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Effect of Sympathectomy upon Blood Supply of Bone.

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Elevation of skin temperature following sympathectomy is a matter of common observation. This has been shown to be due to vascular dilatation and increased circulation. Leriche and Policard,¹ Ferrannini,² Frugoni,³ and Introzzi⁴ have shown that, following interruption of sympathetic nerve supply to bone, some degree of decalcification occurs as evidenced by roentgenogram or ash analysis. They have assumed that this effect was due to increased blood supply to the bone. But, so far as we know, no evidence has been presented that any increase in the blood supply actually occurs. The purpose of this study is to determine the effect of sympathectomy upon the blood supply of bone.

Method and Material. Previously Griffith, Zinn and Comroe⁵ reported the effect of bilateral lumbar sympathectomy upon the vasa vasorum of rats. Carbon particles, in the form of ink, were injected into the blood stream and later identified in unstained sections of the femoral artery. It was found that lumbar sympathectomy increased the number of carbon particles in the outer coats and immediately about the adventitia of the femoral artery, and it was therefore believed that it had increased the number of open vasa vasorum. Twelve of the legs used in this study had been preserved, including those of 6 normal and 6 sympathectomized animals. All the tibiae were decalcified and prepared for histologic section. Sections were examined both stained and unstained and the carbon in the minute vessels of the bone noted.

Results. It was obvious that, in general, there was much more carbon in the bones of the normal animals than in bones of sympathectomized animals. The manner of expressing this difference was a problem. It was decided to arbitrarily grade the carbon concentra-

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¹ Leriche, R., *Physiologie et pathologie du tissu osseux*, Paris, Masson et Cie, 1939.

² Ferrannini, A., *Pathologica*, 1935, **27**, 777.

³ Frugoni, P., *Arch. di Biol.*, 1934, **88**, 27.

⁴ Introzzi, A. S., *Semena Med.*, 1934, **1**, 1641.

⁵ Griffith, J. Q., Jr., Zinn, C. J., and Comroe, B. I., *Arch. Path.*, 1938, **26**, 984.

TABLE I.
Incidence of Carbon in the Small Vessels of Bone in Normal and Sympathectomized Rats, in Order of Ascending Concentration.

Amount of carbon	No. of animals	
	Normal	Sympathectomized
+	0	1
++	1	2
+++	1	3
++++	4	0

tion in the bones in 4 degrees. This grading has been designated in Table I by plus signs. Roughly, ++++ concentration is 4 times + concentration.

Discussion. In the previous study⁵ it had been shown that more carbon was present in the vasa vasorum of the femoral artery of the sympathectomized animal. This was in accord with the general observation of increased blood supply to the skin after sympathectomy. The present findings in respect to bone appear to be contradictory to this trend. The following explanation is offered. Vascular dilatation may be said to occur if (1) already open vessels open wider, or (2) small vessels open that had previously been closed. Studies based on carbon injection show changes principally if the second circumstance applies, *i.e.*, if new vessels open. Thus it may be that in bones most or all of the vessels are constantly open, whereas in the skin less than half of the vessels are usually open at a single time. Even if some new vessels in the bone do open, the amount of blood reaching them might be diminished due to their sharing the common blood supply of the leg with more widely open vessels in the softer parts. This effect would probably be most marked the greater the dilatation of the vessels in the soft tissues. In this connection it should be stressed that the studies were made on the fifth day postoperatively, at which time dilatation is thought to be maximal. These relations might not hold at a later period.

Conclusions. On the fifth day following lumbar sympathectomy the blood supply to the tibia in the rat is decreased. This paradoxical effect may be the result of disproportionately greater dilatation of the vessels in soft tissues.