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The Progress in Physics in Iowa in the Quarter Century

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BY FRANK F. ALMY.

In attempting to outline the progress in Physics in the State of Iowa since the organization of the Iowa Academy of Sciences, it may be advisable to begin with some statement of the status of that subject in the State at that time. Note that this was six years before the writer, now selected as the patriarch of his group, entered the ranks of teachers of Physics in the State. I can hardly appropriate the term physicists, for, in the main, our work has been administrative and pedagogical.

The available information is rather meagre. I do not think that at the time of the organization of this Academy there was a Chair of Physics in any institution for higher education in the State. To appropriate the appellation due to Oliver Wendell Holmes, there were several "settees" of physical science, but not so called, for while the term "physical science" was coined, it had not been adopted into the working vocabulary. At the State University of Iowa, Professor L. W. Andrews was Professor of Physics and Chemistry and Director of the Chemical Laboratory. The Department of Physics became a separate department in 1889, with A. A. Veblen, who as Assistant Professor had shared the "settee" for three years, assuming the chair as Acting Professor of Physics and receiving full title the following year. At the Iowa State College Professor J. C. Hainer was Professor of Chemistry, Physics and Mechanical Engineering; in 1890 Physics and Electrical Engineering became a department, and a year later Professor W. S. Franklin came to that department. At the Iowa State Normal School Diela Knight was in charge of Natural and Physical Sciences and Gymnastics, Professor A. C. Page coming into charge of Natural and Physical Sciences in 1889, Professor L. Begeman coming into a separate department of Physics in 1899. At Iowa College Professor S. J. Buck was in charge of the department of Mathematics, Natural Philosophy and Astronomy until 1893, when the writer came to share the bench, and within the year it was worked over into two chairs, Mathematics and Astronomy, and Physics. At Cornell College Professor Alonzo Collins was Professor of Chemistry and Physics. Professor W. S. Barnard was in charge of the work in science at Drake University. Professor J. L. Tilton has been in charge of the department of Geology and Physics at Simpson College since 1888. Professor C. O. Bates began his work at Coe College in 1889 in charge of Mathematics, Chemistry and Physics, and so continued until 1902, when Professor L. D. Weld came, taking the Mathematics and Physics. Courses in Physics were also probably given at that time at Central University, Des Moines College, Iowa Wesleyan University, Lenox, Parsons, Penn, Tabor and Western Colleges and Upper Iowa University, but concerning that work I have no data.

The subject matter of Physics of that date is fairly represented by Avery's Elements of Natural Philosophy, The New Physics by Professor John Trowbridge, Kimball's revision of Snell's Olmstead's College Philosophy, Atkinson's

translation of Ganot's Physics, Everett's translation of Des Chanel's Natural Philosophy, and the then recent Text-Book of Physics by Professors Anthony and Brackett of Cornell University. And while the classical treatises of Faraday, Maxwell, Mascart and Juobert in Electricity and Magnetism; of Lord Rayleigh on Theory of Sound; Thomson and Tait's Natural Philosophy, ante date 1887, Maxwell's Electricity and Magnetism is the only one of them that was in the library of the State University at the time, and probably there was not another copy of any of these treatises in any college library in the State, or, aside from Assistant Professor Veblen, a teacher in the state who had any particular use for any of them.

I am not reliably informed, but there was probably no provision for laboratory work in Physics except at the State University and at Ames. Grinnell had an investment of about $2,000 in physical apparatus, the insurance recovered after the cyclone of 1882, but the apparatus, while of recent purchase, was almost wholly for demonstration work. In this connection we may pause to recall that the Massachusetts Institute of Technology is a contender for the honor of having been the "earliest institution in which laboratory Physics was pursued according to a systematic plan for its educational value." In April, 1869, Professor Edward C. Pickering was "very anxious to be ready by the next October to instruct the third year's class by laboratory work." In 1871 Pickering says "There are now in America at least four similar laboratories in operation or in preparation." One of these was undoubtedly that of the University of Iowa, for laboratory work in Physics was begun there by Professor Hinrichs in the fall of 1870. From this it is apparent that systematic laboratory instruction in Physics antedates the period under consideration by only eighteen years—less than another quarter century. Pickering's "Physical Manipulations," Glazebrooke and Shaw's "Practical Physics," Stewart and Gee's "Practical Physics," Kohlrausch's "Physical Measurements," and Glazebrooke's "Physical Optics" were the sources of inspiration for the instructor in laboratory Physics. The Harvard "Descriptive list of Elementary Physical Experiments" appeared in 1887 and was the beginning of systematic laboratory instruction in elementary Physics.

I judge that it would be a liberal estimate to say that probably a hundred students a year were receiving some instruction in Physics in the colleges of Iowa. This was mainly text-book instruction with the solution of numerical problems, mostly elementary, and certainly considerable of it of a grade that would now belong in the secondary schools.

At the present time there are at least fifteen colleges in the State that offer a course in General Physics, given by an instructor, who, at least from the point of view of educational training in the subject, is as competent as any one teaching Physics in Iowa in 1887. Eight of these offer courses in advance of a year course in General Physics. Four colleges besides those of the State institutions probably have better equipped laboratories in Physics than had the State University in 1887; and all have abundantly better texts and laboratory experiments than were available at that time.

So nearly as I can judge from the information at hand there must be about seven hundred and fifty students taking college courses annually in Physics in the colleges of the State, of whom fully one hundred are in advanced courses. Several of the colleges in addition to the State College and the University are

giving advanced courses and graduating students prepared to enter upon graduate work in Physics; and several teachers of Physics have come into Iowa colleges comparatively recently who should further strengthen the undergraduate teaching of Physics in the state in this respect. At the University there has been some graduate work for a number of years. Under Professor Veblen this was chiefly by men who after graduation were held for a time as graduate assistants or as instructors. Under Professor Karl E. Guthe—a real physicist and enthusiast—came a development of graduate work, and now with the new Physics laboratory, equipped, manned and directed, it would seem that Physics was entering into its place in the graduate school of the State. Some research is being carried on at the State College by students, chiefly, however, by undergraduates and in Applied Physics.

The subject matter of Physics as well as the form in which it is available has made relatively equal progress in the quarter century. Maxwell's electromagnetic wave theory, then on the point of being confirmed by the discoveries of Hertz (1888), is generally accepted, and but a small gap remains between the known radiations from hot bodies and the known electro-magnetic waves, and we are just now calling for congressional enactment regulating the use of them! The induction motor, that has made long distance transmission of power practicable, was just in embryo. (Ferraris had built a small two-phase motor in 1885, but did not consider a system requiring more than two wires for transmission practical and did not publish until 1888.) Electrolytic conduction was not satisfactorily explained; the work of Arrhenius and others on solutions, that clarified matters in the field of Electro-Chemistry and gave us the Physical Chemistry of today, was just beginning to appear at that time. A decade later we have the recognition of the electron by Professor J. J. Thomson, the discovery of the Roentgen ray, the Becquerel rays—"alpha," "beta" and "gamma"—the separation of the radio-active substances and the introduction of a new science—Radioactivity—now just in its beginnings, possibly at a stage comparable with that of Chemistry before the discovery of any means of accelerating or controling chemical actions.

The productive work in the State has been chiefly pedagogical, although sufficient research has gone forward to contribute some reports at almost every meeting of this Academy since 1895. For the purpose of this paper I have collected chronologically the titles of papers on physical topics that have been presented before the Academy.

1895: Andrews, President's Address; Recent Advances in the Theory of Solutions.

Andrews and Ende, Studies of the Physical Properties of Lithium Chloride in Amyl Alcohol.

Franklin, New Method of Studying the Magnetic Properties of Iron. Design of Transformers and Alternate Current Motors. Note on the Phenomena of Diffraction in Sound.

1896: Hall, Physical Theories of Gravitation. Unit Systems and Dimensions.

1901: Veblen, President's Address; The Relation of Physics to the Other Material Sciences. Some Improved Laboratory Devices.

Boehm, A Ruling Engine for making Zone-plates.

Smith, N. F., The Influence of Temperature on the Index of Refraction of a Gas when heated at a Constant Volume.

1902: Almy, Some Observations on the Action of Coherers when subjected to Direct Electro-Motive-Force.

1903: Begeman, A Convenient Voltaic Cell.
Lorenz, Stereoscopic Projection in Natural Colors.
Morrison, New Method of Cohesion of Water and Adhesion of Mercury Apparatus.

1905: Begeman, J. J. Thomson's Theory of Matter.
Lorenz, Three Color Projection.
Page, A Laboratory Barometer.
Tilton, The Storage Battery and Switch-board at Simpson College.

1906: Almy, The Physical Laboratory at Iowa College.
A Simple Demonstration of the Doppler Effect in Sound.
The Effect of Pressure on Lines in the Spectrum of Iron.
Begeman, Mutual Induction and Internal Resistance of a Voltaic Cell.
Guthe, Electrical Standards.
Morehouse, Photographic Accessories of the Drake Observatory.

1907: Page, The Physical Science Laboratory of the State Normal School.

1908: Begeman, Determination of the charge on an Electron, by Wilson's Method, using Radium. Nucleation, according to Barus.
Guthe, Some Peculiarities in the Elastic Properties of certain Substances.

1909: Morehouse and Woodrow, The Hysteresis Loop.
Smith, A. G., Evaporation from free Surface of Water.
Weld, Effect of Temperature Inequalities on the Balance.
Woodrow, The Googler Primary Battery.

1910: Stewart, Concerning a Study of Kerosene Oils by Physical Methods.
Sieg, Some Recent Discoveries Concerning the Behavior of Platinum-Iridium Wires.

1911: Almy, The Doppler Effect in Electrodeless Discharge.
Clark, Use of a Ballistic Galvanometer and a Pendulum for Measuring rapidly fluctuating Resistances.
Crum, Some Characteristics of Light-Negative Selenium.
Ford, Illuminating Engineering—A New Profession.
Sieg, On the Rate of Recovery of Elastic Properties of a Certain Wire.
Weld, Some Remarks on the Solubility of Certain Salts in Water.

In text-books: Nichols and Franklin's "Elements of Physics" was published while Professor Franklin was at Ames. Begeman's "Physics" has found a demand requiring several editions to be printed. Professor Spinney has filled one of the "long felt wants" with his recently published "Text-Book of Physics" for engineering students; and the manuscript of Reed and Guthe's "College Physics," published last year, must have been worked up while Professor Guthe was at Iowa City.

In addition: Professors Franklin and Spinney published a paper on the "Elastic Properties of Glass;" Professor Spinney presented a paper at a meeting of the A. A. A. S. on "The Analysis of Vowel Sounds," and has published a number of papers on problems of Illumination and Illuminating Engineering, and a good deal of investigation has been done in his laboratory in the line of Applied Physics. Professor Guthe published several papers in the Physical Review while at the University and several members of the present staff are

publishing frequently, altho their time must be very much occupied with the preparation for entering into their enlarged work in their new laboratory.

Among those who, during the quarter century, have been, for a time, of our number, and who have contributed to our progress, mention should be made of Professor A. A. Veblen (now retired) who was Head of Department at the University from the establishment of the Department of Physics until his retirement in 1905, and President of the Academy in 1901; Professor W. S. Franklin, of Lehigh University, who was Head of Department at Iowa State College, 1891 to 1897, and President of the Academy in 1897; Professor Karl E. Guthe, of the University of Michigan, who was Head of Department at the State University of Iowa, 1905 to 1909, and a stimulus to all who were privileged to associate with him in the work in Physics in the State; Professor Edwin Morrison, of Earlham College, Professor at Penn College, 1901 to 1906.

Probably not less than thirty graduates of Iowa colleges within this period have continued their work in Physics, have contributed to the literature of the subject, and are now college or university teachers. Professor L. B. Spinney succeeded his teacher, Professor Franklin, at the State College; Professor A. G. Smith came into the department with his teacher, Professor Veblen, at the University; Professor D. W. Morehouse came into the Physics end of the "settee" occupied by his teacher, Professor C. N. Kinney, at Drake University. Professors L. A. Parsons, of Pennsylvania State College, L. P. Sieg, of the State University of Iowa, L. D. Weld, of Coe College, A. H. Hoffman, of Iowa State College, Oscar Veblen, of Princeton, C. H. Bowman, of Montana School of Mines, S. R. Williams, of Oberlin, F. C. Stanley, of Penn College, C. V. Kent, of Carleton College; Doctors L. B. Morse, of Columbia, W. M. Boehm, of the University of Pennsylvania, Frederic A. Harvey, of Syracuse University, H. H. Marvin, of the Massachusetts Institute of Technology, are some of the graduates of Iowa colleges who as undergraduates pursued advanced courses in Physics in Iowa within the quarter century.

At the present time the departments of Physics in eight Iowa colleges are in charge of men with recent graduate training and whose chief interest is in the subject of Physics. In several others the work is in charge of men with recent graduate training in Physics, but whose chief interest is in another subject. There are about twenty teachers of Physics in the colleges of the State with graduate training who should be associated for their mutual benefit and for the good of the work in the State, in the Academy of Sciences.