

Life on Earth - Two Faiths – 2

Cells are now known to be **VERY COMPLEX** things - far more complex than when Darwin first put forward his theory of evolution. Scientists have studied cells in great detail to see if they can **find out how** they carry out the functions of life - **constructing** large molecules from small ones, and **using these** to grow and reproduce themselves. Their findings were summarized in the *Scientific American*, "**Anatomical and chemical views of the cell have now converged to show that it is not a droplet of protoplasm, but a highly organized molecular factory.**"

The inside of a typical cell contains **two main types** of large molecules. First there are **PROTEINS**. There are **hundreds** of different kinds of protein molecules in cells, but they have one thing in common: they all consist of a long chain of much smaller molecules called amino acids.

Although more than 100 amino acids occur naturally, **only 20** are used in all living organisms for **protein synthesis**. The differences between individual kinds of proteins are due to the differences in **sequence** of some combination from these 20 amino acids in the chain. Think of the complete molecule as a chain of different colored beads, and the individual beads as the amino acids. The important thing about proteins is that, **for a given protein**, all these amino acid 'beads' **must be in a special sequence**, otherwise the protein cannot do its job.

For example, **hemoglobin, the protein found in red blood cells, has about 600 amino acid units in its molecule**. The **type and order** of these units is so important that if only two of these six hundred are substituted by another type, the protein **cannot work** properly, causing in humans a sometimes fatal disease called sickle cell anaemia.

In 1978 Riggs and Itakura, after **ten years'** effort, managed to make one protein in the laboratory, insulin. It is one of the **smallest** proteins, containing only about **fifty** of the amino acid 'beads' in its chain. Other protein molecules are **ten or a hundred times bigger**. The number of different patterns you could make in a string of fifty beads having an assortment of twenty colors indicates why it took scientists ten years to first decipher the sequence of the amino acids and then synthesize the protein. **Certainly this could never have occurred by chance**. Yet the microscopic cell can probably produce this substance in as many seconds as the scientists took years.

What is **the function** of the proteins in the cell? Some of them are used to form **the basic structure** of the cell, and others are used to **control** the various **chemical processes** that go on in the cell. So **proteins - accurately made proteins - are essential for life**.

Large molecules of the **second type in the cell are called NUCLEIC ACIDS**. As the name suggests, these are found mainly in the **nucleus** of the cell. Their molecules are also in the form of a **chain**, but it is **very much longer** than the protein chain and is composed of a different kind of unit. Scientists now know that these nucleic acids hold **the key to life**.

They have discovered that down the length of these chains there is, in **coded form**, a complete **set of instructions** for assembling **in their right order** the amino acids of **all the proteins** the cell needs. Proteins determine both **the structure** of the cell and **the way the cell works**: the nucleic acids contain **the instructions** for the **synthesis** of the proteins which make up the cell.

At the same time **the nucleic acids depend on proteins for their formation and their activity**. This **interdependence** of protein and nucleic acid is one of the reasons that makes the **chance** development of a cell so difficult to imagine. More next time, God willing.