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SOME PROBLEMS IN THE GENETICS OF THE FUNGI¹

By Dr. B. O. DODGE

THE NEW YORK BOTANICAL GARDEN

INTRODUCTION

Not every one has had an opportunity, or the desire, to study the fungi critically. Most people, however, are more or less familiar with molds, mildews, mushrooms and yeasts. Those of you who were brought up in the country districts may remember how you enjoyed kicking over toadstools and puffing puffballs in each other's faces. The man who collects wild mushrooms in woodlands for food seldom thinks of them as plants. Botanists, on the theory that all living things must be either plants or animals, place the fungi in the plant kingdom. They say that if fungi ever had chlorophyll they have lost it through degeneration, and degenerates make little progress in

evolution. It is a very common belief that the fungi are of little economic importance except as they cause decay and disease, and, since they show little evolution, their study would promise little as to throwing light on the great life processes. As a matter of fact, just to mention two examples, the fungi and bacteria are of incalculable value in building the soil and maintaining its fertility. Yeasts rival our boasted billion dollar corn crop, if we count the value of alcohol and other useful products of fermentation.

The old attitude is changing, as witness the interest in sex and genetics of fungi manifested during the past ten or fifteen years. This work will certainly be greatly facilitated in the next decade by the use of growth substances and sex hormones to bring into fertile cultures species of obligate parasites not now at all adapted for this type of genetic study. We may

¹ Presented at a general session of the Third International Congress for Microbiology, New York, September 6, 1939.

of limited quantity is to be analyzed, the apparatus can be clamped shut at the proper moment. A tuning fork whose frequency of vibration per second is 512 is placed over the upper end of the tube. By striking the tuning fork and raising and lowering the column of water, points of resonance (accentuation of the hum of the tuning fork) are found. The distance between two adjacent points of resonance is half of one wavelength. This distance times two, multiplied by 512 (the frequency of vibration of the tuning fork) equals the velocity of sound per second. A small correction, which is rarely significant, is made in the velocity for variation in laboratory temperature (Table 1);

TABLE 1
CORRECTION OF VELOCITY OF SOUND FOR VARIATIONS OF
TEMPERATURE FROM 24° C

Velocity of sound, meters per second	to 650	750	850	900 and over								
1° C. equals (meters per second)	± 0.5	± 0.14	± 0.3	special correc- tions (see be- low)								
Add or subtract with rise in temperature	subtract	subtract	add	add								
<i>Special corrections for velocities of 900 meters per second and over:</i>												
18° C.	19	20	21	22	23	24	25	26	27	28	29	30
-4.1	-3.6	-3.0	-2.4	-1.7	-0.9	0.0	+1.1	+2.2	+3.5	+5.0	+6.7	+8.5
"—" indicates subtraction for correction to 24° C. ; "+" indicates addition.												

changes in the temperature affect the velocity by changing the density of the gases and by changing the amount of water vapor in the mixture.

The formula for the velocity of sound in a gas is

$$V = \sqrt{\frac{\gamma P}{d}},$$

where

V = velocity of sound in centimeters per second;

γ = C_p/C_v = ratio of specific heat at constant pressure to that at constant volume (γ for oxygen is 1.401; for nitrogen it is 1.404; for helium it is 1.66);

P = pressure in dynes per square centimeter; and
d = weight of gas in grams per cubic centimeter.

A chart (Fig. 2) has been constructed on the basis of computation of the theoretical velocity of sound for many different mixtures of helium, oxygen and nitrogen. In using the chart one can read horizontally from the experimentally determined velocity of sound, corrected for temperature, to the determined percentage of oxygen, which may have to be interpolated, thence vertically to the percentages of helium and nitrogen in that portion of the gas remaining after deducting the oxygen. In practice, a large-sized replica of Fig. 2 on graph paper is used.

No attempt has been made to control all the sources of error, most of which are small and may offset one another. It is possible to determine the velocity of sound with our apparatus with an accuracy of ap-

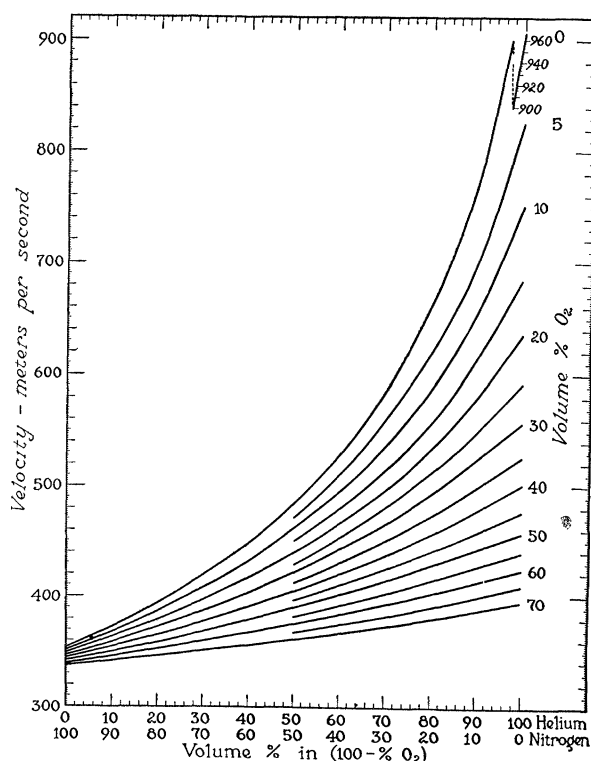


FIG. 2. Chart showing the velocity of sound at 24° C. in mixtures of helium, oxygen and nitrogen, saturated with water vapor.

proximately ± 0.5 per cent. (range of variability) and to determine the percentages of helium and nitrogen in the whole mixture with an accuracy of approximately ± 1.0 per cent. (range of variability). The apparatus and method are intended for practical use in medicine or industry where this degree of accuracy is satisfactory. The apparatus is inexpensive, mobile, simple and easy to use.

WILLIAM B. DUBLIN
WALTER M. BOOTHBY
MARVIN M. D. WILLIAMS

THE MAYO CLINIC

BOOKS RECEIVED

- ARNOW, L. EARLE. *An Introduction to Physiological and Pathological Chemistry*. Pp. 555. 143 figures. Mosby. \$3.50.
- CHARLES, BROTHUR H. *Biology*. Pp. viii + 408. Illustrated. Bruce. \$1.72.
- EALLES, N. B. *The Littoral Fauna of Great Britain; a Handbook for Collectors*. Pp. xvi + 301. 24 plates. Cambridge University Press, Macmillan. \$3.50.
- EDDY, SAMUEL, CLARENCE P. OLIVER and JOHN P. TURNER. *Guide to the Study of the Anatomy of the Shark, the Necturus and the Cat*. Pp. vii + 100. 15 figures. Wiley. \$1.50.
- PARKER, JOHN B. and JOHN J. CLARKE. *An Introduction to Animal Biology*. Pp. 503. 163 figures. Mosby. \$3.75.
- WHITEFORD, G. H. and R. G. COFFIN. *Essentials of College Chemistry*. Second edition. Pp. 534. Illustrated. Mosby.

New Books

THE DEVELOPMENT OF THE MINKOWSKI GEOMETRY OF NUMBERS

By Harris Hancock

Professor Emeritus of Mathematics, University of Cincinnati

In this new volume, a sequel to his "Foundations of the Theory of Algebraic Numbers," Professor Hancock again makes an important and original contribution to mathematics. He uses the theorems of Minkowski to develop and clarify the relationships between the number theory, intuitive geometry, and the theory of functions, and to show how studies in algebra, geometry, and arithmetic are harmoniously interrelated. By thus making use of the concepts of geometry he is able to broaden the substructures of the generalized realms that are founded on algebra, numbers, and geometry; and ascertains further the teleological nature of such realms. "Minkowski came to his theorems through special intuitions," writes the author in a *Preface*. "Due to the limitations of a manifold in three dimensions he presented his theory in a purely analytical manner. Thus while he was able to treat manifolds in any order, his work is far more difficult of comprehension than if he had first derived his results in a two or three dimensional geometry with illustrative figures, and then presented the general theory analytically with the use of expressions indicative of geometric concepts. From this standpoint I have given the entire theory."

864 pages

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A SHORT HISTORY OF SCIENCE

By W. T. Sedgwick

Late Professor and Head of the Department of Biology, Massachusetts Institute of Technology

and H. W. Tyler

Late Professor and Head of the Department of Mathematics, Massachusetts Institute of Technology

Revised by H. W. Tyler and R. P. Bigelow

Professor Emeritus of Zoology, Massachusetts Institute of Technology

The Sedgwick and Tyler History of Science has been for years the standard college text for orientation courses in the sciences. The present extensive and thorough revision brings the book up to date. It now contains the complete story of scientific development from the number systems and early astronomical notions of ancient Islam to our twentieth century conceptions of the behavior of atoms and hormones. Throughout the book the progress of scientific methods as well as of concepts is traced, and an equitable treatment is given to all branches of science, both biological and physical. For anyone seeking a clearly understandable, well balanced knowledge of the historical background of modern science, this book is a preeminently satisfactory answer.

To be ready in November. Illustrated.

c.510 pages. \$3.75 (probable).

Macmillan, New York

McGraw-Hill Books in Photography

THE PHOTOGRAPHIC PROCESS

By JULIAN ELLIS MACK, University of Wisconsin, and MILES J. MARTIN, Milwaukee Extension Center, University of Wisconsin. 586 pages, 7 x 9½, illustrated. \$5.00

Here is a unified, comprehensive treatment of photography, presented simply enough for the student who is not trained in chemistry, yet with sufficient scope and scientific rigor to justify its use in a course in photography at the college level. The manual section of the book gives working directions for a variety of specialized operations, including lens testing, shutter testing, the use of polarizing discs, sensitometry, color photography, etc.

HANDBOOK OF PHOTOGRAPHY

By KEITH HENNEY and BEVERLY DUDLEY, Editors, *Photo Technique* and *Electronics*. 1000 pages, 6 x 9, illustrated. \$7.50

Intended to supplement the many volumes available covering elementary, specialized, or purely artistic phases of the subject, this book presents a comprehensive, authoritative treatise on the technique of the photographic process and the scientific basis underlying photography and its applications.

COLOR PHOTOGRAPHY FOR THE AMATEUR

By KEITH HENNEY. *Whittlesey House Publication*. 281 pages, 5½ x 8, illustrated. \$3.50

In this book the author provides a practical manual of field and laboratory procedures in color photography. All phases of the subject are described in detail, and complete practical information is given on films, filters, and supplies; negatives and exposures; transparencies and paper prints; dye and pigment processes, etc.

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