containing 0.10625%, and all tubes containing 0.053125%. After standing 24 hours there was a shift of hemolysis, in some instances several dilutions higher when normal saline was used as a vehicle. On the other hand, with the blood serum vehicle no such marked shift was noted.

The foregoing results indicate that both white mice and red cells are protected by blood serum to a considerable degree from the toxic effects of bile salts. This substantiates our belief that either the serum has a neutralizing effect or that the serum molecules by affording a surface capable of being coated by bile salts diverts in part or toto this substance from the red cell and thus prevents or delays hemolysis.

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Peripheral Course of Sensory Nerves Supplying Arteries of Lower Extremity.

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Lumbar sympathetic gangliectomy abolishes the reflex vascular spasm, the central feature of Raynaud's disease. The immediate relief of the accompanying pain is so striking that it has led clinical observers to conclude that some type of sensory nerve to the lower extremity is sectioned in the course of the sympathectomy. This view is strengthened by the experiments of Johnson[1] and of Kuntz and Farnsworth,[2] which demonstrated that certain of the dorsal root components of the lower dorsal and upper lumbar spinal nerves pass to the lumbosacral sympathetic trunks and are distributed from them to the lumbosacral plexus.

During the course of experiments in arterial visualization, we noted that cats under sodium amytal anesthesia reacted in a characteristic manner when a concentrated solution of sodium iodide was injected into the femoral artery. The entire body stiffened with the legs straining at the leashes; hyperpnea; dilatation of the pupils; tossing of the head accompanied by vocalization, the outcry possess-

[1] Johnson, S. E., *J. Comp. Neurol.*, 1921, **33**, 85.

[2] Kuntz, A., and Farnsworth, D. I., PROC. SOC. EXP. BIOL. AND MED., 1928, **25**, 808.

ing sometimes a plaintive note and sometimes a note of anger. This reaction of the anesthetized animal is identical with the external manifestation of the perception of acute pain during conscious states. It is not accompanied by subjective perception of pain, for Woodworth and Sherrington[3] showed that such "pseud-affective" reactions persist after ablation of the cerebrum and diencephalon. It results, we may presume, from afferent impulses which, were the function of the brain intact, would evoke "pain".

We made use of this "pseud-affective" reaction of the amytalized cat in an attempt to determine the course and termination of the "pain" fibers stimulated by the intra-arterial injection of the sodium iodide. When the iodide is confined to the trunk artery by the ligation of its branches, no reaction occurs. Therefore the fibers do not terminate in the lining of the large vessels. (Odermatt[4] arrived at the same conclusion as regards other irritating solutions.) Such an experiment lacks conviction when applied to the femoral artery where ligation of the numerous branches requires such isolation of the vessel in its bed as conceivably to interrupt its nerve supply. The left subclavian artery of the cat, however, courses for nearly 2 inches before branching. When it is ligated proximal to this branching, an injection with sodium iodide evokes no reaction whatever.

The experimental blocking of the femoral arterioles with lycopodium spores delays the appearance of the reaction considerably. This delay suggests that the fibers terminate either in the capillaries or in adjacent cellular tissues to which the iodide may diffuse. We have not yet succeeded in localizing further the nerve endings upon which the irritating solution acts. The end-organs of cutaneous sensibility, however, are not involved, since the reaction occurs upon injection of arteries of purely visceral distribution such as the hepatic artery and the splenic.

Quite definite information has been obtained regarding the peripheral course of the fibers conveying the impulses in question. Unilateral or bilateral resection of the entire lumbar sympathetic chain neither prevents nor modifies the reaction. In contrast, the division of the branches of the ipsolateral lumbosacral plexus prevents the occurrence of any reaction whatever. As a parallel, if one lumbar sympathetic chain is removed and the branches of the contralateral lumbosacral plexus sectioned, a typical "pseud-affective" reaction occurs when the femoral artery of the sympathectomized

[3] Woodworth, R. S., and Sherrington, C. S., *J. Physiol.*, 1904, **31**, 234.

[4] Odermatt, W., *Bruns' Beiträge z. klin. Chir.*, 1922, **127**, 1.

side is injected, whereas no reaction results from injection of the opposite vessel. Therefore it is obvious that the afferent fibers concerned in the reaction reach the cord by way of the peripheral spinal nerves and not by way of the sympathetic chain. This finding is in agreement with that of Bradford Cannon,[5] who, using buried electrodes, could elicit no sign of pain upon stimulation of the lumbar sympathetic chain in the unanesthetized animal.

It is concluded that the intra-arterial injection of irritating solutions causes pain through the stimulation of afferent nerve endings located in or in close association with the finer arterial branchings. Lumbar sympathectomy does not abolish pain of this origin and relieves only pain arising directly or indirectly from arterial spasm.

[5] Cannon, Bradford, 1932, personal communication.