Thus a second and more plausible hypothesis regarding the boy's behavior would attribute the temporary "acute mania" to the injury in the region of Broca's area. Such an injury would especially account for his linguistic disabilities. The distance of Burghersdorp from Grahamstown, and the fact that there is no mention of the baboon incident in the hospital records, would likewise seem to discount the existence of a "feral" period in Lucas' life.

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FREEZING OF HOT AND COLD WATER

PROFESSOR THOMPSON[1] and his reply[2] to Professors Sanford, Lyon and Wakeham[3] stimulated an interesting discussion on the basis for the belief that hot water freezes more quickly than cold. Additional variables have occurred to me which I believe would have a considerable bearing on the explanation of this problem, in addition to the thermal factors mentioned in the above articles.

The freezing rates of liquids depend not only on temperature and rates of heat transfer and mass, but also on the freezing-points of the liquids.

Heating certain samples of water expels dissolved gases, decomposes bicarbonates, precipitates compounds whose solubilities decrease with increase in temperature, etc. This lowers the concentration of dissolved matter, and consequently raises the freezing-point.

Then, if the external temperature is between the freezing-points of the heated and unheated samples, the "hot" water will not only freeze first, but will be the only one to freeze, regardless of all other circumstances. These conditions could have been fulfilled unwittingly many times by kettles of water (alike or unlike) and by hot and cold water in pipes.

Many of us have observed a similar phenomenon in opening a bottle of carbonated beverage which had been outdoors in freezing weather. The liquid is not frozen and doesn't freeze on shaking (probably not supercooled), yet when the cap is removed, the liquid may suddenly freeze solid or become mushy with ice crystals. The temperature of the liquid was between the freezing-points of the liquid with and without the CO_2 lost by removing the cap.

Of course, even if the external temperature should be below the freezing-points of both the heated and unheated samples, occasional combinations of circumstances still might permit the heated sample to freeze first.

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I READ with great interest the letters in SCIENCE of April 19 under the title, "Roger Bacon Was Mistaken," and also Professor Thompson's recent letter. Whether it was Roger or Francis, here was a challenge:

> The belief that hot water does freeze more quickly seems to be firmly ingrained in the public mind so that many persons believe if hot water is placed in the ice-cube compartment of an electric refrigerator it will freeze faster than if cold water is placed therein. Perhaps it will if a large portion of it is lost through evaporation.

I went so far as to try the experiment myself. I report my results without explanation, not in order to confuse but to illustrate how seldom we know all about any experiment. I reserve my explanation so as to present this picture-puzzle. What is wrong with it?

A liter of water at 0° C was placed in the usual aluminum tray of the refrigerator and left to freeze without interruption for 60 minutes. The water left unfrozen was then poured out and measured. The volume was 720 cc. Apparently 280 cc of water had been frozen at 0°.

Then I heated to boiling another liter of water, put it into the same aluminum tray and into the same refrigerator compartment and left it also undisturbed for 60 minutes. Then I removed it and found only about 600 cc of liquid water and 400 grams of ice, which I thawed out and measured. In other words, the hot water had frozen faster.

Was Bacon really mistaken?

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SCIENTIFIC BOOKS

THE HYPOTHALAMUS

The Hypothalamus and Central Levels of Autonomic Function. Research Publications of the Association for Research in Nervous and Mental Disease, vol 20. Edited by JOHN F. FULTON, S. WALTER RANSON and ANGUS M. FRANTZ. xxx + 980 pp., 35 tables, 319 illustrations. Baltimore: Williams and Wilkins Company. $10.00.

THE pituitary body, or hypophysis, has been termed the master gland of internal secretion. It is attached to a small eminence at the base of the brain, and these two structures comprise the hypothalamus. In the brain of a fish or a salamander this part may be much more than a thirtieth of the total bulk of the brain, but in a man it is only one tenth of that. This is

[1] SCIENCE, March 29.
[2] SCIENCE, May 24.
[3] SCIENCE, April 19.

not due to shrinkage in relative importance of these organs in higher animals, but to the addition of other parts of the brain with different functions; for the hypothalamus in all these animals is the great central adjuster of some of our most fundamental vital processes. As Dr. Cushing expressed it, "Here in this well-concealed spot, almost to be covered by a thumb-nail, lies the very mainspring of primitive existence—vegetative, emotional, reproductive—on which, with more or less success, man has come to superimpose a cortex of inhibitions."

The most puzzling thing about this automatic visceral adjuster is its relation to that "cortex of inhibitions," because emotion, which may be consciously experienced and regulated, is under some measure of control by the cerebral cortex. The nature and mechanism of this cortical control have been studied in man by examination of cases where these functions are disturbed by injury or disease and in other animals by various experimental methods, including complete removal of the cortex and analysis of the remaining hypothalamic functions. The fishes and amphibians have no cortex to complicate the picture. Their very large hypothalamus has been well described anatomically, but the physiologists have so far neglected the opportunity here presented to investigate the intrinsic functions of the hypothalamus with minimal disturbance of normal relations.

Our useful knowledge about this puzzling region has been practically all acquired within the present generation. One of the first clinical symptoms associated with it is Fröhlich's syndrome, described in 1901, and Dr. Fröhlich remarked at the symposium here reported, "All we knew at that time was that the hypothalamus was an anatomical region lying beneath the thalamus." His memorable case report is quoted in full in Dr. Fulton's historical introduction to the volume here reviewed.

This is a notable book for several reasons besides the comprehensive scope and excellence of the researches reported. Confusion and mystery are here reduced to order and precision, not because all problems have been solved, but because critical analysis and systematization of existing knowledge are used as a basis for interpretation of known facts and reformulation of the problems. This report may therefore be regarded as a model which sets a standard of procedure in the cultivation of fields at the frontiers of knowledge. About two years before the symposium was presented detailed plans were formulated for its preparation. A confused terminology was systematized and the forty-two contributors cooperated to make the reform effective. Each of the thirty-four papers is a unit, with its own condensed bibliography, and at the end of the volume these citations (and some others) are assembled in a comprehensive bibliography of 68 pages which is probably the most useful survey of the literature of the embryology, comparative anatomy, structure, functions and clinical significance of this enigmatic part of the brain. The book is not a mere digest of literature; it contains much new material; it is well indexed and is appropriately dedicated to Dr. S. W. Ranson, director of the Neurological Institute of Northwestern University. Following Dr. Fulton's introductory historical sketch, the work is divided into three parts, dealing with the anatomical, physiological and clinical aspects of the hypothalamus.

The first research by Dr. Papez on the embryological development is brief and clear. The second paper on comparative anatomy by Drs. Crosby and Woodburne (Chapter III)) is the longest in the book (118 pages), including a comprehensive survey of the anatomy of this part of the brain in all vertebrates below mammals. Previously recorded work is reviewed, but the substance of this paper is original research by the authors based chiefly upon the Huber neurological collection of the University of Michigan. The fishes and amphibians are briefly surveyed. The accounts of reptiles and birds are more detailed, as is appropriate because of the more complicated structure and because these types have been so exhaustively studied by Dr. Crosby and her associates. These well-illustrated descriptions lay a secure foundation for the analysis and interpretation of the hypothalamic differentiations shown by the mammals.

The organization and connections of the hypothalamus of man and other primates are presented in Chapter V by Dr. Ingram. The existing confusion in the literature is clarified by a nomenclature consistent with the comparative anatomy of submammalian forms, and an especially valuable feature is the indication of the many places where further anatomical and physiological study is needed before a clear picture of the clinical significance of the hypothalamus can be drawn. A long step in this direction is taken in the papers by Doctors Rasmussen (Chapter VI) and Magoun (Chapter VII), which recount experiments localizing the courses and functions of the efferent fibers.

The most striking cellular elements of the hypothalamus of all vertebrates are the large neurons of the supraoptic and paraventricular nuclei, whose axons have been shown experimentally to supply the very rich innervation of the nervous part of the hypophysis. The peculiarities of these cells have long been known—large size, deep stain, rich vascularization, eccentric and multiple nuclei and astonishing variability of internal structure. In Chapter IV Dr. and Mrs. Scharrer summarize an extensive series of histological and experimental studies which, they believe, indicate that these neurons produce an internal secretion in addition to the performance of ordinary nervous functions.

They contain masses of colloid in amounts varying from none to inclusions almost completely filling the cell. The appearance and behavior of these colloid droplets closely resemble those long known in the secretory cells of the thyroid and hypophysis, and these droplets are extruded from the cells in a similar way.

The idea that normal nerve cells may perform the glandular functions of an endocrine organ is so unconventional that a critical attitude, if not skepticism, is to be expected. But the histological evidence marshalled is impressive, and the fact that nerve cells whose axons terminate in an endocrine organ may themselves have an endocrine function is not so anomalous as it seems, when viewed in the light of actual neuroglandular relations in various invertebrates (tunicates, nemerteans, insects, etc.) as revealed by investigations of many competent workers and especially of the Scharrers themselves. They are now attacking the problem from the physiological side, and it is not improbable that these studies may point the way toward the solution of some of the most puzzling problems of endocrinology.

The anatomical part of this work concludes with chapters on the blood vessels of this region by Drs. Finley and Craigie, with findings that seem to favor the hypothesis that the peculiar cells to which reference has just been made are chemoreceptors sensitive to certain chemical constituents of the blood.

In Part II our knowledge of the physiology of this part of the brain is summarized in chapters on cardiovascular regulation (Bronk, Pitts and Larrabee), body temperature (Ranson), pilomotor regulation (Walker), water metabolism (Hare, Gersh and Barbour), fat metabolism (Gildea and Man), gonadotropic functions (Brooks), sexual behavior (Bard), anterior pituitary function (Uotila), gastro-intestinal regulation (Sheehan), vesical activity (Langworthy), effects of analeptic drugs (Masserman), sleep (Harrison), somatic responses (Hinsey).

These papers present an imposing array of carefully controlled experiments by qualified experts, with technical aids which have been available only within the last few years. The net results are still confused and in some cases contradictory, yet the methods are good and further work along these lines is sure to resolve many obscure and controversial questions. The special value of several of these chapters and of the clinical papers which follow in Part III lies in their negative evidence—the exclusion of some supposed functions of the hypothalamus and the determination of "the exact state of our ignorance" concerning some others.

Diseases involving the hypothalamus include some of the gravest and most puzzling disorders with which medical practice is confronted. The clinical studies of Part III summarize the known facts and still unsolved problems.

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SOCIETIES AND MEETINGS

THE SIXTH WASHINGTON CONFERENCE ON THEORETICAL PHYSICS

March 21–23, 1940

"THE Interior of the Earth" was the subject of three days of intensive discussion at the Sixth Annual Conference on Theoretical Physics held in Washington from March 21 to 23, under the joint auspices of the George Washington University and the Carnegie Institution of Washington. A group of fourteen investigators in geophysics and in theoretical physics from various universities in the United States joined a similar number of Washington investigators in a series of informal meetings, in large and small groups, for technical examination of some of the outstanding problems concerning matter in great bulk and under large pressures and temperatures, as found inside the earth. The chief aim of the discussions was to formulate these problems more clearly for future joint efforts.

The first meeting was devoted to the pressure-volume relation at high pressures and associated questions concerning the probable composition and physical state of the earth's deep interior. Professor Fermi introduced the topic. He showed that for pressures higher than about 10^8 atmospheres the pressure-volume relation can be estimated statistically, and that all materials must behave in a similar way. At these pressures the outer electronic shells of the atoms are crushed; the electrons continue to move in different orbits but can be treated as independent of each other. In this region the pressure increases with the 5/3-power of the density. However, the pressure in the interior of the earth only reaches a value of about 3×10^6 atmospheres at the center. Professor Fermi reported the results of a paper by Jensen (*Zeits. Physik*, 1938), who extended these calculations to somewhat lower pressures. Jensen's results are valid only down to about 10^7 atmospheres, but by interpolating between his results and the experimental data at 2 to 5×10^4 atmospheres, one finds agreement with the densities and compressibilities which geophysicists have deduced for the iron in the core of the earth. As one immediate result of these discussions, calculations along similar lines are now in progress for the intermediate pressure region (10^5 to 10^6 atmospheres).

Professor Fermi also estimated the melting-point of iron under a pressure of 3×10^6 atmospheres. He used