THE TENDENCY TOWARD PATTERNING AND ORDER IN MATTER AND IN THE PSYCHE

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Introduction

Throughout history man has envisaged a cosmogony, an account of himself and nature. This has invariably formed the very ground of his awareness. Unfortunately the contemporary myth of creation is incomprehensible to most individuals.* Its scope is so vast, its subject matter so outwardly oriented and impersonal, that modern man tends to feel threatened rather than to experience a oneness of existence. Since Galileo in the seventeenth century turned his telescope to the heavens, and Leeuwenhoek in the same century peered down through his primitive microscope at the minutiae, scientists have been delineating the forms of matter occurring in space and on earth with such impressive thoroughness that large numbers of people in our modern world have come to think of matter as the only reality.

In the early part of this century a countertrend appeared. Attention was directed to the subjective world of man. Of all the great pioneering psychologists—among them Freud and Adler—it was Carl Jung of Zurich who turned most unequivocally to this inner realm of the psyche. It was part of his genius to regard psychological data such as dreams, fantasies, recurrent mythological themes, *et cetera* as *empirical facts*, not merely as reflections of the outer world. He studied these data as other scientists study their artifacts, specimens and instrument readings. In so doing he made his great discoveries—the existence of the objective psyche and the presence of autonomous formative tendencies at work in the unconscious. Most scientists in other fields are still unaware of the importance of these discoveries, which are extremely meaningful for the future.

Several years ago an intelligent but highly agitated young woman of twenty-

* The term myth is used in a positive sense as something native, necessary and meaningful to man. A distinguished physicist, Herman Bondi, has said, "We would be foolish to regard our present theories as infallible or final. It is not the purpose of any scientific theory ever to be infallible or final or true. Its purpose is to be fertile." [1]

eight came to consult me. Jung's theories had been presented to her as dogma by a well-meaning older friend. The effect had been destructive rather than helpful. She reasoned that if autonomous forces in the unconscious were conditioning her motives and ideas she could not make responsible decisions. She could not live with the concepts, but neither could she give them up. In one of the hours when my patient was speaking of the theory of archetypes with bitter vituperation, I realized that, although I had experienced the reality of archetypal forces and was subjectively aware of their compelling nature, I had no conception of how they fit into the current world view. I needed to discover whether common ground could be found between these mysterious formative forces at work in the inner world of the psyche and those described in the outer world of the physical and biological sciences. It was necessary for me to reconnect with my past life as a biologist, before the time I entered the medical world to become, later on, a psychiatrist and analyst. I recalled what Jung had said:

> In my picture of the world there is a vast outer realm and an equally vast inner realm; between these two stands man, facing now one and now the other, and, according to temperament and disposition, taking the one for the absolute truth by denying or sacrificing the other.[2]

My patient and I could not afford to sacrifice our orientation to the outer realm of contemporary thought. After working on the origins of her personal problems within the matrix of the family in early life, she returned to the university to study the history of earth and man. I took up the challenge to attempt a *rapprochement* between my former studies in the empirical sciences and my present accumulated experience of the inner world of the psyche.

During the preparation of this work I often felt drawn to nature. I sat in a ravine in the forest where the mosses and ferns formed a carpet and the roots of the great redwood trees drank up water from the streambed. I needed to become one with this environment of earth and rock, stream and trees. I felt that I, too, was part of nature, that the formative and ordering tendencies which had created the ferns and the trees were also built into my body and into my psyche. In contemplating the ways of nature around me, and in becoming aware of the ways of nature within me, perhaps I could approach the ground of my being and begin to discover a sense of oneness in existence. It soon became apparent that the natural forces I was observing and the scientific data I was studying shared a common characteristic—a tendency toward patterning and order.

In this paper I shall focus attention not primarily on individuation but on the genesis of the *individual being*, on the background from which he has emerged and on the mysterious processes at work that have formed him.

The macrocosm

Figure 1 shows the misty middle star in the sword of Orion. It is not an actual star but a great nebula of interstellar dust and gaseous hydrogen. According to current theory areas such as this are the birthplaces of stars. The turbulent cloud of matter gradually condenses, under the influence of gravitational forces, into globular masses. In the hot, dense center of such a mass, nuclear reactions release large amounts of energy and a luminous star such as our sun is born.

The stars are clustered in gigantic concentrations, the galaxies. With the largest light-transmitting telescopes astronomers have now penetrated almost five billion light years into space, and with radio telescopes seven billion. (Light travels 186,000 miles a second—nearly ten times around the earth at the equator in one second. A light year is the distance light travels in a year at that speed.) At the outermost limits there are galaxies. The total number in the observable universe is estimated to be around one trillion.[3,4,5]

The galaxies appear in three main forms—as irregular clouds of dust and stars (*Figure 2*, upper left), as elliptical or globular concentrations of stars (lower left), or as spiral forms of varying shape (*Figure 2*, right). Eighty per cent are spirals. The Milky Way, the galaxy we inhabit, is a spiral form approximately one hundred thousand light years across, containing about one hundred million stars. Is it any wonder modern man tends to feel inconsequential?

Our immediate home, the solar system, was formed, according to current theory, from swirling dust clouds circling a star—our sun (*Figure 3*). When order had emerged from the chaos, nine spherical planets were revolving in a pattern around the central body. Modern techniques of dating, based on relatively accurate time clocks of radioactive decay in rock, place the creation of the earth with its orbiting moon about four and one half billion years ago.[6]

The microcosm

Let us now turn our attention from the reaches of space to the intimate structure of matter. Everything, whether solid, liquid or gas, is made up of atoms. Less than one hundred millionth of an inch in diameter, each atom is an ordered world in itself. It consists of a central nucleus of positive charge with planetary electrons of negative charge rotating around it. (Note the presence of opposites in this basic unit of matter.) Hydrogen, the simplest atom, is represented schematically in *Figure 4*. One electron circles about the nucleus. All of the ninety-two naturally-occurring elements that make up matter throughout the universe have been formed from this simplest element in fusion reactions at great heats.[4,7] As the number of electrons in rotation increases

For illustrations accompanying the paper on "The Tendency towards Patterning and Order in Matter and in the Psyche":

FIG. 1. Great nebula in the constellation Orion, faintly visible to the unaided eye as a fuzzy spot of light in the sword. (Courtesy Lick Observatory, University of California)

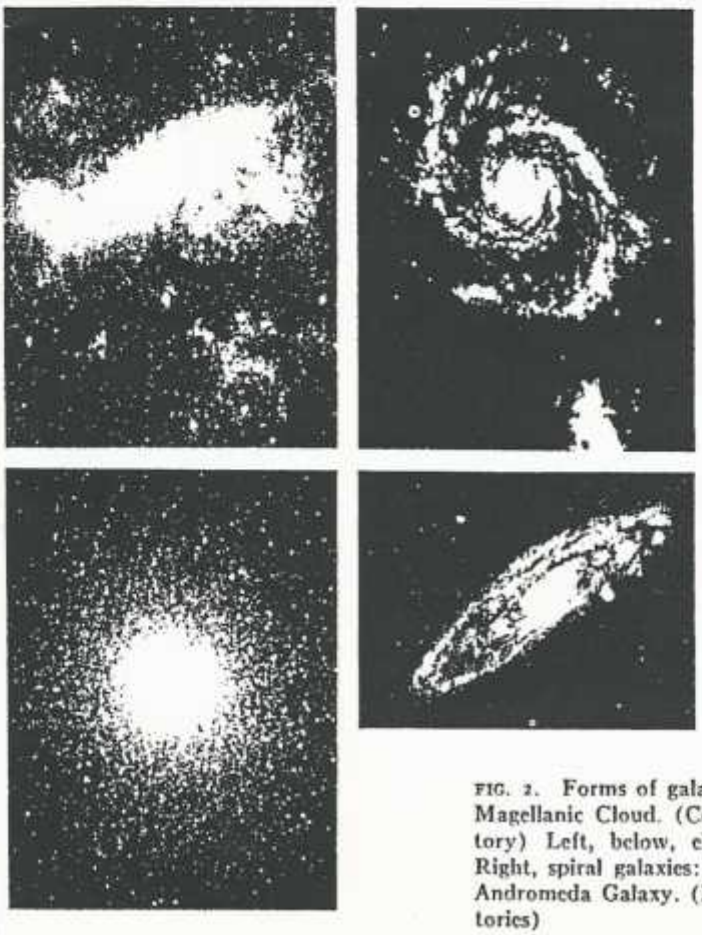


FIG. 2. Forms of galaxies. Left, above, irregular galaxy, Magellanic Cloud. (Courtesy Harvard College Observatory) Left, below, elliptical galaxy, Hercules Cluster. Right, spiral galaxies: above, Whirlpool Galaxy; below, Andromeda Galaxy. (Mt. Wilson and Palomar Observatories)

FIG. 3. Theoretical development of a planetary system. Above, cloud of interstellar gases; center, shapes beginning to appear; below, central star defined, with orbiting planets. (Matt Greene, Time-Life Books, *The Universe*, copyright 1966, Time, Inc.)

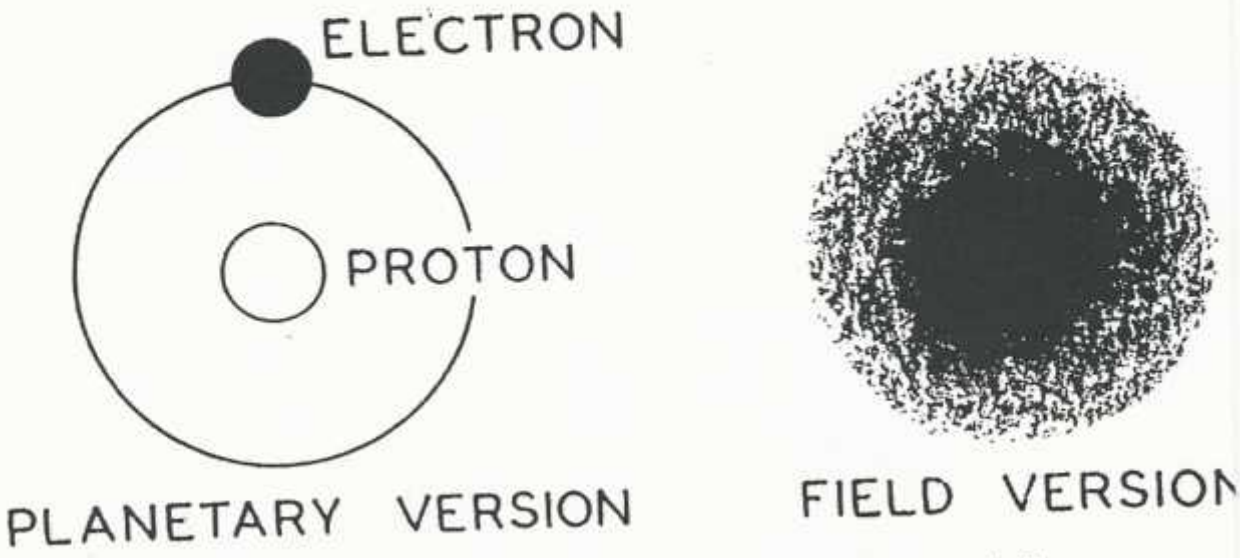


FIG. 4. The simplest atom, hydrogen, with one negative electron circling the positive proton (nucleus).

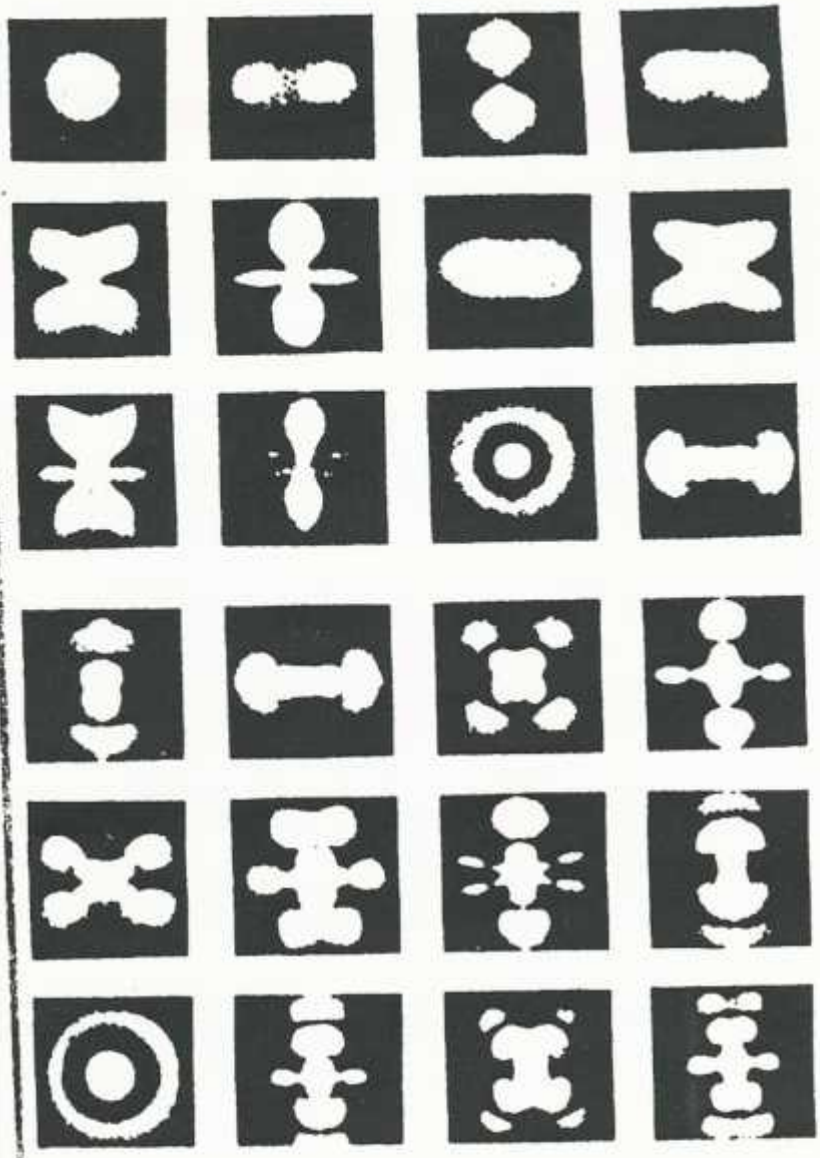
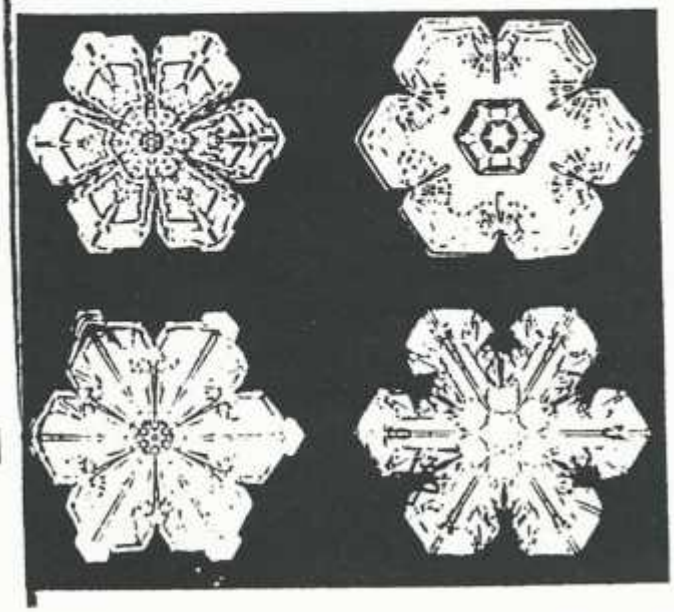


FIG. 5. Models of electron wave patterns. Single electron in hydrogen atom (top, left) forms a symmetrical, spherical field only in the ground state. When energy is added, the electron assumes the next higher pattern, in successive quantum states. When another electron is added to form a new element, that electron assumes the next higher pattern, and so on. (From *Knowledge and Wonder* by Victor E. Weisskopf; copyright 1962 by Educational Services Incorporated, Science Study Series; reprinted by permission of Doubleday & Co., Inc.)



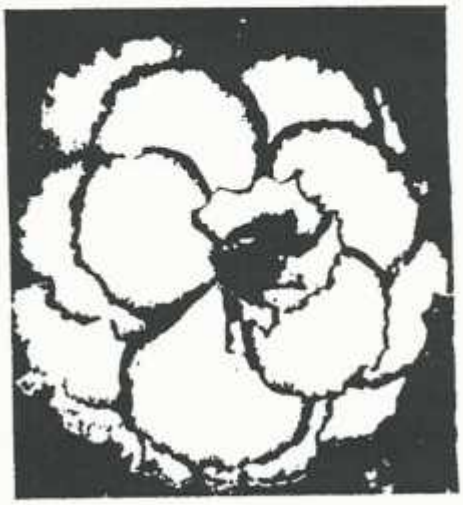


FIG. 6. Left, highly magnified snow crystals, formed of two elements only, hydrogen and oxygen, and always in a six-sided pattern. (From *Snow Crystals* by W. A. Bentley and W. J. Humphreys; courtesy Dover Publications, Inc.) Patterning is also apparent in flower on right.

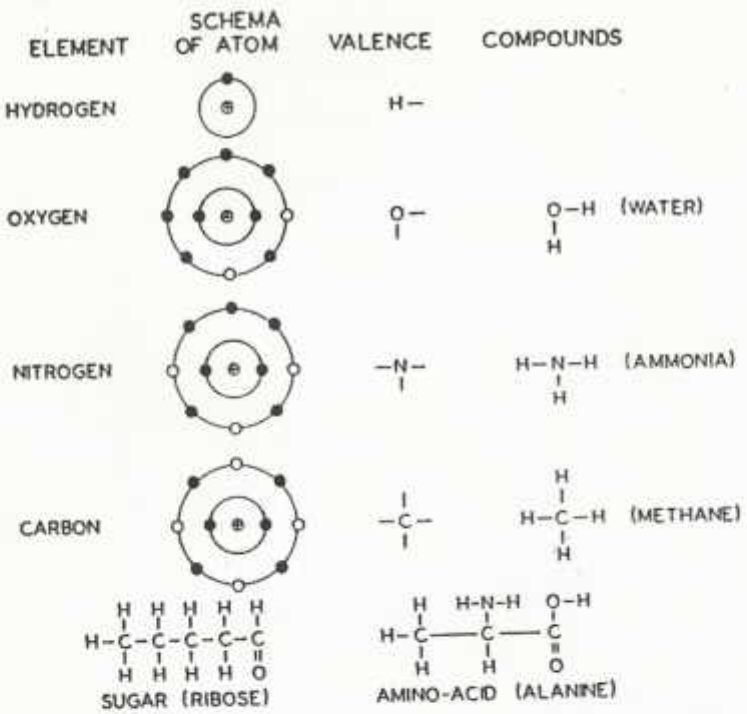


FIG. 7. Formation of organic compounds from the four basic elements.

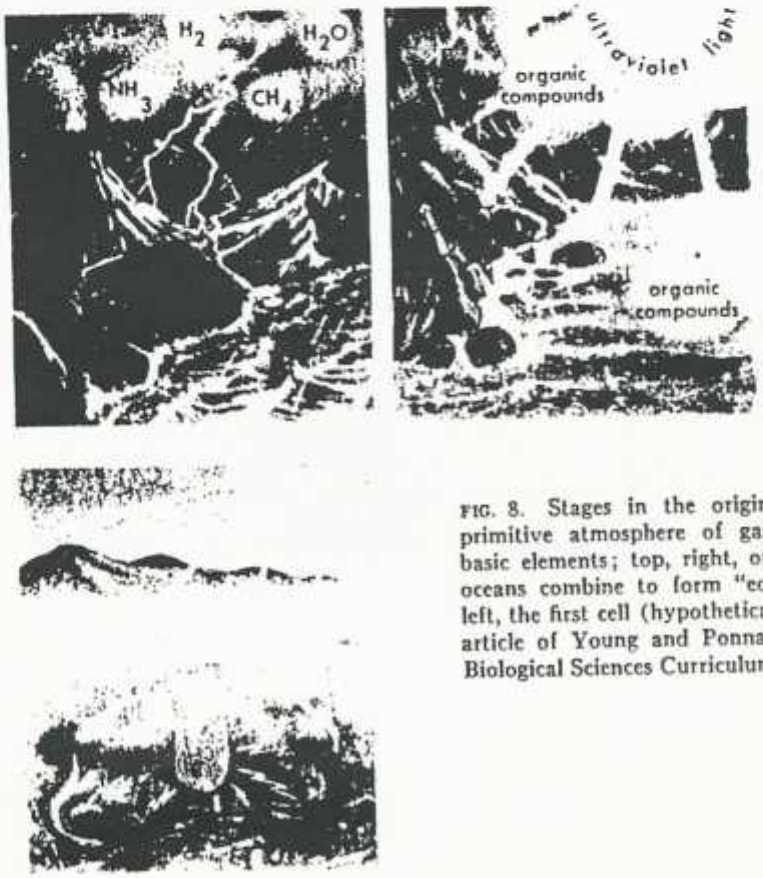
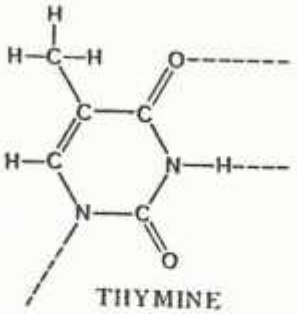


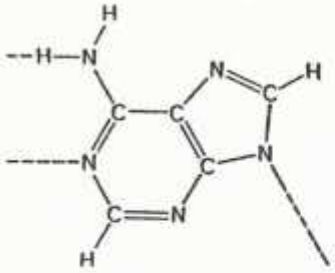
FIG. 8. Stages in the origin of life. Top, left, primitive atmosphere of gases formed by four basic elements; top, right, organic compounds in oceans combine to form "eobiotic soup." Lower left, the first cell (hypothetical). Selected from the article of Young and Ponnamperuma. (Courtesy Biological Sciences Curriculum Study)

PYRIMIDINES

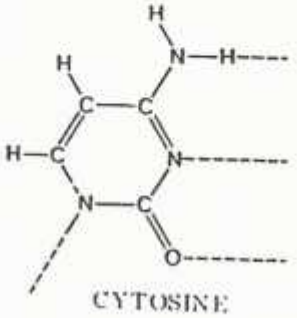
PURINES



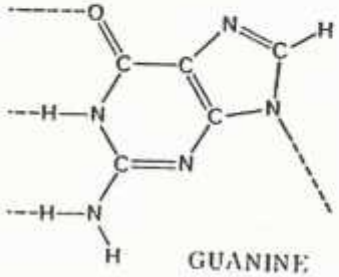
THYMINE



ADENINE



CYTOSINE



GUANINE

FIG. 9. These four compounds are the alphabet of matter. They combine with ribose and phosphoric acid to form DNA.

FIG. 10. DNA helix. The order of arrangement of the paired compounds is genetically determined, and differs for each living thing. (Matt Greene, Time-Life Books, *Evolution*, copyright 1964 Time, Inc.)

ADENINE LINKS WITH THYMINE

GUANINE LINKS WITH CYTOSINE

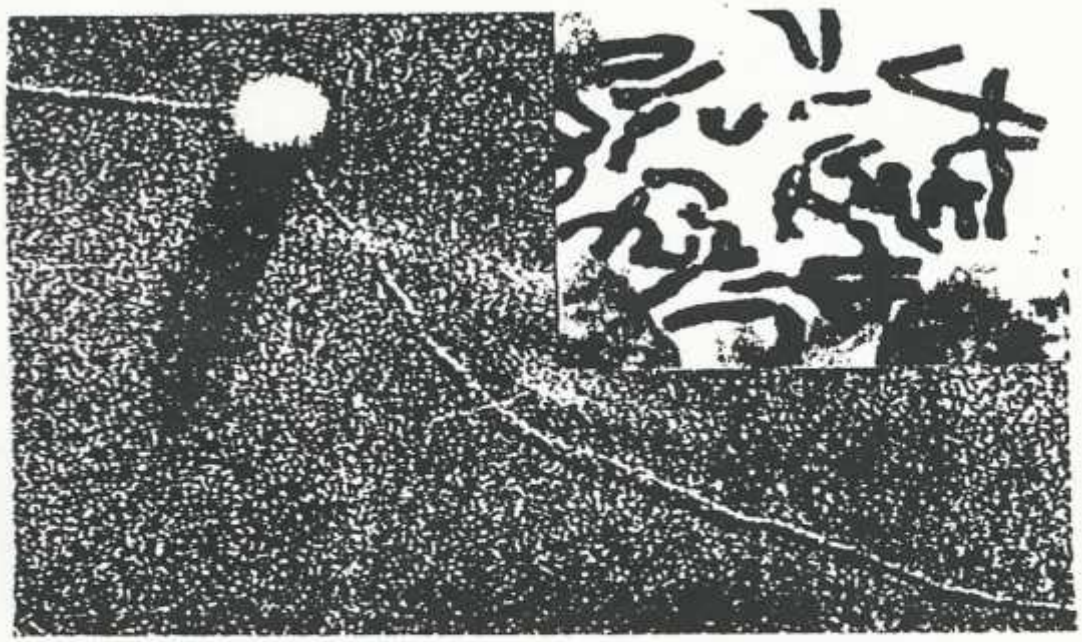


FIG. 11. DNA thread viewed with electron microscope. White sphere is size marker, 880 Angstrom units. (Courtesy Dr. Cecil E. Hall, Massachusetts Institute of Technology) Insert shows DNA tightly coiled in chromosomes, present in this form at the time of cell division. (Courtesy Dr. H. G. Callan, St. Andrews University, Scotland)

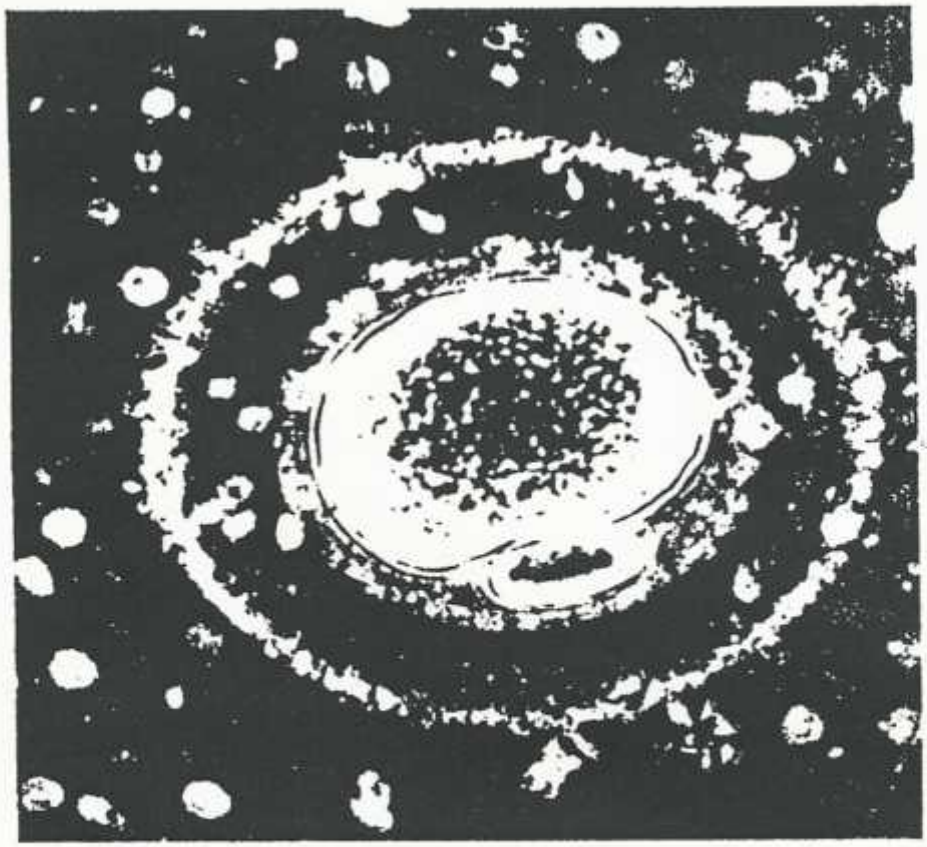


FIG. 12. Human ovum surrounded by spermatozoa, one of which will penetrate the egg, thus combining the DNA of both parents. (L. B. Shettles, *Ovum Humanum*, Hafner Publishing Co., New York)

FIG. 13. Human embryo at six and one-half weeks is one-half inch long. (Courtesy Time, Inc.)

FIG. 14. Fetus at 18 weeks is well-formed, about six inches long. (Courtesy Time, Inc.)

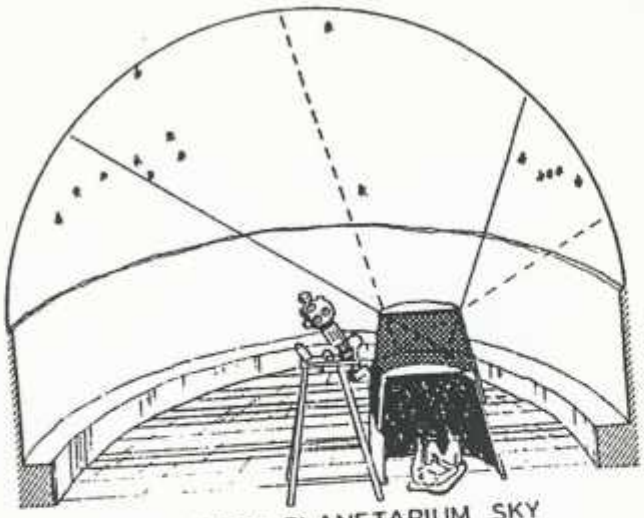


FIG. 15. Experiment with warblers under planetarium sky. Length of lines on lower charts represents proportion of time bird spent heading in various directions. (Adapted from "Celestial Navigation by Birds" by E. G. F. Sauer; copyright 1958 by Scientific American, Inc.; all rights reserved)

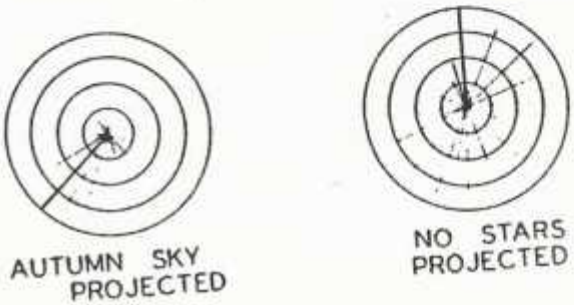
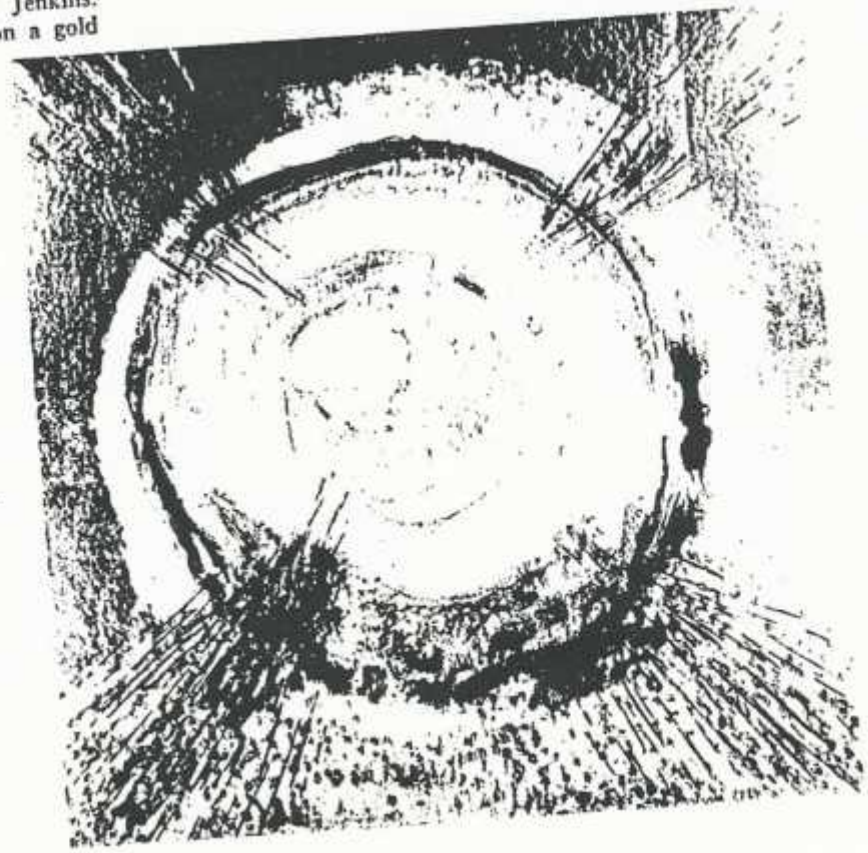


FIG. 16. Contemporary painting, "The Ovum," by Louisa Jenkins. (The original is in color on a gold background.)



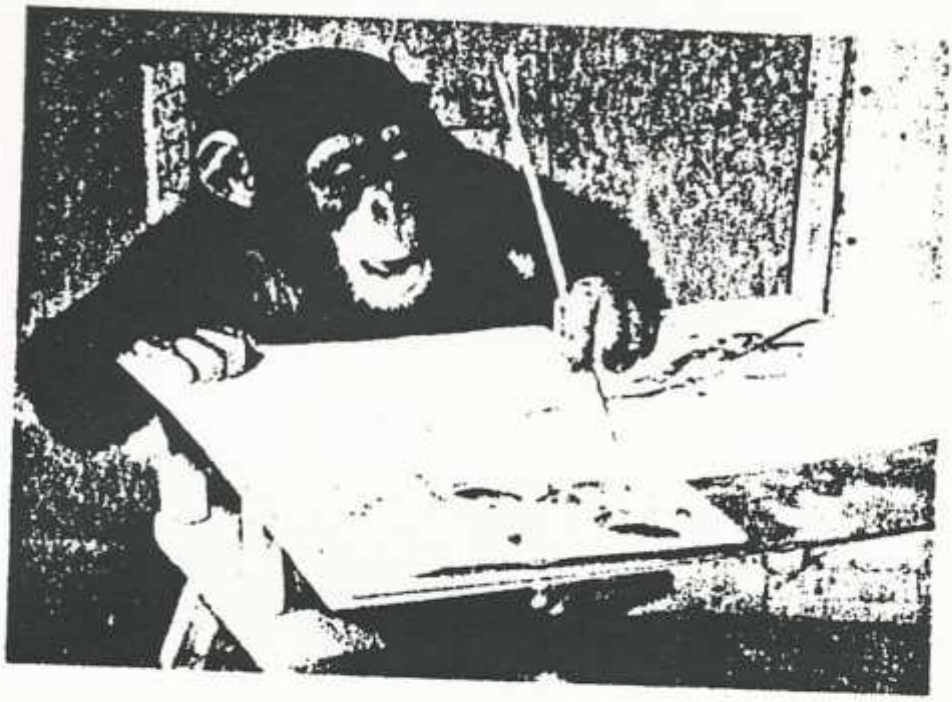
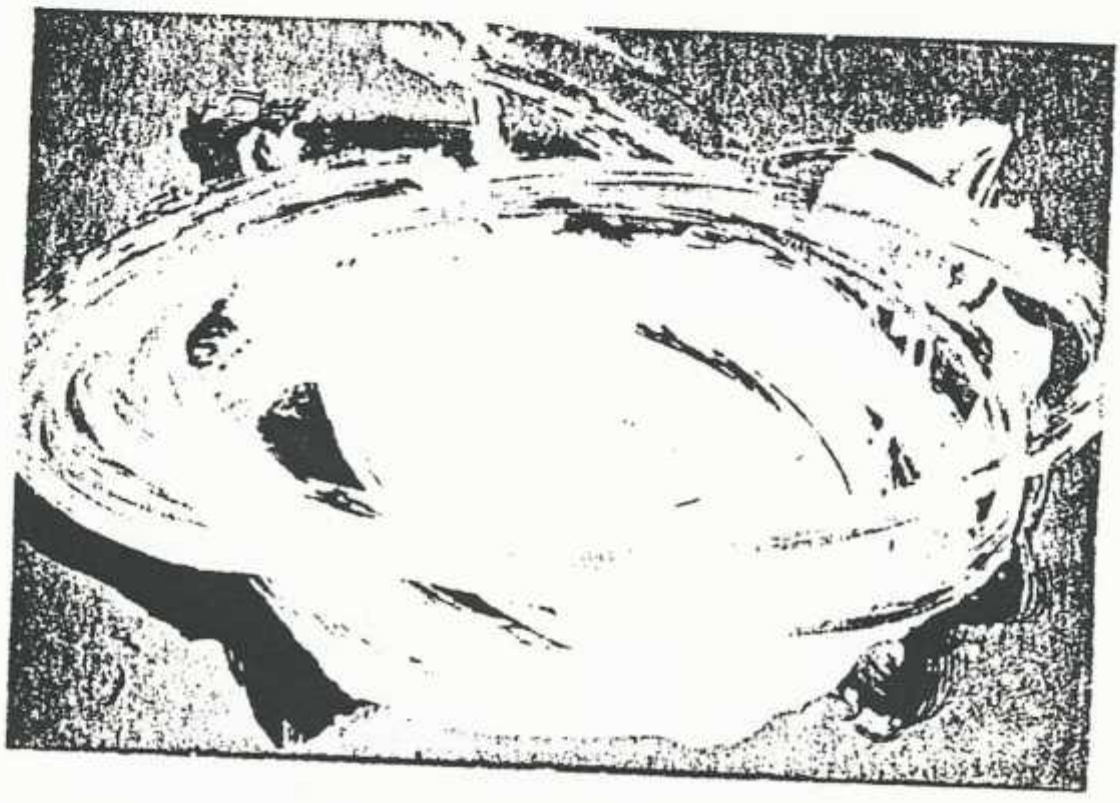


FIG. 17. Congo, an ape in the London Zoo, and one of his paintings. (Courtesy Desmond Morris)



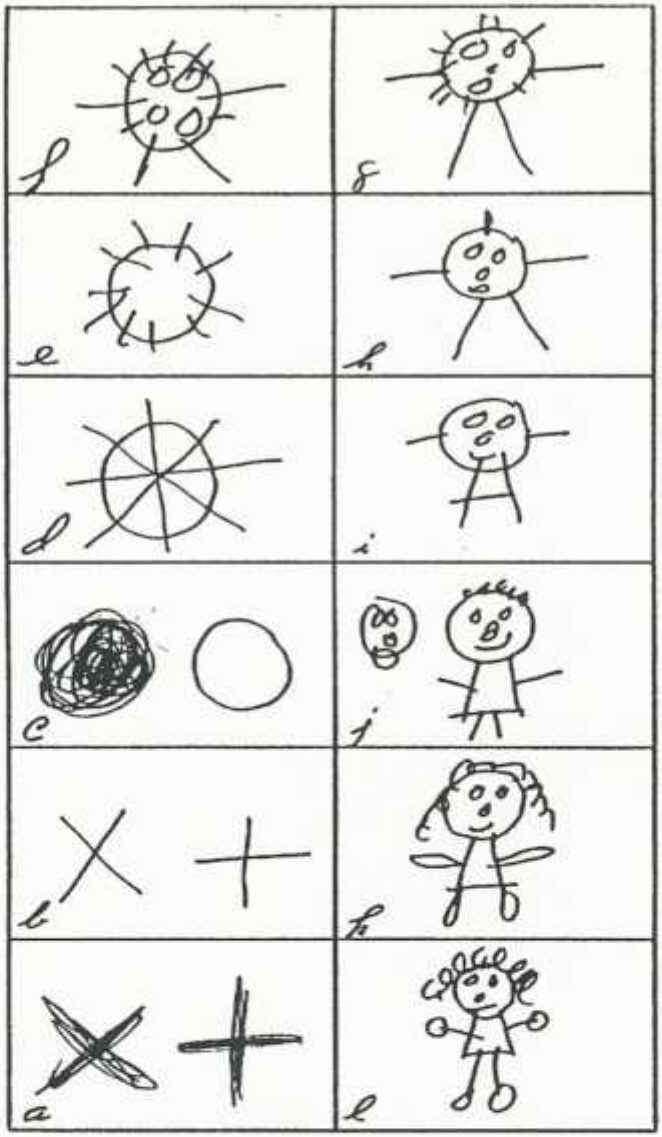
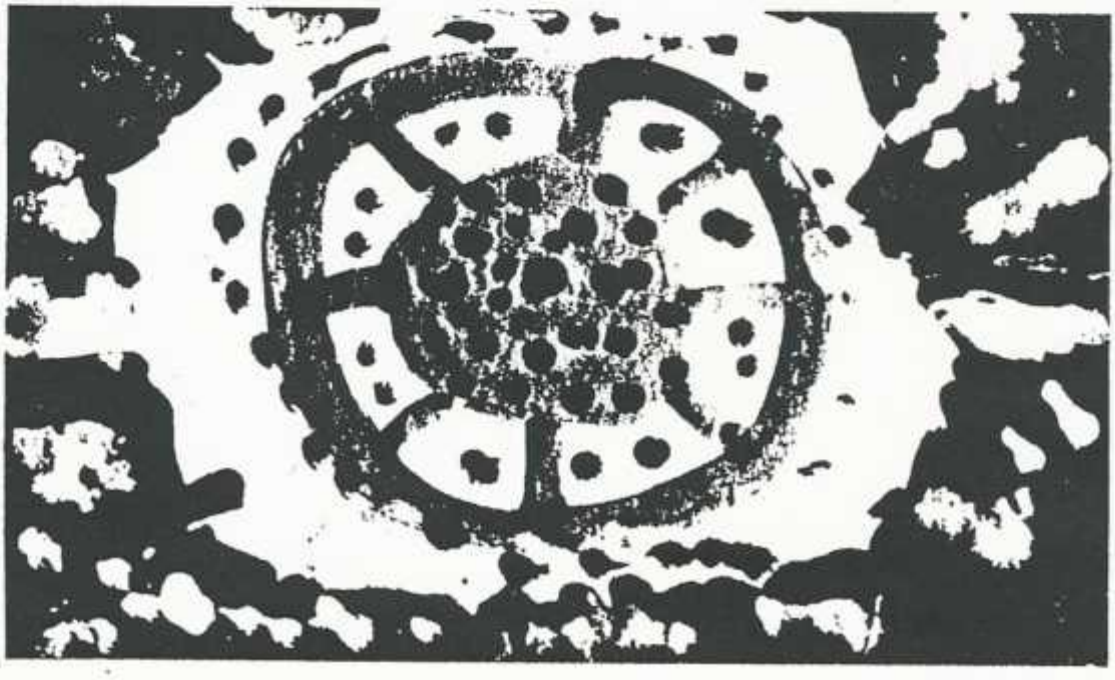


FIG. 18. Evolution of the human figure in children's drawings, shown in sketches drawn for the author by Rhoda Kellogg. The child progresses from "diagrams" (a, b, c) to "combines" (d, e) to "aggregates" (f), and thence to the human figure. In d, e and f, mandala forms are clear.

FIG. 19. Mandala painting by seven-year-old child in therapy. Note eight divisions of the circle. (Courtesy Routledge & Kegan Paul, Ltd.)



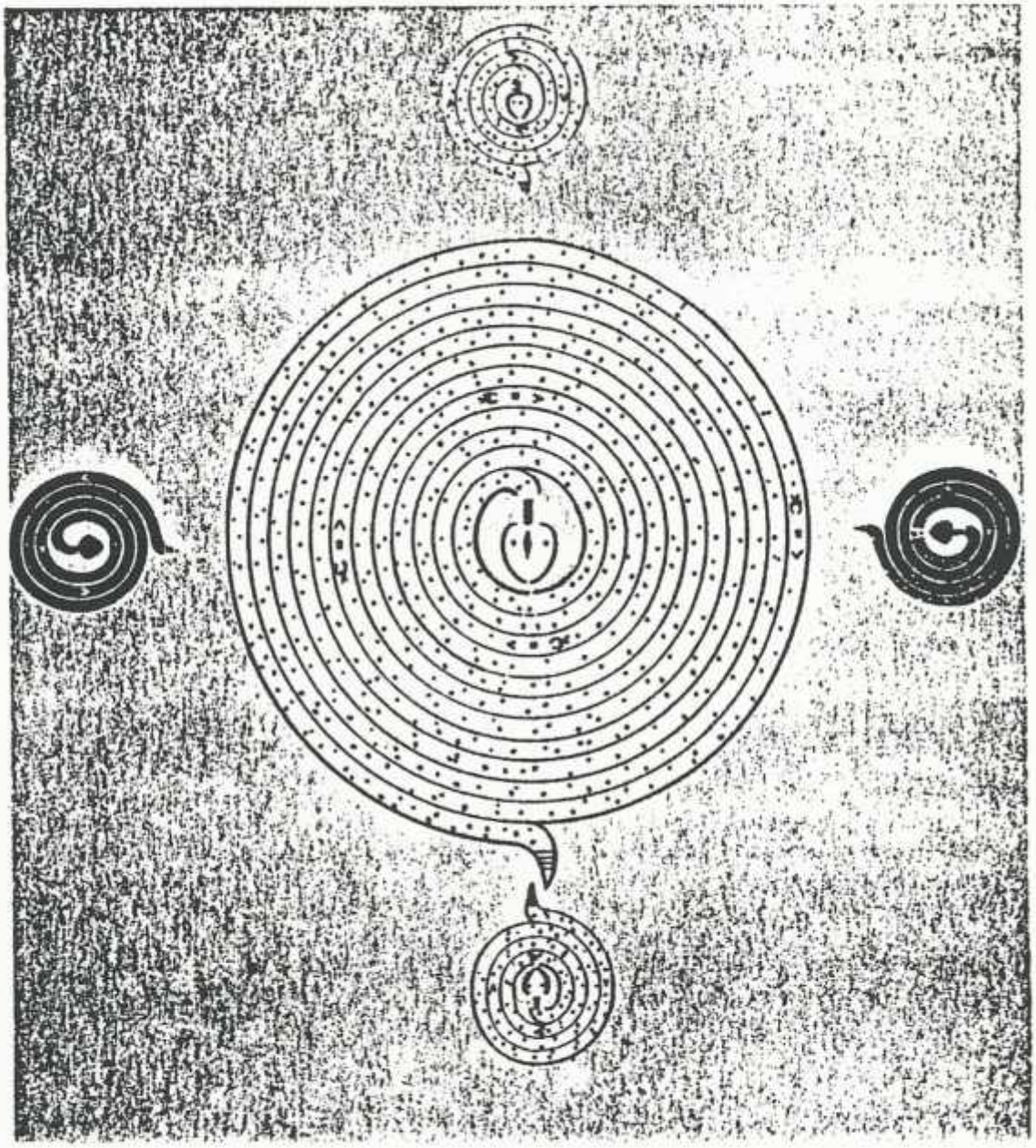


FIG. 20. "The Big Snake with No End." Navaho sand painting.
(Courtesy Maud Oakes)

FIGS. 21 & 22. Left, patient's drawing of lightning striking water represents deep impact of an emotional experience on the psyche. Below, second painting by same patient shows chaotic effect of the experience on the patient's life, but is not without form and order.

FIG. 21

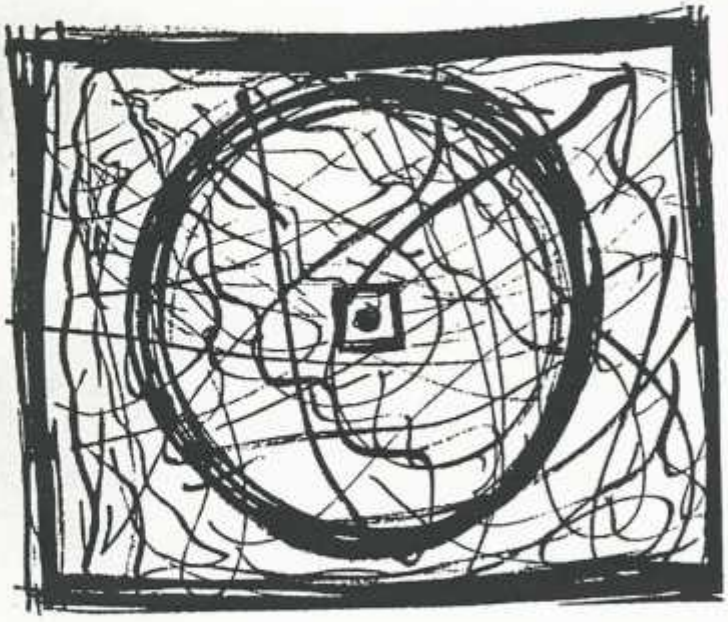


FIG. 22

FIG. 23

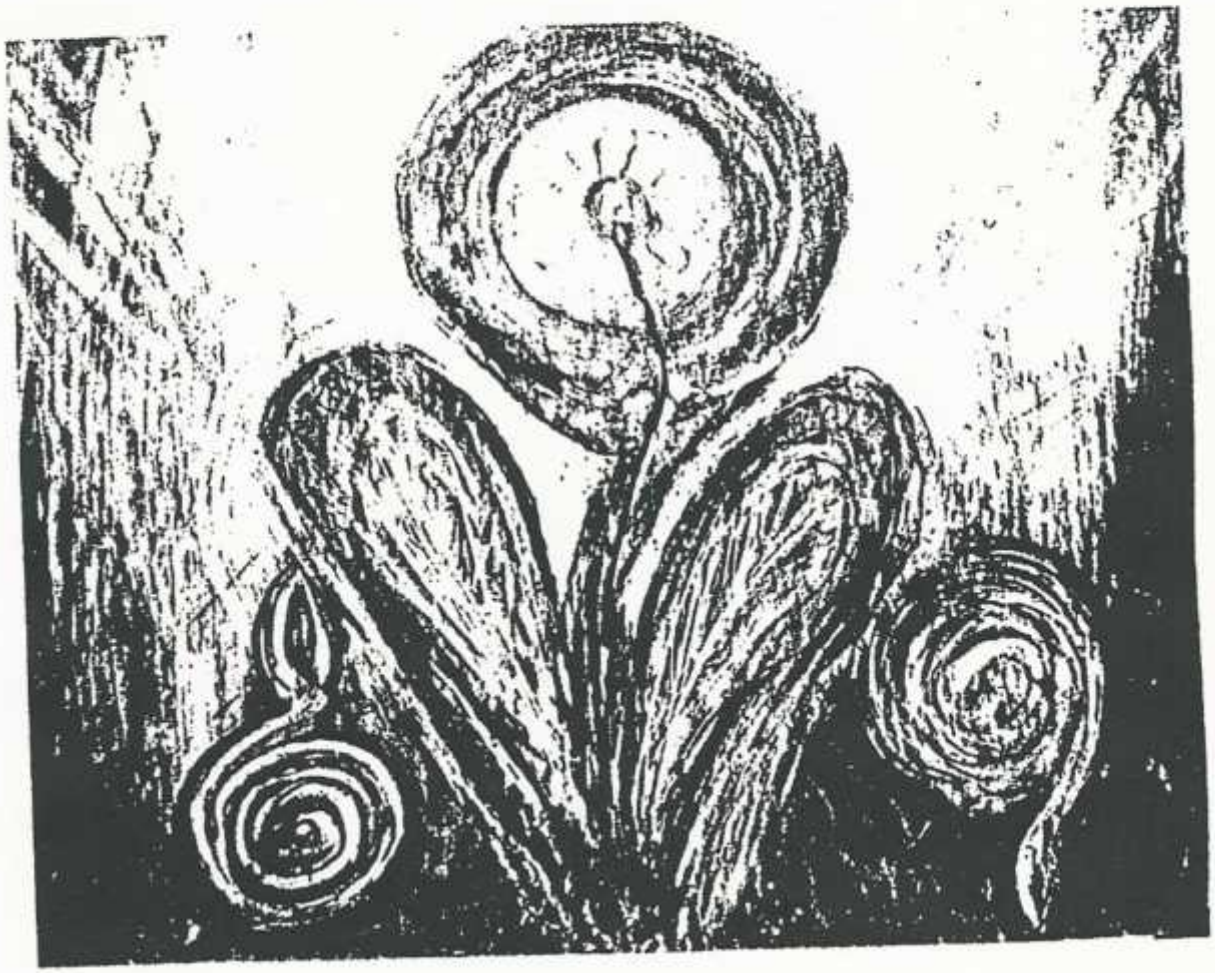


FIG. 24

FIGS. 23 & 24. *Left*, a further step in the patient's unfolding. Eye represents coming consciousness to the embryonic (undeveloped) understanding. *Above*, the solution—self-realization, represented by the flower, growing out of the swamp of the unconscious.

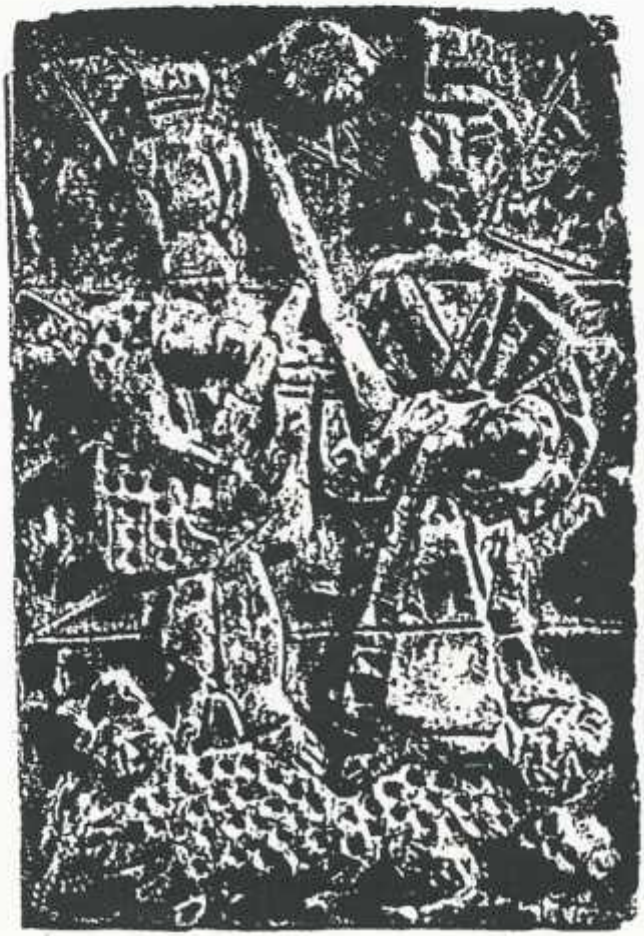
For illustrations accompanying the paper on "Plastiken in der Therapie von Psychosen/Plastic Art in the Therapy of Psychoses":

ABB. 1/Illustration 1

ABB. 2/Illustration 2

ABB. 3/Illustration 3

ABB. 4/Illustration 4



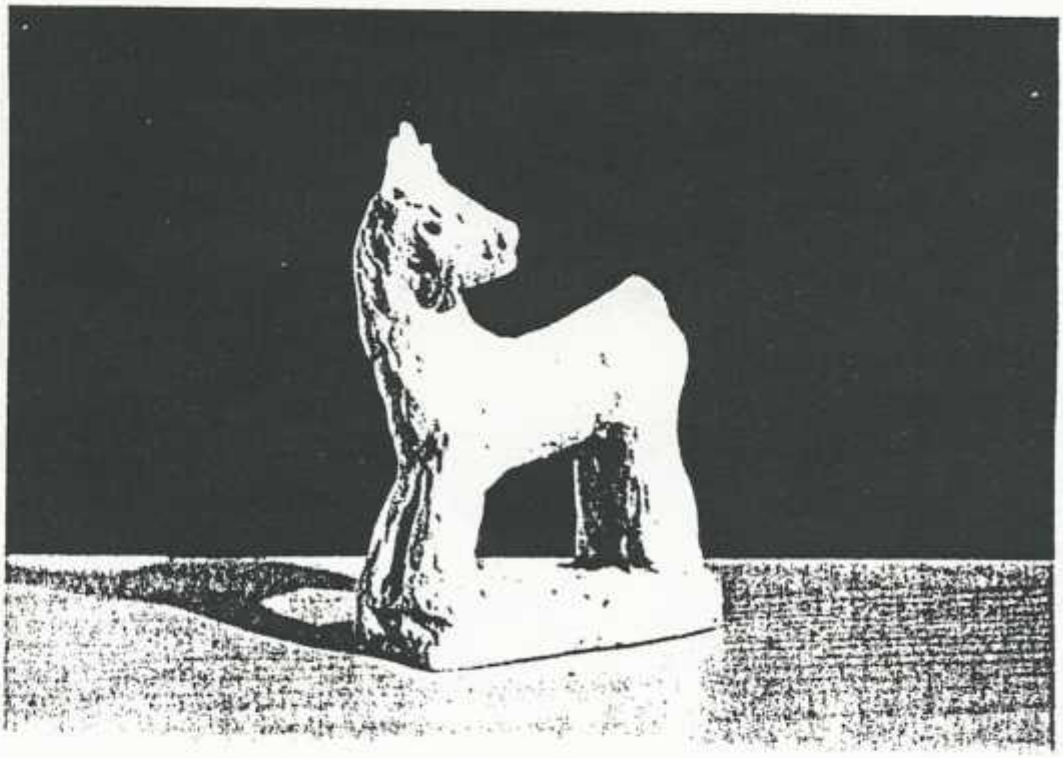


ABB. 5/Illustration 5

ABB. 6/Illustration 6

ABB. 7/Illustration 7

ABB. 8/Illustration 8

ABB. 9/Illustration 9

ABB. 10/Illustration 10

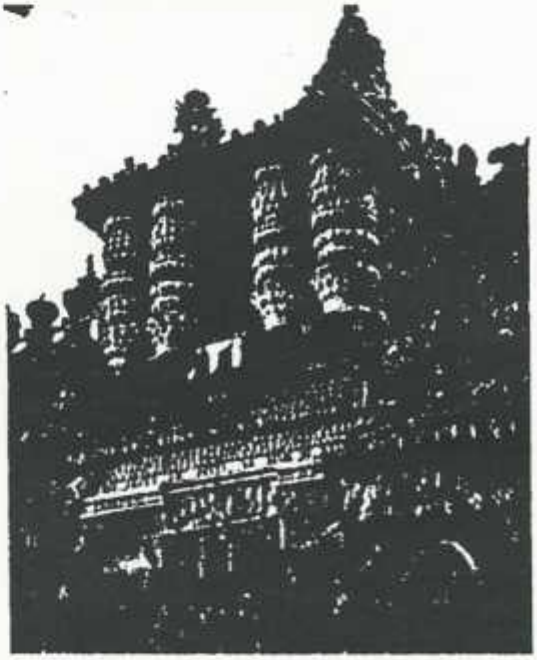


ABB. 11/Illustration 11

from one to ninety-two, the patterns of the orbits become marvels of complexity and order. However, if heated to sufficiently high temperatures the order can be disrupted and a so-called "plasma" formed. In this chaos of subatomic particles the atoms have lost their typical patterning. Plasma is formed in nature in the hot gases expelled from stars.

The nucleus of the hydrogen atom was long thought to be indivisible, but in the 1930's a world of subatomic particles opened to view. (The present count is over ninety.) Physicists now know that particles and antiparticles exist, and that in highly energized places continuous creation and annihilation of particles occur.[8] Some of the most exciting fundamental research, which is certain to affect future myths of creation, is centered in this world of elementary particles.

I have always found it difficult to imagine how minute, planetary-like systems, combining to form compounds, could make fluids or solids, animate and inanimate. The concept of wave mechanics has made the process more understandable. It was discovered that an electron may be looked upon as a particle in one sense only. In another, it is a wave of given wave length. This wave, confined by the attracting force of the nucleus, forms a *field* around the nucleus (*Figure 4*). The possible shapes in which electrons may vibrate were calculated by Schrödinger. The probability of finding the electron at any point is proportional to the brightness in the photograph of the models (*Figure 5*). Quoting the physicist Weisskopf:

> Here we are touching the very nerve of nature. . . . Quantity becomes quality in the atomic world. . . . The simple beauty of a crystal reflects on a larger scale the fundamental shapes of the atomic patterns. Ultimately all the regularities of form and structure that we see in nature, ranging from the hexagonal shape of a snowflake to the intricate symmetries of living forms in flowers and animals, are based upon the symmetries of these atomic patterns.[4]

Snowflakes (*Figure 6*) are made up of only two chemical elements, hydrogen and oxygen. The regularity of these exquisite crystalline structures depends on the constancy of the electromagnetic forces we have been considering. The compounds forming the flower (*Figure 6*) are vastly more complex, but order and patterning still obtain.

Matter and life

Of what do living things consist? Of the ninety-two naturally-occurring elements four are basic to the structure of all living things, plant and animal—hydrogen, oxygen, nitrogen and carbon. Carbon atoms link together into complex networks and patterns—often with hundreds or thousands in a single molecule. They form the very skeleton of all organic compounds.[9] The dominat-

ing principle in the linking of carbon atom to carbon atom, or to other atoms to form organic molecules, is the formation of a stable octet of shared electrons in the outermost electron shell (*Figure 7*). For example, with four empty spaces, *i.e.*, four valences, the carbon atom readily adds four hydrogen atoms to form methane. Nitrogen, with a valence of three, adds three hydrogen atoms to form ammonia, and oxygen adds two to form water. Two examples of simple organic molecules present in all living things are ribose, a carbohydrate, and alanine, one of the simplest of the amino acids (*Figure 7*).

What does current theory say about the origin of life on this planet? The reconstructed story goes back two and one half billion years. The oceans had formed and the earth was surrounded by a primitive atmosphere. The gases in that atmosphere contained the four basic elements. Under the influence of energy supplied from great bolts of lightning and from the heat of the sun and radiant energy from outer space, the elements combined to form complex compounds of carbon. Carried down by torrential rains over millions of years, they formed in the oceans the "eobiotic soup" (Gr. *eos*, dawn), literally the dawn-of-life soup (*Figure 8*). Life appeared when these compounds aggregated in some fateful moment of time and formed either a large molecule or a primordial kind of cell that could replicate itself. Under conditions simulating those of the hypothesized dawn period, basic organic compounds have actually been synthesized in flasks in the laboratory.[10,11]

Through the millennia the four elements have become elaborated into an almost infinite variety of compounds, each with a specific structure defining a specific function. One group, consisting of the twenty amino acids, is found throughout the plant and animal world. The amino acids are strung together in endlessly varying ways to form the substance of our skin, eyes, organs, brain cells, *et cetera*. How do they know to combine in the correct sequence to form the stuff of a given tissue?

The secret lies with the four compounds seen in *Figure 9:* adenine, guanine, cytosine and thymine. This is the great unifying discovery made in biology in the past two decades. It is now known that these four constitute an *alphabet* by means of which *matter communicates with matter*. In combination with the sugar, ribose, they make a long, threadlike compound, deoxyribonucleic acid (DNA), which is present in the central portion, the nucleus, of every living cell—of amoeba, flower or man.[12]

In all species the DNA molecule has the same basic structure. It is shaped like a twisted ladder (*Figure 10*). On the rungs of the ladder the four compounds are arranged in pairs, adenine pairing with thymine, and cytosine with guanine. These always recognize each other and know that they belong together. It is like a *hierosgamos* on a molecular level. The order in which the four compounds are arranged along the length of the ladder conveys *information*—just as the written characters on an Oriental scroll convey information. This order, or code, is different for every living thing.

These molecules have a unique property, the ability to replicate themselves. The double helix divides down the middle and uses itself as a template to make a new molecule. The order is faithfully duplicated each time a cell divides. It has been estimated that the DNA in each single cell of the human body contains about four billion of the molecular-sized ladder steps. Translated into our conventional alphabet, this amount of information would fill one hundred large dictionaries. In the entire body there are about one hundred million million such sets of dictionaries.[12,13]

Figure 11 shows an actual thread of DNA, magnified under an electron microscope. This is indeed the thread of life. Geneticists now know that the ephemeral gene, which determines heredity, is composed of these DNA threads.

The individual organism

Many simple organisms subdivide to form two new individuals; the chromosomes divide in half and thus genetic continuity is assured.

Most higher forms in the plant and animal world have differentiated into male and female. A pooling of the DNA from each is required to make the new individual. To accomplish this, gonadal cells—unlike body cells—undergo a special process of chromosome reduction. They have lost half their DNA before coming together. The first sperm that penetrates to the interior of an ovum (see *Figure 12*) will contribute its fifty volumes of DNA instructions to the fifty already present in the egg. The two together make a full set of instructions for the formation of the new individual.

The fertilized ovum begins to divide, the one cell becoming two, two becoming four, *et cetera*. Tissues differentiate out, and at the end of six and one-half weeks the human embryo appears as in *Figure 13*. At the end of eighteen weeks it is a well-formed child, such as the fetus in *Figure 14* sucking its thumb. It appears to have a nascent, sleeping kind of awareness. Has this intrauterine infant begun to dream? Recent studies in the rapidly developing field of the physiology of sleep reveal that the newborn child shows all the typical central nervous system signs of REM (rapid eye movement) sleep, the type associated with intervals of dreaming in adults. The human infant spends more time in REM sleep (approximately 50 per cent) than does the adult (20 per cent), and the premature infant more than does the infant born at term. Dement states, "We feel there is probably a time during the gestational period when the intrauterine organism exists *only* in the REM state."[14] Is it too early to wonder whether the dreaming of the intrauterine and the new-born infant plays a role in activating dynamic reaction patterns in the nervous system and in structuring the psyche?

Returning to the ovum at the moment of fertilization—how does this originally undifferentiated, single cell produce descendants that become eye cells or

skin cells? Molecular biologists are beginning to penetrate these mysteries. Recent work indicates that the DNA molecule functions as a molecular-sized computer in a circular feedback relation to enzymes and cell constituents specific to a given species of organisms. As the master control center of the cell, DNA programs the intricate chemical reactions necessary for differentiation and growth. Each cell continuously assays itself and keeps informed of the appropriate next step in the developmental path. Recent work indicates that non-chromosomal components in the cytoplasm of cells make them more flexible and responsive to changing environment.[15,16,17] In a young embryo, a skin cell transplanted to where the eye should be will become an eye cell. If an adult organism is injured, proliferation of cells stops when the wound is healed. The wholeness of the organism is the apparent end in view.

Evolution of man

Evolutionists do not stop now at tracing the development of man back through the primates and mammals. They carry his origins back beyond the first living forms to the very elements themselves as they sifted out of the cooling star dust. *Table 1* shows the time scale of man's evolution.

TABLE 1. *The Evolution of Man*

Event	*Time since occurred (years)*
Cro-Magnon man in Europe	20–50 thousand
Fully human primate. Tool making	600,000 thousand
Ape-like man. Crude tools used	1.75 million
Mammals appear	125 million
Fossil record begins	500 million
Appearance of life on earth	2.5 billion
Formation of elements, galaxies, stars, planets	5–20 billion

Dr. and Mrs. Louis Leakey, who have spent their lives unearthing evidence in eastern Africa, feel it is likely that man-like creatures roamed the area twenty million years ago. In their finds of fossilized bones in the lowest beds of the now famous Olduvai Gorge they have definitely established the existence of an ape-like man, a crude tool-user, one and three-quarter million years ago.[18] Professor Bryan Patterson of Harvard University, working in Kanapoi, Africa, has recently discovered a human-type bone two and one-half million years old. Cro-Magnon man lived in Europe between twenty and fifty thousand years ago. He painted the marvelous animals on the walls of the caves at Lascaux and elsewhere. What an artists's soul he had by then acquired!

Since Darwin first published his theory in 1859, evolution has come to be

much better understood. But Adolph Portmann and co-workers have repeatedly pointed out that the neo-Darwinian theories, which place such emphasis on mutation, isolation and selection, offer only fragmentary insights into the complexities of living things.[19] The nature of the evolutionary process is by no means fully understood.

The nervous system and memory

In this story of genesis let us now turn our attention to the nervous system. What do contemporary scientists say about man's ability to remember an event from childhood? What enables a bird to fly thousands of miles to his winter home without having been shown the way?

The nervous system is composed of cells called neurons, linked together into a vast, interconnecting network over which electrochemical impulses pass. Incoming pathways bring sensory data to the brain from the outside world and from the body itself; outgoing pathways carry messages to the motor system and to the organs and tissues of the body. The great knot of nervous tissue, the brain, is the main coordinating center. Unlike other body cells, neurons do not divide. They are laid down in the original ground plan and provide a basis for continuity of the individual's life experience. The average human brain contains an estimated ten billion neurons as compared with nine hundred in the brain of the bee.[20] The immense complexity of the interconnecting network of neurons and of the electrochemical events taking place in and around the network has become increasingly apparent in the past two decades with the development of the computer sciences.

How is memory stored in this remarkable tissue? Neurophysiologists and biochemists have made progress in answering this key question. Penfield's[21] work in the 1950's led to challenging hypotheses. He discovered, while operating on epileptic patients, that a gentle electrical stimulus applied to certain areas of the temporal lobe of the brain evoked vivid memories. He labeled this the interpretive cortex. For example, during an operation under local anesthesia, a young woman relived the experience of her mother singing a lullaby each time the same spot in the cortex was touched. Flashbacks carried more detail than could be recalled voluntarily. Penfield proposed that memories have specific representation in altered molecules in nerve tissues.

The Swedish neurobiologist, Hydén, advanced a molecular hypothesis in 1958 based on ingenious experimental work on nerves from the vestibular apparatus (sense-of-balance center) of rabbits. He made the animals dizzy in a centrifuge, then analyzed the cells by microtechnics. He found that the cell bodies of stimulated neurons were much richer in RNA than were those of non-stimulated neurons. (RNA is made off the template of DNA and has a similar structure. It is the working form present in the cytoplasm of cells.) Hydén

postulated that the incoming electrochemical impulses not only increase the RNA but also change its coding. The changed code produces changed proteins and these are the molecular representatives of memory. He conjectured that they have the property of recognizing the same electrical pattern that created the RNA at the time of the original stimulus.[22,23]

Evidence has been accumulating from diverse types of experimental work that RNA may actually be involved in the coding of memory.[24,25] If this is substantiated it is certain to have a great effect on psychological theory. *A rational basis will have been found for considering the interrelations between genetically determined memory and acquired memory in the living organism.*

There is already an extensive literature on the relation between innate and learned behavior in animals. The study of animal behavior assumes new theoretical meaning for psychology now that it seems probable the story is similar for the animal and for the human being at the molecular level of their nervous systems.

Behavior patterns in animals

A good illustration of the genetic determination of a behavior pattern is an experiment of Dilger[26] with two closely related species of the lovebird. In making its nest species number one uses mass-production methods and tucks several strands of nesting material into its tail feathers at a time. Species number two carries a single strand in its beak. Dilger crossed the species and the hybrid was greatly confused. It would begin to tuck a strip of material but would be unable to let go of it; or tucking movements would change to preening and the strip would fall to the ground. It was three years before the hybrid's bill-carrying ability had been perfected. Even then it occasionally attempted to carry nesting material in its tail feathers without success.

Lorenz's early work on *innate release mechanisms* and *imprinting*[27] has now been amplified by many investigators, and there is an extensive literature on such things as critical *periods of sensitivity*, the *gestalt* of the releasing stimulus, *et cetera*.[28,29] Much of this important work on the relation between innate and learned behavior in animals awaits critical evaluation in relation to inheritance in human beings.

A history-making experiment of Franz Sauer[30] at the University of Freiburg has special relevance to the relationship between the inner and outer worlds. Following earlier work by Kramer on bird migration, Sauer raised European warblers in light-proof, sound-proof rooms. In autumn, the season for migration to South Africa, the birds became restless. It was known that baby warblers could take off and fly the route in advance of their parents. How did they chart the way? The bird was placed in a box so that it could view the night sky (*Figure 15*). Results were the same whether it was the natural sky or

a sky projected in a planetarium. The observer beneath recorded the way the bird headed. When the dome was illuminated with diffuse light, the warbler was unable to choose a preferred direction. With the autumn sky projected, the bird took up the correct position for migration over the usual route. When the planetarium sky was rotated to show the stars at a different latitude, the warbler corrected its flight direction for that latitude. In other words the bird was apparently selecting its flight direction by the pattern of the stars. We have now arrived in the world of images.

Patterning and order in the inner world

In his collected works Jung has documented in great detail ordering processes that tend to appear in individuals in divided or chaotic states, at important stages in the growth of consciousness or in situations experienced subjectively as threatening, overpowering, unknown or awesome. Perry[31] later confirmed in carefully recorded studies that, even in the apparent chaos of certain acute schizophrenic syndromes, an ordering process is going on in the depths of the psyche. The content is archetypal and the symbolism mainly endogenous.

But it is not only in disturbed states that the tendency toward a subjective ordering manifests itself. Anaximander, a Greek philosopher living in Asia Minor around 600 B.C., conceived a cosmogony which is a marvel of intuited order. He envisioned the universe as having its source in "the limitless." This was a misty stuff, at once both matter and soul, revolving eternally and sifting out from itself the opposites. These, then, formed all things. When things perished, they again merged with the limitless.[32]

Herbert Read, in his book *Education through Art,* eloquently describes his surprise at discovering the natural order and symmetry in classroom drawings of young adolescent schoolgirls when they were encouraged to close their eyes, feel at peace and then draw a "mind-picture." He said, "For us the real significance of these mind-pictures is their revelation of a process of integration within the mind of the child and below the level of consciousness. . . . It is not dependent on external perceptions, nor on images derived from external perception, though these may intrude." In discussing the aesthetic, philosophic and social implications, he said, "Below the level of consciousness, and extending to a level of experience which is more than individual, a wider and deeper chaos seeks the harmony and stability of the aesthetic pattern. . . . On the most primitive level of our unconscious being, we seek conformity with the organic laws of nature and the cosmic laws of matter." [33]

In a painting entitled "The Ovum" the contemporary American artist, Louisa Jenkins, pictures the embryonic center of nascent life against a background of alchemical gold (*Figure 16*). The radiations at the four corners give a feeling of energized connection with the universe around the cell, an ordered connec-

tion. It was painted after a period of deep introversion during which the artist had resolved some opposing tendencies in herself. It anticipated the birth of a new conscious attitude and a change in style of painting.

Apparently not only human beings find satisfaction in aesthetic order. In his book, *The Biology of Art*, Desmond Morris has given a fascinating account of the picture-making behavior of a group of apes at the London Zoo.[34] The apes showed a consistent tendency to balance and center their drawings. Congo, one of the more talented artists, is shown in *Figure 17* selecting his palette. In the example of his painting, multiple circling with a suggestion of underlying diagonal crossing is apparent.

Rhoda Kellogg[35] has made an important study of the developmental stages in children's drawings. She has collected and classified thousands of spontaneous productions from the nursery schools of San Francisco. The children begin with scribbles and progress, between ages two and four, through "diagrams," "combines" and "aggregates" to arrive at representations of the human figure (*Figure 18*). Mandala forms typically appear. Congo advanced as far as stage "c" (*Figure 18*), a stage of development comparable with that of a two-year-old child.

Michael Fordham of London has documented the emergence of mandala symbolism in a compelling series of drawings of a disturbed child, age seven, in therapy. The painting shown in *Figure 19* was the last in the series and coincided with the resolution of a deep conflict. In his theory of the development of the ego Fordham has stressed the importance of the circle in children's productions. "The circle . . . represents the boundary of the ego but refers at the same time to the self." [36]

The Navaho sand painting (*Figure 20*) was collected and drawn by Maud Oakes. It is called "Big Snake with no End." The medicine man gives instructions for this design to be painted on the desert floor with colored sands and pollens and then invokes the spirit of the big snake in his chant when treating persons with nightmares about snakes or those bitten by snakes. The little snakes are guards and messengers; "they tell the big snake everything, and he tells them what to do." [37] There is urgent need for a sense of connection with the universal order of things. Is it possible to imagine a more powerful ritualistic expression of such a need?

The tendency for an ordering process to appear spontaneously in the depths of the psyche of an adult under conditions of emotional stress is depicted in a series of drawings done by a patient in an active phase of analysis (*Figures 21–24*).

This forty-five-year-old professional woman, a thinking type, had felt she was through with a love life. Suddenly came a bolt of lightning. She unexpectedly fell in love. The drawing in *Figure 21* shows how deeply this event hit in the psyche. Only the impregnating fire from the sky and the disturbed primal

waters of the unconscious appear. It is reminiscent of the dawn state of the world (*Figure 8*) before living things formed. As Jolande Jacobi has pointed out, "The deeper the unconscious stratum from which the archetype stems, the scantier will be its design, but the more possibilities of development will be contained in it, and the richer it will be in meanings." [38]

The patient pictured the state of confusion into which she had fallen (*Figure 22*). Her life had suddenly become chaotic, but in the background of the drawing we see the possibility of order and wholeness. *Figure 23* shows that she had been hit in the emotional center, in *manipura*. The star overhead indicates it was fated. That this had to do with coming consciousness is suggested by the size of the eye. This embryonic thing is a good image of how undeveloped her capacity was to recognize and to accept her real feelings.

The relationship was not a suitable one for marriage. The patient had to endure a disappointment with much suffering, but in so doing she experienced in depth the realities of her instinctual being. This woman learned in the searing heat of this experience that *needing to be loved* is a polar opposite to being *able to love*.

A year later she pictured the *inner solution* to the problem. A fully formed flower (*Figure 24*) had grown out of the swamp of unconsciousness. She had become acutely aware of the opposites in her nature and of the energy of their polarity as represented by the two snakes on either side. One points down to the realm of the chthonic, earthy instincts; the other points up to the realm of the spiritual instincts. Between, rooted in the earth, grows the living symbol—the vivid representation of self-realization. Here again is the theme of opposites that become one. Subjectively the patient felt enlivened, rooted in her own nature and at one with herself.

Like the warbler, man navigates by the stars. Like the snake, he crawls on the earth and partakes of its dynamism. Does he differ from the animal mainly in his ability to *perceive* that he does both?

Matter and psyche

Is common ground being found between the outer world of matter and the inner world of the psyche? Certainly striking analogies can be pointed out. Among them we note the emergence of form from the unformed, the progression from simple to more complex forms. In both outer and inner worlds we find repeated themes; namely, the circle and the sphere; the distribution around and orientation to a center; the repeated occurrence of the two, the four and the eight; the theme of the opposites and their *conjunction*, or union, on level after level. We have noted the union of oppositely charged elementary particles in the atom, the combination of positively and negatively charged atoms to form molecules, the two threads of the DNA molecule in union as op-

posites, the sperm and the egg, male and female. In the depths of the human psyche we have noted the separation out of opposites and their re-combination in highly energized states to produce a subjective sense of wholeness.

We have noted the state of chaos, the absence of patterning and order, in both inner and outer worlds. Consideration of this would require another paper with emphasis on the themes of creation, and mythologies of death and rebirth.

It must be emphasized that the similarities have been noted as analogies only. We are still in the stage of observing and describing. Deeper connections lie hidden beyond, in the realm of the unknown. When these things are better understood, surely it will be a time when more is known about the origin and nature of matter, about the origin and nature of the psyche and about the formative processes in both.

In his last major work, *Mysterium Coniunctionis*, Jung said:

> Though we know from experience that psychic processes are related to material ones, we are not in a position to say in what this relationship consists or how it is possible at all. . . . Microphysics is feeling its way into the unknown side of the matter, just as complex psychology is pushing forward into the unknown side of the psyche. Both lines of investigation have yielded findings which can be conceived only by means of antinomies, and both have developed concepts which display remarkable analogies. If this trend should become more pronounced in the future, the hypothesis of the unity of their subject-matters would gain in probability.[30]

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