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Occurrence of Porphyrins in Peripheral Nerves.* (23731)

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The occurrence of porphyrins in the central nervous system of a wide variety of animals was first described by Klüver(1). In his extensive survey of the nervous system of a large number of vertebrates, he(2) was able to demonstrate that the white matter of the central nervous system of warm-blooded animals contained coproporphyrin. Later, he extracted protoporphyrin in variable amounts. Klüver's spectroscopic examination of the peripheral nerves revealed that porphyrins were present in the optic, trigeminal, facial, and auditory nerves(1,2). He was unable, however, to detect the presence of porphyrins in the occulomotor group of nerves (III, IV, VI) or in spinal nerves. Further quantitative and qualitative study of the porphyrins in the central nervous system(3,4) confirmed Klüver's observations and it became apparent that the porphyrin in the central nervous system was a mixture of coproporphyrin and protoporphyrin. The discovery that the coproporphyrinuria in patients with poliomyelitis involved a type III porphyrin(7) focused attention on the coproporphyrin III concentration of the nervous system. Blanchard isolated and crystallized the coproporphyrin from beef brains and established that this was the type III isomer on the basis of the melting point of the methylester. It was early observed by one of us that the red fluorescence of the porphyrins in the nervous system was not uniformly distributed. Quantitative determinaton revealed a higher concentration of coproporphyrin III in the medulla oblongata and brain stem than in cerebellum, cerebrum or spinal cord. Since porphyrin was abundant in the conduction areas of the central nervous system, and was found to be most concentrated in the important medullary region, it was postulated that the porphyrins may be involved in the process of conduction of nerve impulses. However, such a hypothesis would be untenable if porphyrins were absent in peripheral nerves. It was, therefore, decided to determine whether porphyrin was present in peripheral nerves and in what amounts. It was found that both protoporphyrin and coproporphyrin were relatively abundant in peripheral nerves. Moreover, it was observed that the peripheral nerves contain approximately 2 molecules of coproporphyrin to each molecule of protoporphyrin.

Methods and materials. The lumbo-sacral trunk and portions of the sciatic nerve were removed from the pigs immediately after they had been slaughtered. The nerves were transported to the laboratory in plastic bags packed in salted, crushed ice. They were separated from fat and blood vessels, washed in distilled water to remove blood, and either used immediately or wrapped in Saran and stored in the deep freeze. For each determination, 150 g quantities of nerves were homogenized in a blendor with 500 ml of 4:1 ethyl acetate-glacial acetic acid for 20 to 30 minutes. The mixture was placed in the deep freeze until the temperature reached 6°C and was then filtered through a Büchner funnel. The filtercake was extracted with cold ethyl acetate-glacial acetic acid (4:1) until the filtrate became colorless. The porphyrins were

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TABLE I. Porphyrin Content of Peripheral Nerves of Pigs.

	Coproporphyrin III/100 g	Protoporphyrin/100 g	Coproporphyrin / Protoporphyrin
	(μg/100 g tissue)		
	91.5	42.0	2.18
	96.0	47.3	2.03
	93.6	48.2	1.94
	99.0	44.6	2.21
	93.0	42.0	2.21
Avg	94.6	44.8	2.11

separated according to the method of Schwartz and Wikoff(6). Quantitative determinations of copro- and protoporphyrin concentrations were made fluorometrically(5).

Results. The results of 5 determinations are shown in Table I. It is apparent from this that the amounts of porphyrin in peripheral nerves are even more abundant than in the central nervous system. The porphyrins in peripheral nerves were found to be difficult to demonstrate spectroscopically, but the emission bands of porphyrins in peripheral nerves were observed with a Gaertner quartz spectrograph.

The dominant porphyrin in peripheral nerves as in the central nervous system was coproporphyrin III. It was noted, however, that there was a constant ratio of coproporphyrin to protoporphyrin when the nerve tissue was protected from autolysis before the determination.

Summary. Both coproporphyrin III and protoporphyrin were determined in the peripheral nerves of pigs. An average of 5 determinations showed that 100 g of nerve contained 94 μg of coproporphyrin and 45 μg of protoporphyrin. The ratio of coproporphyrin to protoporphyrin was approximately 2:1 and appeared to be constant.

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Absence of Gastro-Intestinal Lesions in Rats Following Ingestion of Silica. (23732)

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The finding of solid silica in lungs and other tissues and its toxicity when inhaled or injected intravenously has led to attempts to produce lesions by ingestion. (Piezoelectric effects of crystalline silica have been blamed but no piezoelectric effect is possible unless the crystal is compressed in one direction.) Silica occurs in food and to the extent of 2% in human blood ash. We wished to determine whether 10% of the diet as silica dust would be toxic. Seventy weanling rats were divided into 7 groups of 10 rats each. One group was fed Purina dog chow and the others 90% Purina dog chow and 10% of one of the forms of silica shown in Table I.

The rats were fed these diets 3 months and then killed and histological preparations made of the stomach, small and large intestine, liver, spleen, pancreas, adrenals, mesenteric lymph nodes and lung. No lesions were found in any of the organs studied.

It may be objected that 3 months is not sufficient time to produce lesions with silica. Clinical symptoms of silicosis have been reported in humans breathing silica dust for 6 months but most cases studied have been exposed to silica dust from 1 to 40 years. If the rat is to be used as an experimental animal it must be assumed that it lives more rapidly and that changes occur in less time than in