ronic acid. In preparation of the extract, ether was used for extraction. Hexuronic acid is insoluble in ether.

These results may indicate that the adrenal cortex through cortin aids in the utilization of vitamin C.

6571

Effect of Cyanide, Hydrogen Sulphide and Carbon Monoxide on Response of Smooth Muscle to Drugs.

FRANCIS O. SCHMITT AND PAUL A. NICOLL.

From the Department of Zoology, Washington University.

Attention has been called to the fact that cyanide in low concentration may reversibly inhibit the stimulating action of drugs on the smooth muscle of rabbit uteri and intestinal strips.[1] The usual procedure* was to produce a contracture by the addition of a certain amount of drug to the solution bathing the muscle in the Trendelenberg apparatus. After washing out the drug, a solution of neutralized, buffered M/2000 NaCN was added. Three to 5 minutes later the drug was again added in the original concentration. This almost invariably failed to produce any contracture whatever. Washing and again testing the tissue with the same concentration of drug produced a contracture similar to that first obtained.

Garry[2] noted that the response of smooth muscle to certain drugs may be abolished by oxygen lack, and that the normal tonus of the strips was decreased by small amounts of cyanide. We find that cyanide in concentrations as low as M/200,000 is capable of exerting an inhibiting action on the response of the strips to drugs. This suggests the possibility that the effect may depend upon a heavy metal catalytic system such as Warburg has demonstrated to be involved in biological oxidation. To test this possibility we have studied the effect of hydrogen sulphide and of carbon monoxide on this system. Hydrogen sulphide in a concentration of M/2,000, completely blocked the action of acetyl choline (2×10^{-6}) on intestinal strips. Furthermore, it was found that mixtures of carbon monoxide and oxygen inhibited the action of adrenalin on uterus and of

[1] Schmitt, F. O., and Nicoll, P. A., *Am. J. Physiol.*, 1932, **101**, 91.

* The expenses of this investigation were defrayed in part by a Research Grant to Washington University by the Rockefeller Foundation.

[2] Garry, R. C., *J. Physiol.*, 1928, **66**, 235.

acetyl choline on the intestine in the dark in concentrations in which a mixture of nitrogen and oxygen of similar percentage composition had no such effect. This indicates that carbon monoxide acts specifically in this case, the action being independent of asphyxial complications due merely to an insufficiency of oxygen. If such a carbon monoxide-poisoned preparation which has responded feebly to a drug be illuminated there is a fairly immediate increase in contracture which lasts throughout the period of illumination and which returns to the initial level upon discontinuance of illumination.

Some 25 experiments were performed on the blocking action of cyanide, 10 on the blocking action of carbon monoxide, and 4 on the light reversal of the carbon monoxide block. In none of these experiments have we observed any exceptions to the blocking actions of these substances or its reversal by light, as described above.

It would appear that some mechanism is involved in the response of smooth muscle to drugs and possibly also to autonomic nerve impulses which has the characteristics of a heavy metal catalytic system.

6572

Relative Depressant Effects of Certain Barbiturates on Heart of Elasmobranchs.

GEORGE B. ROTH.

From the Department of Pharmacology, The George Washington University, and the Mt. Desert Biological Laboratory.

Apparently no comparative study has been made of the relative cardiac depressant effects of the widely used barbiturates, perhaps because the effects on the central nervous system are so pronounced, as compared with the effects on the heart, that attention centers largely on their central actions.

Opportunity was afforded for studying the relative degree of cardiac depression produced by certain barbiturates, nembutal (sodium ethyl-methyl barbiturate), amytal (sodium iso-amyl barbiturate; luminal (sodium phenyl-ethyl barbiturate), and veronal (sodium di-ethyl barbiturate).

The study was carried out on the isolated heart of elasmobranch fishes, chiefly the *Squalus acanthias* or spiny dogfish, which is admirably adapted for such a study. The number of animals used