trated HCl, may be used as the stock solution for a perfusion fluid which has proved highly satisfactory for dogfish and skate hearts. Preparatory to its actual use, this modified sea-water must be diluted as follows:

Modified sea-water	30 cc.
Urea, 20 per cent. sol.	10 cc.
Distilled water	60 cc.

The acidity will then need to be adjusted with dilute HCl to pH 7.4, to correspond with the pH of elasmobranch serum. The diluted mixture compares favorably in its physiological effects with Knowlton solution, the standard artificial salt-mixture for elasmobranch tissue; and it has the advantage of being much simpler and cheaper to make up.

Determinations of the Ca and Mg content of solutions prepared in this way yielded the following results. Unmodified sea-water similarly diluted and Knowlton solution are included in the table for comparison:

	Ca-Mols/liter	Mg-Mols/liter
Modified sea-water (a)	.0020	.0037
" " " (b)	.0019	.0046
" " " (c)	.0021	.0042
Plain sea-water	.0032	.0145
Knowlton solution	.0040	.0050

A detailed study of the precipitation of Ca and Mg from sea-water by NaOH[3] shows that the removal of more Mg entails the loss of so much Ca and the gain of so much Na that the physiological salt-balance is destroyed. It is therefore impossible to extend the foregoing technique to the preparation of a medium suitable for land-vertebrates.

ELEANOR M. KAPP

MARINE BIOLOGICAL LABORATORY,
WOODS HOLE

SPECIAL ARTICLES

THE SEXUAL STAGE OF FUNGI INDUCED BY ULTRA-VIOLET RAYS

ON January 29, 1928, while studying the effect of ultra-violet radiation of fungi in agar plate cultures radiated on January 25, it was noted that perithecia, the sexual stage of the fungus, had formed in great numbers on certain portions of the exposed plates.

The fungus under consideration was one, our laboratory number "G 10," of several strains of *Glomerella cingulata* that have been under close observation for some months. This culture was originally derived from apples affected with Bitter Rot and in October a single conidium was isolated in my laboratory. All cultures of "G 10" since that time have been from this monosporous strain. In no case were perithecia observed to develop on this monosporous strain.

This same essentially non-sexual strain in all agar cultures exposed to ultra-violet rays of certain intensity and for certain time develops perithecia literally by millions. Thus in the plate represented in the figure more than one hundred perithecia were visible in one focus of one low power field of the microscope or more than 1,500 on the exposed region of this small colony. It will be observed that no perithecia developed in the non-radiated part. Perhaps the most striking evidence that the radiation induces the perithecia was given by projecting the rays through a circular aperture of 0.5 mm. diameter upon a susceptible colony. The perithecia developed in great quantities in the small area radiated and only in that area. Their origins are visible two days after radiation as hyaline globose bodies and they can probably be traced to a much earlier time, since unusual branching is apparent within a few hours after radiation. In four days they appear as well-developed, spherical black bodies; asci and spores soon form. The perithecia differ from those naturally formed in that they are spherical and non-stromatic, but the asci and spores agree precisely with those found in nature.

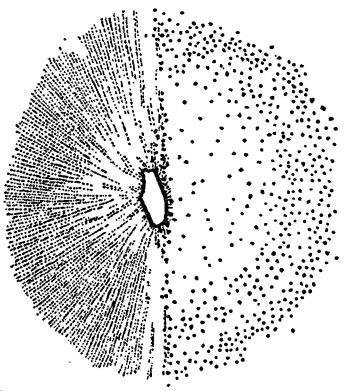

FIG. 1. Portion at right directly radiated; at left not so. Dotted region is perithecial; these on the right induced by direct radiation, the few at the left by indirect radiation.

All other strains of Glomerella that have been tested have given responses like those of "G 10." It appears certain that these ultra-violet rays or others near them have also a greatly accelerating effect on conidial production in this and other genera of fungi, for example, a Coniothyrium that normally produces pycnidia only at the end of several weeks and when the colony has completely occupied the petri dish, when radiated responds within a few days with numerous pycnidia.

[3] Kapp, E. M., Unpublished.

Exposure was to full radiation from a Cooper Hewitt quartz mercury arc, half of the colony shaded with cardboard to serve as a control. Two kinds of radiation resulted in perithecia: a, direct rays upon the exposed half of the colony, which resulted in perithecia deeply buried in the agar; b, indirect rays diffused to a few millimeters under the edge of the cardboard shield, which gave superficial perithecia.

The activating region of the spectrum has been determined by means of various screens as in the far ultra-violet, probably between the Ångstrom wave-lengths of 2760 and 3130.

That the effect is not the result of a chemical change produced in the medium by the radiation, but is a direct response by the mycelial cells to radiation, is rendered extremely probable by the results of several experiments directed to this special question.

Studies are now being made to determine the exact wave-lengths involved and the effect of these rays upon other species and genera of fungi both of the Ascomycetes and Fungi Imperfecti; the relation of the age of the mycelium to its susceptibility to stimulation; and the various steps in the development of the perithecium from the time of stimulation onward.

A presentation of this study was made at the meeting of the Illinois Academy of Science in April and a more complete account will be published soon in the *Botanical Gazette*.

F. L. STEVENS

UNIVERSITY OF ILLINOIS

THE AMIDE NITROGEN OF BLOOD

WHEN it was established by Folin and Denis[1] that blood contains exceedingly small quantities of ammonia, it became necessary to consider whether or not such amounts were capable of furnishing the ammonia found in urine by simple excretion by the kidney.

Nash and Benedict[2] reasoned that the kidney must form the ammonia it excretes because they found no increases in blood ammonia with kidney ablation, and increases in urinary ammonia seemed to be unaccompanied by significant increases in the ammonia content of blood. Their belief in the special ammonia-forming function of the kidney was strengthened by their observation that the blood leaving the kidney is richer in ammonia than the blood that enters it.

The subsequent finding of Bliss[3] that other organs, notably the pancreas, show increases of ammonia in the blood leaving the organ suggested that ammonia formation, instead of being limited to the kidney, is a general tissue phenomenon.

He was not only able to demonstrate accumulations of ammonia in the blood of nephrectomized dogs, but found that such dogs only maintain low levels of blood ammonia concurrently with the elimination, by way of vomitus, of amounts of ammonia quantitatively comparable to their normal urinary excretion of ammonia.

While unsuccessful attempts have been made to demonstrate the existence of complex ammonia combinations in blood, this phase of the subject has now been studied with very favorable results. The demonstration of ammonia in a form not yielded by the ordinary methods, yet available within the body under the influence of enzyme action, would clear up a large body of facts already known about ammonia metabolism.

It seemed that the kidney might possess an enzyme that is capable of liberating ammonia from its combination in blood, and the search for such an enzyme revealed its presence.

The determination of ammonia that is obtained from blood by the use of this new kidney enzyme furnishes amounts of ammonia approximately a thousand times the old value—and for human blood the value is 115–125 mg instead of 0.05 to 0.10 mg nitrogen per 100 cc blood.

When purified casein was tried as a possible substrate for the enzyme, ammonia was liberated in appreciable amounts.

Using casein as a substrate, the new enzyme was compared with trypsin as to the rate of formation of amino-nitrogen and ammonia. Hunter and Smith[4] found that 37 per cent. of the casein nitrogen was in the form of amino-nitrogen after twenty-four hours' contact with trypsin, while the kidney enzyme liberated somewhat less than that amount in three days. A comparison of the formation of ammonia from casein by both enzymes shows that the kidney enzyme is much more specific for ammonia formation. Trypsin yielded 0.8 per cent. of the total casein nitrogen as ammonia in twenty-four hours, and 4.26 per cent. in eighty-eight days, while the kidney enzyme liberated more (5.1 per cent.) in four days than had trypsin in eighty-eight days (4.26 per cent.).

Hunter and Smith say:

> The absence of relation, in our experiments, between peptolysis and amidolysis is so conspicuous that these processes would really seem to have been catalyzed by two separate enzymes. We venture accordingly to suggest, as a working hypothesis, that the liberation of the

[1] Folin, O., and Denis, W., *J. Biol. Chem.*, xi, 161 (1912).

[2] Nash, T. P., Jr., and Benedict, S. R., *J. Biol. Chem.*, 1921, xlviii, 463.

[3] Bliss, Sidney, *J. Biol. Chem.*, 1926, lxvii, 109.

[4] Hunter, Andrew, and Smith, Ralph G., *J. Biol. Chem.*, 1924, lxii, 649.