device postulated by neo-Darwinian genetics that supposedly solely determines the hereditary makeup of the individual. The random recombination of the nucleotides (which contain the biological order) in the process of meiosis, may have little biological importance as a function affecting evolutionary development because of its very random nature. The biological significance of sex and the related process of meiosis may be that it is only a dispersal process whose function it is to split the structure of the DNA molecule and thus prevent undue symmetrization from occurring in the underlying biological order (the menstrual cycle of the female may be a part of the same function) and insure its continuity; the randomness of the recombinations of the genetic structures may be simply a byproduct of this dispersal process. The objection to accounting for the genetic process in terms of a purely random combination of genes and in accounting for evolutionary development in terms of chance occurrences such as accidental mutations becomes all the more serious when one attempts to apply a process based on the laws of chance to explain the evolutionary origin and continuous, progressive development of the highly organized and ordered psychological processes. Unitary theory sees in the orderly psychological processes an elaborated version, with new properties to be sure, of what occurs on the genetic level; in other words, the same organizing process operates on all levels of the organizational hierarchy and simply uses structures of different complexity on the various levels.

From the unitary view, evolution is the result of a continuously operating structuring process which causes the selective elimination, reordering and creation of new quantum structural aggregates (with the resultant of an increasing ordered complexity in an underlying biological order) during the entire life span of individual organisms. These innovations are passed on from parent to offspring. Biological evolution was thus due to the unitary process continuing its one-way tendency of 249
facilitating normalization on each level of the organizational hierarchy and, since the environment was a perpetual source of normalizing distortion, one-way development proceeded so as to make the organism conform to his environment. That is, the normalizing process selectively promoted those processes, structural organizations and functions that adapted the organism to its environment. The various forms of normalizing distortion due to environmental variations were, however, the factors that differentiated out the evolving entity. The environment, rather than being the primary factor in driving evolution, as implied in the concept of "natural selection," was a cooperative factor furnishing the differentiating factors in evolutionary development. The driving causal factor in evolution was, however, the normalizing process operating in the organism that furnished the ATP-nucleoprotein system with the potentiality to be differentiated by the environment and which used these differentiations to develop structuro-functional organizations to offset these forms of normalizing distortion so that the normalizing tendency would be facilitated. (In other words, unitary theory, while not neglecting the importance of the environment, would shift the emphasis of evolutionary process to the organism itself which the neo-Darwinian view regards as almost a passive machine-like entity.) To be sure, individuals of some species must struggle to survive; chance and hazard are important factors in the life of the individual and in the survival of the species but these, this writer contends, were not the major factors in

evolutionary development. It was the ability of the living organism to promote the intrinsic tendency of the normalizing process that was the fundamental arbiter in evolutionary development. The unitary process is not a cruel master which requires that many of its creations should fail; rather, it might be interpreted that much of the intense competition which prevails is due to the fact that the unitary process operates in such a way that all of its creations should live, grow and prosper. This can lead to competition or cooperation between individuals of a species and usually both. This pertains particularly to man.

> It is part of this unique status that in man a new form of evolution begins overlying and dominating the old organic evolution. . .This new form of evolution works in the social structure. . .and it depends on learning, the inheritance of knowledge. . .Its possibility arises from man's intelligence and associated flexibility of response. His reactions depend far less...on physically inherited factors, far more on learning and on perception. . .of new situations.
>
> This flexibility brings with it the power and the need for constant choice between different courses of action. Man plans and has purposes. Plan, purpose, goal, all absent in evolution to this point, enter with the coming of man and are inherent in the new evolution, which is confined to him. 250
>
> Simpson: Epilogue in *The Meaning of Evolution*

Thus, in summary of this section on the origin of life, the origin of the ATP-nucleoprotein system (within which functioned a continuously operating structuring process acting to develop patterns of structures that facilitated normalizing) marked the appearance on our planet of an organizing field process with structural and force properties and diverse labilities in potential form. This was destined to lay down the molecular basis for the subsequent evolutionary appearance of both the plant and animal kingdoms. The properties: flow and ratio of components, self-regulation to sustain the balance of components and to maintain the structuro-functional integrity of the pattern of the entity, irreversibility, growth characteristics, minimal entropy production, synthesis and catabolism including reproduction, and the characteristic of the metabolism of living organisms to form proteins containing only 1-amino acids, motility and the basic sensory labilities found in living organisms, all can be traced to this simple structuring process (which in itself had a long history traceable to the creative-formative process underlying the universe). This process had structural properties and free energy labilities in potential form that could be differentiated out by configurational environmental variations and structured by this organizing process to form an underlying biological order. From this biological order were eventually developed all the diverse forms to appear on our planet. From this view the dynamic characteristics of life and their organization are a manifestation of the intrinsic creative potentialities present in the unitary structured field. These potentialities will manifest themselves anywhere in the universe, provided the conditions on a planet permit the higher levels of the organizational heirarchy to manifest itself. Life is a far, far more common occurrence in the universe than was envisioned by the "collision theory" cosmologists of two or three decades ago. The universe, compared to those views, must literally teem with life. * * * [Page 251 is a very short paragraph omitted as not germane to other content.] 251

VI

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THE HUMAN NERVOUS SYSTEM AS A HIGHLY DYNAMIC AND CREATIVE STRUCTURING SYSTEM

The task or at least the ideal and methodological standard of any science remains to derive teleological features within the frame of a causal mechanism.[1]
Gustav Bergmann

A. Statement of Hypothesis

The human nervous system is postulated to be the highest expression on this planet of a unitary formative process that pervades the entire universe. The human nervous system, as the most complex manifestation of this formative process, appears as a hierarchical system of three levels of quantum (structural) aggregate formation whose synchronized operation yields our psychological processes. The basic idea is that all external and internal stimuli are varying patterns of electromagnetic, mechanical, thermal, or chemical energy. The exteroceptors and interoceptors transform these patterns into the common denominator of the nervous system—quantum field structures. These patterns of quantum field structures are spatially and temporally dispersed; the field process operating on the three levels of structuring in the human nervous system restructures the stimuli after they have become differentiated by the memory structures within the organism. On each level of the human nervous system there are: memory levels to complex (differentiate) incoming quantum structures or stimuli, a center of structuring[2] of the incoming quantum structures, and patterns of internal and external muscular contractions which are selectively activated by structural aggregates formed in these centers. Moreover, on the third or 253
highest level of structuring there exists a semi-autonomous structuring process (that is, a process which can act independently of, or in synchronization with, the lower two levels) which is the basis of the human's cognitive processes—other than those of perception—and which most clearly manifests the creative and highly plastic nature of the formative process operating in the system of sub-systems we call the human nervous system.

The following development is based on the fundamental assumption that amid stupendous complexity (one aspect of which, e.g., is the numerical complexity of the nervous system—the ten billion plus central neurones), there is an underlying simplicity and that amid an equally stupendous neuro-physiological and psychological diversity there is an underlying unity of operation. Simplicity and unity amid vast apparent complexity and diversity of operation in all systems is the fundamental conviction of the unitary-synthetic theorist; it is in fact the fundamental conviction of all science. The basic aim of unitary theory is the understanding and explanation of the structure and events of our universe in terms of unitary concepts. . . [Ed.Note: Page 254 was omitted as immaterial social commentary.] 254

B. CHANGING CONCEPTS IN THE FIELD OF NEURAL FUNCTIONING 255

The field of brain theory has been particularly fertile in providing for a great number of theoretical concepts attempting to explain various aspects of psychological and neurological functioning. In this section a few of these main concepts, some almost historical and some quite current, pertinent to the subsequent development will be briefly passed in review. Among the many concepts and conceptual schemes that are currently approaching the classical designation because of lack of supporting evidence or because of negative evidence are the following:

1. DUALISM

Dualism in its several conceptual forms and the associated doctrine of interaction: The doctrine of dualism, phrased in terms of modern neuro-physiological theory, postulates that neural functions (psychological processes) and muscular functions (locomotion and manipulation) are the resultants of two basically different substrata. The doctrine of interaction is the postulated mode of process between these two supposedly different substrata. In the past several centuries of experimentation, no one single *accepted* datum of evidence has been brought forth to justify the dualistic hypothesis. The doctrine of dualism has long been regarded by most scientists as a conceptual scheme achieved by virtue of postulation only. The research in the biological fields of the past sixty years has only confirmed this view. The biological evidence ranging from micro-biology to neuro-physiology and psychology indicates that, rather than being of basically different substrata, neural and muscular action ("mind" and "body") have fundamental similarities of operation. Any functional differences in the two is regarded as being due to differences in organization of the underlying structures.[4] To admit the dualistic hypothesis a degree of sophistication in any field, in or out of science, seems simply to concern oneself with a conceptual illusion. In terms of Whyte's theoretical framework the attitude of the modern scientist toward dualism, which

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[[4] Szent-Györgyi puts it this way: "Four decades of research have left no doubt in the author's mind that there is only one life and one living matter, however different its structure, colorful its functions, varied its appearances. We are all but recent leaves on the same tree of life and even if this life has adapted itself to new functions and conditions, it uses the same basic principles over and over again."]

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includes "psychophysical parallelism" is ". . .matter, life and mind are but 256
aspects of process which human thought wrongly hypothesized into entities or independent existence." As regards interaction, either in physics, neuro-physiology, or psychology, the weight of evidence is against this mode of process primarily because the dichotomous, interacting entities postulated by dualistic thought constantly undergo internal changes. That there are dichotomies such as organism and environment is a fact, but these entities are in process—in dynamic flux or transaction. This does not mean in the least that organisms and environment are less real, but it does mean that all structural organizations in the universe are in a state of process and if we

aim to understand the real nature of these entities we must take this salient feature into account. The term "transaction" has been suggested to describe the nature of process in physics and psychology and will be used in the following development.[5]

2. TELEOLOGY

The doctrine of teleology (often called functionalism in psychology) is that point of view which postulates that psychological functions[6] are to be explained or understood by determining the ends or purposes that these functions are providing the organism in adjusting to its environment. The more accepted viewpoint as regards this type of explanation is essentially that of Bergmann, above. In other words, the nature of psychological and other functions is to be discovered by determining the nature of the basic causal structure (the nervous system) of which the functions are highly differentiated processes. Thus, the purposes, values, and ends, which are of salient importance to the human being whom such functions are serving, will be found to be due to past learning or to be adaptations which the organism or his species acquired only after long experiential or genetic contact with the environment. "Functionalism both in psychology and in life generally, is a viewpoint of deepest human significance. The entire program of applied science is based upon this view" (Allport). In other words, the values and ends of human organisms are of supreme importance but it is doubted that a knowledge of these ends can throw much light on how the functions (perception and learning, for example) are brought about in the first place.

[[5] The term "interaction", however, other than connoting a fundamental mode of process, is still a valid descriptive term and will be used below.

[6] A sub-system and related process that is specialized to perform a particular activity such as breathing, digestion, learning, perceiving, etc. is called a function.]

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3. VITALISM

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This includes the various doctrines which postulate that the functions of living organisms have at their core an unanalyzable causal agency unavailable to scientific scrutiny and analysis. This doctrine has appeared in psychological theory in various forms and is often associated with the doctrine of "psychophysical parallelism." Its most sophisticated expression is in the doctrine of holism. This is the point of view that the nervous system functions as a whole and that the various segments of the functioning whole derive their characteristic properties by virtue of their participation in this holistic functioning. Or in other words, the "whole" in some way determines the properties of the parts. From the viewpoint of modern neurophysiology and psychology, it is known that various sub-systems can and do function semi-autonomously and that their properties do not depend upon what is happening in other sub-systems in the nervous system.

> It is commonplace to say that an organic whole has properties other than the sum of the properties of its parts in isolation. The necessary corollary is this: do not

> take for granted that the parts of a neural complex—or that any one part—must act in parallel with the action of the whole.
>
> *Hebb*

The concept of a structuring process and synchronized action is opposed to the notion of a supersummated whole that determines the properties of the parts.

4. ASSOCIATION

This is the doctrine which postulates that relations within and between sensory modalities take place exclusively in the cortex via the so-called "association tracts" and "association areas." For example, the parastriate area (Broadmann 18) was long regarded as an association area for visual stimuli. A wealth of accumulating evidence wherein the "association tracts" have been transected for therapeutic purposes—in some cases with wholesale transection or removal of the tissue—indicate little or no ensuing defect in relational capabilities on the part of the patient. Temporal relationships seem to be subserved by the anatomical tracts that connect bilateral cortical areas with centers in the brain stem which Penfield calls the centrencephalic system. This latter system is the reticular complexes mentioned above in the footnote to the initial hypothesis. Unitary theory, as interpreted by the writer, conceives the temporal aspects of psychological processes to be effected by the spatial ordering of quantum structural aggregates (which are the basic units of psychological meaning). That is, psychological processes are the result of certain changes going on in these structural aggregates and as these structural aggregates are being 258
arranged and related in space, the temporal aspects (serial order within a specific modality and inter-sensory relations between the various modalities) of our experiences arise. Thus, the time relations of psychological processes are effected by spatial-structural relationships of quantum structural aggregates—the basic units of psychological meaning. Psychological processes, as a function of structural changes in quantum structural aggregates and their temporal ordering effected in reticular complexes, will be more fully discussed below.

5. PROJECTION THEORY

This is the doctrine that a stimulus is topographically projected from the receptor area to anatomically specific "projection areas" of each sensory modality; e.g., area 17 for the visual modality. (Or, in other words, the idea is that there is a one-to-one correspondence of points in the receptor pattern with processes or structures in the cortical areas.) There has been a good deal of debate regarding the significance and interpretation of these well-established neuro-anatomical projection tracts and areas. "Perception must depend on other structures besides area 17. But we now find at the level of area 18 and beyond that all topographical organization in the visual process seems to have disappeared" (Osgood). In other words, if perception depends upon projection of the receptor area on the cortex why isn't topographical organization continued throughout the cortex until the site at which perception occurs is reached? A different point of view as to the function of the projection tracts will be offered below, the basic concept

being that the projection tracts actually are a dispersal means for stimuli ascending to cortical areas.

6. ISOMORPHISM

The Gestalt concept of isomorphism,[7] related to the view of psycho-

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[7 According to Gestalt theory, proximal stimulation sets up fields of electrical energy in an interneutronic chemical medium. These disturbed fields then tend toward equilibrium or a steady state. The resulting steady state of the field process is the isomorphic basis of the precept. Köhler's concept of neural field activity is based on the classical notion of field. For Köhler, the cortical field is an electrical, macroscopic, spread-out affair which operates in the chemical medium set up between synaptic junctions in the cortex. The theory accounts for the configurational aspects of perception by an electrical field coming to a steady state and by the doctrine of the "determinable whole." The "determinable whole" operates by its own laws which determine the properties of its parts. The theory to be presented below is based on the notion of the unitary field. The site of operation of the field process is in the reticular complexes of the brain stem. Psychological processes are the resultant of the two aspects of the unitary process

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physical parallelism, holds that for every perceived spatial form there is a 259
gross corresponding "cortical field form."

> Some go so far as to propose a relation of isomorphism between resultant field configurations in the cortex and the spatial characteristics of perception. This bold conception of the early days of Gestalt Theory cannot be said, in my (Fessard) opinion, to have many chances to survive.
>
> *Brain Mechanisms*

The newer concept is a relational isomorphism rather than a purely geometric one—one of the invariant spatial-structural relationships that incorporate temporal relationships. The concept to be offered below is that isomorphism is a resultant of invariant spatial-structural relationships of underlying equivalent quantum structures; that is, these structures are equivalent configurationally, spatially, and temporally to environmental objects, situations, and events. The isomorphism we have is due both to relative environmental constancy of the underlying quantum structural aggregate.

7. NERVE IMPULSE THEORY[8]

This is the doctrine that the nervous system carries on its activities

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acting in cooperation to form a structuring process. The structural aggregates formed by this structuring process and their intrinsic processes produce our psychological experiences. The field structures are sub-nuclear particle in size and the structuring process is localized. The development below rejects the nerve impulse as the basic parameter and emphasizes learning in perception (either phylogenetic or ontogenetic and defined in terms of unitary theory). All of these are contrary to Gestalt Theory.

We should not, however, overlook Köhler's brilliant insight. This was the point of view that the perceptual process has its basis in the organizing properties of field rather than in the organization of neural elements. In recent years, good evidence has been brought forth which indicates that the concept of field action in the brain, as Köhler envisioned it, is not supported by the facts. Consequently, the concept of field (applied to psychological processes) has slowly

fallen into disrepute among psychologists. However, this writer suggests that it is not field theory, nor Köhler's insight, which is at fault but the source of the difficulty lies in the classical conception of field. If the present application and interpretation of field theory is correct, then Köhler's insight can be said to be corroborated, however, with the substitution of a new notion of field. Gestalt psychology, moreover, despite its holistic, philosophical onus from Plato, Kant, and Husserl, may be considered the forerunner of unitary theory in psychology. The Gestalt psychologists have a rich store of information with which to expand the notions expressed in this development.

[8] A much fuller account of the nerve impulse and nucleoprotein doctrines appears as Appendix A in this book which is entitled: The Rise and Fall of the Nerve Impulse Doctrine. See this appendix for Bernstein's "classical membrane theory" of neural transmission; for the newer "sodium-pump" theory of neural transmission; Nachmansohn's chemical mediation hypothesis; the testing of the nerve impulse doctrine by the Macy foundation symposiums; the nucleoprotein viewpoint in some detail; and a short summary of the unitary view of the fundamental psychological parameter.]

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via electrical nerve impulses. It is the view that all gradients of feeling, 260
sensation, and action of which we are capable are provided by variations in the frequency of nerve impulses and by the place that specialized nerve fibers end—thus, all psychological phenomena are due to nerve impulses moving through specialized neural areas. Theories attempting to deal with the problems of psychological processes via changes in synaptic resistances and formation of cell assemblies, and those that compare various neurological arrangements to various electrical circuits, employ the nerve impulse concept in their theory; in fact, the majority of workers in the neuro-physiological and related fields (including the field theories stemming from Köhler) measure and graph patterns of action potentials. There are many reasons for the continued use of the nerve impulse doctrine: the relative ease of electrical stimulation and recording of the nerve spike patterns, its continuing successful use in delineating major functional areas within cortical and sub-cortical areas, its important clinical uses such as in the location of tumors, the amenability of the data to statistical treatment, etc. Perhaps the major reason for the continued employment of the nerve impulse as the basic neural parameter (which has been called "a misleading analogy to the conduction of electricity in linear circuits") has been the lack of a clear-cut alternative. Moreover, the continued use of the nerve impulse concept is in face of the fact that, within the last fifteen years, the very basic experiments from which the nerve impulse theory was derived have been shown to have been erroneously interpreted—at least in regards to the equating of the injury potential to the potential of the nerve spike. However, the most serious source of criticism lies in the virtual abandonment by modern micro-biology of the basic assumption upon which the nerve impulse hypothesis rests. This refers to the fact that the cell is no longer regarded as a basic functional unit.

> But like the erstwhile atom in chemistry, the cell has lost its prestige as the ultimate unit in biology. Both the atomic and the cellular theories have become obsolete. . .but the concept of a cell as the unit of life has been thrown out of the window together with the atom.
>
> Morgulis in Oparin
> ---*Origin of Life*

Moreover, the implications from modern research in micro-muscular and neural thermodynamics—for example, the similarities of fundamental principles of operation between these two functional structures—have led a growing number of researchers and theorists to suspect that finer events than varying gradients of neural action potentials underlie neuro-physiological and psychological processes. The alternative most often proposed is that the significant underlying events are changes in neural protein or neural nucleoprotein configuration; i.e., changes in the configurational 261
patterns of side or end groups of protein or nucleoprotein molecules with the nerve impulse playing a biochemical role—possibly furnishing the energy to disengage acetylcholine from the receptor protein to which it becomes bound during the configurational changes in the protein structure. The general conceptual scheme offered by these theorists is somewhat as follows. Configurational stimulations acting upon a specialized receptor cause the side groups, end groups, and hydrogen bonding, which characterize protein and nucleoprotein molecules, to undergo characteristic changes in pattern. These changes in pattern travel down the nerve fiber as waves or pulses of denaturation-renaturation of the axoplasmic neural membrane walls eventually leading to pulses of patterning or orientation of previously "random" paracrystalline protein lattices, in specialized sub-cortical and cortical areas. These pulses of orientation then serve as memory traces in the nervous system. In short, the protein or nucleoprotein chains in receptors, neural membrane fiber walls, and the membrane of cortical and sub-cortical cells are conceived to serve as relatively stable carriers of specifically polarizable end and side groups whose changing configurations convey stimuli (in terms of these biochemical correlates) from the external environment to the differentiated neural areas and which are the subsequent sources of memory traces.[9] The author, in the section following the next field theory, postulates that these molecular parameters may not be fundamental and that others may well exist.

C. The Universal Causal structure and Process

1. A NEW CONCEPTION OF FIELD

Since the new concept of field is so fundamental to the development which follows, a reiteration of some of the major points of this concept

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[9 Perhaps it might be asked, "Does the human nervous system have the potential pattern capacity from this viewpoint to account for the vast number of memories a human accumulates during a lifetime?" According to an unpublished paper by Sickles, one calculation sets the number of such possible alternations at the fantastic figure of 10^{2700}. This is in comparison to the 10^{80} memory traces than an average human is estimated to accumulate during his lifetime. Current neural net theorists, whose concepts are based on the cell and nerve impulse hypothesis, have a very difficult time accounting for even this number of traces and have postulated intricate schemes of cumulative storage mechanisms. It should be noted that the

memory traces of the above are conceived to be micro-traces and far from the gross traces visualized by current neural net theorists and super-macro traces visualized by Gestalt field theory. (Another way of calculating the memory traces or "bits of information" that a human acquires during his lifetime sets the total number of memories at 10^{12} or 10^{13}. But this is still more than the 10^{10} neural cortical cells the human possesses and cumulative storage mechanisms must still be postulated.)]