and artists produced by Russia since social conditions have changed. If the ancient Greeks or still earlier the Egyptians or Chinese had used the same argument, they would have classified the northern Europeans as belonging to an inferior race, incapable of ever attaining cultural eminence. The proof of racial superiority certainly has to be based on other evidence. It is curious to note that when it suits the author's emotional attitude he changes his argument completely and indulges in flings at the assumed claim of racial preeminence on the part of the Germans—an attitude which hardly helps to make convincing a treatise that attempts to be scientific.

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SPECIAL ARTICLES

PHYSICO-CHEMICAL BASIS OF PSYCHIC PHENOMENA

EVER since Galvani discovered the relation between an electric current and muscular action there has been a feeling among scientists that the nerves are electrical conductors and that nerve impulses are really electrical currents. There has, however, been no satisfactory explanation as to how the conductivity of the nerve could be changed by the action of narcotics and nerve stimulants, as it must be changed to account for the effect of these substances on nerve impulse and psychic phenomena in general.

The explanation of the action of these compounds on the nervous tissue is very simple and in accord with the known facts concerning the composition of nervous tissues and the chemical and physical properties of narcotics and nerve stimulants. It is also based on well-founded laws of physical chemistry and is subject to laboratory verification.

This explanation postulates that the nervous tissue, which is composed of from 10 to 15 per cent. of lipins and from 70 to 85 per cent. of water, is essentially a two phase system of two immiscible liquids. One of these phases is a water solution, the other is a lipin solution. The relative dispersion of these two phases will depend upon their interfacial tension and on their relative internal pressure.

Any substance which will dissolve in the lipin phase and lower its surface tension but will not dissolve in the water phase will have a tendency to cause the lipin phase to become more continuous and for the water phase to become less continuous. Since the lipin phase is a poorer conductor than the water phase the conductivity of the nerve will be reduced as the lipin phase becomes more continuous. Any substance that will produce this result will be a narcotic. On the other hand any substance which will dissolve in the water phase and lower its surface tension but will not dissolve in the lipin phase will cause the water phase to become more continuous and the lipin phase less continuous, thus increasing the conductivity of the nerve. Such a substance will be a nerve stimulant.

This hypothesis will coordinate the following well-known, but apparently isolated facts:

A. The nervous tissue has a very high percentage of lipins.

B.[1] In a two phase system where the phases are immiscible liquids, either phase can be made continuous by dissolving in them a substance having the proper distribution coefficient and at the same time having the desired effect on surface tension.

C.[2] The narcotic action of a compound depends on its distribution coefficient between lipins and water.

D.[3] Not all substances which have a distribution coefficient which shows them to be much more soluble in lipins than water are narcotic in their action. In addition to this solubility in lipins the substance must lower the surface tension of the lipin phase to be narcotic.

E.[4] Narcotics do not form a definite chemical compound in the nervous tissue but are adsorbed.

F.[5] Surface tension is a factor in the action of narcotics.

G.[6] Too great a preponderance of sodium

[1] Clowe's *Jour. Phys. Chem.*, xxix, 407, 1916.

[2] Overton, "Studien über narcose," Jena, 1901.

[3] Curliny, "Text-book of Pharmacology," p. 128, 1904.

[4] Moore and Roaf, *Proc. Roy. Soc.*, 73, 1904.

[5] Traube view as reported on page 48 of "The chemistry of synthetic drugs," by Percy May, 1921.

[6] Frederick F. Tisdall, Vol. LIV, 35, 1922.

over calcium in an animal will produce tetany.

H.[7] Narcotics lower the metabolism of nervous tissue.

I. Sodium increases the permeability of cell while calcium lowers it.

This hypothesis affords an explanation of the make and break of contact at the synapses. The contact is broken so far as conductivity is concerned, when the lipin phase is on the outside, that is, when it is continuous. The contact is made when the water phase is on the outside.

This changing of the phases of the water-lipin two phase system will also account for many other little understood phenomena of other living cells and brings into coordination many isolated facts in the field of biology.

If experiments which are now being conducted in this laboratory bear out the above hypothesis it will be of great value to those interested in the manufacture of synthetic drugs. It will give the neuro pathologist a real basis on which to work. But, still more important, it will give to the experimental psychologists the physical basis for nerve impulse for which they have been searching without success and will establish psychology as a truly natural science.

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THE NATIONAL ACADEMY OF SCIENCES

THE annual meeting of the National Academy of Sciences was held in Washington on April 23, 24 and 25, when the following scientific program was presented:

AFTERNOON SESSION

Important mammals and reptiles recently discovered by the Third Asiatic Expedition in the heart of Mongolia, and their significance: H. F. OSBORN.

Asiatic relationships of American Pliocene faunas: J. C. MERRIAM.

Preliminary report on the life zones of Ecuador: DR. FRANK M. CHAPMAN. A study of the results of the field work in Ecuador, extending over a period of ten years, confirms previous conclusions in regard to the zonal distribution of bird-life based on similar data from Colombia. Both the character of the avifauna and the altitude of zones in southwestern Ecuador have, however, been strongly affected by a branch of the Humboldt current which washed the Ecuador coast north to about 1 degree S. lat. Four life-zones exist in Ecuador between sea-level and snow-line, a tropical, subtropical, temperate and paramo. The tropical zone in eastern Ecuador is wholly humid and composes the Ecuadorian portion of the Amazonian fauna. The tropical zone in western Ecuador contains two strikingly unlike faunas, one of which is humid and of northern, the other of which is arid and of southeastern origin. The more northern, extending southward on the coast to about 30 degrees S. lat., is the southern end of the Colombian-Pacific fauna which occupies the tropical zone of western Colombia and eastern Panama. For the more southern part of the tropical zone of western Ecuador, the name equatorial arid fauna is proposed. Climatically, this is a transition area between the humid coastal region of Colombia and northwestern Ecuador, and the arid coastal area of Peru and northern Chile. The collections of Noble and explorations now in progress by Watkins for the American Museum indicate the important discovery that the characteristic bird-life of this fauna has been derived from the valley of the Maranon with which it has been faunally connected at a very recent period. The bird-life of the entire western, or Pacific portion of the tropical zone, is believed to be, geographically, of post-Andean origin. The subtropical zone, or zone of mountain rain-forest, lies between the altitudes of 4,000 to 5,000 and 8,000 to 9,000 feet on the eastern slope of the Andes, but on the southwestern slope the lower temperature produced by the Humboldt current brings the inferior limits of this zone locally down to 1,200 feet above the sea. The temperate zone has well-defined humid and arid divisions. The former includes the upper forested areas on both slopes of the Andes. The latter is contained in the treeless interandine tableland. Like the subtropical it reaches a lower altitude in southwestern Ecuador than in other parts of the republic, and in western Peru it actually falls to sea-level. The fourth, or paramo zone, lies between the upper limits of the temperate zone and the lower limits of snow. On the outer slopes of the Andes the trees of the upper margin of the humid temperate zone border the treeless slopes of the lower limits of the paramo zone. The bird-life of the former includes ar-

[7] Shiro Tashiro, "A chemical sign of life," 1917.