form which has been reduced in size and massiveness as it developed in the direction of modern man. *Sinanthropus pekinensis* is morphologically so close to *Pithecanthropus erectus* that he can be regarded as a parallel form of the latter. *Sinanthropus* may have taken its origin also from *Gigantopithecus,* with the only difference that in this case his transformation may have taken place on the mainland of Asia itself to the north of the original center.

All this is, of course, hypothetical and must be verified by additional and more complete material, and particularly by stratigraphic work on the sites concerned. Also the answer to another question which forces itself upon the mind has to be postponed until further evidences are at hand. Are gigantism and massiveness indispensable features of the earliest mankind and, consequently, characteristic of all human forms; or have they to be regarded as accidental, regional or individual variations as they occur in other mammalian groups? The occurrence of large fossil human skulls with very thick individual bones in early or late stages, for instance in *Homo soloensis, Homo rhodesiensis* and in the Heidelberg jaw, seem to indicate that gigantism and massiveness may have been a general or at least a wide-spread character of early mankind.[3]

ON NATURALLY OCCURRING PORPHYRINS IN THE CENTRAL NERVOUS SYSTEM[1]

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WE have found that the fluorescence spectrum of the white matter of the central nervous system, in numerous animals, reveals a well-defined emission band at 630–620 mμ with a maximum at about 625 mμ. When the brain and spinal cord of an adult rat are examined under the light of a mercury vapor lamp which has passed through a Corning filter No. 5874, the reddish fluorescence of the spinal cord is found to contrast strikingly with the greenish fluorescence of the cerebral and cerebellar cortex. When portions of white matter are removed from larger mammals, such as freshly killed monkeys, dogs or pigs, and examined, the 625 emission band is found to appear in the funiculi of the spinal cord, the fiber tracts of the pons and medulla oblongata, the medullary center and laminae of the cerebellum, the cerebral and cerebellar peduncles, the internal and external capsules, the corpus callosum, the fornix, the anterior commissure, the optic chiasm, the centrum semiovale and the medullary centers of the frontal, parietal, occipital and temporal lobes. The cortex and the basal ganglia, with the exception of the globus pallidus, exhibit a continuous fluorescence spectrum (about 630–430 mμ). The 625 band, although relatively weak, is found to be present in the globus pallidus, thalamus and lateral geniculate body.

Spectroscopic examination reveals the presence of the 625 band even in the white matter of a live animal. After death, the band is still present in animals killed with ether, chloroform, carbon monoxide, pentobarbital sodium, lactic acid, methylene blue, insulin, mescaline, bulbocapnine, metrazol, quinine, harmine or strychnine. Furthermore, an emission band in the red region remains present in the white matter: (1) after immersion in liquid nitrogen, (2) after boiling for 1 hour in distilled water, (3) after irradiation with 200 r or 2,000 r of x-rays and (4) after several weeks in darkness at room temperature. Exposure of the white matter to light, however, leads to a disappearance of the 625 band.

In examining the brains and spinal cords from animals of 33 different species, the 625 band has been found to be present in the white matter of all the following 25 species of mammals and birds studied: man, rhesus monkey, green monkey, cebus monkey, spider monkey, squirrel monkey, common brown bat, cat, dog, rabbit, guinea pig, rat, mouse, pig, ox, sheep, goat, hartebeest, Grant's gazelle, opossum, common rhea, duck, chicken, pigeon and great horned owl. On the other hand, we have been unable to detect the 625 band in any of the following 8 species of fully grown amphibians or reptiles: leopard frog, bull frog, iguana, gila monster, Texas collared lizard, bull snake, milk snake and indigo snake. It seems, therefore, that the fluorescence spectrum indicates the presence of a fundamental constituent of the white substance of warm-blooded animals. The position of the band and the fact that the spectrum is one of Dhéré's[2] Type I strongly suggest a porphyrin.

In an attempt to extract and identify naturally

[1] This research has been aided by a grant from the Committee for Research in Dementia Praecox founded by the Supreme Council 33°, Scottish Rite, Northern Masonic Jurisdiction, U. S. A.

[3] For details, illustrations and references the reader is referred to a paper of mine in preparation which will be published under the same title in the "Anthropological Papers of the American Museum of Natural History," Vol. 40.

[2] C. Dhéré, "La fluorescence en biochimie." Paris, 1937.

occurring porphyrins, we have chiefly used the acetic-acid-ether and the ethyl acetate-acetic acid methods.[3,4,5,6,7,8] The porphyrin which we have never failed to extract from the white matter of various mammals, including man, appears to have the characteristics of a coproporphyrin. The spectrochemical evidence has been derived from data on solubility, HCl number, and the fluorescence spectra in ether, acetic acid, 0.2, 5 and 25 per cent. HCl, concentrated H_2SO_4, pyridine, 5 per cent. $NaHCO_3$, 0.1 *N* KOH and 0.1 *N* NaOH. Measurements of the fluorescence spectra have furnished values which agree satisfactorily with those published in the literature[2,9,10] and with values found by measuring the fluorescence spectra of coproporphyrin extracted from the meconium of various animals or obtained from other sources. When the porphyrin in the 0.2 per cent. HCl fraction is driven into ether and then extracted with 20 per cent. NaOH, the porphyrin remains in the NaOH layer. There is no precipitation of insoluble sodium salts at the interface of the ether and NaOH solutions. When the porphyrin is taken into 0.2, 5 or 25 per cent. HCl and shaken with chloroform, all or almost all of the porphyrin remains in the HCl solutions. In measuring the fluorescence spectra of various porphyrins at the temperature of liquid nitrogen, we have found that the principal emission band of coproporphyrin in ether shifts about 60 Å towards shorter wave-lengths. Exactly the same shift is observed when the porphyrin in the 0.2 per cent. HCl fraction is taken into ether and studied under similar conditions. (In measuring the absorption spectra of porphyrins at liquid air temperature, Conant and Kamerling[11] have also found a shift towards shorter wave-lengths.[12]) At present we do not know whether the white matter contains coproporphyrin I or coproporphyrin III.

Extractions of the white matter also furnish varying amounts of protoporphyrin. When the original 5 per cent. HCl extract is esterified with methyl alcohol-HCl and the free porphyrins, after saponification of the ester, are studied, the spectrochemical evidence also points to the presence of coproporphyrin and protoporphyrin. No other ether-soluble porphyrins have been obtained in extracting either the white matter or the whole brain and spinal cord of normal animals.

Spectroscopic examination or extraction procedures have furnished no evidence for the occurrence of appreciable amounts of porphyrins in the pineal gland, the hypophysis, the chorioid plexuses, the cerebrospinal fluid, the aqueous and vitreous humors, and the meninges of the brain and spinal cord.

Postnatal development in mammals and birds seems to be characterized by an "ascending porphyrinization." The 625 band is not present at birth. It has been observed first in the spinal cord and, finally, in the white matter of the cerebral hemispheres. The band is definitely present in the spinal cord of rats 20 to 23 days old and in that of ducks 8 weeks old. Throughout life the band may remain more intense in the spinal cord than in the cerebrum. In numerous mammals the band appears less intense in the corpus callosum and fornix than in the centrum semiovale and less intense in the prefrontal lobes than, *e.g.*, in the occipital lobes.

The fluorescence spectra of the cranial nerves reveal marked differences. The 625 band is clearly present in the optic, trigeminal, facial and auditory nerves, but appears to be absent in the third, fourth and sixth nerves. We have not been able to detect it in the olfactory bulb. The 625 band is generally present in the olfactory tract, *e.g.*, sharp and well defined in the pig and dog, but weak or even absent in the monkey. Closer examination strongly suggests that the 625 band is always absent in the peripheral nonglial segment of the cranial nerves. Since the sensory roots contain longer glial segments than the motor roots,[13,14] the 625 band is chiefly a characteristic of sensory nerves. It is, of course, of special interest that the optic nerve contains one of the most remarkable photodynamic substances ever discovered. Although we have not ascertained the localization of the fluorescence phenomena within the white matter, the question arises whether the occurrence of porphyrin is correlated with the presence of neuroglia or, more particularly, the presence of oligodendroglia. In examining brain slices of animals with extensive cerebral lesions of long standing, the 625 band has been observed in all portions of the white substance.

[3] H. Fischer and H. Orth, "Die Chemie des Pyrrols." Vol. II, part 1. Leipzig: Akad. Verl., 1937.

[4] O. Schumm, Hdb. d. biol., *Arbeitsmethoden*, ed. by Abderhalden. Abt. IV, Teil 4, pp. 1439–1462.

[5] O. Schumm, *Arch. exp. Path. Pharmak.*, 191: 529–544, 1938.

[6] C. J. Watson, *Jour. Clin. Invest.*, 16: 383–395, 1937.

[7] K. Dobriner, *Jour. Biol. Chem.*, 120: 115–127, 1937.

[8] J. Thomas, "Contribution à l'étude des porphyrines en biologie et en pathologie." Lons-Le-Saunier, 1938.

[9] M. Borst and H. Königsdörffer, "Untersuchunger über Porphyrie." Leipzig: Hirzel, 1929.

[10] A. Stern and H. Molvig, *Zeits. physik. Chem., Abt. A*, 175: 38–62, 1935; 176: 209–225, 1936.

[11] J. B. Conant and S. E. Kamerling, *Jour. Am. Chem. Soc.*, 53: 3522–3529, 1931.

[12] The splitting up and sharpening of bands found by Conant and Kamerling also occur in the fluorescence spectra of the porphyrins. As regards the shift to the blue, it may be noted that the principal emission band shifts about 50 Å at −195° C even in the fluorescence spectrum of fox squirrel bones.

[13] H. A. Skinner, *Arch. Neurol. Psychiat.*, 25: 356–372, 1931.

[14] I. M. Tarlov, *Arch. Neurol. Psychiat.*, 37: 1338–1355, 1937.

Furthermore, a strong emission band in the red region remains present in the white matter after incubation with solutions of myelolytic substances, such as saponin or sodium taurocholate.

In view of the presence of iron-porphyrin complexes in the central nervous system it deserves emphasis that the 625 band is absent in those regions in which the absorption bands of the cytochromes are clearly present (cerebral and cerebellar cortex, caudate nucleus, putamen). The 625 band is only present in regions which have little, if any, cytochrome. Keilin[15] has expressed the view that coproporphyrin is a derivative of cytochrome. Furthermore, we have not been able to detect the 625 band in the sympathetic and spinal ganglia or in the spinal nerves.

In examining tissues and organs of various animals, we have found that in the large majority of mammals and birds the fluorescence spectrum indicates the presence of porphyrin in only one organ. This organ is the central nervous system. That the porphyrins may play a significant rôle in neurological and psychiatric disorders has been suggested by several lines of evidence.[16,17,18,19,20,21] Numerous theories have been offered to account for the fact that acute porphyria produces such a wide variety of nervous and mental symptoms. In relating our results to facts and considerations reported in the literature, we are led to the hypothesis that certain neurological and psychiatric disorders are associated with a "cerebral porphyria" or a disturbance of the metabolism of certain pyrrol compounds.[22] Investigations are in progress to determine the distribution, amounts and kinds of porphyrins occurring in the brains and spinal cords of patients with various neurological and psychiatric disorders, ranging from demyelinizing diseases to the major psychoses.

OBITUARY

THOMAS SCOTT FISKE

THOMAS SCOTT FISKE was born in New York City on May 12, 1865. He was the son of Thomas Scott Fiske, a business man of New York, and Clara Pittman. He studied at the Old Trinity Church School in New York City, and at the Pingry School in Elizabeth, N. J. He entered Columbia College in 1881, obtaining the A.B. degree in 1885, and continued graduate work in the university, earning the A.M. in 1886 and the Ph.D. in 1888.

His principal teacher at Columbia College was Professor Van Amringe, and Fiske was his assistant for several years. Van Amringe advised him to continue the study of higher mathematics at the University of Cambridge, England. This wise advice had a great influence on Fiske's intellectual career. (It will be recalled that most mathematicians of his period studied in Germany.)

Fiske was fortunate in arriving in Cambridge with letters of introduction from one of the Columbia trustees, George L. Rives, who had himself studied in Cambridge many years before, had in fact been one of the wranglers at the mathematical tripos in 1872, and had been offered a fellowship at Trinity, a very high honor. These letters were addressed to the well-known mathematicians, Cayley, Glaisher, Frost, Forsyth and George Darwin. So young Fiske was welcomed as a guest and attended lectures by most of these men. He also did private reading with Dr. H. W. Richmond.

Fiske himself stated that the teacher of greatest influence was Dr. Glaisher, who made him an intimate friend and traveled with him to London to meetings of the London Mathematical Society. To quote Fiske's own words: "On my return to New York I was filled with the thought that there should be a stronger feeling of comradeship among those interested in mathematics and I proposed to my classmates and friendly rivals, Jacoby and Stabler, that we should try to organize a local mathematical society."

These three young men, all born in the year 1865, sent out an invitation to local mathematicians, and on November 24, 1888, the first meeting was held in Columbia College, attended also by Van Amringe, Rees and Maclay. Thus began formally the New York Mathematical Society, with Van Amringe as president and Fiske as secretary. The society grew very rapidly, new members coming from Harvard, Yale, Princeton and Johns Hopkins. Six years later the membership was really national and the name of the organization was therefore formally changed to the American Mathematical Society. It is now the largest and most influential mathematical society in the world, having a membership of about three thousand. Fiske was the first secretary and the seventh president. He played the leading role in founding the two leading scientific journals, *The Bulletin* (1891) and *The Trans-*

[15] D. Keilin, *Proc. Roy. Soc. London* (*B*), 98: 312–339, 1925.

[16] J. Waldenström, *Acta med. scand.*, suppl. 82: 1–254, 1937.

[17] J. Waldenström, *Acta psychiat. neurol.*, 14: 375–379, 1939.

[18] H. Günther, *Ergebn. allg. Path. path. Anat.*, 20, part 1: 608–764, 1922.

[19] A. Vanotti, *Ergebn. inn. Med. Kinderhk.*, 49: 337–377, 1935.

[20] P. Eichler, *Zeits. ges. Neurol. Psychiat.*, 141: 363–379, 1932.

[21] C. Carrié, "Die Porphyrine." Leipzig: Thieme, 1936.

[22] H. Klüver, *Jour. Psychol.*, 17: 209–227, 1944.