dustry in Illinois. Assistance is now being rendered to those who are engaged in or who are contemplating the development of the rock wool resources of the state.

Rock and Rock Products: A detailed study of the physical and chemical character of the limestones and dolomites of Illinois is being made along lines helpful to their uses in the construction, metallurgical, chemical and agricultural industries.

Fluorspar: The electrical resistivity method, supplemented by stratigraphic and structural studies, is being employed cooperatively with the U. S. Geological Survey in exploration for additional reserves of fluorspar in Hardin County. Laboratory studies are investigating the chemical properties of fluorine and the possibilities for its use in the manufacture of products having special properties, on account of the fluorine, that will make them widely useful.

Other Studies: Additional studies include: sand and gravel resources for farm-to-market roads; the completion of reports on intensive areal and economic geology studies of the Chicago region and other industrial areas; geological assistance in ground-water development; geological studies of highway engineering problems; economic analysis of the competitive position of Illinois coals in the Illinois coal market area; cooperation with the Geographic Society of Chicago in the preparation of a comprehensive geographic atlas of Illinois; and continuation of educational extension work.

This represents the normal research program of the Illinois Geological Survey. To maintain such a program and to meet the increasing call for information from industries, state departments and the citizens of the state, the staff is organized into: (1) a geological resource section with divisions in coal, oil and gas, non-fuels, areal and engineering geology, stratigraphy and paleontology, subsurface studies, petrography and physics; (2) a geochemistry section with divisions in fuels, non-fuels and analytical work; (3) a mineral economics section; (4) a topographic mapping section (in cooperation with the U. S. Geological Survey); and (5) a publications and records section. The survey's full-time technical staff numbers thirty-four; non-technical and clerical, eleven. The part-time staff, which reaches a maximum during the summer field season, ranges up to twenty-five.

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SPECIAL ARTICLES

NATURE OF CRYSTALS FOUND IN AMOEBA

THE crystalline inclusions of Protozoa, in particular Amoeba, have long been objects of study. A comprehensive review of the older literature is given by Schubotz.[1] From Schubotz's work to the present, little work has been done upon the nature and rôle of the crystals of Amoeba. These crystals have been held by various workers to be composed of calcium oxalate, calcium carbonate, leucin, calcium urate, calcium phosphate and a double salt of sodium and potassium phosphate. In structure the crystals have been described as octahedral, as doubly pyramidal, as many-sided bipyramids and as rhombic plates. Schubotz describes them as having "in most cases, the form of many-sided bipyramids with shortened poles or rhombic plates." He observes that they are doubly refractive, that they are colorless and range in size from 2 to 5 microns, and that they appear to lie directly in the plasma.

Our interest in the nature of these crystals arises from the fact that at certain times amoebae in culture are quite clear and have relatively few crystals, while as the culture grows older and the pH of the milieu rises toward neutrality, the crystals become very numerous, the water content of the organism apparently decreases markedly, and the amoebae become opaque to transmitted light. We undertook the determination of the chemical identity of the crystals in the hope that thereby we could understand their rôle in the metabolism of the organism.

The most prominent crystalline inclusions of Amoeba are tabular and six-sided and most probably belong to the orthorhombic system. There is a slight possibility that they belong to the tetragonal system. Their average size is approximately 2.5 microns in length, the range being from 0.5 to 3.5 microns. The corner angles of these polygons measure, on an average, 112°, and the lateral angles 142°, a total of 720° as against 732° for a regular six-sided polygon. Closer agreement could not be obtained because of the smallness of the crystals, and the fact that Becke lines obscure the exact outline of the crystal under the high magnification required. The crystals are doubly refractive. No interference figures were obtained upon study with the petrographical microscope. The crystals are colorless, although they appear to be yellow when viewed immersed in oil.

The index of refraction, as determined by the Becke method, using a mixture of methyl iodide and a-monobromnaphthalene, is 1.668. The refractive index of the liquid was determined in a standard sodium light (Na_D 589). The smallness of the crystals made a study of their Miller indices impossible.

The melting point is somewhere in the region of 290° C. This was determined approximately by

[1] H. Schubotz, *Arch. f. Protistenkunde*, 6: 1–46, 1905.

comparing the fusion point of the crystals with that of a known standard, in this case fumaric acid (M. P. 287° C.).

Several attempts were made to determine the pattern of the crystals by means of x-rays, the "scatter" method being used. Three early attempts were entirely negative. A fourth test, made with some 15,000 amoebae massed into a clump the size of a pin-head and exposed for fifty hours, resulted in a series of vague lines which are of doubtful value. An attempt to produce a single large crystal for such analysis failed.

Certain chemical tests have been carried out and are being continued. At present, taking into consideration the physical constants of the crystals and the results of the chemical tests already performed, it seems possible that these crystals may be composed of calcium chlorophosphate. We shall report further upon the subject.

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PLANT PIGMENTS AND REPRODUCTION[1]

THE suggestion of Murneek[2] that the amounts of carotinoid pigments in the plant may bear a significant relation to reproduction recalled to mind some unpublished measurements of the pigments in apple leaves in 1933 at the time of blossom bud differentiation which were given a different interpretation. A second series of samples were collected in October, 1934, from Wealthy trees. The results follow (Method of Schertz[3]):

TABLE I
PIGMENTS IN WEALTHY APPLE LEAVES, 1934

Vegetative condition	Fruiting condition	Milligrams per 100 sq. in. leaves: Chlorophyll	Carotene	Xanthophyll
"Under-vegetative"	Non-fruitful	6.08	0.225	0.545
Moderately vegetative	Fruitful	12.30	0.483	0.396
Same, girdled	Very fruitful	4.21	0.355	0.426
Strongly vegetative	Slightly fruitful	38.56	1.388	0.896
Same, girdled	Very fruitful	17.19	0.868	0.817
"Over-vegetative"	Non-fruitful	34.55	1.451	0.962

These data are similar to those of 1933 in that the presence of the three pigments measured is in general directly proportional. Also the carotinoid content is not related to fruitfulness, unless it be the intermediate contents. The samples were not collected at the period of blossom bud formation, but the relative colors in the early season remained the same in the fall except in the case of girdled branches.

The pigment content of leaves of beet, Datura and Maryland Mammoth tobacco plants in which fruitfulness was regulated by photoperiod treatments is given in Table II. These data further fail to indicate a correlation between the carotinoid pigments and fruitfulness.

TABLE II
PIGMENT CONTENT OF FRUITING AND NON-FRUITING PLANTS, APRIL, 1935

Plant	Condition	Milligrams per 100 sq. in. leaf area: Chlorophyll	Carotene	Xanthophyll
Tobacco (in sand)	Fruiting	18.4	0.55	1.29
	Vegetative	25.3	0.81	1.41
Tobacco (in soil)	Fruiting	31.8	1.03	2.14
	Vegetative	32.5	1.19	1.85
Beet	Fruiting	27.4	0.78	2.50
	Vegetative	31.5	0.82	...
Datura	Fruiting	21.5	0.78	1.41
	Vegetative	22.9	0.80	1.71

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[1] Published with the permission of the director of the Agricultural Experiment Station.
[2] A. E. Murneek, SCIENCE, 79: 528, 1934.
[3] F. M. Schertz, *Plant Phys.*, 3: 211–216, 1928.

THE CULTIVATION OF THE VIRUS OF ST. LOUIS ENCEPHALITIS

RECENT experimental work[1,2,4] has established a specific filterable virus as the etiological agent responsible for human epidemic encephalitis of the type encountered in St. Louis during 1933. Further, the susceptibility of the white mouse to the virus following its introduction by intracerebral or intranasal routes has been demonstrated.[2,3,4]

The object of this communication is to present evidence of successful *in vitro* propagation of the virus in the presence of living cells.

The brains of mice, dead or moribund following the intranasal instillation of the "Daily" strain of St. Louis encephalitis virus,[5] were used as a source of

[1] R. S. Muckenfuss, C. Armstrong and H. A. McCordock, Pub. Health Repts., U. S. P. H. S., 48: 1341, 1933.
[2] L. T. Webster and G. L. Fite, SCIENCE, 78: 463, 1933.
[3] C. Armstrong, Pub. Health Rept., U. S. P. H. S., 49: 959, 1934.
[4] L. T. Webster and G. L. Fite, *Jour. Exp. Med.*, 61: 103, 1935.
[5] We are indebted to Dr. Ralph S. Muckenfuss, Washington University School of Medicine, St. Louis, for the "Daily" strain of virus. Dr. Muckenfuss has written us that he obtained this strain originally in 1933 by inoculating brain tissue from a patient into *Macacus rhesus* monkeys. After 3 monkey passages, he carried the virus in mice, sending it to us in glycerolated mouse brain suspension. We transferred the virus serially by intracerebral and intranasal inoculations into Swiss mice through 9 generations before undertaking the cultivation experiments.