The Role of Consciousness in the Origin and Evolution of Life

Allan T. Emrén. To appear in Aspects on Consciousness, ed Fredriksson, McFarland & Company, Inc., Publishers, (North Carolina), in press 2014

Abstract

During the origin and evolution of life, there were a number of essential large steps that had to take place in addition to a more or less steady evolution. Common to those steps is that no known mechanism is efficient enough to make them happen. In the present paper a "super Darwinian" approach will be taken in an attempt to make it plausible that life and evolution towards a conscious species is possible.

Example of the obstacles is that a self replicating peptide has to be smaller than 37 units for life to be probable on earth, or less than 111 for the entire universe. This could be compared to the smallest known RNA sequence able to copy another molecule, being 165 units long.

Furthermore, the initial genetic code had to switch into the present DNA based one. As the original code probably was very different, switching from one to the other was extremely difficult, similar to an evolution of Chinese written language into English.

Thus, intelligent life should not be able to appear anywhere in merely 14 billion years. As we are here, however, there has to be some mechanism that makes intelligent life possible, unless we are created and developed in a supernatural way.

In the Super Darwinian theory presented here, life has been able to overcome the evolutionary obstacles by taking advantage of the fact that consciousness coupled to matter appears to be required for the quantum mechanical wave function to collapse.

When energy is converted to matter, the particles form entangled states. Such states persist until a measurement forces collapse of the wave function. Consequently, one could expect that the entire universe was in a state describing all possibilities simultaneously. Among all those possibilities, there should have been a huge number in which life was initiated at different locations in the universe.

Then, the potential instances of life have undergone evolution. Each of the successful evolutionary routes would lead towards a particular kind of intelligent species, humans being one of them. Other routes would possibly have been developing towards very different kinds, like intelligent insects, or stranger species, like Donald Ducks, trolls, or even an intelligent species built from interstellar gas clouds.

The parallel processing would make evolution fast enough to overcome the difficulties mentioned above. Different branches of evolution would proceed at different rates. Finally there would appear a species with a brain intelligent and efficient enough to handle consciousness. The universe would have produced a conscious observer and its wave function had to collapse.

Instantaneously, all other branches disappeared. This super Darwinian mechanism would cause extinction on a far greater scale than any other known. Actually, there would be no fossils left from erased branches. They were erased not only from continued existence, but even from history itself.

There are at least three ways in which this super Darwinian theory could be falsified, one of them being that if intelligent life is found anywhere else in the universe, the theory is probably wrong.

Introduction

During the origin and evolution of life, there were a number of essential large steps that had to take place in addition to a more or less steady evolution. Common to those steps is that no known mechanism is efficient enough to make them happen.

First of all there is the fine tuning of physical properties of the universe. The most reasonable explanation for that is that the universe has been created with the purpose of being inhabited by living organisms. There have been several attempts to find alternatives [1], but they all appear to fail in some way. Some of those theories require the constants of nature to be able to have a huge number of possible values (if not infinite). Furthermore, they would require a multitude of universes with different sets of constants and properties. There is no evidence whatsoever for the requirements to be fulfilled. There is also no mechanism proposed, that would prevent one of the universes to have a set of constants, that would cause it to "break free" and destroy all the other. One could also state that none of the theories include a kind of physics, that gives rise to consciousness, as we observe it.

Secondly, life has started somewhere in the universe, and probably upon the earth. Current theories on the origin of life could at best be considered as suggestions. There is a lack of evidence, and most of them make use of steps that makes them very unlikely. An example of such problems is that most of the theories ignore the fact that peptide bonds are not stable in aqueous solutions, and as a consequence, peptides do not form spontaneously in a solution of amino acids.

Further problems are the large information content in even simple living organisms, the rapid establishment of the DNA based genetic code, and the rapid evolution of life to form increasingly complex and efficient species, culminating with mankind.

In the present work, a "super Darwinian" approach will be taken in an attempt to make it plausible that life and evolution is possible. In this theory, it is assumed that the universe developed according to the quantum mechanical laws with wave function dispersion going on where interactions did not occur, and the output channels staying open during creation/annihilation events as well as collision events and other kinds of interaction events. This caused evolution to proceed at rates orders of magnitudes faster than would be possible according to classical mechanics. When evolution had resulted in a brain complex enough, a filtering of the universal wave function occurred and the less successful forms of life were extinguished.

Origin of life

There is no agreement on how life actually started on earth. Some authors [2] even find the probability for this to happen so low, that they assume that life has started somewhere else, and have spread in some way across interstellar, or even intergalactic space.

Most hypothesis, however, assume that life has started by simple organic molecules being dissolved in water. It could be the ocean, some lake, or a pond. In this environment, the molecules have reacted to form chains, like peptides, RNA-sequences etc. By chance, one chain thus formed would be able to replicate, and life would be running. Once such a chain was present, it would undergo Darwinian evolution, increasing the level of complexity. Finally, billions of years later, the present biosphere would have formed.

Pre biotic life

As mentioned above, it has been proposed that life actually did not start on the earth, but at some place in the universe, where the conditions were more favourable. After life had formed there, it would spread as spores or tiny seeds across the galaxy. It has even been proposed that seeds or entire organisms have been transported by purpose in space ships, and planted into other worlds, the earth being one of them.

There are several arguments against this kind of hypothesis. First, it is difficult to imagine an environment more favourable than the early earth, for formation of primitive life. The temperatures were in a range where chemical reactions could proceed at reasonable rates, while not high enough to prevent formation of complex molecules. Furthermore, the reducing atmosphere protected organic molecules from being oxidized to water and carbon dioxide.

Secondly, life could not form in a very young universe, as the elements available during the first billions of years were merely hydrogen, helium and lithium. No carbon, no nitrogen, no oxygen, no sulphur etc. Such elements are formed in the centres of stars when their fuel has been consumed. If a star is large enough, it will explode violently, and the elements in its interior will be spread into space. From there, it is able to serve as raw material for high density planets, like the earth.

Thirdly, once life had originated, there should be a mechanism that makes seeds in huge quantities leave the planet and the solar system in which they were formed. When they had entered interstellar space, they had to survive a very long journey without being destroyed by radiation. The radiation doses collected during millions of years in space are huge, and it looks more or less impossible for the genetic information to survive, even in a dry and frozen state.

Considering such facts results in the conclusion that the most probable place for life to have started would be on the Earth itself, some 3.5 or 4.0 billion years ago. The building materials, simple organic molecules like amino acids may have formed in the reducing atmosphere through reactions driven by electrical discharges or UV light. They may also form in space, where the reactions may be driven by UV and gamma radiation. Then they could have reached the Earth via comets and dust from space.

Most of the simple organic molecules would fall into the oceans, where they would be diluted to very low concentrations. This makes it highly unlikely that the life started in the oceans. As will be discussed below, there are other, and even more serious obstacles preventing life from starting in the sea. Some of the organic material, however, would fall to the solid ground, like volcanic islands. There, no dilution would take place. Rather, accumulation during extended periods of time would cause concentrations that were thousands of times higher than in the oceans.

Thermodynamic obstacles

The theories of life starting in water usually neglect one very important fact: The bonds tying monomers together, e.g. peptide bonds, cannot form spontaneously in an aqueous solution. In a cell, such bonds form by a condensation reaction, like

$$HNH\text{-}R_1\text{-}CH\text{-}OCOH + HNN\text{-}R_2\text{-}CH\text{-}OCOH \rightarrow HNH\text{-}R_1\text{-}CH\text{-}OC\text{-}NH\text{-}R_2\text{-}CH\text{-}OCOH + H_2O \quad (1)$$

The symbol R_i is used to denote an unspecified organic group. The peptide bond, -OC-NH-, is not stable in aqueous solutions. The change in enthalpy of reaction (1), ΔH, is positive [3], while the change in entropy, ΔS, is slightly negative, as can be seen from the reaction scheme. The change in free enthalpy, ΔG, is given by

$$\Delta G = \Delta H - T\Delta S \quad (2)$$

Due to the signs of changes in enthalpy and entropy, ΔG is positive. This means that reaction (1) cannot happen spontaneously. Rather, if a peptide bond is formed by chance, it will break spontaneously by hydrolysis. So the natural reaction is

$$HNH\text{-}R_1\text{-}CH\text{-}OC\text{-}NH\text{-}R_2\text{-}CH\text{-}OCOH + H_2O \rightarrow HNH\text{-}R_1\text{-}CH\text{-}OCOH + HNN\text{-}R_2\text{-}CH\text{-}OCOH \quad (3)$$

Raising the temperature does not improve the situation. As ΔS is negative, an increase in temperature causes ΔG to become even larger. Principally, one could move in the direction of spontaneity by a decrease in temperature, but if proper values of thermodynamic parameters are used, one finds that negative absolute temperatures would be required for the reaction to become spontaneous.

In living cells, the reaction is driven in a direction opposite to the natural, by coupling it to other reactions, rich in free energy. Such schemes are complicated, and could not be considered as plausible for the origin of life.

Dew drop cell

There exists a possibility for reaction (1) to become spontaneous. To see this, one has to write ΔG in terms of chemical potentials. Denoting them by μ, one will get [4]

$$\Delta G = \Sigma\, n_{products}\mu_{products} - \Sigma\, n_{reactants}\mu_{reactants} \quad (4)$$

The symbol n denotes mole numbers of the species. Chemical potentials may be expressed in terms of activities [5]. We will use the pure solid or liquid substances as standard states. Then

$$\mu_i = \mu^*_i + RT \ln a_i \quad (5)$$

Here, a_i is a notation for the activity of a substance i, R is the gas constant, and T is the absolute temperature. For practical purposes, one may consider the activity to be approximately the same as concentration (mole fraction). Using (5) in (4) and (1) gives

$$\Delta G = \Sigma\, n_{products} (\mu^*_{products} + RT \ln a_{products}) - \Sigma\, n_{reactants} (\mu^*_{reactants} + RT \ln a_{reactants}) \quad (6)$$

Rearranging (6) gives

$$\Delta G = \Sigma\, n_{products}\, \mu^*_{products} - \Sigma\, n_{reactants}\, \mu^*_{reactants} + \Sigma\, n_{products}\, RT \ln a_{products} - \Sigma\, n_{reactants}\, RT \ln a_{reactants} \quad (7)$$

The first two sums in (7) are constants, and are usually denoted by ΔG^*, the change in free enthalpy if the reaction takes place in such a way that both reactants and products are pure solids or liquids. So (7) can be rewritten as

$$\Delta G = \Delta G^* + RT (\Sigma\, n_{products}\, \ln a_{products} - \Sigma\, n_{reactants}\, \ln a_{reactants}) \quad (8)$$

The products term has two components, the peptide and water. Writing that explicitly gives

$$\Delta G = \Delta G^* + RT (n_{peptide}\, \ln a_{peptide} + n_{H2O} \ln a_{H2O} - \Sigma\, n_{reactants}\, \ln a_{reactants}) \quad (9)$$

The reaction will become spontaneous if either of the product terms becomes small enough. Making the peptide activity very small, of course is a possibility, but then, the point is missing, as no peptides are formed. The other possibility is making the water activity very small. Then one has to realize that even in a saturated solution of NaCl (approximately Dead Sea water), the activity of water is still about 0.75 [6]. This is far too high to turn ΔG into a negative number.

If the monomers are dissolved in a small quantity of water, e.g. a dew drop, the situation may change. It is well known that clay minerals, like montmorillonite, are weathering products of volcanic ash. Typically, clay minerals are composed of poly anions built from aluminium silicates, and more or less free cat ions. The anions form networks, filled with pore water inside the clay. Thus, a dew drop upon such a substrate will be in contact with the pore water. When the dew evaporates during day time, the water activity at the surface will decrease, and it is able to reach extremely low values, far below the point at which ΔG becomes negative. Then, the reaction (1) changes to become spontaneous, and peptides may form. One should also remember that the temperature generally is higher during daytime than during nights. So the formation of chains tend to be more rapid than the hydrolysis. In this way, the chains are able to survive, and to grow in length.

During night time, dew precipitates, the peptides will be dissolved in the drop. Without a catalyst, the hydrolysis reaction (3) is slow enough that most peptides will remain through the night.

Next day, the drop will evaporate again. Clay that has been dissolved will precipitate. Initially, it will bind to the peptides that fitted into clay structure. The aggregates formed will serve as nucleation seeds when more clay precipitates to form colloidal clay particles. The clay colloids will serve as sorption centres for amino acid monomers, that then will tend to form a pattern similar to the peptide that functioned as nucleation seed. When the evaporation is completed, the dissolved species do not form a dry circular disk on the substrate. Instead, there remains a ring of peptides, peptides to be, and almost dry clay, as seen in Figure 1.

Figure 1. Three stages during the evaporation of a liquid drop. Due to surface tension, dissolved substances tend to form a ring after the liquid has disappeared. The shape is caused by the fact that the angle between substrate and liquid remains approximately constant during the process.

The reason is that when a drop of water on a surface evaporates, the shape of the drop changes. Initially, the drop may look like a part of a sphere. As the liquid evaporates, the contact angle between liquid and substrate remains approximately constant (the wetting angle). The surface tension causes the free surface to be as small as possible with a given volume and given contact angle. The result is that the surface initially becomes flatter, and eventually concave in the central parts. Finally, the centre of the surface gets in contact with the substrate. Then the angle there too has be be equal to the contact angle, and a ring is formed. In this ring, most dissolved substances are concentrated.

The quantities of earlier dissolved substances at different parts of the ring will depend upon inhomogeneous properties of the substrate. Next night, the local irregularities will serve as

nucleation centres. In this way, the contents of a certain drop will be distributed among several drops next night. This will cause a spread of the peptides. One has got a cell division mechanism that does not require any membranes or other complex structures to work.

One unsolved mystery in connection with peptides is that of chirality. Each amino acid is able to exist in two shapes, L and D, being each others mirror images. It is well known that all life on Earth is built exclusively from the L variant. This could be explained by the montmorillionite hypothesis. An amino acid of type L, sorbed upon the clay will not be able to couple to an acid of D-type, as the resulting peptide does not fit into the clay structure. With all bonds being of type L-L, or D-D, a good fit will occur. If this hypothesis is correct, it is merely by chance that we have L acids, rather than D acids in living cells.

One should keep in mind that the scheme suggested above, is merely one out of several ways in which pre biotic life could have started. The advantage is that it avoids several of the obstacles found in other suggested pre biotic life schemes, and it also offers an explanation to the fact that all amino acids in life are the L-form. According to this model, the common chirality amino acids in living cells suggests that all life on Earth originates from one single molecule in one single drop of water.

Limitations of probabilistic nature

Rather soon after the first occurrence of pre biotic life, several mechanisms had to evolve. Most important perhaps is the formation of multi component life. As an example, one may mention that with a protein like pepsin, that is able to break the peptide bond, a large stock of raw material would become available for building new auto replication systems. Other components that would be of great advantage during early stages were some mechanism for building cell membranes to keep the parts together, and a mechanism for splitting the membrane into two separate "cells".

Although there are peptides in the body that consist of merely a few amino acids, such small peptides do not have the properties required to actually perform enzymatic catalysis. The small peptides, 5 to 40 units in length rather function as signal substances triggering more complex systems to start or stop working. Modern enzymes being able to break the peptide bond are far larger. Typically, pepsin consists of some 325 amino acids. So although, the presence of such an enzyme would be of great advantage, it is not easy to see how it could form by random, or primitive evolutionary processes.

Another obvious obstacle is the formation of a molecule or a set of molecules that is self replicating without assistance from clay minerals. It is easily seen that if the first system of that kind was a peptide, the chain length had to be less than 35 units for its occurrence to be probable on earth, and less than 94 for it to occur at any place in the entire universe.

Similarly, if one imagines an RNA based pre biotic life system, one would not be able to have chains larger than some 37 for it to be probable on earth, or 111 for it to be probable anywhere in the universe. This is far smaller than the smallest RNA sequence (165 units long) known to be able to copy another molecule. Although it has such a considerable length, the fidelity of the copying process is rather poor, and it is not able to copy itself [7].

Except for the Super Darwinian mechanism to be presented below, there does not appear to exist obvious ways to overcome such probabilistic obstacles. The alternatives are either, an entirely unknown evolutionary mechanism, or an almost impossible chance, or a direct Divine intervention.

RNA-DNA code for amino acid sequences

Next, the present (DNA based) genetic code had to be established. It is obvious that the code is very old, and it is also obvious that it appeared in one place, perhaps even in one single line of pre biotic cells. Once a code was established, there does exist theories on how the modern code came into being. Even there, however, the number of theories show that the question still is not answered. Also, all the theories suffer from difficulties [8].

Apparently, there is a lack of theories for establishment of the first, perhaps incomplete, DNA-RNA based code. In the first primitive code making pre biotic life able to copy itself, there would have been either peptides, or chains of nucleic acids making copies of themselves. In some way, an entirely new mechanism would have to be created, in which peptide chains and nucleic acid chains interacted making replication of the other kind of chain more efficient.

This happened while life was still rather new upon earth, probably at least three billion years ago. At that time, life could not have existed on earth more than about one billion years. As the two kinds of coding are very different, entirely new mechanisms had to be established. How to do that in small evolutionary steps is unknown, if it is even possible. The problem is similar to the (hypothetic) problem of finding a process causing a gradual evolution of Chinese written language into the Western kind.

Evolution

As soon as the pre biotic life had been initiated, it probably also started its evolution. The dominant theory at present is that of Darwinian evolution. Other theories have been around, but they have not been as widely accepted. A problem common to all such theories, including the Darwinian, is that none have been proven, and ways for falsification have not been proposed. To take Darwinian evolution as an example: Whenever it has been found that some property is of advantage, this has been looked upon as a support for the Darwinian mechanism. When, on the other hand, some finding appears to contradict the theory, it is supposed that the problem will be resolved in the future, or by some minor modification of the theory. This is a phenomenon that has occurred many times during the history of science when a paradigm shift is about to happen.

Darwinian mechanism

The evolutionary theory of Darwin has been modified gradually, as new facts have been found. Possibly, the most dramatic change took place when the mutations were discovered. This meant that rather than a continual change of properties of individuals, the properties were found to change in discrete steps. The steps, however could be small enough for the evolution to proceed in almost smooth ways. With mutations, however, there was also the introduction of possibilities for huge steps to be taken at once. So in the evolutionary process, not only the direction of change was found to be random, but also the step length. Later, it was found that entire genes could be transferred from one kind of organism to another, and also that in some cases the environment could cause the genetic properties to change in non random ways, beneficial for the species.

One could summarize the Darwinian process in the following steps:
1. A random number of mutations take place in the genome of an individual in a certain population.
2. The mutation(s) take place at random locations in the genome.
3. The mutated genome is transferred to the next generation.
4. As a result, the new individuals will differ in their ability to mature and give rise to a new generation in the present environment. The differences in that ability may be extremely large, but generally, the effect is small, or almost negligible.
5. In the next generation, there will be a slight increase in the number of individuals with favourable genomes as compared to those with less favourable.
6. After a large number of generations, the population becomes more efficient than originally.

To this scheme, one could add that when two populations of the same origin are separated from each other, they might develop in different directions causing different species to occur.

Evolutionary algorithms

The Darwinian mechanism has been used to to solve difficult problems in physics numerically. Computer programs are then written, that take random steps in the variable space. When a step leads away from the desired solution according to some criterion, it is rejected. If, on the other hand, it is closer, it is used as a starting point for the next random step.

It has been found that the genetic algorithms are very efficient for solving some kinds of problems, like finding extreme values of multi variable functions. There is a limitation, however. Generally, the algorithm cannot get closer to the true solution than about half the step length. So to get accurate solutions, one has to take very small steps. But this makes the program inefficient in terms of number of steps required to find the solution.

In living systems, a high degree of optimization often is found. This means that with small step lengths, the evolutionary process could be expected to be extremely slow. In genetic algorithms, one common way to handle the problem is to use large steps while far from the solution, and then gradually decrease the step length as the solution is approached. Similar mechanisms might be at play in living populations due to the differences in importance of different codons in the genome.

Problems in evolution

The success of genetic algorithms suggests that the Darwinian mechanism could easily explain most of the properties of life today, as well as giving a possible route leading to it from the first biotic life appearing on earth. In other words, from the first primitive cell up to humans and all our surrounding biosphere. This might, however, not be the case, due to the obstacles mentioned, and that have to be overcome in the evolutionary process.

Local traps

An evolutionary algorithm is granted to find the solution if the problem can be described in terms of a monotonous function. In many physical systems, this is not the case. Rather, there are local extremes, establishing traps for many kinds of algorithms, and the genetic ones are no exception. In the case of evolution this is the case whenever two or more kinds of properties have to co-develop. There may be other cases too. To overcome that kind of obstacles, there is a need for a variable step length in genetic algorithms. In evolution, there has to exist cases in which the natural selection does not work. To overcome such traps, it has to be possible for less favourable mutations to survive long time enough. It is also necessary that the mutation rate varies by orders of magnitude.

Simulating evolution
Several evolution simulations have been developed [9a, 9b]. Typically, they express Darwin's mechanism in terms of differential equations, in some cases combined with stochastic variations of population size. At best, such simulations can tell that if a population is large enough, and if the mutation rate is small enough, the best possible mutation becomes dominant. Generally, they do not take spatial variability into account, and the results apparently contradict the fact that in most cases, evolutionary progress takes place during short periods of time, while no evolution at all takes place during most of the time while the populations are large and environments rather constant (punctuated equilibrium). [10]

To get an idea of the efficiency of the Darwinian mechanism, a program has been written to examine the rate at which optimization takes place. In the program [11] an individual is built, with a genome consisting of bit strings. In the simulations so far, there are two genes, each 24 bits long. The genes are chosen by setting each bit randomly to one or zero. The individual is put into a square grid, where it is able to multiply. Each time seeds are formed, they may undergo mutation at a random location in the genome. A mutation turns a one bit to zero and vice versa.

After a rather small number of generations, about 90 percent of the available space is filled with individuals. This coverage remains essentially constant during the simulations. The system sizes has varied from 50 up to 40000 locations.

The simulation results indicate that optimization of the population occurs only if the mutation rate is small enough. Also, the number of generations required for the population to be optimized is more or less independent of the size of maximum possible population (system size). If a population has reached optimal properties (as defined by a fitness value of at least 99 percent of what is theoretically possible), and the mutation rate is allowed to increase considerably, the Darwinian mechanism switches to cause degeneration rather than optimization.

This has two important implications. First, there has to be some mechanism in living systems that regulates the mutation rate. Secondly, there is a limit to the rate at which life has been able to optimize using Darwinian evolution. Typically, 30 generations per bit are required for optimization of a population if the mutation rate is as favourable as possible. If the mutation rate deviates by one order of magnitude from the best value, the number of generations required increases by a factor of three to ten.

It is also found that most favourable mutations are extinguished. Only in rare cases, a favourable mutation is able to survive for a considerable number of generations. As an example, it may be mentioned that if the population size is around 2 000, more than 1.2 million mutations are required to optimize the 48 bits of the genome. So about 25 000 mutations per bit are required for optimization. The rate of favourable mutations is between 30 and 50 percent. Thus, in a population of about 2000 individuals, something like 10 000 favourable mutations of a certain bit are extinguished before one of them is able to grow throughout the population.

Seen from another point of view, one may consider that the human genome consists of some three billion DNA units. As the information content of a DNA unit is 1.46 bits, the total human genome has an information content of 4.38 billion bits. In a random sequence, half of the bits will have optimal values from the start. Consequently, for optimization, of a random sequence of 3 billion DNA units, at least 65 billion generations are required to reach the present state by random mutations and natural selection if the mutation rate is optimized for fastest possible evolution. This would require a time period orders of magnitude larger than the age of the earth. If the mutation rate is not optimal, the time required could be even larger than that by orders of magnitude.

In the simulations so far, it has been assumed that different properties of individuals may evolve independently. This is generally not the case. Getting a mutation for a bigger brain is of no use if it is not accompanied by a mutation causing the skull to get bigger, which requires the birth channel to increase in width etc. The program mentioned above has the capacity to simulate co evolution, but no such simulations have been performed yet. One could expect, however, that such constraints will cause the evolution to proceed significantly slower.

There are several examples of processes in which co evolution has been necessary. Among those, one may mention development of multicellular organisms, development of two sexes. During some periods, the evolution has proceeded at incredibly high rates, the Cambrian explosion being one of the well known examples [12]. Also, the human brain appears to have required a high degree of co evolution, even if one does not consider its ability to be conscious.

The conclusion to draw from the preliminary results, is that the Darwinian mechanism is far too inefficient to explain our presence here. One could not expect this mechanism to bring forth humans in a time that is less than 100 billion years. On the other hand, on such time scales, one could not expect the universe to be as good to support life, as it is today.

We should simply not be here. On the other hand, we are, and this tells us that something else than Darwin´s theory is required. Other processes of radically different kinds have to go along with Darwinian evolution to explain our presence.

Just lucky, or perhaps Divine intervention?

Taking such facts into account, intelligent life appears to be almost impossible in a universe that is merely 14 billion years old. Nevertheless, we are here, so unless we are created and developed in supernatural ways, there has to be some mechanism that makes intelligent life possible.

One possibility is that extraordinarily good luck has made evolution proceed at a rate far greater than random processes could be expected to give. One could have a huge number of cases in which combinations of favourable mutations and other processes with low probability made the evolution proceed at an unnatural rate. After all, there is no physical law preventing a dice to give the number six one thousand times in one thousand throws.

This possibility cannot be ruled out, but if one is forced to accept such an explanation, one will have to give up the idea of a universe that is ruled by laws, and therefore intelligible.

Another possibility would be a direct intervention by God to direct the evolution and speed it up, perhaps by deciding which mutations were to happen, and when. If no other possibility, except an incredible chance, is available, this could be a footprint that God has placed in the creation to make it possible for us to see that He is the ultimate source of everything. If, on the other hand, it is found that there exists another solution, that can explain the evolution without direct intervention, God would be silly to put such a mechanism into the universe, and then avoid making use of it. Such a mechanism is the Super Darwinian mechanism proposed below.

Quantum mechanical wave function

Observable states

During the first half of the 20th century, it was found that all measurable properties of material systems can be described in terms of wave functions. The functions generally are very complicated, and the values of a function are complex numbers except possibly at certain locations in space and time. The wave function, Ψ, of an object does not have any physical significance, but together with its complex conjugate, Ψ^*, and possibly one or more operators, it is able to tell the results that may be found if a property described by the wave function is measured. Wave functions may describe properties like position or momentum in ordinary spaces, but in addition to that, also any other property that one is able to observe, like spin or charge. To calculate the actual value, or the possible values, one has to let an operator work upon the wave function. As an example, to find the energy of a system, one has to apply the Hamiltonian operator (H). If the property in question has a specific value, the operator acting upon the wave function gives the same wave function back, multiplied by a number.

$$H\Psi = E\Psi \qquad (10)$$

In this case, E is the energy of the system. Generally, the operator changes the wave function to a different one, so that rather than (10) one would get

$$H\Psi = \Psi' \qquad (11)$$

Here, the system described by the wave function Ψ does not have one specific energy, but could be said to have several energies at the same time. Similar interpretations of results are valid for other operators.

In many cases (here if the operator H is not time dependent), equations like (11) can be written as sums

$$H\Psi = \Sigma\ c_i\ \psi_i \qquad (12)$$

in which the ψ_i functions fulfil equations like

$$H\psi_i = E_i\ \psi_i \qquad (13)$$

In this case, (12) describes a situation in which the system can be said to simultaneously carry all the energies E_i that are given by (13) for any of the i values in (12). One should note that the energy of the system is NOT something like the sum of all the individual E_i values, or their weighted mean value. There simply does not exist a value for the energy of that system. If the energy of the system is actually observed (measured), the value found will be ONE of the E_i values.

Wave functions describing different objects may be combined to form global functions of the shape

$$\Psi = \Psi_A\Psi_B \qquad (14)$$

if the objects do not interact. In the case that they do interact, the interaction operators will force the overall wave function to be a linear expression (a sum) of such terms, so that

$$\Psi = \Sigma\ c_i\ \psi_{Ai}\ \psi_{Bi} \qquad (15)$$

Here, ψ_{Ai} and ψ_{Bi} are the i:th function fulfilling equations similar to (13) for the corresponding

interaction operator. Such functions are named eigenfunctions of the operator, and the corresponding numerical values are named eigenvalues.

Collapse of the wave function

In the common case that the wave function is not an eigenfunction of the operator that describes properties thereof, that property, could be determined by a measurement. Before the measurement takes place, all eigenvalues are possible results of a measurement. When the measurement has been completed, only one of the possible values remains.

One possibility, of course, would be that the coefficients of the wave function, c_i in (12), are not constants, but vary with time, so that all of them except one approach zero, while one approaches one. This possible explanation suffers from two problems. First, it violates conservation properties, e.g. energy conservation. The problem is avoided if energy conservation is merely a statistical law. But there is another problem with the explanation: Experiment.

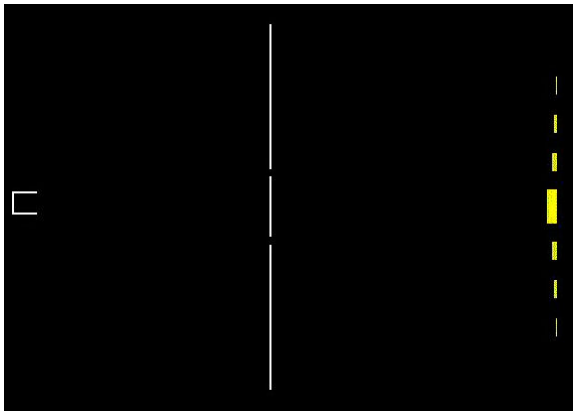

Figure 2. Double slit and the pattern that results from interference of the wave function. The pattern is a result from additive interference where the distances to the two slits is close to a number of whole wavelengths so that wave tops meet, while at the dark areas a wave top from one slit meets a bottom from the other, so that they cancel each others.

In a double slit experiment, one has a source of particles, e.g. photons or electrons directed towards a wall with two holes or parallel slits. Behind the wall, there is an array of detectors. This could be a white wall, or a device that gives off light when it is hit by a particle. If the system is undisturbed, one finds a pattern with light and dark areas (see figure 2). The explanation is that waves travelling through the two slits, have different distances along their paths to points at the detector array. In some locations, the waves interfere to extinguish each other (dark areas), while they add to each other at other locations (light areas). In such an experiment, the interference pattern appears in the detector array only if it is not known through which slit a particular particle (e.g. photon) passes. So if the wave function can be written as

$$\Psi = \text{const} \left(\psi_{\text{upper slit}} + \psi_{\text{lower slit}} \right) \qquad (16)$$

an interference pattern is seen, but if the experiment is modified, so that one is able to find the route of the photon (which slit it actually went through), the interference pattern disappears. Then only one of the terms in (16) is present, and no interference is able to occur. The outcome depends upon which knowledge the observer is able to have.

An even more strange kind of observation can take place if some kind of quantum eraser is involved. This is a device that is able to undo a measurement. In a way to take an event, that has already happened, away from the history of the universe, so that it never happened. One simple example of that is a set of experiments that can be performed upon photons.

Figure 3. When light that is not plane polarised enters a plane polariser (PP), half of the photons will exit each of the two channels. The same happens when light that is not circularly polarised enters a circular polariser (CP). Light cannot be both plane polarised and circularly polarised.

A photon may be polarized in two ways. Either, the polarization may be linear or it may be circular. It cannot be both at the same time. If photons in arbitrary states are allowed to enter a plane polariser (PP), the result will be plane polarized photons leaving the device via one out of two channels. Either via the channel for vertical (upper) or the one for horizontal (lower) polarization as indicated in figure 3. Half of the photons will exit via each channel. A similar result applies if the photons are sent into a circular polariser (CP). Half of them will leave via the channel for clockwise polarization, and the rest will be polarized anti clock wise.

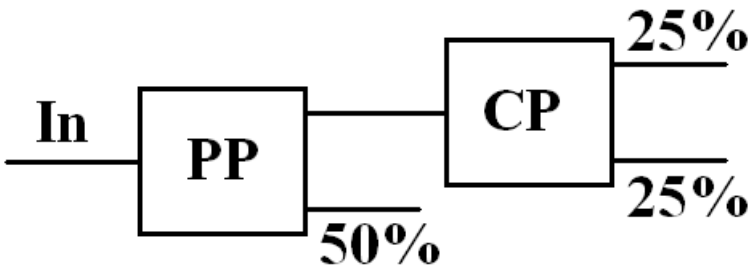

Figure 4. The output of a plane polariser cannot carry any circular polarisation. So when the output of a plane polariser is fed as input to a circular polariser, half of the photons will appear in each exit channel.

If the two kinds of polarisers are put in cascade, so that a circular polariser (CP) get its input from one output of a plane polariser (PP), 25 percent of the photons entering PP will exit through each output channel of CP, as indicated in figure 4. The reason is that the plane polariser destroys any kind of information on circular polarisation that the photon might have had earlier.

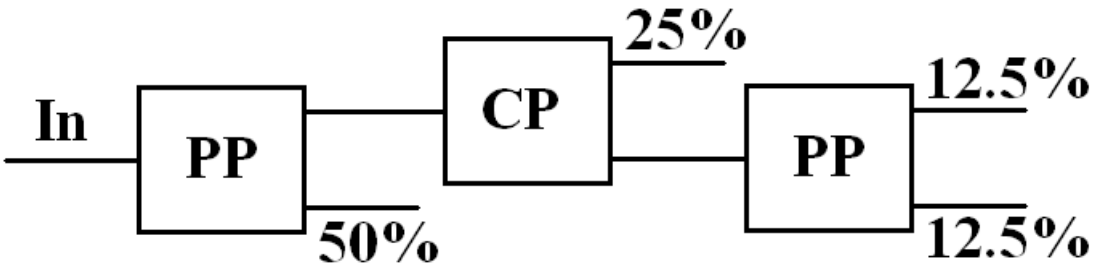

Figure 5. Any information on plane polarisation is destroyed by a circular polariser, so if one of its output channels is fed into a plane polariser, half of the entering photons will use each of the output channels.

Now, let us put a second plane polariser at the output of the circular polariser. Then, 12.5 percent of the original photons will exit through each of the last polariser's output channels, as seen in figure 5. All this is exactly what to expect. Measuring circular polarization destroys all information about plane polarisation an vice versa.

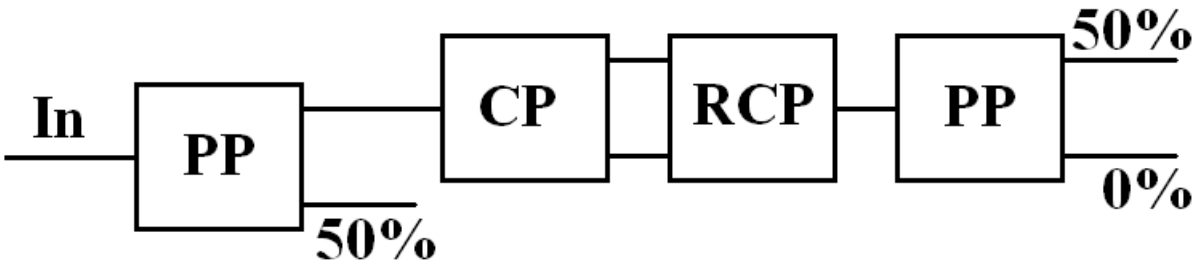

Figure 6. If a reverse circular polariser (RCP) is placed between CP and PP of figure 5, all photons entering CP will exit through the upper exit channel. The information that was destroyed has been restored. Although each photon passes merely one output channel of CP, both channels have to be fed into RCP for the information to be restored. When nobody observes, each photon will pass through both channels.

In figure 6, we have a sequence of four devices. After the circular polariser, we have put a reverse circular polariser (RCP), and after that a plane polariser. Then strange things start to happen. Although the circular polariser (CP) destroyed all information about plane polarisation, this has been restored. It is like the RCP is able to undo what the CP did, a quantum eraser. The distance between CP and RCP does not matter. We could place a mirror at one of Jupiter's moons, send the output of CP there, have it reflected back to earth to enter the second PP. The result would be the same. The RCP acts like it could go back in time, even several hours, to undo an event that happened then.

One could decide to break one of the channels between CP and RCP, AFTER the photon has passed CP. So although the photon will use only one output channel of CP, the information that RCP is in place, or not in place, has to proceed backwards in time to influence the photon when it passed CP.

Even stranger results will appear if we create the photons by letting an electron and a positron form an atom consisting of the two particles. Such an atom may exist during a few milliseconds, and is named Positronium. If it is prepared in a state with zero angular momentum (the 1s state), two photons are created when the atom annihilates. They move in opposite directions, and when sent through some kind of polariser, they will exit through separate output channels. If one is found to be polarised clockwise, the other is found to have anti clockwise polarisation. On the other hand, if one

is found to be polarized horizontally, the other will carry vertical polarisation. A photon cannot carry both circular and planar polarisation. So this is strange enough, as measurement upon one will tell something about the other, even about properties that it did not have when it left the location of its creation. That kind of state is given the name entangled.

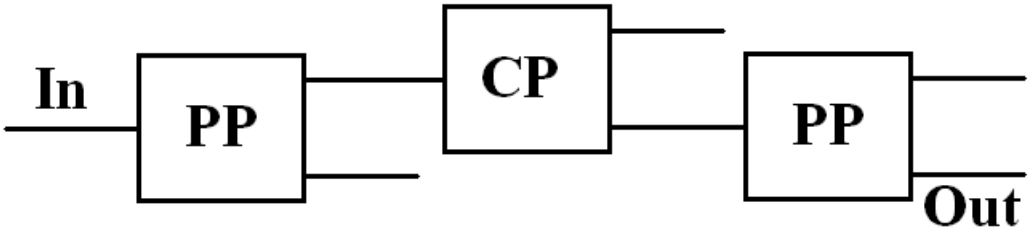

Figure 7. Let one photon in an entangled pair pass through a sequence of polarisers (PP+CP) that destroys any information on polarisation before the photon entered the first plane polariser. Then use a second PP to analyse the output of the sequence. The photon will exit through one of the outputs, e.g. the lower.

The really strange things happen if we allow one of the particles to enter an array of the kind shown in figure 7. In this figure, merely parts of the polarisers are drawn. The actual array should have one CP at each output of the first PP, and one PP at each of the outputs of the two CP:s. So in all, there should be eight possible output channels, but the photon can exit through only one of them. Assume that it exits as indicated in figure 7. Then, if we let the other photon enter a similar array, perhaps after travelling for years away from earth, we will know in advance that it will exit through the channel indicated in figure 8. How can the photon know how its twin reacted to such an array? Information should not be able to travel faster than the photon itself (speed of light). Or could there be hidden variables telling it how to react? But how could it store information about all kinds of possible experiments that could be done with its twin photon? The most reasonable explanation appears to be that all parts of the wave function are in instantaneous contact.

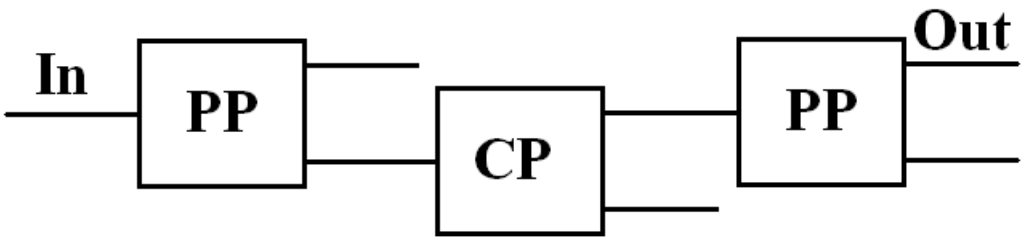

Figure 8. The partner of the photon studied in figure 7, will follow a predicted path through a similar set of information destroying polarisers. In some way, the two photons are able to communicate instantaneously in violation to the theory of relativity. They behave as one single very large object.

Building wave functions

Now, let us have a closer look upon measurement processes. To make a measurement, one has to use some kind of device, and that device also is an object following the laws of quantum physics. While the measurement takes place, this gives rise to an extremely complicated expression, in which the wave function has to contain all kinds of cross terms.

$$\Psi = \Sigma\Sigma\ c_{ij}\ \psi_{Ai}\psi_{Mj} \qquad (17)$$

Before and after the measurement process, the interaction between the object (A) and the measuring device (M) is negligible. Then all the cross coefficients c_{ij}, where i differs from j, become zero and (17) reduces to the much simpler

$$\Psi = \Sigma\ c_i\ \psi_{Ai}\psi_{Mi} \qquad (18)$$

So the measuring device (M) should show all the different possible values simultaneously. Or it could also be in a totally undefined state. As this is not what we usually observe, it is obvious that (18) does not give the full description of what happens during the measurement. One possibility could be that measuring devices are not bound by the laws of quantum physics. But why should they not? A measuring device can consist of merely one elementary particle. So how could it know that most interactions are ordinary, and should follow quantum rules, but that some are measurements, and should result in a different behaviour? From the point of view of the interacting particles, there is no difference.

To get around this, one has to introduce an observer (O) as well. If the observer too is a quantum object, the total wave function includes that of the observer too. After the end of interaction between object A, the measuring device M, and the observer O, the overall wave function has to be

$$\Psi = \Sigma\ c_i\ \psi_{Ai}\psi_{Mi}\psi_{Oi} \qquad (19)$$

The interpretation is that when an observer (O) reads the measuring device (M), all possible values are seen at the same time. This too is contradictory to our experience. We see merely one value. This means that there is something in the human observer that goes beyond quantum physics. Or alternatively, that quantum physics includes a term that goes into action when an observation takes place and a human observer is involved. The only known property that differs between a human observer and any other kind of measuring equipment is the presence of consciousness in the observer.

Consciousness and collapse

The experience is that when we observe an event, we see merely one out of the multiple realities that exist simultaneously according to (19). So the observation causes (19) to change giving

$$\Psi = \Sigma\ c_i\ \psi_{Ai}\psi_{Mi}\psi_{Oi} \quad \rightarrow \quad \Psi = \psi_{Aj}\psi_{Mj}\psi_{Oj} \qquad (20)$$

All possibilities except one, possibility j, have been filtered away. The phenomenon is given the name 'collapse of the wave function', and obviously, it is caused by the consciousness, or at least coupled to it. Possibly, our consciousness is actually located in the brain, although it looks more probable that it extends well outside our bodies, as will be discussed below.

The collapse happens instantly, and as wave functions in principle extend across the entire universe, this causes interactions propagating at infinite speed as seen in our universe of three (or four) dimensions. Generally, wave functions are located essentially to small regions of space, but in some cases (e.g. entangled particles), the wave function is able to give high probabilities in several locations separated by huge distances. In spite of that, the collapse happens everywhere in the same instant (whatever that may mean relativistically).

This contradicts the theory of relativity, as according to that, nothing carrying information is able to proceed at a speed faster than the speed of light. Strictly speaking this is not exactly true. Relativity tells that it is impossible for matter to accelerate to the speed of light. In case some kind of matter is created in a state faster than light, or if it makes a quantum jump to a speed exceeding the speed of light, it is able to reach any higher speed, but not the speed of light or lower.

One consequence of the instantaneous nature of the wave function collapse, is that causality is not absolute. As far as nothing happens faster than the speed of light (inside the light cone), the order in which events occur is unique. But outside the light cone, there does not exist unique definitions of 'before' and 'after'. Rather, the order in which events happen depends upon the frame of reference in which the event is observed. This means that the cause of an event may happen at a time later than the event itself. Consequently, the collapse of the wave function has the potential to change history. Or to be more accurate, to choose one out of several possible histories. This is exactly what happens in the polariser experiments described above.

Brain and wave function collapse

Obviously, consciousness is tied to the brain in some way. If the brain of a person is caused to be out of function, consciousness disappears as well, at least as seen from an external observer. This suggests that consciousness is a process going on inside the brain. Walker suggested [13] that consciousness is caused by quantum mechanical phenomena, like tunnelling among the synapses. This could be a possibility.

Another possibility is that parts of the brain rather are kinds of receivers and transmitters that are able to connect an immaterial consciousness to ordinary matter. If so, consciousness itself dwells outside the body, perhaps even outside the physical universe, something that is not impossible in Walker's model either.

Whatever the connection is between consciousness and brain, this connection gives us the possibility to interact with objects far from ourselves, and with past times as well. Once, however, the collapse has taken place, the process is irreversible as far as we know. Possibly, this is the true arrow of time. Before the collapse, time might be able to proceed in any direction, but when the collapse takes place, it is impossible to move back to an earlier event to change it. It could even be that the photons in the double slit experiment move forwards and backwards in time to actually pass through both slits. When the photon is observed at the detector array, it thus has passed through both slits. This interpretation would be consistent with Feynman's results, in which he showed that the wave function can be described in terms of a collection of all possible paths between starting point and end point [14].

The role of consciousness in the collapse of the wave function gives rise to the well known paradox of Wigner [15]. This paradox deals with two persons, Wigner and Wigner's friend. In the original version of that paradox, Wigner's friend observes an event, and the tells Wigner the outcome. We could modify the paradox slightly, to let both Wigner and his friend observe the same event. The distance between them may be large, as well as the distance between each of them and the location of the event, and they may be moving with respect to each other, and to the object that undergoes the event. Each of them observes the event, and will cause collapse of the wave function. When they meet later, we know that they will both have caused collapse of the wave function in the same way. Out of all possibilities described by the uncollapsed wave function, both have observed the same kind of collapse. Of course, if one of them was first to do the observation, the other one would see a collapsed wave function, and is bound to do the same observation.

From their own point of view, however, it might be impossible to tell who was first to make the observation. Both may be the first one in his own frame of reference, so who caused the wave function to collapse, and who did simply observe a collapsed wave function?

This question could be resolved if the frame of reference of the observed event is taken as preferred frame (for this purpose). Information on the event cannot move faster than the speed of light, so the observer that is closest in this frame should be the one that causes the wave function to collapse.

But what if both are at the same distance in that frame of reference? One possibility is that some random mechanism makes a choice on who will cause the collapse, and who will just view the result. It could also be that the minds are connected in some way via a global pool of consciousness, that causes Wigner and his friend to collapse the wave function in the same way. A third possibility is that the minds simply trigger the collapse to take place, but that the outcome is determined by some mechanism that is not at all connected to consciousness. The three possibilities mentioned here would give slightly different outcomes, so there exist in principle a possibility to find out which is the correct one. This, however, is outside the scope of the present work.

Theory of Super Darwinian Evolution

As has been discussed above, the universe appears to be far too young for the traditional Darwinian evolution to explain our presence. The laws of quantum mechanics offer a solution to that problem.

The initial state of the universe is unknown, but eventually, when the age was tiny fractions of a second, there was a violent evolution, with all kinds of particle pairs popping into existence and then rapidly disintegrating and also annihilating again whenever an anti particle was met. The temperatures were extremely high. As the universe cooled down, stable and metastable particles formed. Protons, neutrons, and electrons being the most important. Still the universe was hot enough for all reactions to be able to maintain their equilibrium states. Macroscopically, the universe could look in merely one way. Any deviation from this state by random fluctuations was quickly cancelled by the rapid equilibration processes. The universe was in a state of heat death. Macroscopically, all possible states were identical. The wave functions of individual particles were combined to a global wave function consisting of a huge number of products of the kind shown in equation (15), but now extended to one factor for each particle in the universe.

$$\Psi = \Sigma\, c_i\, \psi_{Ai}\, \psi_{Bi}\, \psi_{Ci}\, \psi_{Di}\, \psi_{Ei}\, \psi_{Fi}..... \qquad (21)$$

At an age of a few minutes this situation changed dramatically, as the low temperature (still hundreds of million degrees) caused the universe to freeze in a non equilibrium state. Equation (21) is complicated beyond any imagination, but from the time when the universe woke up from the state of heat death, the complexity of the situation increased dramatically. As each of the factors in (21) is a linear combination of possible eigenvalues of operators that are able to work upon the wave function, each factor has to be written as

$$\psi_{Ai} = c_{Ai1}\, \psi_{Ai1} + c_{Ai2}\, \psi_{Ai2} + c_{Ai3}\, \psi_{Ai3} + ... = \Sigma\, c_{Aij}\, \psi_{Aij} \qquad (22)$$

From this time, terms in the wave function could cause different macroscopic results depending upon what events are described by that term. As an example, ψ_{Ai1} , could describe the situation that particle A collides with an anti particle and annihilates. From that moment, the coefficient c_{A1} becomes zero. That term then describes a situation in which particle A does not exist any more. The partial wave ψ_{Ai2} and all the other could perhaps avoid the collision, so in their descriptions of reality, particle A still exists, and interacts with other particles.

Consequently, a huge number of different histories of the universe started to develop. As time went on, the complexity of the universal wave function continued to grow at a exponential rate or faster. As mentioned above, it is not even clear that the time proceeded in any particular direction then. But the result does not depend upon the local direction of time, as the wave function describes the states of the universe at specified times. So how time was able to reach a certain value is irrelevant for the result.

When the age of the universe was some 300 000 years, it had cooled to a few thousand degrees, and became transparent, and the space between atoms was filled with free photons, so in addition to being filled with hydrogen and helium, the universe was also filled with visible light. There was also dark matter present, at least that is the most common explanation to the structure of the universe as we see it today. The continued expansion of the universe had two effects. The gases became thinner and the light waves were stretched by the expansion. After a few million years, the light was no longer visible. The universe became a dark place filled with thinning gas.

Irregularities in the gas and in the dark matter caused collapse of the dark and cold gas. Initially, clouds were formed, and some parts of them collapsed to form galaxies and stars. Some 100 million years after Big Bang, the stars were ignited and started the processes eventually leading to formation of heavy elements, that were sent out to form dust clouds when heavy stars exploded.

The locations and properties of individual galaxies and stars, depended upon details of the partial wave functions. Such processes are highly non linear, and very small differences in initial states have huge influences upon the final result.

Parallel evolutions

About five billion years ago, one specific out of an innumerable number of terms in the global wave function had caused formation of the earth. In even much larger numbers of terms, the earth did not exist at all, but other similar planets in other galaxies. Some terms should describe a universe, in which no planets were formed, or even no stars. On could imagine the wave function as describing huge numbers of potential universes, each with individual properties, developing in parallel.

In many of the potential universes containing the earth, life was started, perhaps as described above. Similarly, life also started in other potential universes, in which the earth did or did not not exist. Possibly, life also started in potential universes not having any planets at all. This could be like living gas clouds, as imagined by Hoyle in his novel 'The black cloud' [16].

All those life forms would undergo evolution at different rates. Most of them too slow to ever being able to go beyond one cellular organisms, or even beyond pre biotic life. The obstacles against evolution described above would cause life to stay in very primitive states. But the exponentially growing number of potential universes would assist Darwinian evolution in many cases. Whenever, the evolution hit an obstacle due to the Darwinian mechanism being too inefficient, the formation of new terms in the global wave function overcame the low probability in each individual potential universe, by supplying a number of branches large enough for the evolution to take place there in spite of low individual probabilities.

Consequently, evolution was able to proceed rapidly in a large number of branching potential universes. Due to the numerous possibilities, the different branches developed in different directions. One could speculate on what would have happened here, if the earth had not collided with an asteroid or comet about 65 million years ago. Would the earth have been inhabited by intelligent dinosaurs, or perhaps intelligent birds rather than humans?

So the branches would aim at very different intelligent species: humans here, dinosaurs in another, trolls, elves, intelligent insects, centaurs, Donald Ducks, or even intelligent trees in some branches. All the branches were developing at different rates according to possibilities for the life in each individual branch.

Super extinctions

At some time, a brain complex enough to handle consciousness appeared in one of the potential universes. Either, powerful consciousness developed inside the brain, or the brain became efficient and intelligent enough, to connect an existing external consciousness to matter. The potential universe, in which we live was first to reach that state. Suddenly, the universe had a conscious observer looking out towards the surroundings. Instantly, the global wave function had to collapse, and the universe went into a definite state. Time could not go back again beyond that moment. A unique universe and a specific direction of time became real.

Out of the myriad potential universes, merely one survived. Or to be more accurate, merely one group of potential universes continued to exist. Due to the uncertainty relations, there still remained a huge number of potential universes, but compared to the number immediately before the collapse, the number was negligible, and all of them included a rapid route towards a human observer.

The extinction taking place was far more radical than any extinction found among the fossil records. There, traces remain telling about species that once existed, and then disappeared. But in the case of collapse of the global wave function due to occurrence of a human observer, no kinds of fossils could remain. The erased universes were erased not only from continued existence. They were erased from the history of the universe. No kind of trace remained. They were erased from ever having existed. The universe had chosen its history.

We had not only survival of the fittest, but survival of the fittest and fastest. This is what Super Darwinian Evolution is about.

In a way, this resembles many kinds of phenomena found in nature. A female fish produces ten thousands of eggs. Most of them become little fishes, but just two out of the ten thousand survive to become mature individuals. All the other perish in different ways. It is remarkable that nature is able to make just enough survivals to keep the fish population essentially constant.

Similarly, after ejaculation during human intercourse, millions of sperms participate in the race towards the egg. Each of them strive to be fastest. One of them will reach the egg a tiny fraction of a second before anyone else. Within milliseconds, the egg changes its membrane, to become impenetrable for all other sperms. The one successful will give rise to a new human, while the millions of losers will die and hydrolyse into their monomeric components.

So it is nothing unusual or very remarkable with the need for a huge numbers of potential universes to evolve and then disappear in order to produce one real universe inhabited by humans.

Falsification

When a theory is launched, it is desirable that criteria can be given, that would falsify the theory if one or more of the criteria are found to be fulfilled. If the theory stands one or more falsification tests, this does not grant the theory to be correct. Similarly, if a theory makes predictions that turn out to be correct, this is no evidence for the theory to be correct. The theory of relativity as well as theories on quantum physics have both turned out to correctly predict the results of large numbers of experiments. Nevertheless, one of them or both have to be wrong, as they give contradictory predictions under certain circumstances, e.g. at very small distances.

The theory of super Darwinian evolution, can be falsified in at least three ways. The first, and conceptually easiest is that if one is able to find an intelligent and conscious species somewhere else in the universe, the theory is probably wrong. Conceptually, this is easy. Meeting one would be an example. And it is easily seen that such species should not be there, as all virtual universes leading to one, would have been erased from history in the moment there existed a human observer. Practically, finding such a species is very difficult. During decades, search for exo planets and extra terrestrial life has been performed. The results are discouraging. Among thousands of planets found, there are a handful that possibly could have environments in which life would be possible. None of them can be said to be even similar to the earth. Similarly all attempts to receive radio signals originated from intelligent species have been failures so far.

The second way to falsify the theory would be to prove that consciousness is not involved in the collapse of the wave function. As this collapse is a cornerstone of the theory, it cannot survive such a finding. There is, however, nothing found so far, that makes this plausible.

The third condition would be if it can be proven that no collapse actually happens. There exist theories of that kind. An example is Everett's multiverse theory. According to that theory, the universe splits in several parallel universes each time there is a possibility for more than one outcome. So far, the contents of the theory is similar to that of virtual universes described above. The difference is that in Everett's theory, the universes continue to exist after the observation, but they become isolated from each others. Also, the theory does not clearly state the difference between an observation and other kinds of interactions.

Another theory that does not have collapse of the wave function is Bohm's theory of pilot waves. In this theory, it is assumed that all variables describing a particle are exact. There do not exist any uncertainty relations in the particles themselves, but the values are externally hidden, so viewed from outside, there is an illusion of uncertainty. Such theories avoid one problem by introducing one or more other, and possibly more serious.

If such a theory is found to be correct, the super Darwinian theory is more or less wrong. In the case that the multiverse theory is correct, all the kinds of evolutions described above would be real, but there would not be more than one intelligent species in each universe. So far, there is no evidence against collapse of the wave function, and all theories without such a collapse have in themselves consequences that are even more strange.

Conclusion

Quantum physics describes the universe and its components in ways that are so far from our everyday experience, that it is far stranger than any earlier imagination, including philosophies, myths, or even fairy tales. To a large extent, it is still unexplored, and more surprising facts could be expected to be found in the future.

The Super Darwinian theory for origin of life, and its evolution, gives a reasonable explanation to the astonishingly rapid rate at which evolution has taken place. Unfortunately, there is no known way to verify the parallel development of the universe along innumerable paths, one of them leading to the universe in which we are living, and to ourselves. As mentioned above, this is impossible, as the past of the universe was chosen when humans appeared on the earth. So the alternative histories do not exist any more, and have never existed. No alternate fossils. They are erased from ever having been along.

As far as is known, there is no direct way to prove correctness of the theory. As mentioned above, there are ways to falsify it. Most promising, probably, is the search for extra terrestrial civilizations.

So according to my view, this search is of major importance, as each failure to find one increases the probability for the theory to be correct.

If the theory is correct, new questions arise. The Super Darwinian theory may be interpreted in terms of the universe being a huge quantum super computer programmed for finding a way to couple consciousness to matter. It worked at an incredible speed along innumerable parallel processes for 14 billion years until it found the solution of the problem. Then it stopped, to present the result, and here we are.

This raises new questions. If the universe is a kind of computer programmed to find us, then, we are the purpose of the universe. This is amazing. For centuries, mankind has been removed from the centre of the universe, to a tiny planet in the outer regions of one galaxy among billions. Now, we apparently are back again. Not merely back into the centre of the universe. Our role has increased to being the purpose of the entire universe.

So who did the programming? And why? Throughout history, people have felt messages telling that Someone even outside the universe has a purpose with mankind. Could such messages tell us something important? Could future scientific studies of consciousness lead to a better understanding of its source, and its location, if location is a correct word?

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