their cellularity. In the face of the admitted fundamental agreements in the structures of protozoan individuals and metazoan cells, the arguments advanced by Dobell and by Hyman become irrelevant and of no vital consequence. The cell theory stands as one of the valid generalizations about the protoplasmic systems of animals.

ALAN BOYDEN
Department of Zoology, Rutgers University, New Brunswick, New Jersey

References

1. C. C. Dobell, *Arch. Protistenk.* **23**, 269 (1911).
2. L. H. Hyman, *The Invertebrates.* Part I. *Protozoa through Ctenophora.* (McGraw-Hill, New York, 1940).
3. J. Hadži, "Turbelarijska teorija knidarijev" (Turbellarien-Theorie der Knidarier), (*Sloven. Akad. Znanosti Umetnosti Ljubljana,* 1944), *Systematic Zool.* 2, 145 (1953).
4. A. Lwoff, *Biochemistry and Physiology of Protozoa* (Academic, New York, 1951).
5. S. H. Hutner and L. Provasoli, in *Biochemistry and Physiology of Protozoa,* A. Lwoff, Ed. (Academic, New York, 1951).
6. J. B. S. Haldane, *New Biology* **16**, 12 (1954).

31 October 1956

Reticular Activating System of Brain Stem and "Animal Hypnosis"

During the evolution of animals and man, certain basic types of reactions to stimuli from the external environment are to be found, the manifestations of which may differ at various evolutionary stages, but whose mechanism is principally identical. These basic types of reactions are called "biological radicals" by Kretschmer (*1*), and their mechanism is considered by this author to be "phylogenetically preformed." Such a biological radical is the so-called "panic reaction" (*Bewegungssturm*); another is the *Totstellreflex,* which is also called "animal hypnosis." The latter phenomenon has a number of analogs in clinical pathology in the form of various manifestations of the stupor-hypnoid syndrome of Kretschmer (*2*).

The onset and the dynamics of "animal hypnosis" as an experimental model of some psychiatric and neurological syndromes have been reported in a number of papers (*3*). In this report, a part of the electroencephalographic analysis of animal hypnosis is brought forward.

Animal hypnosis in a rabbit was experimentally elicited by standard rotation of the animal about its vertebral axis in a special apparatus. After this phenomenon had been evoked, changes characteristic of the onset of sleep and later electric activity of deep sleep appeared in the electroencephalographic record.

When the animal, in a state of animal hypnosis, is exposed to arousing stimuli, then there are changes present in the EEG record that are identical with those produced by arousing stimuli during normal, natural sleep. It is demonstrated in Fig. 1, where the first part of each record represents the wakeful EEG rhythm and the second part represents the rhythm during animal hypnosis, that the applied stimuli (indicated by arrows) lead to a change in the EEG record from the electric activity of sleep to a rhythm of greater frequency and of lower amplitude (record *A,* nociceptive stimulus; *B,* clapping of the hands three times in quick succession; *C,* labyrinth mechanical stimulus; *D,* labyrinth galvanic stimulus). This change can be seen simultaneously in all the electrodes, even though the depression of sleeping activity is not as marked in every electrode. The significance of the arousing stimuli in animal hypnosis is different. Labyrinth stimulation was found to be most effective, with nociceptive, olfactory, acoustic, and optic stimuli following in succession.

The simultaneous appearance of the EEG arousing reaction in animal hypnosis in all the cortical regions at the same time indicates that Magoun's brainstem reticular activating system is capable of function during this inhibitory state. This system represents—in contrast to the classical sensory and sensitive tracts, leading to the primary cortical receptor regions—a secondary afferent tract with a diffuse cortical projection via the thalamic and extrathalamic tract (*4*). The presence of the EEG arousing reaction from animal hypnosis shows that in the course of this form of generalized central inhibition, this system, which is important to the animal's existence and which insures the waking up from sleep, remains functionally active. It is known that, during central inhibition that is evoked, for example, by narcosis, this system is functionally eliminated (*5*).

It is perhaps possible to assume that this observation of the function of one of the most important brain systems during animal hypnosis can contribute toward the elucidation of the mechanism of those human pathological syndromes that appear during regressive forms of human behavior and of which the animal hypnosis represents an experimental model.

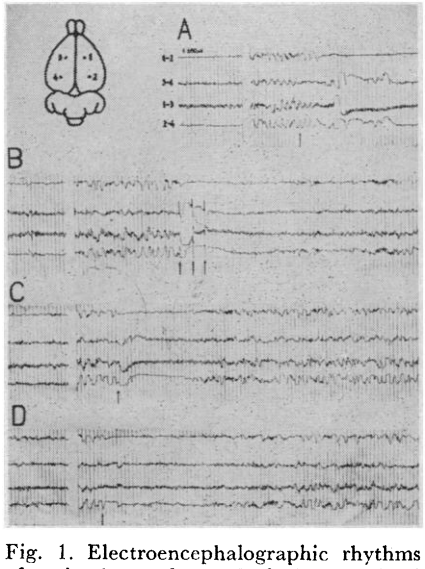

Fig. 1. Electroencephalographic rhythms of animals awake and during "animal hypnosis."

DOMIN SVORAD
Institute of Physiology, Czechoslovak Academy of Sciences, Prague, Czechoslovakia

References

1. E. Kretschmer, *Hysterie, Reflex und Instinkt* (Leipzig, 1944).
2. ———, *Medizinische Psychologie* (Leipzig, 1941).
3. D. Svorad, *Physiol. bohemoslovenica* 3, 217, 406 (1954); 4, 170 (1955).
4. H. W. Magoun, *Arch. Neurol. Psychiat.* 67, 145 (1952).
5. J. D. French, M. Verzeano, H. W. Magoun, *ibid.* 69, 519 (1953).

11 September 1956

Antileukemic Action of Reserpine

During the course of studies in our laboratory on the effect of lysergic acid diethylamide and *d*-amphetamine on the toxicity and marked depression of animals that were administered large (25 mg/kg) doses of reserpine (*1*), we have directed our attention to the metabolic alterations produced by reserpine and reserpine derivatives. Since large doses of reserpine produce marked changes in the normal metabolic patterns (*2*), it was thought possible that reserpine might alter the metabolism of tumor cells more extensively than it did that of normal cells and thereby prove detrimental to the tumor. The data presented here show that reserpine can exert an antileukemic action (*3*).

Hybrid male mice [(BALB/cAn × DBA/2J)F_1] (8 to 10 weeks old and of weight 20 to 25 g) were inoculated in the right hind leg with 0.1 ml of a suspension of leukemic (L1210) cells (*4, 5*). The animals were allowed to develop leukemia until the local tumor had reached a diameter of approximately 9 to 12 mm (estimated by palpation) at which time the disease is generally systemic as well as local. When the disease had reached this preterminal stage, the mice were randomized and the designated groups were treated with a single injection of reserpine. The animals were weighed daily and observed for mortality. The size of the local tumor at the site of leukemic inoculation was obtained by palpation.

The results of a typical experiment are summarized in Fig. 1. A single treatment with reserpine produced an almost threefold increase in the remaining lifetime of mice with advanced leukemia. The mean survival time was an increasing function