sessions. The various contributions cover a wide variety of hydrobiological subjects relating to inland waters, including not only the biological aspects but also the geological, physical, chemical and sanitary phases of this field of science.

The limnological papers deal with the sediments of natural and artificial lakes, the penetration of solar radiation into natural water, dissolved oxygen and lake types, aquatic bacteria in relation to the cycle of organic matter in lakes, trematode parasites of fresh-water snails, the rôle of aquatic fungi in hydrobiology, the limnological rôle of the higher plants, the photosynthesis of algae, the relation of hydrological conditions to speciation in fishes, the age and growth of fresh-water fishes, the fish production of inland lakes and streams, pond fish farming and the effect of pollution on fish life.

The sanitary contributions relate to swimming pool sanitation, water-borne diseases, the chemical treatment of lakes, the food economy of certain mosquito larvae, the relation of hydrobiology to malaria control, the significance of plankton in relation to the sanitary condition of streams, schistosome dermatitis and its control, the microbiology of sewage and sewage treatment and the biochemical relations in the activated sludge process of sewage treatment.

Most of the contributions carry illustrations and include generous bibliographies.

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REPORTS

THE OUTLOOK FOR EDUCATION[1]

A RISING public anxiety respecting the economic difficulties of the after-war period is shared by all our institutions, public and private. Colleges and universities are expected to find their income greatly decreased. Will fewer and fewer students be enrolled as the private incomes of parents shrink in a post-war period of deflation? Will some institutions have to be closed? Will federal support be required for continuation and is it desirable to receive or solicit it? Will the individual members of our faculties come to be as meanly supported as those of continental Europe in the two decades following 1918? Will courses of study tend to become narrowly "practical"?

I believe there are American-style answers to be made to these timorous questions. The post-war period may witness surprisingly great industrial and commercial expansion to satisfy enormous reconstruction and delayed consumption requirements. It is too early to prophesy doom and it is a grave disservice to assume it. In any event we have a sound pioneer tradition in education whose hall-mark is democratic *experiment*. Whatever we may have borrowed from Europe in ideas, materials and techniques, we can trace definite lines of experimentation directed down the years toward our own conditions. The first of these conditions is that education must be adapted to a democratic way of life. Our educational system did not become inclusive by accident. It did not expand by accident. It was an indispensable part of the avowed design of America in the colonial period and still more emphatically at the beginning of our national life. The bulwark of democracy was to be an educated electorate. We are absolutely committed to that course. An illiterate people will not and can not be united. Our union, to be either effective or free, must rest on understanding, and as "no one can know it all or miss it wholly," discussion and compromise are indispensable. Education to know America, to know its history, its social life, its industrial expansion, its artistic and literary creations, its scientific achievements, its power to work together on so vast a scale and at so high a level of efficiency—all this, and all our defects and colossal shortcomings as well—make an educational program that the American public, in our opinion, will sustain. The after-war period will require, as earlier periods of crisis have required, that our cultural institutions keep asking and attempting to answer the question, "How do we want to live in America?" This is the question and the experiment that unites us. There are two deadly dangers in education, the unquestioning acceptance of routine in teaching, and complacency with respect to existing standards and objectives of research. The spirit that maketh alive is compounded in part of free inquiry and controlled experiment; in part also of a high dissatisfaction with the limits of yesterday's horizon.

After this war is ended, whether or not we participate, America will not be like any other country in the world. It will still have more mechanical and electrical power per person by several hundred per cent., it will have its commitments to democracy and inter-group habits of cooperation, there will still be private property and private incomes, there will be a characteristically American outlook in which enterprise, hope and hard work will be blended.

More advanced experimentation will probably mark our educational policies in the post-war years. How can we deepen the study, within the university, of great human problems whose solution is the surest guarantee of the future unity and freedom of Amer-

[1] From the annual report of Dr. Isaiah Bowman, president of the Johns Hopkins University.

ica? It is the crowning distinction of the American university that it has built a worthy part of the national temple. While there may be confusion in confused minds concerning university purpose, could anything be clearer than that free inquiry and report is itself one of the greatest and most highly moral educational purposes in a democracy? The university is not designed to be authoritarian and say the last word in morals, ideas, research or teaching. We can avoid the authoritarian road only by choosing the free road. A body of prescribed doctrine, approved books, dialectical smartness and *a priori* opinion masquerading as "wisdom" can give "unity" also, as authoritarian governments have amply demonstrated. The strength of our American unity is in our free way of uniting. Our purpose is to train that freedom into responsibility. The growth of our educational program is due to the demonstrated need for the trained and responsible men and women we help to produce, with all faults of training and learning fully and freely admitted. In part our directive principles and powers grow out of what we find, in part out of a high court of moral judgment called informed opinion. No earthly device can make all our people wise or infallible in judgment. Wisdom that serves unity and fair social living is not an affair of graven tablets to be memorized, nor yet a delusion based on "ragged notions and babblements," but experience of the individual with the world after some thought about human experiences as recorded in the books by minds that are trained to be critical. "Scientific method" is one of several ways by which such training may be developed. We are not far enough advanced biologically to get assured wisdom at 21, as a result of some final scheme of formal education that has so far eluded us according to the critics.

SPECIAL ARTICLES

PYRIDOXINE AS A GROWTH FACTOR FOR GRAPHIUM

PYRIDOXINE (vitamin B_6) is known to be essential for the growth of excised plant roots,[1,2] for certain mutant strains of *Neurospora*,[3] and for the G.M. strain of yeast.[4] In connection with our studies on the vitamin requirements of fungi, an interesting example of pyridoxine deficiency has been found in cultures of *Graphium ulmi,* the organism which causes Dutch elm disease. This preliminary report on *Graphium* presents an example of the requirement of an accessory growth factor necessary for the life of a parasitic fungus. In view of recent work on chemotherapy by use of analogs which compete with natural growth factors in certain microorganisms causing diseases, it is hoped that this information may be of some use to phytopathologists who are attempting to control the Dutch elm disease.

The basal solution used for cultivating *Graphium* contained the following in one liter of triple distilled water: recrystallized asparagine, 4.0 gm; dextrose, 40 gm; KH_2PO_4, 1.5 gm; $MgSO_4 \cdot 7H_2O$, 0.5 gm; $CaCl_2 \cdot 2H_2O$, 0.1 gm. The elements, B, Mn, Zn, Cu, Mo and Fe were supplied in appropriately small quantities. Vitamins were added to this medium in the following amounts per liter: thiamin, 300γ; lactoflavin, 100γ; nicotinic acid, 500γ; pyridoxine, 200γ; inositol, 500γ; pantothen, 200γ; biotin, 0.4γ; and ascorbic acid, 500γ. The medium was dispensed into pyrex flasks, 25 ml per flask, and autoclaved at 15 pounds for 20 minutes. Inoculation was accomplished with bacteriological precautions by pipetting a drop of spore suspension into each flask. Growth was determined at the end of two weeks by weighing the washed and dried mycelium on filter paper.

A typical experiment was set up with basal medium to which no vitamins were added, basal medium containing the 8 vitamins, and a series of media in which one vitamin was omitted at a time to give 8 kinds of single deficiencies. Five replications were employed for each kind of medium. Growth was obvious only in the media containing pyridoxine. The presence or absence of the other accessory substances made little difference in growth. In another experiment each of the 8 vitamins was added singly to the basal medium in order to determine the effectiveness of each in the absence of the other 7 accessory factors. Growth occurred only in the medium which contained pyridoxine. It appears that *Graphium* is able to grow in the basal medium supplemented with only pyridoxine. Either these other vitamins are not essential, or what is more likely, the fungus synthesizes out of elementary compounds other factors which are necessary for growth.

TABLE 1

Pyridoxine gamma/liter	Dry weight of *Graphium* mg/flask
0.005	0.2
0.01	0.3
0.1	1.5
1.0	4.5
50.0	14.2
500.0	13.5

1 W. J. Robbins and M. B. Schmidt, *Proc. Nat. Acad. Sci., U. S. A.*, 25: 1, 1938.
2 J. Bonner, *Amer. Jour. Bot.*, 27: 692, 1940.
3 G. W. Beadle and E. L. Tatum, *Proc. Nat. Acad. Sci., U. S. A.*, 27: 499, 1941.
4 R. J. Williams, R. E. Eakin and J. R. McMahan, University of Texas Publication 4137: 24, 1941.