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Ultraviolet Radiation Needed to Cure Rickets with Respect to Area of Skin Exposed.*

ARTHUR KNUDSON.

From the Department of Biochemistry, Medical Department of Union University, Albany Medical College.

Information upon the amount of radiation needed to cure rickets with respect to the area exposed is very meagre. Maughan and Dye[1] have shown that in chickens only a small amount of radiation is necessary to cure rickets and that the area covered by the feathers receives very little or perhaps none of the beneficial rays.

Eighteen rats at 4 weeks of age were put upon the Steenbock rachitic diet 2965 and after 21 days, having developed a severe degree of rickets, were ready for treatment. Treatment was continued for 21 days and degree of healing was judged by radiographic examination. As a source of ultraviolet radiation the General Electric Sunlamp with the Type S1 bulb was used. Previous studies had shown that exposure of the whole rat 30 minutes per day to the G. E. Sunlamp at 3 feet brought about complete healing of rickets in 3 weeks' time.

It was found that very little radiation is effective through the hair of the rat as an exposure of 2 square inches of unshaved back of the rat for 40 minutes daily produced only a beginning healing. Irradiation of the skin of the rat is much more effective as an exposure of one-fourth square inch of shaved back of rat for 20 minutes daily at 3 feet brought about complete healing of rickets in 3 weeks. Irradiation of this area of the skin produces greater healing of rickets than exposure of the whole animal for the same length of time. According to recent work of Diack[2] on the surface area of rats, this area of one-fourth square inch amounts to about one-eightieth of total surface area. It is surprising that such a small fraction of the total surface area of the rat can absorb sufficient of the rays to heal rickets. It is also surprising to note that the total amount of ultraviolet energy below 3200 A° needed to cure rickets in the rats is not more than 1.2 small calories.

In another series of experiments with 20 rats, it was found that

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[1] Maughan, G. H., and Dye, J. A., *J. Opt. Soc. Amer.*, 1930, **20**, 279.

[2] Diack, S. L., *J. Nutrition*, 1930, **3**, 289.

the amount of radiation needed to cure rickets is directly proportional to the area of skin exposed. Thus an exposure of one-fourth square inch of skin for 20 minutes daily heals rickets completely in 3 weeks and similar results were obtained with an exposure of one square inch for 5 minutes, 2 square inches for 2.5 minutes or one-eighth square inch for 40 minutes daily.

In a third series of experiments with 14 rats it was noted that the total irradiation which was found by daily exposure to produce complete healing can be given in as little as 2 exposures 10 days apart.

These experiments emphasize how very little ultraviolet radiation is needed to cure or prevent rickets. Assuming that a similar relationship holds for humans as has been shown in the case of the rat, it is apparent that much smaller amounts of ultraviolet radiation will be effective in preventing or curing rickets than has hitherto been appreciated.

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Heparin in Blood Calcium Analyses.

G. WALTERMANN HOLT. (Introduced by Esther M. Greisheimer.)

From the Department of Physiology, University of Minnesota.

Many investigators have assumed that the calcium of heparin is not available for oxalate precipitation, as performed in the Clark-Collip[1] modification of the Kramer-Tisdall[2] method. Interest in this question was aroused by the difference of opinion of various workers regarding the concentration of calcium in serum and in heparin plasma. Cantarow,[3] in a series of 100 determinations, using heparin as an anticoagulant, found that the calcium level was 0.5 mg. to 1.0 mg. less in each 100 cc. of plasma than in the corresponding serum. Greisheimer and Arnold,[4] and Loucks and Scott[5] have published data on this question.

In the present study several different samples of heparin were used. Heparin was added to redistilled water, to calcium chloride solutions, to plasma, and to serum. These heparinized solutions,

[1] Clark, E. P., and Collip, J. B., *J. Biol. Chem.*, 1925, **63**, 461.

[2] Kramer, B., and Tisdall, F. F., *J. Biol. Chem.*, 1921, **47**, 475.

[3] Cantarow, A., Calcium metabolism and calcium therapy, 1931, 36.

[4] Greisheimer, Esther M., and Arnold, A. W., *Am. Rev. Tuberc.*, 1926, **14**, 479.

[5] Loucks, M. M., and Scott, F. H., *Am. J. Physiol.*, 1929, **91**, 27.