

# SCIENCE

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FOR THE ADVANCEMENT OF SCIENCE.

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

## THE FIRST PAN-AMERICAN SCIENTIFIC CONGRESS, HELD IN SANTIAGO, CHILE, DECEMBER 25, 1908-JANUARY 6, 1909

THE first Latin-American Scientific Congress, which was convened in Buenos Aires in 1898, was projected by the Scientific Society of that city, and successfully carried out. It was attended by representatives of twelve Latin-American republics, and yielded results of such importance that a second congress was convened at Montevideo in 1901; and this was followed by a third at Rio Janeiro in 1905. Arrangements were made for a fourth meeting at Santiago, Chile, in 1908, and the Chilean organization committee,<sup>1</sup> feeling that the activities of the congress, which had been limited to the discussion of Latin-American problems and interests chiefly, should be extended to a fully Pan-American scope, decided that the Santiago meeting should be known as "The First Pan-American Scientific Congress."

The organization committee, through the medium of the Chilean government, extended to the government of the United States an invitation to participate. Secretary Root brought the matter to the attention of President Roosevelt,<sup>2</sup> and the

<sup>1</sup> The organization committee was constituted as follows: *Honorary President*, Marcial Martinez; *President*, Valentin Letelier; *Vice-president*, Manuel E. Ballesteros; *General Secretary*, Eduardo Poirier; *Assistant Secretary*, Augusto Vicuna S.; *Treasurer*, Octavio Maira; *Alejandro Alvarez*, Jose Ramon Gutierrez, Salvador Izquierdo S., Alejandro del Rio, Miguel Varas, Luis Espejo Varas, Anselmo Hevia Riquelme, Vicente Izquierdo, Domingo V. Santa Maria.

<sup>2</sup> *The President*: The government of Chile has invited the government of the United States to

President transmitted the invitation to Congress, accompanied by a commendation to join in and to be represented by delegates at the Pan-American Scientific Congress, which is to assemble under its auspices at the capital city of Santiago during the ten days beginning December 25, 1908. The work of the congress will comprehend nine sections, devoted, respectively, to pure and applied mathematics, physical sciences, natural sciences, engineering, medicine and hygiene, anthropology, jurisprudence and sociology, pedagogy, and agriculture and animal industry.

Latin-American scientific congresses were held in 1898 at Buenos Aires, in 1901 at Montevideo and in 1905 at Rio de Janeiro. Growing out of these previous conferences the congress of 1908 will be for the first time Pan-American. It will study and discuss many great subjects in which all the American republics have in common special interests; and its aim is to bring together the best scientific thought of this hemisphere for the scrutiny of many distinctively American problems and for an interchange of experience and of views which should be of great value to all the nations concerned.

It is therefore eminently appropriate that the United States should be adequately represented at this important First Pan-American Scientific Congress and should embrace this opportunity for cooperation in scientific research with the representatives of the other American republics. It is worthy of consideration that, in addition to the purely scientific interests to be subserved by such a congress and in addition to the advantages arising from an interchange of thought and the intercourse of the scientific men of the American countries and the good understanding and friendly relations which will be promoted, there are many specific relations arising from the very close intercourse between the United States and many Latin-American countries, incident to our expanding trade, our extending investments, and the construction of the Panama Canal, which make a common understanding and free exchange of opinion upon scientific subjects of great practical importance.

To make our representation possible I have the honor to recommend that the Congress be asked to appropriate the sum of \$35,000, or so much thereof as may be necessary, to enable the United States to send a number of delegates corresponding to the number of sections into which the congress is to be divided, together with a secretary

tory message.<sup>3</sup> In due course the invitation was officially accepted, and a liberal sum appropriated for the purposes of the congress. The committee of organization also extended invitations, through the Department of State at Washington, to a number of universities and other institutions and societies. As a result a large delegation was accredited to the congress. The membership of the delegation and the institutions represented are as follows:

*Government Delegates*

L. S. Rowe, University of Pennsylvania.  
Paul S. Reinsch, University of Wisconsin.  
Hiram Bingham, Yale University.  
A. C. Coolidge, Harvard University.

and disbursing officer, and to pay other necessary expenses.

Inasmuch as it is desired that all communications or scientific works to be presented to the congress be received before September 30, it is much to be hoped that provision for the participation of this government may be made at an early date and that the appropriation be made immediately available.

Respectfully submitted,

ELIHU ROOT

Department of State,

Washington, December 19, 1907.

*To the Senate and House of Representatives:*

I transmit herewith for the consideration of the respective Houses of the Congress a report of the Secretary of State representing the appropriateness of early action in order that in response to the invitation of the government of Chile the government of the United States may be enabled fittingly to be represented at the First Pan-American Scientific Congress, to be held at Santiago, Chile, the first ten days of December, 1908.

The recommendations of this report have my hearty approval, and I hope that the Congress will see fit to make timely provision to enable the government to respond appropriately to the invitation of the government of Chile in the sending of delegates to a congress which can not fail to be of great interest and importance to the governments and peoples of all the American republics.

THEODORE ROOSEVELT

The White House,

December 21, 1907

William C. Gorgas, United States Army.  
 W. H. Holmes, Smithsonian Institution.  
 Bernard Moses, University of California.  
 George M. Rommel, Bureau of Animal Industry.  
 W. R. Shepherd, Columbia University.  
 W. B. Smith, Tulane University.

#### *University Delegates*

Bernard Moses, University of California.  
 Albert A. Michelson, University of Chicago.  
 J. Lawrence Laughlin, University of Chicago.  
 W. R. Shepherd, Columbia University.  
 Thomas Barbour, Harvard University.  
 A. C. Coolidge, Harvard University.  
 J. B. Woodworth, Harvard University.  
 Adolph Hempel, University of Illinois.  
 W. H. Holmes, George Washington University.  
 Orville A. Derby, Cornell University.  
 H. D. Curtis, University of Michigan.  
 W. F. Rice, Northwestern University.  
 L. S. Rowe, University of Pennsylvania.  
 Webster L. Browning, Princeton University.  
 William B. Smith, Tulane University.  
 Paul S. Reinsch, University of Wisconsin.  
 Hiram Bingham, Yale University.

#### *Scientific Societies*

L. S. Rowe, American Academy of Political  
 and Social Science.  
 L. J. Doran, National Educational Association.

In June, 1908, meetings of the government delegates were held at the State Department, Washington, under the tutelage of Secretary Root, who conveyed to them such instructions as were deemed necessary. Arrangements were made for the preparation and translation of papers dealing with appropriate subjects for presentation at the congress, and for the disposal of the sum allotted by the Department for the purposes of the congress. The organization of the delegation was completed by the selection of Dr. L. S. Rowe as chairman and Professor Paul S. Reinsch as vice-chairman.

Under the guidance of Dr. Rowe a number of the delegates assembled in Buenos Ayres early in December, where they were the recipients of the hospitality of the president of the republic and the members of his cabinet, and of the ministers of the

United States and Chile. Visits were made to numerous institutions of learning, hospitals, municipal buildings, parks, etc., and the visit to the University of La Plata was signalized by an exceptionally cordial interchange of courtesies. On December 10 the party crossed the Andes and established headquarters in the Hotel Oddo in Santiago. Here, before and during the sittings of the congress, the delegation held frequent meetings to plan and discuss their work in the congress. Meantime other delegations, representing seven North American and Central American and nine South American republics, were on hand; and the meeting for the selection of officers for the congress was held at the University of Chile on December 24.<sup>4</sup>

At 10 P.M. on Christmas Day the opening session was held in the spacious Municipal Theater, and proved a most impressive ceremony. The president of the republic, Señor Pedro Montt, was present, and addresses were made by various officials of the congress and by chairmen of the various national delegations. The address of Dr. Rowe, chairman of the American delegation, delivered in Spanish, was enthusiastically received.<sup>5</sup>

<sup>4</sup> The result was as follows: *President*, Enrique R. Lisboa, Envoy Extraordinary and Minister Plenipotentiary of Brazil; *Vice-presidents*, Lorenzo Anadon, Envoy Extraordinary and Minister Plenipotentiary of Argentina; Fredrico Susviela Guarch, Delegate of Uruguay, and Matias Manzanilla, Delegate of Peru; *Secretaries*, Emilio Fernandez, Delegate of Bolivia; Melchor Lasso de la Vega, Delegate of Panama, and Enrique Martinez Sobral, Delegate of Mexico.

#### <sup>5</sup> ADDRESS OF DR. L. S. ROWE AT THE OPENING SESSION

*Your Excellency, Ladies and Gentlemen:*

This congress possesses an historical significance which it is difficult for us to appreciate at the present time. It marks an epoch in the intellectual development of the American continent.

Complete isolation from one another has characterized the situation of the countries of this

The committee of organization was prompt in the preparation of the program continent. This isolation has been one of the greatest obstacles to progress. The failure to develop a spirit of intellectual cooperation has resulted in a great loss of energy and has been one of the most important obstacles to the solution of many problems which would long ago have been solved had we been able to unite our energies and profit by each other's experience. The true scientific spirit has a far deeper significance than the mere desire to conduct investigations. It can not reach its highest expression if there exist petty rivalries or jealousies. For this reason the development of the scientific spirit contributes so much to the growth of a true international fraternal spirit. A vigorous spirit of cooperation, developed amongst the scientists of the American continent, will enable us to destroy the last traces of the epoch in which the words "stranger" and "enemy" were synonymous.

The industrial development of the last century offers lessons of much importance to the scientific world. A study of the economic growth of modern countries clearly shows that the principle of competition is gradually giving way to the principle of cooperation.

The formation of trusts as well as the growth of trades' unions constitutes the concrete expression of these new tendencies. The eighteenth century and a considerable portion of the nineteenth were dominated by a spirit of individualism. During more than four generations, it was taken for granted that human progress is dependent on the struggle for existence and the conflict between individual and individual. During the nineteenth century the application of biological principles to human society strengthened this idea. It is the mission of the twentieth century to demonstrate that we must regard the principle of cooperation rather than that of competition as the fundamental principle of social progress.

In this congress it is our high privilege to inaugurate a new epoch giving concrete form to the idea of intellectual cooperation. In the International Bureau of American Republics we have a central organization admirably adapted to contribute toward the realization of this idea. We need such a center in order to place investigators in different portions of the American continent in contact with one another, and in order that the results of such investigations may be made the common property of all the nations of America.

of meetings, and the press of the city was most generous and helpful in its treatment of the congress. The sectional meetings, which continued during eight days, were held separately under the following heads:

1. Mathematics, Pure and Applied.
2. Physical and Chemical Sciences.
3. Natural Sciences—Biology, Paleontology, Geology, Anthropology, etc.
4. Engineering.
5. Medicine and Hygiene.
6. Jurisprudence.
7. Social Sciences.
8. Pedagogic Sciences.
9. Agriculture and Zootechny.

The program was followed, with necessary modifications from day to day. The majority of the papers were read in full or in extended abstracts, and discussion was free and often spirited. Naturally, popular interest centered largely about the sections dealing with practical problems, as education, sanitation, social science and engineering; but the more abstract sciences were not neglected. Owing to the great range of the work of the congress and the multiplicity of papers presented in the various sections, no attempt can be made in this place to present the work and results in detail. The list of papers presented by members of the American delegation and forwarded by the other

In the name of the delegation of the United States of America, I desire to express our sincere thanks for this opportunity to take part in the deliberations of this congress. No better opportunity could have been offered to become acquainted with our colleagues and fellow investigators. The ties here formed possess a significance far deeper than the personal satisfaction they imply. This visit can not help but enlarge our mental horizon, broaden our scientific activity, and strengthen the influence of our university instruction. We congratulate ourselves on the privilege of being present, and desire also to express our appreciation of the great service performed by this republic in giving such vigorous impulse to the spirit of scientific solidarity.

contributors for the United States is as follows:<sup>6</sup>

*Astronomical Problems of the Southern Hemisphere:* H. D. CURTIS.

*The Electronic Theory of Matter:* W. B. SMITH.

*Recent Progress in Spectroscopy:* A. A. MICHELSON.

*Statistics of the Use of Nitrate of Soda in the United States:* CHARLES E. MUNROE.

*The Economy of Fuels:* WILLIAM KENT.

*Recent Studies in Experimental Evolution:* THOMAS BARBOUR.

*Notes on the Origin of the North American Prairies:* C. H. HALL.

*Origin of the Minnesota Iron Ores:* C. H. HALL.

*The Peopling of America:* W. H. HOLMES.

*The Newer Geological Views Regarding Subterranean Waters:* JAMES F. KEMP.

*The Mineral Wealth of America:* R. W. RAYMOND and W. R. INGALLS.

*The Shaler Memorial Expedition in Brazil and Chile:* J. B. WOODWORTH.

*The Application of Electricity to Railways:* FRANK SPRAGUE.

*Sanitation in the Tropics with Relation to Malaria and Yellow Fever:* W. C. GORGAS.

*Frequency and Prevention of Yellow Fever:* C. J. FINLAY.

*Notes on the Sanitation of Yellow Fever and Malaria from Isthmian Experience:* H. A. CARTER.

*Plague; Methods of Control:* J. C. PERRY.

*America in the Pacific:* A. C. COOLIDGE.

*America and International Law:* PAUL S. REINSCH.

*Public Opinion in the American Democracies:* L. S. ROWE.

*Why the English Colonies on Achieving their Independence Constituted a Single State, whereas the Latin-American Colonies could not Form a Federation among Themselves, nor even a Confederation:* HIRAM BINGHAM.

*Geological Work in Brazil:* ORVILLE A. DERBY.

*Foundations of the Spanish and English Colonial Civilization in America:* BERNARD MOSES.

*American Banks:* J. LAWRENCE LAUGHLIN.

*Uniformity and Cooperation in the Census Methods of the Republics of the American Continent:* S. N. D. NORTH.

*The Influence of Urban Environment on the Life and Thought of the People:* L. S. ROWE.

<sup>6</sup>This list is in part a translation from the Spanish, and may be somewhat imperfect.

*The Treatment of Indian Tribes of the United States:* FRANCIS E. LEUPP.

*Race Degeneration:* W. B. SMITH.

*The Reclaiming of Arid Lands in the United States:* F. H. NEWELL.

*Instruction in Animal Husbandry at Agricultural Colleges of the United States:* GEORGE M. ROMMEL.

*National Sanitary Police in the United States:* GEORGE M. ROMMEL.

*The Tendencies of Female Education and its Bearing on the Social Mission of the Women of America:* WM. F. RICE.

*Laws of Heredity:* THOMAS BARBOUR.

*Adaptation of Instruction to the American Social Medium:* W. R. SHEPHERD.

*Nurses as Assistants in the Medical Inspection of Schools:* DORA KEEN.

*Recent Advances in the Study of Typhoid Fever:* M. J. ROSENAU.

*Pensioning Mothers who Depend on the Labor of their Sons, to Enable the latter to Pursue their Studies:* DORA KEEN.

*Plans and Gauges of Intercontinental Railways:* WM. J. WILGUS.

*Some Phases of the Early History of Mexico and Central America:* ALOËE FORTIER.

*The Writing of History in the United States:* W. M. SLOANE.

*The Value of Gas Power:* CHARLES E. LUCKE.

*Uniformity of Commercial Law throughout the American Continent:* ROSCOE POUND.

*Pan-American Terminology:* C. O. MAILLOUX.

*Car Lighting in North America:* R. M. DIXON.

*Reinforced Concrete Construction for South America:* WM. H. BURR.

*The New Philippine Currency System:* E. W. KEMMERER.

*Water Supply of Cities and Towns:* ALLEN HAZEN.  
*Use of Tertiary Coals in General Metallurgy and in the Manufacture of Coke:* WM. HUTTON BLAUVELT.

*The Supply of Potable Water:* RUDOLPH HERING.

*An Analysis of Five Hundred Cases of Epidemic Meningitis Treated with the Antimeningitis Serum:* JAMES W. JOBLING and SIMON FLEXNER.

*American Agriculture in Its Relation to Chilean Nitrate:* WM. S. MYERS.

*The Processes for the Concentration of Ore:* ROBERT H. RICHARDS.

*Future Supply of Iron Ore:* HENRY M. HOWE.

The concluding session of the Congress was held at the university in the forenoon of January 5, and various matters of gen-

eral interest were disposed of. These included a discussion of methods of procedure, policy and scope of future congresses, relation of the congress to government and science, etc. A number of resolutions, passed by the sections or presented by the delegations, were offered and adopted.<sup>7</sup>

<sup>7</sup> Resolution, extending to the governing board and director of the International Bureau of American Republics the thanks of the Pan-American Scientific Congress for the offer of cooperation:

WHEREAS: The Pan-American Scientific Congress has received with much satisfaction the cordial message of greetings from the Bureau of American Republics, and the kind offer of cooperation, be it

*Resolved*, That the formal thanks of the congress be transmitted to the governing board and director of the bureau, and that it be recommended to the members of the organization committee of the next Scientific Congress to avail themselves in every possible way of the valuable services which the bureau can render.

Resolution, recommending the establishment of a Section of American Bibliography in the International Bureau of the American Republics.

Recognizing the importance of establishing closer relations between investigators throughout the American continent and of disseminating the results of scientific investigations, the Pan-American Scientific Congress

*Resolves*, To recommend to the governing board of the International Bureau of the American Republics:

1. That a special section be established in the International Bureau of the American Republics to be known as the "Section of American Bibliography."

2. That the director of the bureau invite authors and investigators to send their publications to the bureau, on receipt of which notice thereof will be published in the Bulletin, which notice shall include a brief summary of the contents of such publication and the price thereof.

3. That the bureau secure for investigators any such publications at a price to be indicated in the Bulletin.

4. That the bureau endeavor so far as practicable to secure official publications for investigators.

5. That the bureau keep a record of the published progress of larger schemes of scientific investigations of Pan-American bearing.

By a practically unanimous vote it was decided to hold the next meeting in Washington in October, 1912. This action was cabled to the State Department, and Secretary Root responded in the following message:

Please express to the Pan-American Scientific Congress the satisfaction with which this government receives the announcement that Washington has been selected as the meeting-place of the congress in 1912.

A committee of five members<sup>8</sup> was appointed to arrange with the Department of State at Washington for the appointment of a permanent organization committee for the prospective meeting.

A farewell session was held in the Municipal Theater on the afternoon of January 5, at which fitting addresses were made by officials and delegates;<sup>9</sup> and at

<sup>8</sup> L. S. Rowe, George H. Rommel, W. H. Holmes, John Barrett, director of the Bureau of American Republics, and Elmer E. Brown, commissioner of education.

#### <sup>9</sup> CLOSING ADDRESS OF DR. L. S. ROWE

*Mr. President, Ladies and Gentlemen:*

The honor conferred upon my country through the designation of Washington as the next meeting place of this great assembly is the more significant because of its spontaneous character. For this demonstration of confidence, good will and fraternal solidarity I want to thank you, not only in the name of the delegation of the United States of America, but also on behalf of that larger body of scientists and investigators who are imbued with the same spirit that has actuated this congress, and who now look forward to the privilege of welcoming to our shores the men upon whose efforts the progress of this continent depends. We can not hope to surpass the hospitality of this great republic, but we can assure you that the welcome will be no less sincere, and the determination to place every possible facility at your disposal, no less effective than has been the case here in Chile.

Viewed in its proper perspective, this congress has been one of the most extraordinary assemblages of modern times; more extraordinary in many respects than either the Hague or the Pan-American conferences. That a large group of men,

night a dinner was given in the hall of the university, at which there was a generous representatives of every section of a great continent, should be able to get together and, casting aside all petty prejudices, freely and frankly exchange the results of their careful investigations and ripe experience, is not only a tribute to the culture of this continent, but is also an indication of the extent to which our ideas have advanced beyond those which we inherited from our European mother countries.

The fact that we have met to place the results of the best scientific thought at the disposal of all the countries here represented, and through them at the service of the civilized world, contains a lesson of deep and lasting import which no other assembly of modern times has been able so clearly to impress upon the civilized world.

The historian of the intellectual development of the American continent, in reviewing the work of these assemblies, will probably give to the Santiago congress the honor of having clearly demonstrated that the republics of the American continent, because of their geographical position; because of the peculiar conditions under which they were settled; and because of the special racial problems which they present, are confronted by a series of problems distinctively American. The mere fact of the existence of these problems involves an obligation not only to ourselves, but to the civilized world to concentrate our efforts upon their solution. Through their solution we can make that contribution to the progress of mankind which the world has the right to expect of us.

We can best hope to do this by carrying to our respective countries the spirit that has hovered over this congress—that of service in its broadest and highest sense. This spirit of service must be made the key-note of our national and of our international relations. The republics of the American continent must demonstrate to the civilized world that the willingness and determination to be of service to our fellow-men is the cornerstone of a philosophy which the nations of this continent are determined to make the guiding principle of their conduct.

I can see a time, not far distant, when with each conquest of science the question will immediately arise in the mind of every American, "How can these results be made of service to the democracies of this continent?"—a time when in every field of endeavor the American republics may call upon one another for counsel in the solu-

expression of good feeling and a striking display of oratory.

The social features of the congress were most noteworthy. The president of the republic, besides giving the usual official reception, entertained the foreign delegates at dinner, invitations being extended to a limited number each day during the congress. Receptions were given under government auspices at the principal social clubs. The American Minister, the French, Brazilian and Argentine Ministers, and numerous prominent citizens entertained the delegates. Members of the American and other delegations were guests at a number of charming haciendas in the vicinity of Santiago; and the American delegation entertained at dinner members of the organization committee, chairmen of various national delegations and others. Visits were made to institutions of learning, museums, art galleries, hospitals and manufacturing establishments, and no effort was spared by the officials of the congress to make the visit of the foreign delegates enjoyable and profitable. The writer wishes to express his personal appreciation of these courte-

tion of their problems, and be certain to receive the best expert advice. Then, and not till then, shall we have developed a real continental spirit; then, and not till then, shall we have fulfilled the obligations which our privileged position in the world's affairs has placed upon us. I can imagine no greater distinction for the next congress than the possibility of marking a further step in the development of this spirit of service and of continental solidarity.

And now, in closing, let me again extend the thanks of the delegation of the United States of America to you, the members of the organizing committee, for your broad grasp of the purposes of the congress and the skill with which these purposes have been made real and effective; to you, our colleagues, for your cordial reception of newcomers in your midst, and finally to the government and people of Chile for the warm-hearted hospitality which we have enjoyed.

sies and attentions, and to say that he approached South America somewhat oppressed by the thought that he should find himself a stranger in a strange land, but that, on the contrary, there was not a day of the two months spent in the Latin-American countries on which he was not made to feel entirely at home and among appreciative and generous friends.

The universal feeling at the close of the congress was that the meeting had fully justified the plans of its projectors; and the story is not entirely told when it is stated that the elaborate program, covering nearly every branch of science, was successfully carried out. The more thoughtful find in this and in kindred assemblages, much that is of significance for the future of the American republics. This congress was a decided step in the direction of bringing about a better understanding among the nations represented. It was a step toward a fuller appreciation of the common interests of each and every American nation. It was an appreciable forward step in the development of the means and methods of promoting the common interests of the continent. It was a step toward making the experience and the accumulated wisdom of each people represented the experience and wisdom of all. In the Section of Pedagogy, the best that has been developed in the theory and practise of teaching was made the common property of all the American republics. In the Section of Sanitary and Medical Science, the latest achievements of each nation in the battle with disease were made familiar to every participant. In the Section of Agriculture and Zootechny, steps were taken in the direction of properly utilizing and conserving the resources of the continent in these important realms. In the Section of Engineering, the best methods of overcoming the various physical obstacles to progress and of winning the riches of the earth, were

explained for the benefit of all America. In the Section of Government and Law, the principles of statecraft and the administration of justice were discussed for the benefit of every American government. In the Section of the Fiscal Sciences, practical methods of conducting the monetary affairs of the nations were presented and explained. And in every other branch of science, practical and abstract, the various forces and agencies that contribute toward progress and enlightenment were in a measure the subject of serious attention. The congress was an initial step toward making the best of all the peoples of the western hemisphere. It was an initial step in making the best, for to-day and for all time, of the resources of the continent. It was an initial step which in many ways must make for the peace and prosperity of the continent. It was a noteworthy step in conformity with manifest destiny as expressed in the phrase "America for Americans."

The success of the congress of 1912 depends upon the interest displayed in it by the scientific world, and on the support accorded by the Pan-American governments. The time is ample, and the appointment of an organization committee representative of a wide range of scientific interests is the first step in making the Washington meeting an event worthy of the nation and its capital.

W. H. HOLMES

BUREAU OF AMERICAN ETHNOLOGY

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MARTIN HANS BOYE

DR. M. H. BOYÈ died at Coopersburg, near Bethlehem, Pa., on March 5, aged ninety-seven years. He was born in Copenhagen, Denmark, in 1812, and in 1832 was graduated from the University of Copenhagen and in 1835 from its Polytechnic School, studying under Oersted, Zeise and Fodchhammer. In 1836 he removed to Philadelphia and entered the University of Pennsylvania, studying chemis-