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The influence of light on the toxicity of quinidin and quinin sulphates.

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It is well known that solutions of quinin and quinidin sulphates are fluorescent. This fact suggested an inquiry into whether such solutions are as toxic in the dark as when exposed to light. Accordingly the present investigation was undertaken to settle this question. Such an inquiry was deemed to be worth while especially in view of the older observations by H. Tappeiner and O. Raab in 1900,[1] who noted that solutions of the dye *acridin* were much more toxic for paramœcia in sunlight than in the dark. The present author began his studies on frogs. An *aqueous* solution of quinidin sulphate was made. Various doses of the same were injected into the anterior lymph sacs of frogs and the effects of the drug were studied by exposing some frogs to light while keeping others in darkness. It was found that the quinidin solution was much more toxic when animals were exposed to sunlight than when they were kept in the dark. Thus for instance in one experiment a dose of quinidin sulphate, 0.5 mgm. per gm. weight, was injected into the anterior lymph sac of a *rana clamata*. Exactly the equivalent dose of quinidin from the same solution was injected into a second frog in the same way. The first frog was exposed to sunlight. It was found to be paralyzed 25 minutes after injection, and the heart was found to have been arrested completely 30 minutes after injection. The second frog was placed in a dark cupboard and was still alive 24 hours after the beginning of the experiment. Similar experiments with varying doses of quinidin were performed many times and a comparison of the data thus obtained clearly indicated that the toxicity of the drug was much greater when the frogs were exposed to sunlight. Insamuch as a difference in temperature may affect to some extent the condition of frogs, especially as regards their central nervous system, control experiments were made to determine

[1] *Zeit. f. Biologie*, 1900, xxxix, 37.

whether the above differences were due to the differences in temperature. This was shown not to be the case: it was the illumination and not the temperature which rendered the drug more toxic. Further experiments revealed that it was the light waves from the violet end of the spectrum that were the most effective in increasing the toxicity of quinidin. In still other experiments the rays of an electric arc lamp were utilized instead of sunlight and the same potentiation in toxicity was qualitatively noted. Finally a few experiments on excised frogs' hearts were performed and the results obtained so far have maintained the above findings.

In the above experiments an aqueous solution of quinidin was used because quinidin solutions are known to lose much of their fluorescence when alkalis or even sodium chloride are added to them. Tests made however by adding various amounts of blood serum and even sodium chloride to solutions of quinidin sulphate indicated that while these decreased the fluorescence markedly they did not abolish it completely; and it was further found that even such poorly fluorescent substances showed the difference in toxicity as between light and darkness described above.

Quinin solutions were found to behave in much the same way as those of quinidin. It may also be added that the toxic effect on frogs appears much more rapidly if the animals are placed in such a position as to allow the sunlight to fall directly on the white unpigmented skin of the abdomen, instead of the pigmented skin of the rest of the body. Further and more extensive work on the subject is in progress and will be continued. The present note is published as a preliminary communication and in order to fix priority of date of discovery.

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The therapeutic effect of germanium dioxide in anemia.

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The erythropoietic action of germanium dioxide in animals and in one normal man was demonstrated by Hammett and