FTD-HT-66-294

FOREIGN TECHNOLOGY DIVISION

DISCOVERING THE SECRETS OF THE HUMAN PSYCHE

by

P. I. Bul'

EDITED TRANSLATION

DISCOVERING THE SECRETS OF THE HUMAN PSYCHE

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English pages: 57

SOURCE: Raskryvaya Tayny Chelovecheskoy Psikhiki, "Znaniye", Moskva, 1964, 47 pages.

Translated under: Contract AF 33(657)-16409

CIRC ABSTRACT WORK SHEET 0897 0112

(01)Acc No.	(65)SIS Acc No.	(40) Country of Info	(41)Translation Nr.
TM6001539		UR	FTD66000294
(42)Author	BUL', P. I.		Priority II Distribution STD

(43)Source RASKRYVAYA TAYNY CHELOVECHESKOY PSIKHIKI

(02)Ctry	(03)Ref	(04)Yr	(05)Vol	(06)Iss	(07)B. Pg	(45)E. Pg	(73)Date	(47)Subject Code
UR	0000	64	000	008	0001	0047	NONE	05, 06

Language			
RUSS	N/A	N/A	N/A

(39)Topic Tags psychic stimulation, psychoneurosis, sleep, psychophysiology

(66)Foreign Title
SEE SOURCE

(09)English Title DISCOVERING THE SECRETS OF THE HUMAN PSYCHE

(97) Header Clas	(63) Clas	(64)Rel	(60) Release Expansion
0	00	0	

ABSTRACT: This booklet is primarily a diatribe against religion and western "bourgeois" science as they apply to the human psyche. Engels and Pavlov are the only cited authors. English Translation: 57 pages.

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DISCOVERING THE SECRETS OF THE HUMAN PSYCHE

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SCIENCE AND RELIGION ON THE PSYCHE

The various approaches to an understanding of psychic activity depend on the general philosophical views of one scientist or another. We, as materialists, assert that the human psyche is inseparable from cerebral activity — that it originates and develops together with the brain. Church-followers and bourgeois scientist-idealists try to persuade us that the reverse is true. Scientist-materialists have proven that consciousness dies at the same time as the human body, but the representatives of religion try to prove the opposite. According to their pseudo-scientific views, the psyche may allegedly exist even outside the brain, in the form of a so-called "soul" which is preserved even after the death of the organism.

At the same time that many bourgeois scientists, echoing the clergy, have attempted to maintain an idealistic understanding of the psyche (asserting that the brain is not an organ of thought, and that thought is not a function of the brain), our own scientists (I. M. Sechenov, I. P. Pavlov, V. M. Bekhterev, N. Ye. Vvedenskiy et al.)

had already arrived at the only correct point of view, according to which the brain and the psyche together represent something unified and indivisible. The materialistic idea of psychic activity is based on firm scientific discoveries in the natural sciences and dialectical materialism. As V.I. Lenin wrote, "... the spirit does not exist independently of the body... the spirit is secondary, a function of the brain, a reflection of the external world."

Studies of children born without cerebral hemispheres have shown that they lack even the smallest signs of psychic activity.

The human brain consists of two hemispheres, formed from white and grey brain matter. The outer surface of each hemisphere is covered by a layer of grey matter with a furrowed and convoluted appearance. This layer of brain matter plays a tremendous role as an anatomic substratum of neuro-psychic activity and is called the cerebral cortex. There are more than 14 billion nerve cells in the cerebral cortex. These nerve cells form clusters, called nerve centers, which carry out a specific function. The centers of smell are distributed in the frontal portions of the cerebral cortex, while the vision centers are localized in the occipital sections; destruction of these latter centers leads to partial or complete blindness. The centers of hearing are located in the temporal sections of the cortex, and damage to them leads to deafness. The motor centers are localized in the parietal section of the cerebral cortex. A hemorrhage or wound in this area will lead to the loss of arbitrary motion ability and to the occurrence of various paralyses.

Knowledge of the localization of nerve centers in the grey matter has proved to be a very important discovery in the study of the higher brain functions. Millions of years of development, natural selection and constant perfection were necessary for nature to transform the brain nerve cells of the lower animals into powerful brain hemispheres, covered with a cortex. One does not need to be a scientist to realize how ridiculous and primitive is the biblical legend that God created man in one day, in "ready-made" form.

At a time when the cerebral cortex had still not been formed in the lower animals, it had already developed sufficiently among the higher animals and begun to perform a series of important functions in their still-primitive higher nervous activity. In man himself, the cerebral cortex developed sufficiently for the appearance of a new, qualitative degree of spiritual life: the psyche (thought, speech) — everything that characterizes man. Thus, the anatomic-physiological data examined by us show that psychic phenomena are possible only in the presence of the material basis of the psyche — the cerebral cortex with its complex nerve centers — and that these phenomena take place, in spite of the assertions of church-goers and idealists, like all that exists on our planet: in space.

The question arises: do psychic processes also take place in time? Indeed, churchmen and theologians assert that psychic phenomena are, allegedly, independent of space and time. Scientific research has shown that the speed at which the various neuro-psychic processes take place may be registered and measured. Thus, it has been calculated that the speed at which a stimulation is transmitted along the nerves in the lower animals does not exceed 30 meters per second. This speed increases in the nerves of the higher animals and reaches 100-150 meters per second in man.

Psychic activity is impossible without the process of stimulation. This statement is confirmed by living facts. When we sleep, the activity of our cortex slows down, and psychic activity is halted. If a dream occurs, this signifies that one or more zones of the cerebral cortex, for one reason or another, have increased their activity and the process of stimulation has begun. This occurrence is particularly obvious during anaesthesia — the most complete inhibition of nerve-cell activity in the cortex and the immediate sublayer of grey matter. Stimulation of the nerve cells may be arbitrarily halted, for example, by clamping off the carotid arteries, which supply blood to the brain, and therefore halting its blood circulation. As soon as the blood circulation is reestablished, for which a specific amount of time is required,

consciousness returns. It would be appropriate to introduce here the following experimental observations performed with animals. If blood is introduced through rubber tubes into the severed head of a dog, then a gradual reestablishment of neuro-psychic activity may be observed. The dog's head, so to speak, "revives." The eyelids open, the eyes turn about and look at the experimentors, the ear shells arise and turn in the direction of any sounds. At the sight of food the head salivates and licks its lips. The nose wrinkles if tickled with a straw, and so on.

Experiments conducted by Professor Negovskiy, in reviving men who had died from wounds suffered in battle, showed that with the reestablishment of blood circulation and the fundamental life functions in the men being revived, the psychic functions are also gradually reestablished. The subject returns to consciousness, as if after a deep narcotic sleep, the sensation of touch is reestablished, the pupils begin to react to light, sight and hearing return, and finally, he begins to think.

During the war, life was returned to many soldiers and officers who are living and working today. The reviving of men and animals demonstrates once again the power of science, dispelling the legend of "life beyond the grave" so deftly used by theologians until our time. When the soldier Cherepanov, who had entered "the other world," was asked by correspondents what he remembered and what he felt during the time of his clinical death, he answered: "I remember the shell exploding, and something hit me... I lost consciousness. I came to several days later, on a bed in the hospital... I saw people dressed in white."

Thus we see that the psychic processes may take place only during the normal activity of a cortex which is in a state of stimulation.

At the present time, it has been established by science that the processes of stimulation in the nerve cells are accompanied by electrical phenomena, which may be picked up by sensory probes and recorded in the form of an electroencephalogram. Such studies are very important, since they permit us to investigate at first hand the

processes of stimulation and inhibition in the "psychic organs" themselves. On the other hand, if one or another zone of the cortex of a test animal (rat, dog or ape) is exposed by trepanation of the skull, and then stimulated by an electric current applied through a needle-shaped electrode in contact with the brain matter, it is possible to obtain an answering response in the nerve center thereby stimulated. Moreover, it is possible to implant such an electrode in any center of the brain of a particular animal and, after the sutures have healed and the animal has recovered, to conduct experiments.

One such experiment was performed on a rat with an implanted electrode, wherein the animal itself could switch on the current by pressing on a specially constructed pedal mechanism and thereby stimulate its nerve center. In the experiment, a "pleasure center" was accidentally discovered in the rat's brain, which it constantly stimulated by pressing on the pedal. This self-stimulation continued for twenty hours a day, during which the rat neither ate nor drank (although food was within reach), until it finally went to sleep, exhausted.

It may be deduced from the examples described above that the phenomena of neuro-psychic activity are closely connected with the processes of stimulation and inhibition, and that they take place both in space and time.

However, in order to confirm definitely the materialistic point of view on psychic processes, it was necessary to prove that all neuro-psychic phenomena are just as subject to the laws of causality as the other phenomena of the world around us; i. e., to prove that man is not free in his behavior. It is important to prove this since the theologians have declared human behavior to be a free manifestation of the soul ("everything comes from God"), allegedly subject to neither the principle of causality nor to any other earthly laws.

The great Russian physiologist I. M. Sechenov succeeded in answering this important question and dispelling the religious tales of "the freedom of the human soul"

in his famous book Reflexes of the Brain, which was banned by the tsarist government at the demand of the clergy. Sechenov's work was a revolutionary turning point in our understanding of the causality of neuro-psychic activity in man.

Another famous scientist and physician, S. P. Botkin, observed a severely ill man who had suffered a loss of most of his sense of touch and the organs of feeling. This man was deaf in one ear and blind in one eye. It was necessary only to close the healthy eye and stop up the healthy ear, and he would fall into a deep sleep which would continue as long as no one removed the earplug or opened his good eye.

The brain constantly receives an infinite number of the most varied stimuli from the outside world. The brain answers these neural impulses with motor reactions. A sound is heard — and the head turns in the direction from which it came. A bright light flashes — and the eyes blink. A speck of dust enters the nose — and the person sneezes. Something hot touches the hand — and the hand is instantly withdrawn. All of these examples give us some idea of the reflexes of the brain.

Thus we can see that man is not free in his behavior; his activity is an answering reaction to one or another external stimulant.

For a long time, scientists knew only of the process of stimulation, taking place in the cerebral cortex. However, another process, opposite to that of stimulation, was soon discovered: the process of inhibition. It was then established that inhibition may also take place spontaneously within the nerve cells of the cerebral cortex. Up to the present time, physiologists have never discovered any neural processes in the cerebral cortex other than those of stimulation and inhibition. In the final analysis, then, it may be seen that it is precisely these two fundamental neural processes, taking place within the cerebral cortex, which cause all neuro-psychic phenomena. The waking state of the cerebral cortex corresponds to the so-called "cortical mosaic," during which some parts of the brain may be in a state of stimulation, while others may be in a state of inhibition; these states may be exchanged according to the type of activity

taking place. When the processes of inhibition begin to predominate in the cerebral cortex, gradually taking over more and more of its regions, sleep results.

I. P. Pavlov, guided by the scientific discoveries of his predecessors, opened a new era in physiology with his studies of conditioned reflexes.

Studying the functions of the digestive glands, he called attention the fact that in dogs the mere sight of food or its smell caused salivation and secretion of gastric juices. Such secretion, at the mere sight of food held at a distance, Pavlov called "psychic secretion." Analyzing this phenomenon further, Pavlov formed a definition of conditioned reflexes as being individually acquired on the basis of living experience, as opposed to unconditioned reflexes, which already exist in an animal at the moment of birth, and which constitute the essence of instinct.

Pavlov subsequently worked out a technique of educating and reinforcing conditioned reflexes for all the systems of an organism. The laws discovered by Pavlov's experiments on animals were later tested on humans, confirming that the majority of them are also valid for human beings.

As Pavlov wrote, "it is hardly possible to dispute the fact that the most common basic features of higher nervous activity in the large hemispheres of the brain are the same in higher animals as in man." At the same time, he proved the qualitative difference of certain reflexes peculiar only to the human brain.

In the development of man's capability for abstract thought, the rise of speech and the ability to perform creative work, there appeared something higher, setting him apart from the animals. In spite of the seeming likeness in the basic neuro-psychic processes which take place in the cerebral cortex of man and the higher animals, there are certain features peculiar to the human brain which fundamentally differentiate its psychic activity from the brain activity of even the highest animals. These peculiarities were finally discovered and explained by F. Engels in his famous formulation: "First of all labor, and then together with it articulate speech, were the two most

important stimuli under whose influence the brain of the apes was gradually transformed into the human brain, which, for all its similarities to that of the apes, is still far superior to it in size and perfection."

In Engels' opinion, the speedy development of the human brain with its various sensory organs proceeded under the influence of a concurrent labor activity, which demanded the ability to communicate over distances, in the form of articulate sounds. On the other hand, the appearance of speech permitted the further development of the brain, leading to the ability to think abstractly, which in turn had a favorable effect on working skills. A powerful new factor also operated in the same direction — man's transition to the social way of life.

It is very difficult to imagine the physiological mechanism of speech and its concomitant manifestation of abstract thought, i.e., thought in the form of verbal symbols and ideas.

V. M. Bekhterev felt that speech is a unique "symbolic reflex;" he reasoned that the sounds of words, and their depiction in the form of written marks, serve as special signals for man, signs ("symbols") of the conditioned and nonconditioned stimuli of the environment. These verbal signals can completely replace and substitute for any natural stimuli of the environment which might normally be perceived by our sensory organs. In this way, with the appearance of a second signalling system in man there appeared also the ability to think in non-specific forms; he could now think not only in terms of specific actions and objects, but also in terms of their verbal symbols or ideas. Thus arose abstract thought, the material basis of which lies solely in the hemispheres of the human brain.

Thus we see that the cerebral cortex is the real source of the psyche and behavior. It establishes a thin but precise relationship between the human organism and the external world. However, the cerebral cortex has another and no less important role. It has established that the cortex, through the subcortical centers, also controls the activity of all internal organs.

The brain, with its developed cortex, may be seen as a sort of unique headquarters, constantly receiving from the various internal organs of the human body a multiplicity of signals concerning their activity, which may be either normal or affected by illness. In response to these neural impulses, the cerebral cortex sends out certain orders, which may, for instance, cause a dilation or constriction of the vessels, or may intensify or reduce the activity of one or more organs (such as the stomach, kidneys or heart).

In turn, many internal organs, by means of their neural connections or the secretion of special chemical messengers (hormones) into the blood, exercise an influence on the cortex, and through it, on the neuro-psychic condition of the person. This two-sided relationship between the cerebral cortex and the internal organs has been carefully studied by K. M. Bykov, I. T. Kurtsin, M. V. Chernorutskiy and other scientists and clinicians. It was shown by experiments on apes that the frontal portion of the cerebral cortex contains the higher nervous centers, responsible for the functioning of the various internal organs. Electric stimuli applied to specific sections of this zone result in secretion of digestive juices, intensification of the motion of the intestines (peristalsis), dilation of the blood vessels, perspiration and other changes in the activity of the organs.

Thus we have seen a general description of the neuro-psychic processes which take place in the brain.

At the same time that materialistic science in our country is penetrating deeper and deeper into the very essence of the physiological laws of the neuro-psychic life of man, many foreign scientists are echoing, in a pseudo-scientific form, the conjectures of churchmen that the psychic activity of man is mysterious and unknowable. This is precisely why it is important to examine from a purely materialistic, scientific position a series of complicated phenomena in the psychic activity of man, only recently discovered by science and having received, at last, physiological substantiation.

Among such rare phenomena of the brain and psyche are hypnosis and suggestion, "miraculous cures" sleep-walking, lethargic sleep and others.

HYPNOSIS AND "MIRACULOUS CURES"

The phenomena of hypnosis and suggestion have been known to mankind from the farthest reaches of antiquity. From the so-called "Papyrus of Gnostics," which dates to the second century A.D., we know that the representatives of religious cults -- the priests of ancient Egypt, Babylon and Greece -- were already acquainted with the phenomena of hypnosis and suggestion in very ancient times. The priests adroitly utilized these phenomena for the creation of various "religious miracles." As described in the Papyrus, the priests devised with hypnosis various tricks and methods which are still used even today.

Making use of the fact that with hypnosis it is possible to induce various illusions and hallucinations (i.e., sensory illusions) by verbal suggestion, a hypnotically-adept priest could plunge one of his religious fanatics into a state of "holy" (hypnotic) sleep and then suggest to him, for instance, that he was not in the temple but, instead, was wandering in a world beyond the grave, meeting the dead or his slain ancestors, or seeing and hearing the gods. Upon awakening, the subject would believe that he really had been in "the other world," and could, as an eyewitness, colorfully relate his impressions to those around him. The influence of such methods on religiously inclined people undoubtedly strengthened the authority of the church.

Later, in ancient Greece, the phenomena of hypnosis and suggestion were also being used by the priests, even for "miraculous cures." The curing of "paralytics" and the blind, the deaf and the mute is attested to by historic documents of that time, primarily those of the Catholic Church. Jumping forward, we should point out that we are not concerned here with real, organic diseases of the human organism, but with functional disorders of the type of hysterical neurosis (hysteria), during which one or more functions (sight, hearing, etc.) sometimes undergo a temporary disturbance. Since a hysterical disturbance appears very similar in outward form to a true organic affliction of the nervous system, this also made it possible for churchmen to profit by such cases. It is easy to imagine how effective was the sight of such "healing" in ancient times, when real medical aid for the sick was out of the question, when there were almost no doctors and the level of medicine was extremely low. However, even in the present time the church continues to make use of various stories of cases of such quick healing of certain functional disorders of the nervous system, passing them off as the intervention of God.

Science has completely exposed these "miracles," showing that there is absolutely nothing supernatural in these cures. It has been established that in some cases of hysteria, an ill person under the influence of a morbid auto-suggestion (especially in connection with some sort of nerve-wracking experience such as fright, unexpected news, the illness or death of someone close), may experience one or more disturbances of the nervous system. It has been proven by science that all diseases of man may be conditionally divided into two major groups: organic and functional.

Under the heading of organic disease we include all those wherein there is destruction of the integrity of the cell itself or its tissue. Thus, a skull wound may be accompanied by disruption of the motor nerve centers, which are responsible for the movement of the hands or feet; this may then result in the organic paralysis of one or another extremity. In a functional disturbance of the nervous system, no destruction of the

integrity of the tissues in the human body is observed. For example, in motion disorders all the nerve cells and conductors are intact, and only a functional disturbance of one or another extremity takes place. From the outside, both organic and functional paralysis look the same; in either case, the hand or foot has lost its ability to move. However, for the doctor it is very important to establish the nature of the given illness, since in one case (that of organic paralysis) it is impossible to achieve a speedy recovery, while in the other case (that of functional paralysis) the illness may be eliminated in a few minutes with the aid of hypnosis or suggestion. What is the point here? Why may we expect a speedy recovery in the case of functional paralysis (hysteric blindness, deafness, muteness) as opposed to that produced by organic disease?

In order to clearly understand the mechanism of a functional disorder in one or another activity of the organism, it is necessary to turn again to the studies of Academician I. P. Pavlov. Pavlov learned that in the human nervous system, in the cerebral cortex, there is a continuous alternation of two neural processes: stimulation and inhibition. Without the interaction of these two processes there can be no movement, sensation or thought. Such a comparatively simple motor activity as opening or closing the hand can take place only in a condition where certain specific centers are inhibited and others, conversely, are stimulated. Here, for example, the centers which control the "opening" muscles are inhibited while the centers responsible for the "closing" muscles are stimulated, and the hand closes. If the speech centers are suddenly inhibited, then the victim cannot utter a single word, no matter how dearly he may so desire.

The inhibition of one or more nerve centers may occur suddenly, under the influence of severe fright or excitement. In such a case the nerve cells of the brain cannot withstand the unusually severe stress, and they are disengaged from normal functioning by the process of inhibition, which thus protects these cells from complete breakdown and death as a result of the excessive stress. Thus, in a functional disease there is no destruction of the nerve cells, but only a halt in their normal activity or function. After a certain period of rest and treatment these cells can once more resume their temporarily

interrupted function. In an organic affliction of nerve tissue its cells are destroyed and cannot be restored, since nerve cells do not possess the capability of regeneration. Only after several months, and under favorable conditions, can the other nerve centers sometimes take upon themselves a part of the work originally performed by the destroyed cells.

Consequently, it is only in functional diseases that quick cures are possible, primarily with the aid of suggestion and hypnosis; organic diseases demand prolonged and persistent treatment by other methods. It now becomes clear that the so-called "miraculous cures" used in every possible way by churchmen for their own profit actually hide nothing mysterious or supernatural.

In what does the power of hypnosis and suggestion lie? What do they represent from the scientific, physiological standpoint? It should be mentioned here that the phenomena of hypnosis and suggestion belonged for a long time to the area of "the enigmatic" and fascinated not only the uneducated people, but scientists also. It has been historically established that for many years these phenomena were used by various charlatans and quacks for their selfish goals. At various times hypnosis and suggestion were used for profit by servants of the church, members of different sects, and common adventurers like G. Rasputin, who, it has been established, took lessons in hypnosis from a visiting Italian professional hypnotist. Just how well the "hypocrite" Rasputin had mastered this method may be adjudged from the manner in which he "spelled away" (halted) the bleeding of the heir to the throne, who suffered from hemophilia, which all the more won for him a reputation with the Romanovs as a "holy elder."

Using the phenomena of hypnosis and suggestion, many religious charlatans successfully strengthened the faltering belief of people in God. As an illustration we may refer to a narrative by F. Engels, who was personally present at a similar performance. Regarding this occasion, Engels wrote: "And so it turned out that during the winter of 1843-44 I also saw in Manchester this Mr. Spencer Hall. He was a quite ordinary charlatan, traveling

about the country under the patronage of several priests and performing magnetic-phrenological experiments upon a young woman, which were supposed to prove the existence of divinity, the immortality of the soul and the falsity of materialism, which was being preached at that time by scientists in all the large cities. He brought this girl to a state of magnetic (hypnotic -- P.B.) sleep, and she, after the operator had touched any hallucinatory organ of her skull, entertained the audience with theatrical-demonstrative gestures and poses representing the activity of the corresponding organ... at the very top of her skull he revealed the organ of the prayerful state; when he touched it, the girl fell upon her knees and clasped her hands, depicting before the amazed Philistine audience an angel lost in a prayerful ecstasy" [1].

Engels wrote further that he had personally begun to investigate hypnotism and that he had not found anything unsual in this phenomenon. As a scientist-materialist he approached the phenomenon of hypnotism from a scientific position. Engels wrote: "With a fixed gaze directed at him (the boy used in the experiments -- P.B.) or a light stroking, it was not difficult to arouse a hypnotic state in him... Aside from the easily produced stiffening of the muscles and a loss of sensation, we were able to ascertain a state of complete passivity of will in combination with a unique super-excitability of the feelings" [2].

At first, when great scientists, physiologists and doctors in all countries began to study hypnotism seriously, there was much enthusiasm, but also much misunderstanding. Several foreign scientist examined hypnosis and suggestion from an idealistic standpoint and thus were unable to correctly, scientifically discover the mechanism of these phenomena. To the great merit of our native scientists V. M. Bekhterev, I. P. Pavlov and K. I. Platonov, there finally appeared the formulation of a harmonious, materialistic theory of this complex and interesting phenomenon.

A particularly great amount of work was done in this report by I. P. Pavlov, his co-workers and students. Pavlov showed that hypnosis and ordinary, natural sleep are qualitatively related states, which had already been guessed by ancient scientists. The

word "hypnosis" itself, when translated from the Greek, means "sleep." And of course, if one actually compares two people, one in a state of natural sleep and the other under hypnosis, then one is struck immediately by the great similarity between these two states. And just as we differentiate normal, nocturnal sleep according to its depth, so also may we divide hypnotic sleep into three degrees of depth: light, medium and deep hypnosis.

Light hypnosis is characterized by the fact that the subject's entire body feels weak (as if covered with lead), there is a light fog in the head, and the subject does not want to move or think. He does not have the strength to open his eyes. Consciousness is retained by the subject, however, and after awakening he can recall everything that happened to him during the course of the seance.

During medium hypnosis, all of the above-described phenomena grow more pronounced; "gaps" appear in the subject's consciousness, and he loses the ability to move independently. Upon awakening, the subject is not able to recall all of the circumstances and events which occurred during the period of his hypnotic sleep. He experiences what is called partial amnesia.

In deep hypnosis the subject has no realization at all of what is happening around him. His consciousness is completely inhibited. The subject's body is in a state of deep hypnotic sleep; his skin surfaces have lost their sensitivity to pain and temperature (the occurrence of what is called the anaesthesia and analgesia of the skin surfaces), which may be used for painless operations under hypnosis. The subjects of this deep hypnosis cannot recall what happened to them during their hypnotic state.

For a long time, men could not understand how it was that a hypnotist, by staring steadily into the eyes of another person and using "magical" motions of his hands along the body and whispering, could put another person to sleep. In ancient times the personality of the hypnotist was credited with a special role. It was thought that a hypnotist was a special person, endowed from birth with some kind of unusual qualities, strength of will and black or green "serpent's" eyes.

The church willingly bestowed a halo of "holiness" and "divine power" upon the representatives of religious cults who possessed a knowledge of the techniques of hypnosis and utilized its phenomena in their religious activity. However, it has been proven by science that the personality of the hypnotist hides nothing "mysterious" within itself, and it is possible to teach any person to be a hypnotist. At the present time, every doctor who has completed his studies at a mecical institute has learned the basic methods of hypnotherapy and can, if necessary, use this knowledge in his medical pratice. It has been shown that the techniques of hypnosis, the tricks and methods of hypnotizing, contain no secrets and are subject to the laws of physiology.

There are many methods of hypnotizing. One of the most widely used is the method of fixation of the eyes on some sort of brilliant object. The subject is made to look steadily at a medical hammer, a shiny bead or into the eyes of the hypnotist, thus tiring the vision centers and beginning the process of hypnotic inhibition. This process, once begun, soon spreads to the neighboring portions of the brain. Sleep occurs, but not a normal sleep; it is artificially induced -- a hypnotic sleep. Another method consists of having the subject listen to some sort of monotonous sound -- the noise of drops falling into a vessel, the sound of a metronome or an inductor. In the past, for instance, in ancient Babylon, the priests would have a religious fanatic listen for the "murmuring of a holy brooe." Straining his ears, and overcome with fasting and prayer, such a person would quickly fall into a peculiar "holy" (hypnotic) sleep.

Suggestion, which will be discussed in more detail in a later chapter, is another means by which the hypnotist uses the subject's hearing apparatus. Through verbal suggestion, the hypnotist arouses in the subject an idea of sleep and the symptoms which accompany it. He applies the so-called formulas of suggestion (phrases constructed and pronounced in a specific manner), by which the hypnotist seeks to induce sleepiness in the subject. For example: "Breathe quietly, evenly, deeply...your whole body seems to be getting heavy, as if covered with lead...you feel a pleasant peacefulness, quiet, sleepiness

begins to embrace you...it is growing quieter, darker, everything is growing more peaceful around you...an irresistable sleepiness and drowsiness is overcoming you...you are drifting, drifting deeper into sleep...etc." The subject gradually shows the signs of sleepiness and drowsiness, and he falls asleep; it is not normal sleep, but hypnotic, and the subject maintains the ability to hear and perceives keenly the voice of the hypnotist who has put him to sleep.

In the past, and even to day, an especially strong impression was made upon observers by the following method of hypnosis. The hypnotist strokes along the body from head to foot with soothing hands, lightly touching the skin. It appears that in this case the hands of the hypnotist stimulate the nerve endings located in the subject's skin, and a nerve impulse is sent from them to the cerebral cortex, to the nerve centers which perceive the sensitivity of the skin to touch (tactile sensation). Under prolonged influence, the nerve cells of the cerebral cortex responsible for analyzing skin sensation become exhausted, and the process of inhibition occurs in them. This inhibition subsequently spreads to the neighboring parts of the brain, and sleep occurs -- in this case, artificial, hypnotic sleep.

So-called "passes" are also used to induce hypnosis -- regualr motions of the hands along the body of the subject, but without touching the skin. In this case the heat radiated from the tips of the hypnotist's fingers act upon the heat-sensitive nerve endings in the subject's skin, stimulating them. These weak temperature stimulations, as in the preceding method, are transmitted to the cerebral cortex; there they first stimulate, then exhaust, the nerve cells of the cortex, and again the process of inhibition is begun. This method, the most ancient of all, remained unexplained for a long time and appeared to be a complete mystery. One man lies down, another makes strange "magical" motions over him, and suddenly the first begins to experience sleepiness and drifts off to sleep.

In light of the studies of I. P. Pavlov on the inhibition of the cerebral cortex under the influence of monotonous, weak stimuli, even this method of hypnosis loses its old mysteriousness.

An interesting method of instantaneous hypnosis was used in Portugal in the 18th Century by the priest Faria. He would seat a visiting believer in an armchair and explain to him that in order to ease his suffering, he, Faria, would use "divine power" to put him to sleep. Faria would assure the believer that his "soul" would not be threatened by any kind of "unclean power" and then, fixing the eyes of his subject with his powerful gaze and suddenly crying "sleep!", Faria could plunge his visitor into an instantaneous sleep. It should be noted that the Abbot Faria wielded considerable authority among his parishioners, for which he was in no small degree indebted to hypnotic suggestion.

At the present time, even this method of hypnosis has been explained by science. According to Pavlov, the inhibition of the nerve cells of the cerebral cortex may be brought about not only by weak, uniform, prolonged stimulating activity, but also by short, overpowering "shock" stimuli, of very short duration but possessing extraordinary force. In this case, the nerve cells of the brain cannot withstand such powerful stimulation and immediately fall into a state of "protective inhibition," guarding the nerve cells from destruction as a result of the overstimulation.

At the present time, this shock method is used only very rarely in medicine, primarily for the treatment of alcoholics and others stammering in hysteria. It cannot be used in the hypnosis of children, pregnant women or those suffering from heart ailments, since it may cause the appearance of undesirable complications, which never occur during the use of weak, uniform stimuli.

And so an analysis of the techniques of hypnosis has shown that physiologists and doctors have thoroughly studied the mechanism of hypnosis, and that it is no mystery for science.

It is often asked upon what does the successful application of hypnosis depend, and who yields most easily to hypnotization. Basically, it depends on three factors. First, on the personality of the subject; second, on the environment in which the seance is conducted; and third, on the art of the hypnotist, his knowledge and experience.

According to the data of authoritative hypnotists, those most susceptible to hypnosis are children between 4 and 16 years of age, since they possess a heightened suggestibility. The very old and the emotionally disturbed are very poor subjects for hypnosis.

The efficacy of hypnotism depends on the higher nervous activity, and also upon the type of personality possessed by the subject: artistic or thoughtful (according to Pavlov). It is felt that people of the artistic type are more susceptible to hypnosis. This is not surprising, since people of this type tend to think in vivid images; they are endowed with rich fantasies and impressionability, at the same time that people of the thoughtful type tend to think abstractly, inclining to excessive analysis and critical judgement. People of the thoughtful type are not very susceptible to hypnosis and suggestion. It is undoubtedly true that the environment in which the hypnotic seance is conducted also has much to say about the success of the experiment. If it is possible to hypnotize approximately 25 per cent of the subjects involved in an experiment in the conditions of a noisy, crowded auditorium, then in the conditions of a "hypnotarium" (a room specially equipped for hypnosis), it will be possible to hypnotize 90 per cent of the subjects. This is why the representatives of religious cults preferred to hypnotize their religious fanatics in the conditions of a cell or a chapel, and only in an extreme case would they risk performing hypnosis in a crowded temple during religious services.

At the present time, we differentiate three types of hypnosis: lethargic, cataleptic and somnambulistic. Let us examine these three types.

The lethargic type of hypnosis is characterized by the fact that the weakness of the subject's body increases with the degree of depth to which the sleep is induced. If, under light hypnosis of this type, the subject's hand is raised high and then released, it immediately falls as if lifeless. In a medium hypnosis of this type, the weakness of the entire skeletal musculature will be expressed to an even greater degree, while in deep hypnosis it is possible to observe the phenomenon of a so-called "lethargic arch," wherein the

body of the subject, when placed with the spine against a narrow prop or the back of a chair, will bend as far as it is possible to bend the bony frame.

On the other hand, in hypnosis of the cataleptic type it is possible to observe a hardening of the muscles of the entire body. If the subject's hand is raised, then it remains stretched in the air and shows some degree of resistance to any attempt to lower it. In medium hypnosis of this type, the hardening of the musculature will be even more pronounced. A so-called "wax-like pliability," may be observed, wherein it is possible to mold the subject's body, as if it were wax, into various figures and poses which the hypnotized subject can hold indefinitely. In deep hypnosis of the cataleptic type, it is possible to observe the phenomenon of the so-called "cataleptic bridge." This experiment consists in the following: if the subject's head is placed on one chair and the feet on another, then a unique type of "bridge" is formed from a human body. It is possible to stand, or even place a large weight, upon the body of such a cataleptic.

In the past, when various professional hypnotists demonstrated hypnotism, they performed the following demonstration. They would place a large limestone rock upon the chest of such a sleeping subject, and then smash it into little pieces with a large hammer. The subject continued to sleep, feeling no pain, and after awakening remembered nothing of the experiment conducted with him.

The somnambulitic type of hypnosis is particularly interesting. In somnambulitic hypnosis the sleeping subject retains the ability to move, while remaining in a sleeping, hypnotic state. Thus, in light hypnosis of this type, if one hand is made to revolve around the other, then this motion will continue as long as is desired. In medium hypnosis of the somnambulitic type, the motions may be quite complex. The hypnotized subject may carry out any professional motion; he can write, draw or sketch, remaining under hypnosis. The somnambulitic can sleep with his eyes open, answer questions, and so forth. In deep hypnosis it is possible to observe all the "miracles" which the vaudeville hypnotists so loved to demonstrate. The hypnotized subject, remaining under hypnosis, can freely move, walk, sing or dance. All of his movements are fluid, free and relaxed. Such a somnambulist

does not give to an observer the impression of a sleeping person. It is possible to suggest to hypnotized somnambulitics, for example, that they are sitting not in a room but on the bank of a river and are trying to catch a fish. They will cast an imaginary "fishing line" into an imaginary river and behave as if they were real anglers. "You're being attacked by bees!" suggests the hypnotist, and the subjects begin to frantically beat off the imaginary insects swarming about them. "Water!" suggests the hypnotist, "A flood has begun!" -- and the subjects climb in panic upon chairs and tables, trying to save themselves from the flood. If a subject is handed a stick and told it is a snake, he will throw this imaginary snake away in horror. Observers are particularly impressed by such demonstrations. Somnambulists have been given various types of inedible items such as chalk, cotton and coal but told they were bread, meat and cheese; the subjects have eaten these "food products" with obvious pleasure. Moreover, their glands secrete gastric juices (as shown by laboratory tests) -- not for cotton and chalk, but for "meat" and "bread."

In this way it was proven that complex verbal stimuli may be more powerful than the natural stimuli of the surrounding environment. Interesting results were obtained in experiments wherein elderly people were hypnotized and told they were actually quite young, that they were still children. These fully grown people then acted as if they really were little children; they sat on the floor, made little "cakes" out of imaginary sand, jumped rope or played "tag," and even their handwriting and voices changed. But it was especially important to prove scientifically that in the hypnosis of many subjects it is possible to cause dermo-tropic changes through the use of verbal suggestion.

Soviet scientists such as Finne, Pod'yapol'skiy, B[illegible], Sumbayev, Bekhterev, Platonov and others have reproduced experiments on the so-called "suggestive burn." This experiment was usually conducted in the following manner: some sort of cold item is placed in the hand of a hypnotized somnambulist who is in a state of deep hypnotic sleep, and he is thereupon told that he is really toching a red-hot metal bar. "I have burned you!" cries the hypnotist, whereupon the subject shows all the evidence of a person whose skin

has actually been burned. Sweat breaks out on his forehead, his pulse rate increases, his blood pressure changes, a painful grimace appears on his face, and so on. Within a short period of time erythema (reddening) appears on the skin of the hand around the area of the imaginary burn, and then an actual blister, filled with interstitial fluid -- all the signs of a real second-degree burn. In our own time, this experiment has helped expose one "religious miracle."

The miracle of Louisa Lotto consisted in the fact that this woman, suffering from a hysteric neurosis, religious to the point of fanaticism and under the influence of a sick autosuggestion, showed upon her palms and feet bloody spots (so-called "stigmata") in exactly the same locations where, according to the Biblical legend, the nails were driven in during the crucifixion of Jesus Christ. One can well imagine what sort of impression this miralce had upon religiously inclined people of that time. The church, naturally, made good use of this phenomenon in stirring up religious fanaticism. They began to take Louisa Lotto around to the various cities of Europe, demonstrating her as a new "religious miracle." The Parisian Academy of Sciences of that time could not explain what was happening. The clergy asserted that since scientists refused to explain this phenomenon, that meant it was really a "driven miracle." Only in our time has the mechanism of this interesting dermo-trophic phenomenon been understood, and all thanks to the study of hypnosis. What is hypnosis, then? Of what does it consist?

According to the studies of Pavlov and Bekhterev, hypnosis is a state close to that of common, normal sleep. According to Pavlov, if the common, physiological type of sleep is a process of inhibition which embraces the entire cerebral cortex, then hypnotic sleep is only a partial inhibition, embracing only separate (isolated) sections of the cortex, at the same time that other regions of the cortex continue to remain in a state of more- or less-expressed stimulation. Whether or not normal and hypnotic sleep are qualitatively related states may be judged from the following observations. Let us imagine that we have placed someone in a hypnotic sleep. How long will he sleep without awakening? It turns

out that such a hypnotized person will awaken by himself after a few hours. Why does this occur? Because the gradual hypnotic inhibition of the cerebral cortex is only partial and narrowly localized; it will begin to spread to other regions of the brain, that is, it will become a general, widespread inhibition which is characterized by a transition from hypnotic sleep to common, normal sleep. When this transition has taken place the subject may awaken independently, for any normal reason (noise, light, uncomfortable position, etc.).

On the other hand, we know of methods with which it is possible to transform the common, normal type of sleep into its analog -- hypnotic sleep. The general, widespread inhibition is transformed into partial, narrowly localized inhibition (i.e., hypnosis). In order to do this it is necessary to carefully approach a person who is sleeping normally and, taking care not to awaken him, make the "passes" about which we have already learned, suggesting all the while in a hushed voice that the subject must not awaken. "Continue to sleep... You will listen to my voice, but continue to sleep... Answer my question, but do not wake up... How are you sleeping? Good?.. Deeply?... Continue to sleep... What is your name?" If the subject, continuing to sleep, begins to answer the questions of the experimentor, then the goal has been achieved. The hypnotist has succeeded in transforming normal sleep into the hypnotic. In such a case the subject will begin to answer your questions; according to the suggestions of the hypnotist, the subject can stand, walk around the room and carry out all the orders of the hypnotist. Upon awakening in the morning, he will remember nothing of what occurred with him during his sleep.

We know from history that priests and other representatives of religious cults in ancient Egypt and India used the state of normal sleep (transforming it into hypnotic sleep) to elicit whatever information and secrets from believers which was useful to the clergy. In a state of hypnotic sleep, as we have already shown, it is possible to suggest to a subject various illusions and hallucinations (visual, auditory or olfactory).

Just as a normal sleeper behaves upon dreaming some kind of frightening dream (crying out, fending off the imaginary danger, shedding tears, etc.), so the hypnotized person believes everything that the hypnotist suggests to him. What is the point here? The point is that, just as in normal sleep, in a hypnotized person the higher centers of the cerebral cortex which perform the functions of analysis and criticism are disengaged (inhibited).

A person in a state of normal sleep dreams that he is a small child who has been undeservedly punished, and he believes this dream and cries bitter tears, and when he awakes he will feel these tears upon his cheeks. If it is suggested to a hypnotized person that he is present at a sad event, he will see this tragic scene and also cry. A person who is awake, retaining his powers of analysis and criticism, will behave quite differently. He is told "There's a dog standing in front of you!" but the subject is not asleep, his nerve centers are not inhibited and he is capable of critical judgement. "No, that's not a dog I see, but a chair!" he will state. But suppose that we have hypnotized this person and, again pointing to the chair, suggest that there is a dog before him. He will approach the chair, begin to pet it, shake its "paw" and begin to converse affectionately with the imaginary animal.

The well-known similarity between dreams and hypnotic suggestion also bears witness to the common nature of hypnosis and real sleep. I. P. Pavlov, his co-workers and students established on the basis of exact experimental data that the basis of hypnosis, just as in real sleep, lies in the process of inhibition. Pavlov wrote "...that hypnosis is, of course, the same as sleep. In essence it does not differ from sleep, but differs only in certain particulars, such as the fact that, for example, it is a type of sleep which progresses very slowly, that is, only a very small, narrow region is overcome at first, and then, gradually spreading further and further, finally reaches the point where it passes from the large hemispheres to the subcortical matter, with only the centers of breathing, heart action, etc., remaining untouched, although even these activities are reduced to a certain degree" [3].

What, then, is the practical difference between real, normal sleep and the hypnotic? The difference consists in the fact that in hypnogenesis there is established between the hypnotist and his subject a special psychic bond, something which we call a "rapport." In a state of normal sleep a person is equally insensitive to whatever sounds may come to him from the outside world; his nerve centers for hearing (the auditory analyzer) are under the influence of the process of inhibition spreading throughout the cerebral cortex. A subject in a state of deep hypnosis also does not realize where he is, does not react to external stimuli, nor does he hear the voices of those present; but he does show an acute sensitivity to what proceeds from the hypnotist. He hears only the voice of the hypnotist, and answers only him in his sleep. The hypnotist becomes a sort of intermediary between the subject and the surrounding world. This isolating rapport is the most important thing which differentiates hypnosis from normal sleep. It was pointed out earlier that hypnosis is thought to be a kind of partial sleep. This means that not all of the cerebral cortex is undergoing the process of inhibition. The limited area of the auditory analyzer which has to do with the subject's sensitivity to the voice of the hypnotist and his suggestions continues to function, hence the "response sentinel" is operating. There is nothing unusual in the phenomena of isolated rapport in hypnosis. Under special conditions, the "sentinel" frequently functions even in normal sleep. A mother, for example, having fallen asleep by the bed of a sick child, will not hear any extraneous noises — her cortex is inhibited; but no sooner does the child begin to cry and she immediately awakes, since the "response sentinel" in her cortical auditory analyzer has remained isolated, sensitive to any sounds issuing from her child.

The phenomena of hypnosis are widely known not only inhuman society, but also in the animal world. It is possible to hypnotize insects, frogs, crawfish and other reptiles (snakes, crocodiles, etc.), hens, rabbits, dogs, horses and apes.

In Russia, the hypnosis of animals was studied by the famous Khar'kov scientist V. Ya. Danilevskiy. During the 1870's he was the first to take up the experimental study of hypnosis in animals. If an animal's movement is suddenly arrested, leaving him in an

unsual pose, or if he is made to undergo various physical stimuli, then the animal will fall into a peculiar numbness, with the loss of reaction to pain stimuli. Danilevskiy considered the sensing of danger to be the most important factor in the mechanism of hypnosis in animals.

Even in ancient times, people already knew how to hypnotize animals. The priest of ancient Egypt hypnotized crocodiles, the priests of India hypnotized various types of venomous snakes, and the priests of ancient Greece hypnotized predatory animals (lions and tigers), with which they threw religious fanatics into a holy tremor. Biblical legends abound with stories of the influence of various "saints" and "favorites of the Lord" over wild animals, tamed with one glance.

It is interesting to note that the Biblical tale of the transformation of a rod into a serpent may be easily accomplished under the influence of hypnotic suggestion. For this it is sufficient to suggest to a hypnotized person holding a rod that he has a "serpent" in his hand, and he will throw the imaginary snake away with a cry of horror, because he not only sees the imaginary reptile in his hands, but also feels its slippery, cold body. On the other hand, it is easy to transform a real snake into a "rod," if one grasps it deftly at the place where the head joins the rest of the body and shakes it vigorously. In this experiment the body of the snake hardens, losing its mobility and flexibility, and is transformed, as it were, into a sort of rod.

Hypnosis in animals has a defensive character, and is developed as an unconditioned (innate) protective reflex. This supposition may be illustrated best by the following example. A live rabbit is thrown into a cage with a boa constrictor. As soon as the rabbit notices the boa he falls by reflex into a state of protective cataleptic hypnosis, losing his mobility as if he were petrified by fear. And, in actuality, this may save him from certain death. The boa will not eat such an immobile rabbit. But if the boa sees the moving rabbit first, he will quickly strangle his prey and swallow it. Of course, the hypnosis of animals may only in a small degree be compared with the hypnosis of human beings, in

which verbal suggestion occupies the most important role. A tremendous part in the development of our knowledge about suggestion and hypnosis was played by the outstanding Russian scientist and Academician V. M. Bekhterev. He marked a beginning in the experimental study of the phenomena of suggestion and hypnosis in human beings. He attached meaning to both the psychic and physical factors in the generation of hypnosis. According to his opinion, uniform physical stimuli in conjunction with verbal suggestion will lead to the hypnosis of a human being faster and better than anything else.

SUGGESTION AND AUTOSUGGESTION

V. M. Bekhterev assigned a leading role to suggestion. Concerning the nature of hypnosis, he considered it to be not an unhealthy state, but simply a physiological one, a unique variant of natural sleep. Academician Bekhterev did a great deal toward discovering the essence of suggestion. He felt that suggestibility is a normal property of the human psyche, expressed, however, to a different degree in different people, and that the phenomena of suggestion, mutual suggestion and autosuggestion are significantly more widespread in human society than had been previously thought.

The phenomena of suggestion accompany man from his childhood years to his old age. As Bekhterev put it in a figure of speech, suggestion (as opposed to persuasion) enters the human consciousness "not through the front door, but, so to speak, up the back stairs," by-passing the critical watchman. Everything that is accepted on faith, without the necessary criticism, without the appropriate critical examination by the brain of a given individual, is suggestion.

If we say that it was V. M. Bekhterev who assigned a psychological basis to the phenomena of suggestion, then it was another great scientist, I. P. Pavlov, who gave these phenomena a really scientific, physiological foundation.

Pavlov also felt that, among the hypnotic phenomena in man, that which we call suggestion deserves special attention. How, then, are we to understand this phenomenon from the physiological standpoint? Pavlov showed that for man, speech is a conditioned stimulus just as real as all the others common to animals. In addition to that, speech is, for man, an even more multi-meaningful, conditioned stimulus, not in any way comparable (qualitatively or quantitatively) to the conditioned stimuli of animals. Indeed, for an animal a word is only a sound, having no thought-invoking meaning, but for man every word carries thought and meaning. Because of the entire preceding life of a grown man, wrote Pavlov, a word is connected with the external and internal stimuli entering the large hemispheres of the brain, and it can therefore cause all of the actions and reactions of the body which condition these stimuli. Pavlov summarized it by saying that "suggestion is the simplest, most typical conditioned reflex of man."

Let us attempt to illustrate this postulation with a simple example. Imagine that a researcher places a slice of lemon in the mouth of his subject. What happens? In response to the natural food stimulus (the lemon), on the basis of an inborn food reflex, saliva is secreted. It is possible to obtain the very same secretion of saliva even without giving the lemon to the subject, by simply showing it to him (acting through the visual analyzer).

Such a case comes to mind. One "lemon lover," entering a park and taking a seat in front of a band playing there, began to eat a lemon right before the eyes of the band members. The band soon stopped playing, because the throats of the wind instruments had become "obstructed" with saliva. In this case a salivatory reaction was engendered through the so-called "primary signalling system," according to Pavlov (through the sense of sight, hearing or smell). However, it is possible to obtain the very same salivatory reaction without having the subject taste a lemon or showing it to him, but only speaking about a lemon and its sour taste. "I'm taking a big lemon, cutting it, and the sour juice of the lemon is beginning to trickle into a glass," says the experimenter, and from this talk about a lemon and its sour juice the subject begins to salivate. In this case we

have used a stimulation through the "secondary signalling system," closely connected with the primary signalling system, and considered by Pavlov to exist only in man.

According to studies by Pavlov, animals have only the "primary signalling system," which is based on the subcortical system. In man, however, the "secondary signalling system" was developed, refined and consolidated in the process of evolution. A word can substitute for a direct stimulus in the signalling activity of the brain. In the given case the word "lemon," as a conditioned stimulus of the secondary signalling system, activates the primary signalling circuit found in close connection with it, and furthermore, through the subcortex, causes a conditioned reaction — salivation. The word may not even be pronounced, which often occurs during autosuggestion. In this way, a verbal stimulus, being connected in a person's past experience with a stimulus of the primary signalling system designated by him, due to the durability of this conditioned connection, is capable of completely replacing a natural food stimulus. In the analysis of the phenomena of suggestion it must be remembered that the primary signalling system is inseparably interconnected with the secondary signalling system and lies at the basis of speech and thought, and that the primary signalling system does not exist in "pure form" in man.

We know that in many people pricking the skin with a pin causes a noticeable increase in the pulse rate, and also a corresponding defensive reaction (the reflex withdrawal of the hand). It is found that exactly the same defensive reaction and increase of the pulse rate may be caused in these people even by showing the pin or simply pronouncing the words "pin!... painful!" In the given example, repeated concidence of the word with the reactions caused by an unconditioned stimulus (a real pinprick) transforms the work into a conditioned reflex. A word reflects both the socio-historical experience of the human race and the individual experience of any given person. For this reason the content of even one phrase may be extremely complex, and the answering reactions to it may be just as complex. The same word may cause different answering reactions in different people, depending on those conditions under which it was received and

understood in past experience and under which it is pronounced and understood at any given moment. New verbal stimuli, thanks to the constant functional connections in the cerebral cortex, may reactivate the tracks of old verbal stimuli. The range of meanings of a work is great: from the simple, conditioned designation of an object to the abstract representations and conceptions which reflect human thought. Corresponding to this, the range of verbal stimulation and suggestion of one person on another is multiform and wide. If it is possible to cause a salivatory reaction by saying the word "lemon," and to cause the secretion of stomach juice and a motion reaction of the intestines (rumbling in the stomach) in a hungry person by saying the word "food," then there is nothing surprising in the fact that with the words "sleep!" or "go to sleep" it is possible, by the mechanism of suggestion, to cause sleep (an artificial — hypnotic — sleep).

Let us now attempt to demonstrate, based on an example from everyday life, the role and meaning of suggestion, mutual suggestion and autosuggestion. Imagine that you are sitting with a group of people waiting for something. The time passes very slowly. Suddenly one of those present yawns, then another, and after him a third. What has happened? Why did the first yawn appear to be so "infectious?" What had happened was that the first person, with his yawn, had suggested a yawn to the others! A unique chain reaction occurred, under the influence of suggestion and mutual suggestion. Let us take another example. You find yourself in the movies or in a theater. Suddenly you hear one man cough (then another), and soon a peculiar "lightning flu epidemic" seems to have broken out in the hall! Suggestion has played a role here also.

It is possible to list even more such examples. You are sitting at home and waiting for a visit from a friend. The time passes, but still your guest doesn't come. You begin to get nervous, listen for every sound, even stare out the window. And then, when you are just about on pins and needles, you suddenly hear the bell or a knock at the door. With a hearty cry of "Welcome!" you open the door and . . . you see there's no one there. In such cases we say "It must have been my imagination!", "I thought I heard something!" or "I must have been dreaming!" The fact of the matter is that you were the victim of an

autosuggestive auditory hallucination (a sensory illusion), which developed in you as a result of your waiting. Here is still another example: You are walking in an unfamiliar rural area, and it is beginning to get dark. Suddenly you see in front of you, not very far away, a "lurking man" who, perhaps, is laying in wait for you with evil intentions. Many people would immediately turn aside, while others, more decisive, head straight toward the danger. But then, when the person walks closer, he suddenly sees that before him stands only a stump or a plank of a rickety old fence. In such situations we say "I could have sworn I saw something!" or "My eyes are playing tricks on me!" In actual fact, you have fallen victim to an autosuggestive hallucination, having taken a stump for a lurking man.

Once the following experiment was performed. In one class the students were told: "Comrades! Today we shall study the activity of the olfactory analyzer. You will please give your attention to the following experiment." With these words a few drops of a dark liquid from a specially prepared flask were droped onto a wad of cotton. Those present were asked to raise their hands as soon as they smelled a disagreeable, sharp odor. Soon a few hands were raised in the front rows. Then the odor spread farther and farther into the auditorium until it finally reached the last rows of the amphitheater. By this time it had gotten so bad for some of those sitting in front that they had to be led out of the auditorium. All the greater was the students' surprise when, after the end of the experiment, they were told: "Colleagues! There was no odor at all! The odor was only suggested to you! You were expecting it so tensely, preparing yourself to smell it, so to speak, that you developed a suggestive, mass olfactory hallucination." As is evident from this experiment, which was conducted in an alert state (without putting anyone to sleep), suggestion turned out to be quite strong. If it is possible to cause an olfactory hallucination of mass character in young, intelligent and educated people, then there is nothing surprising in the fact that in the Middle Ages, or even in more recent times, mass hallucinations could break out under the influence of suggestion by representatives of the church.

The nerve system and psyche of the people of that time were prepared for the reception of suggestion by endless wars, epidemics of cholera and the plague, and other especially dangerous infections with a great death rate of the population. Against a background of constant nerve-wracking experiences, terror and systematic malnutrition the death rate of the population from neuro-psychic diseases was extremely high. Various forms of hysteria, madness and "falling sickness" flourished. The churches were jammed with crowds of "God's fools" and "those who had offended God." Together, all of the circumstances enumerated above created the conditions for the occurrence of mass "psychic epidemics." One such psychic epidemic which took on a mass character was the epidemic of "possession by the Devil."

During the Middle Ages in Europe, the Catholic Church had a particularly strong influence. The representatives of Catholicism suggested to believers that the Devil was just as all-powerful as the Lord God himself, and that demons in the form of ordinary people could freely penetrate into their living quarters and come into contact with them. Furthermore, the Devil could even penetrate into a person's body through the natural apertures of the human body. In such a case the man becomes a plaything in the hands of the Devil, who would begin to direct his deeds and actions. A person "possessed by the Devil" (this was more often than not a woman, suffering from hysteria), as a rule, could not bear to be in "holy places" (such as temples, churches and chapels), and would begin to "writhe" at the sight of a cross or an icon. Sufferers of this possession usually fell into contortions, their bodies were bent into an arc (the hysteric arch), they would cry out blasphemous words, spit upon icons, foam would appear on their lips and their bodies would shudder with convulsions. These "obvious manifestations" of possession and frenzy were fully sufficient for the fathers of the Holy Inquisition to seize these unhappy people and drag them into church torture chambers, where, under torture, the victims would admit to their connections with the Devil. According to the laws of the most Holy Church they would be sentenced to a purifying death by fire. And thus the fires of the Inquisition burst into flame. According to statistical data, in Europe alone during

the Middle Ages about 400,000 perfectly guiltless, sick people were burned to death in the fires of the Inquisition.

The fact that they were actually sick people, suffering from hysteric neurosis, is attested to by the symptoms of the illness, described in detail by the witnesses and executioners of the Inquisition in their records of the proceedings. One of the most important signs of "possession by the Devil" was thought to be the "Devil's handprint" — a section of skin on the body of a sufferer which lacked sensitivity to pain, temperature or touch. With special needles, the Inquisitors would examine the entire body of their unhappy victim and, if they found such a place with no sensation, then the death sentence was immediately passed. It is in hysteria in particular, as every doctor knows today, that such a loss of sensation (temperature and pain) in the skin occurs.

Attacks of spasms and convulsions, with the bending of the body into an arc (the "hysteric arch") during serious hysterical attacks, and also the cries and tears which accompany these attacks, are inherent in hysterical neurosis. It is interesting to note that these people themselves, under the influence of autosuggestion and suggestion by the church, fully believed that they were under the control of the Devil. Another "proof" of a person's possession by the Devil was one sign in particular. A person suspected of connections with evil forces was bound hand and foot with ropes and thrown into the water. If the bound person drowned, then it was believed that a mistake had been made and the bictim was buried with all ceremonial church rites. But the majority of the possessed ones did not drown, coming instead to the surface of the water, which was taken to be an indisputable proof of a connection with the Devil. There followed further tortures and burning at the stake.

At the present time it is well known that in certain forms of hysteria it is possible to observe that which we call aerophagia — swallowing a great quantity of air during a hysteric attack or during a meal. This swallowed air, in particular, could easily support a victim on the surface of the water in spite of, it would seem, the laws of physics. In other persons suffering from hysteria were observed the previously-described (Louisa

Lotto) "stigmata of Christ" — bloody spots on the body in the same places where, according to the Biblical legend, the nails were driven in during the crucifixion of Jesus Christ. It is curious that the stigmata were located on the hands and feet of the victim in accordance with the usual iconographic representations, but not in the places where the nails were actually driven during the crucifixion of criminals in ancient Rome. It is interesting to note that the church glorified the bearers of such stigmata in every way possible, attributing them to the countenance of the saints, creating thereby a heavenly life on Earth. This was fully natural, since these people reinforced the belief of their parishioners in divine power and religious "miracles."

There is nothing surprising in the fact that mass hallucinations with a religious content often arose in religious fanatics, weakened by fasting and prayer, in the appropriate surroundings (a darkened temple with lighted candles). The representatives of the church understood very well the effect of the psychic factor and suggestion on their believers and knew how to create the appropriate atmosphere with brilliant raiments, the singing of hymns, organ music and dramatically staged processions, fervent preaching and the other attributes of religious services. Nor did churchmen disdain the use of direct trickery (weeping and self-restored icons, self-lighting candles, phosphorescent crosses that glow in the dark, and so on). It is not surprising that in such an atmosphere hallucinations could take place and did indeed occur (visions of the apostles, angels, crosses, icons, and so forth); these hallucinations were promptly supported by "eyewitnesses" who spread rumors and tales which were continually enriched with new details and conjectures from the fanatics and the servants of the church.

Let us now examine some phenomena connected with autosuggestion. It has been well established by science that, together with suggestion and mutual suggestion, an enormous role is played by that which we call autosuggestion. Many cases of illnesses which have arisen from the fertile soil of autosuggestion have been described. If the path to suggestion or hypnosis has often been blocked by the conscious or unconscious resistance or critical reaction on the part of a person who has been made the target of

such action, then it is clear that autosuggestion has no such barriers, and because of this it often turns out to be much stronger than suggestion. Let us illustrate this with a few examples. Suppose that in the imagination of some person, for one reason or another, the idea has arisen that he has contracted cancer. The more he thinks about his imaginary illness, the stronger is his attention fixed upon this or that symptom of the disease.

Such a case comes to mind. A young girl of 23 was acting as nurse to her mother, who was suffering from cancer of the stomach, and she herself gradually began to acquire all the symptoms of the disease. The neglected illness of her mother ended in death. Immediately the shaken girl began to distinctly "feel" exactly the same symptoms which she had observed in her mother. Pains appeared in the region of her stomach and mouth; the girl experienced a loss of appetite and began to grow thin. She went to a doctor, and all the appropriate tests were carried out: the stomach fluid was examined, and analysis was made for concealed bleeding, X-ray pictures of her stomach were made, and so on. As it turned out, no confirmation of the disease whatsoever was discovered, but nevertheless the "invalid" would not believe the doctors, and none of the symptoms of the "disease" disappeared. The assurances of the doctors that she had absolutely no cancer at all were interpreted by her as a desire to pacify a "hopeless case." Only after the girl had undergone a prolonged course of treatment by hypnotherapy (20 sessions) was she finally freed from her carcinophobia (imaginary cancer).

In another case a young man, impressionable and imaginative, found himself in a clinic undergoing an examination of his stomach for suspected catarrh. But in the bed next to him lay another patient, 76 years old, with a severe heart disorder — infarct of the miocardium. This patient often called for the duty doctor, and various medicinal substances were administered to him intravenously (injections of heart stimulants). In view of the fact that the illness was really serious and the patient had not been to a doctor for a long time, but later, in spite of restrictions, broke his strict bedrest and

refused to lie in the hospital, a sharp deterioration in his condition occurred, which led, in the end, to his death.

The whole fight by the doctors for the life of their patient had occurred before the eyes of our young man, and so it was that under the influence of these events, and being reinforced by autosuggestion, the same chest pains and heart palpitations appeared in him also, he developed a fear of impending death, and the patient himself made his own diagnosis: acute miocardial infarct. All of the assurances by the doctors that he had no heart ailments whatsoever were to no avail, and he obstinately repeated his claims that "I also have an infarct! I have the very same symptoms that my neighbor had!" An electrocardiogram showed that the young man's heart was in perfectly good condition, but the complaints did not stop, which finally forced them to assign him to a hypnosis clinic to undergo a course of treatment by hypnosis. This "sick man" subsequently recovered completely and could play volleyball excellently.

It is possible to introduce a multitude of such examples, demonstrating the powerful influence of autosuggestion. Let us limit ourselves to only one. I. P. Pavlov records that he was shown a sick woman in connection with her autosuggestive (imaginary) pregnancy. This woman fervently wanted to be a mother, but she had not been successful as a result of poorly treated women's diseases which she had experienced in the past.

And so this impressionable person, with hysterical traits of character, supposed that a pregancy had finally befallen her. She felt all the signs and symptoms of pregnancy: menstruation ceased, her chest glands began to swell, and the size of her abdomen increased (due to the deposit of subcutaneous cellular material), and so forth. At the first visit by her to a doctor it was difficult to confirm the presence of pregnancy. The woman began to sew baby clothes and prepare herself for motherhood. But the time finally came, of course, when it became clear that she was not pregnant.

In exactly the same way, under the influence of autosuggestion, imaginary illnesses may arise. It is not difficult to imagine that in such "victims" it is possible to

effect, under known conditions, "miraculous cures," if such a person turns to the representatives of a religious cult who can treat him with "holy water" or "saintly relics."

SLEEPWALKING (SOMNAMBULISM)

Let us now turn our attention to a malady known to the reader under the name of sleepwalking (somnambulism). This rare ailment is characterized by the fact that the victim may, obeying a pathological impulse, arise from bed during a period of normal, nocturnal sleep and begin to move about. Such a victim of this malady is not conscious of his actions. He can automatically get dressed or undressed, open a window or door, even go outside, into the courtyard or along the street. A sleepwalker can go up the stairs to the loft, walk out on the roof of the house and take a dangerous stroll along the edge of the roof or the cornice of the building or a balcony. The unfamiliar Latin term "somnambulism" corresponds to the more accurate and understandable colloquial word "sleepwalking" —walking in one's sleep.

Which one of us has not heard fantastic stories about sleepwalkers? This is what the famous Russian scientist I. I. Mechnikov, in his "Essays on Optimism," writes about the subject: "In one hospital a hysteric young girl or 24, who turned out to be a somnabulist, was taken on as a nurse. One night the duty doctor observed the following scene. The girl arose from bed and went up to the top floor, where there was a room in which she used to sleep. Climbing up to the highest landing of the stairs, she opened a window

which gave access to the roof, went out through the window, "strolled" along the edge of the roof before the terrified eyes of another nurse who had followed her, returned again through another window and went back down the stairs. 'At the moment we saw her,' stated the duty doctor, 'she was walking noiselessly, her movements seemed automatic, and her arms were hanging beside her somewhat-tilted trunk; she held her head straight and immobile; her hair was in disarray and her eyes were opened wide. She looked exactly like some kind of fantastic toy someone had set in motion.'"

This strange phenomenon has been known to people for thousands of years; science has been able to explain it only relatively recently. And it is no wonder that sleepwalking served as the source of all sorts of beliefs and legends. This is understandable: if such a figure could seem so fantastic to a biological scientist, then all the more shocking would the experience be for one of our religious, superstitious and mystically inclined ancestors to meet with such a phenomenon! Just imagine: at night, going outside, he suddenly sees, moving along the top of the stone fence of a deserted house, a figure in white clothing, shining in the moonlight, with arms raised before it and wide-open, but unseeing, eyes. The figure glides, so to speak, along the wall, "vaporizes" into the air and disappears. What was it — a phantom, a dream? In point of fact, it was the regular "strolling" of a person suffering from sleepwalking. The actions of sleepwalkers are usually without any specific aim or purpose, but there are exceptions to this rule. It is said that some somnambulists, in the night hours when everyone else is asleep, have performed various types of housekeeping work: they sweep the floor, wash the dishes, mix dough and so forth. In the morning they can remember none of their nocturnal activities. And thus arose the old folk belief in a "good spirit" — the brownie or house god.

In past centuries, and, unfortunately, even in our own time, the state of sleepwalking was explained as the action of some supernatural forces or the influence of moonlight. It is not at all difficult to prove that the moon has nothing to do with it. Sleepwalkers can perform their nocturnal ramblings even on dark, moonless nights, although it is easier to see them, of course, on a bright, moonlit night. The tendency for sleepwalkers to

climb upwards, to the roof, is also anything but obligatory. They can just as easily head downhill, into a ravine, or climb downstairs to the basement. Something else is much more difficult to explain: the extraordinary agility and strength with which these sick people are able to perform their extraordinary excursions.

In the opinion of I. I. Mechnikov, "cases of this type prove that during a period of real somnambulism (sleepwalking — P. B.), a person acquires abilities which he does not possess in a normal state, so that he becomes strong, agile, an excellent gymnast, very much like his primate ancestors... Man has inherited from his ancestors a multiplicity of brain mechanisms whose activity was suppressed by inhibitions which developed later. In a somnambulistic state these ancient mechanisms are released as a result of the inhibition of the more recently acquired sections of the cerebral cortex peculiar to man." This theory of Mechnikov's is supported by the views of I. P. Pavlov on the nature of dreams, in which he asserts that, as a result of the inhibition of the highest, genetically most recent sections of the cerebral cortex in normal sleep, the more primitive type of thought is activated. In a somnambulistic state the more ancient automatic motor systems which modern man, it would seem, had already lost, are awakened. It was not by chance, evidently, that one of the doctors observing such a somnambulistic "acrobat" noticed in him habits which are characteristic of climbing apes: the thumbs of his hands were protruding, and the toes of his feet were pointed inward.

And so, as the scientists have told us, somnambulism is one of the forms of "partial" sleep, in which inhibition embraces only the area of conscious activity, leaving uninhibited the cortical and subcortical motor formations (centers). The evidence of such a partial reawakening of individual motor-control zones of the cerebral cortex during sleep is often seen during hypnosis, and sometimes even in everyday life. For example, a person may cry out or talk in his sleep. This results from the fact that the motor centers of speech are activated, at the same time that the remaining regions of the cortex are still in a state of inhibition. Let us take another example. A cavalryman is sleeping

while sitting in the saddle, but not all of the centers of his cerebral cortex are in a state of inhibition. Those centers which are responsible for maintaining equilibrium are still in a state of stimulation, "maintaining" the vertical position of the sleeper. Particularly extensive regions of the brain (the motion analyzer) are to be found in a state of local stimulation during hypnotic sleep, when a hypnotized person is capable of moving about perfectly freely, even though he is in a state of sleep, which has even caused scientists to give hypnosis the name of artificial somnambulism.

In sleepwalking, by virtue of abnormal causes, the motor centers are almost completely awakened, and this makes it possible for a sleepwalker to perform very complicated automatic movements, which may be unexpected in an untrained person, but in no event are they supernatural. Let us attempt to illustrate this with a specific example. Imagine that a long, narrow plank is placed flat on the ground. A group of people, who are in a normal, wide-awake state, are asked to walk along it. All of the subjects perform this task easily and freely. But let us raise this plank to the height of a six-story building and again ask them to walk along it. Now not all of them would dare to attempt such a risky journey. The awareness of danger, the thought that "I might fall!" remains in many. The width of the plank has not been changed in the meantime, and the very same people easily walked along it while it was on the ground. However, a trained athlete or an acrobat could easily walk along it, even at a great height. A sleepwalker could just as easily negotiate this path, without experiencing fear, because his consciousness is inhibited, "asleep," while the centers of equilibrium are stimulated, "working." A hypnotized person, obeying a suggestion, could also successfully negotiate such a plank. But an inexperienced, untrained person would soon fall, since his fear would cause a powerful dizziness or "petrify" his muscles.

Somnambulism is a malady which is sufficiently rare that a doctor, encountering it in his practice, would not remember such a case for very long. Once the father of a young boy came to our office. He had begun to notice, in his words, "oddities" in his son: he would sometimes get out of bed at night and walk around the room.

There were times when the half-dressed boy had left the apartment and gone out onto the street, and once he was on the point of going up on the roof, but the door, luckily, was barred. The father — a cultured man — knew of the symptoms of somnambulism and suggested that this malady was affecting his son. It was decided to perform treatment by hypnosis during normal sleep. At a specified time we arrived at the apartment and were shown to the patient. The boy was sleeping soundly. Placing our hand on his head, with the appropriate suggestions we transformed his normal sleep into a hypnotic one. The sleeper began to answer our questions, without awakening. We suggested to him that he repeat the events of the last occurrence. Still asleep, the boy arose from the bed, walked across the room, went up to a shelf of books, rummaged around and, selecting one of them, went back to bed. The father confirmed that the last occurrence of sleepwalking exactly corresponded to that which we had just witnessed. This time, all of the boy's actions were performed with his eyes closed. But sometimes his movements were performed with his eyes open. It was suggested to the boy that similar movements in his sleep were not to be repeated in the future. And indeed, during the next two years, as long as contact was maintained with this family, there was no repetition of the boy's sleepwalking.

And so we see that sleepwalking may be treated with hypnosis. It is interesting to note that the behavior of a sleepwalker has much in common with the behavior of a hypnotized person. The fact of the matter is that in both sleepwalking and hypnosis, those areas of the cerebral cortex which are responsible for the critical, conscious awareness of the surrounding environment are disengaged (inhibited) in the subject. The very same thing, we should imagine, occurs even during normal sleep, when a dream occurs. And thus disappears the "mystery" which surrounds the phenomena of sleepwalking.

LETHARGIC SLEEP (APPARENT DEATH)

Let us now take a look at another rare and interesting pathological condition that has been explained by science only recently. One story, told by Pavlov, appeared in many journals: a certain Kachalkin "went to sleep" in 1898 and woke up after the October Revolution, after having "slept" for more than 20 years. The second patient observed by Pavlov in the same psychiatric clinic in Udel'naya was a girl who fell asleep at the age of four and woke up as a grownup young woman. What is this strange sleep we are dealing with here?

The lethargic sleep is not an independent illness; it strikes a person after a serious, exhausting nervous and psychic illness. Patients suffering from lethargic sleep have two or three rather weak pulse beats every minute instead of 70-80. Instead of breathing 16 to 18 times a minute, he breathes maybe once or twice during the same time, and even then very superficially. His breathing is so weak that a mirror put in front of the mouth of the person asleep does not become misted. The body of the patient feels cold, but its temperature is nevertheless higher than that of the surrounding medium. There are no symptoms of life, all the reflexes are dead; on the other hand, however, there also are no symptoms of death. We can say that the person is suspended between life and death.

There is no doubt that in the past phenomena like the ones described above aroused many a supersticious, mystical rumor and talk. Imagine the stunning impression, the terror provoked by the sudden awakening of the "sleeper" from his sleep. Let us suppose that a "deceased" person is taken to church for the funeral service, or even to the cemetery, and all of a sudden he rises from the coffin! Everybody present is seized by panic, they scream and yell and run away. The clergy, of course, exploited such events to the utmost limit in order to uphold and enforce superstition and the religious mood of the faithful. There can be no doubt that the biblical tale of the "resurrection of the dead" takes its origin from similar occurrences. It is likely that in the old times there were tragic cases of premature burial. Be it as it may, a tragicomical event happened in Spain in the last century.

In the course of a New Year's celebration, a Spanish nobleman had too much to drink and fell on the floor. When he was picked up and put on a bed to recover, it was found that his pulse had stopped, he was no longer breathing and was stone-cold. The date of the funeral was set, but before the services were over, his grief stricken, incon solable relatives managed to get at each other's throats because of the inheritance. But a last shock was in store for them: during the funeral mass the deceased all of a sudden resuscitated and walked out of his coffin!

And so, a person is asleep and yet isn't. Now the question arises: does he feel anything while he is in that strange kind of sleep? After he woke up, Kachalkin told Pavlov that he heard and understood quite a few things while be "slept", but he was unable to move his hands, arms or legs, or even his tongue to say something, he could not move his eyelids to open his eyes. He felt an insurmountable heaviness in all his limbs and muscles, so much so that he had trouble breathing. All the motor centers in his brain were completely inhibited, while those parts of the cortex which control sensitivity and hearing were in a state of weak excitation. The second patient, instead, asked immediately for her toys as soon as she woke up, as if she had spent a regular night's rest. An 18 year old girl was interested in her dolls, as if she were a little child! This shows

that the development of the brain and the psyche goes hand in hand with the growth and development of the entire organism. In the case cited above, the brain was completely inhibited and did therefore not develop or grow while the body continued to grow and put on weight. This development could take place, of course, only because the patients were put in a first-class clinic where they were artificially fed by means of a rubber hose, washed and otherwise taken care of. If the patients had not been artificially fed, they would doubtless have died from exhaustion in the course of a few weeks.

What happens to the brain when a person falls into a state of lethargic sleep? For a long time scientists could not agree on a solution to this problem It is only in the last ten years or so that a clear idea has been formed regarding the mechanism of this phenomenon.

Pavlov has shown that in certain psychoneurotic diseases (schizophrenia and others) inhibitory processes can prevail over regular stimulation processes, in which case they spread over the entire cerebral cortex and attack the portions of the brain located below, in particular the medulla oblongata, which, as is known, is the seat of the higher automatic centers that control breathing, cardiac activity, thermo-regulation, and so on.

Lethargic sleep consists in the main of extreme weakness and exhaustion of the nerve cells of the brain which fall into a state of a protective or preventive inhibition as soon as they are subject to the slightest stimulation or excitation. Under normal physiological conditions, nerve cells are capable of functioning for a long time under the action of various stimuli from the outside, only gradually expending their "stimulable substance" and slowly sinking into a state of inhibition. In the case of lethargy, the nerve cells are totally exhausted from preceding nervous disorders and are chronically in a state of "stagnant inhibition".

Pavlov termed this a state of "protective" inhibition because by opportunely cutting off the nerve cells of the brain from work, this process protects them from further deterioration which might end up with their destruction, i.e., with an irreversible process. Lethargic sleep is an unusual, pathological condition in man. In animals, however, such

as marmots, bears, some reptiles, and others, this is a fairly common phenomenon, a physiologically normal condition which has a strictly protective purpose. In fact, it protects certain animal species during winter colds or summer draughts and helps them survive. Animals in a state of "hibernation" exhibit a sharp drop in their oxidation processes, their need for food and water is greatly reduced and they can thus endure much better the difficult season.

It is interesting to note that by means of autohypnosis or special exercises some people can get themselves into an artificial state similar to that of lethargic sleep. Fakirs and Yogis from India undertake such practices for mystical and religious purposes in order to prove the supremacy of the "spirit" over the flesh. Their nose is sealed with wax, they are wrapped in a cloth and placed in a box which is then lowered into a "tomb" and covered with earth. After eight or ten hours the tomb is opened again, the body of the yogi is taken out and unwrapped from the shroud. His nose is unsealed, and as the spectators watch he gains color in his face, his pulse becomes normal, he takes the first deep breath and "resuscitates".

There is nothing mysterious in these experiments. To control cardiac activity, for instance, one need not be a yogi. In a Leningrad clinic there was a woman patient who could at will change her pulse rate upon request of the physician. She was a professional actress, and a very nervous, even hysterical person; by imagining herself in a specific role she could bring about a certain emotional condition which never failed to reflect itself upon her cardiac activity. The experiments were conducted in the following way: pickups from the recording apparatus were attached to the patient's body; then she was asked to produce a high pulse rate. Soon the recording curve showed an increase in the pulse rate from 60-70 to 100-120 beats per minute. Thereupon the patient was asked to reduce the frequency of her pulse to a minimum. Soon the curve showed a drop in the pulse rate to 45-50 heartbeats per minute. When the patient was hypnotized to sleep, not only the pulse but breathing and perspiration could be changed. When asked how she could change the number of heartbeats, she said that in order to increase her pulse rate she

imagined herself involved in some terrible mishap, and visualized herself rushing upstairs into her apartment on the fifth floor to see the accident. In the case of slowing down her heart she imagined herself at the seaside, sunning herself on the beach in a state of complete relaxation and bliss.

Physiologists have long known that an emotional state may reflect itself upon the activity of the heart, the lungs, the sudorific glands and even on the composition of the blood. Our readers know that too, of course. Frequently the sole idea of addressing a group of friends, for instance, may bring about an intense tachycardia, blushing, excessive perspiration and other symptoms. All of the conditions mentioned above are the results of the activity of the nervous system.

Sleep and Dreams

Sleep amounts to one-third of a person's life, and when a man has reached the age of 60, he finds that he has slept for 20 years of his life. What is this condition without which man and animal cannot exist? To underscore the importance of sleep in man's life, let us juxtapose the following facts. Man can live without food for more than 30 days (such instances are known from life, such as the caving-in of mines, shipwrecks, and so on); he can survive without water for 5 to 6 days, but neither man nor animal can live without sleep for more than 10-12 days. Under experimental conditions a dog has been left without sleep for a long time, and usually on the 7th or 8th day the animal presents symptoms of an acute "poisoning". The animal begins to vomit, has spasms, sialorrhea, widened pupils, etc. It looks as if the animal were poisoned by some chemical venom.

Why do we sleep? There exist many theories and hypotheses on this subject. One of the oldest theories on sleep is the chemical one, according to which sleep sets in following the concentration in the blood and the cerebrospinal fluid of man (or animals) of specific chemical substances known as hypnotoxins (from Greek hypnos, sleep, and toxikon, poison). The followers of this theory hold that these substances are metabolic wastes which concentrate in the organism during the day, especially when the person is awake. As they concentrate

in the blood, they are carried by the blood stream to the brain where they "narcotize" the nerve cells. To prove that their theory is right, they conducted the following experiment.

A needle was introduced into the cerebrospinal canal of a dog that was completely exhausted from lack of sleep, and a certain amount of cerebrospinal fluid saturated with hypnotoxins was removed into a syringe. It was then introduced into the cerebrospinal canal of a well-rested control dog. What happened? The control animal almost immediately fell into a deep sleep. Thus the theory seemed proven. Yet, it has a few weak spots. In fact, if we accept the chemical theory of sleep, then it becomes extremely difficult to explain why a person who has slept enough (all the hypnotoxines have been destroyed and eliminated from the organism during the night) may wake up in the morning, turn around to the other side and go to sleep again.

Another fact, observed by Prof. Anokhin, is also difficult to explain under these circumstances. In 1939, grown together twins [Siamese twins] were brought into a Moscow clinic. They had a common body, one heart, a common blood circulation system, but two heads. It was frequently observed that one head went to sleep while the other stayed awake. Thus, if the theory of the self-poisoning with chemical substances ("hypnotoxines") is true, then one cannot understand why the twins with a common blood circulation system and one heart (that is, with blood of the same chemical composition) could be found in two different states at the same time: namely, one head being awake while the other slept.

A correct answer to the problem of sleep and its causes was found by Pavlov and his collaborators. He proved that sleep is a condition of diluted inhibition of the nerve cells of the cerebral cortex. During sleep nearly all the cells of the cortex are involved in the process of inhibition. When we go to bed and prepare for sleep, the following happens. In a portion of the cerebral cortex there arises a particularly "stubborn" center of inhibition. It may arise under the effect of some weak, uniform, monotonous stimuli: the ticking of a clock, a lullaby, rocking, complete silence, warmth, and so on, may contribute to the formation of such a center. Subsequently, from it the process of inhibition begins to

spread to neighboring groups of nerve cells and extinguishes, as it spreads, all excitation centers until it finally involves the entire cortex. At this stage the subject is overcome by deep sleep without dreams.

Thus, sleep comes as the result of the process of inhibition prevailing over the process of excitation in the cerebral cortex of a subject. Consequently, Pavlov was right in pointing out that the inhibition process is a protective state of the nerve cells of the brain. Furthermore, during sleep the nerve cells have time to rid themselves of harmful wastes and recover their normal chemical composition, since it has been shown that assimilation (reduction) processes prevail during sleep over dissimilation processes (decomposition, decay and destruction). This is why a systematic lack of sleep, and the neglect of regular rest at night may lead, in the end, to a disease of the nervous system. It also becomes clear why such a satisfactory therapeutical effect can be obtained with the aid of sleep prolonged artificially, viz., the sleep therapy introduced by Pavlov and his pupils.

Sleep accompanied by dreams is a sleep in which the inhibition of the cells of the cerebral cortex is incomplete. For a long time the mechanism of dreams was not understood, and people gave a completely wrong interpretation to this phenomenon. But even today there are superstitious people who continue to believe in so-called prophetic dreams which, they claim, foretell the future.

At the present time science has been able not only to penetrate the mystery of the mechanism of dreams, but to artificially induce dreams, so to speak, on order. The experiment is carried out as follows. The subject is placed in a special sound-proof room. To his body special electrodes are attached which are connected with high-precision devices which record the subject's vital activity in the form of curves. When the subject falls into a natural sleep (which is immediately recorded by the device), his eyes, hearing, skin, etc., are subjected to some stimulus. Thus, for instance, in one case water was dropped from a pipette onto the mucosa of a sleeping subject. He immediately became restless, turned on his stomach and began to make swimming movements with his arms.

Then he was awakened and asked what he dreamt. He said: "I dreamt that I fell into the water and saved myself by swimming." In another case a scented substance was put under the nose of the sleeper. When he was awakened he said he had dreamt that he was in Cairo in a perfume shop (where he had actually been shortly before the experiment). In the third experiment, the subject had a "polar dream"; he dreamt that he was somewhere in the north, amidst snowdrifts, ice, freezing winds blowing from the left, and he even saw a seal. He huddled himself up and, as it frequently happens, woke up. Then he saw that on his left there was a powerful fan that was blowing cold air toward him, and his blanket had been removed on his left side.

It can be seen from these observations that dreams are frequently caused by the stimulation of some sensory organs or of the skin. From the peripheral nerve endings the impulses are conveyed to the inhibited cortex of the hemispheres where they disinhibit certain sections of the brain. Usually toward morning, when the cells of the cerebral cortex are rested and therefore free of hypnotoxines, sleep inhibition is considerably reduced and the centripetal impulses begin to penetrate from the periphery through the labyrinth of interwoven nerve cells. The stimulus passes from one group of cells to the other, disinhibits them and causes entire series of images (mostly of visual character) which are, in fact, received as dreams. The exceptional clarity and brightness of dreams has played a leading role, it must be assumed, in the formation of the belief in a "future life" among superstitious people.

The leaders of the church have, of course, greatly exploited the phenomenon of dreams. All biblical legends are full of prophetic interpretations of the dreams of "saints" and "apostles", and these dreams are claimed to be revelations of God.

In addition to external stimuli which, as we have established, are the cause of most dreams, stimuli originating from internal organs can also produce dreams. Stimuli reaching the brain from the stomach, the heart, the lungs, the bladder, the liver and other organs are capable of disinhibiting the nerve cells of the cerebral cortex. As a rule, during the day these signals are not noticed by us because they are drowned by the

stronger stimuli coming from the environment. At night, however, the situation changes abruptly; the weaker the activity of the sensory organs, the stronger become the signals directed from the internal organs to the brain. This is comparable to the light of a candle which is nearly invisible in the daytime but grows in intensity and brightness as the darkness of night approaches.

If during sleep there occur some unfavorable conditions for the operation of the heart, the lungs, the stomach or other internal organs, then the sleeper is frequently seized by nightmares. If the heart of the sleeping person beats slower, more intensely, then, as a rule, he has a nightmare: he thinks he is running away from somebody and nearly collapsing from fatigue.

Persons having the bad habit of eating a heavy meal at night, before going to sleep, are also likely to suffer from nightmares. They frequently dream that they are buried by a landslide, caught by a bear or strangled by a burglar. The feeling of lack of air is explained by the fact that the digesting stomach presses against the diaphragm which, in turn, presses against the heart and the lungs whence impulses are sent to the brain. In an experiment, the nose of the sleeping person was closed with cotton. Invariably, the following was observed: the subject became restless, moaned and groaned, and woke up; he then reported that he has been dreaming of a monster that was trying to strangle him. In the old days superstitious people used to say about such dreams that "the brownie was after him".

Thus, the causes for dreams have been established. The question now arises as to what is the source of a dream. Science has shown that this source is our experience in life. Anything we have ever seen, felt, read or heard about may at some time become the basis for a dream. It may be a motion picture, or a landscape seen through the window of a train, or the face of a stranger encountered in the streets. Frequently we have dreams which, seemingly, bear no resemblance to anything we have ever seen or experienced in our life. This, however, is not so. It has been experimentally proven that "accidental" or "random" experiences are not ignored by our brain; in the cortex

of the cerebral hemispheres, the "storages" of our brain, there remain traces of memories and impressions.

This is why the question "Are there prophetic dreams?" is categorically answered by science "No, there are no such dreams!" We never dream about anything that will happen in the future; we can only dream about things, events or feelings that have already happened. Sechenov once remarked that "dreams are an unreal combination of very real impressions". Dreams are the distorting mirror of reality.

Occasionally a dream will use only part of a visual image and change it to a point that it becomes unrecognizable. Once an acquaintance of mine asked me to interpret a rather strange dream. "I dreamt," he said, "about a midget with the face of a girl-friend of mine, but her eyes were those of a Chinese dragon." We began to analyze together this seemingly absurd dream. It turned out that my acquaintance had gone to the circus about a week ago, where he was particularly impressed by a group of performing midgets. This explains the first image. He is bound to know very well the face of his girl-friend whom he sees very frequently. So much for the second image. About a month ago he was looking for a present for her. He saw a Chinese vase in an antiques shop, and was struck by the representation of a dragon with huge, protruding eyes. This takes care of the third image. All three images were tossed together in the dream which appeared puzzling and mysterious to my acquaintance.

Frequently questions are asked as to the origin of dreams where the subject sees himself fly, as if he had wings, and experiences the feeling of flying. Such dreams appear to be caused by the following circumstances. A person may have the habit of covering his head before going to sleep. Later it becomes difficult to breathe, so he instinctively frees his head from the covers. A flow of air enters his lungs, and this is when he experiences the sensation of flying in his dream.

Then there is another dream where the subject is falling into a precipice. This seems to be as unlikely a dream as the preceding one dreamt by people who have never flown in their life. However, the subject may be sleeping in a crouched position. If he suddenly

straightens his legs (or if this is done by the experimenter), the muscles and ligaments of the lower extremities send the brain a nervous impulse (known as the muscle-joint feeling) which disinhibits certain motor nerve center of the cortex. This creates a dream associated with the feeling of falling or jumping from great heights. As to the feelings of flying or falling, their "storage" goes back to the days of early childhood: remember the flights from swings, the falls from haystacks, and similar events?

There is no doubt that in the past the belief in prophetic dreams was corroborated by the fact that dreams connected with the health of a person may have revealed some hidden (incubation) period of an illness. The following facts are known. The German physician K. Gesner dreamt that a snake bit him in the breast. Soon thereafter an ulcer appeared on that spot which did not heal for a long time. Another person had for many nights the same "extraordinary" dream. He dreamt that he was swallowing some alien objects. Some times later it was found that he had a benign tumor in his throat. A third individual dreamt that he had a "petrified" leg. Soon thereafter that same leg became paralyzed. In all three cases the persons concerned were already affected by the disease, but its symptoms escaped their consciousness because they were involved in the stronger sensations and events of every-day life.

Thus, dreams may have some diagnostic significance which, however, must not be overrated.

Many aspects of dreams connected with their exceptional vividness and irreality can be explained by I. P. Pavlov's teachings about two signaling systems.

Pavlov teaches that the conventional stimuli (sound, light and smell) in the formation process of conditioned reflexes become signals of unconditioned stimuli and may even be capable of replacing them. These signals and the conditioned reflexes generated by them together form what is known as the first signal system. This system is the basis for the psychic activity of higher animals and small children who are not yet capable of speaking. This first signal system was also predominant in the primitive peoples who had not yet developed a more evolved speech system. Without speech there can be no logical thinking,

and there are therefore no abstract concepts. At this stage of the evolution of the psyche, only thinking by means of concrete and vivid images is possible — but how strikingly clear are these images! As speech gradually develops, there appears, along with the first signal system, the second signal system. The word becomes the vocal symbol of the signals of the first system, a "signal of signals". Thinking continues to acquire a more logical and abstract character while losing its original imagery and vividness. But during sleep the second signal system, being of a later origin, is inhibited and thus the first signal system is freed from its influence and acquires a predominant role. This means that thinking by images returns with all its colorful vividness and irreality.

Sleeping persons take the most unreal and outright impossible dreams for actual reality, and only after they wake up do they begin to think critically again. It must be emphasized that the solution of the problem concerning the physiological mechanism of dreaming and sleeping is a great achievement of Soviet science.

It is interesting to note that during natural sleep there may also arise what is known as "creative dreams". Cases are known where famous persons have seen in their dreams the solution to the problems they have intensely been working with while awake. There are even some mathematical problems which have been solved in a dream. The German chemist Kekule discovered the structural formula of benzol in a dream. The Italian composer Tartini wrote several of his sonatas after he woke up: in his dream he had heard them played by someone else. Voltaire dreamt about one variant of his poem "Henriade". Similar facts have been reported also by other outstanding personalities, such as Bekhterev, Burdach and others.

There is nothing transcendental or supranatural in phenomena like these. They only prove that the sleep of persons involved in intense, creative work is frequently partial and incomplete. Those portions of the cerebral cortex which have been intensely working in the daytime could not be completely inhibited because of persistent excitation sources in the brain which continue to function also at night.

Such are the contemporary views about sleep and dreams.

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3. I. P. Pavlov. Complete Collected Works, Vol. III, Book 2, pp. 413-414.