

Ivan Petrovitch Pavlov

Excerpts from Lectures on
Conditioned Reflexes,
Volume II: Conditioned
Reflexes and Psychiatry

Introduction by W. Horsley Gantt

World War II provided medicine with rare opportunities for studying the breakdown of normal persons subjected to intense stresses. In England at the time of the Normandy invasion in June, 1944, special arrangements had been made to deal with a new crop of acute military and civilian neuroses resulting from this operation. One day while travelling to an emergency neurosis centre, soon after the start of the invasion, I stopped at an American neuro-psychiatric hospital to visit a colleague, Dr. Howard Fabing. He had just been reading a book by the famous Russian neuro-physiologist I. P. Pavlov, called *Conditioned Reflexes and Psychiatry*, and strongly advised me to do the same at once. This book consisted of a series of lectures given by Pavlov not long before his death in 1936 at the age of eighty-six; but they had not become available in English until 1941. Stocks of the translation had been destroyed in the London Blitz that same year, but Dr. Fabing had managed to secure a copy. Like several other neuro-psychiatrists of World War II, he had found Pavlov's observations on animals extremely useful for the better understanding of certain behaviour patterns observed when human beings break down under abnormal stress.

Pavlov's clinical descriptions of the 'experimental neuroses' which he could induce in dogs proved, in fact, to have a close correspondence with those war-neuroses which we were investigating at the time. Also, many of the physical treatments that had gradually been developed by trial and error during the war to relieve acute nervous symptoms, had obviously been anticipated by Pavlov as a result of his prolonged research on dogs. It was now clear that what was needed was a much more careful study of certain of these findings, in their possible relation to human psychiatry, than had recently been given them either in England or in America. William Sargent, *Battle for the Mind*, Pan, London, 1957, pp. 14-15.

Application to Psychiatry

Pavlov's applications of his concepts to psychiatry in the last decade of his life were based upon his previous experimentations with dogs. An analogy was made between the symptoms obtained in the laboratory with those seen in patients. By this method he thought that he was able to illuminate the origin and development of the several forms of human psychoses, particularly schizophrenia, hysteria, obsessions and paranoia. The observations upon which his deductions were based concerned first, his four constitutional types or temperaments – those in which excitation predominated (choleric, sanguine) and those in which inhibition predominated (phlegmatic, melancholic). The central group which did not ordinarily break down included the

sanguine and the phlegmatic – both, however, stable, well-balanced animals. The extreme groups, choleric and melancholic were liable to a breakdown either in the direction of excessive excitation or excessive inhibition.

As causes of the experimental neurosis Pavlov considered not only the type of animal (heredity), but the situation (environment), the chief elements of which had to do with the method of giving the conditioned stimuli involving a “collision between the excitatory and inhibitory processes.” In Vol. I of Lectures on Conditioned Reflexes Pavlov described the experimental neurosis, or disturbance of behaviour in the animals; entailing a so-called collision of the excitatory and inhibitory processes. In the present volume he showed that, in addition to collision, an excessively strong excitatory stimulus would also produce a disturbance. The intensity of the conditioned reflex has been shown (by Gantt et al), to depend upon the intensity of the unconditioned stimulus, i.e., the motivation or emotional tension, and by Pavlov (Lyman, Kupalov, et al), to depend also upon the intensity of the conditioned stimulus – a loud bell produces a greater food excitation than a faint one. This is true within certain ranges of the intensity of the conditioned stimulus, but beyond a certain maximal intensity variations of the effect may lead to certain phases – equivalent (in which strong and weak stimuli produce the same effect), the paradoxical (in which the weak stimuli give a greater response than the strong), the ultraparadoxical (in which the excitatory conditioned stimuli become inhibitory and vice versa). Such conditioned stimuli, too strong to give the maximal conditioned reflex, Pavlov termed transmarginal or supramaximal, which I have translated here as ultramaximal.

Pavlov considered that inhibition was a protective mechanism. When the conditioned stimuli became so strong that the result produced would exceed the capacity of the given nervous system, by the foregoing law excitation became replaced by inhibition, thus protecting the weak cortical cells from excessive excitation. Underlying this explanation was the hypothesis that excitation and inhibition rested upon independent substances. Although there is little experimental evidence for such a view, in recent years an indication of its truth has been received from the experiments of Loewi, Babkin, Wolff; Stavratsky on acetylcholin as a stimulus for certain peripheral nerves and the experiments of Cannon, Rosenblueth, Rioch et al on sympathin – a substance stimulating peripheral nerves having in general opposite effects to those stimulated by acetylcholin.

In dogs with a “weak nervous system” the above-described phases, particularly the ultraparadoxical, were prominent. Such animals showed negativism, stereotypy and other symptoms comparable to what is seen in the schizophrenic patient. For example, these dogs continued to make certain useless, stereotyped movements over and over again. “Negativism” was expressed by their refusal of food, when it was offered, and, on

the other hand, turning toward food as it was taken away. Also some of these dogs fell into a “hypnotic” state in which there was paralysis of the motor skeletal musculature, especially of those muscles most concerned with the given excitation, i.e., those of eating. Such animals stood like marble statues, drooling at the mouth but unable to take the food. These Pavlov considered analogous to the patients, catatonics, who exhibit catalepsy and remain immobile to even painful stimuli, and consistently refuse food so that they have to be fed through the nose. Cyclism has also been seen in certain of Pavlov’s dogs, corresponding to the succession of mania and depression in human patients.

Pavlov was guilty of over-simplifying an extraordinarily complex subject, but as a first approximation in a field where doubt, mystery and prejudice reigned before, it had the outstanding virtues of a new and compelling hypothesis: it crystallised a great problem and clearly indicated the path to be followed for its solution. John Fulton, ‘Ivan Petrovitch Pavlov,’ *Scientific Monthly*, April 1935, Vol. XLII, pp. 374-377.

Critical Evaluation of Pavlov’s Work

(Also) Pavlov’s honesty and methods are in general beyond criticism. He wholeheartedly admitted the existence of secretin when discovered by Bayliss though he had to modify his own theories. And this was after he had tested the results in his own laboratory – “Of course they are right; we can not aspire to the monopoly of knowledge.” He was the first to admit his error in having stated that he had proven the inheritance of acquired characteristics (conditioned reflexes).

Except for a few instances, as the above, no successful criticism has been made of Pavlov’s facts. Another example referred to the data on which the law of irradiation and concentration was built. Lashley, Loucks, and others contended that the mathematical analysis of the experiments showed that Pavlov had insufficient factual material for the laws. Hull, on the other hand, confirmed Pavlov’s results in human subjects, but gave a different explanation to the facts. As far as Pavlov’s experimental results have been tested it would seem, then, that no significant error has been found in any of the data. An explanation can be found in Pavlov’s careful, painstaking methods, his adequate controls, his habit of giving the same problem to several collaborators working in separate laboratories or institutes, with whom he checked results and supervised experiments except in the last years of his life.

Pavlov is, however, especially vulnerable to criticism in the theories, laws and deductions which he has built upon his scientifically obtained facts.

Only science, exact science about human nature itself, and the most sincere approach to it by the aid of the omnipotent scientific method, will deliver Man from his present gloom, and will purge him from his contemporary shame in the sphere of inter-human relationships. Pavlov, *Lectures on Conditioned Reflexes*, Vol. 1, p. 41.

(On the other hand) Pavlov had the advantage of being easily understood and his theories are so clearly stated that they may be put to the test. The necessity of theory in science has been mentioned in the preceding pages, but a closing remark of the great English physiologist, Sir William Bayliss, is stated here in defence of Pavlov's manner of stating theories:

As Bacon has well pointed out, truth is more likely to come out of error, if this is clear and definite, than out of confusion, and my experience teaches me that it is better to hold a well-understood and intelligible opinion, even if it should turn out to be wrong, than to be content with a muddle-headed mixture of conflicting views sometimes miscalled impartiality, and often no better than no opinion at all. Sir Wm. M. Bayliss, *Principles of General Physiology*, 1931, p. xviii.

Straus in his brilliant treatise on Pavlov says he, like Columbus, while not finding what he set out for, nevertheless made a great discovery.

Says a prominent American physiologist and historian:

Pavlov was indeed one of five or six individuals of the last generation who caused mankind to think in new terms; like Freud he created a new horizon, but unlike Freud he remained wholly objective in his mode of collecting scientific data. John Fulton, 'Ivan Petrovitch Pavlov,' *New England Journal of Medicine*, March 5, 1936, Vol. 214, No. 10, p. 5.

Let us then accept Pavlov at his word, admit that his imposing and clear-cut theories conveyed by the terms, concentration and irradiation of excitation and of inhibition, induction, internal inhibition and sleep, are but stepping stones, or are even beyond the pale, that they have served their day, what then remains? Granted that these should one day reach the scrap-heap, are we left emptyhanded? For generations to come every investigator in the field of physiology and more especially psychobiology may be thankful to Pavlov for having blazed a path, for having demonstrated the use of an

objective method to measure important aspects of behaviour (as well as of secretion) in the intact, healthy, though restrained, animal. Pavlov's careful elaboration of the method and the painstaking, scientific, and bold demonstration of its use will permanently elevate him to a place among the Great Scientists.

W. HORSLEY GANTT

Modern Definitions

TERM	EXAMPLE	DEFINITION
Unconditioned Stimulus (US or UCS)	Food	A stimulus which produces an <i>Unconditioned Response</i> without conditioning being required
Unconditioned Response (UC or UCR)	Salivation	An automatic or inherent response to the <i>Unconditioned Stimulus</i>
Conditioned Stimulus (CS)	Bell	Initially neutral with respect to the <i>Unconditioned Response</i> which is, by conditioning, associated with the <i>Unconditioned Stimulus</i>
Conditioned Response (CR)	Salivation	The response to the <i>Conditioned Stimulus</i> once classical conditioning has been established
Classical Conditioning	Salivation in response to a bell	Said to have occurred when the <i>Conditioned Stimulus</i> produces the <i>Conditioned Response</i>

Pavlov's Definitions

TERM	DEFINITIVE QUOTES BY PAVLOV (unless stated)
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Ambivalence	A symptom peculiar to schizophrenics appearing very intensively and extensively in the ultraparadoxical states (149)
Behaviourism	At the present time, on the basis of nearly thirty years of experimentation done by myself with my numerous co-workers, I feel justified in asserting that the total external as well as internal activity of a higher animal, such as the dog, can be studied with complete success from a purely physiological angle, i.e., by the physiological method and in terms of the physiology of the nervous system (44)
Concentration	The basic processes of the whole central nervous system are obviously identical – excitation and inhibition. There is sufficient reason to believe that the chief laws of these processes are irradiation and concentration and their reciprocal relations (87)
Conditioned Reflex	The organism responds with a definite complex activity to an external excitation to which it did not respond previously (47). A temporary connexion between an external agent and the activity of the organism called forth in response to it (169)
Cyclism	Succession of mania and depression (Gantt 14). Alternating periods of weakened activity and abnormally increased activity (184)
Delayed Reflex	A special adaptation [due to inhibition], in order that the conditioned reflex might not occur prematurely, so that energy beyond the necessary measure is not uselessly expended (121)
Echolalia	Syndrome common in schizophrenia: The pronunciation by the patient of the words of the one with whom he is conversing (41)
Echopraxia	Syndrome common in schizophrenia: The performance of all the movements of the person to whom he is giving his attention (41)
Extinction	A dog without cerebral hemispheres does not react to the mass of stimuli falling on him from the external world, the external world for him is, so to speak, contracted. Such a dog is not able to extinguish reflexes, for example, inhibition of the orienting reflex takes place only after many repetitions, while in the normal animal extinction occurs after 3-5 repetitions (66-7)
Feelings	There is reason to think that the described physiological processes in the cerebral hemispheres correspond to what we subjectively call in ourselves, feelings, in the general form of both positive and negative, with the innumerable shades and variations, thanks to either their various combinations or their different tensions. Here belong the feelings of difficulty and facility, alertness and fatigue,

gratification and vexation, joy, triumph and despair, etc. Frequently, it seems to me that the depressed feelings experienced by a change in the customary mode of living, such as loss of a position or of loved ones, to say nothing of mental crises and shattered beliefs, have their physiological basis to a large extent in the changes, in the destruction of the old dynamic stereotypy with the difficulty of establishing a new one (100)

- Freedom Reflex The reaction of struggling when the movements of the animals are hampered (53)
- Hypersthenia In dogs of the excitory and strong type, the neurosis consisted in almost complete disappearance of the inhibitory reflexes, i.e., a marked weakening almost to zero of the inhibitory processes (cf. neurasthenia) (fn 74)
- Hypnosis Paralysis of the motor skeletal musculature, especially of those muscles most concerned with the given excitation... animals stood like marble statues, drooling at the mouth but unable to take the food (Gantt, 14). Inhibition... has a tendency to spread, unless it meets with a counteraction in the conditions of a given environment. It expresses itself in phenomena of either partial or total sleep. Partial sleep is, evidently, the so-called *hypnosis* (51). Besides the conventional historical method of hypnotising dogs (turning them on the back and holding them in this unnatural position)... hypnosis can be produced by the continuation of one and the same stimulus, finally resulting in an inhibitory state of the corresponding cortical cells, representing on the one hand various degrees of tension and the other hand a varying extent of spread over the cerebral hemispheres and farther down into the brain (75)
- Hypnotic Phase Intermediate phases between the waking state and complete sleep (39)
- Hypnotism Naturally with the greater complexity of the human brain the hypnotic phenomena are considerably more varied in the human than in the animal. But it is possible that some of the hypnotic phenomena for one or another reason are more clearly marked in the animal, the more so because human hypnosis presents considerable variations depending upon the individual and the methods of hypnotization (40)
- Hysteria Due to the weakness of the cerebral hemispheres in the hysteric there is a continual manifestation in different combinations of three special physiological phenomena: the readiness with which the hypnotic state occurs because even the habitual daily stimulations are ultramaximal and are accompanied by

transmarginal overflow of inhibition (paradoxical phase), the extreme fixation and concentration of the nervous processes in separate points of the cortex, thanks to the predominance of the subcortex, and finally the extraordinary intensity and extension of the negative induction, i.e., inhibition in consequence of the reduced positive tonus of the other parts of the cortex (114)

Inhibition	A protective mechanism. When the conditioned stimuli became too strong that the result produced would exceed the capacity of the given nervous system... excitation became replaced by inhibition, thus protecting the weak cortical cells from excessive excitation (Gantt, 14)
Inverse phase	Phase associated with negativism (40)
Irradiation	The processes of excitation and inhibition, originated at definite points of the cortex under the influence of corresponding stimuli, necessarily irradiate over a large or smaller area of the cortex, and then again concentrate in a limited space (the law of irradiation and concentration of nervous processes) (49)
Negativism	In our experimental animals such negativism in our experimental animals was customary. With the conditioned food stimulus we feed the dog but he stubbornly turns away. Another interesting detail is especially marked in the inverse phase. When you remove the food from the dog he now attempts to get it. This can be repeated time after time. But when hypnosis disappears the dog greedily takes the food (40)
Neurasthenia	In inhibitory and weak dogs [when neurosis was manifest], all positive conditioned reflexes vanished and the dog became very drowsy (cf. hypersthenia) (fn 74)
Neurosis	This happens mainly under three conditions, three circumstances. Either extremely strong stimuli in the nature of conditioned stimuli are used in the place of those that are only weak or moderately strong and which ordinarily determine the animal's activity; i.e., its excitatory processes are overstrained. Or the animal is required to exert a very strong or a very protracted inhibition; i.e., its inhibitory processes are overstrained. Or, finally, a conflict between both these processes is produced; i.e., conditioned positive and negative stimuli are applied one right after the other. In all these cases with the proper animal there develops a chronic disturbance of the higher nervous activity, <i>a neurosis</i> (84)
Orienting Reflex	The investigatory reflex [to stimuli] (52)

Paradoxical Phase	Phase in which the animal loses its reactions to strong stimuli, but reacts normally to the weak (40)
Periodicity	Another fact which was frequently observed in the study of pathologic conditioned reflexes and which is obviously related to human neuroses and psychoses is the cyclism displayed by nervous activity. Disturbed nervous activity appeared to be more or less regularly fluctuating. First came a period of extremely weakened activity (conditioned reflexes were chaotic and often entirely disappeared or were reduced to a minimum); after several weeks or even months this was followed as though spontaneously and without any apparent reason by a more or less complete return to the normal condition – which was sometimes even entirely reestablished – only to be succeeded by another period of pathological activity. In other cases this <i>cyclism</i> was manifested by alternating periods of weakened activity and of abnormally increased activity. One cannot fail to see an analogy between these fluctuations and cyclothymia and manic-depressive psychoses (184)
Perseveration	Many descriptive names may be applied [to this] pathological phenomenon – blockage, unusual inertia, increased concentration, exceptional tonicity. Henceforward we shall preferably use the term “pathological inertness” (153)
Reciprocal induction	Having formed conditioned inhibition by differentiation we can see that such an inhibition is active rather than indifferent, because a positive stimulus used immediately after the inhibitory is without effect, showing the existence of an inhibitory state. This may be constant or, in the case of a delayed reflex, temporary, saving the cortex from useless work. The inhibition may spread (irradiation) or become concentrated, or evoke the opposite process – excitation (reciprocal induction) (63)
Schizophrenia	The first to come under my observation was schizophrenia. My attention rested particularly on the symptoms of apathy, dullness, immobility and stereotyped movements, and, on the other hand, playfulness, unconventionality and in general childish behaviour inappropriate to patients with such illnesses (hebephrenia and catatonia)... I came to the conclusion that they are the expression of a chronic hypnotic state (39-40)
Sleep	We have established beyond doubt the fact that sleep is inhibition spreading over all the hemispheres (39)
Stereotypy	Stubbornly continued repetition of the same movements. In several of our dogs too this is clearly observed (40)

Supramaximal	<i>Supramaximal</i> and <i>transmarginal</i> are both translated to <i>ultramaximal</i> (Gantt, 14)
Transmarginal	<i>Supramaximal</i> and <i>transmarginal</i> are both translated to <i>ultramaximal</i> (Gantt, 14)
Ultramaximal Phase	Stimulations which on account of their intensity produce an effect opposite to the normal stimulation (Gantt, fn. 88). Above a certain limit of intensity an excitory stimulus produces inhibition (103)
Unconditioned Reflex	Making the cut [in the brain] still higher, extirpating only the cerebral hemispheres, you have very complex reflexes for the purpose of special movements to preserve the whole organism and its form. Such a dog arranges his internal activity well, and thanks to this he can remain healthy and live very much like a normal animal. He tries to get food, defends himself from every harm, does not tolerate a limitation of his movements; the orienting reflex is clearly present. These complex acts we call unconditioned reflexes (61). A permanent connexion between an external agent and the activity of the organism called forth in response to it (169)

CHAPTER XLII

TRIAL EXCURSION OF A PHYSIOLOGIST IN THE FIELD OF PSYCHIATRY

(From *Archives Internationales de Pharmacodynamie et de Therapie*, 1930, in the volume dedicated to Cley and Heymans.)

RAISON D'ÊTRE OF PAVLOV'S STUDY OF PSYCHIATRY – MANIFESTATIONS OF SLEEP AND HYPNOSIS NOTED IN PSYCHOTIC PATIENTS, ESPECIALLY SCHIZOPHRENICS, ALSO IN ALCOHOLIC NARCOSIS – ATTITUDE TOWARD PATIENT.

AT THE present our material relates not only to normal activity but to pathology and to therapy. We have definite experimental neuroses in our animals (dogs) and in the same animals what is analogous to human psychoses, and we know their treatment. This was the *raison d'être* for my becoming thoroughly acquainted with psychiatry, of which practically no trace remained from my student medical days. Thanks to my medical colleagues I now have the opportunity to see different forms of mental disturbances. The first to come under my observation was schizophrenia. My attention rested particularly

on the symptoms of apathy, dullness, immobility and stereotyped movements, and, on the other hand, playfulness, unconventionality and in general childish behaviour inappropriate to patients with such illnesses (hebephrenia and catatonia).

What is this from the physiological point of view? May not the physiologist group these phenomena, see in them a single general mechanism? Let us turn to the facts obtained from the conditioned reflex studies.

On the one hand the processes of excitation are constantly participating in the varied activity of the animal during the waking state, and on the other hand inhibition is ever appearing in the rôle of a guardian of the most reactive cells of the organism, the cortical cells of the cerebral hemispheres, protecting them against extraordinary tension of their activity when they meet with very strong excitations, securing for them necessary rest, after the usual daily work, in the form of sleep.

We have established beyond doubt the fact that sleep is inhibition spreading over all the hemispheres. We have also been able to study the intermediate phases between the waking state and complete sleep – the hypnotic phases. These phases appear to us, on the one hand, as different degrees of the extent of inhibition, *i.e.*, a more or less spreading of inhibition in the areas of the hemispheres themselves and also in different parts of the brain; and, on the other hand, as different degrees of intensity of inhibition in the form of varying depths of inhibition at one and the same place. Naturally with the greater complexity of the human brain the hypnotic phenomena are considerably more varied in the human than in the animal. But it is possible that some of the hypnotic phenomena for one or another reason are more clearly marked in the animal, the more so because human hypnosis presents considerable variations depending upon the individual and the methods of hypnotization. Bearing in mind the whole symptom-complex of hypnosis, I shall in the future use the hypnotic phenomena observed in humans as well as in animals.

Studying the aforementioned schizophrenic symptoms I came to the conclusion that they are the expression of a chronic hypnotic state. Apathy, dullness, immobility, etc., are not necessarily manifestations of a hypnotic state unless I am able to find more justification for this view in the special symptoms.

First I shall mention the following facts. Apathy and dullness are generally expressed by the patient's failures to react to questions, as if he were completely insensitive. However if these questions are put to him very softly in very quiet surroundings he answers. This is a characteristic hypnotic phenomenon..... It is to be regretted that for this very important symptom there is in the clinic no special name such as is given to other symptoms. In our animals this symptom is one of the most frequent signs of the beginning of hypnosis – met with in the so-called paradoxical phase in which the animal loses its reactions to strong stimuli, but reacts normally to the weak. In the well known case of a five-year sleep described by Janet, rapport with the patient was established only on this basis. Indeed the patient came out of the hypnotic state only at night when there was an interruption of the ordinary stimulations.

Negativism was manifested in the patients we analysed. Also in our experimental animals such negativism during the beginning of hypnosis was customary. With the conditioned food stimulus we feed the dog but he stubbornly turns away. Another interesting detail is especially marked in the inverse phase. When you remove the food from the dog he now attempts to get it. This can be repeated time after time. But when hypnosis disappears the dog greedily takes the food.

The analysis of the mechanism of this hypnotic symptom and of others I shall postpone until later, turning now to the evident facts of the hypnotic state.

One of the most extreme symptoms of schizophrenia with certain variations is *stereotypy* – a stubbornly continued repetition of the same movements. In several of our dogs too this is clearly observed. In the case of the conditioned food reflex, when the dog is fully awake, after feeding he habitually licks for a short time the front part of the body, the front part of the chest and the front paw. During beginning hypnosis this licking is exceedingly prolonged, often lasting until the next feeding. Also other movements are repeated once they have been used by the animal in a certain way.

A common occurrence in schizophrenics is the so-called echolalia and echopraxia, *i.e.*, the pronunciation by the patient of the words of the one with whom he is conversing and the performance of all the movements of the person to whom he is giving his attention. This is a familiar phenomenon in a hypnotised normal subject, which, as I recall, occurs especially easily and frequently during hypnosis produced by the so-called passes.

A common manifestation in schizophrenics is catalepsy – the continued maintenance by the patient of any position of the body (which can be easily given to him without opposition of the muscles by another person) or of those positions which he himself takes under the influence of one or another temporarily acting stimulus. Again this is a symptom readily produced in normal hypnosis.

An obstinate symptom in some schizophrenics, appearing even in a definite form, is catatonia, *i.e.*, a tense state of the skeletal musculature strongly opposed to every change in a given position of a part of the body. This catatonia is nothing more than the operation of tonic reflexes thanks to which a hypnotised normal subject may be made as stiff as a board.

Finally here, to this group of every variation of central inhibition, it is necessary to relate even the symptoms of playfulness and foolishness observed especially in hebephrenics, and also a capricious and aggressive excitement accompanying the above-mentioned symptoms in other schizophrenics. All these phenomena bring strongly to mind the usual picture of the beginning alcoholic intoxication, and also the characteristic state seen during awakening and especially during the falling to sleep of children and young animals such as puppies. In these cases there is reason to think they are the result of a beginning general inhibition of the cerebral hemispheres, as a consequence of which the neighbouring subcortex is not only freed from its usual control, the constant inhibition from the hemispheres during the waking state, but even, on the basic mechanism of positive induction, there ensues an excitatory chaotic condition in all the centres. Hence

during alcoholic narcosis there appears without cause now an unusual frolicsomeness and gaiety, now sensitiveness and tears, now rage, and during the falling to sleep of children every possible caprice. An especially characteristic picture is the drowsy child during the middle months of its first year, when may be seen on its face the kaleidoscopic play of varied expressions – signs of a lack of organisation in childhood of the primitive sub-cortex. Thus the schizophrenic in certain phases and variations of its illness manifests this phenomenon now in long, now in short, periods.

After all the above cases one can hardly doubt that schizophrenia in certain variations and phases actually represents chronic hypnosis. That these variations and phases may continue for years is no refutation of this conclusion. If one may speak of a five-year sleep (case of Pierre Janet) and even of a twenty years' sleep (Petersburg case) why can there not be such continued hypnosis, the more so because these examples are more correctly called hypnosis rather than sleep?

What produces the chronic hypnosis of schizophrenia? What is its physiology and pathology? What is its course and outcome?

The ultimate basis of this hypnosis is, of course, a weak nervous system, especially a weakness of the cortical cells. This weakness can issue from different causes – hereditary and acquired. We shall not concern ourselves with these causes. But naturally such a nervous system on meeting with difficulties – most frequently in the critical physiological and socialising period – after an overwhelming stimulation inevitably enters into a state of fatigue. But fatigue is one of the chief physiological impulses to the creation of the inhibitory process as a protective process. Hence chronic hypnosis, representing inhibition in various degrees of extension and tension. Thus this state is, on the one hand, pathological, as it deprives the patient of his normal activity; on the other hand it is in its mechanism physiological, a physiological measure because it conserves the cortical cells against a threatening destruction consequent to an overwhelming task. We now have in the laboratory an amazing example of continued inhibition restoring the weak cortical cells for a certain period to normal activity. There is good reason to think that while the inhibitory process is acting the cortical cells remain uninjured; for they may return to a completely normal condition, they may recover from an extreme exhaustion. This according to contemporary terminology is only a functional illness. That this is actually so is confirmed by the following facts: Certain forms of schizophrenia, particularly hebephrenia and catatonia, *i.e.*, forms having a hypnotic character, according to Kraepelin, one of the greatest psychiatric authorities, result in a fair percentage of complete recoveries (catatonia to 15%), which is not true in certain other forms, particularly paranoia.

In conclusion allow me to make a therapeutic suggestion, hardly altogether sentimental and yet not professional. Although there has been no revolutionary progress in the treatment of the mentally ill from ancient times until our own, we have, I think, nothing to regret. The majority of the patients still retaining consciousness to a certain degree can sustain on the one hand violent stimulations in the form of crises and extraordinary scenes, and on the other hand as direct force, but it is necessary to consider as useless an added threat to the weak cortical cells. Consequently we should as soon as possible think

of such mentally ill as we do of other suffering patients, whose feelings of human dignity are not so severely tried.

CHAPTER XLVI

EXPERIMENTAL NEUROSES

(Read in German at the First International Neurological Congress, Berne, September 3, 1931.)

NEUROSES IN DIFFERENT TYPES – EFFECT OF CASTRATION – ANALOGY WITH HUMAN NEUROSES.

AS NEUROSIS we understand a chronic deviation of the higher nervous activity, lasting weeks, months, and even years. For us the higher nervous activity is manifested chiefly in the system of conditioned positive and negative reflexes to any stimulus and partially, but to a lesser degree, in the general behaviour of our animals (dogs). The factors which have produced neuroses in our animals are: first, stimuli too strong or too complex; secondly, a strain of the inhibitory process; thirdly, collision (direct consequential) of the two opposing nervous processes; fourthly and finally, castration.

Neuroses are expressed in a weakening of both processes separately or together, in chaotic nervous activity, and in various phases of the hypnotic state. Different combinations of these symptoms give entirely distinct pictures. Whether or not the animal breaks down and in what form depends upon the type of nervous system.

On the basis of our investigations we found three main types. The central type is the ideal normal type in which both opposing nervous processes exist in equilibrium. This type is represented in two variations: the calm stable animal, and on the contrary the very lively ones. There are two other extreme types: one strong, even too strong but not completely normal, because the inhibitory process is comparatively weak; and the other, a weak type in which both processes are weak but especially the inhibitory one. Our classification of types more nearly coincides, it seems to me, with the classical Hippocratic grouping of temperaments.

For the sake of brevity I shall mention only a few examples of our latest experiments on castrated animals. In animals of the central type the evident disorder continues generally only some months after castration; later the animal behaves normally. Only under increased excitability was it possible to be convinced that the functional ability of the cortical cells had suffered. The excitability in the case of the food conditioned reflexes is easily changed by different degrees of hunger.

In some individuals of the strong type the evident pathological state after castration continues for many months, for years and longer, and improves only very gradually. In

such animals there is a sudden temporary return to normal brought about by interrupting our experiments or giving bromides. During the daily work the conditioned reflexes are chaotic. An interruption of three days between experiments restores the reflexes to normal. The fact that each one of our experiments represents a serious work for the nervous system is thus evident. The normal activity is restored and preserved during the daily experiments by bromide therapy.

Unexpectedly and very peculiarly difficulties appeared during this régime. Ordinarily the more or less strong types directly after castration show a lowered function of the nervous system; the positive conditioned reflexes decrease. The opposite is true of the weak type; the conditioned reflexes become greater for several weeks after castration. A marked weakness of the cortical cells appears only later; in this case bromides, instead of helping, make the situation worse. This extraordinary fact can also be satisfactorily explained, but I cannot now stop to give details.

I must conclude. To make analogies between the neurotic state of our dogs and the various neuroses of man is to me, a physiologist not thoroughly acquainted with human neuropathology, a problem hardly attainable. But I am convinced that the decision, or the conditions favourable to a decision, of many important questions of etiology, the natural systematisation, the mechanism and finally the treatment of neuroses in the human being lies in the hands of the animal experimenter.*

Therefore the main purpose of my participation in the present Congress is to recommend heartily to the neuropathologists the work with normal and pathological conditioned reflexes.

* Several of these points have now I think received confirmation from the clinical side. Producing artificially in our dogs a deviation of the higher nervous activity we saw examples of difficult nervous problems in dogs of different types of nervous system, two separate forms of nervous disorder, two different neuroses.

In dogs of the excitatory and strong type, the neurosis consisted in almost complete disappearance of the inhibitory reflexes, *i.e.*, a marked weakening almost to zero of the inhibitory process. In the other, the inhibitory and weak dogs, all positive conditioned reflexes vanished and the dog became very drowsy. In this neurosis the first dogs quickly recovered under bromides. In the second type the dogs became rapidly worse with bromides, and recovery was very slow, and was possible only with an interruption of the experiments.

Unacquainted with clinical neuroses we erroneously began, although guided by several considerations, to call the neurosis of the first dogs neurasthenic, and of the second group hysteria. Later we found the neurosis of the first dogs more similar to hypersthenia, and to call the neurosis of the second group neurasthenia, reserving the term hysteria as probably better for disturbances of the nervous system from other causes, manifested now in our experiments.

At this Neurological Congress, Dr. L. Szondi concluded that the present clinical form of neurasthenia should be separated into two neuroses, related to two opposite constitutions corresponding, in my opinion, to our above neuroses.

CHAPTER XLVIII

CONCERNING HUMAN AND ANIMAL NEUROSES

(Reply to Schilder's Criticism – Neuroses and the Physiological Analyses.)

DISCUSSION OF ANALOGIES IN AN EXPERIMENTAL CASE.

IN THE *Journal of Nervous and Mental Diseases*, volume 70, there is printed an article by Dr. P. Schilder, entitled "The Somatic Basis of the Neurosis," in which the author recognises that what we, I and my collaborators, call neuroses in our experimental animals (dogs) "are formed of the manifestations of neuroses." Such recognition from a competent source is, of course, very valuable for us. But I most emphatically object to what the author further says concerning the comparative study of these neuroses in man and in animals. He says, "The important experiments of Pavlov and his pupils on neuroses can be understood only if we look upon them in the light of our experiences in the neuroses. We cannot interpret the neurosis by means of the conditioned reflex, but by means of the psychic mechanism we have studied in the neurosis we can well explain what occurs in the conditioned reflex."

What is the meaning of the term "interpretation" or "understanding" of the phenomenon? The reduction of the more complex to the more elemental is a simple thing. Consequently the human neuroses should be explained, understood, *i.e.*, analysed, by the help of the animal neuroses, as naturally the more simple, and not by the reverse procedure.

In man it is necessary first to determine exactly wherein lies the deviation from the normal. But the behaviour of the normal is exceedingly varied in different persons. Then one should consider together with the patient, or independently of him, or even against his resistance, among the chaos of affairs vital to him, those conditions that have acted immediately or gradually and with which perhaps the origin of the illness may be justifiably linked. Further, one must know why these conditions and difficulties produced such a result in our patient, when they are without influence on other people. And why does this lead to a certain complex in one patient and to an entirely different one in another patient. I am taking only the most important group of questions, omitting the details. Are there always entirely satisfactory answers to all these questions?

But this is only a part of the matter if one attempts a complete and final analysis. Of course the deviation in behaviour of our patient comes from a change in his nervous system. Who can now deny that? Therefore it is necessary to answer this question: how and why do there arise in the given case changes in the normal processes of the nervous system? Are not these real prerequisites? And where are they all satisfied? With what does one deal in the dog?

First of all, one sees that neuroses are possible to obtain and without difficulty, if only one has an animal in whose makeup there is not a proper balance between its fundamental reactions of nervous activity – as yet not further analysed physiologically – that is, between the excitatory and inhibitory processes.

Further, with such an experimental animal it is definitely known that this insufficient balance, peculiar to the make-up of the particular animal, finally breaks down under certain fundamental conditions. This happens mainly under three conditions, three circumstances. Either extremely strong stimuli in the nature of conditioned stimuli are used in the place of those that are only weak or moderately strong and which ordinarily determine the animal's activity; *i.e.*, its excitatory processes are overstrained. Or the animal is required to exert a very strong or a very protracted inhibition; *i.e.*, its inhibitory processes are overstrained. Or, finally, a conflict between both these processes is produced; *i.e.*, conditioned positive and negative stimuli are applied one right after the other. In all these cases with the proper animal there develops a chronic disturbance of the higher nervous activity, *a neurosis*. The excitatory type loses almost completely its ability for any inhibition and generally becomes unusually excited; the inhibitory type, though hungry, refuses even to eat under the influence of the conditioned stimuli and generally becomes exceedingly ill at ease and also passive with the least change of its surrounding environment.

One can conceive in all likelihood that, if these dogs which have become ill could look back and tell what they had experienced on that occasion, they would not add a single thing to that which one would conjecture about their condition. All would declare that on every one of the occasions mentioned they were put through a difficult test, a hard situation. Some would report that they felt frequently unable to refrain from doing that which was forbidden and then they felt punished for doing it in one way or another, while others would say that they were totally, or just passively, unable to do what they usually had to do.

And so, what my associates and I have found with our animals are elemental physiologic phenomena – the frontier of physiologic analysis (in the present state of knowledge). At the same time it is the prime and most fundamental basis of human neurosis and serves as its true interpretation and understanding.

Hence in the case of man, under the complications of his existence and with his many different reactions to it, when it comes to analysis and to the ultimate aim of curing him, one always has to face the very difficult question: What circumstances in his life are excessively strong for the nervous system in question, where and when has he encountered a conflict intolerable for him, requirements that he become active and

requirements that he hold himself back? How in the opinion of Dr. Schilder could the innumerable subjective experiences of the neurotic patient under the extreme complexity of human higher nervous activity, as compared with dogs, give anything useful in the way of an explanation of the elementary neuroses of animals. when those experiences are only different variations of one and the same physiologic process, so clearly seen in dogs? Of course, for the final physiologic analysis of the problem of neuroses and psychoses there remain a number of unsolved questions. Is it possible to produce neuroses in cases of well balanced nervous systems? Is the initial unbalance of the nervous system a primary phenomenon: *i.e.*, an innate property of the nervous tissue itself, or a secondary one depending on some innate peculiarity of other systems of the organism apart from the nervous system? Do there not exist along with the innate properties of the nervous system also other conditions in the organism which determine this or that degree of normal function of that system? I am busy at the present time with some of these questions and already have material for their decision.

It stands to reason that, apart from these special questions which concern the general problem of disorders of normal nervous activity, there remains before the physiologist the question relating to the physicochemical mechanism of these very elemental nervous processes: of excitation and inhibition, of their reciprocal relations and tensions, and of excessive strains on them.

CHAPTER L

AN EXAMPLE OF AN EXPERIMENTALLY PRODUCED NEUROSIS AND ITS TREATMENT IN THE WEAK TYPE OF NERVOUS SYSTEM

(Read at the VI Scandinavian Neurological Congress, Copenhagen, August 25, 1932.)

BROMIDES IN DIFFERENT TYPES OF DOGS – DESCRIPTION OF A CASE OF EXPERIMENTAL NEUROSIS.

AT THE International Neurological Congress in Berne last year I reported only the most general characteristics of our experimentally produced neuroses. Here I shall proceed to give an example of a neurosis which I have just now thoroughly studied with one of my oldest and most esteemed co-workers, M. K. Petrova.

When dealing with purely experimental neuroses we must begin with the question of types of the nervous system of animals (dogs). We differentiate three basic types: the strong, even very strong, and unbalanced; the strong and balanced, *i.e.*, with the two opposite processes at the same level; and the weak.... There are of course varying degrees or variations of these types especially of the weak. We have a considerable

number of experiments by which we have gradually defined these types and their grades. A correct diagnosis of type can be made only after repeated experiments.

The purely experimental neuroses, obtained by giving difficult nervous problems, have appeared only in animals of the extreme types. With them this condition may be readily produced in several ways. I shall describe here a case of repeated neurosis in a dog of the weak type.

This dog was a mixture of cur with foxterrier, weight about 12 kgm. According to the external behaviour, the work with the conditioned food reflex, and according to several of our experiments on this type, this animal appeared in the beginning as a strong and balanced animal; but two further experiments convinced us that he belonged to the weak type: first, there was an increased food excitability (on the day before the experiment the dog went without food), and second the administration of large doses of bromide placed him in the weak group. In animals of the strong type with an increased food excitability usually either the effects of all the conditioned positive stimuli increases (if the effects of the strong are not transmarginal), or in the opposite case, only the effects of the weak approach the strong.

Large doses of bromides given daily for many weeks or months have proved in our hands to be free of any harm; and in the strong and unbalanced types it even has a useful action, increasing their inhibitory function and then enabling them to regulate their nervous activity.

In our dogs both of these measures led to a diminution, to a destruction of the conditioned reflexes: the effects of the positive stimuli fail, but the negative continued to produce normal inhibition. In this case it was clear that with the gradually decreasing doses of bromide we could even improve the nervous activity. Formerly we came to an erroneous conclusion here: not regulating the dose of bromide correspondingly to the type, we thought that its administration in weak animals was never helpful and that in large doses it was injurious.

Thus our dog belonged to the weak type, but of moderate degree. Under the ordinary circumstances he works satisfactorily; a system consisting of six positive stimuli of different kinds and intensities and of one negative, applied daily in the same order and with equal intervals, always produces in this dog regular and correct responses. The behaviour of the animal during the experiment is more or less lively and equilibrated. In short it is a stable object for the study of conditioned reflexes. Such a condition was observed over a period of five months.

Now we produce the neurosis. Until now the inhibitory stimuli had acted only for thirty seconds. In the following experiment we prolong it for an entire five minutes. On another day we repeat the five minute inhibition, and this was enough to change radically the whole dog, to make him acutely ill.

Of the regularity of the conditioned reflexes there remains not a trace. Each day showed a characteristic picture. All the positive conditioned reflexes were markedly diminished,

several completely disappeared. The inhibitory were disinhibited. Sometimes the ultraparadoxical phase set in, *i.e.*, the positive stimulus was inactive and the inhibitory one differentiated from it gave a positive effect. During the experiment the dog was extremely excitable, sometimes breathing vigorously, very restless, sometimes showing marked excitatory weakness, reacting to the slightest fluctuation of the environment. Frequently he refused the customary feeding given after each positive conditioned stimulus. In a word, concerning the work with conditioned reflexes there was no doubt of an extreme, chaotic condition of the nervous activity. The same was manifest in the behaviour of the animal. Putting the dog on the stand and preparing it for the experiment, and also removing it was not easy; for the animal was intolerant and uncontrollable. When free he conducted himself very strangely; when lying on the floor he would turn on his side and crawl up to some one, which he never did before. The *Diener* who took him to and from the kennel reported that he had become mad.

Neither interruption of the experiments (rest) nor substitution of the inhibitory stimuli by the positive had a beneficial influence. His condition, instead of improving, continued for two months to get worse. Then we began the treatment. Thirty to forty minutes before each experiment we gave sodium bromide. On the second day there was a marked improvement and on the third day the dog was in all relations normal. The bromide was discontinued after the twelfth dose. For the next ten doses the animal remained completely well.

Now we pass to another experiment.

Together with the old positive conditioned reflexes in this dog, instead of the moderately loud noise, we applied for thirty seconds, like all the other positive conditioned reflexes, an exceedingly loud noise, even intolerable to our ears, and then we offered food. The animal gives a marked fear reaction, struggling from the stand and not taking food even at the cessation of the stimulus. However with the two following usual stimuli he reacts normally and takes the food. The application of the extraordinary stimulus was limited this time, but on another day the above described illness of the dog returned completely, and notwithstanding an interruption of ten to fifteen days and a regular rest of two days, his condition did not change for more than a month. Now we again give the same dose of bromide as at first; the improvement was marked on the third day, and on the sixth to seventh days the animal was altogether normal. Bromide was discontinued after ten doses. Here the experiments were interrupted by the vacation period.

It is not an exaggeration, it seems to me, to say that these experiments have a machine-like character. It is evident that they represent two pathological moments for the nervous activity: the excessive tension of the inhibitory process and the very strong external stimulus. Then a salutary factor in both cases was the production and strengthening of the inhibitory process just as at the basis of many other of our experiments bromides have been shown to have a direct relation to the inhibitory process, both producing and reinforcing it. Finally, a most important part of the therapy is the exact dosing corresponding to the precise type of nervous system.

CHAPTER LVI

TYPES OF THE HIGHER NERVOUS ACTIVITY, THEIR INTERDEPENDENCE WITH NEUROSES AND PSYCHOSES AND THE PHYSIOLOGICAL MECHANISM OF NEUROTIC AND PSYCHOTIC SYMPTOMS

(Read at the Second International Neurological Congress, London, August, 1935)

PATHOLOGICAL DISTURBANCES IN THE HUMAN RELATED TO SPEECH – ANALOGIES WITH ANIMAL DISTURBANCES – NARCOLEPSY, ETC. PRODUCED BY WEAKNESS OF EXCITATION – NEURASTHENIA IS WEAKNESS OF INHIBITION – PERSECUTION AND INHIBITION.

WE have at our disposal an enormous amount of material obtained by the use of the conditioned reflex method in dogs. Out of this material I shall choose three points concerning the pathological disturbances of the higher nervous activity. These are: 1) the intensity of the fundamental processes of the nervous system, excitation and inhibition; 2) the intensity in relations of these two processes, their equilibrium; 3) finally the movements, the lability of these processes. These points constitute the basis, on the one hand, for the types of the higher nervous activity, which types play a major rôle in the origin of the so-called psychological diseases; and, on the other hand, for the characteristic alterations in the pathological conditions of the higher nervous activity.

In order to understand the pathological behaviour of man it is necessary to add to the types or temperaments described earlier by us for dogs, the special human types.

Until the time when *Homo sapiens* appeared animals were connected with the environment so that the direct impressions fell upon the different receptors and were conducted to the corresponding cells of the central nervous system. These impressions were the several signals of the external object. However there arises in the developing human an extraordinary perfection, the signals of the second order, the signals of the primary signals in the form of *words* – the spoken, the heard, the seen word. Finally it came about that through these new signals everything was designated that the human being perceived both from the environment and from his inner world, and these signals commenced to serve him not only in communicating with other men, but also when he was alone. The chief significance attached to the word was the predominance of these new signals – yet it remained a word, only a second signal of reality. And we know that there are numbers of people who operate only with words from which they deduce

everything would experience everything without coming into contact with reality. And from this they wish to base their own life as well as to direct the lives of others.

Thanks to this second signal of signals and to its constant effects in various aspects of life, all of the human race can be separated into several types: artists, thinkers, and a middle type. The latter unite in proper proportions and activity both signals. These two divisions can be seen among individuals as well as among nations.

I now pass over to the pathology.

We have become convinced in our experimental animals that the chronic pathological deviations from the normal are expressed in the excitable and in the weak type by a mild form of neurosis. The excitable animals lose almost completely the ability for inhibition; in the weak animals, the higher nervous activity is either destroyed completely or becomes chaotic. Kretschmer, who describes only two types corresponding to our excitable and our weak types, as far as I can judge, properly places the manic-depressive psychoses in the first type and schizophrenia in the second. My own clinical experience has been very limited, although I have visited regularly the neurological and psychiatric clinics for the last three or four years, and hence I offer the following remarks presumptively. Constitutional neurasthenia is a form of general weakness, occurring in the middle human type. Hysteria is the result of general weakness in the artistic type; psychasthenia (Pierre Janet), a product of weakness in the thinking type. Hysteria has to do with a general weakness especially of the second signalling signal, which in the artistic type, is normally subservient to the first signal, while in the average person the second signalling system is the highest regulator of human behaviour. Hence the chaotic condition of the activity of the first signalling system and of the emotional background occurs in the form of fantasies with unrestrained motivation and a profound disturbance of the general nervous equilibrium (now paralyses, now contractions, now convulsions, now lethargy) and the consequent chaos in the synthesis of the personality. In the psychasthenic the general weakness is also in the relationship of the organism to the environment, but in the first signalling signal, on the basis of the emotions; therefore, the lack of reality feelings, the complete incapability and uselessness, the ideas of compulsion, phobias, and the constant, distorted melancholy. Thus I conceive in general of the origin of the neuroses and psychoses and their relationship to the human types of nervous activity.

The experimental investigation of the pathological changes in the fundamental processes of the nervous activity makes possible a physiological insight into many neurotic and psychotic symptoms, including individual symptoms as well as those occurring in the symptom complex.

The weakness of the process of excitation leads to a predominance of inhibition, both in its general form and in its different partial forms, such as sleep and the many phases of hypnosis. The paradoxical and ultraparadoxical phases in the latter state are especially characteristic. To this mechanism one must, I think, refer many pathological symptoms, *e.g.*, narcolepsy, cataplexy, catalepsy, the "*sentiments d'emprise*" of Pierre Janet, or

inversion according to Kretschmer, catatonia, etc. The weakness of the excitatory process is produced either by its strain or by its collision with the inhibitory process.

Among the phenomena not yet altogether explainable is the alteration in the movement of the excitatory process, its pathological lability, as seen in the laboratory. In the clinic this has been known for a long time under the name of "irritable weakness" (*Reizschwache*). It consists in an unusual reactivity, in a weakness of the excitatory process followed by rapid exhaustion. Our positive conditioned stimulus in such cases gives a quick and very unusual effect which, however, during the normal time of action of the stimulus disappears; the positive action drops to zero as it becomes transformed into inhibition. Tentatively we call this phenomenon explosiveness. In our material we also find the opposite pathological alteration in the movement of the excitatory process – pathological inertia. The excitatory process persists even in the face of conditions which should normally convert it into the inhibitory process. The positive stimulation is slightly or not at all influenced by the after-inhibition of the preceding inhibitory stimulus. Such a pathological condition may result from a continually increasing tension of the excitatory process or through its collision with the inhibitory process. The relationship of such symptoms as stereotypy, ideas of compulsion, paranoia, etc., to this pathological persistence of the excitatory process is evident.

The inhibitory process likewise may be weakened either through strain or through collision with the excitatory process. Its weakening results in an abnormal predominance of delay and other normal phenomena of which inhibition is a part, expressed also in the general behaviour of the animal, struggling, impatience, unruliness, and finally as pathological phenomena, *e.g.*, neurasthenic irritability; in man as a hypomanic or manic condition.

My collaborator, M. K. Petrova, who has enriched the experimental pathology and therapy of the higher nervous activity, during the past year has studied these phenomena of pathological lability of the inhibitory process. A dog who formerly took food from the edge of the table is now no longer able to do this. He shies back and gets as far away as possible from the edge. The significance of this phenomenon is perfectly clear. A normal dog remains standing at the edge by inhibiting his forward movement, to a degree necessary to balance himself. Now this inhibition is strongly exaggerated. The reaction to depth being excessive, inhibition holds the dog away from the edge more than required for his interest. Subjectively this is doubtless a condition of fear; evoked and also removed, *i.e.*, the experimenter controls the conditions of its origin.* I presume that also the delusion of persecution rests in many cases upon the lability of the inhibitory process.

Instances of pathological stability of the inhibitory process has been observed previously by us in the laboratory.

Before us remains the difficult task of exact definition in all cases, the statement of when and under what special conditions one or another pathological alteration of the basic process occurs.

* This fact was demonstrated by Dr. Petrova for several days at the XV International Physiological Conference in Leningrad.

Ivan Petrovitch Pavlov, *Lectures on Conditioned Reflexes, Volume II: Conditioned Reflexes and Psychiatry*, translated and edited by W. Horsley Gantt, Lawrence & Wishart Ltd., London 1941.