THE AUTONOMIC NERVOUS SYSTEM AND THE HYPOTHALAMUS*

DURING recent years much research has been carried out on the autonomic nervous system and an account of the various influences that this system exerts upon the body and on the numerous functions of the hypothalamus so far as they are connected with this system, is very interesting. Prof. De, in his Presidential Address, deals only with a few of the more important functions which are under the control of the hypothalamus. He has traced the history of the development of the knowledge of the sympathetic nervous system as far back as 1727, when du Petit first suggested the autonomy of the sympathetic nervous system. Jacque Benigne Winslow introduced the term "sympathetic" and the term "vegetative nervous system" was first used in 1880 by Marie Bichat. There has been some difference of opinion regarding the interdependence of these two systems. Towards the end of the last and the beginning of the present century new light has been thrown by the work of Langley and his school and the work of Gaskell on the vegetative nervous system. Gaskell demonstrated the connection of the sympathetic peripheral mechanism with the central apparatus and with the nerve cells in the spinal cord and pons. The presence of synapses in the path of the fibres was first revealed by Langley. Every fibre of the sympathetic system forms one synapse with a nerve cell at some point in its course and this is the only break in the continuity of the fibre. Each fibre path is composed of two sections—the pre-ganglionic and the post-ganglionic. The name "autonomic nervous system" was given to this system by Langley who divided the whole system into tectal, bulbosacral, thoracio-lumbar and enteric. The tectal and the bulbosacral outflows were grouped by him as "parasympathetic" and thoracico-lumbar as "sympathetic". Langley noted the antagonism between the sympathetic and the parasympathetic systems. The sympathetic system is catabolic and the parasympathetic system is anabolic. A delicately balanced co-ordination of the sympathetic and the parasympathetic activities is required to maintain the uniformity of the conditions of the body.

Prof. De then proceeds to discuss the various theories of transmission of nerve impulse. With the progress of work along these lines, the question of transmission of nerve impulse and of the liberation of the chemical transmitter at synapses in the autonomic ganglia, and of the release of sympathin and acetylcholine at the neuromuscular and neuroglandular junctions, has attracted much attention in recent years. A purely electrical theory cannot explain all the data satisfactorily. The chemical theory like the electrical one has not received universal acceptance. Probably both the chemical and electrical factors are concerned with the transmission in the synapses and neuromuscular and neuroglandular junctions and further work will bring the two views into harmony.

Dealing with the autonomic nervous system, its centres in the brain stem and somatic response and the cortical control, Prof. De says that the evidence of control exercised by the cerebral cortex over the autonomic activities is fairly full and conclusive; nevertheless, some workers have doubted the accuracy of these conclusions. The weight of evidence, however, from the numerous experimental investigations and from clinical observations of various workers points to a localisation in the precentral cortex, more particularly in the areas 4 and 6 (Brodmann). Recently, much attention has been paid to the hypothalamic region of the brain and evidence has accumulated to show that it plays an important part in some of the vital reactions of the body. It is now generally agreed that in the hypothalamus and in the other parts of the upper brain stem, there exists a number of nuclei—supra-optic, paraventricular, infundibular and mamillary—which govern to a great extent the reactions of the autonomic nervous system. Karplus and Kreidl (1927) were the first workers to show that electrical stimulation of the hypothalamus produced excitation of the sympathetic nervous system. Evidence of the presence of the parasympathetic centre in the hypothalamus was given by Cushing (1932). Heslop (1938) also established that the anterior part of the hypothalamus is a parasympathetic and the posterior part a sympathetic centre. The importance of the hypothalamus in the regulation of body temperature is now unquestioned. From the experimental evidence, it is concluded that there are two distinct centres for the regulation of heat and cold. The centre for reactions to heat is situated in the anterior part of the hypothalamus. Lesions located in the medial part of the hypothalamus in the region of the infundibulum have no effect on either centre. On the clinical side evidence is accumulating that tumours in the neighbourhood of hypothalamus produce changes in the body temperature. Since the mechanism of heat production is activated by the posterior hypothalamus, it stands to reason that it is governed by the adrenergically (sympathetic) innervated structure coupled with the somatically controlled shivering reflex; on the other hand, the mechanism of heat loss is primarily governed by a cholinergic mechanism (parasympathetic). The function of maintaining body temperature is thus a highly integrated reaction involving both divisions of the autonomic system and also the important somatic reaction.

Finally, the author deals with the part the hypothalamus plays on the control of blood-sugar. Borbeck (1940) showed that in cats, lesions in the hypothalamus predisposed to insulin shock and to serve hypoglycæmia. From this and various other facts it is reasonable to infer that the spinal sympathetic nuclei may be capable of maintaining the blood-sugar level to some extent when their connections with the higher centre is severed. De investigated the role of general anæsthetics on the blood-sugar level on the spinal sympathetic nuclei when these nuclei are separated from higher centres. He could not find any signifi-

* Summary of Presidential Address delivered by Dr. P. De, before the Section of Physiology, Indian Science Congress, Bangalore, 1946.

cant part being played by these nuclei in the production of hypoglycæmia. The numerous facts and observations of Bard (1928) and Foulton (1929) and Ingrahm (1929) led De to believe that all the general anæsthetics release the sympathetic hypothalamic centre from the cortical control. The poorer the cortical depression, the less the hypoglycæmia, and with the deepening of anæsthesia, as more and more of the cortical control was withdrawn, the greater and greater was the rise of blood-sugar.

From the foregoing statements, it is clear that the hypothalamus plays a very important part in the body and controls a large number of body reactions. The results of observations on this subject, especially their association with the automatic nervous system, though quite extensive, are still very incomplete and await further work.

N. N. De.

THE INSIDIOUS TYPE OF LEAD POISONING*

IN his Presidential Address, Dr. Bagchi has presented some of the important features of his investigations on lead poisoning and its bearing on the post-war industrial reconstruction. By the term lead poisoning or plumbism is meant that one has imbibed lead in quantities larger than what is normally ingested with food and drink or inhaled with air or otherwise absorbed, and has been adversely affected or intoxicated by it. Lead poisoning, like all other kinds of poisoning, may be acute or chronic. Dr. Bagchi has discussed only the chronic form of lead poisoning, which is mostly of occupational or industrial origin and to a less extent accidental. He then goes on to describe the toxicity of lead and lead compounds. Lead, in whatever form it is introduced in the system, acts as a poison. Even metallic lead is a potent poison—the toxicity depending on the extent of its surface exposed to the tissues. The route by which lead is introduced into the system is also a determining factor in the causation of the toxic symptoms. It has been proved that lead is absorbed in larger quantity and much more quickly through the lungs than through the alimentary tract or the skin and that lead introduced into the system by inhalation is about 100 times more toxic than when it is swallowed. Discussing the insidious type of lead poisoning—its pathology and symptomatology—the speaker says that the classical type of lead poisoning or plumbism in which all the characteristic signs and symptoms described in the text-books develop, offers no difficulty in diagnosis. But quite a large number of people who happen to absorb only very small amounts of lead over a long time either from drinking water, cooking utensils, vermillion or similar other sources do not develop any of these symptoms and yet are known to suffer from plumbism. These cases have lately attracted the attention of the workers in this line and have been proved by chemical and therapeutic tests to belong to the insidious types of lead poisoning, which had hitherto escaped the notice of the clinicians.

There are many difficulties that stand in the way of diagnosing cases of lead poisoning. In the diagnosis of plumbism, the history of exposure to lead is a very important factor. This guides the physicians in the right direction and the laboratory findings confirm his suspicion, while clinical features help him to clinch to his diagnosis. The laboratory tests include examination of urine and fæces by modern methods of chemical analysis and chemical examination of tissues, *e.g.*, liver, kidney, heart, lungs, intestine, spleen, cartilage, skin, brain and bone. Hair has been found to be a suitable material for the detection of abnormal lead absorption in the system. The chemical examination of blood does not help in any way in cases of insidious type of poisoning; in chronic cases, even with well-developed symptoms, the blood lead does not usually exceed the normal limits. Amongst other signs and symptoms may be mentioned blue line in the gums, and punctate basophilia, but unfortunately, both these are most unreliable and even when present they do not indicate lead intoxication but only lead absorption. Wrist drop, arteriosclerosis, and vascular spasms may be found only among those who absorb lead in heavy doses; rarely these are to be expected in insidious types.

Before concluding Dr. Bagchi laid stress on the importance of lead poisoning, particularly of the insidious type and its implication. As it is mostly of industrial origin and as rapid industrialisation is expected early, he puts it forward as a plea for reorientation of the system of Public Health Administration and Medical Education in this country. Dr. Bagchi impressed on the importance and development of Industrial Hygiene and felt that the establishment of a Central Research Institute for Industrial Hygiene, creation of an Industrial Health Research Board and raising the standard of teaching in Medical and Public Health Sciences will be helpful in bringing about the solution of new problems of health and disease arising from the industrialisation of the country and thus to protect and improve the health of the workers.

N. N. De.

* Abstract of Presidential Address to the Section of Medical and Veterinary Science, delivered by Rai Bahadur K. N. Bagchi, before the 33rd Session of the Indian Science Congress, Bangalore, 1946.

DEVELOPMENT OF KIDNEY IN FISHES*

WHILE the kidney in all vertebrates is, more or less, derived from the same embryological source, the precise mode of its development varies in different classes of vertebrates. The first developed part of the kidney which is functional in the larval life of frogs, bony fishes and some other fishes is very rudimentary amongst sharks. The larval kidney serves the larva for some time. But as development proceeds, the succeeding portions of kidney develop and this development takes place in two stages. The first stage represents the whole kidney in all fishes except sharks where the hinder elements alone function in the adult and in this respect the sharks resemble the

* Abstract of Dr. Moghe's Presidential Address to the Section of Zoology and Entomology, Indian Science Congress, Bangalore, 1946.