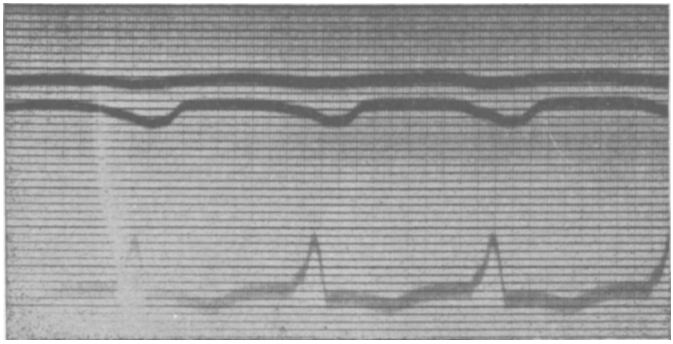

FIG. 2.

Nodal rhythm and depressed intraventricular conductivity under strophanthus. Coordinates as above.

sign of depressed intraventricular conductivity. These observations permit us to describe the action of a digitalis body as purely myotropic, having the same effects in the cold blooded heart denervated by chloral hydrate, as in the normal organ. These preliminary statements will be followed up by a report including particularly the bathmotropic and tonotropic reactions of the chloralized heart to digitalis substances.

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Cataphoresis of ultramicroscopic particles in protoplasm.

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The cataphoresis of microscopic granules suspended in the fluid protoplasm of various cells was years ago recorded by several observers (Carlgren,[1] Pearl,[2] and others).

Recently, I have succeeded in demonstrating the cataphoresis not only of microscopic granules, but also of ultramicroscopic particles in the fluid plasmodia of the slime-mould *Stemonitis elegans.*

[1] Carlgren, *Archiv. f. Anat. u. Physiol.*, 1900, 49.

[2] Pearl, *Am. J. Physiol.*, 1900, iv, 96.

This Myxomycete is an excellent object for a prolonged study of the structure and behavior of living matter and for experimental observations under highest magnification. It will, moreover, continue its plasmodial stage for months under a bell-jar in the laboratory, if the conditions of moisture, temperature (about 20°C.) and light (free from direct sunlight) are kept reasonably constant.

Cataphoresis of microscopic granules.

If a portion of one of the newly-formed pseudopodia be carefully excised and mounted in a shallow hanging drop on a cover slip, which is then inverted over a moist chamber, with transmitted light one may observe in the protoplasm numerous microscopic granules of various shapes and sizes. Especially the smaller granules exhibit dancing, Brownian movements such as to indicate a distinctly fluid consistency of the protoplasm.

Upon applying a weak direct current (of about 0.02 of an ampere) by means of non-polarizable micro-electrodes, these smaller, oscillating granules gradually migrate toward the anode. If the induced current be very little more than that of 0.02 of an ampere, or if other conditions such as temperature, viscosity and probably additional factors not yet definitely determined be not optimal, migration of the granules may be markedly deterred, or it may not occur.

Cataphoresis of ultramicroscopic particles.

The protoplasm of Myxomycetes may easily be freed from most of its microscopic granules by allowing the plasmodium to migrate through a bit of moist, loosely packed cotton (Lister[3]). Indeed, granule-free pseudopodia quite readily creep up an inclined cover slip against water dropping from a suspended capillary tube. The coverslip is then carefully removed, with a suitable portion of the plasmodium remaining intact, and inverted over the moist chamber for observation and experiment.

Demonstration of the cataphoresis of ultramicroscopic particles was made with dark-field illumination and by means of an exceedingly weak, direct current (4×10^{-6} amperes) which was applied through especially designed, very minute, non-polarizable

[3] Lister, A., 1888. Notes on the plasmodium of *Badhannia utricularis* and *Brefeldia maxima*. *Ann. Bot.*, ii, 1.

micro-electrodes. (Tips of the micro-electrodes were 1-2μ in diameter).

An 8-ampere arc light, the heat rays of which were screened out by two water filters, was the source of illumination.

The lens system used was that of a modern Leitz mono-objective binocular which included 15X oculars and a 1/7A oil immersion objective, giving a magnification of about 1200 diameters. The dark-field condenser was one recently devised for use with a moist chamber which stands about 5 mm. above the stage of the microscope.

This equipment, when carefully adjusted, reveals in the more or less granule-free, fluid protoplasm of *Stemonitis,* hosts of ultramicroscopic particles displaying exceedingly active Brownian movement.

Upon inserting the micro-electrodes into the protoplasm at points well inside the boundary of the microscopic field, an initial marked effect is usually obvious: Brownian movement of the ultramicroscopic particles ceases, and at times one gets the impression of a clustering of these particles into numerous groups; at any rate, a decided increase in the viscosity of the protoplasm is evident. Within a minute or so, however, Brownian movement reappears, quite as active as before the insertion of the micro-electrodes.

If now an exceedingly weak, direct current (of about 4×10^{-6} amperes) is applied, a most interesting and probably very significant phenomenon soon appears: The ultramicroscopic, dancing particles begin migration. But unlike the microscopic granules which migrated only toward the anode, these ultramicroscopic particles migrate, some toward the anode and some toward the cathode. And if the current be prolonged for some 15-20 seconds, one observes also a considerable group of the particles, still in rapid Brownian movement, remaining about the center of the field. These show no tendency of migration toward either electrode, and so are apparently electrically neutral.

The unique behavior of these ultramicroscopic particles in the protoplasm of *Stemonitis* suggests an interesting analogy in the recent findings of Foster and Schmidt[4] who were able to isolate the amino-acid histidine from arginine and lysine, depending upon the acidity of the protein hydrolysate, by means of the electric current.

[4] Foster and Schmidt, *J. Biol. Chem.*, 1923, lvi, 545.

It may be inferred that these particles in the protoplasm of *Stemonitis* which, it will be noted, are apparently of colloidal dimensions, are possibly protein in nature and an integral part of the living substance.

It is of considerable theoretical interest to note also that, since particles of similar dimensions have in recent years been observed in the protoplasm of various cells, it is reasonable to assume that the specific behavior of the colloidal particles in this slime-mold may prove to be of general fundamental importance in further study of the colloidal properties of protoplasm.

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Compensatory hypertrophy of the kidney: The effect of pregnancy and of lactation.

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The stimulus to compensatory hypertrophy was given by the removal of one kidney from a rat. The degree of hypertrophy was measured by comparing the weight of the remaining kidney forty days after the operation with the weight of the kidney of rats in which one kidney had been exposed but not removed. This value is expressed as a percentage. Thus if the weight of one kidney of the control rat was 1000 mg. and the weight of the remaining kidney in the nephrectomised rat was 1300 mg., the degree of compensatory hypertrophy was 30 per cent. The percentages given are the averages of groups of rats. It was intended that there should be 25 rats in each group, but since all of the animals did not become pregnant at the expected time this number was not reached in all of the experiments. The diet used was adequate for growth and for reproduction and contained 17.8 per cent of protein, 24.9 per cent of fat, and 42.2 per cent of carbohydrate. The amount of food taken was nearly the same in all experiments except in the lactation experiment. In this instance the caloric intake rose from 25 calories to 90 calories per 100 grams of body weight per day.