

its terminal meristem are elongated cells which, later, give rise to fibro-vascular tissues. The cotyledon, *c*, is also for the first time visible, and beside it is the stem-meristem, *s*. Below is the very massive foot, *f*. Figure 50, lithographed from a photomicrograph, represents a still later stage of development. Here the root is almost ready to burst the *calyptra*, *cal*. The cotyledon is distinctly seen, and at this stage, for the first time, covers over the stem-apex, which now lies on the side of a transverse fissure. No vascular tissue appears till the root has grown to a length varying from five to twenty millimetres, and has burst the *calyptra*. The first tracheides arise in the proximal region of the root after it has emerged from the prothallium. Subsequently they make their appearance in the cotyledon and the stem-axis.

Before referring to the further developmental changes in the nascent sporophyte, it will be well to consider an interesting abnormality. In figure 51 is represented part of a prothallus in which tracheides are present, near a region of superficial decay. The decayed spot probably marks the position of an embryo which has been injured and in consequence has rotted away. So far as I have been able to learn, by reference to the literature on the subject, such prothallial tracheides are the invariable accompaniment of apogamy. Their presence was first described in connection with this phenomenon by Farlow²⁴ in the apogamous prothallia of *Pteris cretica*. They have since been seen by many observers under similar conditions. Lang²⁵ has recently found them in the interesting reduced, apogamous, sporangiferous sporophytes of *Lastrea dilatata*, Presl, var. *Cristata gracilis*, Roberts and *Scolopendrium vulgare*, L., var. *ramulosissimum*, Woll. According to Bower, tracheides also occur in the prothallia [endosperm] of certain Cycads. In view of the recent discoveries of antherozoids in the pollen-tubes of this group, it would be interesting to know if the Cycads also manifest the phenomenon of apogamy.

The example figured is the only occurrence of prothallial tracheides which has come under my notice in examining a large number of gametophytes. In this case both *antheridia* and *archegonia* were present. Recently an example of apogamy in *Pteris aquilina* has come under my observation in which an apogamous and a normal embryo were produced side by side on the same archegonial pad. The former was accompanied by a single prothallial tracheid. The apparent rarity of the phenomenon in *Botrychium virginianum* may be due to the conditions under which the Metis specimens, which I have almost exclusively

24. Quarterly Journal of Microscopical Science, vol. xiv., N.S., p. 266.

25. Annals of Botany, vol. xi., pp. 157-168; also, Proc. of Royal Society of London,