minds to the constructive task of actually creating the computer power to simulate a universe, many theorists both in Hollywood and in academia have taken to assuming that the technology to simulate a universe will one day be developed, and they have jumped to the fun stage of imagining that they themselves might be living in a universe simulated by ‘someone else’. In this chapter I have attempted to deal with the theory, as it has emerged, in chronological order.

The notion of a ‘universal quantum computer’ was first put forward by David Deutsch in 1985 in a paper *Quantum theory, the Church-Turing principle and the universal quantum computer*. Originally, Church and Turing considered there to be ‘universal limitations on what can be computed’. Deutsch set out to redefine Turing’s vague expression ‘functions which would naturally be regarded as computable’, and came up with the notion of a ‘perfect simulation’. Essentially, a computing machine is capable of perfectly simulating a physical system if there exists a program that renders the machine computationally equivalent to the physical system. This renders the machine ‘functionally indistinguishable’ from the physical system. This gives rise to the following principle: *Every finitely realizable physical system can be perfectly simulated by a universal model computing machine operating by finite means*. He defines ‘finitely realizable physical systems’ as including *any physical object upon which experimentation is possible*. The core notion to this principle is if the program is good enough or complete enough then, in principle, the real physical world can be perfectly simulated.

In his article, Deutsch refers to the ‘universal quantum simulator’ that was proposed by Richard Feynman in 1982, which was not a computing

machine, because it lacked a ‘programming’ that endowed it with the desired dynamical laws; and it was not placed in a desired initial state, which is essential to the computing process. Deutsch then went on to demonstrate how quantum gates could function in a similar fashion to traditional digital computing binary logic gates. Interestingly, he felt that a model quantum computer would have two components: a finite processor and an infinite memory, *of which a finite portion is ever used*. “The computation proceeds in steps of fixed duration T , and during each step only the processor and a finite part of the memory interact, the rest of the memory remaining static.” In Chapter 3 it was demonstrated how our own DNA has just such an *infinite* memory capacity. Also, Deutsch’s model of a universal quantum computer was based on the notion of qubits of information stored in ‘spin rotations’, and it was demonstrated in Chapter 4 how the DNA acts as a quantum computer by processing the qubits of information contained in the \uparrow and \downarrow spin states of the valence electrons of the DNA molecule. The DNA becomes just such a universal quantum computer as proposed by Deutsch. We will find that it is capable of *perfectly simulating* physical systems, and therefore becomes *functionally indistinguishable* from the supposedly real, physical systems. For the whole physical universe to be simulated Deutsch felt that it must have a *finite-dimensional state space*, and thus our own physical universe is a suitable candidate for perfect simulation.

The universal quantum computer would be capable of ‘quantum parallelism’, a method which would enable certain probabilistic tasks to be performed much faster than by a classical computer; and for this reason Deutsch seems to subscribe to the ‘parallel universes’ interpretation of quantum theory given by physicist Hugh Everett. According to this theory all possible alternative histories and futures are real, and so there are actually an infinite number of worlds or universes where all these different scenarios are being played out. In relation to our own universe, every possible thing that could have occurred in our past and didn’t, has actually occurred in one or some of the other universes. For example, in some other real, physical universe, the United States and its allies didn’t actually attack Iraq in 2003. Here is not the place to examine the credibility

of this theory. I mention it only because Deutsch claims to advocate it, and he sees it as a limitation on the capacity for parallel processing of his universal quantum computer. He reasons that because the quantum computer has to simulate the real physical system in each of these infinite number of universes, it will slow down the parallel processing to the point where it would be as slow as one conventional computer simulating the system in our own universe.

Deutsch doesn't address the problem of how his computer could simulate all possible parallel universes when all he is inputting is the initial data for only our own universe. There is no logical reason why an infinite number of parallel universes should have started with our Big Bang. Surely when programming his universal quantum computer, he will set the boundaries of his simulation to one universe only, rather than attempt the clearly impossible task of simultaneously simulating every parallel universe as well.

The essential point about this is that Deutsch is quite clear that it will one day be possible for a universal quantum computer to simulate a real physical system (and ultimately our real physical universe) with such perfection that the simulation will be indistinguishable from the real thing. At that point you will have one real physical universe and one exact copy of it. The simulated scientists in the exact copy will not be in a position to know that they are merely a copy. In addition, our counterparts in at least some of the infinite number of other real physical universes will likewise develop their own quantum computers, and they likewise will be making perfect simulations of their own universes. At this point, we need merely ask how anyone can be so certain that real physical systems (and real physical universes) can actually exist externally at all to the mind of the observer.

In his book, *Pi in the Sky*, John D. Barrow examines the philosophical implications from the development of computer simulations of physical events. Here again, we may notice that he is talking about the simulation of an event or system that is actually existing in a real physical world. He says that an astronomer who wants to create a computer simulation of the galaxy formation process would start out by programming the computer

with the laws of Nature: in this case, the way gravity acts between particles of matter such as gas and dust, as well as heating and cooling processes and the like. The initial state would be a random distribution of billions and billions of particles and the computer would provide an unfolding history of events leading up to the formation of a gigantic galaxy. At the time he was writing, 1992, computer simulation was still rudimentary, and more than 20 years later, there have been considerable advances; but Barrow goes on to extrapolate this project far into the future, and he speculates on the exquisite detail that computer simulations will ultimately be able to achieve.

At that future time all the known laws of Nature will be put into the computer. It will be able to simulate not merely how pieces of material can move about and cluster, but will be able to follow the condensation of that material into objects we can recognize as real stars, and then the formation of planets around those stars exactly like the real physical systems that we see around us. As we are now talking about all the known laws of Nature, the computer would go on to simulate the evolution of simple molecules on the surface of some of those planets, and then to the replication of complex biological molecules. "Next, with finer resolution still, the simulation should reveal the development of living things, appearing and dying on the accelerated timescale which the computer hardware dictates. Ultimately, the simulation could give rise to states of such complexity that they exhibit rudimentary aspects of that phenomenon we call 'consciousness'. At this stage some parts of the computer simulation will be able to communicate with other parts of the simulation; they will be 'aware' of their own structure; they will be able to make observations to ascertain the overall structure of the simulation they are embedded within."

This is presented as more or less typical theorizing about the future of computer simulation. And it can be seen for starters that it makes some rather extraordinary assumptions, not the least of which is that we would be able to input the data about all the material that was initially available in the universe, all the laws of Nature, and all the processing power of a single computer to simultaneously run billions of human beings with

consciousness as well as the trillions of other creatures that exist in our own minuscule place in the universe. Also, no matter how technologically advanced we become, we will never be in a position to know all the conditions necessary for the development of intelligent life here on Earth. There are huge gaps in the fossil record and, in any event, much of our evolution is said to have come about due to random mutations in the DNA of earlier creatures.

Then there is the question of the accelerated timescale set by the program. How do you simulate the development of intelligent life over billions or even millions of years? Even if you allow, say, one second of simulated time for each year of time that passed in the real physical system, you would end up at the end of it with conscious beings just like us with an average lifespan of just 70 to 80 seconds. It is a technologically advanced human race that has developed this technology, so maybe at that point the average life span is 200 years, but the simulation is of their primitive ancestors as they exist today. So, in their simulation the conscious beings would live for 80 seconds. Which raises another interesting problem: at this rate the simulated beings would rapidly overtake the real physical, technologically advanced human beings that started the simulation in the first place.

Putting aside for the moment all those problems, the laws of Nature must include the probability quantum theory, so there is no telling just how many simulations would have to be run before we ended up with a simulated universe that was exactly like our own. This is where Everett's parallel universes actually might make some sense. Quantum theory dictates that if we were to run computer simulations of the universe, we would eventually end up with all possible universes, including one just like our own. At that point we would have our own real physical universe, an exact copy of our own universe as well as countless copies of other universes. All these simulated universes would be *virtual* and whatever living creatures they contained would be living in *virtual reality*.

The other point I would like to make is that there is no talk about how the simulated universe makes the leap from being merely the output of a computer, which is to say how can it ever become anything other than

images on a computer screen? Barrow is talking about simulating conscious beings like humans, but surely they must take on some composition other than pixelated two-dimensional images. For these simulated beings to become conscious, they must themselves see images of an external world (not necessarily via an upside-down image on our visual cortex at the back of our head like we do). Not even the most powerful quantum computer is capable of generating a simulated living being that is itself accessing images of a world external to it, unless the computer is generating these images in an extended external space from within the simulated being. For that computer to generate billions and billions of such beings, this same computer must not only be inside all the other simulated beings, but also be capable of phenomenal parallel processing. In the movie *The Matrix* (which we will come to presently) this problem was addressed by having the AI machines input the sensory data via a bioport at the back of everyone's skull. How fantastic and unbelievable is that?

Our own computer technology has recently developed to the point where a computer can print a standalone three-dimensional object. But we are still a long way from printing billions or even trillions of such objects, each with its own consciousness of living in its own dedicated space, independent of the computer lab where it was printed. And even if that were possible, how would the advanced scientists observe the output of their simulation? It would require something like looking into a crystal ball and seeing a hologram of the entire simulated universe. A hologram where it was somehow possible to zoom in on individual simulated beings.

Nevertheless, Barrow is the Professor of Astronomy at Cambridge University, so we must assume that he knows what he is talking about. The simulated beings have become 'aware' of their own structure and they are making observations about the simulated world around them. "This process they will call 'science' and it will enable them to gradually piece together the laws of Nature, which we have programmed in to determine how the simulation at one time is connected to its past state. They will not, of course, be able to determine that they are part of someone else's

simulation, but it is very likely that some self-conscious parts of the simulation would indulge in 'theological' speculations about the origin of the 'world' about them, the nature of its initial state and what lay before it, and whether these considerations point to some Initiator of Everything."

Barrow goes on: "Let us now examine the state of affairs a little more closely. The computer simulation is just a means of carrying out very long sequences of intricate mathematical deductions according to particular rules commencing from a given starting state. The print-out of our results, either on paper or as a movie, is just a way of visualizing the consequences of the mathematical rules that we have laid down. If we remove the prop of the computer hardware, then we see that the entire sequence of events that unfold in the simulation – the stars, the planets, the molecules and the 'people' – are all just mathematical states. So if we think of the simulation as a vast web of mathematical deductions spanning out from the starting state, then, as we search through this network of mathematical possibilities, we will eventually come across the mathematical structures that correspond to the self-conscious beings. Both they and the possible communications they can make with other parts of the mathematical structure are parts of the structure. Processes like those that we call 'thinking' are just particular types of very complex inter-relationship. When we reach this stage we see that we really have no need for the computer hardware we started with; indeed, its particular identity is really irrelevant. We could have run our program on all manner of different types of computer architecture. But surely, if we are of the Platonic viewpoint, we need not have run the program on any hardware at all. This means that we think of the mathematical formalism as containing self-conscious states – 'minds' – within it."

He comes to the rather remarkable conclusion: "This speculative line of reasoning turns the Platonic position inside out. We no longer need to think of mathematical entities as abstractions that our material minds are battling to make contact with in some particular way. *We exist in the Platonic realm itself. We are the mathematical blueprints*" (italics are mine). So it would seem that Professor Barrow, as a result of his speculations about

simulating a virtual universe, has decided that we must actually be simulated beings ourselves. Our body is the computer hardware which houses the processor and the program for a simulated universe within.

So, what is this Platonic realm that Barrow is referring to? This is the eternal debate about '*What is mathematics?*' Barrow says: "The most remarkable example of the effectiveness in mathematics in describing the physical world are those which are to be found in the realm of the most elementary particles of matter and in the astronomical sciences." In other words, the parts of the 'physical' world that we can't actually perceive through the five senses. Sure, in relation to the distant galaxies, we get an image on the cortex of our brain of multiple specks of light in an otherwise dark expanse of space. But that's it. The vast body of astronomical science provides mathematical interpretations of what those specks of light might actually be. We can only see with the naked eye a speck of light that we take to be our closest neighbor, the Andromeda galaxy. If we look at it even through an optical telescope, we are already immersed in a mathematical interpretation of how a telescope works, the mathematical properties of light and lenses, etc. Anything and everything that requires some sort of instrument to observe, measure or define it has now become purely mathematical.

Every single piece of data in the vast science of astronomy is conjecture based on mathematics; that includes distant galaxies, the CMB (Cosmic Microwave Background), the age of the universe, the composition and evolution of stars etc., etc. And even more so for any object that is too small to see, such as elementary particles, atoms and molecules. We can know nothing about them that is not mathematical. It is impossible for us to prove that they exist independently of the mind of someone who can do the math. Using quantum mechanics, for example, a physicist can do a calculation which will tell him/her where a particle is most likely to be found, or what mass or momentum it is most likely to have; and then he/she will make an experiment using an instrument that will yield a result. All the physicist will see at the end of this is the result, never the actual particle. It is all mathematics, and nothing but mathematics.

These issues were already being discussed in ancient Greece. For the Pythagoreans mathematics was the essence of everything. According to Philolaus of Croton: “All things which can be known have number; for it is impossible for a thing to be conceived or known without number.” The Pythagoreans came to look upon numbers as living things in their own right. Plato developed this notion further. He reasoned that the essence of all the particular things that we perceive around us via the five senses had a real existence somewhere else as pure mathematical models. That ‘somewhere’ was not simply the human mind, because we humans are incapable of inventing these mathematical models; we can only discover them. Plato asked what gives the ‘chairness’ to a chair, but let us ask instead what gives the ‘particleness’ to an elementary particle. All we can know about this particle comes from quantum mechanics which tells us nothing about what the particle is doing; it merely tells us the probability of it doing something. Did we invent quantum mechanics or did we discover it? Plato would say the latter. Somehow the mathematics came from somewhere else which tells us what elementary particles are likely to be doing with an exceptionally high degree of accuracy. We don’t have to bother ourselves with the hard questions of how these elementary particles, that we can’t actually see, can somehow do the math themselves, decide where they are supposed to be, and then go there. Evidently, particles are behaving according to some mathematical model.

Many physicists have already stated their opinion that the universe is just one gigantic quantum computer, and these real physical particles as they shuffle about are all simply engaged in quantum computing processes. Seth Lloyd, the Professor of Mechanical Engineering at MIT, estimates that a computer made up of all the energy in the universe could perform 100,000 googol (10^{105}) operations at one moment in time, and over the past 14 billion years it has performed 10,000 billion billion googol (10^{122}) operations. In addition, the cosmological computer could store 100 billion billion billion billion billion billion billion billion billion billion (10^{92}) bits of information. When you consider all the other real parallel universes as well, this is a massive amount of computer processing. And in these days of miniaturization, the notion of a quantum

computer the size of the universe (not to mention all parallel universes) where every elementary particle is in a superposition of states, and thereby becomes a qubit engaged in quantum processing, is a bit rich, I think. There is no way Nature would require a quantum computer as big as everything that exists in order to run everything that exists. And let's face it, the particles themselves can't do the math, so there must be some central processor.

Lloyd would not agree with this however. In his recent book *Programming the Universe*, he says: "To perform such a simulation, a quantum computer needs at least the same number of bits as the system to be simulated. In addition, to simulate each elementary event that occurs in the simulated system – for example, each time an electron moves from here to there – the quantum computer requires at least one op. A quantum computer that simulates the universe as a whole must have at least as many bits as there are in the universe and must perform at least as many ops as the number of elementary events (or ops) that have occurred since the universe began." Does this suggest that the advanced humans who are doing the simulation of our universe had to start it 14 billion years ago in order to get us to the stage we're at right now. Yes, I'm afraid it does.

The reason why he seems to think that the quantum computer must have at least as many qubits as there are elementary particles in the universe is that all the physical elementary particles have to be mapped one-to-one with the same finite number of qubits in the computer. He says: "...the universe – or at least the accessible part of the universe – is finite in space and in time. All the pieces of the accessible part of the universe can in principle be mapped onto a finite number of qubits. Similarly, the physical dynamics of the universe, consisting of the interactions between those pieces, can be mapped onto logic operations that act on those qubits." I can think of many reasons why this could never be done 'in principle' by our illustrious descendants, no matter how technologically advanced they may become.

Here are two of those reasons. First, there's the time factor. They start with the first elementary particle and map all its quantum information onto a qubit, but by the time they get to the last elementary particle the

states of all the other particles will have well and truly changed. To simulate this universe they would have to map all the information in all the elementary particles onto their respective qubits simultaneously. Essentially, they would have to snap their fingers and say “Let there be light!” just like God did.

The other problem is all the ghost particles and virtual mirror particles, which are obviously playing a role in our universe. For instance, something like 85 percent of the total matter in the universe is said to be dark matter. The most recent explanation of what dark matter might be is a sterile neutrino. There are currently three types or ‘flavors’ of neutrino, and each flavor has its own corresponding antiparticle, called ‘antineutrino’. To account for all this dark matter these sterile neutrinos would have to be much more massive, and at the same time react even less with regular matter than their sibling neutrinos. They are impossible to detect directly so scientists are looking for evidence of their decay into X-ray photons and ordinary neutrinos. One wonders how our descendants are going to handle simultaneously mapping all these sterile neutrinos onto their respective qubits. Not to mention their antiparticles!

Lloyd also states: “You and I, and the differences between us, came from quantum accidents. And so, from quantum seeds, came the universe itself. *Quantum fluctuations are the monkeys that program the universe.*” (his italics) These are not elementary particles at all, but derive from quantum field theory. If our descendants ever get to the point where they can effectively map the theoretical field quanta which supposedly form the basis for all the elementary particles, virtual or otherwise, onto an array of qubits, then I think our noble progeny will be able to truly claim to have risen above their humble beginnings as ‘monkeys’.

Lloyd is not arguing that our universe is simulated by our descendants. He is merely saying that the universe has to be as big as it is in order to generate itself as a quantum computer. But if he is right, it raises the question of how the advanced humans could ever make a quantum computer as large as the universe in order to simulate the universe. Assuming they’ve got such a quantum computer (which is actually a perfectly absurd statement), they would also have to program

the accelerated timescale into the simulation; otherwise they would be sitting around for 14 billion years waiting for it to spit out a result. Divide 14 billion by 31,536,000 seconds in a year, and you will come up with 420 years that the advanced humans have been running the simulation just to get us to this stage. And that's on the basis that we are living for 80 seconds, although I must admit it seems to be a lot longer than that.

Fortunately, there is a way out of this conundrum. Evidently it is quite ludicrous to assert that you would need a quantum computer as big as the universe in order to simulate the universe; and that computer would have to process all the elementary events of all the elementary particles since the universe began. The computer, in fact, does not have to simulate any of the elementary particles at all. All it has to do is run movies on the cortex of the brains of the simulated pseudo-physical robots. The computer just has to make it appear like a real universe. It is true that the number of qubits in the human DNA is nowhere near the number of supposed elementary particles in the universe, but there are surely sufficient qubits there to simultaneously run nine billion movies as well as store it all in memory. In this way the quantum computer can easily simulate 14 billion years of our evolution and give us a decent life span as well.

The fact is that physicists today know nothing about the 'matter-ness' of matter, they know nothing about the 'time-ness' of time, they know nothing about the 'particle-ness' of particles; they have, however, discovered mathematical equations which give very accurate descriptions of many of the properties of these things. These are the exact same equations that a universal quantum computer would have to use if it was simulating our universe. In which case, there would be no need for real elementary particles external to our minds, that are themselves engaged in complex mathematical calculations as they charter their trajectories through the universe. All the universal quantum computer would have to generate is consistent space-time images of what the simulated beings are seeing and experiencing as they live out their simulated lives. This would involve much less computer processing than the currently accepted scenario, where each individual physical elementary particle is continuously engaged in complex quantum processing calculations.

If Plato is right, the only place where these mathematical blueprints can be located is within a universal quantum computer that is actually simulating the universe. They cannot be in the human mind because it is patently clear that a great deal of matter has been happily existing long before humans came onto the scene. You would end up with the absurd situation where humans are actually ‘inventing’ the mathematics which determines the makeup and operations of their own brains and bodies. Either every single elementary particle is itself performing pre-human mathematical calculations, or the mathematical blueprints are in some universal quantum computer that is running the show. There is no third alternative.

Roger Penrose, in his book *The Emperor’s New Mind*, gives a detailed description about the network of neurons in the brain. The neuron is a central bulb (*soma*) where the nucleus is to be found. At one end is a long nerve fiber (which often can be up to several centimeters long) which is the *axon*, and this is what transmits the cell’s *output* signal. The axon bifurcates a number of times into many smaller branches which terminate with *synaptic knobs*, which become the junction with other neurons. At the other end of the soma are the tree-like branching *dendrites* that are responsible for the *input* data being carried into the soma. Generally speaking, the synaptic knobs from other neurons are attached to these dendrites as well as to the soma itself. There is a small gap between the synaptic knob and the dendrite or soma of the next neuron known as the *synaptic cleft*. At these synapses between neurons, chemical neurotransmitters are emitted which are responsible for propagating the signal across the gap, and thus can either encourage or discourage adjacent neurons to fire. Here we may note the neurons themselves all contain DNA in their nucleus and the neurotransmitters are synthesized from the DNA, and all remain within the DNA information network.

The actual mechanisms which cause the neurons to fire are too complex to go into in any detail. The essential factor is that it involves positively charged sodium and potassium ions and negatively charged chloride ions. Outside there are more sodium/potassium ions; and in the resting state there is a net positive charge, while inside the nerve there are

more chloride ions than sodium and potassium together, which means there is a net negative charge. When a signal propagates along the nerve fiber, this delicate balance between a positively charged outside and a negatively charged inside is reversed. This is brought about by negative sodium ions passing through the cell membrane to the outside, and positive sodium/potassium ions coming inside. This description of the firing of a neuron may appear chemical in nature but essentially it is all about electromagnetic waves, the exchange of positively and negatively-charged particles. As described by Penrose: "Imagine oneself to be situated on the nerve fiber ahead of such a region of charge reversal. As the region approaches, its electric field causes little 'doors', called *sodium gates*, to open in the cell membrane; this allows sodium ions to flow back through (by a combination of electrical forces and the pressures due to the differences in concentration, i.e. 'osmosis') from outside to inside. This results in the charge becoming positive inside and negative outside." A single biophoton, which is similarly an electromagnetic wave would therefore be capable of triggering this chain of events, and thus causing a neuron to fire. We have already discussed how the DNA emits biophotons in Chapter 5.

The signal across a synapse is an 'all-or-nothing' phenomenon. It's strength does not vary; either it is there or it is not. So this suggests that the brain works similarly to a digital computer, where the nerve connections behave just like electrical circuits with logic gates. As explained in Chapter 4 the presence or absence of a nerve pulse would denote a 'true' or a 'false' (a 0 or a 1) just like in conventional computing. Combinations of firings in other nerve circuits, as well as multiple synapses attaching to any one nerve cell, would allow for more complex processing such as 'true' AND/OR 'false' etc. Given the complexity of the circuitry and the number of synapses in the brain, it may be assumed that the processing that is taking place is very complex indeed. But this doesn't change the fact that the number crunching means nothing unless there is input data and a code or program to interpret and execute it. As Penrose says: "We need to have some new way of coding the digits, since the *absence* of a signal does not trigger off anything." In other words, there

must be logic gates that attach some significance to the absence of a signal which means that there must be a code or program to execute that logic.

Penrose attempts some sort of logic language instructions based on multiple nerve impulses and he concludes: "Of course, these explicit examples are not to be taken as serious models for what the brain actually does in detail. I am only trying to indicate that there is an essential logic equivalence between the model of neuron firing that I have given and electronic computer construction. It is easy to see that a computer could simulate any such model of neuron interconnections; whereas the detailed constructions give an indication of the fact that, conversely, systems of neurons are capable of simulating a computer – and so (could) act as a (universal) Turing machine."

For the brain, clearly, the bulk of the input data comes via the five senses as well as from the various organs and structures in the body. This data is then processed; and then there must be models in the brain that will simulate what the data is saying about the external world, and those models appear on our visual cortex as a computer image just like we were watching television. A question arises, however, in relation to our intelligence, that is to say our thinking processes. When we have a thought about a purely abstract concept such as the nature of time, or the nature of justice, etc., where is the input data that causes the brain to process this 'thought'? An impulse must come from somewhere in the brain that causes various neurons in the language areas of the brain to fire, and those thinking impulses must come from some sort of program that is internal to us, and is capable of inputting data for processing. It would seem that it is both the sensory data and the intelligence data that are somehow merged in the processing to generate our 'consciousness'. Mathematics is in the nature of pure thought and therefore must come from the code within.

In this book it is demonstrated how the DNA acts as a quantum computer and emits its output as biophotons that are capable of causing neurons in the brain to fire. The DNA would therefore be capable of inputting both the sensory data and the 'thinking' data into our brain from within, and thus generating within us the 'consciousness' of being a

human being living on a planet in the universe. But here lies the most essential thing. The universe is not the same for me as it is for you! The universe that I see is from my perspective and I don't see myself in it. The universe that you see is from your perspective; and if we were in the same proximity you would see me in it, but you wouldn't see yourself in it. You cannot be both the observer of the universe and in the universe you are observing although, of course, this 'appears' to be the case. So, in order to simulate one universe it is actually necessary to simulate an infinite number of parallel universes for all the 'conscious' beings that are its simulated inhabitants.

Deutsch thought his universal quantum computing would be incapable of simulating an infinite number of parallel universes as, of course, it would be if it was set the task of simulating an infinite number of *real* physical parallel universes. This is how Lloyd describes parallel processing: "The number of things a quantum computer can do at once – the number of voices in the symphony of quantum computation – grows rapidly as the number of bits of input increases. Even a small number of qubits allows an extraordinarily rich texture of interpreting waves as they compute. A quantum computer given 10 input qubits can do 1,024 (2^{10}) things at once. A quantum computer given 20 qubits can do 1,048,576 (2^{20}) things at once. One with 300 qubits of input can do more things at once than there are elementary particles in the universe (2^{300}). Quantum parallelism allows even a relatively small quantum computer, containing only a few hundred qubits, to explore a vast number of possibilities simultaneously".

If it is actually the DNA inside us which is the universal quantum computer then, of course, there is no limit to the number of simulations of the *one* universe, where every conscious being has its own unique perspective. A rough estimate on the number of valence electrons in the human DNA, which would be the qubits, is 480,000,000,000. And that's just in one human being. Multiply that by 7 billion and you've got the total number of qubits available to the DNA to simulate the universe. The number of ops the DNA could do at once is ($2^{480 \text{ billion} \times 7 \text{ billion}}$). That is such a big number that no conventional computer on Earth could work it out.

It would actually take a quantum computer to do it. That number is trillions of times larger than the number 10^{105} which is Seth's earlier figure for the number of operations the computational universe is performing at any one time (his earlier figure was based on the amount of available energy in the universe, not the number of qubits). So, I think I have established quite convincingly that a quantum computer as small as the DNA, would be capable of simulating the entire universe (and indeed an infinite number of parallel universes as well).

That is to say, in the beginning there was only the DNA and it set about simulating 14 billion years of our evolutionary history, bringing us up to the present time. No, this is not quite correct. The DNA has sufficient processing power to simulate our past and our present simultaneously. Now, this is what I call parallel processing! We are simulated in the NOW, complete with memories and evidence that we have a past. The simulation is instantaneous for the DNA, although we the simulated think that the universe started some 14 billion years of simulated time ago.

Our brain becomes merely like a workstation on a computer network. It needs to have a lot of processing power because it is generating an entire universe from our own unique point of view. If two or more of us are looking at the same object, then identical nerve circuits in our respective brains will fire and the same model for that object will appear on our visual cortex. The mathematics necessary for us to view the model from a different perspective would be child's play for a universal quantum computer. In addition, all sorts of incidental thoughts and stimuli would likewise be inputted into our particular viewing of that model based on our unique consciousness of who we are. These thoughts evidently originate in the unconscious mind (the embryo brain region where the Inner Self is located as per Chapter 6) and ultimately from the DNA.

The movie *The Matrix*, which was released in 1990, continues to attract comment because it has become a benchmark in the movie industry for melding sci-fi with philosophy, and then projecting it onto the public in the form of an action/thriller. At the time of release the movie was nominated and awarded only one Oscar for Special Effects, but since then there has probably been more theorizing and speculation about the true

meaning of *The Matrix* than any other movie in the history of Hollywood. This movie deals with the most fundamental question of all: *What is reality?* The hero, played by Keanu Reeves, has a day job as a computer programmer, and at night is a geek hacker on the internet where he operates under the name of Neo. The Wachowski Brothers threw in a hotchpotch of allusions to the post-modern theories of French sociologist Jean Baudrillard as well as Judeo-Christian and Buddhist teachings; and to develop the action/thriller motif of the movie, the public is invited to adulate Neo as the Messiah, the Buddha and the Terminator all rolled into one. In this discussion, all this pseudo-theology is ignored and we shall address only the core issue of what the movie has to say about reality.

The nerdy, law abiding computer programmer, Thomas Anderson is contacted by a rebel leader, Morpheus who attempts to convince him that his everyday existence is, in fact, a false reality. Morpheus plays a sort of John the Baptist-type role heralding the coming of the chosen one - Neo. His job is to make Thomas Anderson question his reality, which is not that difficult because Neo as a cyber-freak already has misgivings about his everyday life, which to him is almost a torture like a 'splinter in the mind.' The name Morpheus comes from Greek mythology as the god of dreams. His name is the linguistic root of such words as 'morphine' (a drug that induces sleep and freedom from pain) and 'morphing' (where computer technology enables the seamless transformation from one reality to another). Morpheus asks: "Have you ever had a dream, Neo, that you were so sure was real? What if you were unable to wake from that dream, Neo? How would you know the difference between the dream world and the real world?" Morpheus is setting up the scenario where Neo will discover that his waking life, which he thought was so real, is in fact a virtual reality, the 'matrix' that is being fed directly into his mind through the manipulation of his senses by a sinister and all-powerful force referred to as AI (Artificial Intelligence), which now actually rules the human race.

We are told that it is actually the year 2199, and the surface of the Earth is a wasteland as a result of a devastating war between humans and AI machines. There are a few humans that remain living in the 'desert of the real' but the vast majority of humankind is now being kept underground

in pods, where they live on in an embryonic state. They have become merely a source of energy for the AI machines. Through the direct input of data into their sensory organs the humans are living in a virtual reality, a dreamlike state where they believe they are actually living a normal life in an American city in the year 1999. It is this dreamlike state, or virtual reality which is referred to as the 'matrix.'

MORPHEUS: Do you want to know what it is? The Matrix is everywhere, it's all around us, here even in this room. You can see it out your window or on your television. You can feel it when you go to work, or go to church or when you pay your taxes. It is the world that has been pulled over your eyes to blind you from the truth.

NEO: What truth?

MORPHEUS: That you are a slave, Neo. Like everyone else, you were born into bondage, born inside a prison that you cannot smell, taste or touch. A prison for the mind.

The rebels who are now attempting to rescue Thomas Anderson from his dreamlike state are some of the few humans that are continuing their fight against the AI machines. Just like Jules Verne's Captain Nemo, Morpheus is their leader, and they cruise the underworld in a hovercraft, the *Nebuchadnezzar*. (The dreams of King Nebuchadnezzar featured in the Bible. Even though the King himself couldn't even remember them, Daniel was able to interpret them which led to a series of prophecies proclaiming the Messiah.) There are many parallels between the crew of the *Nebuchadnezzar* and the apostles of Jesus, including one crew member, Cypher, who sells out to the AI machines, thus performing the role of Judas. So, the essential scenario is that a malevolent power has managed to hijack the sensory input of all human beings and has thus been able to gain control of their minds, and make them believe they are living a normal life in a real world; whereas, in fact, everything around them is false and is a classic virtual reality.

The AI machines have developed sentient programs and have the ability to directly download sensory data into the human brain, and thus create a virtual reality indistinguishable from our dreams. One

commentator thinks that 100 years from now this may not be so far-fetched. He refers to Moore's law and the exponential growth of computing, particularly nanotechnology, and believes that the time is coming when it will be possible to infiltrate the human brain and body with nanobots that can directly target sensory nerve endings, and thus simulate sensory input that, in our consciousness, is indistinguishable from data that is coming from a real external world. Once we accept that all the input from the external world is just data, then all we can ever know about the source of the data is included in the data package itself. We can never directly experience an external world; we have to take at face value the information in the data that it is coming from our senses, that we are informed are impinging on objects in an external world. Even now, with conventional computers, we have virtual hard drives and virtual instructions given to the computer as to the source of data; so, there is no reason, in principle, why technology should not develop to the point where nanobots could feed false sensory information into the human brain. In the movie there is a thick cable entering Neo's brainstem via a bioport, but this is purely for the visual effect on the audience. Even the nanobots in use today in many branches of medicine are wireless.

The question of the nature of reality in Western philosophy goes back as far as Descartes in his search for a certain foundation of knowledge. He asked the question: "What *can* I know with absolute certainty?" In order to answer this question, he set about to systematically examine what could be doubted. He made the primary observation that all his ideas about truth and certainty had been derived from or through the senses, so he was led to consider whether what our senses tell us is free from all doubt. He was forced to admit that our senses can sometimes deceive us, and so we can never fully trust them. In particular, he gave the instance where a completely lucid dream can seem perfectly real, and so he pondered the possibility: "Could I, perhaps always be dreaming, when I think I'm awake?" The exact same question that Morpheus put to Neo. Descartes himself concluded, "There are no certain marks distinguishing waking from sleep; and I see this so manifestly that, lost in amazement, I am almost persuaded that I am now dreaming." Descartes also considered the

possibility that a powerful being, an “evil genius”, might actually be capable of planting all his sensory experiences in his mind, in which case “the sky, the earth, colors, shapes, sounds and all external things are illusions and impostures of which this evil genius has availed himself for the abuse of my credulity.”

Descartes’ contribution was simply that he started to ask the right questions because, unfortunately, he finally came to a conclusion that rendered all he had said before an absurdity. He came up with the famous solution: “I think, therefore I am.” He felt that it was impossible to doubt the contents of his own conscious experience, nor could he doubt his existence as a “thinking thing.” Of course he was writing in the 17th century, long before the advent of computer technology. These days it should be manifest to everyone that our consciousness is nothing but processed data which can be manipulated and falsified with consummate ease. Our thoughts are merely one small part of consciousness and, likewise, must be the output of computer processing. Descartes went on to develop a complete epistemology (theory of knowledge) based on his certainty of his existence as a “thinking thing”, whereas in point of fact *nothing* could be less certain. Your own PC could be easily programmed to come up with that conclusion!

We have to look to George Berkeley writing in the early 18th century to elucidate the true philosophical position about the external world. His theory is explained in more detail in a later chapter. For him “sensible” objects (the physical objects that we sense) are nothing more than a collection of sensations. He also, of course, was writing before the computer age so he could never arrive at the conclusion that our consciousness is simply processed sensory data. For something to be real for Berkeley, however, it had to be perceived or sensed. This is what Morpheus is referring to when he says, “How do you define real? If you’re talking about what you can feel, taste, smell or see...” Berkeley thought that physical objects are real because they are part of our experience. These days we would probably substitute the word ‘consciousness’ for ‘experience’. There is nothing beyond our experience. He arrived at the strictly logical position that, because we can have no idea of physical

objects except as a collection of sensations, and sensations cannot exist without a mind, then to talk about an external world that is not being perceived or observed by someone is a self-contradiction. There is a famous anecdote about Dr. Johnson who was discussing Berkeley's theory with Boswell. Dr. Johnson says, "You ask how can I refute Berkeley. Quite simply. By doing this..." and he kicked a rock. He, of course, meant that it was self-evident that the rock existed; but, in fact, this is precisely the point that Berkeley was making. The faithful Boswell subtly pointed out to his mentor that no matter how ridiculous Berkeley's theory seemed to be, still it could not be proved wrong as a matter of logic.

Because Berkeley was writing before the computer age he, as well as his detractors, seemed to assume that the issue was "What is real?" Berkeley himself accepted that an external object that is perceived or observed by someone is real. The essential issue is as asked by Morpheus: "How do you define *real*?" Everything in consciousness is real, and because it can only exist in consciousness as processed sensory data, everything in consciousness is virtual. There is only one question: "Are there physical objects external to consciousness?" In other words, is there a physical universe that would still be there if there was not a single sentient being to observe it? The difficulty is that it is quite impossible to prove either with physics or logic that this is so. Just to mention one obvious problem: it is beyond question that all color is generated in the brain. So, if you are certain that there is an external universe that is not being observed, then it must be colorless. Such a universe would not only be invisible, it would be inconceivable (where both these adjectives assume an observer in any event). It would just be a bunch of electromagnetic waves not in the visible spectrum. The universe would be like the microwave mobile phone network!

In this context I should also mention the teachings of Mahāyāna Buddhism which is a philosophy of mind. This is the 'Consciousness Only' school which, like Berkeley, asserts that the objective world we perceive to be real is ultimately a product of our minds. The mind is simply a movie projector and the external world we experience is the projection of our consciousness. Opinions differ whether this school goes

so far as saying that the external world does not exist, but they do argue that every object is significantly altered by our conscious perception. We can only ever know external objects secondhand as ideas, and we can never know them before they are transformed into our consciousness. Again, we find principles that were formulated before the age of computers. Ultimately, things are transformed into our consciousness through no other means than the processing of sensory data. So, here again we can only ever know the virtual reality in our consciousness. Whether or not a physical world actually exists external to our mind becomes a meaningless and irrelevant issue. Adherents of this school are taught to renounce the external world as illusory, and enlightenment is achieved with the cessation of all desire, attachment and suffering.

Here we are discussing only the issue of reality as it is portrayed in the movie, *The Matrix*. In this movie the protagonist Thomas Anderson learns that he, along with the bulk of humankind, is living in a computer-generated simulated world; that is to say, he is living in a virtual reality. In the movie the computers that have generated this virtual reality, and are inputting false sensory data, are said to be evil AI machines that managed to take control over the humans that made them. I hope I have given you enough information about the movie to explain the Hollywood input into this debate about whether or not we are living in a simulation. The philosophical aspect of the movie becomes submerged into a sci-fi flick that is intended for entertainment only.

In 2003 the Yale philosopher, Nick Bostrom, wrote an article *Are you living in a computer simulation?* This article was after *The Matrix* and, in fact, he states that “for most viewers, this scenario is interesting as science fiction, but inconceivably remote from anything that exists today or is likely to exist in the future. But, upon careful consideration, a scenario much like this is much more than conceivable. *It is quite likely.*” (italics are mine) That is to say, at some time in the future, be it in 100 years or 1,000 years or even 1,000,000 years, humans will have developed ‘virtually infinite computing capabilities’. At this point we will not be humans anymore; we will be ‘post-human’. He can’t tell us much about this advanced civilization, it could be similar to our own or it could be

radically different, “but the one thing we do know, by definition, is that post-human civilization has access to virtually unlimited computing power.” It is not possible to confidently set any upper limit to the computing power of these post-humans; they may, for example, be able to convert ‘planets or other astronomical resources’ into supercomputers, a quantum computer perhaps.

It’s not clear to me what qualification the word ‘virtually’ places on the ‘unlimited’ or the ‘infinite’ computing power; it may mean that they developed the capacity to go beyond their own real physical, limited universe, or it may just be a qualifying word inserted to make the bold prediction sound a little less absolute. It matters little for our purposes for it has emerged just a few short years after *The Matrix* and after Bostrom’s article that our own DNA does, in fact, have ‘infinite’ and ‘unlimited’ computing power. Whatever can be done, conceived or imagined, the DNA can do! It is interesting, though, that Bostrom specifically refers to the post-humans converting a physical system such as ‘the planets’ into a quantum computer because presumably, if they could do that, then how easy would it be for them to take a specimen of their own DNA and convert that into a quantum computer? We are already very advanced with genetic engineering, and it is a safe bet that ultimately there is no limit to where this is taking us. If that is what actually happens, then we could indeed be living in the simulated universe, and the space-time continuum we find ourselves living in will have been generated from a piece of junk DNA that is even now sitting in a petri dish on the bench of some laboratory way in the future of the real physical universe.

This presumably would make us a simulation within the real universe, but we can’t see the real thing because of the limits set in our simulated universe by the arbitrary speed of light. This scenario is even more likely because a universe simulated from a specimen of DNA from a post-human is going to generate a simulated universe with the same physical characteristics as the real physical universe, the same constants of Nature etc., because this is the only type of universe that the DNA can survive in. It also solves some of the other obstacles that have to be overcome before we can do a near perfect simulation of our own universe.

The DNA acting as a quantum computer inside us enables us to see the simulated universe external to us on a computer screen internal to us, and to be completely unconscious of the computer, or of the fact that we are merely computerized output. Also, converting a specimen of post-human DNA into a quantum computer will get around the quantum mechanical problem of the mathematics not actually stating what will happen; it merely gives the probability of particles being found in a certain state. But if the post-human DNA is actually the quantum computer doing the processing, then all the quantum probabilities will naturally branch off into the actual real physical universe where the post-humans reside.

Similarly, we simulated beings will be like them in every respect, only less advanced. This solves the problem that they themselves originally evolved from random mutations in their real physical DNA. Any other quantum computer might have to simulate a trillion universes before it came up with conscious intelligent life evolving from random mutations. We have already seen above that, according to Lloyd, the 'seeds' of these random mutations can be traced back to random bits generated from quantum fluctuations in the wake of the Big Bang. How difficult are they going to be to duplicate in any simulation? It may even solve the data input problem for the initial state of the simulated universe. If the DNA is the quantum computer, then it will already have all the data for the prehistory of the human race. The initial state for the simulation could be as recent as, say, the Egyptian civilization or the ancient Greek civilization; and the awareness of our history prior to that, the fossil record etc., would already be there in computer memory. The DNA would not have to simulate billions and billions of years of pre-human history, whereas this would be essential for any other super quantum computer that the post-humans developed.

Bostrom worded his conjectures very cleverly. He made it look like scientific hypothesizing which could then be accepted or rejected by logical deduction from data about current scientific advancement. In addition, he picked the only possible simulators, namely a more advanced civilization of humans or 'post-humans', that the scientific community would accept. Mention God or aliens and they will dismiss you as a kook,

but come up with a theory that it is a more advanced version of ourselves and they will accept you with open arms. Bostrom's theory has attracted widespread scientific interest. They are actually taking it seriously, notwithstanding it leaves unanswered how a computer could actually run a perfect simulation of the universe complete with us as pseudo-physical robots at a much earlier stage of development; or why the post-humans would even want to simulate an earlier version of themselves. Surely with that sort of technology, they would be looking to explore new possibilities!

So this is how Bostrom presented his groundbreaking hypothesis:

1. This essay explains the simulation argument, which argues that *at least one* of the following statements is true: The human species is very likely to become extinct before reaching a 'post-human' stage.

2. Any post-human civilization is extremely unlikely to run a significant number of simulations of their evolutionary history (or variations thereof).

3. We are almost certainly living in a computer simulation.

In explaining these statements he says the first one is straightforward, which it is, and no more need be said about it by way of explanation. Assuming however that statement is false, which logically would be incorrect because right now it remains 'extremely likely' that we will become extinct before we ever enter the post-human stage. Even if by some miracle we do, in fact, avoid extinction and become post-humans, that doesn't in any way negate the proposition that it is extremely likely that we won't.

Pedantics aside, in explaining statement number 2 he says that the post-human civilization is impossible to fully imagine, as are the uses to which a virtually infinite supply of computing capacity could be put. He then goes on to the creation of complex simulations of human civilizations. Let me pause there and say that I myself could easily imagine in such a post-human civilization, with an infinite supply of computing capacity, that it would be a fairly routine exercise for students in middle school to simulate more primitive human civilizations, as a prelude to

simulating new and exciting universes in high school. Personally, I would cry “FALSE” to statement number 2.

Bostrom evidently thinks statement number 2 is true, however. He thinks that these simulations would not simply be elementary practice exercises for school kids. It is the post-humans that earn a living as historians that would want to run these simulations of their evolutionary history. “Imagine historians of the future simulating various historical scenarios. These would not be the simplistic simulations of today. With the vast computing power at their disposal, the simulations can be extremely fine-grained – every building, every geographical feature, every individual. And each of these individuals could be given the same level of computing power, complexity, and intelligence as a living human. Like Agent Smith (in *The Matrix*) they would be built out of software, but they would have the mental characteristics of a human. Of course, they might never realize they were software. To create an accurate simulation, the perceptions of the simulated individuals would have to be indistinguishable from those of people living in the real world.” All I can say is that the Wachowski Brothers must have doubled up with laughter when they read this. All Bostrom has done is taken the evil AI machines in *The Matrix* and turned them into historians of the future. No mention of what simulations other academics and scientists might be running, nor for that matter what post-human computer geeks like Neo might be up to; yet we are supposed to accept that statements 2 and 3 are true and, although we are ‘almost certainly’ living in a computer simulation, mercifully this computer simulation is ‘extremely unlikely’ to be only one of many. I guess that means that although it is only a computer simulation, it is about as real and meaningful as you could possibly hope for.

Bostrom does indeed warn us that we are not physical, and we are living in an artificial world. We are worse off than the people in *The Matrix* because they were actually physical but they had a bioport in the back of their skull which enabled the AI machines to highjack their senses. We are pseudo-physical robots entirely composed of software. He doesn’t actually use the word ‘robots’. He asks whether us simulated humans are really ‘people’. He asks whether we would be intelligent and conscious

even though we are not physical and composed only of software. He then goes on to explain some deep and meaningful stuff that philosophers of the mind have come up with. "The reality is no one really knows. But it is common for philosophers of the mind to make the assumption of *substrate-independence*. Basically this means that consciousness may depend on many things – knowledge, intelligence (processing power), mental organization, the details of computational structure, and so on – but one of the things it doesn't necessarily require is biological tissue. It is not an essential property of consciousness that it is implemented on carbon-based biological neural networks inside a cranium; silicon-based processors inside a computer could, in principle, do the trick as well." This is pretty much the same message that Barrow delivers above, that I especially put in italics *We exist in the Platonic realm itself. We are the mathematical blueprints*. The essential point to note in Bostrom's theory, and in the theory of Barrow as well, is the post-humans who simulated us are themselves real and physical, as is the universe they inhabit. In their world there are real physical elementary particles buzzing about external to their mind. They are the lucky ones. Sadly we are just copies, mere simulacra.

Bostrom says: "There are approximately six billion biological humans living in 2003. In a post-human age, there may very well be trillions of software-based humans living in the year 2003 of their simulated world, all believing they are biological, just as you and I do. The math is simple; the overwhelming majority of these individuals are wrong; they believe they are biological and they are not. There is no reason to exclude our civilization from this calculation. The odds are overwhelming that we are living in a simulated 2003 and that our physical bodies are a software illusion." So we have now gone to an overwhelming probability that we are simulated, notwithstanding his Proposition 1 that we are very likely to become extinct long before we ever reach this post-human condition. Evidently he means that the odds are overwhelming that we are simulated, provided we get through the one chance in 1,000 that we don't become extinct. On that basis I would have thought that right here and now the odds are underwhelming that we are simulated. Indeed, I would

think that we are about as likely to be simulations made by our post-human descendants as we are to be simulated by the advanced aliens living on planet Zenox (and I don't even know if there is such a planet).

Be that as it may, Bostrom goes on to speculate about our post-human descendants being Godlike. Yes, he started off with what appeared to be cold, logical, philosophical reasoning; and then he let the 'god' word insinuate itself into his later speculations. Not only are the post-humans godlike, but given the overwhelming odds that we are simulated by our post-human descendants, then we have to 'suspect' that they in turn were simulated by their descendants, which are presumably post-post-human; and the post-post human descendants are simulated by the post-post-post human descendants, and so on *ad infinitum*. Thus, there may be levels of 'reality', though why this is so is not clear, because he remains very clear that originally there was a real physical world with real physical people who started this mad frenzy of simulating earlier human civilizations; and all the simulations are just software copies or copies of copies or copies of copies of copies etc. So, in his theory there is always only one reality, and then there is an indefinite chain of simulations which are all equally virtual or 'unreal'.

And in this hierarchy of simulations our immediate post-human descendants who simulated us must therefore be considered in the nature of demigods, a bit like in the ancient Greek pantheon of gods. I kid you not! These are his exact words: "Although all the elements of such a system can be naturalistic, even physical, it is possible to draw some analogies with religious conceptions of the world. In some ways, the post-humans running a simulation are like gods in relation to the people inhabiting the simulation: the post-humans created the world we see; they are of superior intelligence; they are 'omnipotent' in the sense that they can interfere in the workings of our world even in ways that violate its physical laws; and they are 'omniscient' in the sense that they can monitor everything that happens. However, all the demigods except those at the fundamental level of reality are subject to sanctions by the more powerful gods living at lower levels." The fundamental level of reality is the post-post-post-post... humans who started the simulations in the first place

because they were the only ones who inhabited the real physical world, and they are the only ones who are actually biological. And they are the ones who have the virtually infinite computing power because all these other universe simulations (and there may be billions of them) are all imbedded in the first simulation. So let's drop the word 'virtually'. It is their computer that is ultimately doing all these simulations within simulations so it must have infinite processing power indeed; infinite to the power of infinity more like it!

Not all scientists, of course, accept Bostrom's theory. One prominent physicist, Paul Davies, felt that the high probability of living in a simulated reality is a *reductio ad absurdum* to his cherished notion that multiverses of all possibilities exist. It would mean not only that all real physical universes of all possibilities exist, as well as all universes that could possibly be simulated by software, and this is not just from post-humans in our universe. Real biological super intelligent beings in other parallel universes would no doubt be developing their own simulation software. It seems he thought that Bostrom's theory would tend to confuse matters, make it a little more difficult to acquire any sure knowledge about the Universe!

Obviously, we are at the very bottom of this hierarchy of simulated universes, because we cannot satisfactorily simulate a single hydrogen atom that has one proton in its nucleus and one electron hovering about. We are the 'primitives' or the 'savages' and what's more it's very likely we will become extinct before reaching even the first rung of the ladder of post-human demigods. Notwithstanding this, learned articles have been written about how we should conduct ourselves given that there is some possibility that we are a simulation. Robin Hanson, who specifically states that he was immediately inspired by Bostrom, as well as indirectly inspired by *The Matrix*, seems to have reduced Bostrom's overwhelming odds that we are living in a simulation to a non-zero probability that we are living in a simulation. Pity he can't be more specific about it because one chance in a trillion is still a non-zero probability.

So let us be charitable and call the non-zero probability as one chance in a million. And let's be even more charitable and not draw attention to

the fact that if we are living in a simulation, then we are created by software, and that we are incapable of performing any act or having any thought that is not allowed for in the program. Robin Hanson entitles his article *How to Live in a Simulation*. Our world is like the *holodeck* in the television show *Star Trek:Next Generation*. I don't watch the show myself and I know almost nothing about it, but Hanson tells us that "in a holodeck, a simulated person might not realize that they were simulated. So the question arises: how sure can we each be that we are not a simulated person in a future holodeck simulation?" I don't know about you, but I for one am absolutely 100 percent certain that I am not a simulated person in a future holodeck simulation. I know this for a fact because I have yet to meet Mr. Spock in my simulated world. This aside, Hanson tells us that we can't be sure we are not simulated, that down the track they might be able to develop software that can give a simulated being 'consciousness'.

He warns, however, that even though you may be a simulated being with consciousness, you can't be sure that the others around you have the same reasoning capacity as yourself, and your own semblance of free will that you seem to enjoy; nor may they have your own capacity to feel pain and suffering. "Also, in general the behavior of many people, far from the simulated people of interest, might be randomly generated based on statistics from previous simulations, or come from 'cached' records of previously simulated people. Some 'people' in a crowd simulation might even be run by very simple programs that have them wiggle and mumble 'peas and carrots' like extras supposedly did once in movie crowd scenes. Assuming you don't care as much about these fake simulated people, then all else being equal, you shouldn't care as much about how your actions affect the rest of the world." In other words, because there is a non-zero probability that you are simulated, you shouldn't really care about the people who were killed or injured in the bombing at the Boston Marathon, because actually they were just generated from cached records of previously simulated people and they were just moving their lips, mumbling 'peas and carrots'. Pity if Bostrom's Statement 1 was actually true and we are in fact a primitive race of real biological people, and those people who were injured at the Boston Marathon were really suffering!

I must admit I find this argument compelling: that we shouldn't care so much about the other simulated beings, even though I am somewhat aghast at the thought that godlike post-humans with virtually unlimited computing power would still have to resort to the primitive methods used by Cecil B. DeMille in the crowd scenes of his movies circa 1930 in the Christian era. I find it compelling because I myself have actually come across plenty of people who may as well have been mumbling 'peas and carrots' for all the conscious awareness and intelligence they were exhibiting.

Again, remembering that the post-humans have virtually unlimited computing power, Hanson observes: "Simulating events in full detail can be enormously costly, however. Therefore most computer simulations today vary the detail at which they simulate various events. For example, a vibrating airplane wing is usually simulated in finer detail at places where it bends more, or where air currents near it change more. In general, the level of detail appropriate for any one place depends on how much more expensive it is to produce such detail, and on how influential larger errors are in producing errors in the final results of interest. Since it is harder to vary the simulation detail in role-playing simulations containing real people, these simulations tend to have some boundaries in space and time at which the simulation ends." You can see how Bostrom's initial hypothesis is being watered down. Maybe the godlike post-humans don't have unlimited computing power after all, and they have to cut corners when they are simulating our universe. Maybe you are the only pseudo-physical robot that is conscious, and can reason and suffer and feel pain; and any people around you that you can see talking, but can't hear what they are actually saying, are just shadow people that are mumbling gibberish. This is now a long way from Bostrom's notion that the simulation we are living in is so perfect that we are really quite convinced that we are real, physical, intelligent beings. I think that if the post-humans are cutting corners in the way Hanson imagines, then we are going to have a little nagging doubt, like a 'splinter in the mind' just like Neo in *The Matrix*. The next time I catch an international flight I will be looking closely

at the wings on the airplane to make sure they're not simulated, that's for sure.

Hanson concludes his advice on how to live in a simulation by telling us that we should care less about others, live more for today, make our world look likely to become eventually rich (this is because he conceives the post-humans as being rich, and would therefore be more interested in simulating rich people); he tells us we should expect and try to participate in pivotal events (because the post-humans would be more interested in simulating 'pivotal' people and events from their history, and so you should try to do something 'pivotal', otherwise the post-humans might get bored with the simulation and close you down); we should be entertaining and praiseworthy (because 'All the world's a stage' and we want to entertain the post-humans, again because of the fear that they will close us down); and this is the one I really like: "If our descendants (the post-humans) sometimes play parts in their simulations, if they are more likely to play more famous people, and if they tend to end simulations when they are not enjoying themselves, then you should take care to keep famous people happy, or at least interested. And if they are more likely to keep in their simulation the people they find more interesting, then you should try to stay personally interesting to the famous people around you." So again, on the basis of this non-zero probability that you are simulated, you should pack up immediately and go to Hollywood and become an autograph-hunting *paparazzo*, or maybe go on the road as a groupie for your favorite rock band. Here again, too bad if you are, in fact (and which is far more likely), a real biological person for I guess you will have seriously screwed up your life.

It would appear that Hanson actually got this notion, that some of the particulars in the simulation may be fudged, from Bostrom who suggested that there may be more selective simulations in addition to the ancestor simulations, which may include only a small group of individuals or maybe even only one individual. The rest of humanity in these smaller, more selective simulations would be mere zombies or 'shadow people', who would be given enough human characteristics so as not to arouse suspicions for the fully simulated people. Bostrom goes on to admit that

it is not at all clear to himself how this could possibly be achieved, and he leaves it up to us to decide whether there might possibly be anywhere up to one hundred billion more of these 'me-simulations' (that is where only you are the conscious software simulation, and everyone you come across is a zombie), than the full ancestor simulations made by historians, which from his statement 2 are unlikely to run to a significant number (including variations). Bostrom doesn't give a reason for these 'me-simulations' which are evidently much less expensive, and billions of times more numerous, but it is difficult to understand why computing costs or complexity would be a factor for these godlike post-humans. Why would they be interested in running billions and billions of substandard small-scale simulations, and why indeed would they want to run a solitary simulation of the life of YOU the reader?

Mainstream scientists have taken these suggestions by Bostrom and Hanson seriously, however. Barrow wrote an article *Living in a Simulated Universe*. He refers to his own theory and refers to the 'slippery slope' that opens up before you once you accept that all possible real physical universes exist in parallel. "We see that once conscious observers are allowed to intervene in the universe, rather than being merely lumped into the category of 'observers' who do nothing, that we end up with a scenario in which the gods reappear in unlimited numbers in the guise of the simulators who have the power of life and death over the simulated realities that they bring into being. The simulators determine the laws, and can change the laws that govern their worlds. They can engineer anthropic fine-tunings. They can pull the plug on the simulation at any moment, intervene or distance themselves from their simulation, watch as the simulated creatures argue about whether there is a god who controls or intervenes, work miracles or impose their ethical principles upon the simulated reality. All the time they can avoid having a twinge of conscience about hurting anyone because their toy reality isn't real, is it? They can even watch their simulated realities grow to a level of sophistication that allows them to simulate higher-order realities of their own."

You would think that Barrow as a sober and well-respected Professor of Astronomy at Cambridge University would take a good long look at this slippery slope that has opened up before him and say: “Whoa! This is getting way too weird!” But he doesn’t. My guess is that he is actually a closet *Trekkie* and he has been spending way too much time perched in front of the TV imagining himself in the *holodeck*.

He goes on to suggest ways whereby we as software-simulated primitive human beings might actually be able to spot flaws in the simulation, and thus ascertain that we are not real biological beings like we thought, but are actually virtual beings living within the simulation. Here we come to the essential point of this whole simulation universe debate. Neither Barrow, nor Bostrom, nor Hanson have ever doubted for even a moment that there is a real physical universe with biological post-humans that did the initial universe simulation, and thus started an indefinite chain of virtual universes. In this real physical universe there are real elementary particles, a real CMB (Cosmic Microwave Background) and real constants of Nature etc. I particularly draw your attention to the real constants of Nature. These are arbitrary numbers which the scientists have to stick into their equations to make them work! And all these real objects actually exist externally to the mind of the biological post-humans. Yes, even the real constants of Nature have to exist external to the mind of the post-humans because Nature is external to the mind of the post-humans. The external world existed long before there were ever humans in this first and only real physical universe so obviously the elementary particles had to ‘know’ the constants of Nature so they could do the math, and figure out at any given instant where they are supposed to be and how fast they should be going.

Barrow says: “Firstly, the simulators will have been tempted to avoid the complexity of using a consistent set of laws of Nature in their worlds when they can simply patch in ‘realistic’ effects. When the Disney company makes a film that features the reflection of light from the surface of a lake, it does not use the laws of quantum electrodynamics and optics to compute the light scattering. That would require a stupendous amount of computing power and detail. Instead, the simulation of the light

scattering is replaced by plausible rules of thumb that are much briefer than *the real thing* but give a realistic looking result – as long as no one looks too closely.” (italics are mine) You can see that he has advanced the argument in as much as he refers to fudging techniques used by Walt Disney in his movies circa 1950 in the Christian era rather than the tricks of Cecil B. DeMille in the 1930s. He clearly doesn’t realize that the real physical world that the biological post-humans see about them could actually be merely Disneyesque movies running on the visual cortex of their brains. They don’t ‘see’ the elementary particles, the electromagnetic waves, the constants of Nature either. All they see are images of ‘results’ on the cortex of their brain that tell them what these real, physical, microscopic objects are doing. All they ever see are Disneyesque movies of what appears to be an external world. How can it be that a very intelligent scientist like John D. Barrow who clearly thinks there is some possibility that he is living in a universe simulated by his post-human descendants, cannot go that one stage further and ask whether perhaps the original real physical universe was actually a simulation as well.

Barrow tells us that the post-humans would, of course, have an advanced knowledge of the laws of Nature, but it may be a philosophical impossibility for them to have a complete knowledge. “They may know a lot about the physics and programming needed to simulate a universe but there will be gaps or, worse still, errors in their knowledge of the laws of Nature. They would, of course, be subtle and far from obvious. Otherwise, our ‘advanced’ civilization wouldn’t be advanced. These lacunae do not prevent simulations being created and running smoothly for long periods of time. But gradually the little flaws will begin to build up. Eventually, their effects would snowball and these realities would fail to compute.” If that happens then the post-humans might have to intervene in our universe with *ad hoc* patches to fix the problems. Simulated scientists like him might start to get puzzling results from their experiments. This is where he clearly misses the point. All the post-humans have to do is run Disneyesque movies of the macroscopic external world on the cortex of his brain to simulate his universe. *They never have to simulate every single elementary particle.*

In relation to all the microscopic objects, all the post-humans have to do is include in the Disneyesque movies *images of the results* of the experiments that the simulated scientists like himself are conducting. Does he honestly believe that a simulated scientist like himself is ever going to have anything other than access to *results* of experiments made on the software-simulated universe, when even real biological scientists themselves can only get *results* of experiments made on their real physical universe. All the godlike post-humans have to do is simulate the same *results*. And this is a simulated scientist who has written a book entitled *The Book of Nothing* where he deals with all that theory by his contemporary, real, biological scientists who seriously speculate that their real physical universe appeared magically out of NOTHING! In Chapter 9 of that book he deals with *Being out of Nothingness* and *Creation out of Nothing*. But never ask John D. Barrow or any other mainstream scientist to suspect even for one moment that perhaps the universe where the original post-humans did their first simulation might actually also be a simulation!

A group of distinguished scientists have recently published a paper *Constraints on the Universe as a Numerical Simulation*, where they put forward a complex mathematical argument as to how we might possibly detect that we are living in a simulation. They state "In this work, we have taken seriously the possibility that our universe is a numerical simulation. In particular, we have explored a number of observables that may reveal the underlying structure of a simulation performed with a rigid hyper-cubic space-time grid." Essentially, they have assumed that the universe is simulated with the same lattice structure that is currently being used in Quantum Chromodynamics (QCD) to model the strong nuclear force among protons and neutrons: "These simulations are currently performed in femto-sized universes where the space-time continuum is replaced by a lattice, whose spatial and temporal sizes are the order of several femtometers or fermis ($1\text{fm} = 10^{-15}\text{ m}$), and whose lattice spacings (discretization or pixelation) are fractions of fermis." We may note at this point that space-time is a highly artificial mathematical concept. Essentially, you start with the Riemann curvature equations which are

good for two and three-dimensional curves, and simply plug in time as a fourth dimension. You end up with something called the curvature of space-time but it can't be visualized in our 3D world. So, right from the outset it is clear that this is going to be a purely mathematical theory.

There is a basic concept in experimental physics called Lorentz symmetry. Essentially, the experimental results should not reflect the orientation or framework of the experimental apparatus. Using a cubic space-time lattice to simulate electrons and muons, at some point it is necessary to introduce a specific operator into the equations, which will fine-tune away the 'lattice spacing' artifacts. This operator has to do with recovering Lorentz symmetry in the lattice calculations. As the lattice spacing vanishes when compared with the scales of the system, however, the Lorentz symmetry is recovered without the necessity of introducing this operator. They therefore calculate an approximate upper bound on the lattice spacing, below which the artifacts will not be observed. So, they conclude that this breaking of rotational symmetry, if they were to observe it out there in the real physical world, "would be a solid indicator of an underlying space-time grid, although not the only one." They go on to point out that "another scenario that gives rise to rotational invariance violation involves the introduction of an external background with a preferred direction".

It just so happens that the upper limit for high energy cosmic rays corresponds roughly with their upper limit for lattice spacings in their simulations and "therefore, the lattice spacing used in the lattice simulation of the universe must be $b \leq 10^{-12}$ fm in order for the GZK cut off to be present or for the lattice spacing to provide the cut off in the cosmic ray spectrum." These cosmic rays are high energy charged particles (normally the nuclei of atoms but they can also be high energy electrons, positrons and other subatomic particles) that strike the Earth's atmosphere from all directions and come from outer space. The Greisen-Zatsepin-Kuzmin limit (GZK) is a theoretical limit on their upper energy which is brought about by their interaction with the CMB over long distances. They are actually charged particles, and are therefore affected by the Earth's magnetic field, and therefore could have considerable

effects for their rotational symmetry. A magnetic field would flip the spin of the particle which would presumably change its 'handedness'. Indeed the entire universe is said to have a magnetic field. The question arises whether the universe's magnetic field would provide the other scenario they mention that gives rise to rotational invariance violation, namely 'the introduction of an external background with a preferred direction'.

The researchers go on to say: "The most striking feature of the scenario in which the lattice provides the cut off to the cosmic ray spectrum is that the angular distribution of the highest energy components would exhibit the cubic symmetry in the rest frame of the lattice, deviating significantly from isotropy. For smaller lattice spacings, the cubic distribution would be less significant, and the GKZ mechanism would increasingly dominate the high energy structure. It may be the case that more advanced simulations will be performed with non-cubic lattices. The results obtained for cubic lattices indicate that the symmetries of the non-cubic lattices should be imprinted, at some level, on the high energy cosmic ray spectrum." Presumably this means that if these rays were exhibiting isotropy they would be going in all possible directions, and if that were found not to be the case then it *might* be due to the fact that they are simulated on a cubic framework. I can think of at least three other factors that this might be due to. The fact that the universe is one gigantic magnetic field. And the fact that the cosmic rays might be coming from specific directions in the first place, such as supernova explosions. And the fact that they might have passed through galactic magnetic fields, which have caused their path to bend in a consistent fashion.

What can be said about this argument? The worst that can be said about these researchers is that they have a severe case of wanting to leap tall buildings in a single bound before they can even crawl. Leaving aside for the moment that much mystery still surrounds even the source of the cosmic rays, can they really be suggesting that the post-humans with the most powerful quantum computer imaginable would have used a lattice space-time foundation to simulate our universe, of the same scale they themselves use with a conventional computer to simulate 'femto-sized universes'? Their simulations are about the size of maybe two or three

protons (several fermis), and yet they are dreaming about simulating our entire universe. In addition, it is evident from their argument that their femto-sized simulation is far from satisfactory. They say that they have successfully simulated the strong nuclear force subject to this rotational symmetry-breaking problem, and the electromagnetic force; but they are having insurmountable difficulties with the weak nuclear force and quantum gravity.

Actually, it is quite likely that the universe is simulated on a space-time lattice framework, but even a non-physicist can deduce that the lattice spacing is likely to be in the order of Planck's constant which sets the lower limit to the size of any 'physical' packet of energy. The real issue is whether it is even remotely likely that the simulation has been done by our post-human demigod descendants way, way, way in the future. Referring to Nick Bostrom's article, they say: "Extrapolations to the distant futurity of trends in the growth of high-performance computing (HPC) have led philosophers to question – *in a logically compelling way* – whether the universe that we currently inhabit is a numerical simulation performed by our distant descendants". (italics are mine) And they conclude their article by saying that, because it has been so easy in their simulations to correct these rotational symmetry-breaking artifacts and preserve chiral symmetry ('handedness'), it is 'unlikely' that any but the earliest simulations would have had patches applied. They lament the fact that these patches or 'improvements' would likely be effective in masking their ability to probe the simulation possibility.

Rather than try to pick holes in their argument, let's try to take an overall view. For a start, these are simulated scientists being able to detect (and suspect the authenticity of) the exact same lattice-like structure in the external world that they themselves were simulated upon. It might help if these scientists go back and review some elementary computer theory. This is the way Seth Lloyd explains it: "Gödel showed that the capacity for self-reference leads automatically to paradoxes in logic; the British mathematician Alan Turing showed that self-reference leads to uncomputability in computers." So, if you try to give pseudo-physical computer-generated robots the capacity to 'deconstruct' themselves, the

whole simulation would crash. In any event any such lattice-like structure is only mathematical in nature. It's just factored in to the image of the results. It's like the real biological post-human scientists being able to see the discrete gaps in their real physical world imposed by Planck's constant. They can't do it no matter how godlike they have become. *The post-humans do not have to simulate every single cosmic ray that has been buzzing around in the universe for the past 14 billion years.* All they have to simulate is the mathematical data that becomes our *entire* knowledge about these cosmic rays.

The argument advanced by these simulated scientists is purely mathematical and says nothing about what they are actually seeing. And after they do their experiments and get the 'results' they can actually see, of course these results will likewise be purely mathematical. To think the post-humans might have to intervene with a patch in the software because we are about to discover that we are virtual might make for a good episode of *Star Trek*, but from a philosophical point of view it is childish and delusional. The post-humans can tell us anything in mathematics about the foundations of these images we are seeing, and we have to believe it. It's my guess that far into the future, in some real physical world, some real biological post-human demigod historians are having a good belly laugh right *now*. What can be funnier than a thinking toy that you have made actually coming out with some extremely complex, mathematical thoughts *that it is a toy*?

All jokes aside, it's not possible for a simulated being to see anything other than the mathematical foundation of the 'external' environment they are 'seeing'. And the only reason why we can actually 'see' the mathematics is because the post-human demigods have 'enabled' that in the simulation program. They simply generate an image in *mathspeakese* on the cortex of the brains of these scientists, of results that are thoroughly consistent with all these infinitely large number of cosmic rays being 'real'.

The possibility we are using computer-generated *mathspeakese* to address the question of whether we are simulated suggests maybe we should take another look at the mathematics. What about Heisenberg's uncertainty principle, for example? We can never know all there is to

know about a physical system in order to make a perfect simulation of it. Generally speaking, the uncertainty principle states that the more certain we are of the value of some physical quantity, the less certain we become of a complementary quantity. It applies to all aspects of an elementary particle. If we know its exact position, we can know nothing about its momentum. If we know its exact energy value, we can know nothing about the time that has elapsed. If we know its spin about the vertical axis, we can know nothing about the sideways axis. Essentially, we can only know exactly 50 percent of the observables, and of the other complementary 50 percent, we are totally ignorant; and these can include both position and time which are crucial coordinates in any space-time lattice used as the framework for a simulation. Heisenberg's uncertainty becomes a fundamental and insurmountable barrier to our having complete knowledge about the system. In addition to this, there is the measurement problem. The math tells us that any measurement will tend to disturb the system we are measuring. So, no matter how much computer savvy our descendants develop in the future, they themselves will hit this barrier as well. Ergo, they will never actually be able to make a perfect simulation of something as modest as a chemical reaction in a test tube, let alone a perfect simulation of the entire universe.

Let's look at some other examples of our cherished mathematics as well. Maybe the math the post-humans use tells them with certainty that a particle 'exists' in a certain state, not some vague probability that if we make an observation, we will find a particle in a certain state. The space in the real physical world where the post-humans live may have straight up and down Cartesian coordinates, or at least nice, solid Riemann curvature they can actually 'see', not some weird mathematical, hypothetical, curved, simulated space that we 'think' we live in. The post-humans can tell us anything in *mathspeak* and we are programmed to believe it. What about these constants of Nature, these *ad hoc* numbers we have to stick into our equations to make them work? These could actually be the patches that they have had to apply to our simulation.

This raises a very interesting question. What if the probability theory, the uncertainty principle, Einstein's space-time, the measurement

problem and the constants of Nature are merely the mathematical laws of Nature that have been encoded into our simulation? The real biological scientists in their real physical universe will evidently have the Theory of Everything. In their world they can point to any particular particle and tell you exactly where it is and exactly the speed it is travelling. They can tell you exactly the change in energy as well as the exact time that has elapsed. They can measure any quantity they like without collapsing a probability wave function. They don't have to pluck bogus numbers out of the air to make their equations work. They can, therefore, do a perfect simulation of their real physical universe, but in the simulation they take care to impose upon us a more limited knowledge of the laws of Nature. Indeed, it would be very prudent of them to do so; otherwise our simulated world could overtake their real world, and we would become their masters. Where's Mr Spock when you need him? We need to get someone's advice on this. Where's my TV guide, dammit?!



Bishop Berkeley and networked intelligence

According to his notebooks, George Berkeley, later Bishop of Cloyne, had already discovered the “amazing truth... that nothing properly but... conscious things do exist”¹ while he was still a young man, recently graduated from Trinity College, Dublin. By the time he was 25 years old he had become the founder of the doctrine of Immaterialism in *A Treatise concerning the Principles of Human Knowledge* that was first published in Dublin in 1710. According to the doctrine of Immaterialism, there is no reality outside of the human mind, and material objects have therefore to be perceived by a human mind in order to exist. In modern terms, George Berkeley’s doctrine of Immaterialism would support the notion that the Universe is a virtual reality.

Berkeley certainly was not the first person to come up with this notion, that all objects in the external world can be taken as mental constructs by virtue of the fact that they can only be perceived through the senses of the observer. In the western philosophical tradition this notion can be found as far back as the ancient Greek philosopher Pyrrho of Elis (360?-275? BC); and in the eastern philosophical tradition, this notion that the external world is illusionary, mere ‘name and form’, is a dominant theme of the Hindu Upanishads dating back about 1,000 years BC.

Taken in its historical context, Berkeley’s theory was a reaction against the attempts by certain philosophers, notably René Descartes, who were asserting that it was possible to be certain that an external world did in fact exist, which would therefore enable humanity to systematically build up an edifice of knowledge concerning the nature of this external world. Interestingly, the famous assertion by René Descartes, that it was beyond all doubt that he “thinks” and therefore he must exist, is hardly a substantial proof that the external world is composed of some physical material. The most that can be said is that he certainly thinks that the external world is material, which does not weaken the arguments of Pyrrho of Elis in the slightest; indeed, if anything, it enhances the case for skepticism.

Be that as it may, Descartes was asserting that he was certain that he exists because he is certain that he thinks, and this was sufficient to give validity to the body of knowledge that was beginning to accumulate about the external world. Other notable philosophers such as Pierre Gassendi (1592-1655) and John Locke (1632-1704), although conceding the fact that ultimately in our knowledge about the external world we were only dealing with appearances, our beliefs about those appearances were sufficiently certain to enable us to build up a body of knowledge that will work for all practical purposes. Our knowledge about an external world appears to be correct, so to argue that it is not absolute proof that the external world is material is merely splitting hairs.

Enter George Berkeley into the debate who was determined to do away with this “forelorn skepticism” once and for all, because he saw it as potentially undermining Christianity, a religion that he devoutly believed in all his life. He actually genuinely believed if he could irrefutably establish that the external world was of a spiritual, immaterial nature then he would be delivering a fatal blow to the atheists and skeptics who were calling into question Christian dogma. In point of fact, Christian dogma is only understandable on the basis that there is a real, physical Universe and a spiritual, immaterial God somewhere else external to it; but Berkeley didn’t seem to realize this, or if he did, he evidently didn’t consider it a fundamental premise for Christianity.

With great gusto, Berkeley set about to argue that external objects have to be perceived by a mind in order to exist, which meant that he then had to deal with the problem with what happened to these objects when they were not being observed? Did they simply cease to exist? Were they no longer real? How can any rational person be asserting that objects can simply appear, disappear and then re-appear? There were many who called his sanity into question. According to Berkeley, “bodies are annihilated and created every moment, or exist not at all during the intervals between our perception of them.”² Bearing in mind that he is actually talking about mountains and rivers and the like, one minute they are there and the next they cease to exist. A limerick by Monsignor Ronald Knox (1888-1957) very wittily captures Berkeley’s quandary.³

There once was a man who said, 'God
Must find it exceedingly odd
If he finds that this tree
Continues to be
When there's no one about in the Quad.

This is where Berkeley's religious faith comes into play, and it is precisely in this area that he saw himself negating the arguments of the skeptics and atheists. When "all those bodies which compose the mighty frame of the world" are not being observed "they must have no existence at all, or else subsist in the mind of some eternal spirit."⁴ But for Berkeley it was an "absurdity of abstraction to attribute to any single part of them an existence independent of a spirit."⁵ From which he concludes as a matter of simple logic that "there is not any other substance other than *spirit*, or that which perceives."⁶ There are many no doubt who would conclude at this point that Berkeley has taken leave of his senses, but the meaning of his statements are crystal clear. The Universe, in its entirety, is in the nature of spirit. Or in limerick form:⁷

Dear Sir, Your astonishment's odd;
I am always about in the Quad.
And that's why the tree
Will continue to be,
Since observed by yours faithfully, God.

Some have argued that Berkeley is saying that the existence of material objects in God's mind means that God is literally continuing to perceive them, or that the objects are just held in suspense, in limbo, in God's mind and are reproduced on call for the benefit of an observing or perceiving mind. In order for this distinction to have any substance it would be necessary to have some clear idea of what God or spirit is, which is, to say the least, problematical. Berkeley never attempted to answer that question. For him it was a foregone conclusion that God was the

Trinity of orthodox Christianity. But for most people these days, this explanation is far from satisfactory.

For Berkeley, God was directly communicating our visual experience to us like a language. The French philosopher, Nicolas Malebranche, whom Berkeley had studied as a student, had argued that there was an external material reality that was independent of mind and yet we were also “seeing all things in God.”⁸ Berkeley’s argument seems to echo the “seeing all things in God” aspect while fervently denying the mind-independent reality aspect. From which we can conclude that it is Berkeley, and not Malebranche, who is being strictly logical. To have a mind-independent reality and yet at the same time to be “seeing all things in God” is patently absurd. Berkeley’s own view, that there “is not any other substance other than spirit,” is logically acceptable if we are to be “seeing all things in God.” His logic falls down only at the next stage, for his Christian notion of God is not acceptable to clarify his meaning. There is absolutely nothing in Christianity to suggest how God could be communicating to us our visual experience like a language.

Orthodox Christianity would have us believe that there is a distance between ourselves and the Deity that created us, whereas Berkeley’s Immaterialism relies upon the “immediate presence of the Deity.”⁹ Somehow the Deity is actually responsible for causation: it is the Deity that is responsible for producing ideas in us, it is the Deity that is responsible for our perceptions, and it is by means of these perceptions that the appearance of an external material world is created. Berkeley does not specifically say it but it is quite clear that he is arguing that the Deity is responsible for our intelligence and our consciousness. Quite clearly he has now considerably removed himself from orthodox Christian dogma. But his theories remain an enigma because he gives us no clear idea of what form this Deity could take if not the Christian Trinity. We are looking for some sort of Deity that is actually working through us to provide us with our intelligence and our consciousness.

In 2003, German writers, Grazyna Fosar and Franz Bludorf, published a book *Vernetzte Intelligenz* [Networked Intelligence]¹⁰ wherein they argue that the DNA of all sentient beings (including plants) is linked in an

intelligence network that allows for a hypercommunication of information. By “hypercommunication” they mean instantaneous communication – zero time lag. This hypercommunication takes place by means of magnetic wormholes at the subatomic or quantum level where our macroscopic notions of time and space no longer apply. According to this theory the DNA is actually structured as a language, and data is not only transmitted in the DNA but it is also stored. In this respect the DNA acts as a ‘holographic-solitonic’ computer. The DNA emits discreet pulse-like waves that hold their shape, and it is therefore capable of data transmission. This networked intelligence in the DNA is responsible for our individual consciousness, and our group consciousness. It is likewise responsible for our intelligence. It is the networked intelligence that actually puts the ideas into our mind.

For the rest of this chapter it is proposed to take some statements by Berkeley, and make one small modification to them. Wherever Berkeley uses the word “God” or “spirit” or “Deity”, we shall transpose the words “networked intelligence.” Before doing so we should briefly mention the modern doctrine of Phenomenalism that purports to offer “Berkeley without God.”¹¹ Where Berkeley talks of “ideas”, phenomenalism offers “sense-data.” According to the Linguistic Phenomenalism of A.J. Ayer “propositions which are ordinarily expressed by sentences which refer to material things could also be expressed by sentences which referred exclusively to sense-data.”¹²

It is commonplace for all of us that the material objects of the external world are converted by our senses into data that is then mapped or reconstructed on the cortex of our brain, to give us a representation of the external world. It is also commonplace to anyone who knows anything about computers that the nature of data is such that it brings with it the information about its source. That is to say, if our brain is just processing data to make maps of the external world and representations of material objects, we can no longer be certain as to the source of that data. The data itself is telling us that it is coming from the external world, but it could just as easily be stored inside of us. We can never know. So for our added

amusement, let us also see what happens when we transpose “sense-data” into Berkeley’s statements wherever he refers to “ideas.”

Berkeley introduces his work: “What I here make public has, after a long and scrupulous enquiry, seemed to me to be evidently true, and not unuseful to be known, particularly to those who are tainted with skepticism, or want a demonstration of the existence and immortality of [networked intelligence], or the natural immortality of the soul.”¹³ The networked intelligence can store and transmit data, which means that the sense-data for every living creature is actually stored in the DNA as volatile memory. After we are dead the DNA retains a record of our existence. This is what constitutes our soul in Berkeleian terms.

His general thesis: “Some truths there are so near and obvious to the mind, that a man need open his eyes to see them. Such I take this important one to be, that all the choir of heaven and furniture of the earth, in a word all those bodies which compose the mighty frame of the world, have not any subsistence without a mind, that their being is to be perceived or known; that consequently so long as they are not actually perceived by me, or do not exist in my mind or that of any other created spirit, they must either have no existence at all, or else subsist in the [networked intelligence]: it being perfectly unintelligible and involving all the absurdity of abstraction, to attribute to any single part of them an existence independent of a [networked intelligence]. To be convinced of which, the reader need only reflect and try to separate in his own thoughts the being of a sensible thing from its being perceived.”¹⁴

The last sentence is particularly significant, for here we see Berkeley stating the same thing that Hegel maintains in the *Phenomenology of Spirit*, namely that subject and object, or being and thought are identical. Once we know that the sense-data is stored in the networked intelligence in the DNA, then evidently the boundary between subject and object or being and thought is artificial, and this boundary creates the appearance within the unified networked intelligence of a self-consciousness, the “I”, differentiated from “the other.”

Furthermore, Berkeley clearly indicates in the passage quoted above that when the object is not being perceived by a mind, it continues to exist

as sense-data in the networked intelligence. So, Berkeley continues: "From what has been said, it follows, there is not any other substance than [networked intelligence], or that which perceives."¹⁵ This is precisely the same theory as outlined by Georg Wilhelm Friedrich Hegel in his *Phenomenology of Spirit*. Once it is clearly understood that subject-object or being-thought is identical then we must assume that all of life is a "spirit monism" – the networked intelligence.

Immanuel Kant in *Prolegomena* distinguishes his Transcendental Idealism from "the mystical and visionary idealism of Berkeley." According to Kant there is an impenetrable barrier between the object in itself and our knowledge of the object through our senses. The thing in itself is forever separated from us. Kant says: "My idealism concerns not the existence of things (the doubting of which, however, constituted idealism in the ordinary sense), since it never came into my head to doubt it, but it concerns the sensuous representation of things..."¹⁶ Kant's transcendental idealism is flawed logically for he doesn't seem to realize that to have no knowledge of the thing in itself is to know nothing, so how can he even assume that it exists?

Berkeley's Immaterialism (nothing exists unless it is perceived by a conscious mind) is therefore more logical than Kant's theory. Berkeley, like Hegel, was forced to argue that objects continue to exist in the mind of a universal spirit (God), but once we understand that when objects are not being perceived by humans they continue to exist as sense-data in the networked intelligence, then the Idealism of Berkeley as well as Hegel presents a perfectly rational theory about the nature of life. It is actually Kant's Transcendental Idealism that fails for want of a logical basis. Berkeley specifically says: "In short, if there were external bodies, it is impossible we should ever come to know it..."¹⁷ which effectively destroys Kant's Transcendental Idealism in just one sentence. Kant actually admits that he knows nothing about the thing in itself; indeed, to theorize about it is meaningless. To all intents and purposes it does not exist in his theory.

In explaining our perceptions of a real world, Berkeley says: "We perceive a continual succession of [sense-data], some are anew excited,

some are changed or totally disappear. There is therefore some cause of these [sense-data] whereon they depend, and which produces and changes them. That this cause cannot be any quality or idea or combination of ideas, is clear from the preceding section. It must therefore be a substance; but it has been shown that there is no corporeal or material substance: it remains therefore that the cause of [sense-data] is an incorporeal active substance or [networked intelligence]."¹⁸ Berkeley goes on to describe this networked intelligence as "one simple, undivided, active being: as it perceives [sense-data] it is called *understanding*." We can see that Berkeley actually attributes the perception of the sense-data to this unified active spirit. Once we know that we are dealing with a networked intelligence in the DNA, we can interpret Berkeley's intuition that the sense-data is processed in the brain to give us self-consciousness, perception and understanding. There appears to be diversity in the world, but the networked intelligence is the "simple, undivided, active being" that Berkeley is talking about.

So what does Berkeley have to say about reality? "If any man thinks this detracts from the existence or reality of things, he is very far from understanding what has been premised in the plainest terms I could think of. Take here an abstract of what has been said. There are spiritual substances, minds or human souls, which will or excite ideas in themselves at pleasure: but these are faint, weak, and unsteady in respect of others they perceive by sense, which being impressed upon them according to certain rules or laws of nature, speak themselves the effects of a [networked intelligence] more powerful and wise than human spirits. These latter are said to have more *reality* in them than the former: by which is meant that they are more affecting, orderly, and distinct, and that they are not fictions of the mind perceiving them. And in this sense, the sun that I see by day is the real sun, and that which I imagine by night is the idea of the former. In the sense here given of *reality*, it is evident that every vegetable, star, mineral, and in general each part of the mundane system, is as much a *real being* by our principles as by any other. Whether others mean anything by the term *reality* different from what I do, I ask them to look into their own thoughts and see."¹⁹

Evidently Berkeley does not doubt for one moment that he is real, nor does he doubt for one moment that external objects are real. Note that Berkeley emphasizes that what we normally think of as inanimate objects, such as vegetables, stars, minerals, are real beings in his system. However, this is not a physical reality, but a virtual reality. Indeed, Berkeley actually foreshadows what we now refer to as virtual reality: "...it is granted on all hands (and what happens in dreams, phrensies, and the like puts it beyond dispute) that it is possible we might be affected with all the ideas we have now, though no bodies existed without, resembling them... In short, if there were external bodies, it is impossible we should ever come to know it; and if there were not, we might have the very same reasons to think there were that we have now. Suppose, what no one can deny possible, an intelligence without the help of external bodies to be affected with the same train of [sense-data] that you have, imprinted in the same order and with like vividness in his mind. I ask whether that intelligence hath not all the reason to believe the existence of corporeal substances, represented by his [sense-data], and exciting them in his mind, that you can possible have for believing the same thing?..."²⁰

It is one thing to say that the world is an illusion (the Hindus have been saying that since time immemorial); the essential question to be answered is how is the illusion created? No one is doubting that something is happening here – there appears to be a Universe and a great diversity of individuals appear to live in it. What we need is a rational interpretation for these appearances. The answer is that the world we perceive is actually sense-data in the DNA. The data is real. The processing of the data creates a virtual reality. The world is a manifestation of the networked intelligence.



12

The web of the spider and networked intelligence

In 2003, Grazyna Fosar & Franz Bludorf published *Vernetzte Intelligenz* [Networked Intelligence]¹. In the simplest of terms they argue that there is a communication link-up in the DNA of all sentient beings (including

plants) via magnetic wormholes at the subatomic level. These magnetic wormholes facilitate a hypercommunication of information (instantaneous transfer of information, zero time lag, so conventional terms of 'time' and 'space' no longer apply). This networked intelligence in the DNA is responsible for the individual consciousness of all sentient beings (including plants), and moreover it is responsible for group consciousness phenomena, including the "collective unconscious" of Carl Gustav Jung.

It will be demonstrated here that this networked intelligence concept put forward by Fosar & Bludorf can explain certain obscure remarks made by Denis Diderot in his celebrated philosophical work, *Le Rêve de d'Alembert* [d'Alembert's Dream]. In that work Diderot suggests that all of life is like a unified spider's web. He also draws an analogy between our individual consciousness and our group consciousness; and the apparent one-mindedness of a swarm of bees.

Before dealing in detail with what Diderot actually wrote, I shall succinctly list the various grounds upon which Fosar & Bludorf base their networked intelligence theory. First, it has been discovered by a group of Russian scientists, led by Drs. P. Garjajev & V. Poponin, that the DNA has a mysterious resonance. These scientists beamed laser light through a DNA sample, which caused a certain wave pattern to appear on a screen at the rear. However, when the physical DNA sample was removed from the experiment, another wave pattern appeared on the screen at the rear as if there was still a physical sample of DNA present. This same experiment was repeated several times and the same results obtained. They termed this experiment the DNA Phantom Effect. There is some resonating energy in the DNA that is outside of the conventional four-dimensional 'space-time' scenario.

The Russian scientists also found that the 95% plus of human DNA that does not code for protein synthesis, so-called 'junk DNA', is actually structured like a language, and would therefore be capable of information storage. Indeed it is possible to capture the information patterns in the genes using laser light, and then transfer those information patterns from one genome to another, without the need for the cutting and splicing of

chemical genes. By simply transmitting the data via laser light to a different genome they were able to convert a frog embryo into a salamander embryo.

The Russian scientists came to the conclusion that the human chromosome acts as a solitonic-holographic computer. The resonance of the DNA is 'solitonic' in the sense that it consists of discreet pulsating waves that hold their precise shape and are therefore capable of both storing and transmitting information. This, in addition to the findings of German scientist Fritz-Albert Popp, that the DNA emits natural light photons and acts as a superconductor at body temperature.²

Fosar & Bludorf also base their networked intelligence theory on the findings of Finnish physicist, Matti Pitkänen. The thrust of his work was to assimilate quantum theory into biology, and he came to the conclusion that magnetized wormholes in the DNA at quantum level were the most likely candidates to be responsible for our perception. In addition, Matti Pitkänen found that the DNA is capable of storing information in binary format by means of twisted and untwisted magnetic flux tubes.

The combined theories of the Russian scientists and Matti Pitkänen would therefore have us believe that the genome of all sentient beings (including plants) acts as a solitonic-holographic computer capable of storing and transmitting information in binary format that sets up our perception of an external world, and gives us an individual as well as a group consciousness. These processes occur in the 'substratum', that is to say beneath our four-dimensional 'space-time' reality, and do not involve the passing of time or movement in space in any conventional sense. It is a networked, and therefore a unified, intelligence that is at work in the substratum.

According to Fosar & Bludorf, this magnetic resonance in the DNA is capable of interacting with conventional electromagnetic forces in the external world, such as the geomagnetic resonance of the Earth and the Schumann resonance in the biosphere. In addition, it is capable of directing and controlling our brain waves, and this is how it sets up our individual consciousness; and because there is hypercommunication of information at the DNA level amongst all sentient beings (including

plants), it is capable of modulating and coordinating our activity as a group. At the conscious level we think we are all individuals that enjoy complete autonomy of action; but in fact, our individual consciousness is only part of a greater group consciousness which unifies us all at the unconscious level.

Fosar & Bludorf give several examples of a group consciousness that can be created by the networked intelligence in the DNA. For instance, the ability of ants to act in concert, and the way termites building their nests seem to know exactly what they are required to do, even though they are actually blind. Conventional science is at a loss to explain the ability of these insects to act as a group, and often they can perform feats that would be impossible for human beings even with their seemingly more sophisticated means of communication and technology. However, the ability of various species of insect to act as a group can be readily explained on the basis that there is a hypercommunication of information at the DNA level.

In particular, Fosar & Bludorf quote a passage from a book by Lewis Carroll, *Sylvie and Bruno*, observing that a swarm of bees seem to display a single intelligence. Although there may be several hundred of them swarming together, there appears to be only one mind at work. The passage from *Sylvie and Bruno* follows, where a discussion takes place between the storyteller, Lady Muriel, and the Old Earl:

"You mentioned 'division of labour', just now," I said. "Surely it is carried to a wonderful perfection in a hive of bees?"

"So wonderful - so entirely super-human - " said the Earl, and so entirely inconsistent with the intelligence they show in other ways - that I feel no doubt at all that it is *pure* Instinct, and *not*, as some hold, a very high order of Reason. Look at the utter stupidity of a bee, trying to find its way out of an open window! It *doesn't* try, in any reasonable sense of the word: it simply bangs itself about! We should call a puppy *imbecile*, that behaved so. And yet we are asked to believe that its intellectual level is above Sir Isaac Newton.!"

"Then you hold that *pure* Instinct contains no *Reason* at all?"

"On the contrary," said the Earl, "I hold that the work of a bee-hive involves Reason of the *highest* order. But none of it is done by the *Bee*. God has reasoned it all out, and has put into the mind of the Bee the *conclusions*, only, of the reasoning process."

"But how do their minds come to work *together*?" I asked.

"Special pleading, special pleading!" Lady Muriel cried, in a most unfilial tone of triumph. "Why, you yourself, said, just now, 'the mind of the Bee!'"

"But I did *not* say '*minds*', my child," the Earl gently replied. "It has occurred to me, as the most probable solution of the 'Bee'-mystery, that a swarm of Bees *have only one mind among them*. We often see one mind animating a most complex collection of limbs and organs, *when joined together*. How do we know that any material connection is necessary? May not mere neighbourhood be enough? If so, a swarm of bees is simply a single animal whose many limbs are not quite close together!"

Diderot in *Le Rêve d'Alembert* [d'Alembert's Dream] seems to argue that all the cells in the body have this same quality as a swarm of bees in as much as they are connected in a unified intelligence network; and he goes on to suggest that it may also be the same for all supposedly independent, autonomous animals, such as humans and the lesser creatures, particularly bees. In Diderot's work, Mademoiselle de L'Espinasse is relating d'Alembert's dream to Doctor Bordeu:³

MADemoiselle DE L'ESPINASSE: Listen: 'A living point... No, that's wrong. Nothing at all to begin with, and then a living point. This living point is joined by another, and then another, and from these successive joinings there results a unified being, for I am a unity, of that I am certain... (As he said this he felt himself all over.) But how did this unity come about?'... He fell silent, but after a moment he went on as though speaking to somebody: 'Now listen, Mr Philosopher, I can understand an aggregate, a tissue of tiny sensitive bodies, but an animal!...A whole, a system that is a unit, an individual, conscious of its own unity! I can't see it, no, I can't see it.'... Well, he went on, addressing himself: 'Friend D'Alembert, mind how you go, you are assuming that there is only contiguity, whereas there is continuity... Just as a globule of

mercury joins up with another globule of mercury, so a sensitive, living molecule joins up with another sensitive and living molecule. First there were two globules, but after contact there is only one. The same sensitivity is common to the whole mass. And why not? I can mentally divide the length of an animal fibre into as many distinct parts as I like, but in fact that fibre will be continuous, all of a piece, yes, all of a piece. Contact between two homogenous molecules – perfectly homogenous – gives the continuity, and this applies to the most complete union, cohesion, combination or identity imaginable... Yes, Mr. Philosopher, all very well if those molecules are simple and elementary, but suppose they themselves are aggregates, compounds... The combination will still take place, and consequently there will be identity and continuity... A wire of pure gold is one comparison I remember his making, a homogenous network into the interstices of which others fit to form, perhaps, a second network, a tissue of sensitive matter which is in contact with the first and which assimilates active sensitivity here and inactive there and passes it on like movement... So everything works together to produce a sort of unity which is only found in the animal world... Really, if that isn't what you call truth it is very like it...' After this preamble he started shouting: ...'Have you ever seen a swarm of bees leaving their hive?... The world, or the general mass of matter, is the great hive... Have you seen them fly away and form at the tip of a branch a long cluster of little winged creatures, all clinging to each other by their feet? This cluster is a being, an individual, a kind of living creature... But these clusters should be all alike... Yes, if he admitted the existence of only one homogenous substance... Have you seen them?... If one of those bees decides to pinch in some way the bee it is hanging on to, what do you think will happen?... this second bee will pinch its neighbour, and that throughout the entire cluster as many individual sensations will be provoked as there are little creatures, and that the whole cluster will stir, move, change position and shape, that a noise will be heard, the sound of their little cries, and that a person who had never seen such a cluster form would be tempted to take it for a single creature with five or six hundred heads and a thousand or twelve hundred wings.'

BORDEU: Look at your notes and listen: 'A man who took that cluster for an animal would be making a mistake.'... 'Do you want him to give a more balanced opinion? Do you want to change the cluster of bees into one individual animal? Soften the feet with which they cling to each other, that is to say make them continuous instead of contiguous. Obviously there is a marked difference between this new condition of the cluster and the preceding one, and what can this difference be if not that it is now a whole, one and the same animal, whereas before it was a collection of animals?...are only distinct animals kept by the law of continuity in a state of general sympathy, unity, identity...'

MADemoiselle de l'EspInase: After that gibberish of yours – or his – he said: 'Take this cluster of bees, there, you see it over there, and let us do an experiment... Take your scissors; are they sharp?... Now carefully, very carefully, bring your scissors to bear on these bees and cut them apart, but mind you don't cut through the middle of their bodies, cut exactly where their feet have grown together. Don't be afraid, you will hurt them a little, but you won't kill them. Good – your touch is as delicate as a fairy's. Do you observe how they fly off in different directions, one by one, two by two, three by three? What a lot there are! Now if you have followed me...

BORDEU: Nothing simpler. 'Suppose that these bees are so tiny that the thick blade of your scissors always missed their bodies, in fact that you can cut them up as small as you like without ever killing one, and that the whole mass, composed of bees too small to be seen, will be a real polyp, that can be destroyed only by crushing. The difference between the cluster of continuous bees and the cluster of contiguous ones is precisely the same as that between ordinary animals, such as ourselves or fish, and worms, serpents and polypous creatures.'

It seems fairly clear that Diderot is saying, as it is with a swarm of bees, so is it with us all. We all appear to be autonomous or contiguous creatures but in reality we are all continuous. All creatures can be likened to a unified swarm of bees. In the discussion that takes place between Diderot and d'Alembert before the dream, Diderot makes certain pointed observations about the indivisibility of the Universe. He seeks to explain

all of life in terms of a harmonious interplay of resonances, and all sentient beings as being the means by which the resonances are played and recorded: "Thus if this sensitive and animated clavichord were endowed with the further powers of feeding and reproducing itself, it would be a living creature and engender from itself, or with its female, little clavichords, alive and resonant... Thus, there can come a moment of madness when a sensitive clavichord imagines that it is the only one that has ever existed in the world, and that all the harmony in the universe is being produced by it alone."³ Diderot talks of a certain resonance, and suggests that in the last resort there is only this resonance and nothing else. This resonance is to be found in our DNA – it is the networked intelligence – a precise resonance that is storing and transmitting data.

Diderot also draws on the metaphor of the spider's web to demonstrate the networked intelligence. Again, Mademoiselle de L'Espinasse is talking to Doctor Bordeu as d'Alembert sleeps:³

MADemoISELLE DE L'ESPINASSE: Doctor, come nearer. Imagine a spider at the centre of its web. Disturb a thread and you will see the creature rush up on the alert. Now suppose that those threads that the insect draws from its own body and draws in again at will were a sensitive part of itself.

BORDEU: I follow you. You are assuming the existence inside yourself, in some part of the brain, for example the part we call the meninges, of one or more points to which are signalled all the sensations produced anywhere along the threads.

MADemoISELLE DE L'ESPINASSE: That's it.

BORDEU: Your idea is as sound as could be, but don't you see that it is roughly the same thing as a certain swarm of bees?

MADemoISELLE DE L'ESPINASSE: Ah, so it is. I have been speaking prose without really realizing it!

BORDEU: And very good prose, too, as you are about to see. Anyone who only knows man in the form he presents at birth doesn't know anything about him at all. Man's head, feet, hands, all his limbs, his viscera, his organs, nose, eyes, ears, heart, lungs, intestines, muscles,

bones, nerves, membranes are really nothing more than crude extensions of a network which takes form, grows, extends and throws out a multitude of imperceptible threads.

MADemoiselle de l'Espinasse: Back to my web; and the starting-point of all those threads is my spider.

BORDEU: Exactly.

MADemoiselle de l'Espinasse: Where are the threads? And where does the spider live?

BORDEU: The threads are everywhere; there isn't a single point on the surface of your body that is not the terminus of one of them, and the spider lurks in a part of your brain I have already mentioned, the meninges, which can scarcely be touched without reducing the whole organism to unconsciousness.

MADemoiselle de l'Espinasse: But if the smallest speck of matter makes one thread of the web vibrate, the spider is alerted, excited and darts here or there. At the centre she is conscious of what is going on at any point in the huge mansion she has woven. Why don't I know what is going on in my own system or in the world at large, since I am a bundle of sensitive particles and everything is touching me and I am touching everything else?

BORDEU: Because messages weaken in proportion to the distance they come from.

MADemoiselle de l'Espinasse: Yet if there is the very gentlest tap on the end of a long rod I can hear it if my ear is applied to the other end. Even if that rod had one end on earth and the other on Sirius, the same phenomenon would be produced. If everything were interconnected and contiguous, as in the rod if it really existed, why can't I hear whatever is going on in the limitless spaces around me – especially if I listen attentively?

BORDEU: And who has suggested that you can't, to a greater or lesser degree? But the distance is so great, the initial impression so weak and so confused on its way by others, and you are surrounded and deafened by so much violent and varied din. In particular, between Saturn and you there are only contiguous bodies, and not continuous, as there should be.

MADemoiselle de l'Espinasse: That seems a pity.

BORDEU: True. Were it otherwise you would be God. Through your oneness with all the beings in nature you would know everything that is going on, and thanks to your memory you would know everything that has been.

MADemoiselle de l'Espinasse: And will be?

BORDEU: As for the future, you could make some very shrewd guesses, but they would be subject to correction. It is just as if you were trying to guess what is going to happen inside you, or at the extremity of your foot or hand.

MADemoiselle de l'Espinasse: But how do you know that the whole world hasn't its meninges, or that there isn't a big or little spider in some corner of space with threads extending everywhere?

BORDEU: Nobody knows, but still less does anybody know whether there has been one or will be one in the future.

MADemoiselle de l'Espinasse: But how could a God like that

-

BORDEU: The only conceivable kind of God -

This passage about the spider's web is perhaps one of the most famous aspects of Diderot's work. He was writing at a time when nothing was known about genetics. It is only since 2003 that this theory about the networked intelligence in the DNA has emerged. And yet once we re-read Diderot's words, with the knowledge of the possibility that the genome of all living creatures (including plants) may be linked in an intelligence network, it is difficult to see what on earth Diderot could be talking about, if not precisely that.

Diderot has been credited with the development of biological materialism. Laurent Versini, who edited the complete works of Diderot states: "What differentiates Diderot from a Jean-Jacques Rousseau or a Montesquieu, moralists and jurists of the soul, or from a Voltaire, a poet as well as a critic and gifted mathematician, is his definitive orientation right from the start towards psychophysiology and biology. Aristotle also has his *Metaphysics* and his *Physics*."⁴ Furthermore, Versini states: "Diderot discovers with wonder that matter is creative, effervescent and

percolating which can serve as the underlying principle for all that exists and reconcile determinism and evolutionism: this is Neo-Spinozism.”⁵ Diderot insists throughout his career that ‘determinism is universal’, that is to say that there is some specific force or energy in nature that is responsible for the course of events, and “Under the influence of Maupertius, Diderot never hesitates to confirm that a psyche is inherent in matter.”⁶

Biological materialism can only be explained on the basis that the networked intelligence in the DNA is actually responsible for our perceptions of an external world, so that psyche is inherent in inert matter because it cannot exist independently of a perceiving being. Effectively then, biological materialism becomes one global resonance, a unity. As Diderot himself states in his *Entretien entre D’Alembert et Diderot*, “And to give my system all its force, note as well that it is subject to the same insurmountable difficulty that Berkeley proposed against the existence of the physical body. There is a moment of delirium where a sentient piano would think that it is the only thing in the world that exists and that all the harmony of the universe is created within itself.”⁷



13

VALIS and the networked intelligence

Towards the end of his life, the science fiction writer Philip K. Dick had a profound religious experience, an epiphany. The core experience occurred in February and March 1974 and for the rest of his life he would refer to his awakening as 2-3-74. He lived for about eight years after this experience, and during that time he managed to write an 8,000 page

Exegesis (most of which is unpublished) and three novels, all trying to come to grips with what he experienced during 2-3-74.

Throughout his life, Dick was notorious for drug abuse, principally speed and antidepressants, and in fact 2-3-74 was triggered by a girl from his local drug store making a delivery of painkillers to his home.

Dick was very partial to young, slim, dark-haired girls – he actually married five of them – and his delivery girl not only fitted this mold but in addition she was wearing around her neck the ancient Christian fish symbol – the sign of Jesus Christ. It is this fish symbol that particularly fixated his attention, and led to an ‘encounter with God’. This encounter was purely mental and subjective in nature, and it endured for the rest of his life.

In his novel, *Radio Free Albemuth* he describes the initial eight hours of his experience:

“The dazzling presentation of modern abstract graphics continued all through the night, with Paul Klee giving way to Marc Chagall, and Chagall to Kandinsky, and Kandinsky to an artist whose style I did not recognize. There were literally tens of thousands of graphics by each master artist in turn... which caused a peculiar thought to enter my mind after two hours had passed. These great artists had never produced so many works; it was patently impossible for them to have done so. Of the Klees alone I had now seen more than fifty thousand, although admittedly they had gone so rapidly that I had not been able to glimpse any distinct details, but rather only the general impression of fluctuating balance points in the various pictures, changing proportions of dark and light colors, adroit black strokes of the brush that gave harmony to what would otherwise have been less than high art. I had the intense impression that this was a telepathic contact of some sort from a very remote point, that a TV camera was sweeping out the various displays of pictures in a museum somewhere.”¹

Dick, in his *Exegesis*, and his last three novels, advances many theories as to the source of this information download. Much of his theory involves Christian mysticism where he no longer regards Jesus as a person, but rather he sees the Christ figure as somehow embracing the entire

Universe. For instance in his novel, *VALIS*, he writes: "...You know of Meister Eckehart, then... He was the first person to conceive of the Godhead in distinction to God. The greatest of the Christian mystics. He taught that a person can attain union with the Godhead – he held a concept that God exists within the human soul!.. The soul can actually know God as he is! Nobody today teaches that!.. Sankara in India, in the ninth century; he taught the same things Eckehart taught. It's a trans-Christian mysticism in which man can reach beyond God, or merges with God, as or with a spark of some kind that isn't created, Brahman... *VALIS*... this would explain the revelations about the Buddha and about St. Sophia or Christ. This isn't limited to any one country or culture or religion."²

VALIS is an acronym of Vast Active Living Intelligence System. And we see how Dick comes to regard the Christ figure as simply the sum total of all biological matter in the Universe.

VALIS is the key to Dick's encounter with God. What is clear is that he is talking about an intelligence system in which all of us as living creatures participate. In 2003, Grazyna Fosar and Franz Bludorf wrote a book entitled , *Vernetzte Intelligenz* [Networked Intelligence] and this is the closest thing I have found to explain *VALIS*. According to Fosar & Bludorf the DNA of all sentient creatures (including plants) are connected in a networked intelligence that allows the hypercommunication of information via magnetic wormholes at the sub-atomic level. This networked intelligence not only has the capacity for information transfer so we are all actually linked at the genetic level, but most importantly, the networked intelligence allows for memory storage and data retrieval. In addition, it is this networked intelligence that sets up our consciousness as individuals, and also gives us a group consciousness that can be likened to the 'collective unconscious' of Carl Gustav Jung. *VALIS* can also be likened to the web of the spider of Denis Diderot, and many parallels can be drawn between Diderot's « biological materialism » and what Dick actually says about *VALIS*.

In his novel *VALIS*, Dick lists various attributes of this Vast Active Living Intelligence System: "30. The phenomenal world does not exist; it is a hypostasis of the information processed by the Mind". In order to

understand this point we need only refer to the theory of George Berkeley, Bishop of Cloyne, who in his *Principles* states his famous formula '*esse est percipi*' (quoted earlier).³

In addition, Dick regards the objects in the external world in the nature of language, as does Berkeley. Dick says:

"Journal Entry 37. Thoughts of the Brain are experienced by us as arrangements and rearrangements – change – in a physical universe; but in fact it is really information and information processing which we substantialize. We do not merely see its thoughts as objects, but rather as the movement, or, more precisely, the placement of objects: how they become linked to one another. But we cannot read the patterns of arrangement; we cannot extract the information in it – (i.e.), it is as information, which is what it is. The linking and relinking of objects by the Brain is actually a language, but not a language like ours (since it is addressing itself and not someone or something outside itself).⁴

"And Berkeley says about the images we see of an external world in the nature of divine language: 'In the *New Theory of Vision*, the signs connected arbitrarily with the world's spatial features are ideas of sight, or sensations that accompany sight. The language comprising them is therefore exclusively visual.' In *A Treatise concerning the Principles of Human Knowledge*, where all ideas of sense are portrayed as « marks or signs for our information » (PHK 66), what was at first a language of vision becomes a language of experience. Because careful introspection reveals that ideas of sense have no causal power (PHK 25), « the connexion of ideas does not simply imply the relation of cause and effect, but only a mark or sign with the thing signified » (PHK 65). Berkeley's examples in the *Principles* include not only the visible idea of fire – which is not the cause of the pain I suffer on approaching it but merely « the mark that forewarns me of it » - but also the noise of colliding bodies, which is not the effect of the collision but the sign that draws it to our attention. The scientist's task is to discover the laws of nature. These laws, however, do not pick out causes and their effects; they are, instead, the grammatical rules of the language in which God speaks to us..."⁵

Dick continues: "All creation is language and nothing but a language, which for some reason we can't read outside and can't hear inside. So I say, we have become idiots. Something has happened to our intelligence. My reasoning is this: arrangement of parts of the Brain is a language. We are parts of the Brain; therefore we are language."⁶

Dick's position is also similar to Berkeley as regards motion and time. Concerning motion, Dick says:

"14. The Universe is information and we are stationary in it, not three-dimensional and not in space and time. The information fed to us we hypostatize into the phenomenal world."⁷

In addition, in Journal Entry 37 quoted above, we see Dick explaining motion and movement as arrangements and rearrangements of information – namely information processing. At another point in the novel *VALIS*, he states: "First you change it into space and then you walk through it, but as Parsifal realized, he was not moving at all; he stood still and the landscape changed; it underwent a metamorphosis."⁸

Although Berkeley expressed enthusiasm for Newton's *Principia*, he argued strongly that Newton's doctrine of absolute space and motion must be abandoned. Berkeley argues that conceiving of motion requires conceiving of two bodies; thus, absolute motion is inconceivable (PHK 112-14). "Having declared absolute motion to be incomprehensible, there is no need to posit absolute space. Furthermore, pure space, independent of all body, is likewise inconceivable" (PHK 16).⁹

How about this for a re-statement of Berkeley, according to Dick: "*Matter is plastic in the face of Mind.*" (his emphasis)

Is any world out there at all? For all intents and purposes Gurnemanz and Parsifal stand still, and the landscape changes; so they become located in another space – a space which formerly had been experienced as time. Fat thought in a language of two thousand years ago and saw the ancient world appropriate to that language; the inner contents of his mind matched his perceptions of the outer world.¹⁰

Compare what Dick says above with Berkeley's statement in *De Motu*: "For no other cause of the existence of the successive existence of body in different parts of space should be sought, it would seem, than that cause

whence is derived the successive existence of the same body in different parts of time (DM 34)."¹¹

It is well known that Berkeley's theory about time actually anticipates Einstein's Theory of Relativity.¹² For Berkeley, time is constituted by a succession of ideas in a mind. Your time is different from mine. There is, in short, no external, absolute, public time. Berkeley rejected both absolute time and absolute space. He thought they were false abstractions... On Berkeley's theory, I do not move through the great containers of space and time. Rather, time is in me: it is simply the succession of my ideas. A number of striking consequences follow from this. Since ideas can succeed each other more or less swiftly, time can also vary. Hence, if my ideas are brisker and faster moving than yours, then I have (or live) more time than you.¹³

Likewise Dick regarded time as essentially a fiction. He says: "It all had to do with time. 'Time can be overcome,' Mircea Eliade wrote. That's what it's all about . . . It has to do with loss of amnesia; when forgetfulness is lost, true memory spreads out backward and forward, into the past and into the future, and also, oddly, into alternate universes; it is orthogonal as well as linear."¹ "We knew that apostolic Christians armed with stunningly sophisticated technology had broken through the space-time barrier into our world, and, with the aid of a vast information-processing instrument had basically deflected human history."¹⁴

Dick could also be describing the networked intelligence theory of Fosar & Bludorf when he says:

"22. I term the Immortal one a *plasmate*, because it is a form of energy; it is living information. It replicates itself – not through information or in information – but as information."¹⁵

Fosar & Bludorf, when describing the networked intelligence in the DNA, liken our collective consciousness to the apparent one-mindedness of a swarm of bees; and Dick says in *Radio Free Albemuth*:

" 'I said, "For a little while I saw the universe as a living body."

"Yes," she said, nodding somberly.

"And we are in it. The experience was so strange – it's hard to express it. Like a hive of bees, millions of bees, all communicating over vast

distances by means of colored light. Patterns of light, exchanged back and forth, and us deep inside. Continual signaling and response from the – well, bees or whatever they were; maybe they were stars or star systems of sentient organisms. Anyhow, this signaling went on all the time, in shifting patterns, and I heard a humming or a bell-like sound, emitted by all the bees in unison.”

“The universe is a great group mind,” Sadassa said. “I saw that too. The ultimate vision imposed on us, as to how things are in comparison to how they simply appear.”

I said, “And all the bees, as they signal across great distances to one another, are in the process of thinking. So the total organism thinks by means of this. And throughout it exerts pressure, also across great distances, to coordinate every part, so it’s synchronized into a common purpose.”

“It is alive,” Sadassa said.

“Yes,” I said. “It is alive.”

“The bees,” Sadassa said, “were described to me as stations. Like transmitting and receiving on a grid. Each lit up as it transmitted. I guess the colors were prearranged different frequencies of the light spectrum. A great universe of transmitting and receiving stations, but, Nicholas, sometimes many of them, differing at different moments, were dark. They were temporarily inactive. But I kept watching lit-up stations receiving transmissions from distances so far off that – I guess we use the word parsecs for distances like that.”

Sadassa said, “Did we see a kind of brain?”

“More like a jungle gym that kids play on,” I said, “with colored buttons stuck all over.” Her analogy was too heavy for me: the universe as a giant brain, thinking.”¹⁶

Dick is a mystical writer, but there are many aspects of the networked intelligence in DNA theory to be found in the above passage. The hypercommunication of information. Every sentient being transmitting and receiving on a grid in a giant network. Effectively, the Universe becomes a giant brain. And all sentient beings are linked at the unconscious genetic level much the same as a swarm of bees, seemingly

acting with a unified mind. This is *VALIS* – the Vast Active Living Intelligent System. In addition, this passage about bees virtually parallels the famous passage about the swarm of bees in *Le Rêve de d'Alembert* of Diderot.

An essential part of *VALIS* is the notion of gene pool memory, which again is directly complementary to the networked intelligence in the DNA theory, as well as the biological materialism of Diderot. Dick states:

“48. ON OUR NATURE. It is proper to say: we appear to be memory coils (DNA carriers capable of experience) in a computer-like thinking system which, although we have correctly recorded and stored thousands of years of experimental information, and each of us possesses somewhat different deposits from all the other life forms...¹⁷ “Phylogeny is recapitulated in ontogeny,” as it is put. The individual contains the history of his entire race, back to its origins. Back to ancient Rome, to Minos at Crete, back to the stars. All I got down to, all I abreacted to, in sleep was one generation. This is gene pool memory, the memory of the DNA...¹⁸

“...He, too, like the Buddha and Pythagoras, could remember his past lives. What they did not talk about was their ability to “remember” future lives.

“The three-eyed people who Fat saw represented himself at an enlightened stage of his evolving development through his various lifetimes. In Buddhism it’s called the “super-human divine eye” (*dibba-cakkhu*), the power to see the passing away and rebirth of beings. Guatama the Buddha (Siddhartha) attained it during his middle watch (ten P.M. to two A.M.). In his first watch (six P.M. to ten P.M.) he gained the knowledge of all – repeat: *all* – his former existences (*pubbeni-vasanussatinana*). I did not tell Fat this, but technically he had become a Buddha. It did not seem to me like a good idea to let him know. After all, if you are a Buddha you should be able to figure it out for yourself.”¹⁹

Dick even comes to regard the fish symbol that the delivery girl was wearing as actually a sign not of Jesus Christ, but of the DNA.

“It seemed to me that the Christian fish sign appeared on it once. As the design,” I said.

“No,” Kevin said emphatically.

"No?" I said.

"I thought so, too, the first time," Kevin said. "This time I looked closer. You know what it is? The double helix."

"That's the DNA molecule," I said.

"Right," Kevin said, grinning. "In the form of a repeated design running around the top of the pitcher."

We all remained silent for a time and then I said, "DNA memory. Gene-pool memory..."²⁰

I said, "Then the Christian fish sign is Crick and Watson's double helix. The DNA molecule where genetic memory is stored..."²¹

Dick came to regard all human beings, and by implication, all sentient beings as:

"A terminal of *VALIS*," Kevin said. "An input, output terminal of the master system *VALIS*..."²²

"A purely technological phenomenon," Kevin said. "A major technological breakthrough."

"Using the human mind as transducer," I said. "Without an electronic interface."²³

...

"What exactly did I have to do? I didn't know. None of us knew. Already I had heard the AI voice in my head, and others would hear that voice, more and more people. *VALIS*, as living information, would penetrate the world, replicating in human brains, crossbonding with them and assisting them, guiding them, at a subliminal level, which is to say invisibly. No given human could be certain if he were crossbonded until the symbiosis reached flashpoint. In his concourse with other humans a given person would not know when he was dealing with another homoplasmate and when he would not."²⁴

Finally then, we see that Dick's encounter with God in 2-3-74 and Berkeley's philosophy, as well as Diderot's biological materialism all ultimately merge in the 'transcendent monotheism' of Xenophanes of Colophon (c.560-c.470 BC). Dick says in *VALIS*:

"Could the universe possibly be irrational?"

"You mean not guided by a mind. I suggest you turn to Xenophanes."

"Sure," Fat said. "Xenophanes of Colophon. 'One god there is, in no way like mortal creatures either in bodily form or in the thought of his mind. The whole of him sees, the whole of him thinks, the whole of him hears. He stays always motionless in the same place; it is not right - ' "

" 'Fitting,' " Dr. Stone corrected. " 'It is not fitting that he should move about now this way, now that.' And the important part, *Fragment 25*. 'But effortlessly, he wields all things by the thought of his mind.' " ²⁵ ...

Entry 33 in Fat's journal (i.e. his exegesis):

"This loneliness, this anguish of the bereaved Mind, is felt by every constituent of the universe. All its constituents are alive. Thus, the ancient Greek thinkers were hylozoists." (his emphasis)

A « hylozoist » believes that the universe is alive; it's about the same idea as pan-psychism, that everything is animated. Pan-psychism or hylozoism falls into two belief-classes:

- 1) Each object is independently alive.
- 2) Everything is one unitary entity; the universe is one thing, alive, with one mind. ²⁶



14

East meets west

It is widely accepted that the major difference between Hindu philosophy and Western philosophy is the issue of the substratum. According to Hinduism, the Inner Self – *Brahman* - resides in all sentient beings and is the source of all life. Whereas, Western philosophy and religion do not recognize this concept, and choose instead either to deny the existence of a divine being, or on the other hand, assert the divine being is to be found somewhere external to this universe. In this article it is argued, however, that even as far back as Plato in Ancient Greece, there has in fact been a clear and unequivocal reference to the substratum, and indeed to the widely held belief in India that the external world is an illusion: *Maya*, just as it is espoused in the *Upanishads*. In addition, a very influential branch

of philosophy has grown up in the West, generally referred to as Sociobiology, according to which the human species, and all other species as well, are determined by our DNA (in the nucleus of the eukaryote cell and in the cytoplasm for prokaryotes), which sets up characteristic behavior patterns in all species, right up to and including in the human being our sociality and our altruistic behavior. It would be hard to get a more precise and tangible concept of the substratum than this *science* of genetics, although I know of nobody in the West who realizes that our genetic blueprint and the Hindu Inner Self bear some very striking similarities.

In a lecture on the *The metaphysical concept of 'production'*, in Martin Heidegger's interpretation of Plato, given at the Institut Catholique de Paris in November, 2003, Professor Stanley Rosen of the University of Boston made the statement that the famous Cave analogy in Plato's *Republic* is a reference to a substratum. Professor Rosen, who is an expert on Heidegger and a classical scholar of renown, did not seem to attach any particular significance to Plato's Cave being a substratum, and in answer to questions after the lecture did not know of anyone over the past two and a half thousand years who have likewise interpreted Plato's Cave in this manner. Plato is, however, universally regarded as the father of Western philosophy, and it seems to me that if Plato was asserting that the external world is an illusion on account of the true reality residing in the substratum, then his work has been very seriously misinterpreted in the West for a very long period of time.

What follows is the relevant section from Plato's *Republic*:¹

<'Next, then,' I said, 'take the following parable of education and ignorance as a picture of the condition of our nature. Imagine mankind as dwelling in an underground cave with a long entrance open to the light across the whole width of the cave; in this they have been from childhood, with necks and legs fettered, so they have to stay where they are. They cannot move their heads round because of the fetters, and they can only look forward, but light comes to them from the fire burning behind them higher up at a distance. Between the fire and the prisoners is a road above their level, and along it imagine a low wall has been built, as puppet

showmen have screens in front of their people over which they work their puppets.'

'I see,' he said.

'See, then, bearers carrying along this wall all sorts of articles which they hold projecting above the wall, statues of men and other living things, made of stone or wood and all kinds of stuff, some of the bearers speaking and some silent, as you might expect.'

'What a remarkable image,' he said, 'and what remarkable prisoners!'

'Just like ourselves,' I said. 'For, first of all, tell me this: What do you think such people would have seen of themselves and each other except their shadows, which the fire cast on the opposite wall of the cave?'

'I don't see how they could see anything else,' said he, 'if they were compelled to keep their heads unmoving all their lives!'

'Very well, what of the things being carried along? Would not this be the same?'

'Of course it would.'

'Suppose the prisoners were able to walk together, don't you think that when they named the shadows which they saw passing they would believe they were naming things?'

'Necessarily.'

'Then if their prison had an echo from the opposite wall, whenever one of the passing bearers uttered a sound, would they not suppose that the passing shadow must be making the sound? Don't you think so?'

'Indeed I do,' he said.

'If so,' said I, 'such persons would certainly believe that there were no realities except those shadows of handmade things.'

'So it must be,' said he.

'Now consider,' said I, 'what their releases would be like, and their cure from these fetters and their folly; let us imagine whether it might naturally be something like this. One might be released, and compelled suddenly to stand up and turn his neck around, and to walk and look towards the firelight; all this would hurt him, and he would be too much dazzled to see distinctly those things whose shadows he had seen before. What do you think he would say, if someone told him that what he saw before was

foolery, but now he saw more rightly, being a bit nearer reality and turned towards what was a little more real? What if we were shown each of the passing things, and compelled by questions to answer what each one was? Don't you think he would be puzzled, and believe what he saw before was more true than what was shown to him now?

'Far more,' he said.

'Then suppose he were compelled to look towards the real light, it would hurt his eyes, and he would escape by turning them away to the things which he was able to look at, and these he would believe to be clearer than what was being shown to him.'

'Just so,' said he.

'Suppose, now,' said I, 'that someone should drag him thence by force, up the rough ascent, the steep way up, and never stop until he could drag him out into the light of the sun, would he not be distressed and furious at being dragged; and when he came into the light, the brilliance would fill his eyes and he would not be able to see even one of the things now called real?'

'That he would not,' said he, 'all of a sudden.'

'He would have to get used to it, surely, I think, if he is to see the things above. First he would most easily look at shadows, after that images of mankind and the rest in water, lastly the things in themselves. After this he would find it easier to survey by night the heavens themselves and all that is in them, gazing at the light of the stars and moon, rather than by day the sun and the sun's light.'

'Of course.'

'Last of all, I suppose, the sun; he could look on the sun itself by itself in its own place, and see what it is like, not reflections of it in the water or as it appears in some alien setting.'

'Necessarily,' said he.

'And only after all this he might reason about it, how this is he who provides seasons and years, and is set over all there is in the visible region, and he is in a manner the cause of all things which they saw.'

'Yes, it is clear,' said he, 'that after all that, he would come to this last.'

‘Very good. Let him be reminded of his first habitation, and what was wisdom in that place, and of his fellow-prisoners there; don’t you think he would bless himself for the change, and pity them?’

‘Yes, indeed.’

‘Then again,’ I said, ‘just consider; if such a one should go down again and sit on his old seat, would he not get his eyes full of darkness coming in suddenly out of the sun?’

‘Very much so,’ said he.

‘And if he should have to compete with those who had been always prisoners, by laying down the law about those shadows while he was blinking before his eyes were settled down – and it would take a good long time to get used to things – wouldn’t they all laugh at him and say he had spoiled his eyesight by going up there, and that it was not worthwhile so much as to try to go up? And would they not kill anyone who tried to release them and take them up, if they could somehow lay hands on him and kill him?’

‘That they would!’ said he.

‘Then we must apply this image, my dear Glaucon,’ said I, ‘to all we have been saying. The world of our sight is like the habitation in prison, the firelight there to be the sunlight here, the ascent and the view of the upper world is the rising of the soul into the world of mind; put it so and you will not be far from my own surmise, since that is what you want to hear; but God knows if it is really true. At least, what appears to me is, that in the world of the known, last of all, is the idea of the good, and with what toil to be seen! And seen, this must be inferred to be the cause of all right and beautiful things for all, which gives birth to light and the king of light in the world of sight, and, in the world of mind, herself the queen produces truth and reason; and she must be seen by one who is to act with reason publicly or privately.’>

There is in this passage a fairly clear allegory of something going on down below in the cave that sets up reality as we know it, and that we should not be fooled by the world of appearances into believing that what we see is actually real. Heidegger, however, had apparently accused Plato of being unconscious of the true significance of his own words. Professor

Rosen went on in his lectures to enlarge on the Platonic theory of artifacts, and he informed us among other things that the theory could essentially be encapsulated in the statement that 'the cow exists because of the idea of a cow'. The Professor asked what we should make of this statement. And he then said that Plato could not be referring to the DNA because obviously DNA is not 'ideas'. It seems to me that Professor Rosen made a fundamental error when he said that DNA is not ideas. Ideas are, in fact, intelligence. And DNA is in its nature nothing but intelligence. The intelligence of a computer comes from its software, and the DNA is very evidently the software that is responsible for the workings of the brain. When Plato says that the cow exists because of the idea of a cow, he is clearly referring to the divine intelligence in the DNA which sets up all life.

It seems to me that Plato is saying that our genes are not just a mindless biological substance from which protein is synthesized as the building blocks of our cells; that the cave analogy is a reference to the nucleus of the living cell, where the human genome is located. Plato must be talking about the divine intelligence in our DNA; that there is actually a divine intelligence in our genes which is directing all life on this planet. It is not just directing human civilization, but the lives and behavior of all species. Evolution is itself divinely directed from within. If this is correct, it is not really appropriate to talk about God in our genes. Our genes are in fact in the nature of an intelligence, and therefore DNA *is* God. There is an obvious analogy to be drawn here with the Hindu Inner Self. But it matters not what you call it, Inner Self or God; the point is that it is divine, and that we are created and we are acting according to its rules.

The implications of this finding for moral philosophy, and our obligations to obey the law are immense. However, the space does not permit me to canvass all the various schools of thought and religions; I just want to touch briefly on one line of thought that has already come very close to providing the answer. I recently read a book entitled *What is Man?*²² which was co-authored by Luc Ferry, the Minister for Education in France, and Jean-Didier Vincent, a noted neurobiologist and philosopher. In this book Ferry discusses the evolutionist ethic which has been

championed by Michael Ruse, a colleague of E.O. Wilson, with his Sociobiology. The central theme of all evolutionist ethics is that human morals are a product of evolution. All human sociable characteristics are determined by evolutionist ethics, and in particular morality (a sense of right and wrong, as well as obligations) has to be explained in these terms. Michael Ruse had proposed two principle groupings of our moral makeup, a 'normative ethic' and a 'meta-ethic'. The normative ethic corresponds to the actual content of evolutionist ethics – to protect nature, to practice goodwill and solidarity rather than hostility and warfare, to work towards the common good as much as possible as well as social harmony and fostering equality, to avoid violence as a means of solving disputes etc. Then there is the meta-ethic which is said to resolve the ultimate question about all normative philosophy, namely what gives the right to authorize one course of conduct as being good, and prohibit another course of conduct as bad. Why, for example, should we promote the well-being of the entire human race, rather than the inverse if that happens to be to our own self-interest. Why choose the politics of liberty and equality, if I can reap more personal benefits in a world where inequality reigns supreme. Why choose peace, when more profit can be had from a successful war? Meta-ethics deals with the legitimacy or justification for the content of the normative ethics.

Ferry sets about to criticize the logic of this evolutionist ethic. The principle thesis of the normative ethic of evolutionist flavor is that altruism would have been selected in the natural history of our species. He accepts that Ruse had taken the precaution of distinguishing, at least in the early stages, two forms of altruism: a biological altruism and an ethical altruism. The former does not entail any conception of moral values. It is, one could say, guided purely and simply by instinct, or natural urges. In order to explain how a worker ant, for example, devotes itself to bringing food to the larvae or to the queen, it is certainly not necessary to suppose that it is acquainted with knowledge of the Evangelist or of *The Critique of Practical Reason* of Immanuel Kant. Everything leads us to believe, on the contrary, that it performs this act of devotion without reflection, instinctively, because it is the natural law of

its species. Objectively however, its behavior is none the less, in an analogical sense, 'altruistic'. An ethical altruism, on the other hand, presupposes, as one sees for example in the charitable acts of a Mother Theresa, that the individual has consciously chosen certain values as a guide to action. What the evolutionist ethic fundamentally affirms is these two things: first, that these two forms of altruism are not as far apart as they may appear at first sight. Because notwithstanding the ideology of sacrificial devotion of Mother Theresa, it proves to be in the final analysis, totally useful for the survival of a species, which in the absence of such cooperation, would have undoubtedly already disappeared. To make us biologically altruistic, nature has provided us with thoughts that are literally altruistic. We have innate dispositions, not simply to be social, but also to be authentically moral. The morality is not therefore simply nature's ruse, a means that it utilizes in order to ensure our survival. Whence comes the second affirmation: altruistic morals would ultimately have been selected by evolution, as a form among others of successful adaptation.

Ruse asserts that his propositions concerning altruism are based in empirical reality, and have nothing to do with abstract speculation. In other words, he seeks to instill in his readers the idea that this new morality would have in some fashion, if not an actual foundation, at least a scientific legitimacy. Ferry takes objection to this proposition. He states that it certainly does not prove, at the end of this millennium (when the book was published), that altruism has been selected by history. If Ruse was not actually living the life of a university professor in a country that is itself highly pacifist (Ruse actually lives in the United States!), but instead Ruse had been an unfortunate Tutsi during the recent massacres perpetrated in Rwanda, it would have been quite simply impossible for him to sustain such a thesis. Ferry feels that these affirmations by Ruse are biased, and are therefore questionable. In effect, Ferry dismisses his assertions as being 'romantic' and naïve, when, for example, Ruse says that even only two or three decades ago, the general belief was that nature is little more than a bloody battle for existence, the fierce reign of claw and tooth. However, one must now recognize how profoundly a social

behavior permeates the organic world, and that this phenomenon is explicable with good reason. In nature one often obtains much more by cooperation, than by conflict. "Balderdash!" says Ferry.

The best that you can say about Ruse's propositions, according to Ferry, is that they don't negate the idea that an altruistic morality and pacifist politics are not a product of nature, but rather a slow, difficult and uncertain victory by the democratic culture over nature which, external to us as well as internal to us, has virtually nothing which is *a priori* altruistic. When one looks at the close of the 20th century, with its unbelievable amount of genocides, wars and massacres, one certainly can't peremptorily cut short this debate in favor of a naturalistic optimism that has scientific legitimacy.

These evolutionist ethics hit another stumbling block which to the eyes of Ferry, are even more difficult to explain away. If altruism had really been selected by the natural history of our species, how do you interpret the ethical conflicts, those that Max Weber called 'the war of the Gods', in evolutionary terms, in as much as they can occur in the same epoch, and can erupt in the heart of the same community. How do you explain, for example, as was sometimes the case in reality, that one family member chooses to be pacifist, nonviolent, while another joins the Resistance, and a third supports the collaboration? One can be Zen Buddhist, the second a partisan republican in favor of equality, and the third a national socialist espousing the Nazi values of warfare and hierarchy: is it possible to say seriously that these ethical differences are linked to the history of evolution? And how can you maintain that they have no influence on the dispersion of altruism? There are serious reasons to think that right and wrong, or altruism and its opposite, are options permanently open to human beings, which could not be the case if evolution had really selected the one over the other, the position taken by evolutionist ethics. Even if, for the sake of argument, you accept that globally speaking, evolution is leading us towards moral altruism (and disregard all the catastrophes of humanity that have so heavily pockmarked the 20th century), it is still only a question of a factual observation that the ethical evolutionists are making, and it is still not in

the nature of a normative value that induces us towards altruism as a prescription. And, in any event, why should we choose it as a sort of prescription, if it has really been selected by evolution anyway?

Nor does Ferry agree that the meta-ethic proposed by Ruse delivers the foundation claimed of it as being empirically based in scientific knowledge. In effect, this evolutionist meta-ethic does not adequately resolve the problem introduced by Hume back in the 18th century. From the simple consideration of what *is*, it is impossible to infer what *should be*. Even if the evolutionist ethic was able to demonstrate scientifically that altruism has been selected by our natural history, and has developed for us this evolutionist normative ethic, that still does not resolve Hume's point that we don't have to infer from that a moral obligation on us to obey these norms or values. We still have the choice not to follow the norm, and no one has the right to tell us it is bad or evil. Even if, for example, medical science has determined in a totally convincing fashion that the consumption of tobacco will have a negative impact on our health (which is the case), it still has to resort to an intermediate consideration to draw the necessary prescriptive conclusion. It is necessary in effect that we have to give some value to good health in order for the results of scientific research to generate a *Thou must not*. It goes without saying that this is practically always what occurs with normative prescriptions. This is so evident that it makes us forget that in truth it is always *the subjectivity* (an 'I' or a 'we') that decides in the last instance whether to value or to devalue such and such an attitude. In the absence of such a subjective decision, the imperative that one claims to draw from science always remains hypothetical, because they can never get out of the framework of a formulation of the type: 'If you don't want to have health problems, *then* give up smoking'. But when it's all said and done, it remains possible, at least in this kind of prescription concerning the well-being of the individual, to have other values than the preservation of oneself and to prefer, for example, a short happy life over a long and dull one.

Hume's argument has to be considered for any project involving a scientific foundation for ethics: to affirm that contemporary science teaches us that altruism would have been selected by evolution, admitting

even that it is true, in no way legitimizes it from the point of view of morality. One could, for example, observe the fact in question (on admitting always that it is one), and deplore it in the name of different value systems; or further, more simply and more logically, draw from it a completely neutral conclusion, without any pretension to normative morality of the following type: the human beings are a species that found it necessary to have recourse to solidarity to survive. That necessity, vital for them, gives them the illusion that it is a question of 'normative morality', and of 'good' and 'evil', whereas in truth it is simply a question of utility or inutility, of life or death. What they take for high and noble morals does not in reality have more normative value than any mode of adaptation by squid, elephants or toads.

To the question "Why does one have to favor the well-being of the human species?", here the response of the theoretician of evolutionist ethics is simply that one *has a duty to* do it because man is the product of evolution, and on the basis that we are a product of evolution, it is a *good thing* to do it. Ferry underscores his response – magnificent tautology! Any reader of good faith will detect a significant shift: why talk of 'duty' and of 'good thing' if it is a question of a necessity or a fact? If evolution had really selected altruism, why *must* the practice of altruism be represented as an imperative? It would be an instinctive behavior, common to all the normal members of the same species, and that's that; and the morality of human beings would resemble in every respect the habits of animals. Ferry provides his own response to the question "Why does one have to favor the well-being of the human species?" He says simply that altruistic behavior has been selected by evolution because the survival of that particular species of living beings that are human is better assured that way than otherwise. Period.

What is singular about the evolutionist ethic as per Ruse is that he is perfectly aware of the difficulties. As he admits himself, with laudable honesty to the question of the justification of norms: "In fact, I have nothing at all to offer – at the meta-ethic level we are heading towards the idea that the normative ethic has no foundation". One could think that it is not grave that a morality without foundation is possible, that norms and

values can still subsist as such even if they are not well founded. But Ruse here is more rigorous than most of his materialist colleagues. He perfectly understands that in the absence of justification, the norms become illusory. A real illusion, certainly, and necessary for the survival of the species, but an illusion nonetheless in the sense that we should be convinced that what we take for the good is objectively the good, and doesn't simply involve an unpredictable adaptation among other possible outcomes. As Ruse very well sees it, 'the essential for morality, understood as normative morals, is that it can only function on the condition that we have an absolute belief in it'. Yet evolutionism, explicitly this illusion of the genes: "Just as soon as one sees that the normative ethic is simply an adaptation put into place by natural selection to make us social beings, one can see as well all the naivety involved in thinking that morality (that is to say normative morality) possesses a foundation. Morality is rather a collective illusion of the genes, put into place to render us altruistic". Morality as such has no stature more justificatory than any other adaptation such as our eyes, our hands or our teeth; it is simply something that has biological value, and nothing more; nothing less as well, evidently. Ruse, therefore, has to concede that the ultimate conclusion of his evolutionism is ethical skepticism: "We think that the norms of ethics are true objectively because our biology makes us think very precisely that. But from what our biology makes us precisely think, we cannot deduce that it is truly so."

The problem, unfortunately, is that morality wants to be intrinsically normative – in which it finds itself, according to evolutionism and more generally for coherent materialism, in the grip of an illusion. (Ferry defines materialism as the position that consists of postulating that mental life is both *produced* and *determined* by matter, i.e. by nature and history). One can say anew that it is of little consequence, that the essential is that this normative illusion is real, that it works. All very well: but from which point of view will the essential be satisfied? From the survival of the species? But in what way is that survival more 'moral' than the contrary? That our survival is more useful for us Ferry concedes willingly, but since when have we become so stupid as to confuse utility with morality? Take

for example homosexuality, occurring generally throughout the species, this would no doubt be harmful because it could possibly result in our species dying out: in what way would that be a moral objection against homosexuals? And inversely, does there not exist an infinite number of behaviors that the individual can judge subjectively to be useful, and which have nothing whatsoever to do with morality?

All this, Ruse seems to be aware of, but he doesn't dare draw frankly all the conclusions from the fundamental assertion according to which morality is only a fact among others, and nothing more. The same reticence is to be found in him when it comes to evoking the question of determinism, and for the same reasons: everything leads evolutionist ethics to the conclusion that we are what biology has made of us, and therefore thoroughly determined, even in our apparent margins of liberty, by nature and our history; but to concede that is discomfiting, because it is contrary to all our best felt 'intuitions'; whence comes the necessity, here as well, of an inconclusive discussion.

Ferry gives a glaring example touching the central theme of altruism. Sometimes Ruse affirms that the distinction between 'biological altruism' and 'ethical altruism' is crucial, which tends to lead us into thinking that we human beings can, as distinct from the animals, choose certain values rather than others independently of their biological nature. At other times on the contrary, he does not hesitate to merge the second altruism into the first. Why? Because truth be known, his point of departure is the naturalist and materialist conviction that evolution has made of us these physical creatures determined just as we are, like it has made us social beings determined just as we are, and that there has clearly been a retroaction between these two evolutions – which in truth has resulted in the emergence of one only. Because more and more specialists in the social sciences and in biology are unearthing solid proofs suggesting that humans are strongly motivated by biological tendencies of which the field extends right up to sociality. Which is why, in evoking the 'social contract' in his normative evolutionist ethics, Ruse can calmly declare that it is not really a question of a contract freely entered into, but is rather a contract that is imposed upon us by our genes. We are in this moral situation

because, given our condition as a species, our lot is better this way than if we had tried to struggle on all alone. It is readily accepted that Ruse, like all intelligent materialists, insists on the fact that this naturalistic determinism must not be conceived as tight and rigid: there is a margin of indetermination in human conduct; and then he is forced immediately to add that this margin is itself provided for and determined by nature herself.

Ferry asks us to understand him well. He does not in any way deny the right of anyone to adopt a materialistic and deterministic philosophy. He simply wishes to make the point that one cannot have one's cake and eat it, and it is necessary to be aware of the fact that, if you want to be a logically consistent materialist, this philosophical position is on the one hand incompatible with the idea of a non-illusory normative ethic, and on the other hand that determinism is in no way a *scientific* position, but rather a metaphysical concept, and as such remains contestable.

I have presented this small excerpt from Ferry's book because it presents the essential enigma that Western science and philosophy are attempting to resolve – to what extent is our social behavior and our value systems determined by our genes? Neither discipline can provide any definitive answer, and so the debate rages back and forth. The literature on this topic is vast and I cannot even hope to cover it here. So I will attempt to limit myself to the principal points made by Ferry. If there is a divine intelligence in our DNA that has set up all life on this planet, then it becomes readily apparent that it is responsible for all our behavior, both good and bad, violent and pacifist, social and anti-social, altruistic and non-altruistic. And this is what has caused our normative ethics to evolve in the way they have. The divine intelligence is at one and the same time creating the behavior, and is instilling in us an awareness of the appropriateness or the utility of this behavior. The normative evolutionist ethics that Ferry denounces as illusory, are not therefore illusory at all. They are in effect divinely decreed prohibitions, exactly as they claim to be. Through them the divine intelligence is molding us into beings which are forever evolving towards the good. In order for us to be conscious of this development, it becomes necessary for us to know what behavior is

the opposite of good, that is to say behavior that is bad or evil. So, in answer to Ferry, in any situation where we are confronted with the possibility of acting in an altruistic or a non-altruistic way, whichever way we choose to go, we have made a moral choice. This is not simply a question of choosing altruism because of its utility as tending to ensure the survival of the species. To do an altruistic act is to do a good act as determined by the normative value system instilled in us by the divine intelligence in our genes.

In the same way there is a serious argument being advanced in the West that the human race is in plague phase. In *The Spirit in the Gene*,³ for example, author Reg Morrison argues that our DNA has set up in us this dichotomy between a materialistic drive toward growth and progress, and a spiritualistic drive toward metaphysical goals and abstract values. It would not be that difficult to account for all human behavior in terms of these two contradictory drives. It is the materialistic drive which has driven the human race to plague phase, and it is the spiritualistic drive which has engendered in us an awareness of the divine, and has created the normative value that an obsessive accumulation of material wealth is bad. Again, in answer to Ferry, we find that there is not just a divine intelligence in our DNA which is causing us to evolve with these contradictions, but that we actually have to look upon our DNA as evolution itself. There is *only* evolution. And nothing else. So if we find ourselves in plague phase where the future of our species is actually in doubt, it follows that any behavior that tends to lessen or ameliorate our plague condition is morally correct behavior. Not just evolutionary correct, but *morally* correct. We are not expected to choose this behavior for its utility, as tending to ensure the survival of the species; we are expected to choose it because it is morally wrong to do anything that could put the divine process of evolution in jeopardy.

The main issue with morality is how do you determine *objectively* right from wrong? Most religions lay it down that God has declared such and such a conduct to be right or wrong and it is our duty to obey these commandments. But once you accept that the divine intelligence is within us, directing our every thought and action, there is no longer the

requirement for morality to be objective. It is actually impossible as a matter of logic for it to be. Morality becomes the code of conduct that evolves in the spiritual side of our nature which enables us to appreciate goodness, and to abstain from its opposite. The divine intelligence is in all DNA, so evidently every conception of good in every religion practiced by mankind has this divinely inspired moral element. What we have to accept therefore is that there is a moral order, and that it includes everybody's version of good, where the notion of what is good is itself caught up in the evolutionary process. It is not us that is evolving, it is the divine intelligence in our genes that is evolving through us.

There are many references in the Hindu divine texts to the Self being located in the cave. In the *Ṛg Veda*, 'Because this Resplendent God who is the nourisher of all by His might knows fully the hidden soul or *Ātman* dwelling in the cave of the heart or intellect doing many noble deeds, He is Omnipotent.' (1.23.14)⁴ 'The Supreme dwells in close fellowship with the individual Self in the cave of the human intelligence.' (Rangaramanuja – quoted by Radhakrishnan p.621).⁵ There are dozens of similar references in the *Upaniṣads* to this '*guhā*', this secret place, this cavity, this cave in the intellect which is the *ākāśa*: space. 'It is used as a name of the Supreme, because like space, Brahman has no body and is subtle.' (Radhakrishnan, p. 511).⁵ Similarly in the *Kaivalyopaniṣad* we find a clear reference to the Self as a substratum, '...from Him has sprung up all diversity. He is the substratum, the bliss the individual consciousness, in whom the three cities dissolve themselves.'(14)⁶ And consider what is now known about genetics and the meaning of the following statement, 'The vital force enters into the womb along with the seed and it develops itself into the embryo and all the other limbs such as the eye, the ears and the rest manifest themselves subsequently.' (Sivananda, p.534)⁷ If the vital force is not in the genome then it is difficult to imagine where else it could be.

Compare what Plato says about light and shadow in his cave analogy with what is said in *Ṛg Veda*, 'This (infinite) entity which is reflected in the intellect, which is amid the organs, and which is the self-effulgent light within the intellect. Stimulating the intellect, it roams between this and the next life; it thinks as it were, and quivers, as it were...' (4.3.7)⁴ Also in

R̥g Veda, we find, 'you tell people about eternal cause and the perishable world (which is its effect)'(5.62.8)⁴ '...the transcendent *Brahman*, the underlying support.' (Brahmopaniṣad p. 48)⁶ 'who upholds all His subjects well according to the Law of cause and effect.'(1.LXVII.5)⁴ Plato says, 'the world of our sight is like the habitation in prison, the firelight there to be the sunlight here, the ascent and the view of the upper world is the rising of the soul into the world of mind' and in the *Taittīiṣya Upaniṣad* 'He that is here in the human person, and he that is there in the sun, are one.'(II.viii.5)⁵ Again, according to Plato, '...they can only look forward, but light comes to them from the fire burning behind them higher up at a distance. Between the fire and the prisoners is a road above their level, and along it imagine a low wall has been built, as puppet showmen have screens in front of their people over which they work their puppets.' 'O Arjuna, the Lord, dwells in the heart of all beings, whirling by *māyā* all beings, (as if) on machines mounted.'(*Gita Bhashya* XVIII.61)⁹

'...you should know that twelve-spoked wheel of time (*kala* as it is called) revolves around the sun.' (*R̥g Veda* 1.164.11)⁴ 'There are verily, two forms of *Brahman*, time and the timeless. That which is prior to the sun is the timeless, without parts. But that which begins with (has a beginning from) the Sun is time, which has parts. Verily, the form of that which has parts is the year.'(*Maitri Upaniṣad* VI.15)¹² These are the things that the prisoner who was taken up out of Plato's cave would have to consider 'if such a one should go down again and sit on his old seat, would he not get his eyes full of darkness coming in suddenly out of the sun?.. And if he should have to compete with those who had been always prisoners, by laying down the law about those shadows while he was blinking before his eyes were settled down – and it would take a good long time to get used to things – wouldn't they all laugh at him and say he had spoiled his eyesight by going up there...'

There are so many similarities between the picture Plato paints of his world of light and shadows creating an illusion for the cave dwellers and *māyā*, the illusion of duality. 'He (the Self) wished, "Let me be many, let me be born. He undertook the deliberation. Having deliberated, He created all that exists. That (*Brahman*) having created (that), entered into

that very thing. And having entered there, It became the formed and the formless, the defined and the undefined, the sustaining and the non-sustaining, the sentient and the insentient, the true and the untrue.’ (*Taittīya Upaniṣad* II.vi.1)⁵ A very strong case can be made out that Plato’s cave allegory is endeavoring to convey precisely the same message. *Ātman* resides in DNA. This thing that *Brahman* entered into to create the duality of the manifested world is the nucleus of the living cell where the genome is to be found. The substratum for all sentient beings.

In Book X of the *Republic*¹ Plato sets out his so-called theory of artifacts. The first thing to be noted is that Plato in this discussion is talking about the creator of the manifested world. For example, this excerpt:

<“Now please consider how do you confine this Craftsman.”

“What one?”

“The one who makes everything that separate handicraftsmen can make.”

“What a wonderful, clever man you speak of!”

“Wait a minute – you will say that more than ever directly. This same craftsman can make not only furniture, but he makes all that grows in the earth and fashions all living creatures, all these including himself, and, besides, earth and heaven and gods, and all that is in heaven above and in Hades under the earth – he fashions all!”

“There’s a marvel!” said he, “a real professor of knowledge!”

“Don’t you believe me?” said I: “just inform me – do you deny flatly that there could be such a Craftsman? Or do you think that in one way there could be, and in another way there could not be, a maker of all these things? Don’t you see that there is a way in which you could make all these things yourself?”

“And what way, if you please?” he asked.

“An easy way,” I said, “craftsman-made everywhere and quickly too; most quickly, I think, if you just pick up a mirror and carry it about everywhere. You will then quickly make a sun and all there is in the heavens, quickly on earth, quickly yourself and the other animals and furniture and plants and everything else I mentioned.”

“Oh yes,” he said, “appearances, but not things really existing anywhere.”

“Splendid!” I said. “Just what is needed to help our argument!..”>(p.394)

The core theme in the thesis of the artifacts is that there is 'a general form or idea, one idea, in each class of many particulars to which we give the same name.' (p. 394)¹ Hence the statement by Professor Stanley Rosen that 'the cow exists because of the idea of a cow.' This seems to mirror the many statements in the *Upaniṣads* about 'name and form'. 'So even now the universe is manifested only as name and form, it gets such and such a name and such and such a form.' (*Bṛhadāraṇyaka Upaniṣad* 1.4.7)¹⁰ 'Further, the forms are objects of the eye; the latter is their foundation, for from the same all forms spring forth; this is their community; for it is common to all forms.' (*Bṛhadāraṇyaka Upaniṣad* 1.6.2)¹¹ 'Since it is stated (in the Vedas), "There is no diversity here", and "the Lord, on account of *māyā*, (is perceived as manifold)", "(the Self) without being born (appears to be born in various ways)", it follows that He is born on account of *Māyā* alone.' (*Māṇḍūkya Kārikā* III.24)¹²

It can be seen that there are many similarities between the thesis of the artifacts and the cave analogy in Plato's *Republic*, and the fundamental Hindu concepts of 'name and form' of the manifested world that is created from a divine intelligence in the substratum, the Self or *Ātman*. One of the best known theories advanced by Western science for the cause of the Universe is the so-called 'Big Bang' theory. According to this theory all the matter of the Universe was originally densely compacted into a small ball and, at some point, the internal atomic and gravitational forces became so intense that it exploded. This is said to give the best explanation of why there is tremendous heat at the center of terrestrial bodies such as the earth, and it accounts for the observed fact that the universe is expanding. However it is difficult to see how this theory can give an explanation at all for the obvious fact that there is intelligence in the universe. How can intelligence be created by an explosion of matter? The study of genetics is revealing more and more that there is design and intelligence in the DNA, not just human DNA but all DNA. Western science is making great progress in examining the workings of this intelligence, however there is zero explanation as to how intelligence itself can be created. According to Hindu Philosophy and according to Plato there is an intelligence at work in the substratum, which is the Craftsman

of all life that we see. So, as a matter of logic it would seem to follow that this intelligence quotient in the DNA is divine.

Notes

Chapter 4

1. This introductory material is summarized from G. Doolen et al., *Introduction to Quantum Computers*, World Scientific, Singapore, 1988.

Chapter 6

1. *Eight Upaniṣads*, Vol. 1, Advaita Ashrama; Calcutta, 1986.
2. *Bṛhadāraṇyaka Upaniṣad* by Dr. E. Doer; Nag Publishers, Delhi, 1978.
3. *Chāndogya Upaniṣad*; Advaita Ashrama; Calcutta, 1983.
4. *The Bṛhadāraṇyaka Upaniṣad*, Sri Ramakrishna Math; Madras, 1951.
5. *The Bṛhadāraṇyaka Upaniṣad* by Swami Krishnananda; The Divine Life Society, Tehri- Garwahl, 1984.
6. *Minor Upaniṣads*, Advaita Ashrama; Calcutta, 1988.
7. *Eight Upaniṣads*, Vol. 2, Advaita Ashrama; Calcutta, 1957 .
8. *The Principal Upaniṣads* by S. Radhakrishnan; Oxford University Press, Delhi, 1989.
9. *A Sanskrit-English Dictionary* by Sir Monier-Williams; Motilal Banarsidass; Delhi, 1988.
10. *The Ontogenesis of Hypothalamic-Hypophysiotropic Releasing Factor Regulation of High Secretion* by Selna L. Kaplan and Melvin M. Grumbach; in *International Symposium on Growth Hormone*; Proc. of 2nd int. symp. on Growth Hormone; Milan, 1971, Editor – A. Pecile & E.E. Muller.
11. *Some Correlations between the Appearance of Human Fetal Reflexes and the Development of the Nervous System* by T. Humphrey; in *Progress in Brain Research*, Vol. 4, Growth and Maturation of the Brain, Edited by D.P. Purpura & J.P. Schade, 1964.
12. *Handbook of Electroencephalography and Clinical Neurophysiology*, Editor-in-Chief A. Remond, 1972, Volume 2A, Section 5, Thalamo-Telencephalic Circuits: A Neuroanatomical Survey, 2A-86,

Volume 2C, Section 4, Thalamic Origin of Cortical Rhythmic Activity, 2C-90, Section 5, Reticular Influences on Thalamo-Cortical Activity, 2C-119.

13. *The Oxford Companion to the Mind*, Edited by Richard L. Gregory; Oxford, 1987. See generally, Brain Development, Catecholamines, Dopamine Neurones in the Brain, Nervous System, Neuroanatomical Techniques, Neuropeptides, Neurotransmitters and Neuromodulators, Visual System: Organization.
14. *The Sleep Factor* by J.R. Pappenheimer; Scientific American, 1976, 235, 2V-9.
15. *The Bṛhadāraṇyaka Upaniṣad* by Swami Sivananda; The Divine Life Trust Society, Tehri-Garwahl, 1985.
16. *Core Text of Neuroanatomy* by M.B. Carpenter, Williams & Wilkins, Baltimore, 1978.
17. *The Fetus and Birth* by G.C. Liggins, Vol. 2 of Embryonic and Fetal Development, Editors C.R. Austin and R.V. Short; Cambridge, 1972.
18. *Functions of the Nervous System* by M. Monnier, Vol. 1, Elsevier, London, 1968.

Chapter 7

1. *Chāndogya Upaniṣad*; Advaita Ashrama; Calcutta; 1983.
2. *The Bṛhadāraṇyaka Upaniṣad*; Sri Ramakrishna Math; Madras; 1951.
3. *The Oxford Companion to the Mind*, Edited by Richard L. Gregory; Oxford; 1987.
4. *Clinical Neuroendocrinology* by Joseph B. Martin and Seymour Reichlin; F.A. Davis Company; Philadelphia; 1987.
5. *Eight Upaniṣads*, Vol. 2; Advaita Ashrama; Calcutta; 1986.
6. *The Principal Upaniṣads* by S. Radhakrishnan; Oxford University Press; Delhi; 1989.
7. *Minor Upaniṣads*, Advaita Ashrama; Calcutta; 1988.

8. *In Search of Schrödinger's Cat* by John Gribbin; Corgi Books; London; 1986.
9. *The Philosophy of Physical Science* by Sir Arthur Eddington; Cambridge; 1939.
10. *Inner Self Located* by B.Y. Bartholomew; Vedic Light; New Delhi; July, 1990.
11. *Science and Humanism* by Erwin Schrödinger; Cambridge University Press; 1952.
12. *Eight Upaniṣads*, Vol. 1; Advaita Ashrama; Calcutta; 1986.
13. *Science Theory and Man* by Erwin Schrödinger; George Allen & Unwin; London; 1935.

Chapter 8

1. *Eight Upaniṣads*, Vol. 2; Advaita Ashrama; Calcutta; 1986.
2. *Eight Upaniṣads*, Vol. 1; Advaita Ashrama; Calcutta; 1986.
3. *In Search of Schrödinger's Cat* by John Gribbin; Corgi Books; London; 1986.
4. *Science Theory and Man* by Erwin Schrödinger; George Allen & Unwin; London; 1935.
5. *The Bṛhadāraṇyaka Upaniṣad*; Sri Ramakrishna Math; Madras; 1951.
6. *Science and Humanism* by Erwin Schrödinger; Cambridge University Press; 1952.
7. *Bṛhadāraṇyaka Upaniṣad* by Dr. E. Roer; Nag Publishers; Delhi; 1978.
8. *Chāndogya Upaniṣad*; Advaita Ashrama; Calcutta; 1983.
9. *Physics and Philosophy* by Sir James Jeans; Cambridge; 1943.
10. *Ēg Veda*, Vol. 5; Sarvadeshik Arya Pratinidhi Sabha; Delhi; 1989.
11. *Ēg Veda*, Vol. 2; Sarvadeshik Arya Pratinidhi Sabha; Delhi; 1989.
12. *Minor Upaniṣads*; Advaita Ashrama; Calcutta; 1989.
13. *The Philosophy of Physical Science* by Sir Arthur Eddington; Cambridge; 1939.
14. *Atomic Theory and the Description of Nature* by Niels Bohr; Cambridge; 1934.

15. *Collected Papers on Wave Mechanics* by Erwin Schrödinger; Blackie & Sons; London; 1928.
16. *Āg Veda*, Vol. 4; Sarvadeshik Arya Prainidhi Sabha; New Delhi; 1986.
17. *Mind and Matter* by Erwin Schrödinger; Cambridge; 1958.
18. *The Principal Upaniṣads* by S. Radhakrishnan; Oxford University Press; Delhi; 1989.
19. *Inner Self Located* by B.Y. Bartholomew; Vedic Light; New Delhi; July, 1990.
20. *The Philosophy of Physics* by Max Planck; George Allen & Unwin; London; 1936.
21. *The Oxford Companion to the Mind*, Edited by Richard L. Gregory; Oxford; 1987 – See generally, Color Vision: Brain Mechanisms, Perception of Motion Pictures.
22. *Gita Bhaṣya* by Sri Śankara; Bharatiya Vidya Bhavan; Bombay; 1988.
23. *Āg Veda*, Vol. 3; Sarvadeshik Arya Prainidhi Sabha; New Delhi; 1984.
24. *Letters on Wave Mechanics*, Edited by K. Przibeam; Philosophical Library; New York; 1967.
25. *The Physical Principles of the Quantum Theory* by Werner Heisenberg; University of Chicago Press; 1980.

Chapter 9

1. *Physics and Philosophy* by Sir James Jeans; Cambridge; 1943, p. 172.
2. *Atomic Theory and the Description of Nature*; Cambridge; 1934, p.19.
3. *God and the New Physics* by Paul Davies; Penguin; London; 1990, p.41.
4. *ABC of Relativity* by Bertrand Russell; Unwin; London; 1985, p. 96.
5. *Ibid.*, p.62.
6. *Ibid.*, p. 87.

7. Quoted in *Theories of Everything* by J.D. Barrow; Vintage; London; 1991, p. 89.
8. Quoted in *Ibid.*, p. 89.
9. Quoted in *Ibid.*, p. 89.
10. *Ibid.*, p. 96.
11. *Ibid.*, p. 66.
12. *Ibid.*, p. 107.
13. *Ibid.*, p. 108.
14. *Ibid.*, p. 111.
15. *Ibid.*, p. 112.
16. New Scientist, 10 May 2014.
17. Bertrand Russell, *op. cit.*, p. 25

Chapter 11

1. Quoted in *Introduction to G. Berkeley, Principles of Human Knowledge and Three Dialogues* (London: Penguin, 1988), p.1
2. G. Berkeley, *Principles of Human Knowledge and Three Dialogues* (London: Penguin, 1988), p.48
3. *Op. cit.* note 1, p.16
4. *Op. cit.* note 1, p.16
5. *Op. cit.* note 2, p.55
6. *Op. cit.* note 2, p.55
7. *Op. cit.* note 1, p.16
8. *Op. cit.* note 1, p.16
9. *Op. cit.* note 1, p.22
10. G. Fosar and F. Bludorf, *Vernetzte Intelligenz* (Aachen: Omega, 2003)
11. *Op. cit.* note 1, p.28
12. *Op. cit.* note 1, p.28
13. *Op. cit.* note 2, p.35
14. *Op. cit.* note 2, p.55
15. *Op. cit.* note 2, p.55

16. I. Kant, *Prolegomena* (Illinois: Open Court, 1902), p.49
17. Op. cit. note 2, p.60
18. Op. cit. note 2, p.62
19. Op. cit. note 2, p.19
20. Op. cit. note 2, p.59-60

Chapter 12

1. Grazyna Fosar and Franz Bludorf. *Vernetzte Intelligenz* [Networked Intelligence]. Aachen: Omega, 2003.
2. Rattemeyer M., F.A. Popp, and W. Nagel. *Evidence of photon emission from DNA in living systems*. *Naturwissen* 68 (1981): 572.
3. Denis Diderot. *Rameau's Nephew and D'Alembert's Dream*. London: Penguin Books, 1966.
4. Denis Diderot, *Œuvres*, I, Philosophie, éd. Laurent Versini, Paris, Robert Laffont, 1994, Cf. *Introduction aux Œuvres*, p.7.
5. Ibid p.4.
6. Ibid p.8.
7. Ibid p.620.

Chapter 13

1. Philip K. Dick, *Radio Free Albemuth*, New York, Random House, 1998, p. 100.
2. Philip K. Dick, *VALIS*, New York, Random House, 1991, p.174
3. *The Cambridge Companion to Berkeley*, p.152.
4. *VALIS*, o.c., p.23.
5. *Cambridge Companion to Berkeley*, p.139.
6. *VALIS*, o.c., p.234.
7. Ibid p.230.
8. Ibid p.112.
9. *Cambridge Companion to Berkeley*, p.235.

10. VALIS, o.c., p.41.
11. *Cambridge Companion to Berkeley*, p.55.
12. See Jessop, 'Berkeley and Contemporary Physics', *Revue Internationale de Philosophie* 7(1953), p.95-96.
13. David Berman, *George Berkeley. Idealism and the Man*, Oxford, Clarendon Press, 1994, p.61-62.
14. VALIS, o.c., p.121.
15. Ibid p.161.
16. *Radio Free Albemuth*, o.c., p.190,191.
17. VALIS, o.c., p.238.
18. Ibid p.117.
19. Ibid p.122.
20. Ibid p.145.
21. Ibid p.146.
22. Ibid p.193.
23. Ibid p.196.
24. Ibid p.207.
25. Ibid p.62.
26. Ibid p.70.

Chapter 14

1. *Great Dialogues of Plato*, Translated by W.H.D. Rouse; Signet Classics, New York, 1999.
2. *Qu'est ce que l'Homme?* [What is man?] by Luc Ferry and Jean-Didier Vincent; Odile Jacob, Paris, 2001.
3. *The Spirit in the Gene* by Reg Morrison; Cornell University Press, Ithaca, 1999.
4. *R̥g Veda*; Sarvadeshik Arya Pratinidhi Sabha, New Delhi, 1978-1986.
5. *The Principal Upaniṣads* by S. Radhakrishnan; Oxford University Press, Delhi, 1989.
6. *Minor Upaniṣads*; Advaita Ashrama, Calcutta, 1988.

7. *The Bṛhadāraṇyaka Upaniṣad* by Swami Sivananda; The Divine Life Trust Society, Tehri-Garhwal, 1985.
8. *Eight Upaniṣads*, Vol.1; Advaita Ashrama, Calcutta, 1986.
9. *Gita Bhashya* by Sri Sankara; Bharatiya Vidya Bhavan, Bombay, 1988.
10. *The Bṛhadāraṇyaka Upaniṣad*; Sri Ramakrishna Math, Madras, 1951.
11. *The Bṛhadāraṇyaka Upaniṣad* by Dr. E. Roer; Nag Publishers, Delhi, 1978.
12. *Eight Upaniṣads*, Vol.2; Advaita Ashrama, Calcutta, 1986.