paraffine for twenty-four hours, then into pure paraffine (48° C.) for twenty-four hours. On being sectioned this material showed but little, if any, improvement over the material treated with turpentine.

The next medium used was xylol. Heads dehydrated by absolute alcohol were placed in xylol for twenty-four hours, then into a mixture of one-half xylol and one-half paraffine for twenty-four hours, then into pure paraffine (48° C.) for twenty-four hours. When sectioned on a Heidelberg microtome the heads were found to be well infiltrated and made fine ribbons. A series of experiments was then begun on heads dehydrated by absolute alcohol, giving them shorter time periods. It was found that heads treated with xylol for three and one-half hours, then to a mixture of one-half xylol and one-half paraffine for two hours, then to pure paraffine (48° C.) for two and one-half hours, were infiltrated, and sectioned just as well as heads which had had the extended time treatment.

The conclusions to be drawn seem to be, first, that large heads of composites may be stained successfully in toto, but to insure success a long time is necessary. Incidentally it may be said that, so far as tests made have gone, alum cochineal gives decidedly the best differential stain.

Second, that successful infiltration can be made in a time as short as eight hours by the use of xylol, a longer treatment being unnecessary. That a treatment with turpentine and a mixture of cedar oil and xylol, as far as Vernonia is concerned, gives unsuccessful results with the normal sized heads. Cedar oil alone was not tried, nor are the experiments as to methods yet completed. They are given, however, in the hope that suggestions may be made that will extend their scope and lead to more definite conclusions.

Embryology of the Ranunculaceae. By D. W. Mottier.

Certain Chemical Features in the Seeds of Plantago Virginica and P. Patagonica. By Alida M. Cunningham.

In the study of the genus *Plantago*, to ascertain the value of seed characters in determining specific rank, the peculiarities hereinafter described were noticed as among the results of some of the experiments. These results, in themselves, are perhaps of little or no value in determining the question under investigation, yet, they are so closely connected with the experiments, and altogether so peculiar as to warrant a somewhat extended research.

In the study of the seed characters of the genus *Plantago*, particular attention was given to outline and to the structure of the seed-coat, and it was necessary to make cross-sections of the seeds of each species. Preliminary to this the seeds of each were placed in water for a few hours, in order that they might be more easily sectioned, when the peculiar development of a blue color in *P. Virginica* was noticed. It was thought, at first, this might be due to some substance contained in the water used, so the experiment was repeated, using distilled water with the same unvarying results.

An examination of literature showed that, in all probability, it was a glucoside allied to Indican. This was further rendered probable because such substances are found in widely separated families, as *Euphorbia tinctoria*, and *Polygonum tinctoria*.

The indigo plant is destitute of color until treated with water. The broken and bruised plants are placed in vats, covered with water and allowed to ferment, and the indigo separates from the plants and is precipitated. Indican is soluble in boiling ether, boiling alcohol, glacial acetic acid, carbolic acid, petroleum, chloroform and hydrochloric acid

The seeds of *P. Virginica*, when dry, are golden yellow in color, and the cross section showed the cell contents to be colorless. Within three hours after being placed in water they had turned black on the surface, but an examination of a cross section showed the cell contents of the entire seed coat, except the outer row, the cell contents of the cotyledons and even the cell walls to be a bright blue color. Since this color was developed in a similar way to that by which Indican is produced, the tests for Indican were tried, giving the following results: After the color had been developed by water, thin sections were placed in 96 per cent. alcohol and boiled for ten minutes with no perceptible change. Sections were boiled for three minutes in ether without any change in color. Others were kept in glacial acetic acid for two hours with no change. Sections were kept in petroleum for twenty-four hours, and within that time the blue color was destroyed, leaving the cell contents colorless. The blue remained unchanged after a two hours' treatment with pure chloroform. Sections were kept in carbolic acid for two hours with no perceptible change. Hydrochloric acid destroyed the blue color within ten minutes, and left the cell contents colorless. After comparing these results with those of Indican, it was found that this blue substance in the seeds of *Virginica* resembles Indican in that it is developed in the same way and gives the same reactions with nitric and hydrochloric acids, sodic hydrate and petroleum. It differs from Indican, however, in being insoluble in boiling ether, boiling alcohol, glacial acetic acid, carbolic acid and chloroform.

In order to determine whether this substance was insoluble in presence of water, dry seeds were kept in cold alcohol for twenty-four hours, and during that time there was no change either in the color of the seeds or in the cell contents. The seeds were taken from the alcohol and placed in water, and within three hours they had turned black, and the blue was developed in the cells. Dry seeds were placed in glacial acetic acid, and within twenty-four hours they were turned a light yellow color and sections showed the cell contents to be colorless. These seeds were taken from the acid and kept in water for twelve hours, and during that time no further change took place. Dry seeds were placed in strong ammonia, and within twelve hours they had turned black on the surface and the cell contents were turned brown. After this treatment with ammonia, the seeds were kept in water for several hours, but no further change was perceptible. The dry seeds were kept in pure chloroform for three days, and during that time they retained their golden yellow color and the cell contents also remained colorless. Then they were taken from the chloroform and placed in water, and within three hours they had turned black, and the blue was developed in the cells.

After the color had been developed by water, sections were treated with nitric acid, and the blue color disappeared immediately, leaving the cell contents a yellowish brown color. The blue was turned green immediately upon being treated with sodic hydrate, but was changed to blue again within twelve hours after being placed in glycerine. On account of the small amount of material it was impossible to carry these experiments to a conclusion.

A blue substance is developed by water in the seeds of *P. Patagonica* also, but no chemical experiments were made upon these seeds.

P. Virginica and *P. Patagonica* were the only species examined in the genus *Plantago* which showed this peculiar development of color.

The test for this substance in the indigo plant itself was made upon an herbarium specimen and failed to produce it. The indigo plant must be taken at certain stages of its development in order to produce Indican, and such may be the case in *Plantago Virginica*.

Root System of Pogonia. By M. B. Thomas.

The genus Pogonia is a remarkably interesting group of orchids represented by five species in northeast North America out of a total of forty-three in the whole genus.

The species have a very wide distribution, being found throughout North America, Africa, eastern Asia, and, to a very limited extent, throughout Europe,