The further steps in this study will require the preparation of antisera for these sera by the injection of rabbits, and the testing of such precipitating antisera with all the available Crustacean bloods. It is important in this analysis that the precipitin reactions be performed with really comparable antigens and that the influence of lipoids on the reactions be accurately estimated and corrected. With such precautions evidence is accumulating that the serological data may yield measurements of protein similarities in related species of value to the student of animal relationships.

THE DEVELOPMENT OF THE LEAF AND SPOROCARP OF *REGNELLIDIUM* LIND

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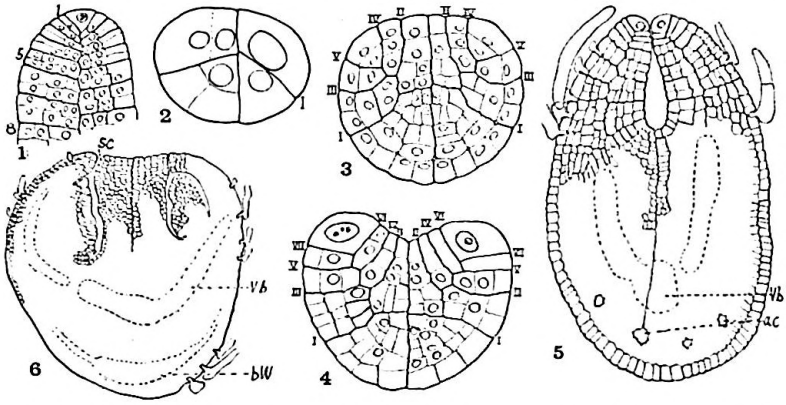
A complete study of the vegetative and reproductive structures of this rediscovered monotypic Brazilian water fern is being made. Last summer's work at Salsbury Cove was devoted to the younger stages of the leaf and of the sporocarp arising from its petiole.

The leaf of *Regnellidium* is developed by a bifacial apical cell (Fig. 1) formed near the dorsal midline of the creeping stem. The first 25 ± semicircular segments of this initial are cut to 5 sectors each, by 5 radial anticlines formed in a regular sequence (Figs. 1, 2, 3). Then each of the sectors and the marginal cell left between the last two sectors are, in the segments forming the petiole, cut by periclines and further anticlines (Fig. 3) to form the epidermis, the central vascular strand and the intermediate parenchyma tissues of the mature leaf stalk. In the 2 or 3 pairs of segments of the leaf initial (Fig. 4) that form the *single* pair of pinnae of the leaf the cutting-off of sectors from the marginal cell continues (Fig. 5) until some 20 + sectors have been cut off from each of the two edges of the marginal cell. Thus are formed the two reniform rounded pinnae which come to lie face to face. Beyond the two pinnae, the leaf initial cuts off several more series of segments (making a total of 30 ± in the whole leaf). These last segments, however, do not form a second distal pair of pinnae here as they do in *Marsilea*. There is no evidence from the development that a proximal pair of leaflets has disappeared, as has been suggested.

The sporocarp of *Regnellidium* is likewise formed by a bifacial initial arising at the base of the petiole. This initial cuts off alternately to right and left some 25 + segments, which in the region of the capsule, are cut by 7 or 8 sector walls to leave a marginal cell between the last 2 walls. Then certain definite marginal cells, distributed along the length of the capsule, elongate radially and divide tangentially to give rise to the radial rows of megasporangia and microsporangia in each of the 6 or 7 sori in each half of the capsule (Fig. 6). Meantime, the sectors formed on the ventral and dorsal sides of these marginal cells grow vigorously in the ventral direction

and so bury the sporangium initials deep in the middle of the capsule, at the inner end of the soral canal that at first opens to the ventral surface by a distinct pore (Fig. 6). The capsule, then, being developed from alternating segments of a bifacial initial, having a like number of sori on each side of the median plane, each sorus with its long axis parallel to this plane and perpendicular to the long axis of the capsule, is a clearly zygomorphic, or bilaterally symmetrical structure closely comparable with the capsule of *Marsilea*.



Description of Figures of Regnellidium diphyllum: Fig. 1. Longitudinal section to young leaf near dorsal surface ⊥ to median plane; showing initial cell with its segments numbered from 1 to 8 on left. x 140. Fig. 2. Approximately transverse section near tip of very young leaf; showing semi-circular form of segments of leaf initial and the first "sector wall" or longitudinal anticline. x 250. Fig. 3. Transverse section of petiole of young leaf showing all 5 sector walls (I to V) in each half; the periclines that end the activity of the marginal cells after wall V is formed. x 200. Fig. 4. Transverse section of upper portion of leaf; showing the initiation of pinnae by continued activity of the marginal cell till 7 sectors have thus far been formed. x 200. Fig. 5. Transverse section of older leaf through two pinnae formed by the cutting off of some 20 sectors from the marginal cell. x 100. Fig. 6. Transverse section of 1/5-grown capsule showing several megasporangium initials, soral canals (S.C.) a portion of the thick inner "basal wall" of the capsule (b.w.) and trichomes on the surface. x 50.

In many details of structure of the mature capsule also the likeness to *Marsilea* is clear. There is the same "S" shaped bend of the vascular bundle of the peduncle as it enters the capsule; the same overlap of a narrow flap of the much-thickened hypodermis from the dorsal part of the capsule over an under-flap from the ventral side. The plan of the vascular bundle system within the capsule is very similar to that in *Marsilea*. The somewhat radial arrangement of the sori in a section transverse to them recalls *Pilularia globulifera*.

There is here no more evidence from the development of leaf and capsule than is found in *Marsilea* for the view that the walls of the capsule are to be thought of as infolded pinnae. The enclosing wall of the capsule is in both cases developed in an entirely distinct manner, not at all closely like the process of development of the

leaflets of the sterile leaf by the persistent formation of sectors on *both* edges of the very numerous marginal cells. This is evident from a comparison of figures 5 and 6.

A COMPARISON OF PARALDEHYDE, CHLORAL HYDRATE AND SODIUM ISOAMYL ETHYL BARBITURATE ON THE HEART OF THE SPINY DOGFISH

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Previous studies made in this laboratory showed that the isolated sinoauricular-ventricular preparation from the spiny dogfish (*Squalus acanthias*), when suspended in a balanced saline solution, was well adapted for ascertaining the comparative effects of chemical agents (Roth 1932, 1933, 1935).

The present report deals with a study made during the summer of 1936 through use of the above-mentioned dogfish preparation, in which a comparison was made graphically of the relative toxic effects of paraldehyde,* chloral hydrate and sodium isoamyl ethyl barbiturate.* The details of the method are essentially similar to those previously reported (Roth 1932) except that the temperature of the saline solution was maintained 16 degrees Centigrade.

The saline solution contained 1.5 per cent of sodium chloride; 0.04 per cent of potassium chloride; 0.03 per cent of calcium chloride (anhydrous); 0.051 per cent of magnesium chloride (anhydrous); 2 per cent urea; 0.1 per cent of sodium bicarbonate and sufficient sodium acid phosphate to bring the pH to 7.55.

Comparison of the hypnotic agents was made either by using (1) the drugs alternately on the same preparation, or (2) each drug on a fresh preparation.

It was found that by the first method the order of depression was as follows: most depressant, sodium isoamyl ethyl barbiturate; least depressant, paraldehyde. Chloral hydrate was intermediate in its depressant activity, approaching paraldehyde in toxicity rather than that of the barbiturate.

The latter method attempted to determine quantitatively the relative depressant activity of the three compounds, using as a criterion the amount of drug that would stop rhythm in 30 to 50 per cent of the preparations within one hour.

By this means it was found that for the barbiturate, 10 mgm. was required; for chloral hydrate, 100-165 mgm.; and for paraldehyde, 530 mgm. On the basis of the actual amounts of each agent used, paraldehyde would, therefore, be about one-fiftieth as toxic as the barbiturate and about one-fourth as toxic as chloral hydrate.

* Paraldehyde was generously furnished by the Niacet Chemicals Corp.; the barbiturate by Eli Lilly & Co.