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**Amount of Ultra-violet Radiation Necessary to Cure Rickets.**

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It has been amply proved that ultra-violet radiations have value in the cure and prevention of disease. Wave lengths of therapeutic value may vary for different diseases, but for rickets the band having a high antirachitic potency is a comparatively narrow one centering around line 2968 A. U.

The depth of penetration of the "vital rays" into the skin is perhaps not greater than  $1\frac{1}{2}$  mm., 95% of the rays being absorbed by the more superficial layers. Some of them do not penetrate the corneum. However, the most superficial blood vessels and nerves of the skin are within 0.2 of a mm. of the surface and are no doubt reached by many of the rays, such as the shortest received from the sun (2900 A. U.).

Rickets, a disease characterized by low blood calcium, lack of bone formation, low metabolism, retarded development, and weakness, responds so promptly and with such uniformity to irradiations from a source of known strength, that results can be predicted with almost the exactness of a chemical reaction.

In experimental and clinical work it has been the usual practice, in the past, to give much longer irradiations than are necessary. After four years experimenting with the problems of the minimum dose of ultra-violet rays necessary for satisfactory results in cure of rickets in chickens, we felt justified in making the following conclusions:

There was a total of 459 animals distributed among 7 series and 44 groups.

1. At a lamp floor distance of  $22\frac{1}{2}$  inches, one minute daily irradiation will bring about 95% cure in 28 days. It takes approximately 28 days to cure a severe form of the disease in chickens, no matter how much the irradiation is increased. At 30 inches about double this length of exposure is needed to bring about the same result. This corresponds to the law which states that the intensity is inversely proportional to the square of the distance.

When the total exposure was  $37\frac{1}{2}$  minutes, the chickens recovered about as rapidly if the treatments were given weekly instead of daily.

2. The benefit received from irradiation is proportional to the

unfeathered area exposed. Female chickens between 4 and 10 weeks of age require about double the irradiation needed for male birds of the same age. This is because the combs of the females are still small and rudimentary. Those of the males have usually begun to develop at 4 to 5 weeks, and have good circulation. The greater improvement of the males, when short exposures are given, is due to the greater uncovered area of their bodies and not to a sex difference.

The feathers of chickens prevent the rays from reaching the body.

Exposure of the unfeathered parts of the legs to ultra-violet rays, for 5 minutes daily, caused as rapid recovery as "total irradiation" for the same length of time.

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### Experiments on Pleural Permeability.

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In connection with an extensive study on pleural effusions, it became necessary to collect data on the permeability of the normal pleura. Experimental data from the literature indicate a high degree of permeability; and Hamburger<sup>1</sup> in particular states that intraperitoneally or intrapericardially injected fluids are quickly changed to isotonicity with the blood serum and are then promptly resorbed. But we did not find any quantitative data which would answer our problem.

Several series of experiments on rabbits were performed; they all reveal, in accordance with previous workers, a very high degree of permeability of the pleural membrane. Two representative series of experiments will suffice to show the ready exchange which takes place between pleural cavity and blood.

In the first experiments the right pleural cavity of 9 rabbits was injected with 10 cc. of sterile, distilled water. The animals were killed 5, 7½, 15, 30, 45, 60, 120, 180, and 240 minutes after the injection. All fluid in the right pleural cavity was collected immediately, measured and examined (depending on a sufficient amount) for chlorides, glucose, sodium, calcium, nonprotein nitrogen, total serum nitrogen, magnesium and potassium. Immediately before death, a sufficient amount of blood was obtained from the carotid

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<sup>1</sup> Hamburger, H. J., *Arch. f. Anat. u. Physiol., Physiol. Abtlg.*, 1895, 281.