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FIFTY YEARS OF AMERICAN MATHEMATICS[1]

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IT is indeed a great honor to participate in this semi-centennial celebration of the founding of the New York Mathematical Society in 1888, which became in 1894 the American Mathematical Society. As one of the speakers I have set myself the challenging task of tracing our mathematical development under the auspices of the society during the years which have passed. Obviously in such a *coup d'oeil* only the principal factors involved can be alluded to, and the point of view adopted must necessarily be more or less personal.

At the very outset it is well to recall the general mathematical background of our country at the time when the society came into existence. In colonial days scientific and mathematical knowledge had a certain definite standing, largely for its practical value but in part also for its own sake. George Washington was a scientifically minded gentleman farmer for much of his life, and in his youth was a skilled surveyor, familiar with trigonometry; Benjamin Franklin discovered experimentally the electrical nature of the lightning discharge, theorized concerning electricity as a fluid, and had enough mathematical interest to devise ingenious magic squares; Thomas Jefferson regarded geometry and trigonometry as "most valuable to every man," algebra and logarithms as "often of value," while he classed "conic sections, curves of the higher orders, perhaps even spherical trigonometry, algebraic operations beyond the 2d dimension, and fluxions" as a "delicious luxury"; in his later years Jefferson spent much of his time in mathematical reading, and was ever a true friend of mathematics. The interest in science and mathematics continued to be genteel and amateurish among American scholars and devotees until towards the middle of the last cen-

[1] Opening portion of an address delivered at the semi-centennial celebration of the American Mathematical Society, New York City, September, 1938.

extracts the substrate, which is redissolved in water after the alcohol is evaporated off. Table 1 gives the oxygen uptake in c.mm. of the various combinations of enzyme, substrate and vanadium after half an hour at pH 6.7 and 37° C. 0.5 cc enzyme suspension and about 10 per cent. of the amount of substrate present in one guinea pig liver was used in a total volume of 2.0 cc in the Warburg vessels.

TABLE 1

	O_2 uptake c.mm.
Enzyme	0
Enzyme + vanadate	0
Vanadate + substrate	0
Enzyme + substrate	12
Enzyme + vanadate + substrate	119

Work on the chemical identification of the substrate is now proceeding. Experiments have shown that it is probably not an amino acid, amine, simple alcohol or aldehyde, purine, low fatty acid, choline, succinate, cholic acid, citrate, lactate, pyruvate, glucose or ascorbic acid. It is probably a phospholipid.

As vanadium is found in small traces in all tissues these results raise the question whether it has a normal catalytic function in the body and whether it is an essential element.

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A COMPARATIVE STUDY OF THE SUBTERRANEAN MEMBERS OF THREE FIELD GRASSES

A COMPARATIVE study was made of the roots and root hairs in upper soil levels for oats, winter-rye and Kentucky bluegrass. Soil samples 3 inches in diameter and 6 inches deep (42 cubic inches) were taken from the fields by means of a cutting tube, and measurements made of the included subterranean plant parts. Total lengths of both roots and root hairs were used in computing the extent and surface exposed by the underground members. In Tables 1 and 2 the values given are the average of the three soil samples surveyed for each species.

TABLE 1
ROOTS*

	Total number of roots	Total length of roots (ft.)	Total root surface (sq. in.)
Oats	4,700	150	50
Rye	6,400	210	78
Bluegrass	84,500	1,260	330

* Per soil sample (42 cubic inches).

In a comparison of the cultivated rye plants grown in competition with a non-competing greenhouse rye plant, previously surveyed,[1] it was found that the field rye had approximately 5 times the number of root hairs per unit of root length as the non-competing greenhouse plant. However, the indoor plant had far more and longer roots, and consequently a greater total number of root hairs.

TABLE 2
ROOT HAIRS*

	Total number of root hairs (in millions)	Total length of root hairs (miles)	Total root hair surface (sq. ft.)
Oats	6.3	4.9	3.7
Rye	12.5	10.0	8.2
Bluegrass	51.6	32.0	16.9

* Per soil sample (42 cubic inches).

Assuming that roots and root hairs were evenly distributed throughout the samples, one cubic inch of soil from this oats field would have approximately 110 roots and 150,000 root hairs, with a combined length of about 630 feet and a surface area of 15 square inches. A similar cube of soil from a field of winter rye would have approximately 150 roots and 300,000 root hairs with a combined length of 1,300 feet and a surface of about 30 square inches. Kentucky bluegrass would have, per cubic inch of soil, approximately 2,000 roots and 1,000,000 root hairs, with a combined length of over 4,000 feet and a surface area of about 65 square inches. When it is considered that these grasses have from 150,000 to 1,000,000 root hairs per cubic inch of soil their importance in the physics of the soil is obvious. From the standpoint of their usefulness as soil binders oats would be least efficient, rye intermediate and bluegrass far superior to either of the others in retarding erosion.

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[1] H. J. Dittmer, *Am. Jour. Bot.*, 24: 417–420, 1937.

BOOKS RECEIVED

AVERY, MADALYN. *Household Physics; A Textbook for College Students in Home Economics.* Pp. xv + 439. 378 figures. Macmillan. $3.50.

BAUGH, HANSELL, Editor. *General Semantics;* Papers from the First American Congress for General Semantics, Held at Ellensburg, Washington, March, 1935. Pp. 111. Arrow Editions, New York. $2.00.

JELLINEK, KARL. *Kurzes Lehrbuch der Physikalischen Chemie, Heft I.* Pp. 314. 163 figures. Æ. E. Kluwer, Deventer, Holland. Hfl. 8.50.

Onzième Congrès International de Psychologie, Paris, Juillet, 1937; Rapports et Comptes Rendus. Pp. 571. 25 plates. Imprimerie Moderne, Paris.

SEIFRIZ, WILLIAM. *The Physiology of Plants.* Pp. vii + 315. 95 figures. Wiley. $3.50.

STEINHAUS, H. *Mathematical Snapshots.* Pp. 135. 180 figures. Stechert. $2.50.

THOMPSON, H. W. *A Course in Chemical Spectroscopy.* Pp. vi + 86. 8 plates. Oxford University Press. $2.25.

WATSON, DAVID L. *Scientists Are Human.* Pp. xx + 249. Watts and Company, London. 7s. 6d.

YOUNGER, JOHN E. *Mechanics for Engineering Students.* Pp. x + 461. 362 figures. International Textbook Company. $3.50.