sistently at a higher level and rising above the peak of the R wave, the latter appearing merely as a notch. The resulting complexes were bizarre. A.-V. block finally appeared. A shifting of the position of the auricular pacemaker was noted in P waves which became negative and returned to upright positive position. In one instance the auricular electrical phenomena continued, while in another the ventricular electrical changes continued after the auricle stopped.

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A structural characteristic of the cardiac poisons.

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Former investigations[1] have shown that strophanthidin is unsaturated and that the double bond is situated within the lactone ring, between the β and γ carbon atoms, so that strophanthidin may be designated as a $\Delta\beta$-γ crotonic lactone. Characteristic of strophanthidin and all of its derivatives which still possess this unsaturated lactone ring is their reducing action on Tollens' solution. On the other hand, dihydrostrophanthidin and its derivatives, or isostrophanthidin, in which the double has been either hydrogenated or shifted to another position, no longer react with Tollens' reagent, or at least far more gradually than in the case of strophanthidin and its derivatives. The behavior towards Tollens' solution is thus a very characteristic test for the unsaturated lactone group of these compounds.

Results of a similar and most striking character have been recently obtained by the use of the sodium nitroprusside test. Strophanthidin and all of its derivatives which still possess the unsaturated lactone ring give positive reactions with this reagent. But as soon as this group is hydrogenated or lost by saponifica-

[1] Jacobs, W. A., and Collins, A. M., *J. Biol. Chem.*, 1925, lxiv, 383; 1925, lxv, 493.

tion to the acid, the resulting substances no longer give this reaction.

In the course of structural studies with ouabain this substance has been found to be unsaturated since it absorbed two mols. of hydrogen with the formation of a tetrahydro derivative. It contains also a lactone group. Because of our experience with strophanthidin, it was of interest to establish the fact whether the lactone group and an unsaturated linking were associated. Ouabain was found to reduce Tollens' reagent and gave also a positive nitroprusside test. On the other hand, tetrahydroouabain failed to react with these reagents. After saponification ouabain likewise no longer reacted with sodium nitroprusside. There appears, therefore, to be a very strong indication that ouabain, like strophanthidin, possesses an unsaturated lactone group.

A similar study has been made of the behavior toward these reagents of the digitalis glucosides, digitoxin, and gitoxin which contain different although possibly related aglucones, respectively digitoxigenin and gitoxigenin. The latter has been demonstrated by Windaus and Schwarte[2] to be a lactone and also to be unsaturated. Although Kiliani had shown digitoxigenin to be a lactone, his hydrogenation experiments with the substance were unsuccessful.[3] However, if one adopts Cloetta's[4] formula, $C_{24}H_{36}O_4$, and the view that it is tetracyclic, it must contain one double bond and, therefore, like gitoxigenin, it is a lactone and at the same time unsaturated. We have studied the behavior of these substances towards Tollens' reagent and sodium nitroprusside and obtained definitely positive reactions in both cases. After gentle saponification, digitoxin and gitoxin no longer gave positive reactions with sodium nitroprusside. Here again the olefinic group must be associated with the lactone group, and there is a very strong suggestion that digitoxigenin and gitoxigenin also possess unsaturated lactone groups.

Of great importance in connection with these results is the interesting observation of Windaus, Bohne and Schwieger[5] that hydrogenation of the unsaturated group of digitalin (a glucoside

[2] Windaus, A., and Schwarte, G., *Ber. Chem. Ges.*, 1925, lviii, 1515.

[3] Kiliani, H., *Ber. Chem. Ges.*, 1918, li, 1631.

[4] Cloetta, M., *Arch. Exp. Path. Pharm.*, 1920, lxxxviii, 133.

[5] Windaus, A. Bohne, A., and Schwieger, A., *Ber. Chem. Ges.*, -924, lvii, 1386.

in all likelihood of gitoxigenin) renders the latter practically non-toxic. A few similar comparative toxicity tests which we have made with tetrahydroouabain have shown it to be at least one hundred times less toxic for frogs than ouabain.

From these observations there is a very strong suggestion that the aglucones of ouabain, the digitalis glucosides and perhaps of other substances of this pharmacological group such as bufotalin, possess, like strophanthidin, an unsaturated lactone group; and that this group may be essential, perhaps in conjunction with other structural features, for the pharmacodynamic action of these substances. We are at present attempting to ascertain by more direct chemical methods, as was accomplished in the case of strophanthidin, whether these substances are indeed inner esters of enolized ketones; and we are also attempting to substantiate by further work the suggested pharmacodynamic significance of the unsaturated lactone group.

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Availability of synthetic media for streptococci.

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Six hundred and seventy-one synthetic media were tested to determine their availability for streptococci. They may be grouped into three series: (1) those testing the availability of carbon compounds (carbohydrates and related substances, glycerol, and organic acids such as lactic, malic, tartaric and citric); (2) those testing the availability of nitrogen compounds (the common amino acids, caffeine, betaine, urea, and inorganic ammonium salts such as $(NH_4)_2CO_3$, NH_4Cl, $(NH_4)_2\ HPO_4$); (3) those testing the availability of some inorganic substances (compounds of Ca, Na, K, and Fe, and S). Most of the media were those previously used for other organisms by different in-