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BIOLOGICAL PSYCHOLOGY AS A SCIENCE

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Nature is the test of dialectics, and it must be said for modern natural science that it has furnished extremely rich and daily increasing materials for this test, and has thus proved that in the last analysis Nature's process is dialectical and not metaphysical.

F. Engels. Anti-Duhring

Biopsychology investigates the laws of the origin and development of psychological activity. Its main method is the comparative investigation of different evolutionary stages in the ontogeny and phylogeny of psychological activity. Thus, biopsychology can with full reason be called comparative psychology.

Biopsychology in its essence should serve as a necessary introduction to human psychology, because it reveals the history of prehuman psychological activity without knowledge of which the investigation of human psychological activity cannot be approached. Moreover, the animal roots of its past still survive in human psychology. All the psychological characteristics of animal origin (for instance, instincts) are preserved in humans. They have changed qualitatively but have not disappeared. This heritage from the past should be taken into consideration by the teacher, the physician, and the lawyer, because under certain conditions (most often of a pathological nature) when the ancient clamor of instincts interferes with our modern life, one should be able to foresee it in order to prevent it in time.

More than occasionally, Marx and Engels made excursions into the field of animal psychology. More than occasionally also, Lenin included this science as an indispensable item in the number of dialectical sciences investigating human psychological activity.

Biopsychology has great practical significance in agriculture and hunting. Unfortunately, this young branch of science has not received sufficient attention and the necessity for teaching it in institutions of higher education is not yet obvious to many people. We can understand why in Czarist Russia, the Ministry of Education considered biopsychology a heretical and harmful science. We can also understand why universities of bourgeois countries of present-day Europe and America are ready to

do their best to obscure the question of the animal origin of the "god-like" bourgeois.

To admit biopsychology as a scientific discipline in the universities where theology is taught would be equivalent to suicide for them. Biopsychology certainly can have no place among university departments where the "truths" of capitalist sociology and legal norms are taught to future administrators, ministers, senators, advocates of fascism, and judges of "monkey trials." It is only in the USSR that biopsychology can and must find a place truly equal to that of other sciences, where it can serve the cause of building socialism.

The investigators of the past became interested long ago in the psychological activity of animals, their interests proceeding most often from theological consideration of the godlikeness of human beings. Thus they create an unbridgeable gulf between animal and human psychological activity. Descartes admitted the existence of conscious behavior only in humans, while considering animals to be living machines with wholly automatic behavior.

The 19th century, the heyday of evolutionary doctrine, which expounded the general character of the laws of evolution as they applied to both humans and the rest of the animal world, could not reconcile these views with the metaphysical idea of the gap between the psychological activities of humans and those of animals. Darwin's followers (as well as Darwin himself to some extent) established firmly the principle that humans possess nothing which is lacking in animals. The difference between them, they maintained, is entirely quantitative and not always significant. This was a quite understandable reaction of evolutionary thinkers to the idea of the uniqueness of godlike nature of man. But, as often happens, the evolutionary point of view saw its healthy basis polemicized beyond the boundaries of scientific objectivity, and a number of prominent Darwinists became subjectively tendentious. Aiming to construct a bridge between humans and animals they began to discover traits in animals that they had never actually observed themselves and to ascribe to them all the elements of human psychology. This period of subjective comparative psychology was characterized by Wundt in these words: "The only rule we can use judging animal actions is to measure their psychological activity by our own yardstick."

The investigators of this school were guided by the idea that no significant difference exists between human and animal psychological activities, and by their wish to find by any means all the elements of human behavior in the behavior of animals. It is clear that in spite of the valuable achievements of the evolutionary method, the inability of these scientists to explain dialectically the difference between human psychology and animal psychology made them deny the existence of such a difference and led them, as we shall see, to fantastically subjective, unscientific conclusions. In the 1860's Karl and Klaus Vogt, strict evolutionists, in

describing the life of bees, tried to find a distinct governmental organization typical of absolute monarchy. According to these scientists, the words "L'etat c'est moi" find their full confirmation in the form of government in the bee colony.

Following this trend, other scientists discovered the republican features in the life of the ant colony. In Romanes' book, "Animal Intelligence," we find many shining examples of what realms of fantasy can be reached under the guidance of the subjective method and analogy with human activities. Professor V. A. Wagner said:

> Such scientific works are numerous and varied. At the same time, they resemble each other very much in their manner of description and in their evaluation of data, which bring them close to "fishermen's stories." Some describe crickets (that soon display cannibalism) as altruists of a higher order; others describe spiders as mechanics, beetles as good companions, beavers as rather good physicists, geese as moralists because they have drowned the arrogant peacock on account of his ambitious behavior, and so on.

These examples are enough, he wrote, to demonstrate the nature of this animal psychology based on subjective analogy, ad hominem. It is most interesting and instructive that the very same subjective method was used by Wasmann, the Jesuit, who fought Darwinism on behalf of the Catholic church. In his attempt to disprove the evolutionary idea of species development Wasmann described the life of an ant colony and of a beehive and found in their human-like pattern of existence the best confirmation of the wisdom of the Creator who, according to his will, endowed not only humans, but insects too, with mind.

Father Wasmann, presenting a large body of observations on insect life dealt with by the subjective method, stated triumphantly that he had struck down the Darwinian theory. He tried to prove that the living world did not develop from lower forms to higher ones, since the life of bees and ants is no less complex, conscious, moral, and so forth, than that of human beings. Since there is no qualitative difference between animal and human patterns of existence, there is no evolution; there exists only the almighty Creator, who gives according to His will some share of His wisdom to both animals and humans. This is the main sense of the arguments of this Vatican entomologist who used the method of monism (*ad majorem storio gloria Dei,* that is, monism "from above").

Although many Darwinists using the same method tried to prove quite the opposite—the triumph of evolutionary ideas—when applied objectively, their observations and conclusions coincide with those of Wasmann the crusader, who was eager according to the Pope's precepts to present all arguments against atheistic Darwinism *ad majorem gloria Dei* and to the glory of the Catholic church.

As time went on, the objective method of biology won the victory for

Darwinism in spite of the opposition of its crafty enemies in the Church and its "friends" who argued from monism ad hominem.

The 19th century, when the natural sciences flourished, provided a different approach to the problem of animal and human psychological activity. Advances in the physiological sciences that proved the existence of differences in structure and function of the nervous system at different stages of evolutionary development, destroyed all the arguments of idealistic monism "from above." The merits and value of this research and of its experimental methods are obvious, as well as the value of the data acquired. It seemed as though the correct solution would come in the near future, but it only seemed so. Materialistic physiologists did not master the dialectical method, and therefore, having crushed "monism from above," they created their own "monism from below," which turned out to be akin to the metaphysical and mechanistic materialism of Fischer and Moleschott, who saw no significant difference between thinking and the secretion of bile by the liver. This is what Loeb, the most prominent and brilliant representative of this school, wrote: "There is essentially no difference at all between a caterpillar feeding and a human being thinking." This scientist could say this because he and his pupils explained the different manifestations of behavior in animals and humans by the presence of tropisms identical to the tropisms of protozoa. All phenomena of life in animals, including humans, were seen not from the angle of determinism, and not in the light of their genetic relationships which would be quite correct but from the view, stated dogmatically, that animals are the same as chemical robots. In doing this they tried to eliminate the qualitative differences which exist between different behavioral and psychological types in animals which belong to different stages of historical development.

We shall not linger over the corrections introduced into Loeb's theory by Jennings, who proved that even protozoan tropisms are not so simple as they may seem. Understanding them requires knowledge of the physiological state of unicellular organisms. It is important to note that Loeb's tropism theory, with certain additions, was quite scientific in general when it was applied to explain protozoan reactions. But it turned out to be thoroughly metaphysical when it was used to reduce all psychological and behavioral phenomena to tropisms and thus represent all living beings, including people, as passive biological automata. And here it is not difficult to realize that some relation exists between "monism from below" and vulgar materialism, which is alien to the dialectical materialism of Marx, Engels and Lenin, their emphasis being on active transformation of the environment, rather than passive compliance and contemplation. The Loeb theory is the best example of the fact that materialism that is not based on the dialectical approach becomes as metaphysical as idealism does.

It is not surprising that the monists "from below" and the monists

"from above" reached the same conclusions in spite of the fact that their points of departure were different. Denying the existence of specific differences between animal and human psychological activity, they both arrived at metaphysics. We may remember that the prominent Darwinist and materialist Haeckel once stated the idea of the "panpsychism" of "atomic souls," and developing this idea logically, stated that, according to his methodology, ants possess a sense of duty in the Christian meaning of this expression as the monistic church understands it. We see the same affecting coincidence in the conclusions of the modern Leduc and the vitalist Lossky, who both arrived at panpsychism. The disciples of both types of monism presented in their dogmatic conclusions a purely imaginary simplicity very remote from true dialectical scientific monism.

The cause of the failure of physiological monism "from below" was, as has already been stated, the fact that the representatives of this trend reduced all behavior of animals and humans to biochemical and physiological processes and went no further. They overlooked thereby the historical path that animals followed from protozoa to human beings, during which they elaborated different types of psychological activity corresponding to different stages of evolution. Biochemical and physiological analyses, although they are capable of producing truly scientific hypotheses of the inner mechanisms of animal reactions, are not capable of explaining the laws of psychological evolution, because such questions are beyond the scope of their investigation.

It is clear that for the scientific solution of the problem of the origin of psychological activity in animals and people the historical method of investigation is required, which alone can demonstrate the main stages of psychological development beginning with the most primitive forms. Important problems are awaiting solution: How can we explain the origin of different types of psychological activity? How can we trace their biological interdependence during development, their relationships with each other?

Comparative psychology (biopsychology) is approaching a solution of these problems. It is capable of elucidating the laws of psychological evolution by means of the historical method.

SOME FINDINGS IN COMPARATIVE PSYCHOLOGY

Basing the evolution of behavior and psychological activity on the excitability of protozoa in the form of various tropisms, biopsychology states that this capacity emerges at the earliest stages of animal existence and has biological significance in three main directions: feeding, reproduction, and self-defense.

These three main paths are the ones along which all further evolution of behavior proceeded, acquiring new forms as the development and increased complexity of the nervous system took place. The initial stage

of the neuromuscular system from the other cells can be seen first in lower *Coelenterata* (*Hydras*). In jellyfish and *Actinia* we see distinct aggregations of nerve cells in the form of the so-called diffuse nervous system. Here too we see that the activity of this diffuse nervous system is manifested in the typical form of a reflex, by which the animal reacts to external stimulation in order to feed or to protect itself. In *Actinia,* we can most distinctly see that the reflex is nothing more than the reactive function of separate body parts not always well coordinated among themselves. The interesting experiments of Pieron, Parker, and Loeb on *Actinia equina* are good examples that enabled Wagner to draw the following conclusion:

> *Actinia* does not react as a whole with the parts of its body, and its reflexes are autonomous. Even in cases when the action of *Actinia* resembles the reaction of the whole organism endowed by psychological unity, as, for example, when the contraction or relaxation of a contraction of the whole body occurs, this unity is only imaginary.

The diffuse nervous system does not enable the organism to act as a united whole. The actions which seem to be coordinated are in fact the result of mechanical summation of a greater or smaller number of separate actions and not the result of activity of a center which organizes the activity of all neuronal systems. . . . Here the activity of animals seems to be a composite rather than a unit.

I shall not cite the data that illustrate these points. Interested readers can find them in many of Wagner's works (volumes I and II of "The Biological Foundations of Comparative Psychology" and other works). Here we are interested only in the fact that a reflex as a reactive function is the result of the dialectical complication of protozoan excitability (tropisms) and is distinctly manifested for the first time in coelenterates.

The further development and complication of the nervous system can be observed in worms. Instead of a diffuse nervous system, we see here a series of ganglia connected with one another by means of a common nerve chain. The number of such ganglia and their corresponding body segments is different in different kinds of worms. According to this number they are subdivided into oligomeric and polymeric groups. For the analysis of further evolution it is important to remember that the polymeric type evolved into the nervous system of *Millipedia, Crustacea,* spiders and insects, while the oligomeric type led to development of *tunicata, hemichordata* and *vertebrata.*

Thus the diffuse nervous system of coelenterates is transformed in its development into the segmentary ganglionic nervous system of worms. At the same time the complication of reflexes occurs. Instead of the autonomous actions of coelenterates, we have reflexes gradually becoming more complex and creating a new superstructure, a new type of animal reaction (instinct). Instinct, the next stage of development, developed

historically on the basis of complicated reflexes, is a behavioral reaction of the whole animal. It is a psychological category with a number of new, specific characteristics, contrasting with the purely physiological category of reflexes as reactions of separate organs.

The typically complex instincts arise in the course of development. Wagner performed experiments in which he ablated the heads of worms, *Millipedia,* caterpillars, etc. He demonstrated that in these animals there is no clear borderline between complex reflexes and primitive instincts. "After their heads have been ablated and sometimes some thoracic segments as well, they retain some capacity for instinctive activity" (Wagner, "Elementary Psychology").

So far, we still observe the high degree of autonomy of separate groups of segments, each capable of primitive instinctive life. At this stage of development it is still difficult to distinguish an instinct from a complex instinctive reaction. After an animal (*Millipedia*) is cut in two, each of its parts is capable of performing the actions characteristic for the whole animal. In other words, the caudal end of the animal performs trials and "learns" in the same way as the whole animal (Wagner).

It is difficult to establish a distinct borderline here between the reaction of body parts (segments) and the behavioral reaction of the animal as a whole. These animals possess no brain such as is present in vertebrates, without which the behavior of the animal as a whole is inconceivable. As to the head ganglion, owing to sense organs connected with it, it plays only the role of a first among equals. Here we are only at the dawn of the emerging psychological activity characteristic of the highly organized matter of the segmentary nervous system, at the sources of the primary psychological activity (elementary instincts) of worms. Thus it is quite understandable that the essence of the difference between the biological roles of the reflex and of the instinct in these animals is still difficult to find. In order to do so one should compare the most extreme points of the evolutionary stages, for instance the reactions of coelenterates and the behavior of insects, in which, as we know, instincts have developed to their higher limits. Then specificity of the instinct—the behavioral action of the animals as a whole—will be shown quite clearly. At the same time its difference from autonomous reflexes is obvious.

> Comparing the life of *Actinia* with that of insects, we see clearly the difference in the biological roles of reflexes and instincts. . . . [The reflex] is always a definite reaction in response to a definite stimulus, and always follows the same pathways. This is why, in reflex activity, we never observe phenomena which are common for instinctive activity; for instance, when worker bees provide different foods for future workers and future females, respectively, that is, when they perform actions which require definite knowledge; although this knowledge may not be individually acquired, it is still real. (Wagner).

The term "knowledge" of course is used here conventionally, only in the sense of ability to perform the series of complicated hereditarily determined actions useful for the species and therefore fixed by natural selection. The term "spontaneity" in describing instinct should be used also conventionally, in contrast to the greater automaticity of reflexes. There is nothing mystical in such "spontaneity"; simply, its mechanism is not yet known.

As they become more complex, the simple reflexes achieve their highest degree of development in the pseudosocial insects (ants, termites, bees). It is characteristic that here development goes through extraordinary phases between its origin and its end result. This was proven in the experiments of Professor Wagner with caterpillars, in which instincts are not so highly developed as in adult insects, but in which the functional antagonism between reflexes and instincts is expressed fairly clearly. The investigator ablated the caterpillar's head and found that in the animal deprived of the head ganglion, the organ which controls predominantly instinctive activity, the reflexes changed dramatically: in response to tactile stimulation, the head-ablated animal developed, instead of a single movement of self-defense (as in the normal condition) a series of reflex movements which continued (because of the elimination of the inhibition effect of instincts) for a long time after the cessation of stimulation, up to total muscular exhaustion without any biological gain. This type of interaction between reflexes and instincts in the evolution of behavior has great biological significance.

Professor Wagner concluded his experiments thus: "Instincts are antagonists of reflex activity, which they can inhibit in certain cases and up to certain limits; they control and govern reflex activity the more noticeably, the higher the organism is in the scale of progressive development of instinctive abilities." The biological usefulness of such relationships, fixed in the course of natural selection, permits the animal to expend its efforts, not to the point of exhaustion, but only to the extent to which it is affected in response to noxious or useful agents.

THE CHARACTERISTICS OF INSTINCTS

It is typical of instincts that within certain limits they are unerring and match their biological tasks perfectly, but as soon as the habitual environment changes the old instincts become quite senseless and useless for the new conditions. Thus the young sazans (fish of the carp family) instinctively stay in the mouths of rivers. As these places become more and more shallow, the fish begin to die, because their instinct still holds them there. Only those few will be saved that will develop new instincts which will help them to shift into new, deeper places (Wagner).

Biopsychology subdivides all instinctive activity into three main groups: the instincts of feeding, of reproduction and of self-preservation. Of

course, this classification, like any classification, is to a certain extent arbitrary; animals never possess these instincts in isolated form. In general, a complicated system of interactions of these instincts exists, with one instinct predominating at a particular moment. When the animal is hungry, the instinct of self-preservation is inhibited and the animal rushes towards its prey, abandoning its usual caution, and frequently can be snared by a hidden trap.

At particular seasons the reproductive instinct inhibits the feeding instinct as well as the instinct of self-preservation. Furious fights occur at these times between males in order to win the female. Animals that usually are very cautious fight each other in open places, paying no attention whatever to potential danger and forgetting hunger. Most often it is the instinct of self-preservation that dominates all animal behavior. Such a complicated phenomenon as parental care, which always impresses the anthropomorphists such as Brehm, at the same time include cases when the mother eats the offspring or when the offspring eats the mother, as with several spider species.

If the infant animal is very young the mother sometimes sacrifices herself and perishes defending it or distracting the attention of the enemy. But when the cub has grown a little, the mother often abandons it in case of danger, leaving it to itself, sometimes dooming it to death. Here the decisive factor is not maternal love but natural selection, which, obeying the law of benefit to the species, regulates the interrelation between the instincts of self-preservation and reproduction.

We happened to observe maternal behavior in shore bird colonies near Murmansk and Novaya Zemlya. Maternal care changed gradually, day by day, as the chick was growing. The bigger and more independent the chick became, the less attention was paid to it by the mother. During the first days of the chick's life, the female guillemot did not leave it even for a little distance, even when the . . . (by fluctuation, or variation) or by means of sudden mutational emergence of sharply different new features (see Wagner's *Comparative Psychology,* I and II, and his *Studies in Comparative Psychology,* No. 3). . . . The whole evolution of instincts is possible only because of this peculiar species-specific plasticity of deviations from the main type which are independent of individual experience.

The unchangeability of instinct is also as relative as the stability of species (Wagner). Within the stable species pattern of instinct, fluctuations in an opposite direction always take place. Only owing to this unity of opposites—pattern of stability and pattern of fluctuation—is the development of new forms of instinct possible.

Each phenomenon needs to be defined. It is difficult to define instinct briefly, because of the complexity of the phenomenon; because of this, psychology is accused of devising overlong definitions. Several attempts to define instincts in a few words have obviously failed (Spencer, Lloyd

Morgan, Ben, Gross, Ziegler). The most appropriate, in spite of its newness, and the most correct, seems to be "Instinct is species knowledge in animals." The very term "species knowledge" implies, of course, its difference from individual knowledge. At the same time, this definition emphasizes that in instinctive activity there are, objectively, results of which the individual animal is not aware, but which are biologically indispensable for species development. Examples which prove the correctness of the view of instinct as species knowledge or species experience are numerous. Several are given below.

The larva of the rhinoceros beetle constructs a cocoon which is greater in dimensions than its own body, but which fits the body size of the future imago, knowledge which the larva could certainly not possess (as even the most ardent anthropomorphists must admit). A cocoon of the same size as the larva itself would imperil the future imago because of the latter's greater size, and therefore would imperil the survival of the whole species.

The domestically raised young beaver tries to construct a dam in its cage using twigs, without any special learning, as if anticipating the vital need for this construction in its natural habitat.

A young bird of a migratory species incubated in captivity and absolutely tame tries unsuccessfully to leave the cage in autumn, at the time of migration, in an attempt to join the migrating conspecifics that it has never seen. In the wild the migratory instinct acts providentially to exchange the summer habitat for a new one long before the winter cold arrives.

All these examples demonstrate that animal instinctive activity proceeds without any individual learning. The same case is true of a bee, which first constructs a cell of wax, then fills it with honey, and only after that lays an egg in the cell. The honey supply is made providentially by the bee for its future progeny, without any sign of individual experience or imitation.

THE CONTENT OF THE NOTION OF INSTINCT

From ancient times to the present, metaphysical philosophers have tried to distort the notion of instinct and to introduce into it some mystical sense of "the wisdom of the Creator." The idealists do such things very well! At the same time it is absolutely clear that biopsychology is by no means responsible for such a falsification of the notion of instinct, a notion which is purely biological. Professor Wagner, who is one of the most qualified experts in the biology of instinctive phenomena wrote: "The seeming mystery of instinct is in fact the mystery of our ignorance." Metaphysicists take advantage of the ignorance of average, educated people, obscuring the scientific investigation of instinctive phenomena with religious and philosophical mist.

Professor Wagner names as one of many instances exposing "the wisdom of the Creator" the construction of swallows' nests. Investigating the nest building activity of swallows, using his biopsychological method, he found that several nests had special foundations that gave them exceptional firmness. This fact, a shining example of biological adaptability, moves to tears the sentimental metaphysicists who believe that it was the Creator who in His wisdom endowed swallows with the ability to fabricate their nests so expediently. But detailed biopsychological analysis of this case reveals quite another explanation of this phenomenon. It appears that this foundation, so well adapted to its purpose, was elaborated as the result of the failure of very many less well adapted nests which were thrown down by winds. Here too, occurred natural selection, almost before the observer's eyes. Mechanically, from year to year, by mercilessly destroying all nests which were of nonadaptable type, natural selection established the type of construction that would serve as the safest home for this species of swallows and its young. Apparently, "the miracle of the wisdom of the merciful Creator," that so strongly moves the learned mysticists had every year arranged a bloody purge of less suitable variations in order that a few young birds would be raised in the adaptive type of nest. Biopsychology produced many such demonstrations. Instinct appears to be no more miraculous than protective coloration or other types of ecological adaptations in various animals. But, in cases of abrupt environmental change or in human-made conditions, instinct became pointless and even destructive owing to its very slowly changing nature. "The miracle of the wisdom of the Creator," that taught the squirrel to bury nuts in the autumn, reveals its total natural futility when the squirrel attempts to bury the nuts under the carpet in a room. But this instinct, useful for the squirrel in the natural environment, was formed by means of natural selection of useful behavioral elements.

No animal learns an instinct. It is born with it, being able to perform a number of extremely complicated actions vitally useful in its natural habitat. A young bumblebee first out of its pupa has never seen the process of cell construction, but still can do it no less perfectly than an old one. Young buzzards are capable of distinguishing a venomous snake from a nonvenomous one in a flash, without any previous learning and without having seen a single snake before, while people often mistake snakes in spite of all their knowledge. Carrier pigeons fly straight to the spot from which they were taken after being transported hundreds of miles in an unknown direction in a closed basket. Nobody taught them this art; they were hatched from the egg with it, therefore they perform it instinctively. The seasonal migration of birds, as well as the most complicated constructions of beavers, are made by instinct. All this animals do without any individual learning (newly born animals doing as well as older ones). All these instinctive skills emerged automatically at

the cost of the lives of myriads of living creatures that did not possess instincts sufficiently adapted to these conditions.

So biopsychology has provided a scientific answer to the problem of this seeming miracle by stating that "here we have an excellent example of the mode of origin and development of instincts suggested by Darwin; that is, the gradual accumulation of useful characteristics developed in various directions without conscious participation (without awareness of purpose), and fixed in that direction by natural selection, which were useful for the species in its struggle for existence" (Wagner).

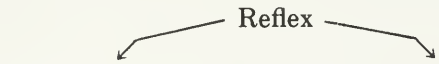
The evolution of intellectual abilities in animals, the bifurcation of the ancestral worm group into oligomera and polymera gave birth to different patterns of further psychological development: in the continuum from polymerous worms to higher insects we can see the increasing complexity of instincts and a very feeble development of individually acquired behavior. The entire body of facts relating to insect learning and training proved to be either imprecisely described or subjectively explained. In fact, higher insects are capable only of instinctive spatial and mosaic-object memory. At the same time, in chordates possessing less developed instinctive reactions (in comparison with arthropods) we can see the highest level of development of behavior and intellectual ability based on individual experience which is finally transformed only in humans into a new, purposeful ability to make artificial tools and to connect sounds into articulated speech. Intentionally, we do not touch here on this special question.

One of many purely biopsychological proofs pointing to bifurcation in the evolution of psychological activity (Figure 1), rather than to a straight course of development as is supposed by certain scientists (Figure 1, B1 and B2), are the facts showing that, for instance, in fishes in which we observe the emergence of truly *individually* acquired behavior (Möbius, Goldschmiddt, Hamburger, Wolf, Frolov and Khotin), the instinctive life is infinitely simpler and less well developed than in insects.

It is clear from these facts that behavior based on individual experience is not the result of a complication of instinct, but that both instincts and intellectual abilities in animals developed from a common basis, that is, from reflexes, with the rate of development differing in different evolutionary branches. Of course, we see the presence of instincts in vertebrates as well, but they do not achieve the same complexity as in arthropods (for example, in insects).

Behavior is based on individually acquired experience developed out of dialectically complicated reflexes; and it stands in contradiction to reflexes, as also do instincts. The proof of this is in the facts of biopsychology, as well as in the following facts from the field of neuropathology (the school of Professor M. I. Astvatsaturov). The activity of the cortex of the brain (the organ of individually acquired behavior), which is the most recent evolutionary achievement, inhibits and controls the reflex

Development of Psychological Activity
Scheme A
Wagner



Instinct

Intellect
(i.e., behavior based on individual experience; purposeful human ability to create artificial tools)

Scheme B

A. Spencer and Darwin	*B. Lewis and Pouchet*
Reflex	Reflex
↓	↓
Instinct	Intellect
↓	↓
Intellect	Instinct

activity of the segmentary levels. This antagonistic "contradictiveness" in the activity of the segmentary levels is revealed most clearly in cases of pathological processes in the cortex and its efferent (pyramidal) tracts. In such cases, when the inhibitory activity of one of the pair of antagonists is switched off, the activity of the other antagonist, that is, the reflex activity of the segmentary structures, increases. At the same time, the most phyletically ancient pathological reflexes begin to appear. These reflexes, such as the grasping reflex of the foot (Babinski and Rossolimo reflexes) were once biologically useful to our tree-climbing, four-handed ancestors, but lost their biological significance in the course of the evolutionary acquisition of erect posture by humans. The child is born with these old reflexes, but by the time of the emergence of upright posture they became inhibited, and in the healthy adult are not seen at all. The antagonism between the activity of the spinal cord and the brain cortex, related evolutionarily with each other, is revealed when the latter is damaged. Then "the beast of the abyss of the past" roars threateningly. The dead grasp the living only when the latter lose their strength.

Having thus elucidated the genetic relationship between the reflex and the intellect (individual experience) in animals, let us see now what is the nature and what are the limits of this animal intelligence and where lies the fundamental principal difference between it and conscious (purposeful) human activity.

Most physiologists consider an animal to be a living machine that functions only on the basis of unconditioned and conditioned chain reflexes. Thorndike's theory of the chain of associations is close to this

mechanistic view of individual learning. On the other hand, the anthropomorphists—Romanes, Espinas, LeTourneau, and others—humanize animals completely. Both points of view are equally alien to biopsychology. Its historical method of investigation adduces a number of facts and observations that prove that animals are not machines operated by reflexes. At the same time biopsychology demonstrates that all the statements of anthropomorphists about "clever dogs," "horse mathematicians," or "ape geniuses" are based on old wives' tales about their exceptionally clever animals or on observations of the results of expert training by circus performers. Their tricks do credit to their skill, but they do no credit to the credulous spectators who take all these cases for scientific proof of animal intellect.

Here are some facts from biopsychological materials on this subject. A bee has constructed a wax cell and begins to fill it with honey. If the experimentor destroys the bottom of the cell so that the honey flows out, the bee, even while aware of this, continues to fill the cell, and the honey will keep flowing out. What is more, a little later the bee will put its egg into the cell and will seal it up in the empty cell, leaving the future larva to starve. Another example: A bird lays an egg in the nest; the experimentor removes half of the nest, including its bottom. The egg inevitably falls through and breaks. But the bird, seeing all this, will proceed nevertheless to lay eggs one by one in the nest, which will all fall to the earth before its eyes and break. Where is the "architect's and builder's" understanding of the goal in such cases?

I happened to observe a cow that "learned" to open the gate in the yard. The cow rubbed its horns against various other objects in the yard, according to its usual custom. During the rubbing movements against the gate, the latch occasionally opened and the animal gained its freedom. After that, the cow always came up to the gate and made the same rubbing movements, thus opening it. It is clear that there was no purposeful use of the latch as a tool here, but that the cow succeeded in opening the gate, owing to the fortuitous association by contiguity between the lifting of the latch and the series of rubbing movements. The similarity of these actions to those of a human being of using tools is only illusory. The owner of the cow was of another opinion. She was absolutely certain of her cow's human intellect and was quite offended by my doubts in this respect.

Lubbock taught his "outstandingly clever" dog to choose from many others the plate with the word FOOD on it, reinforcing this choice by feeding. Here the same type of association by contiguity took place between the food and the olfactory and visual stimulation from the plate. But this enabled some people to be enthusiastic about the dog's "ability to read." At the same time Lubbock was unable to train this dog in arithmetic. After long and fruitless efforts, he stated that "he was disappointed by the dog's inability to distinguish even one stripe from

three." Yerkes analyzed the behavior of one other rather famous dog, Roger, who played cards, wrote words and solved arithmetic problems. After careful analysis, he concluded that this dog had been trained to catch the subtle (intended or involuntary) movements of its owner's hands, eyes, and head. They were not always noticeable to people, but represented a rather easy task for the sharp eye of the dog. The same must be said about horses—various "clever Hanses," "Emirs" and other bread winners of the circus ring. Morgan shares this opinion. Kineman while observing the life of caged macaques saw that they succeeded in opening the cage door by means of random manipulations. But he did not discover any special purposefulness, no wish to be free, in their activity.

During my experimental work on imitative behavior in rhesus monkeys in the Leningrad Zoo I often observed incidentally something that clearly demonstrates the absence of any purposefulness in these animals. The monkeys were trained to open the cover of their food bowl and to take grapes from it. Very soon they began to do it without a mistake. But once one of the animals sat on the cover, and I saw that it tried, unsuccessfully of course, to remove the cover while sitting on it. This animal, as well as those who were near it, could not understand the correct sequence—first, to free the cover of its body weight and only then to remove it. They went without getting food although, I repeat, they had removed this cover a hundred times before.

The special experiments with chimpanzees performed by N. A. Ladygina-Kots in Moscow and the German Professor Koehler in the Tenerife station seem to me to be the most interesting. Ladygina-Kots observed the behavior of chimpanzees performing numerous experiments. Though she somewhat overestimated their abilities, she nevertheless had to admit that their abstractions "were not abstractions in the strict sense of the word, since they were *not* the result of a logical operation based on the formation of ideas and on formal inferences about the essence of the process."

Professor Koehler described in his extensive work several actions of chimpanzees bearing an outward resemblance to the capacity for tool-using and even tool-making. While we acknowledge the great value of these data we disagree with the author in the conclusions he drew from them. Detailed analysis showed that although these actions really had taken place, they were accompanied by such a great number of absurd and purposeless actions of the animal as to compel denial of any possibility of speaking, even with reservations, of the chimpanzee's capacity for "abstractions" as well as for tool-using and manufacturing. Chimpanzee behavior bears only an apparent resemblance to human conscious activity. In their essence the two are as different as the paths of their historical development.

It is not to be forgotten that the human capacity to use tools, and especially to manufacture artificial tools, as well as the capacity for articulated speech, appeared in humans as late as the dawn of their history. This dawn, evidently, never shone for the ancestors of anthropoid apes (because of their specific developmental conditions) and it will never shine for them. The attempts of certain amateurs, "a la Brehm," to look for speech in apes are futile. Of course, primates, as well as many other animals, are capable of using their own "language"—specially modulated sounds—in order to communicate with one another, which we also noticed in our observations of monkey behavior. But this capacity should in no way be compared with the most primitive human purposeful speech, just as the activity of a chimpanzee in joining two sticks together (the accidental end result of numerous inborn nonpurposeful actions) should not be compared with the conscious, if primitive, creative ability of cave dwelling peoples when they manufactured "the crudest stone knife" (as Engels noted).

Because of this it seems to us that those scientists who consider, after studying apes objectively, that they are quite incapable of even elementary thinking, more nearly approach the truth than those like Yerkes who ascribe reason to apes, seeing in their behavior some capacity for "ideation." Admitting that apes occupy the highest position in animal classification, the former scientists still believe that the "summit" achieved by apes cannot be compared with that obtained by humans.

At the same time serious attention should be paid to the views of Leshley, Koffka, Adams, Tolman and Higginson concerning the complexity of the animal's learning process and its nonautomatic nature. What is the explanation of conscious psychological activity in humans, which developed historically from psychological activity in animals?

The human capacity for purposeful and deliberate manufacture and use of artificial tools, as well as the capacity for articulated speech, are the qualities which make humans different from all other animals.

They are all the results of the effortful activity of human ancestors which led to the highest development of the neuromuscular structure of the upper extremities and to the development of brain and language. Thus, the capacity for purposeful acts of work and for speech function are of course, not quite gifts "from above," but represent the next stage in the dialectical evolution of behavior based on individual experience in the conditions of the process of labor.

This capacity, which arose in circumstances that are not yet known to us exactly, enabled humans to modify their environment, adapting it to their needs by means of active, planned action.

The principal difference between human processes of work and animal behavior was noted long ago. Marx and Engels also paid attention to this specifically human capacity. Concluding his well-known example relating

to the activities of the bee and the architect, Marx wrote: "Man is the only one who possesses the following 'simple moments' characteristic of the process of labour: goal-directed activity (that is, labor per se), the object of labor and the means of labor."

Engels, stressing the purely human purposeful quality of labor, noted that "no ape had ever made even the crudest stone knife with its paw."

Biopsychology also states that there is nothing supernatural in the origin of the human capacity for conscious purposefulness; there is also no impassable gulf between this capacity and the activity of individual experience in all other animals. Still, purposeful activity is characteristic of humans, and of no other creatures because "labor created man" (Engels).

Certain physiologists (Savich, Frolov) and jurists (Petrazhitsky and others) do not agree with this. They try to invalidate the assumption of human purposefulness as one of the main criteria of human thinking.

Professor Savich points to Don Quixote's battle with the windmills as an example of nonpurposeful activity. Professor Petrazhitsky states that in everyday life our speech contains many phrases and expressions that are meaningless. He gives as an example characterization of a negative act as "foul," or "criminal," spoken with full knowledge of their meaning, but without intending prosecution. These words are uttered "because" rather than "in order to."

We consider these objections to be without merit. The tragicomic and ridiculous actions of Don Quixote did not at all lack goal understanding, in spite of their actual absurdity. Don Quixote knew what he wanted to do and for what goals he acted. But he could not discriminate between the objects of his banal surroundings and the ideal images that were in his honest but half-mad brain.

If all the actions we perform were always appropriate to actual circumstances, we would never make any errors. But even while learning through error we visualize our goal quite distinctly. Only because of that, we are able, gradually correcting our mistakes, to approach the goal, which is always conceptually present in us at the beginning of any work.

Pertrazhitsky's argument that we perform a large number of habitual actions and utter habitual phrases without understanding their intent is also unconvincing because a habitual action could have become habitual only because it was first performed with full understanding and according to a planned goal. Shaving with an axe cannot, under usual conditions, become an habitual action of a mentally healthy man. But, while performing a habitual task, we act as if we had forgotten the goal that we had clearly in mind originally and used to think over in detail. If we recall a series of habitual greetings and oaths we shall realize that they were once intended literally and were accompanied by appropriate purposeful actions.

The expression "Be well" (Russian for "How do you do") was once a

real wish for good health and strength; "Always at your service" at the end of a letter was not always as trite as it is now. At one time, a person who used such a phrase was truly expressing deep devotion.

Professor Wagner, discussing the difference between animal intelligence (the behavior of individual experience) and human activity, correctly emphasizes that in the latter purposefulness is a factor "if not always an actuality, always a possibility," while animals lack this very capacity. The capacity for individually acquired behavior was transformed in humans, in the course of dialectical evolution, into the capacity for goal understanding.

Some stages of such transformation can be seen in analyzing child behavior. At first, when the child has no understanding of the purpose and convenience of a fork, it takes the food up with its hand, which seems to be easier; but remembering its parents' bidding to use a fork, it spears the food on the fork with its hand, and only then carries it to its mouth. Understanding of the greater convenience in civilized conditions of using a fork is acquired only gradually. Sometimes the child tries to eat soup with a spoon using the convex side, naturally achieving no result. But at a certain age the spoon begins to be used correctly, the goal being understood, and such mistakes are never made again.

Nineteenth century travelers described more than one occasion when natives of Central Africa, given rifles for the first time, and knowing their effectiveness, still used them for a long time as sticks while marching and for knocking down fruit from trees. But "brain capacity" as a morphophysiological precondition for purposeful activity is clearly present in them, as in Europeans when they act in appropriate situations.

This is why the fascist theory of the biological inferiority of psychological activity in colonial peoples, in comparison with those of the "noble" races, can stand no scientific criticism. It is characteristic that bourgeois ideology revealed the face of its class in both cases—in monism from "above" of the social Darwinists and the monism "from below" of mechanistic physiologists who tried to explain human social life by means of the theory of tropisms (Waschweller), the theory of reflexes of freedom and goal (Pavlov, Savich), or the theory of collective reflexology (Bechterev).

Marx and Engels remarked long ago that it is inadmissible to apply biological laws to human social life. They justifiably reproached Darwin, first for extrapolating Malthus' law from bourgeois sociology to the animal world, and second, for applying in the same way the idea of the biological struggle for existence to human society. The organic school of Spencer (Worms and Lilienfeld), and social Darwinism, beginning with Haeckel and ending with modern fascist social theories of the "animal-like psychology of the colored and inferior races incapable of abstract thinking," try to justify the colonial policy of capitalist violence.

THE PRACTICAL SIGNIFICANCE OF BIOLOGICAL PSYCHOLOGY

Let us discuss the applications of biopsychology. From prehistoric times to the present day people have always been interested in the psychological activity of animals.

Each day in the life of primitive humans was a day of furious struggle for existence. They had to fight to obtain food and to avoid predators. They had to know the habits of the beasts they hunted, as well as those of the beasts who hunted them. It was a time of continuous fierce struggle against animals for food and life itself. The death of the conquered secured life for the conqueror. The primitive fisherman struggling for food had to know the habits of local fishes, the places where they gathered, the place and time of spawning, the best kind of bait, and similar matters.

The primitive hunter had to know the habits of different animals in order to read their traces on the snow and on the ground and to counter their caution. He had to know their route to the water, the places where they rested and made their homes, and the degree of development of their senses of sight, smell and hearing. Without such knowledge his life was in danger. Knowledge of these distinctive characteristics enabled him to elaborate different patterns of hunting and self-defense.

At that time torches and flints attached to bones were the only weapons known to *Homo sapiens,* who was physically weak in comparison with the giant predators of those times.

As a result of the collective labors of primitive people, empirical knowledge of animal psychological activity was gradually accumulated, helping them to win in the struggle against the teeth and claws of their enemies. "The dark wisdom" of animal instinct was conquered by collective human knowledge.

An acquaintance with animal psychology also was necessary for humans in the period when they tamed and domesticated wild animals. For domestication, which formed the basis of cattle breeding and later for development of new breeds, a knowledge of the behavioral characteristics of the animals was indispensable.

Thus, during tens of thousands of years, humanity learned to accumulate empirical knowledge of animal psychology, because the rigorous mode of existence required such knowledge. It was a centuries-long learning process.

But the real science of animal psychology was not yet born. For a long time scientists studied anatomy and physiology describing in detail the structure and functions of the animal body. Zoology was studied, but established science was not interested in the psychology of animals. Only after the work of Lamarck and Darwin did the problems of animal behavior begin to be considered, but for a long time still the correct evolutionary historical method was not elaborated.

Then, about 35 years ago, our Russian scientist, Professor Wagner,

laid the foundation of historical biopsychology, on the problems of which he worked until the end of his life. Nevertheless, the majority of scientists paid very little attention to the problems of biopsychology.

At the present time, when the different sciences are organized according to social, practical needs, the process of socialist construction came close to the problems of cattle breeding, fisheries and rational hunting. A variety of old questions arose again: when, where and how to fish best and to hunt animals most effectively, what bait and tools should be used; how to prevent extinction and how to breed different kinds of fish and other animals.

Hunters and dog breeders became interested in establishing the most effective methods of training dogs (quite empirical by the present times). The question arises whether it is possible to organize a special zoopsychological laboratory to carry out selection of dogs for hunting, searching, military, medical and fire fighting purposes, as well as to investigate which breeds of dogs can be most easily trained for each specific purpose.

Carrier pigeons, which were widely used as the living wireless telegraph of the Red Army, and cavalry horses are still awaiting biopsychological investigation. Every cavalryman must know the psychological peculiarities of his own horse, as well as the group behavior of the whole herd, especially because of the possibility of sudden panic.

Our peasants have been paying a quit rent (wolf-tax) since ancient times. Hundreds of thousands of cattle are destroyed by wolves yearly. We still do not know how to remedy the situation radically. In North America wolves have been totally eradicated. It was accomplished only because, after study of the habits of wolves, it became possible to proceed to their mass extermination. Rats consume annually about one million rubles' worth of food. The task of constructing suitable storehouses for foodstuffs should begin with learning about these crafty animals.

The struggle against predators and pests, including locusts, can be successful only when their instincts are better understood. In order to conquer an enemy it must be studied, its psychology must be known. It is biopsychology that can give us this knowledge by investigating the instincts of self-preservation, feeding and reproduction; methods of defense; various habits; nest building; maternal care; social behavior; intellect; and imitative ability of animals, and the like.

THE BIOLOGICAL METHOD OF OBSERVATION IN COMPARATIVE PSYCHOLOGY

In contrast to the method of the anthropomorphists and to the pseudo-objective method of the mechanists, who tend to make a fetish of the experimental method and deny the scientific value of observation, biopsychology perceives observation to be one of its chief methods. The essence of this method is the study of problems of psychological activity in the

course of their development from lower to higher forms. This method includes three stages of analysis.

The first stage is the investigation of the phylogeny of a psychological phenomenon. The basis of this analysis lies in the objective comparative investigation of facts concerning the species, genus, family, and so forth. Darwin's study of the evolution of nest-building behavior in birds can serve as an example. He began his analysis with birds that do not build nests but lay their eggs among stones or in a heap of putrefying leaves (*Talegalla lathami*); then he shifted to elementary nest-building and finally he analyzed very complicated communal nests—those of weaver birds. Darwin used the same method in the analysis of the building instinct. He traced its evolution from the elementary building instinct of the bumblebee, through the intermediate phase of cell making in Mexican *Melipona domestica* up to the most complex building activity in honeybees, the construction of wax cells.

The second stage is ontogenetic investigation of psychological events made on the basis of comparison of different facts of an individual's life. Wagner's investigation of age characteristics of spider instincts can serve as an example. The change in patterns of hole construction in tarantulas clearly demonstrates the ontogenetic development in their building instinct.

The third stage of the biological method is the synthesis of data obtained during phylogenetic and ontogenetic studies of psychological activity. Professor Wagner indicates that ontogenetic evolution in the young tarantula's building instinct recapitulates in many details the evolution of this activity in the spider family. "At first it [the nest] is an occasional hole in the ground; then a small artificial hole, then a still crude horizontal hole; and finally a vertical hole of specific length." He gives numerous examples of such recapitulation of phylogeny in ontogeny, but, concluding this series, he warns against the crude identification, as well as confusion of these two different categories of the evolutionary process, stressing that there are specific distinguishing features in phylogeny (paleogenetic) and in ontogeny (cenogenetic).

METHODS OF BIOLOGICAL AND PHYSIOLOGICAL EXPERIMENTATION

Observation and experimentation are two different methods of investigating nature, each possessing strong and weak features. Observation, producing rich material by studying phenomena in natural conditions, does not permit the observer to intervene actively in these processes and thus to test them by experience. On the other hand, the usual experiment permits us to intervene actively in the processes and to test them in artificial laboratory conditions. At the same time, however, it often prevents the experimenter from discovering the laws of the same processes

as they occur in nature. Thus, it is not surprising that experimental psychological data quite adequate for describing the process under laboratory conditions prove to be inadequate or even in opposition to those obtained by observation in the natural environment. In studying animal psychological activity the experimental method is traditionally used in parallel with observation. Training, problem boxes, method of multiple choice, maze learning—these laboratory techniques possess not only positive, but also negative features of the experiment, such as isolation of animals from the natural environment and sometimes distortion of their psychological activity in the laboratory, as against natural conditions. Fabre and other scientists, in their study of instincts, used the method of observation with only minimal attempts at experimental interference into manifestations of instincts in insects. Professor Wagner having made comprehensive use, on his side, of the observation of nature, (see his work "The Technique of Animal Observation"), used, also, the method of biological experimentation in studying psychological activity in animals (insects, spiders, worms).

One of the main features of biological, as distinct from psychological, experimentation, consists in the possibility of bringing the conditions of the experiment close to those of the natural habitat. The best example of this method is Professor Wagner's interpretation of the flight of bumblebees through the window of his room to their nests. In this investigation the marked insects, living under conditions close to natural ones, enabled the experimenter to change actively the conditions of the start of flight and return to the nest. This allowed him to demonstrate the mosaic pattern and spatial character of their memory. I believe that this still new and little-known method of biological experimentation should become one of the most important ones, equally with the method of observation in comparative psychology.

At the same time physiological experimentation (including extirpation of various parts of the brain) can also have a place in solving the above mentioned problems in animal behavior. Comparative investigations of normal and decapitated segmented animals and insects, though to a certain extent passing beyond the boundaries of pure biological experiment, enabled Professor Wagner to find out that the ablation of the head ganglion by means of ligature or partial damage (in worms, leech, *Millipedia*, cockroaches and several species of higher insects) induces far less change in normal behavior than occurs when the brain is damaged in vertebrates, especially in higher ones. Hence, a conclusion was made concerning qualitative differences between the processes of ganglionic and central nervous systems (Wagner, "Segmentary Psychology").

In our studies of bird colonies on the shores of Murmansk and Novaya Zemlya, in addition to observation, we used the method of biological experimentation and obtained a number of interesting data on the psychological activity of guillemots and kittiwakes.

As a rule, physiological experimentation reveals the laws of the functions of organs and organ systems under more or less artificial conditions, while biological experimentation reveals the interactions of organisms within the environment and with one another in natural habitats. Consequently, these two methods, together with the method of observation, each investigating its respective field of phenomena, do not exclude, but complement one another in a comprehensive investigation of animal psychological activity.

CONCLUSION

In my concluding remarks it is worthwhile to emphasize the essence of the historical method of comparative psychology. This method asserts, first, the continuous variability in the forms of animal behavior and psychological activity, and, second, their saltatory development. Historical development of various forms of psychological activity proceeds by means of quantitative and structural complication of one typical quality being transformed into another.

In our day the advances of the physiological sciences, especially the science of the physiology of higher nervous activity led by Academician Pavlov, have encouraged certain representatives of this school to consider their physiological method to be universal, all-embracing, and to draw erroneous, crudely materialistic conclusions in biology and even sociology. Metaphysical materialism, inadequate even at the time of its origin, is still more inadequate now in its attempts to adequately interpret the biological problems of psychological evolution, not to mention its complete inadequacy in the field of sociology.

The valuable discoveries of the physiological school of Pavlov, as well as those of the biochemical school of Loeb, speak for themselves. Their great significance in achieving understanding of the mechanisms of behavior is truly indisputable. They have given something and promise to give still more within this field. Especially important are their achievements as a weapon against the newest forms of disguised vitalism. At the same time, the tendency of several scientists of these schools to neglect *historical investigation of the evolutionary laws of behavior and psychological development* in favor of chemical and physiological methods of investigation is more naive than was the materialism of Buchner and Moleschott. The time for loud mouthed, superficial, simplistic generalizations has passed. Now it is necessary to combat the assaults of disguised idealism in biology from the right and at the same time to avoid a shift to the left, "left childishness," that is, the new mechanistic tendencies which appear in the form of physiological assertions denying the existence of psychological activity in animals and the validity of biological psychology as a science. Such tendencies really do exist, and not only abroad (Loeb, Baer, Boete, Uexküll, Ziegler, Neel, and the

American behaviorists). Due to such presumptions, physiologists often deny the existence of biopsychology (comparative psychology) as an independent science with its own objective methods of onto- and phylogenetic observation and biological experiment.

The main methodological error of the point of view mentioned above is the mechanistically simplified reduction of complicated phenomena in animal psychological evolution to physiological mechanisms. One of the examples of this is the attitude of the majority of physiologists toward the question of instinct. Some of them are afraid even of the term "instinct." The main trouble is that they know too little about the biology of instinctive activity, and thus it is difficult for them to evaluate to a full degree the significance of the scientific biopsychological investigation of instinctive reactions as a type of behavior. It is true that recently certain physiologists have appeared who want to approach the analysis of behavior not from the standpoint of its mechanisms but from the standpoint of general biological evolutionary study; but they are forced to conclude that to solve this problem the investigation of instinctive behavior as such is necessary. Their fear of the concept of instinct is gradually receding.

I have not touched here on the special problem of the mechanisms of instinct phenomena because it pertains rather to the field of comparative physiology of the nervous system. As was mentioned above, we are interested here in the biological laws of the development of different types of behavior. Even if it had been proved experimentally that the mechanism of instinctive acts is nothing else than a chain of unconditioned reflexes (Pavlov, Savich, Frolov), or is formed on the basis of the humoral dominance of certain endocrine glands (Vassiliev)—even then, the knowledge of the physiological mechanisms alone would help little in the investigation of *biological evolution.*

The experiments of Professor Beritov's school, using the technique of "free movements" are of extreme interest (*Fisiol. Journal,* 1934, nos. 2, 3, 4). Having for several years studied the physiology of the central nervous system by means of conditioned reflexes, Professor Beritov concluded that this physiological method is "absolutely inadequate for the study of animal behavior," and that "the laws of reflex activity cannot be applied to behavior." This scientist drew these conclusions on the basis of numerous facts brought to light by his experimental work.

Beritov contrasts individual "conditioned" reflexes of an animal connected to a special device in an experimental chamber with the individually acquired behavior of an animal ranging freely, considering them to be different in principle. He gives a series of convincing examples and states, "We often face such individually acquired reactions that can by no means be considered as being performed automatically, according to the 'signal-response' rule." From this he concludes that "behavioral science should possess its own techniques of investigation in accordance

with the character of its subject (and in contrast to the study of conditioned reflex mechanisms)."

Basing our opinion on the data of biological psychology, we fully agree with these considerations of physiologist Professor Beritov. At the same time, we do not hide our fundamental disagreement with him on his suggestion concerning the existence of "purposefulness" in animals. We think that this erroneous suggestion is the reaction against dogmatic views of the majority of conditioning investigators who claim the universal applicability of their method to all behavioral manifestations in animals. The bold and sincere disagreement of Beritov and his pupils with this dogma of the majority of physiologists signifies that we are at the beginning of great discoveries, when the physiology of higher nervous activity and biopsychology will find ways to reach real understanding of *instincts*. Actually, the hypotheses about humoral chain reflexes as the mechanism of instincts go contrary to reality, since very often we can see a series of instinctive acts that are not connected with one another by action sequence and have no common basis in endocrine activity (the complex building instincts of insects, spiders and other animals).

The most recent attempt to explain instincts by a physiological hypothesis of autoanalyzing activity was made by N. Nikitina (*Archives of Biological Sciences*, v. 33, "On a physiological approach to the interpretation of the nature of instinct.") Nikitina's attempt is really as far from being a true biological investigation of instincts as all previous efforts by physiologists. But her work is interesting, apart from its special conclusions, in that the old physiological conception of instinct as a chain of unconditioned reflexes no longer satisfies even the physiologists. Unfortunately, up to these days some physiologists continue to ignore the psychological essence of instinct because of their physiological interpretation of it.

Lashley's considerations on the inconsistency of physiological efforts to explain instincts by means of the reflex doctrine are of extreme interest. He writes, in his "Brain Mechanisms and Intelligence":

> Under the influence of the reflex theory I attempted, some years ago, an analysis of the instinctive recognition of their young by birds (Lashley, 1915) in the hope of being able to determine the particular receptor cells and reflex arcs whose excitation aroused the responses. It was speedily clear that the adequate stimulus could not be expressed in any such terms but was a pattern which might vary widely in detail and in the end-organs stimulated. Similar studies of the sex behavior of the rat (Stone, 1922, 1923) and unpublished work on recognition of the young in the rat and the nursing reactions of kittens indicate clearly that the essential element of the stimulus is not the excitation of a pattern of specific sensory endings but the excitation of many endings in a particular spacial or temporal pattern. A review of the literature

> on instinct seems to me to suggest that the characteristic of instinctive behavior as distinct from reflexes is just this capacity to be aroused by a pattern of excitation, irrespective of the particular afferent cells which conduct the stimulus. (p. 158).

And again:

> The theory of the reflex was evolved to account for the most unintelligent of behavior, the activities of the "spinal" animal. It was first elaborated in the doctrine of chain reflexes (Spencer) as an explanation of instinct, at a time when no single instinct had been subjected to really critical analysis. More recently and still more critically it has been promulgated by the Russian objective school as an adequate basis for explanation of all behavior. The theory has the advantage of simplicity which makes for its popularity as a slogan; but when one is confronted with the necessity of accounting for a particular group of activities, above the level of the spinal reflexes, in terms of the reflex theory and of working out that account in detail, the inadequacy of the theory becomes evident." (p. 163).

As is clear from this statement, the opinion of this prominent scientist is in deep disagreement with that of many physiologists and confirms our view that the physiological method, although indispensable for the understanding of the mechanism of individual nervous activity, is unable to resolve the problems of the behavioral and psychological evolution of species. At the same time, the physiologists claim that instincts differ from reflexes only quantitatively, but not qualitatively (that is, in the degree of complexity of the chains of unconditioned reflexes) as is stated by biopsychology. This completely contradicts observational and natural experimental data (Wagner).

We claim that instincts, animal intellect and human purposeful activity can by no means be regarded as quantitative complications of chains of reflexes. One must not ignore the psychological specificity of these phenomena, or, still worse, deny them categorically, as certain physiologists do. We must understand that the biopsychological historical method can on no account be replaced by the method of physiological investigation, any more than the latter can be replaced by the biochemical method. Of course, I do not mean that an impenetrable wall exists between biochemistry and physiology or between physiology and biopsychology. I am not going to appeal to the scientists in these disciplines to further academic separation and isolation. Quite the contrary, I believe that genuine dialectical monism of all the natural sciences is not only possible but even inevitable. I say only that this true synthesis will happen not by way of immature generalizations and reduction of complex phenomena to basic, frequently oversimplified elements, but by way of wide-ranging mutual association and in the course of investigations performed by each

scientist in his respective field of science on the basis of the general historical method.

REFERENCES

Lashley, K. (1933). *Brain and intellect.* Moscow-Leningrad (in Russian).

Loeb, J. (1918). *Involuntary movements, tropisms, and animal behavior.* Moscow (in Russian).

Wagner, W.A. (1914). *The biological foundations of comparative psychology.* Vols. I–II. St. Petersburgh (in Russian).

Wagner, W.A. (1914). Segmental psychology. In *Biopsychology. New ideas in biology* (No. 6). St. Petersburgh (in Russian).

Wagner, W.A. (1925–1928). The origin and development of psychological abilities. *Studies in comparative psychology, 1-9.* (Leningrad, in Russian).