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EDWARD ORTON, GEOLOGIST*

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INTRODUCTION

SCIENTISTS whose names survive are associated mostly with innovations. Newton and gravitation, Darwin and evolution, Agassiz and glaciation, are inseparable. Recognition is seldom granted the humbler role of the interpreter. Now and again, however, there arises an interpreter whose knowledge is so broad, whose judgment is so sound, whose touch with common folk is so full of understanding and whose integrity is so far beyond reproach that recognition is given spontaneously.

Edward Orton was an interpreter. As one studies his life one finds that Orton's contributions to education, to the state and to science lay largely in the wisdom gained from the discoveries of others, in the perception of values and in the interpretation of them to his fellow men. His contributions in geology can be understood and appraised only by an examination of the man himself; hence this review of his career in science must include a survey of his early years.

I. EARLY YEARS

Edward Orton was born on March 9, 1829, when the presidency of the swashbuckling Andrew Jackson was but five days old. When he went to Hamilton College in 1845, conflict with Mexico was stirring emotions. All through his early years many conflicting views raged over political, economic and regional issues. The emotional tensions of people must have been similar in quality to those of our present day, the primary causes similar, though differing immensely in their applications. Candor in speech, honesty and objectivity in

* Part of an address delivered at the dedication of a monument and park—a memorial to Edward Orton—presented to the State of Ohio by Hugh Taylor Birch, of Yellow Springs, Ohio, October 26, 1938.

grow for varying lengths of time in a nutrient solution containing radiophosphorus (obtained through the courtesy of E. O. Lawrence) at the approximate concentration of 3.5 uc/cc. The bean seedlings had been previously grown without phosphorus, and at the time of use gave slight evidence of phosphorus deficiency by the dark color of the leaves. When placed in the solution containing radiophosphorus, the opposite leaves and the first alternate leaf appeared fully mature. The third alternate leaf was just unfolding.

The plants were placed, one after another, in the radiophosphorus containing nutrient solution. After the required interval of time the plant was removed, the roots carefully washed and the plant dissected and placed in the drying oven. When thoroughly dry the parts were ground to a fine powder and samples weighed for analysis. Each sample was placed in a thin Cellophane (du Pont #3100) cone, which was mounted immediately above the sensitive window of a Geiger counter. The Neher-Harper "High Speed Geiger-Counter Circuit"[2] in connection with "A Direct-Reading Counting Rate Meter for Random Pulses"[3] was used for detecting radiophosphorus in the plant samples. The results are shown in Table I.

TABLE I

DISTRIBUTION OF RADIOPHOSPHORUS IN VARIOUS PARTS OF BEAN SEEDLINGS

Length of time in solution	48 hrs.	24 hrs.	2½ hrs.
Mg. of sample used	4 mg. Counts/min.	10 mg. Counts/min.	10 mg. Counts/min.
Roots	2,364*	1,968	1,092
Hypocotyl } Stem }	804	744	228
		468	
Opposite leaves	1,104	504	144
First alternate leaf	1,934	888	204
Second alternate leaf	2,124	1,380	240
Third alternate leaf	2,364*		216
Background	36		

* Counter reached end of scale. True value slightly higher.

It was possible, under conditions of the experiment, to detect radiophosphorus in the uninjured plant by moving the shielded counter tube over the leaves and stem. In order to get away from stray radiation, the following technique was adopted.

Discs of fresh leaf tissue were cut from a plant which had been in the radiophosphorus containing nutrient solution for two and one half hours. They were held over the sensitive window of the Geiger counter. A lead shield with a circular hole 7.5 mm in diameter was used to determine the area of leaf tissue exposed to the sensitive window of the counter tube. The results are shown in Table II.

[2] H. V. Neher and W. W. Harper, *Phys. Rev.*, 49: 940, 1936.

[3] N. S. Gingrich, R. D. Evans and H. E. Edgerton, *R. S. I.*, 7: 450, 1936.

TABLE II

DISTRIBUTION OF RADIOPHOSPHORUS IN FRESH LEAF TISSUE

	Counts/min.	Distance from base of hypocotyl
Opposite leaves	10	18.0 cm
First alternate leaf,		
tip leaflet	46	25.5 "
lateral leaflet	54	23.4 "
Second alternate leaf,		
tip leaflet	20	22.3 "
lateral leaflet	62	20.6 "
Third alternate leaf,		
tip leaflet	38	18.7 "
lateral leaflet	33	17.8 "
Background	36	

The results indicate that phosphorus may be absorbed by the apparently uninjured roots of phosphorus-deficient plants and transported at a rate exceeding 10 cm/hr. From the distribution of radiophosphorus in the plant it appears that movement in the aerial parts is dependent on the transpiration stream, and that the "excretion" of phosphorus into the xylem occurs only after considerable accumulation has taken place in the living cells of the root. Detailed results will be published elsewhere.

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BOOKS RECEIVED

Annual Review of Physiology, Vol. I, 1939. JAMES M. LUCK, Editor. Pp. vii + 705. 3 figures. Annual Reviews, Stanford University. $5.00.

BAITSELL, GEORGE A., Editor. *Science in Progress.* Pp. xiv + 322. 90 figures. Yale University Press. $4.00.

BOGOMOLETZ, A. A., S. J. STEINBERG and M. M. LANGER, Editors. *La Médecine Expérimentale; Organe de l'Institut de Médecine Expérimentale de l'Ukraine, No. 3, 1938.* Pp. 110. Ukrainian Association for Cultural Relations with Foreign Countries, Kiev.

CANNON, WALTER B. *The Wisdom of the Body.* Revised edition. Pp. xviii + 333. 40 figures. Norton. $3.50.

MCCOLLUM, E. V., ELSA ORENT-KEILES and HARRY G. DAY. *The Newer Knowledge of Nutrition.* Fifth edition, revised. Pp. ix + 701. 14 figures. Macmillan. $4.50.

MCCOY, ELIZABETH and L. S. MCCLUNG. *The Anaerobic Bacteria and their Activities in Nature and Disease, a Subject Bibliography; Vol. I, Chronological Author Index.* Pp. xxiii + 295. *Vol. II, Subject Index.* Pp. xi + 602. University of California Press.

NORTHROP, JOHN H. *Crystalline Enzymes; the Chemistry of Pepsin, Trypsin and Bacteriophage.* Pp. xv + 176. 48 figures. Columbia University Press. $3.00.

NEWMAN, H. H. *The Phylum Chordata; Biology of Vertebrates and their Kin.* A revision of *Vertebrate Zoology.* Pp. xii + 477. 235 figures. Macmillan. $3.60.

University of Illinois Bulletin: Vol. XXXVI, No. 23, An Investigation of Rigid Frame Bridges; Part I, Tests of Reinforced Concrete Knee Frames and Bakelite Models. Pp. 48. 14 figures. $0.50; *No. 28, Part II, Laboratory Tests of Reinforced Concrete Rigid Frame Bridges.* Pp. 78. 39 figures. $0.85. *No. 29, The Effects of Errors or Variations in the Arbitrary Constants of Simultaneous Equations.* Pp. 54. $0.60. *No. 37, A Survey of Sulphur Dioxide Pollution in Chicago and Vicinity.* Pp. 32. 1 figure. $0.40. *No. 42, Fatigue Tests of Butt Welds in Structural Steel Plates.* Pp. 58. 20 figures. $0.65. The University, Urbana.