quite constant (within 2½%, which is about the limit of error of method).

As a check and an alternative method for total base in pancreatic juice we have used the freezing point depression and here also the ratio Δ/T.B. ran very nearly constant.

The total base content of the pancreatic juice is very constant from animal to animal, being a few milli-equivalents higher than that of the plasma, and during depletion of plasma base, decreases proportionately. Under these same conditions, the urine is decreased very markedly in both volume and total base. As a secreting gland, therefore, the pancreas takes precedence over the kidney in its lien on both water and base, as may be seen from metabolism experiment on dog 48. This dog was on a diet containing about 30.7 milli-equivalents of total base per day. Before operation a 24-hour urine contained 29.0 milli-equivalents. Five days after operation the urine contained 14.2 milli-equivalents of base, while 39.5 milli-equivalents were lost through juice secretion. After 3 days more, pancreatic secretion had practically ceased owing to a plugged canula, and 24.5 milli-equivalents of base were found in urine.

The symptoms observed, although due to loss of electrolyte, are not dependent simply on the electrolyte level in the plasma. The rate of change is a large factor. Under conditions of slow dehydration the animal may, without any symptoms, attain a low level of electrolyte, which would be fatal if the change were a rapid one.

4909

The Killing of Moulds by an Ordinary Electric Bulb.*

BASILE J. LUYET. (Introduced by Ross G. Harrison.)

From the Osborn Zoological Laboratory, Yale University.

Darkness provides optimum condition for the growth of moulds, and ultraviolet rays exert a rapid and violent fungicidal effect on them, but one does not usually suspect the extreme sensitiveness of the *Mucoraceae* to the feeble light of an ordinary electric lamp. Our

* This work was done under a Seessell fellowship grant. The ultraviolet lamp was provided by Hanovia Company, through the Committee of the National Research Council on the Effects of Radiation on Living Organisms. *Mucoraceae* pure cultures were kindly supplied by Dr. A. F. Blakeslee, of the Carnegie Institution.

attention has been drawn to this point by the fact that *Mucoraceae* cultures, while on our experimenting table, awaiting examination, have been killed by the light of the microscope lamp.

Spores of *Rhizopus nigricans,* in suspension in sterilized water, were spread, by means of a soft brush, on the surface of agarized Coon's medium,† sterilized and distributed in a series of Petri dishes. These cultures were irradiated, through the glass covers of the dishes, by the light of an ordinary bulb, labeled: "Westinghouse, Mazda, 60 W, 115 V." and working on direct current. There was a distance of 5 cm. between the cultures and the luminous filament. An electric fan cooled the dishes and excluded the influence of heat.

Irradiations were made as follows: 1. Half an hour after the inoculation with the spores, that is, before any germination. 2. At the end of 15 hours, when the sprouts were some mm. long. 3. At the end of 30 hours, when the length of the mycelium exceeded 1 cm. 4. At the end of 40 hours, when the sporangia have developed. (These stages of growth are attained in the indicated intervals at a temperature of 22°C.)

Under these conditions we have observed, in 15 different experiments, that 20 to 30 minutes exposure destroyed the spores, that 5 to 8 minutes killed the mycelium of 15 to 30 hours, but that 5 hours irradiation were not sufficient to cause the death of sporangia.

This method of destroying moulds will possibly be of practical application. But, while light can thus be used as an excellent preventive against the sprouting of *Mucoraceae,* the resistance of sporangia to irradiation excludes its use as a curative agent after the mustiness has already developed.

In other experiments, variously colored screens were interposed between the bulb and the culture and it has been possible, despite these rather dark screens, to destroy the mycelium of the same moulds by exposures varying in duration from 5 to 30 minutes. These observations are but preliminary trials of a more complete study, now in progress, of the minimal lethal dose for each wavelength.

Coextensive with the experiments just described, similar ones were performed with ultraviolet light. We used a mercury arc lamp, working with 4 amperes and 60 volts, on direct current. The duration of exposure varied from 5 to 120 seconds. The distance between the lamp and the culture was 30 cm. The dishes were without cover during the irradiation. Observations were made on single

† $MgSO_4$: gr. 0.5; KH_2PO_3 : gr. 1.36; Asparagine : gr. 0.26; Maltose : gr. 3.6; water : gr. 1000.

individuals. After locating a germinating spore, under the microscope, by a small dot of ink placed adjacent to it, we followed its growth by a series of camera lucida drawings, all or half of each Petri dish having been exposed to the light. One hundred and seven experiments have thus been made, 42 on spores, 54 on mycelia and 11 on sporangia.

Under these conditions, 45 seconds irradiation brought about death of the spores, 15 to 45 seconds produced a delay in their germination and growth, and 10 seconds were absolutely ineffective. The same effects were produced on mycelia by 25, 5 to 25, and 4 seconds exposure, respectively. Mature sporangia, removed from the sporangiophores, have been irradiated singly, on a glass slide, for 3 hours. After exposure, germination proceeded normally.

The slowing up in growth, noticed after irradiation of spores and mycelium, is an increasing function of the period of exposure. We observed, in particular, that the greater the exposure the greater was the delay in appearance of sporangia. The radiosensitivity of mycelia did not vary, in these experiments, with their age.

The difference in sensitiveness to ultraviolet light between spores, mycelium and sporangia, already described for *Mucor hiemalis* in a previous notice,[1] has thus been confirmed here in *Rhizopus nigricans,* and extended to the wave-lengths of visible light.‡

4910

A Comparative Study of the Total Red Counts of Wild and Liver-fed Trout.

CHRISTIANNA SMITH. (Introduced by A. E. Adams.)

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Because of the use of liver as a food for young trout, it was suggested to the writer that a comparative study of the blood of wild and liver-fed trout might show the reaction of normal and growing animals to liver. Although the data are limited, the results indicate an increase in the total red counts of liver-fed trout.

Method. It is well known that fish blood is difficult to work with

[1] Luyet, B., *C. R. Soc. Phys. Hist. Nat. Genêve,* xlvi, 2, 107.

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