Herms is Professor S. B. Freeborn, also of the University of California and a small group of students. The present intensive investigation follows a general malara-mosquito survey of California which was completed last summer.

Professor Warren D. Smith, of the University of Oregon, has been given leave of absence to spend a year in geological work for the Philippine government, as chief of the Division of Mines of the Bureau of Science at Manila.

Professor Frank T. McFarland, department of botany, University of Kentucky, has been granted a leave of absence for the year 1920–21. He will spend this summer and next year in study at the University of Wisconsin. While on leave, Professor McFarland's place will be filled by Mr. E. D. Hull, a graduate of the University of Chicago.

By action of the convention of the Sigma Xi Society at its meeting in St. Louis, a limited charter was granted to the University of North Dakota. The installation exercises of this chapter were recently held, Dean Lauder W. Jones, of the University of Minnesota, presiding. These exercises consisted in the formal installation of the chapter on the evening of June 2, followed by the initiation of four active members elected from the faculty, and five associate members from the graduates and the senior class. The exercises were followed by a banquet. On the morning of June 3, Dean Jones addressed the university convocation on the subject of "Science and industry." A fuller account of the proceedings will appear later in the Sigma Xi *Quarterly*.

Dr. Ira Remsen, formerly president of Johns Hopkins University, delivered the commencement address at West Virginia University on June 15. His subject was "This is the Age of Science." After the commencement exercises Dr. Remsen was entertained by the members of the West Virginia Alumni Association of Johns Hopkins, six of whom are heads of departments in the state university.

## UNIVERSITY AND EDUCATIONAL NEWS

Cornell University has received an anonymous gift from a professor and his wife of a trust fund for an institute of pure and applied mathematics. The gift amounts to $50,000 and is to be held in trust for a hundred years and allowed to accumulate.

Wallace W. Atwood, professor of physiography at Harvard University, has been appointed President of Clark University, succeeding President G. Stanley Hall, of the university, and President Edmund C. Sanford, of the college. Dr. Hall, who has been president of the University and professor of psychology for thirty-two years reached his seventy-fourth birthday on February 1.

Hector James Hughes, professor of civil engineering and director of the Harvard Engineering Camp, has been chosen dean of the Harvard Engineering School to take the place left vacant by the retirement of Dean Comfort Avery Adams.

W. H. Chandler, professor in pomology at the New York State College of Agriculture, has been appointed vice-director of research at the Cornell University Agricultural Experiment Station. Professor Chandler has been at the college as professor in research in pomology since 1913.

Dr. Norman McDowell Grier has been appointed professor of biology at Washington and Jefferson College to succeed Dr. Edwin Linton, who has retired under the provisions of the Carnegie Foundation.

Dr. Arthur W. Haupt, formerly professor of biology at Carthage College, Carthage, Ill., has been elected to the chair of biology at Saint Lawrence University, Canton, N. Y.

The following changes have been made in the department of medical zoology of the school of hygiene and public health of the Johns Hopkins University. New appointments: Dr. Chas. E. Simon, lecturer in medical zoology; Mr. D. L. Augustine, assistant in helminthology; Dr. W. H. Taliaferro, from instructor to associate in protozoology; Dr. F. M. Root,

from teaching fellow to associate in medical entomology.

DR. LOUIS J. GILLESPIE, professor of physical chemistry at Syracuse University, who was formerly with the Department of Agriculture, Washington, D. C., has resigned to go to the Massachusetts Institute of Technology as assistant professor of physico-chemical research.

DR. ARTHUR F. BUDDINGTON, Ph.D. (Princeton, '16), and Dr. Benjamin F. Howell, Ph.D. (Princeton, '20), have been appointed assistant professors of geology at Princeton University.

## DISCUSSION AND CORRESPONDENCE

### MODERN INTERPRETATION OF DIFFERENTIALS

IN an advance copy of a note to SCIENCE, which Professor Huntington has kindly sent to me, he says that "*some indication as to the manner in which N is to vary*" is necessary to define $dy = \lim N\Delta y$. This is not true. Of course, there must be some relation between $N$ and $\Delta y$, in order that, for example, $\lim N\Delta y = 5$, but the number of such relations is infinite, and it is only necessary to know that they exist. For example, if $\Delta y = (5/N) + (8/N^2)$, then $N\Delta y = 5 + (8/N)$, and for $\lim N = \infty$, $\lim \Delta y = 0$, $\lim N\Delta y = 5$. It was stated in my note which Professor Huntington is criticizing[1] that $N$ varies from zero to infinity. We are not concerned with the method of approach, but only with the possible value of the limit. The preceding illustration shows that if $y$ be an independent variable, such limit $dy$ exists, and in any value we please to name. It is different if $y$ be dependent, and my note in SCIENCE of May 7, contained a demonstration that $df(x)$ exists when the graph of $f(x)$ has a tangent, and determines its construction, corresponding to any value of $dx$, including in particular, $dx = \Delta x$, which is, of course, not always true.

The problem of differentiation is larger than that of a single value, since it determines an infinite number of corresponding values. We have the analogy of the infinite number of corresponding values of the derivative variable and its argument $x$. We justify this variable as a limit on the ground that it is a true limit for each numerical value of $x$. The example having been set, its extension to differentials can not be denied.

The infinite number of corresponding differentials ($dx$, $dy$, $dz$) pertain to the one set of corresponding variables ($x$, $y$, $z$), just as the increments ($\Delta x$, $\Delta y$, $\Delta z$) pertain to it, and are *corresponding increments of the instantaneous state of the variables*, also, *increments in the first ratio* (Newton's "prime" ratio), etc. This is not a vague idea but one which, in numerical cases, determines numerical values. The source of this terminology is the physical idea that *equimultiples of very small simultaneous increments* are *approximately* increments of the instantaneous state. The differential analysis of Newton, which carries this idea to its logical conclusion, is therefore the mathematical foundation for such physical idea.

It is easy to make statements appear vague by separating them from the facts on which they are based, and such facts appear in the article from which Professor Huntington quotes, with a figure showing the *finite equimultiples* which are becoming exact differentials—differentials which his "modern" method can not represent, since they pertain to a system of two independent variables, and of which the derivative calculus can give no adequate idea. although they are of great practical importance.

Such so-called modern method is crude in its limitation $dx = \Delta x$, narrow in its application *only to plane curves in rectangular coordinates*. A natural extension to space is impossible, but Newtonian differentials are coordinates of tangent planes, from their points of contact as origin. By Newton's method, all kinds of continuously variable quantity, in plane or space, lines, areas, volumes, forces, may have corresponding differentials represented in finite quantities of the same kind, and by the limits of finite and visible values.

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[1] SCIENCE, February 13.