Since there are no valves in the anterior part of the tube and the anterior end is unguarded and freely open into the heart sinuses, it would seem that the forward movement of the blood is the result of differential pressures produced by the passing of peristaltic waves as supported by the valves guarding the ostia. In confirmation of this is the easily observed fact of the pouring in of the blood stream through the ostia during the relaxation stages of the heart tube.

At the wide open anterior end of the cardiac tube the blood flow shows a rhythmic slight backward movement followed by a more pronounced onward rush synchronous with the heart beat. The phenomenon is more clearly observed when accentuated by pressure of the cover slip on an animal mounted in a culture slide.

The blood flow in the body lacunar spaces: The flow in the body cavity and in the appendages is broadly speaking from the cephalic toward the caudal region. But the rate of flow from time to time in particular regions, and to no small extent the direction of flow, varies with the body movements. When the plane of focus is varied between that of the body cavity in the mid-length at the superior surface of the alimentary canal and the slightly deeper plane, blood corpuscles are seen moving along the sides and surface of the gut in a general caudal direction. If a contraction of the digestive tube occurs, then broad fields of corpuscles sweep across the canal surface from one side to the other, now in one direction and now the other.

In the caudal third of the body-cavity well-marked streams of blood are to be observed on each side of the canal that sweep down into the tail lymph spaces and swirl about to enter the lateral as well as the caudal or terminal ostium of the heart. The lateral ostia are clearly marked by entering streams of blood from these two main currents. One can think of these lacunae as pericardial in type, in the sense in which the term is used in the higher crustacean types—crabs, crayfishes, etc.

The blood flow in the appendages: The outward flow of body fluid into the appendages is in more definite channels, and more rapid and constant, especially in the more anterior pairs—the eye stalks, the antennae and the first two or three pairs of legs. In the leg segments, especially in the so-called respiratory plates, the lacunae often form quite definite capillary-like patterns. The blood can be observed to flow out in the larger of these, usually to one side, and back in adjacent and smaller spaces, sometimes on the opposite side of the appendage. However, in the peripheral regions the flow is often reversed, and varies greatly in speed from time to time in particular spaces. Observing different regions at the same time, the variation in rate of flow in symmetrical appendages is a striking fact. This fact seems largely to depend on the mechanical influence of general body movements.

The activity of the heart, the movements of the respiratory appendages and of the alimentary canal all furnish splendid physiological indexes for interpreting the immediate physiological effects of variations in environmental conditions.

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THE REPRODUCTIVE CYCLE OF THE CHARACEAE

A SINGLE tuft of a very interesting species of *Nitella* (as yet undescribed) was found by me several years ago in a pool on the grounds of this university, and the same species has recently been located in a greater quantity elsewhere in this vicinity. Its most striking peculiarity is that the antheridium is divided into longitudinal quadrants only. I had never felt satisfied with my knowledge of this organ and the mode of its development, and its much greater simplicity in this new species led me to undertake its careful study, as well as that of the oogonium.

I had made some substantial progress in this when my work was interrupted for a few years by circumstances that need not be detailed here. I took it up again last summer and have this year devoted my entire time to it for nearly three months. I have now begun upon a comparative study of a member of the same genus in which the antheridium has the classical division into octants. It is my purpose to follow this with a similar study of species of at least two of the other genera that compose the family of the Characeae. I hope to be able in the near future to publish a detailed account of my results. In the meantime I feel that some of those that I have already obtained will be of interest as throwing light upon this peculiarly aberrant group of plants. They refer, of course, to this particular species.

The first of these is the fact that the plant-body, with its very definite structure, is in the diploid phase (the "2x-generation"), differing in that important respect from any of the Green Algae (as far as we know).

The second, and most important, is the location of the reduction divisions in both the oogonium and the antheridium. This takes place in the apical cell, at a very early stage, in the primordium of each organ. This cell, in the oogonium, soon becomes elongated transversely and assumes an ovoid shape in becoming the oocyte: it rests directly upon a nodal cell, which gives off the five sheath-cells and then divides no farther, becoming the stalk-cell of the oogonium. By the time the tips of the earlier sheath-cells have reached the level of the oocyte the latter divides at its smaller end, which is directed slightly upward: the new cell, which is soon separated by a distinct wall, is the first polar body. Very soon after the nucleus of the oocyte divides again in a direction at right angles to the first division, that is, downward and slightly to one side, and the new cell is separated by a distinct wall; it is the second polar body. The new "mature" ovum soon elongates vertically, its nucleus assuming its characteristic position near the base.

The rapid enlargement of the ovum and the inward pressure of the upper ends of the sheath-cells (which have already begun to form the corona) cause the first polar body to move toward the base: on its way it sooner or later divides to form the two secondary polar bodies. This completes the formation of the three famous "wendungszellen" (which, as will be seen, are *not* formed by three successive divisions of the oocyte).

In the antheridial primordium the apical cell early becomes swollen and elongated. The nucleus then divides in a horizontal plane: and this is immediately followed by a second division in the same plane, but at right angles to the first: both divisions take place before any indication of parting walls are seen, the four resulting "resting" nuclei being located in a horizontal group at equal distances from each other in the cytoplasm of the single enlarged mother-cell. The longitudinal parting walls soon follow, thus completing the formation of the quadrant cells. This is the reduction division; and all that now follows is in the haploid phase (the "x-generation"). The further development of the antheridium shows in this species some interesting features that have not yet been noted, but I will not discuss them here, except to say that in this species the total number of spermatic filaments does not exceed sixteen, two being given off by each of the four capitula, and two from each of the four capitella. This can be clearly seen until the filaments become so long and so much intermingled as to fill the entire cavity and hide the basal cells from sight. No branching of the filaments has been observed.

The counting of the chromosomes is very difficult, owing to their small size and their crowding in the very small mitotic figures. Repeated counts, which have in most cases been independently corroborated by colleagues familiar with such work, give 15 (or 16) for the haploid and 30 (or 32) for the diploid phase.

This preliminary notice has been published for two reasons. The first of these (as has been already indicated) is that it may be of interest and service to those who desire to know more about this unique group of plants. The second is that, for the comparative study that I purpose to make, I am in need of material and of assistance in obtaining it. I am very desirous of obtaining well-fixed material of any dioecious species of *Nitella*. One species of *Chara* I have located in an adjoining county; but I should be glad to have other species. I am particularly desirous to get some good material of *Tolypella,* which I have not yet been able to find, here or elsewhere. I should be more than glad to see and study plants of either of the three remaining genera of the family, but they are very rare. Any one, therefore, who can conveniently help me to obtain well-fixed material of either of the three principal genera of the group will do me a great kindness.

It is now probably too late for securing good material in which the formation of the reproductive structures is still going on, except in the more southern regions of this country. I hope, however, that this request for assistance will be borne in mind next season by some of those living in more northern regions where such material can then be obtained.

A few words regarding its preparation. It is essential that the fixing solution be carried to the place of collection and the plants (or tips of large plants) put into it at once. Any good fixing mixture that penetrates (and therefore kills) quickly will serve. Thorough washing should be at once followed by successive alcohols up to 70 per cent.

The material should then be sent by express at my expense to me at the address given below.

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THE PLASTICITY SYMPOSIUM AT LAFAYETTE COLLEGE

PROGRAM of the Plasticity Symposium held at Lafayette College on October 17, Professor Harry N. Holmes, presiding.

Introduction: EUGENE C. BINGHAM, Lafayette College.

Emulsions: HARRY N. HOLMES, Oberlin College.

The plasticity of single crystals as related to their crystal structure: WHEELER P. DAVEY, General Electric Research Laboratory.

The plasticity of clay: WILDER D. BANCROFT and LEON E. JENKS, Cornell University.

The Ostwald viscometer as a consistometer: WINSLOW H. HERSCHEL, United States Bureau of Standards.

Plasticity in relation to gelatine: S. E. SHEPPARD, Eastman Kodak Company Research Laboratory.