creased respiration 300 per cent. An hydrogen atmosphere (no precautions were taken to free the gas from traces of oxygen and CO_2) reduced respiration to 50 per cent. Reducing the atmospheric pressure 5-10 per cent. has no appreciable effect on respiration, while increasing the pressure 10 per cent. has a stimulating effect.

The ratio between the sulfur oxidized and carbon assimilated by the culture is about 32, this ratio varying greatly by changing the conditions of growth and by adding various depressive substances. The presence of nitrates, for example, greatly increases the ratio. When thiosulfate is used as a source of energy the ratio is about 65. Of the total amount of energy made available only about 6.5 per cent. is utilized by the organism. The amount of energy utilized by the nitrite and nitrate bacteria is about 5 per cent. These quantities in comparison with the low utilization of energy by higher plants point to the greater efficiency of the autotrophic bacteria.

4 (1964)

A study of light waves in relation to their protective action in rickets

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In a communication presented a year ago we showed that rickets can be prevented in rats by daily exposures to direct sunlight for about fifteen minutes[1]. A similar result was reported at the same time by others[2]. When rats were placed in a box having flint glass windows it was found that the sun's rays, in traversing the glass, had lost their protective power. In a later communication it was shown that the pigment of the skin also hinders the action of the effective rays, that black rats require more radiation than do white rats[3].

1 Hess, A. F., Unger, L. J., Pappenheimer, A. M., PROC. SOC. EXP. BIOL. AND MED., 1921, xix, 8.

2 Shipley, P. G., Park, E. A., Powers, G. F., McCollum, E. V., PROC. SOC. EXP. BIOL. AND MED., 1921, xix, 43.

3 Hess, A. F., Unger, L. J., Pappenheimer, A. M., PROC. SOC. EXP. BIOL. AND MED., 1922, xix, 238.

These experiments have been extended to ascertain more nearly the wave lengths which exert the protective action. For this purpose glass filters have been used. These filters are manufactured by the Corning Glass Works and have been tested by this establishment and by the United States Bureau of Standards, both in regard to the wave lengths which they transmit, and their percentage of transmission[4]. In this work white rats have been used which were fed the standard rickets-producing dietary (No. 84). Previous experiments have shown that rats on this dietary can be protected against rickets by daily irradiation for two minutes or less, by the mercury vapor quartz lamp at a distance of three feet with a voltage of 76 (a unit dose). The method of procedure was to interpose the various filters and to ascertain to what extent they altered the protective action of the light at exposures of varying intensity. The animals were radiographed after an interval of about 21 days, and killed after 28 days. The interpretation of rickets was based on a microscopic examination of the epiphyses.

The accompanying chart illustrates a series of experiments with various filters. The first (G38H) did not transmit waves shorter than 475$\mu\mu$. It will be noted that protection was not afforded, although irradiation was carried out for 60 minutes at a distance of only 9 inches (480 units; the protective dose being about 2 minutes at 36 inches). Window glass which transmitted rays as short as 334$\mu\mu$ also obstructed the protective rays. Filter G586A allowed the passage of a very small percentage of rays as short as 313$\mu\mu$, and a very small percentage of 302$\mu\mu$ rays. With this filter protection was afforded when long exposures were resorted to. Pyrex glass which transmits a much larger percentage of rays of 313$\mu\mu$, as well as shorter rays, interfered but slightly with the action of the mercury vapor lamp.

From these experiments we may conclude that rays as long as 334$\mu\mu$ have little or no protective action in rickets and that the effective rays begin in the neighborhood of 310$\mu\mu$. The degrees of transmission of the various wave lengths will be discussed in detail in the full report of this work.

The experiment with filter G86B is of special interest. This filter transmits short rays of about the same wave lengths and

[4] Technologic Papers of the Bureau of Standards, No. 119 and 148, also Scientific Paper No. 325.

intensity as does G586A. It will be noted, however, that when the latter was used rickets did not develop with long exposures, whereas when G86B was interposed marked rickets developed, even with exposures of 60 minutes at a distance of 9 inches. The chief difference between these filters is that G86B, which is a nearly neutral filter, allows far more of the longer visible rays to pass than does G586A, which is a purple filter. Further experiments are in progress to ascertain whether the interference of visible rays can account for these divergent results.

Filters of various clothing material were also employed. It was found that woolen as well as cotton goods interfered with the activity of the light in proportion to their thickness, but did not prevent protection if the dosage of irradiation was made adequate. Black cotton material filtered out the protective rays to an extent greater than white material of the same weave.

5 (1965)

The mechanism of bacteriostasis.

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The effect of bactericidal agents is often tested by adding these substances to the media on which the organisms are planted; and the assumption is usually made that if the substances, when present in the media, exhibit a selective hostility to bacteria they will exhibit a hostility—selective in the same sense—when added directly to the organisms themselves. This assumption is usually justified by the facts; no single exception to such a parallelism has been met with in the large number of experiments made with gentian violet and allied tri-phenylmethanes. We are in the habit therefore of reasoning from experiments which test bacteriostasis to conclusions as to bactericidal value, at least so far as selective features are concerned.

Proof will here be presented to show that this sort of reasoning is not always justified by the facts. Suppose for example that we plant *B. prodigiosus* and *B. megatherium* on acid fuchsin agar and find that *B. prodigiosus* grows well and *B. megatherium*