PART 2A REVISION AND EXPANSION of Part 1

In our search for the Origin of Life we have discovered:

Before 1861: People observed living things apparently generated from non living matter. This gave rise to the idea of **Spontaneous Generation.** Such people did not believe matter could become live by the action of the **Natural Properties** alone. They believed such **Spontaneous Generation** was due to the influence of original instructions or **Outside Information** left in the environment after the original creation by God.

This view of Spontaneous Generation can be summarised in the formula:

$$\text{Matter} + \text{Energy} + \text{Time} \xrightarrow{\text{Outside information}} \text{Life}$$

In 1861: Pasteur's experiments proved Spontaneous Generation was impossible under present circumstances. There is no remnant **Outside Information.**

In 1859 Charles Darwin proposed the theory of evolution of living organisms but did not seriously address the origin of life. One implication of his theory was that the original life form was **Spontaneously Generated** by **Natural Properties** and **Processes** of the earth system.

In 1924 Oparin, a Russian atheist and communist believed life must have arisen in the past by organic molecules combining to form life due to their **Natural Properties**. He was proposing a new form of **Spontaneous Generation**. Since **Spontaneous Generation** is not possible under present conditions, Oparin claimed different conditions must have existed in the PAST. No **Outside Information** was being applied to the system.

The formula for this view of Spontaneous Generation of life is:

$$\text{Matter} + \text{Energy} + \text{Time} \xrightarrow{\text{Natural Properties}} \text{Life Form 1}$$

After life was spontaneously generated on earth it evolved into many new life forms due to **Natural Properties** and **Processes** of the universe, as per the formula:

$$(\text{Life Form 1} + \text{Matter}) + \text{Energy} + \text{Time} \xrightarrow{\text{NP}} \text{Life forms } L_2 + L_3 + L_4 \text{ etc}$$

In 1953 Stanley Miller took up the challenge of spontaneously generating life molecules on a 'primitive earth' using only the **Natural Properties** of the primitive earth system. He made amino acids as per the formula:

$$\text{Matter} + \text{Energy} + \text{Time} \xrightarrow{\text{NP}} \text{Amino Acids}$$

Millers experiment had, and still has, a strong impact on the scientific world as shows in a quote from a still widely used high school science textbook: *"Do those experiments suggest a way in which life might have originated in the distant past? Yes..."*

(Reference: Web of Life, 6th edition , p349)

HOWEVER...
Miller's experiment produced a mixture of 50% left and 50% right handed amino acids. Life protein consists of 100% left handed amino acids. After death 100% left handed protein breaks down until it eventually consists of approximately 50% LH and 50% RH amino acids. The **Natural Property** of a pure solution of left handed amino acids is to move towards a 50/50 LH/RH amino acids mixture.

Because of the Natural Properties of amino acids, Miller's experiment produces only molecules which simulate the 50/50 after death state, therefore Miller's experiment is irrelevant to the origin of life.

Pasteur's experiments showed separation of a 50/50 mixture of tartrate crystals into individual left or right handed crystals required manipulation by supplying **Outside Information** which is not a natural property of the system. From Pasteur's day to the present, no natural property of amino acids has been found which enables a mixture of amino acids to become only left or only right handed. Every LH/RH mix of organic molecules discovered has required the addition of outside information to separate the molecules into pure substances.

PART 2B - RNA, DNA and THE ORIGIN OF PROTEINS

Amino Acids for Body Proteins

When you eat food containing protein, it is broken into separate amino acids in your stomach and small intestine. The amino acids are then absorbed into your body by passing into the cells which line the small intestine. These cells then pass them via your blood stream to other cells where the amino acids are used to make new proteins, eg. to build muscles when you exercise.

The Dead Sardine Problem

Foods high in protein include meat and fish. These are usually dead when you eat them but because they were recently living their protein consisted originally of exclusively left handed amino acids. After death the 100% left handed amino acids slowly begin to change to a mixture of right and left handed amino acids. If some high protein sardines, were kept for a very long time before they were eaten, they would contain some right handed amino acids. When you eat some of these long dead sardines, your body simply rejects the right handed amino acids and absorbs only left handed ones. How is this achieved?

Molecules of the food we eat are absorbed by passing through special channels on the surface of the small intestine. These channels only allow correctly shaped left handed amino acid molecules to pass through. Right handed amino acids, which have only a very tiny difference in shape, cannot pass through the channels and are eventually eliminated from the body.

How can the channels be so selective?

The channels are made of protein. Life forms use at least twenty different amino acids all with different chemical properties. When lined up to form a protein, the chemical interactions between different amino acids make the protein chain of amino acids twist and fold to give the channels a very precise shape through which only left handed amino acids can pass. We have previously seen that sorting right handed and left handed molecules requires **Outside Information** applied to a system. The body builds absorption channels which force the separation of right and left handed molecules, using proteins made according to instructions on the RNA. The RNA supplies **Outside Information** to the amino acids to make these proteins.

RNA was the subject of the quote from Time magazine:

"*And although Miller's famous experiment produced the components of proteins, more and more researchers believe that a genetic master molecule - probably RNA - arose before proteins did." (p71)...."It was", says planetary scientist and White House Fellow, Christopher Chyba, "a beautiful picture." "Unfortunately", he adds, "it is probably wrong." (p73)*

(Reference: *Time* October 11, 1994 p. 71,73)

Those scientists who are now asking: was RNA the first life molecule to evolve, are really asking could RNA have been formed by **Natural Properties and Processes**? Let's apply what we have already learned about the effect of the **Natural Properties** of biological molecules to **RNA.**

What is RNA?

RNA is shorthand for **Ribonucleic Acid** - a complicated molecule whose name means:

Ribo: it contains **Ribose**, a type of sugar (like glucose or fructose)
Nucleic: it is associated with the **Nucleus** of the cell
Acid: it is a type of **Acid**

Different Molecule - Same Problem

For RNA to have arisen before proteins, then RNA must have formed spontaneously through the interactions of Matter, Energy and Time due to the **Natural Properties** of the solar/earth system. However the Ribose or sugar part of the RNA molecule (like amino acids), can exist as left or right handed forms. Only **RIGHT HANDED SUGARS** are found in living things. If you eat left handed sugars they pass through the intestine without being absorbed. If you think this sounds like a good idea for a diet which would allow you to eat lots of sweets, don't try it! Unabsorbed sugars in the bowel give you diarrhoea.

Since the 1960's, experiments involving electron irradiation of gas mixtures of methane, ammonia and water have spontaneously produced Ribose Sugars. In every case the sugars, produced using the Natural Properties of this system, have been approximately 50/50 RH/LH mix.

$$\text{Matter + Energy + Time} \xrightarrow{\underline{\text{NP}}} \text{50/50 Sugars}$$

Experiments like **Miller's** using a spark, have not been effective at producing sugars.

All experiments to date have shown the only way to produce 100% RH sugars is to use external manipulation by the supply of **Outside Information** which is not a **Natural Property** of the system.

$$\text{Matter + Energy + Time} \xrightarrow{\underline{\text{OI}}} \text{100\% RH Sugars}$$

Since the same problem occurs for RNA as for amino acids and protein. RNA cannot have arisen spontaneously due to **Natural Properties** because the Ribose of RNA is exclusively right handed - a situation which does not occur spontaneously.

Secondly, RNA is a relatively unstable molecule and even in the protective environment of the cell. It usually lasts only from twenty minutes to several hours before it disintegrates.

Thirdly, RNA is more complicated than protein consisting of chains of molecules called **Nucleotides**. Each **Nucleotide** consists of three parts - a Ribose sugar, a phosphate, and a base. It is the arrangement of four different Nucleotides along the length of the RNA which contains the coded information for making proteins. But if RNA cannot happen spontaneously, where does RNA obtain the information code which enables it to select and join the correct amino acids to make proteins?

The information on RNA comes from a larger and far more complicated molecule named **DNA** which stands for **DeoxyriboNucleic Acid**. eg.

$$\text{DNA} \xrightarrow{\text{Information copied}} \text{RNA} \xrightarrow{\text{Information used}} \text{PROTEIN}$$

DNA also contains a **Ribose sugar**, but the sugar has less oxygen in it, hence its name **Deoxy-ribose**. The information for making RNA is contained in the coded arrangement of nucleotides on DNA. The formula for making RNA using the information on DNA is:

$$\text{or} \quad \text{Matter (base + phosphate + sugar) + Energy + Time} \xrightarrow[\downarrow \text{DNA}]{\underline{\textbf{Outside Information}}} \text{RNA}$$

Could DNA be the first molecule?
To date no-one has suggested **DNA** could have been the first molecule to occur spontaneously via the **Natural Properties** of the solar/earth system. DNA is far more complex than RNA. In addition DNA consists of two strands neatly aligned with one another, then coiled into a helix. DNA carries the information for the living creature to make all other biological molecules it needs, therefore it is often called the **master genetic code**. In addition, new copies of DNA are made when reproducing the next generation of living creatures. By this means the 'coded life' information is passed on.

How does DNA do this?
"*It was soon discovered that DNA does not replicate in isolation but rather requires a number of special enzymes to unwind the double helix and synthesise new DNA strands. The most important enzyme in this process is known as* ***DNA polymerase.".....***

"As DNA polymerase moves along the chain to attach the next molecule, part of the enzyme "proofreads" the work it has just done by checking the nucleotide pair to ensure that the proper base pairing has taken place. If an incorrect nucleotide has been inserted, this portion of the enzyme swiftly removes the nucleotide from the chain, and the molecule starts work over again."
Reference: Levine and Miller *Biology,* 1991, p 415

DNA cannot replicate the coded information it contains without the help of **DNA polymerase** - a **protein**, made from exclusively **left handed amino acids**, which takes us full circle in our search for the origin of life and the original life molecule. Does the existence of DNA polymerase help or hinder the theory of evolution which states that once the first life form arose, its natural properties enabled it to change into new and more complex life forms? We have gone from a situation where there was once no DNA, or no coded information, to a situation where DNA exists in a multitude of different Information Codes for different creatures.

$$\text{Matter} + \text{Energy} + \text{Time} \xrightarrow{NP} \text{Life Form 1}$$

$$\text{Life Form 1} + \text{Matter} + \text{Energy} + \text{Time} \xrightarrow{NP} L_{2A} + L_{2B} + L_{2C} \text{ etc.}$$

or $$\text{No DNA code} \xrightarrow{NP} DNA_1 \text{ code} \xrightarrow{NP} DNA_{2A} + DNA_{2B} + DNA_{2C} \text{ etc.}$$

HOWEVER...
One function of **DNA polymerase** is to ensure the information on DNA is copied correctly. *"If an incorrect nucleotide has been inserted, this portion of the enzyme swiftly removes the nucleotide from the chain, and the molecule starts work over again."* But since the information for making DNA polymerase comes from DNA via RNA, it is obvious that DNA contains an **Information Control Code** which ensures it produces its own kind of DNA.

Which brings us to a **CATCH 22!** How can a DNA code which evolved by repeated changes, due to **Natural Properties,** have a **Natural Property** coded to prevent change in the DNA?

COMING IN PART 3
Could such a sophisticated code as DNA evolve due to the **Natural Properties** of the system? We will consider the properties of known codes, how they originated, then compare them to biologic codes such as DNA.

NOW COMPLETE WORKBOOK 2 BEFORE COMMENCING PART 3