repeated hemorrhage. The diets used consisted chiefly of white bread and salmon, providing a low iron intake, and have been described elsewhere.[2]

Nearly all of the copper is bound in some manner to protein. About two-thirds of the element is split off by trichloracetic acid and about the same amount is removed in the diethyldithiocarbamate procedure, so the binding is apparently not a very firm one. As in the instance of plasma iron, only a small amount of the copper is found tied to the globulin fraction of proteins. The fact that such a small amount of the copper is in the dialyzable fraction suggests that very little of the metal is likely in an ionizable form. Again, as in the case of the plasma iron, the data do not show whether we are dealing with true salt formation or whether the protein tie-up is one of adsorption.

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Inhibition in the Slow Muscle of the Scallop, *Pecten circularis aequisulcatus* Carpenter.

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(Introduced by C. A. G. Wiersma.)

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The adductor muscle of Pecten consists of two parts, the larger of which is responsible for the rapid movements during swimming, and the smaller, which contracts slowly, is responsible for keeping the valves closed. The peculiarities of this muscle have been studied repeatedly.[1, 2, 3] A satisfactory answer has not been given to the question of how the slow muscle can withstand rather large tensions for indefinite periods without appreciable fatigue and at the same time be able to relax very quickly when necessary.

Reflex Relaxation. In Pecten stimulation of the mouth in a normal animal leads to rapid relaxation of the slow muscle. In our experience the sensitive area for this reflex is much wider than hitherto

[1] Uexkuell, J. von, *Z. f. Biol.*, 1912, **58**, 305.

[2] Bayliss, L. E., Boyland, E., and Ritchie, A. D., *Proc. Roy. Soc.*, Series B, 1930, **106**, 363.

[3] Bozler, E., *Z. vergl. Physiol.*, 1930, **12**, 590.

reported, and includes all parts in the vicinity of, and innervated by the cerebral ganglion. Stimulation of the branchial nerves also leads to relaxation, although they do not connect directly with the cerebral ganglion, but with the visceral ganglion. That they nevertheless find their reflex center in the cerebral ganglion is shown by the fact that after cutting both cerebro-visceral commissures their stimulation elicits no relaxation of the slow muscle. As long as either commissure is intact, the reflex relaxation takes place. We were not able to find in this species the reported difference in action of the two commissures.[1, 2] As long as the nerve bands between the visceral ganglion and the slow muscle are intact, mechanical stimulation of these bands results in relaxation. This, too, is most likely reflex as this kind of stimulation becomes totally ineffective after cutting the bands.[2]

Peripheral Inhibition. The relaxation following a contraction produced by direct stimulation of isolated slow muscle is much slower than the relaxation observed when preganglionic mechanisms are stimulated. Pavlov[4] has claimed to have found peripheral inhibiting nerves in Anodonta which cause relaxation, but as Bayliss, *et al.*,[2] have pointed out, these experiments did not exclude the possibility of central inhibition. The muscles of the scallop are reported to be without an intrinsic ganglion system.[2, 5] If it can be shown, therefore, that some of the nerve fibers leading to the muscle have inhibiting properties, the existence of peripheral inhibiting fibers like those of crustacea[6] has to be accepted.

The slow muscle is innervated by two bands of nerves which run on the surface of the fast muscle from the ganglia and by other nerve fibers from the same source which lie in the region between these bands. It was found that by cutting the bands and the intermediate nerve fibers in different ways, preparations could be obtained with noteworthy properties. The most interesting of these is obtained by cutting every connection but the inside of one band. In such a preparation relaxation is obtained by any weak stimulation of the visceral ganglion itself, or of the more central elements of the nervous system. Also, after cutting all the nerves to the slow muscle, it has been possible to stimulate the peripheral ends of the band and obtain relaxation without the action of the ganglion.

If tone is increased in the slow muscle by any of several methods

[4] Pavlov, J., *Pflüger's Arch.*, 1885, **37**, 6.

[5] Drew, G. A., "The Habits, Anatomy and Embryology of the Giant Scallop," Univ. of Maine Studies, No. 6, 1906.

[6] Harreveld, A. van, and Wiersma, C. A. G., *J. Exp. Biol.*, 1937, **14**, 448.

(direct stimulation, by pressing the muscle together or by forcibly keeping the valves closed) it is found that this tone can be made to disappear by the same types of stimulation just described.

It has been possible to a certain extent to study the effect of simultaneous stimulation of the contraction and relaxation mechanisms of this muscle. It was found that small contractions can be completely suppressed. Stronger ones persist but are diminished in size and are slower in development. The relaxation of such contractions is faster than that of uninhibited ones, and after a purely inhibitory stimulation contractions are depressed for some time, showing that the inhibition mechanism outlasts the stimulus to a much greater extent than does the contraction mechanism. This may well be due to the presence in the muscle of a substance which disappears slowly and causes relaxation.

These results aid in clarifying the mechanism of contraction and relaxation of the slow muscle in Pecten. It now seems reasonable to conclude that some type of peripheral inhibitory nerve fibers exists.

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Effect of Anoxia on Blood Sugar in Adrenalectomized-Pancreatectomized Dogs.*

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In a previous investigation by the authors and their associates,[1] it was found that the blood sugar of adrenalectomized dogs was progressively decreased, frequently to hypoglycemic levels, as a result of their being made to breathe an atmosphere with a low oxygen content (5% to 9% O_2). In contrast with this response, normal animals in the post-absorptive state develop a sustained hyperglycemia[2] (as the dogs used in our previous experiments did before

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1 McQuarrie, I., Ziegler, M. R., Stone, W. E., Wangensteen, O. H., and Dennis, C., (a) PROC. SOC. EXP. BIOL. AND MED., 1939, **42**, 513; (b) *Chinese Med. J.*, 1940, **58**, 26.

2 Kelloway, C. H., *J. Physiol.*, 1919, **53**, 211.