

thyroid and hyperplasia follows when this exhaustion reaches the critical level. The thyroid hyperplasia is therefore due immediately to a relative deficiency of iodine and an iodine store sufficient to maintain normal thyroid structure for from 3 to 6 months may be exhausted in 2 weeks by feeding steamed cabbage. The possibility that the thyroid hyperplasia due to feeding cabbage is dependent upon an absolute iodine deficiency can be dismissed.

The mode of action of this goiterogenic agent is unknown, although the data available suggest that it acts by depressing some oxidation system which the thyroid attempts to overcome.

4536

Contribution to the Problem of the Origin and Development of the Sympathetic Nervous System.

ERNEST VAN CAMPENHOUT. (Introduced by H. S. Burr.)

From the Department of Anatomy, Yale University School of Medicine.

Three theories have been proposed regarding the origin of the sympathetic elements, the neural crest, the ventral half of the spinal cord, or the mesodermal tissue. The experimental method alone is able to give a satisfactory answer to this problem.

In embryos of *Rana pipiens*, at the stage of open or closing neural folds, the author has removed the neural crest from the hindbrain to the tip of the tail; the entire spinal neural crest and the dorsal half of the spinal cord were excised by that procedure. Many operated embryos live as long as 45 days after the operation. Their size was very much reduced if compared with the control animals and they showed marked deficiency in their sensitivity. The microscopic study of these embryos shows the absence of the spinal and sympathetic ganglia throughout the entire trunk region. The motor roots are present in all segments but are lacking sheath cells. The spinal cord shows normal motor neurones; the Rohon Beard elements are absent and the central canal is more or less dilated. The chromaffin part of the adrenals is undeveloped and the digestive tube does not show any nervous elements in its walls.

The removal of the hindbrain at the same embryonic stage does not interfere with the development of a vagal ganglion. Its visceral branch is, however, absent. The visceral portion of the vagus nerve seems to be exclusively derived from the medullar neural crest, the other components originating from the placodes. In these embryos

the central and peripheral parts of the sympathetic system are well developed; the adrenals show their 2 constituting anlagen and the intestinal walls contain nervous elements.

The 2 experimental series strikingly confirm each other and they show that, in the frog, the neural crest represents the exclusive source of sympathetic elements, that the visceral branch of the vagus nerve is derived from the medullar neural crest and that the nervous elements in the intestinal walls are to be related to the sympathetic system.

The study of a series of normal chick embryos, stained with ordinary techniques or impregnated by various silver methods, gives very clear pictures concerning the different points of the development of the sympathetic system. There is no evidence of a succession of 2 independent sympathetic chains. Around the sixth day of incubation, the communicating rami become shorter, thus probably corresponding to a neurobiotactic phenomenon resulting from the penetration of motor fibers into the sympathetic ganglia. The exclusive origin of the elements of the sympathetic chains seems to be the ganglionic crest and no migration was found along the ventral roots. The vagus nerves supply the primary innervation to the lungs, to the heart and to both gastric pouches. The small intestine, from the pylorus on, is innervated primarily by sympathetic branches and there is no evidence of any participation of the vagus nerves as late as the eighth day of incubation, when the intestinal walls show a perfectly developed nervous supply with myenteric and submucous plexuses.

The neural crest origin of the sympathetic elements and the sympathetic origin of the intestinal nervous structures are the main conclusions of this contribution.

4537

I. Effect of Intravenous Injections of Sodium Sulphide and Sodium Cyanide on Reflex Response of Anterior Tibialis Muscle.

HAROLD H. GAY. (Introduced by Robert Gesell.)

From the Department of Physiology, University of Michigan.

Glazer¹ has shown that intravenous injection of sodium cyanide increases the reflex response of the anterior tibialis muscle to electrical stimulation. The purpose of this group of experiments was

¹ Glazer, W., *Am. J. Physiol.*, 1929, lxxxviii, 562.