

relative positions of the two liquids by the clock movement, and the accompanying agitation, were found to overcome these inconveniences. Unfortunately, this device was hit upon only after numerous experiments, and when the investigation was almost completed. The transference from benzole to paraffine was effected in a stationary dialyzer, or by evaporating off the benzole in a water-bath, from a ten per cent. solution of paraffine in benzole. Celloidin embedding has also great advantages, but as the material has to be cut into slices not thicker than two millimetres at most, and as the prothallia were often nearly twenty millimeters in length, it was only employed for sections through certain regions of the gametophyte, and for the much less impenetrable young sporophyte. The stains chiefly used were either a combination of alum-cochineal and eosin, or aqueous saffranin, made by dropping a small amount of saturated alcoholic solution of equal parts of Grübler's alcohol and water soluble saffranins. This last method seems worthy of a wider application.

#### IV.

The youngest prothallia obtained were already two millimetres in length by one and a-half in breadth. As may be seen from figure 1, they are of flattened oval shape, and covered with hairs. The growing point is at the narrow thin end, and the prothallium thickens and widens from thence backwards. *Antheridia* alone are found at this stage, and are entirely confined to the upper surface of the gametophyte. They form a cluster at the older end, but thin out into a narrow median row as they extend forward towards the growing point, figure 1, *ar.* In somewhat larger and older plants, the median row of *antheridia* is raised on the crest of a distinct ridge, and the *archegonia* begin to make their appearance upon its sides, figure 2. The antheridial ridge is a marked feature of most of the older prothallia, and must have the same significance in the process of fertilization as the inferior archegonial prominence possesses in the leptosporangiate *Filicinae*. In more mature individuals the ridge is obliterated, especially in the posterior region of the prothallus, by the more rapid growth of the sides of the latter, which seems to be a provision for the nourishment of the fertilized *archegonia*. This phenomenon probably is the cause of the antheridial ridge not being noticed by Campbell<sup>9</sup>. Figure 3 shows a plant in which an embryo, *em.*, has already reached a considerable size. The antheridial prominence is still very marked; the root-hairs, however, have largely disappeared. In figure 5, we have a somewhat younger stage with the rhizoids still abundantly present, especially in the

<sup>9</sup> Op. Cit.