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.

DOCTORATES CONFERRED BY AMERICAN UNIVERSITIES.

WE publish for the seventh year statistics in regard to the doctorates conferred by our universities. The degree of doctor of philosophy or of science was received by 281 candidates from 24 institutions. In addition to the 34 universities and colleges from which returns have been received, there may be a few cases in which the degree has been conferred legitimately by smaller institutions, but they are certainly very few. As a matter of fact, four fifths of all the degrees are conferred by seven universities. There have not during the past seven years, and probably never previously, been so many degrees conferred as in the present year. The numbers for the seven years are 234, 222, 239, 253, 216, 266 and 281. The figures fluctuate from year to year, but indicate an increase in seven years of about twenty per cent. This seems to be disappointingly small. In an article by Dr. Tombo, recently (July 15) printed in this journal, it is stated that the number of graduate students has more than doubled in the past five years, and in an article by Dr. Mayer, also printed here (July 8), it is said that the number of graduate students increased two and a half times from 1890 to 1902. It is not clear why the number who receive the advanced degree should not increase as rapidly as the number of graduate students. This is not due to a raising of the standards, as these have remained about stationary; nor is it due to lack of encouragement on the part of the universities, as fellowships and other in-

ducements are freely offered. Dr. Tombo states that Columbia has almost 700 resident candidates for the higher degrees, yet it conferred only 29 doctorates at the recent commencement. A large number of masters' degrees was conferred, but the men receiving this degree stop short of research.

TABLE I.

DOCTORATES CONFERRED.

	1898	1899	1900	1901	1902	1903	1904	Total
Yale	34	30	26	39	29	36	39	233
Chicago	36	24	37	36	27	32	36	228
Harvard	26	24	36	29	31	28	46	220
Johns Hopkins	33	38	33	30	17	23	31	205
Columbia	22	33	21	25	32	39	29	201
Pennsylvania	24	20	15	25	14	29	18	145
Cornell	19	7	19	21	23	20	13	122
Clark	12	5	9	7	1	4	10	48
Michigan	7	4	5	3	10	10	8	47
New York	5	9	7	6	4	4	9	44
Wisconsin	5	7	5	5	6	2	10	40
Virginia	0	2	2	8	6	3	1	22
Columbia	1	0	5	3	2	4	3	18
Minnesota	1	2	3	2	3	3	3	17
Brown	1	3	3	2	2	5	0	16
Bryn Mawr	3	3	1	2	2	0	5	16
California	1	3	2	2	1	3	3	15
Princeton	0	3	3	3	1	1	2	13
Boston	0	0	0	0	0	4	7	11
Stanford	2	0	2	2	2	1	1	10
Nebraska	2	1	1	1	0	0	2	7
Washington	0	2	0	1	0	1	1	5
Georgetown	0	0	0	0	0	3	1	4
Vanderbilt	0	0	3	1	0	0	0	4
Colorado	0	1	0	0	0	0	2	3
Kansas	0	1	0	0	0	2	0	3
Lafayette	0	0	0	0	0	3	0	3
North Carolina	0	0	0	0	2	1	0	3
Cincinnati	0	0	0	0	0	1	1	2
Iowa	0	0	0	0	0	2	0	2
Lehigh	0	0	0	0	0	2	0	2
Syracuse	0	1	0	0	1	0	0	2
Missouri	0	1	0	0	0	0	0	1
Tulane	0	0	1	0	0	0	0	1
	234	224	239	253	216	266	281	1713

The 1,713 men who have received the doctor's degree during the past seven years have not been selected by a severe process of elimination, but have in large measure been artificially encouraged. Probably not more than one in five of them will advance science or learning to a significant extent. Yet perhaps one half of all academic appointments are made from this small group. Science here suffers severely as compared with medicine or law, each of which professions receives some 5,000 recruits annually, allowing ample material for selection for the higher positions.

The first table gives details in regard to the universities which have conferred the degree during the past seven years. Harvard this year conferred 46 degrees, which is the largest number on the records. Yale, which like Harvard does not require the publication of the doctors' dissertations, still stands first in point of numbers, followed by Chicago, where the numbers are considerably augmented by degrees conferred on students of theology. A group of five universities conferred 181 out of 281 degrees. Wisconsin conferred 10 and Michigan 8 degrees; in view of the constant strengthening of the state universities and the large number of students from the central and western states who pursue graduate studies in the eastern institutions, we may expect a considerable increase in the number of degrees granted by the state universities. It is somewhat surprising that California and Stanford have together conferred the degree but twenty-five times in seven years.

TABLE II.

DOCTORATES CONFERRED IN THE SCIENCES.

	1898	1899	1900	1901	1902	1903	1904	Total
Chemistry	27	32	26	28	26	33	33	205
Physics	11	7	15	23	12	14	17	99
Zoology	12	11	11	15	16	12	15	92
Psychology	18	15	9	13	8	16	10	89
Mathematics	11	13	11	18	8	7	13	81
Botany	11	11	12	8	11	9	17	79
Geology	6	5	5	10	6	10	7	49
Physiology	4	1	4	1	8	8	1	27
Astronomy	3	2	4	5	2	4	4	24
Education	0	5	8	2	1	2	0	18
Sociology	0	5	3	3	4	2	1	18
Paleontology	0	4	2	1	0	2	2	11
Bacteriology	0	1	1	1	1	3	3	10
Anthropology	2	0	2	1	0	1	2	8
Agriculture	0	0	0	0	2	2	2	6
Anatomy	0	0	0	1	0	4	0	5
Engineering	0	0	0	1	0	3	1	5
Mineralogy	0	2	0	0	1	1	0	4
Pathology	0	0	0	0	0	3	0	3
Meteorology	0	1	0	0	0	0	0	1
	105	115	113	131	106	136	128	834

The second table gives details in regard to the natural and exact sciences, in which

about one half of all the degrees are conferred. There is this year a falling-off in the relative number in the sciences, which is, however, not large enough to be significant. The larger institutions, in which half or more than half of the degrees were this year in the sciences, are Harvard, Johns Hopkins, Cornell, Pennsylvania, Clark and Michigan.

TABLE III.

DOCTORATES CONFERRED IN THE SCIENCES.

	1898	1899	1900	1901	1902	1903	1904	Total
Johns Hopkins	19	17	20	19	9	10	17	111
Chicago	12	13	19	16	15	21	14	110
Columbia	10	23	12	13	14	18	11	101
Harvard	11	7	15	15	14	15	23	100
Yale	11	15	10	18	10	13	15	92
Cornell	11	2	11	13	16	13	8	74
Pennsylvania	8	8	6	12	5	14	9	62
Clark	12	5	9	7	1	4	10	48
Michigan	0	3	1	0	5	4	6	19
Wisconsin	2	4	1	3	4	0	4	18
California	1	3	1	2	1	3	2	13
Columbian	1	0	3	1	1	4	1	11
Bryn Mawr	1	2	1	2	1	0	2	9
Virginia	0	2	0	4	1	2	0	9
Brown	1	0	0	1	2	4	0	8
Stanford	2	0	0	1	2	1	1	7
Nebraska	2	1	1	1	0	0	1	6
Princeton	0	3	1	0	0	1	1	6
Minnesota	0	1	1	0	2	1	0	5
Washington	0	2	0	1	0	1	1	5
New York	1	1	0	1	0	0	1	4
Kansas	0	1	0	0	0	2	0	3
North Carolina	0	0	0	0	2	1	0	3
Lehigh	0	0	0	0	0	2	0	1
Vanderbilt	0	0	1	1	0	0	0	1
Colorado	0	1	0	0	0	0	0	1
Georgetown	0	0	0	0	0	0	1	1
Iowa	0	0	0	0	0	1	0	2
Lafayette	0	0	0	0	0	1	0	1
Missouri	0	1	0	0	0	0	0	2
Syracuse	0	0	0	0	1	0	0	1
	105	115	113	131	106	136	128	834

The third table gives details in regard to the separate sciences. There was an unusually large number of degrees with botany as the major subject. Otherwise there is no notable change in the positions of the subjects. The subjects in which three or more degrees were conferred by a university were: *Chemistry*—Yale, Pennsylvania, Columbia, Harvard and Johns Hopkins; *Physics*—Chicago, Johns Hopkins and Clark; *Zoology*—Harvard, Chicago and Johns Hopkins; *Botany*—Harvard and Wisconsin; *Mathematics*—Yale; *Psychology*—Clark.

The names of those on whom the degree was conferred in the natural and exact sciences, with the subjects of their theses are as follows:

JOHNS HOPKINS UNIVERSITY.

James Barnes: I., 'On the Analysis of Bright Spectrum Lines'; II., 'On the Spectrum of Magnesium.'

Harry Preston Bassett: 'Determination of the Relative Velocities of the Ions of Silver Nitrate in Mixtures of the Alcohols and Water and on the Conductivity of Such Mixtures.'

Charles Edward Brooks: 'Orthic Curves; or Algebraic Curves which satisfy Laplace's Equation in Two Dimensions.'

Charles Geiger Carroll: 'A Study of the Conductivity of Certain Electrolytes in Water, Methyl and Ethyl Alcohols and Mixtures of these Solvents; the Relation between Conductivity and Viscosity.'

Walter Buckingham Carver: 'On the Cayley-Veronese Class of Configurations.'

Howard Waters Doughty: 'Phenylsulphone-orthocarbonic Acid and Related Compounds.'

Otto Charles Glaser: 'The Larva of *Fasciolaria tulipa* (var. *distans*).'

Elliot Snell Hall: I., 'A Study of Some New Semi-permeable Membranes'; II., 'Experiments on the Preparation of Porous Cups suitable for the Measurement of Osmotic Pressure.'

Henry Dickinson Hill: 'Measurement of Self-Inductance.'

Arthur Isaac Kendall: 'An Investigation of the Methods of Bacterial Technique, Preparation of Cultural Media, Cultural Characteristics and the Classification of Bacteria.'

Ernest Gale Martin: 'An Experimental Study of the Rhythmic Activity of Strips of Heart Muscle.'

John Joseph Rutledge: 'The Clinton Iron Ores of Stone Valley, Huntingdon County, Pennsylvania.'

Harry William Springsteen: 'The Magnetic Rotatory Dispersion of Sodium Vapor.'

Charles Kephart Swartz: 'The Columbus Formation of Central-Northern Ohio, including an Account of the Geology of the Eastern Part of Marblehead Peninsula.'

David Hilt Tennent: 'A Study of the Life-History of *Bucephalus haimeanus*, a Parasite of the Oyster.'

William Phillips Winter: 'An Investigation of Sodamide and of its Reaction-products with Phosphorus and with Phosphorous Pentachloride.'

Rheinart Parker Cowles: '*Phoronis Architecta:* Its Life-History, Anatomy and Breeding Habits.'

UNIVERSITY OF CHICAGO.

Thomas Eaton Doubt: 'The Effect of the Intensity upon the Velocity of Light.'

George Harrison Shull: 'A Second Contribution to the Establishment of Place-Constants for Aster Prenanthoides Muhl. at Clifton, Ohio.'

Elizabeth Kemper Adams: 'The Esthetic Experience: Its Meaning in a Functional Psychology.'

Jessie Blount Allen: 'The Psychology of the Guinea Pig.'

Raymond Foss Bacon: 'On Sodium Benzohydrol.'

William Henry Bussey: 'Generational Relations for the Abstract Group, simply Isomorphic with the Linear Fractional Group.'

William Harve Emmons: 'The Geology of Haystack Mountains, Montana.'

Fannie Cornelia Frisbie: 'The Effect of Pressure on Magnetic Induction.'

Thomas Carlyle Hebb: 'The Velocity of Sound.'

Arthur Constant Lunn: 'The Differential Equations of Dynamics.'

Charles Dwight Marsh: 'The Plankton of Lake Winnebago and Green Lake.'

John William Scott: 'Studies in the Experimental Embryology of some Marine Annelids.'

Laetitia Morris Snow: 'The Effect of External Agents on the Production of Root-hairs.'

Charles Zeleny: 'Studies in Regulation and Regeneration.'

COLUMBIA UNIVERSITY.

Hal Truman Beans: 'Maminobenzonitrile and Some of its Derivatives.'

Louis Israel Dublin: 'The History of the Germ Cells in *Pedicellina Americana*.'

Myron Samuel Falk: 'On the Elastic Properties of Cement Mixtures.'

Charles Savage Forbes: 'Geometry of Circles Orthogonal to a Given Sphere.'

William Flowers Hand: 'A Further Investigation of Syntheses of the Alkylketodihydroquinazolines.'

William Jones: 'Some Principles of Algonkin Word Formation.'

William Erskine Kellicott: 'The Development of the Vascular System of Ceratodus.'

Arthur Colon Neish: 'A New Separation of Thorium from Cerium, Lanthanum and Didynium by Means of Metanitro Benzoic Acid.'

Naomi Norsworthy: 'The Psychology of Mentally Deficient Children.'

Hervey Woodburn Shimer: 'The Upper Siluric and Lower Devonic Faunas of Trilobite Mountain, Orange Co., N. Y.'

William Cullen Uhlig: 'The Nitrogen Contents of Commercial Distilled Water.'

HARVARD UNIVERSITY.

Edwin Plimpton Adams: I., 'The Electromagnetic Effects of Moving Charged Spheres'; II., 'Water Radioactivity; III., 'The Induced Radioactivity Due to Radium.'

Glover Morrill Allen: 'The Heredity of Coat Color in Mice.'

Lewis Darwin Ames: 'An Arithmetic Treatment of Some Problems in Analysis Situs.'

James Carleton Bell: 'Reactions of the Crayfish to Sensory Stimuli.'

James Mackintosh Bell: 'Report on the Michipicoten Iron Range.'

Albert Francis Blakeslee: 'Sexual Reproduction in the Mucorineae.'

Foster Partridge Boswell: 'Visual Irradiation.'

Daniel Francis Calhane: I., 'The Action of Sodic Ethylate on Certain Dibromdinitrobenzols, with Some New Derivatives in this Class'; II., 'On the Manner of Oxidation to Quinones in the Case of Aromatic Diamines.'

Henry Avery Carlton: 'On Some Addition Compounds Derived from Certain Aromatic Compounds.'

Frederic Walton Carpenter: 'The Development of the Oculomotor Nerve, the Ciliary Ganglion, and the Abducent Nerve in the Chick.'

James Brown Dandeno: 'An Investigation of Some of the Effects of Water and of Certain Aqueous Solutions Applied to Foliage.'

Joseph Horace Faull: 'The Development of the Ascus and the Formation of the Spores in the Ascomycetes.'

John L. Hogg: 'Pressure Gauges for High Vacua.'

Arthur Becket Lamb: 'The Specific Heats of Aqueous Salt Solutions.'

Robert Greenleaf Leavitt: 'Trichomes of the Root in Vascular Cryptogams and Angiosperms.'

Philip Anderson Shaffer: 'An Investigation of Metabolism in the Insane, together with a Discussion of Analytical Technique in Metabolism Experiments.'

Grant Smith: 'On the Eyes of Certain Pulmonate Gastropods, with Special Reference to the Neurofibrillae in *Linax* Maximus.'

Philip Sidney Smith: 'The Copper Sulphide Deposits of Orange County, Vermont.'

Alfred Marston Tozzer: 'A Comparative Study of the Mayas and the Lacandones.'

David Hutton Webster: 'Primitive Social Control: A Study of Initiation Ceremonies and Secret Societies.'

Roger Clark Wells: 'The Atomic Weight of Sodium.'

James Jacob Wolfe: 'Cytological Studies on Nemalion.'

Henry Cook Boynton: 'An Investigation into the Relation between the Treatment, Structure and Properties of Steel.'

YALE UNIVERSITY.

Silas Palmer Beebe: 'The Effect of Alcohol and Alcoholic Fluids upon the Excretion of Uric Acid in Man.'

Howard Logan Bronson: 'On the Transverse Vibrations of Helical Springs.'

Robert William Curtis: 'The Action of the Halogen Acids upon Vanadic Acid.'

Edward Lewis Dodd: 'Multiple Sequences.'

Ralph Davis Gilbert: 'The Estimation of Vanadium.'

George Samuel Jamieson: 'Researches in Organic Chemistry.'

Oliver Clarence Lester: 'On the Oxygen Absorption Bands of the Solar Spectrum.'

Herbert Edwin Medway: 'The Use of a Rotating Cathode in the Electrolytic Determination of the Metals.'

Elbert William Rockwood: 'Studies in Nutrition.'

Burke Smith: 'On Surfaces which may be Deformed with Preservation of a Conjugate System of Curves.'

Clara Eliza Smith: 'Representation of an Arbitrary Function by Means of Bessel's Functions.'

Robert Eccles Swain: 'The Formation of Kynurenic Acid by the Animal Body.'

Mignon Talbot: 'Contributions to a Revision of the Helderbergian Fauna of New York.'

Andrew Lincoln Winton: 'Studies in Methods of Proximate Organic Analysis.'

George Albert Young: 'Geology and Petrology of Mount Yamaska, Province of Quebec.'

CORNELL UNIVERSITY.

Fred William Foxworthy: 'On the Histological Structure of the Wood of the North American Coniferæ.'

Oskar Augustus Johannsen: 'The Chironomidæ.'

Thomas Lyttleton Lyon: 'A Method for Improving the Quality of Wheat for Bread Making.'

Alexander Dyer MacGillivray: 'The Embryological Development of *Corydalis cornutus*.'

Arthur Renwick Middleton: 'The Determination of Acetylene.'

Clarence Lemuel Elisha Moore: 'On the Quadratic Spherical Complex.'

Walter Porter White: 'Spark Damping and Hertzian Waves of Small Damping.'

John Wesley Young: 'On the Group of Sign $(0, 3; 2, 4, \infty)$ and the Functions belonging to it.'

UNIVERSITY OF PENNSYLVANIA.

Donald Sinclair Ashbrook: 'Electrolytic Separations Possible with a Rotating Anode.'

Lloyd Balderston, Jr.: 'An Interference Method for the Determination of the Speed of Sound in Liquids.'

Howard Winter Brubaker: 'Derivatives of Complex Inorganic Acids.'

Roy Dykes Hall: 'Observations on the Metallic Acids.'

Leslie Howard Ingham: 'The Use of a Rotating Anode in the Electrolytic Estimation of Zinc and of Nitric Acid.'

John Franklin Meyer: 'The Thermo-Electromotive Force of Nickel Nitrate in Organic Solvents.'

Sarah Pleis Miller: 'Determination and Separations of Gold in the Electrolytic Way.'

Ralph Emerson Myers: 'Results Obtained in Electro-Chemical Analysis by the Use of a Mercury Cathode.'

Everett Franklin Phillips: 'The Structure and Development of the Compound Eye of the Honey Bee.'

CLARK UNIVERSITY.

Charles E. Browne: 'Psychology of the Simple Arithmetical Processes.'

W. Fowler Bucke: 'Examinations and Grading.'

Edward Conradi: 'The Psychology and Pathology of Speech Development in the Child.'

Josiah Moses: 'Religious Pathology.'

August W. Trettien: 'Psychology of the Language Interest of Children.'

Fred Mutchler: 'A Study of the Structure and Biology of the Yeast Plant, *S. cerevisiae*.'

Jesse Nevin Gates: 'Cubic and Quartic Surfaces in 4-fold Space.'

Arthur L. Clark: 'Surface Tension at the Boundary Between a Liquid and the Vapor of another Liquid in the Neighborhood of the Critical Point.'

Joseph George Coffin: 'The Calculation and Construction of a Fundamental Standard of Self-induction.'

John Charles Hubbard: 'On the Conditions of Sparking at the Break of an Inductive Circuit.'

UNIVERSITY OF MICHIGAN.

Alphonso Morton Clover: 'A Study of the Peroxides of Organic Acids and the Hydrolysis of Organic Acid Peroxides and Peracids.'

Lewis Ralph Jones: 'The Cytolytic Enzyme produced by Bacillus Carotovorus and Certain Other Soft-rot Bacteria.'

Ward J. MacNeal: 'The Pathology of Experimental Nagana.'

Harriet Williams Bigelow: 'Determination of the Declinations of Certain North Polar Stars with the Meridian Circle.'

Edgar Nelson Transeau: 'The Bog Vegetation of the Huron River Valley.'

Frederick Amos Baldwin: 'On the Life History of Trypanosoma Lewisi and Trypanosoma Brucei.'

UNIVERSITY OF WISCONSIN.

Charles Elmer Allen: 'Nuclear and Cell Division in the Pollen Mother Cells of *Lilium canadense*.'

Rollin Henry Denniston: 'The Structure of Starch Grain.'

Susie Percival Nicholas: 'The Nature and Origin of the Binucleate Cells in Some *Basidiomycetes*.'

Fritz Wilhelm Woll: 'On the Relation of Food to the Production of Milk and Butter Fat by Dairy Cows.'

BRYN MAWR COLLEGE.

Virginia Ragsdale: 'On the Arrangement of the Real Branches of Plane Algebraic Curves.'

Marie Reimer: 'The Addition Reactions of Sulphinic Acid.'

UNIVERSITY OF CALIFORNIA.

William John Sharwood: 'A Study of the Double Cyanides of Zinc with Potassium and with Sodium.'

William John Sinclair: I., 'The Exploration of the Potter Creek Cave'; II., 'New Mammalia from the Quaternary Caves of California.'

COLUMBIAN UNIVERSITY.

Frank Van Vleck: 'Improvements in Ship Construction.'

LELAND STANFORD JUNIOR UNIVERSITY.

William Albert Manning: 'Studies on the Class of Primitive Substitution Groups.'

UNIVERSITY OF NEBRASKA.

Mrs. Edith Schwartz Clements: 'The Relation of Physical Factors to Leaf Structure.'

PRINCETON UNIVERSITY.

John Merrill Poor: 'Orbit of Comet 1900 II.'

WASHINGTON UNIVERSITY.

Samuel Monds Coulter: 'An Ecological Comparison of Some Typical Swamp Areas.'

NEW YORK UNIVERSITY.

Frederick G. Reynolds: 'The Viscosity Coefficient of Air and the Effect of the Roentgen Ray Thereon.'

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*SOME ASPECTS OF MEDICAL EDUCATION.**

THIS association has been, should be, and we trust will be the storm center of legislation for reform in medical education. Since the memorable editorials of Wood in the old *Philadelphia Times,* and the masterly papers and addresses of Pepper and the practical action of the University of Pennsylvania there has been virile progress. In most respects it seems definitely settled as to the course of education a candidate for the degree of medicine should take. Questions of pedagogy are still debatable, but we take it that that student who wishes the quickest returns, the most lasting remuneration, perennial stimulation of the intellect and continuous enjoyment in the pursuit of his labors, should take a college education of three or four years, a four years' course in medicine and, if possible, a hospital interneship.

Reference need only be made to the reports to this association, to the famous report of the majority committee of the Association of American Medical Colleges, to the numbers of the *Journal of the American Medical Association,* comprehensively devoted to education, and to many recent admirable addresses in support of the statements.

There is talk about maximum and minimum requirements, about laboratory and hospital courses, the merits of didactic

* Concluding part of president's address at the fifty-fifth annual session of the American Medical Association.