DR. JAMES LUKENS MCCONAUGHY, president of Knox College, Galesburg, Illinois, has been elected president of Wesleyan University, Middletown, Connecticut.

JAMES R. WITHROW, professor of chemistry at Ohio State University, has been appointed professor of chemical engineering in the university and will head the new department of chemical engineering which has just been organized.

DR. THOMAS W. TURNER has resigned as professor of botany at Howard University, Washington, D. C., and is now head of the biology department at Hampton Institute, Hampton, Va.

OTTO KOPPIUS, assistant professor of physics at Oberlin College, has accepted an appointment as associate professor at the University of Kentucky.

DR. JOHN PAUL VISSCHER, late Bruce Fellow of Johns Hopkins University and special investigator of the United States Bureau of Fisheries, has been appointed assistant professor of biology in Western Reserve University.

DR. LOUIS LEON THURSTONE has been appointed assistant professor of psychology at the University of Chicago.

DR. A. C. SHEAD, of the University of Illinois, has been appointed assistant professor of chemistry at the University of Oklahoma.

DR. ROBERT DAY WILLIAMS, professor of psychology at Pomona College, has been appointed visiting lecturer on psychology at Harvard University for the first half of the academic year.

DR. H. H. DIXON, professor of botany in the University of Dublin, has been appointed Regius professor of botany in the University of Glasgow in succession to Professor F. O. Bower, who has retired.

DR. FRANK CLARE WILKINSON, of the University of Liverpool, has been appointed to the newly created chair of dental science in the University of Melbourne, Australia.

DR. PAUL SCHRÖDER, professor of psychiatry and neurology at the University of Greifswald, has been appointed professor of psychiatry at the University of Leipzig to take the place of Professor Bumke who has resigned.

DISCUSSION AND CORRESPONDENCE

ON THE RELATIVITY MOTION OF MERCURY

IN a note published in the September fifth number of SCIENCE, Professor Poor seems to have become confused as to the meaning of the gravitational radius (1.47 km) of the sun as used in Einstein's theory of gravitation. This confusion is perhaps due to the fact that Eddington, in his treatment of the subject, takes the velocity of light as unity and is not very explicit as to the physical dimensions of the quantities which he uses. Making no restrictions as to the units employed, Einstein's theory leads to the following equations for a planetary orbit,

$$\frac{d^2u}{d\phi^2} + u = \frac{m_e}{h_e^2} + 3m_e u^2, \tag{1}$$

$$r^2 \frac{d\phi}{ds} = h_e, \tag{2}$$

whereas Newton's theory gives

$$\frac{d^2u}{d\phi^2} + u = \frac{m_n}{h_n^2}, \tag{3}$$

$$r^2 \frac{d\phi}{dt} = h_n, \tag{4}$$

where m_e is the constant obtained by integrating Einstein's field equations and m_n is the gravitational mass of the sun in astronomical units. Moreover ds and dt are related to a sufficiently high degree of approximation by the equation

$$ds = c\ dt$$

where c is the velocity of light.

Comparing (2) and (4) in view of this relation it is clear that

$$h_n = c\ h_e$$

Eddington shows that the second term on the right hand side of (1) is very small compared to the first. So neglecting this term comparison of (1) and (3) gives

$$m_e = \frac{h_e^2}{h_n^2} m_n = \frac{m_n}{c^2}$$

As we are making the gravitational constant unity, Newton's law has the dimensional form $LT^{-2} = m_n L^{-2}$, showing that m_n has the dimensions L^3T^{-2}. Therefore, the gravitational radius m_e is of the dimensions of a length, and does not change from 1.50 km to 13.5 $(10)^{20}$ km according to the choice of units, as Professor Poor would have it do.

LEIGH PAGE

YALE UNIVERSITY

MODIFICATIONS RELATING TO THE "NEW INTERNATIONAL ENCYCLOPAEDIA"

IN a recent number of SCIENCE, Vol. LX (1924), page 82, attention was directed to a very obvious error relating to Copernicus which appears under his name in the 1923 printing of the well and favorably known American encyclopaedia noted in the heading of this article. It should have been stated then that

this error is found also in Volume 9 of the "Biographie Universelle" (Michaud), nouvelle édition, as well as in the "International Cyclopaedia," which was the predecessor of the work under consideration. One might have thought that the biography of such an eminent scientist as Copernicus would not involve such obvious misstatements nearly four hundred years after his death. In fact, the chief interest in this error is due to its persistence notwithstanding its obviousness. It should be added that most of the modern biographical accounts of Copernicus do not involve this error.

A less obvious but more serious error appears in the work under consideration under the term "Descartes rule of signs." It is here stated that "the rule also bears Harriott's name, being given in his 'Artis Analyticae Praxis'." It has been known for a long time that this rule does not appear here and that Leibnitz was responsible for giving currency to this widespread error. In Volume 10 of the "Bibliotheca Mathematica" G. Eneström noted many places where this error may be found. A still more serious error appears under the term "Descartes," where it is stated that he "placed the theory of negative quantities on a satisfactory basis." In this connection it is perhaps sufficient to refer to the fact that in Volume 2 (1921), page 78, of Tropfke's "Geschichte der Elementar-Mathematik" it is stated that the mathematics of the eighteenth century suffered because a satisfactory introduction of negative numbers was then lacking. This was a century after the time of Descartes.

The student who consults this encyclopaedia for the purpose of securing some general knowledge as regards mathematical groups is referred under the word "groups" to the article on "substitution." This would have been a satisfactory procedure seventy years ago, but since that time the general theory of groups has been developed so extensively that the theory of substitutions forms now a relatively small part of this general theory. Hence the broader theory should have been outlined under the term group, while a reference might properly have been added with respect to more special developments under the term substitution. It may be added that in the present article under the latter term one finds the statement that it was a discovery due to Galois "that eventually led to the proof of the insolubility of the quintic." On the contrary, it is well known that this insolubility was established by Abel several years before Galois was old enough to publish new results relating to mathematics even if he began to publish such results at the early age of 17.

It is well known that the first published *formal* algebraic solution of the general cubic and the general biquadratic equations appeared in the "Ars Magna," 1545, written by an Italian mathematician and physician named Cardan. Since complex numbers were not then understood the authors of these formal solutions necessarily failed to understand their generality and could use them only in special cases. In view of these facts one reads in the present work with amazement the following statement under the term "Cardan": "The publication of the 'Ars Magna' stimulated mathematical research and hastened the general solution of biquadratic equations of which Cardan himself solved special cases, as $13x^3 = x^4 + 2x^3 + 2x + 1$; although the credit of producing the first general solution belongs to his pupil Ferrari." This solution by Ferrari is actually found in the "Ars Magna" in question.

In regard to the cubic equation one finds at the same place the following statement: "The solution had been discovered in 1541 by Tartaglia who communicated it to Cardan under the most solemn vows of secrecy." In fact, Cardan himself stated that he made this discovery in 1535, but this is a somewhat minor matter. It is much more important to note that all modern mathematical historians agree that the formal solution of the cubic had been discovered at a considerably earlier date by another Italian mathematician commonly known as Ferro. It is, of course, clear that Ferro could not have fully understood the generality of his results and that he may not have recognized that all forms of the cubic equation can be reduced to the form considered by him. Since this reduction is so very elementary and since we know very little about the work of Ferro such details will probably always remain matters of conjecture or matters of silence, if ignorance implies silence.

While one should not expect to find always in such a general work as accurate statements as are demanded in the special scientific treatises, yet it seems that in many cases a greater degree of accuracy might reasonably be expected. For instance, under the term "cubic equation" it is stated that the roots of the equation $x^3 + px + q = 0$ will all be real when p is negative and $4p^3 > 27q^2$. This inequality implies that a negative number can be greater than a positive number, since it results from the context that q is supposed to be real. Several other inaccuracies which can also be easily corrected appear under the same term and also under the term "series." Since the history of science is mainly an exposition of the compound interest law as regards the development of fundamental concepts it is very important to secure a clear notion with respect to the early development of such concepts.

Under the term "Trigonometry" it is stated that a ratio called *seqt* in the work of Ahmes "seems to correspond to the cosine or the tangent of an angle." The word "tangent" should evidently be replaced here

by cotangent. What is, however, very much more important is that we find here the statement that "Rheticus (1514–76) made a great advance by considering the functions as ratios instead of lines." This is also a very fundamental question relating to the history of elementary mathematics, and the widespread error involved in this quotation was considered by Tropfke in Volume 5, 1923, page 19, of the work noted above in the second paragraph. It is here explained that the modern conception of the trigonometric functions as abstract numbers did not appear before the second half of the eighteenth century, that is, about two hundred years after the death of Rheticus.

In closing we shall refer to one more misleading statement relating to a historical question of fundamental importance. Under the term "Analytic Geometry" it is stated that "the primitive system of coordinates called rectangular coordinates is due to Descartes (Lat. Cartesius) from which fact they are called Cartesian." On the contrary, Descartes did not have a clear notion of such coordinates and some rectangular as well as oblique coordinate systems were used in very early times, especially by the Greeks.[1] They were also used in Europe long before the time of Descartes. In particular, such a system is found in the works of Oresme in the fourteenth century. From what precedes it is clear that in some particulars the popular work under consideration is still in need of much improvement. It is hoped that this discussion may disclose some facts of interest to the general reader and may also have some influence on speeding the needed modifications, which are fortunately made feasible by the frequent printings. In fact, some important corrections resulted from a similar effort made several years ago. *Cf. American Mathematical Monthly,* Volume 24 (1917), page 106.

G. A. MILLER

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THE CONTROL OF DAMPING OFF OF COTTON SEEDLINGS BY THE USE OF USPULUN

OWING to the unusually large amount of rainfall prevalent in northwest Arkansas in May and the early part of June, 1924, damping off of cotton seedlings became very prevalent, particularly in those rows where the stand was the thickest and best. As this threatened to destroy some valuable breeding work it was felt that something ought to be tried to effect control, although it was recognized that under field conditions there was very little promise of success.

[1] *Encyclopédie des Sciences Mathématiques,* tome 3, Vol. 3, p. 17.

Accordingly, a 0.25 per cent. solution of Uspulun was prepared, the strength recommended by the manufacturers (Bayer Chemical Company), and the solution applied in a sprinkling can to five rows of cotton. Approximately one gallon of solution was applied to the square foot of soil. Only one application was made. The results obtained are so promising that it seems worth while to present this preliminary report.

At the time of application, the soil was quite moist and the solution was taken up very readily. No particular effort was needed to force the solution into the soil, for there was but little surface drainage. The solution was applied directly over the plants with an ordinary sprinkling can, the application being made slowly so as to enable the soil to take up the solution.

No further damping off has appeared in the five treated rows. In the untreated rows damping off continued to develop to such an extent that large parts of the rows are now bare in contrast to the treated rows on which the stand is much better. A microscopic examination showed that most if not all the damping off was caused by Rhizoctonia. The treated plants have shown no ill effects from the treatment.

H. R. ROSEN

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NOTICE TO ZOOLOGISTS OF GENERIC NAMES TO BE INSERTED IN THE OFFICIAL LIST

THE following generic names (with genotype in parentheses) have been submitted to the International Commission on Zoological Nomenclature for inclusion in the Official List of Generic Names.

The secretary will delay final announcement of the votes on these names until January 1, 1925, in order to give to any zoologists who may desire the opportunity to express their opinions.

Mammals: *Alces* Gray, 1821, 307 (*alces*); *Arvicola* Lac., 1799, 10 (*amphibius*); *Ateles* Geoffr., 1806, 262 (*paniscus*); *Bison* H. Smith, 1827, 373 (*bison*); *Bradypus* Linn., 1758a, 34 (*tridactylus*); *Canis* Linn., 1758a, 38 (*familiaris*); *Capra* Linn., 1758a, 68 (*hircus*); *Cebus* Erxl., 1777, 44 (*capucina*); *Cervus* Linn., 1758a, 66 (*elaphus*); *Choloepus* Ill., 1811, 108 (*didactylus*); *Condylura* Ill., 1811, 125 (*cristatus*); *Cricetus* Leske, 1779, 168 (*cricetus*); *Crocidura* Wagl., 1832, 275 (*leucodon*); *Cystophora* Nills., 1820, 382 (*cristata*); *Dasyprocta* Ill., 1811, 93 (*aguti*); *Didelphis* Linn., 1758a, 54 (*marsupialis*); *Erethizon* F. Cuv., 1822, 432 (*dorsata*); *Felis* Linn., 1758a, 41 (*catus*); *Gulo* Pallas, 1780, 25 (*gulo*); *Halichoerus* Nills., 1820, 376 (*grypus*); *Lepus* Linn., 1758a, 57 (*timidus*); *Lynx* Kerr, 1792, 32 (*lynx*); *Mus* Linn.,