

earth. For while the light intensity from an individual star *decreases* as the reciprocal of distance squared, the number of stars in an infinite universe *increases* as the distance squared. The two effects cancel each other, and therefore the observed intensity becomes proportional to the "radius" of the universe. For a steady state model, the intensity should be very great (even assuming some blockage of light by other stars). On the other hand, if the universe is finite in time and expanding without continuous creation, then one expects the night sky to be dark. Once again the steady state theory does not fare well against the observed phenomenon.

On the basis of this experimental data, the big-bang cosmology is assumed correct and we turn to a study of the initial moments. ■

(To be continued)

AN ANALOGY USING THE CELL

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The modern concept of the cell has provided us with a perfect example of a trine in nature. The trine is composed first of the cell nucleus, second the enveloping cytoplasm, and finally the substances released from the cell into the body as a whole. The cell is a system in which an abundance of material forms can give an analogical, ultimate expression to knowledges and ideas contained in Swedenborg's philosophical works and in the Word.

As one example, in his work entitled *Rational Psychology*, Swedenborg wrote of a series comprised of a pure intellect, a mixed intellect, and the consequent uses of thought. The pure intellect is that which "comprehends simultaneously that which thought or our rational mind comprehends successively" (132). Within the pure intellect therefore exist, simultaneously, both the causes and the effects of all things subsequent to it. It does not learn but already knows and is "as perfect in the embryo and infant as in the adult and old man" (134). The pure intellect is above the conscious mind and below the spiritual.

The next in the series is the mixed intellect. Within this intellect the ideas of thought are formed. But while both cause and effect are comprehended by the pure intellect at the same time, they appear in the mixed intellect in a successive order.

Finally, the things which are thought are put into action as forms

of use in society as a whole.

The science of genetics has taught us that all of the knowledges needed for the formation and maintenance of the human body are held within the nucleus of each and every cell within the body. It is therefore the nucleus which comprehends the entire form of the body with its myriad parts and it does so simultaneously. This total comprehension is as perfect in the embryo and the infant as in the adult and the old man. From this it is easy to see a direct analogy between the pure intellect of the mind and the material nucleus of the cell.

The cytoplasm, which encompasses the nucleus, is where the nucleus and the extracellular environment meet. The cytoplasm draws into itself substances from the environment. These are there ordered into forms useful to the cell and to the functions which it subserves to the rest of the body. This cytoplasmic ordering process is done in a sequential manner with information, or knowledges, being brought from the nucleus only as it is needed. The forms being made from the external substances are analogous to the ideas of thought arising from the ordering of external sensations. The ideas of thought are formed in the mixed intellect.

The final step, the expression of uses outside of the cell, is analogous to the expression of thought into forms of use in society.

The usefulness of this analogy becomes apparent when it becomes an aid in clarifying other concepts presented by Swedenborg. Referring again to the *Rational Psychology*, here number 134, he uses the pure intellect-mixed intellect series to resolve the problem of connate versus acquired ideas. Swedenborg's answer is that both positions are correct. Ideas are connate in the pure intellect, but the pure intellect is above the natural or conscious mind. Ideas must be procured from the pure intellect into the mixed intellect, or conscious mind, and this is done only by means of external or sensory experience.

This is exactly what is found in the living cell. The cell experiences the fluid world wherein it lives; and if, for example, a hormone should impinge upon the cell, its sensories in the cytoplasmic membrane respond by altering the cytoplasm. The alteration is generally effected through the release of an enzyme that had previously been sequestered in or near the membrane. The nucleus detects the altered state and, immediately comprehending its meaning, responds by releasing the appropriate information back into the cytoplasm. The cytoplasm uses its new knowledge, obtained not from outside the cell but rather from within, to respond to the

environment in an appropriate fashion. Here is, then, a clear example of sensory experience eliciting knowledge and not imparting it.

Another example of the cell analogy's usefulness is in the problem of memory. For this purpose a special cell type, the lymphocyte or white blood cell, will be used.

A new discovery has been made in genetics which disputes the idea that the information storing substance, DNA, held within the nucleus is the static and unaltering constant it was once thought to be. Indeed, it has been found that in the white blood cells segments of DNA are shifted from place to place along the chromosomes. Furthermore, a relationship between this shifting activity and the white blood cells' immunological activity has been demonstrated. When a substance foreign to the body (an antigen) enters the blood stream and encounters a white blood cell, it interacts with the cell's external or cytoplasmic membrane. What exactly this antigen-membrane event involves is not fully understood; but it has a profound effect on the cell itself. The lymphocyte cytoplasm is altered by the sensory experience, or the antigen-membrane event, through the release of a special substance from its membrane. This substance changes the state of the cytoplasm. Again, the nucleus comprehends the altered state and responds by causing the cytoplasm to produce, and arrange on the external membrane, sensories specifically designed to detect the antigen in question. It is important to note that the antigen does not enter the cell. The knowledge which enables the cytoplasm to construct the new sensories comes from the nucleus alone, with the result that the cytoplasm, and in particular the cytoplasmic membrane, is permanently altered and imbued with a new structure which allows it to "remember" the antigen once it has experienced it. The memory is therefore brought forth from within by means of the senses.

As noted above, the DNA is also altered. But there is a difference; for nothing new is formed within the nucleus. There is rather a rearrangement of what was already present in the structure. The rearrangement of the DNA constitutes a discretely different form of memory.

These are but two examples taken from a countless number of possibilities in which the living cell may be seen as a trine and used as an aid to our understanding. ■