the interval between the two 2-minute radiations was 3 hours. The results are given in tabular form.

TABLE I.

4 min.	2 min.-3 hr.-2 min.
108	104
103	103
101	95
96	92
93	89
90	79
95	84

The average for the single dose is 98; for the split dose 92.29. The average difference is 5.71; the standard error of the difference is 1.52.

In 3 series with a 1½-hour interval values of 102 for the single dose and 103 for the split dose were obtained.

In 2 series in which the 2-minute radiations were separated by simple stopping and starting the machine immediately, the value for both the single and split dose was 107.

Conclusion. Spaced radiation was found to be slightly more effective in inhibiting the migration rate of lymphoid cells when the interval between the radiations was 3 hours. Limited data at the indicated shorter intervals failed to reveal this difference.

9324 P

Origin of the Sympathetic Trunks in the Chick Embryo.

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In most current textbooks of neuroanatomy and embryology the sympathetic trunks are described as arising from the spinal ganglia. This conception is based on the older descriptions and upon the more recent experimental investigations of Mueller and Ingvar[1] or Van Campenhout.[2] On the other hand, the sympathetic trunks are described as arising from the neural tube by a few of the earlier workers and by the majority of later workers, particularly by Kuntz.[3]

1 Mueller, E., and Ingvar, S., *Arch. f. mikr. Anat.*, 1923, **99**, 650.

2 Van Campenhout, E., *Arch. de Biol.*, 1931, **42**, 479.

3 Kuntz, A., *J. Comp. Neur.*, 1926, **40**, 389.

To gain further information on this subject 2 types of operations have been performed on chick embryos at 40-48 hours of incubation. First, the neural crests, with contiguous portion of the neural tube, were removed from the lower cervical and upper thoracic region for as many as 7 segments. The operation was performed under a binocular dissecting microscope by direct ablation with fine iridectomy scissors. The 25 embryos that survived this operation for a total incubation period of 7 days were then prepared for study by a modified Cajal technique, following which the nervous system in the region of operation was reconstructed graphically or in wax.

These 25 embryos may be divided into 2 groups, 13 of which (Group 1) have uninterrupted spinal cords extending throughout the region of operation and 12 of which (Group 2) have interrupted spinal cords, the gap ranging from one to 7 segments. The embryos of the first group show that the removal of neural crests and contiguous areas of the neural tube for as many as 7 segments does not prevent the formation of sympathetic trunks even though the spinal ganglia fail to develop in the area of operation. The embryos of the second group show that in cases where one to 3 segments of the spinal cord are missing (7 specimens) the sympathetic trunks will bridge the gap, but in cases where 2 to 7 segments of the cord are absent (5 specimens) the sympathetic trunks are interrupted. In the latter cases the sympathetic trunks extend into the region of operation for a distance of from one to 5 segments. Sympathetic ganglion cells however, migrate into the region only for a distance of from one to 3 segments. The migration of sympathetic trunks into the area of operation always proceeds from the cephalic end of the wound, never from the caudal end. Accordingly, if 3 segments is the maximum extent of migration of sympathetic neuroblasts, and this migration proceeds only from the cephalic end of the wound, it is apparent that the sympathetic trunks of an embryo in which 7 consecutive spinal ganglia are missing could not have resulted from migration of cells from the ends of the wound. So it must be concluded that the trunks arise from cells of the neural tube that migrate along the pathway of the ventral roots and communicating rami.

Further evidence that this conclusion is correct is afforded by a study of the normal 3-day chick embryo. At this stage the ventral roots of the spinal nerves are crowded with large neuroblasts similar in morphology to those in the wall of the neural tube. A continuous cellular strand of neuroblasts may be followed from the neural tube along the ventral roots and communicating rami to the position of the sympathetic trunks dorso-lateral to the aorta.

The negative results of Mueller and Ingvar[1] who found that destruction of the neural crests in the 48-hour chick would prevent the formation of the sympathetic trunks are explained on the ground that in using an electric cautery, the effects of which cannot be localized, these investigators injured more than the neural crests and so delayed or prevented the outgrowth of neuroblasts from the ventral portion of the neural tube. Also, the significance attached to the occurrence of both spinal and sympathetic ganglia in amyelous monsters without ventral roots is discounted by a 7-day embryo with an unclosed neural tube, but with ventral roots, spinal and sympathetic ganglia—an early stage of what would undoubtedly have become an amyelous embryo.

The weight of evidence afforded by these experiments and considerations, therefore, seems to favor the view that the source of most, if not all, of the neuroblasts that form the sympathetic trunks, is the neural tube.

9325

Production of Canine Blacktongue on Purified Diets.

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Goldberger and coworkers[1] produced the canine disease blacktongue, on diets consisting principally of natural foodstuffs (largely corn, cow peas, and casein). They believed that the ability of certain foodstuffs to prevent the disease was due to their content of a specific heat-stable component of the vitamin B complex identical with the human pellagra-preventive (P-P) factor. The P-P factor has been rather generally considered[2] to be identical with the rat factor, vitamin G (B_2).

Certain doubts have been cast on this view of the production of blacktongue. Zimmerman and Burack[3] maintained dogs on an "artificial, balanced ration adequate in all dietary essentials as far as is known except water-soluble, heat-stable vitamin B_2 (G)," and these dogs did not develop blacktongue but a different disease.

[1] Goldberger, J., Wheeler, G. A., Lillie, R. D., and Rogers, L. M., *U. S. Public Health Reports*, 1926, **41**, 297.

[2] Aykroyd, W. R., and Roscoe, M. H., *Biochem. J.*, 1929, **23**, 483.

[3] Zimmerman, H. M., and Burack, E., *J. Exp. Med.*, 1934, **59**, 21.