SPECIAL ARTICLES

THE DISTRIBUTION OF AMERICAN MEN OF SCIENCE IN 1932

FOR the fifth edition of the "Biographical Directory of American Men of Science" there have been selected by objective methods 250 of those not included in the earlier selections who are regarded by their colleagues as among the leading scientific workers of the United States. The methods used were the same as in the fourth edition; there and in the earlier editions they were fully described and their validity was discussed in detail.[1]

The primary object of the work, begun more than thirty years ago, was to secure a group for scientific study. Still earlier there had been selected by objective methods the thousand most eminent men of history, and measurements had been made of nearly a thousand students of Columbia University. Each of the three groups is suited to scientific study, owing to its sociological interest and to the availability of the material. At that time but little attention had been paid to the measurement of individual differences, the present writer having in 1885 invented the term and published the first quantitative work on the subject.

Arguments may be advanced for and against giving the names of the scientific men selected for study. Each of them is probably among our thousand leading research workers, but there are others who deserve to be included. The situation is the same as in election to an academy of sciences or appointment to a university position, except that the determination of scientific merit is more exact. We also have an analogous problem in the measurement of the ability of a child or a college student.

It is sometimes argued that all such determinations are undemocratic. Democracy, however, does not consist in reducing all to a common mediocracy, but in giving opportunity to each in accordance with his ability and fitness. We long have had school grades, college entrance examinations, requirements for the doctorate, qualifications for a university position, honorary degrees, and societies of limited membership. In so far as psychology is gradually developing quantitative methods to measure individual differences the results may at times seem harsh and inconsiderate of the individual; but in the long run truth is better than illusion.

While there are those who do not approve the selection of a group of leading scientific workers, others urge that the stars should be dropped when a position among the thousand is not maintained. The competition in the earlier selections was less severe, for in 1903 there were only about 4,000 Americans who had published research work, whereas now there are more than 20,000. It is also true that some men do not maintain the promise of their earlier work. A selection which is correct at the time within the limits of the probable error may not hold thirty years later. In order to make the situation definite and to supply information that may be of historical interest, there will be given in the new edition of the book an index number with the star, showing the edition in which the individual was added to the list.

As the number of entries in the book is now so large, it may be desirable to give the list of those to whom stars have been assigned in the fifth edition. The date of reference is approximately January 1, 1932, subsequent changes of address being given in brackets. The 250 names are as follows:

Anatomists

Edgar Allen, University of Missouri
George W. Bartelmez, University of Chicago
Edward A. Boyden, University of Minnesota
J. L. Bremer, Harvard University
Hal Downey, University of Minnesota
George B. Wislocki, Harvard University

Anthropologists

Ruth Benedict, Columbia University
Fay-Cooper Cole, University of Chicago
Ralph Linton, University of Wisconsin
Frank H. H. Roberts, Jr., Smithsonian Institution
Leslie Spier, Yale University

Astronomers

R. T. Crawford, University of California
Milton L. Humason, Mt. Wilson Obs., Carnegie Inst.
Hamilton M. Jeffers, Lick Obs., Univ. of California
Dean B. McLaughlin, Detroit Obs., Univ. of Michigan
Donald H. Menzel, Lick Obs., Univ. of Calif. [Harvard]
Herbert R. Morgan, U. S. Naval Observatory
H. H. Plaskett, Harvard College Obs., [Oxford Univ.]
R. F. Sanford, Mt. Wilson Obs., Carnegie Institution
E. C. Slipher, Lowell Observatory
Harlan True Stetson, Perkins Obs., Ohio Wesleyan Univ.
J. Q. Stewart, Princeton University
Otto Struve, Yerkes Observatory, University of Chicago
Ralph E. Wilson, Dudley Observatory

Botanists

H. A. Allard, U. S. Department of Agriculture
S. F. Blake, U. S. Department of Agriculture
John T. Buchholz, University of Illinois
Roy E. Clausen, University of California

[1] In order to prevent misunderstandings that occur, it may be stated here: (1) The present writer has devised the methods and compiled the returns, but, apart from casting one vote for the psychologists, has had no part whatever in the selections. (2) Residents of North America are included in the book, but only residents of the United States in the selections for the stars. (3) The applied sciences as such are not included. (4) When an individual is selected in more than one science, he is assigned to the science in which he stands highest. (5) The subject of research given in the book is usually, but not always, the subject in which the star has been assigned.

William S. Cooper, University of Minnesota
Otis F. Curtis, Cornell University
F. E. Denny, Boyce Thompson Institute
Carroll W. Dodge, Missouri Botanical Garden
J. Horace Faull, Arnold Arboretum, Harvard University
H. S. Fawcett, Citrus Exp. Sta., University of California
H. M. Fitzpatrick, Cornell University
T. H. Goodspeed, University of California
R. B. Harvey, University of Minnesota
Chas. F. Hottes, University of Illinois
D. F. Jones, Connecticut Experiment Station
Irving E. Melhus, Iowa State College
Raymond J. Pool, University of Nebraska
Alfred Rehder, Arnold Arboretum, Harvard University
William J. Robbins, University of Missouri
Karl Sax, Harvard University
Fred. J. Seaver, New York Botanical Garden
William Seifriz, University of Pennsylvania
Gilbert M. Smith, Stanford University
W. Randolph Taylor, University of Michigan
Sam F. Trelease, Columbia University

Chemists

Homer Adkins, University of Wisconsin
Rudolph J. Anderson, Yale University
Donald H. Andrews, Johns Hopkins University
F. Russell v. Bichowsky, Naval Research Laboratory
Arthur M. Buswell, University of Illinois
Wallace H. Carothers, E. I. du Pont de Nemours and Co.
George L. Clark, University of Illinois
E. J. Cohn, Harvard Medical School
Louis F. Fieser, Harvard University
N. Howell Furman, Princeton University
Reynold C. Fuson, University of Illinois
W. F. Giauque, University of California
G. E. Gibson, University of California
Henry Gilman, Iowa State College
Michael Heidelberger, Columbia University
Arthur J. Hill, Yale University
Charles D. Hurd, Northwestern University
W. A. Jacobs, Rockefeller Institute
John R. Johnson, Cornell University
Oliver Kamm, Parke, Davis and Company
M. S. Kharasch, University of Chicago
George B. Kistiakowsky, Harvard University
I. M. Kolthoff, University of Minnesota
Victor K. LaMer, Columbia University
Wendell M. Latimer, University of California
J. W. MacBain, Stanford University
Edward Mack, Jr., Ohio State University
Carl S. Marvel, University of Illinois
Leonor Michaelis, Rockefeller Institute
Thomas Midgley, Jr., Ethyl Gasoline Corporation
Julius Arthur Nieuwland, University of Notre Dame
John H. Northrop, Rockefeller Institute
W. Albert Noyes, Jr., Brown University
Linus Pauling, California Institute of Technology
Robert N. Pease, Princeton University
F. O. Rice, Johns Hopkins University
George Scatchard, Massachusetts Institute of Technology
H. I. Schlesinger, University of Chicago
Charles P. Smyth, Princeton University
C. M. A. Stine, E. I. du Pont de Nemours and Co.
E. C. Sullivan, Corning Glass Works
E. H. Volwiler, Abbott Laboratories
H. H. Willard, University of Michigan
John Arthur Wilson, Milwaukee, Wisconsin

Geologists

Ernst Antevs, Auburn, Maine
Donald C. Barton, Houston, Texas
Alan M. Bateman, Yale University
Kirk Bryan, Harvard University
Walter H. Bucher, University of Cincinnati
S. R. Capps, U. S. Geological Survey
Ralph W. Chaney, University of California
J. A. Cushman, Sharon, Massachusetts
C. N. Fenner, Geophysical Laboratory, Carnegie Inst.
Henry G. Ferguson, U. S. Geological Survey
Aug. F. Foerste, Dayton, Ohio [U. S. Nat. Museum]
Charles W. Gilmore, U. S. National Museum
Frank L. Hess, U. S. Bureau of Mines
G. F. Kay, University of Iowa
F. H. Lahee, Sun Oil Company
Morris M. Leighton, Illinois State Geological Survey
Chester R. Longwell, Yale University
H. E. Merwin, Geophysical Laboratory, Carnegie Inst.
Raymond C. Moore, University of Kansas
John B. Reeside, Jr., U. S. Geological Survey
Clarence Samuel Ross, U. S. Geological Survey
E. H. Sellards, University of Texas
W. T. Thom, Jr., Princeton University
Chester K. Wentworth, Washington Univ. (St. Louis)
Wendell P. Woodring, U. S. Geological Survey

Mathematicians

C. Raymond Adams, Brown University
A. Adrian Albert, Columbia University [Univ. Chicago]
Jesse Douglas, Massachusetts Institute of Technology
Lester R. Ford, Rice Institute
Tomlinson Fort, Lehigh University
Thornton C. Fry, Bell Telephone Laboratories
Lawrence M. Graves, University of Chicago
Mark H. Ingraham, University of Wisconsin
Rudolph E. Langer, University of Wisconsin
C. C. MacDuffee, Ohio State University
John v. Neumann, Princeton University
Oystein Ore, Yale University
Tibor Radó, Ohio State University
M. H. Stone, Yale University
Dirk J. Struik, Massachusetts Institute of Technology
T. Y. Thomas, Princeton University
J. V. Uspensky, Stanford University
Gordon T. Whyburn, Johns Hopkins University
D. V. Widder, Harvard University
R. L. Wilder, University of Michigan

Pathologists

T. Addis, Stanford University
S. Bayne-Jones, University of Rochester [Yale Univ.]
A. E. Cohn, Rockefeller Institute
Walter E. Dandy, Johns Hopkins University
Edward Francis, National Institute of Health
Evarts A. Graham, Washington University (St. Louis)
Alfred F. Hess, N. Y. Univ. and Bellevue Hosp. Med. Col.
Esmond R. Long, University of Chicago [Phipps Inst.]

K. F. Meyer, Hooper Foundation, Univ. of California
George R. Minot, Harvard University
Arnold R. Rich, Johns Hopkins University
T. M. Rivers, Rockefeller Institute
Carl TenBroeck, Rockefeller Institute
Augustus Wadsworth, N. Y. State Department of Health
Leslie T. Webster, Rockefeller Institute

Physicists

Samuel K. Allison, University of Chicago
J. W. Beams, University of Virginia
J. A. Bearden, Johns Hopkins University
Joseph A. Becker, Bell Telephone Laboratories
Robert B. Brode, University of California
Edw. U. Condon, Princeton University
David M. Dennison, University of Michigan
G. H. Dieke, Johns Hopkins University
Lee A. DuBridge, Washington University (St. Louis)
O. S. Duffendack, University of Michigan
Carl Eckart, University of Chicago
A. Ellett, University of Iowa
L. H. Germer, Bell Telephone Laboratories
R. Clifton Gibbs, Cornell University
Samuel A. Goudsmit, University of Michigan
Ross Gunn, Naval Research Laboratory
G. R. Harrison, Massachusetts Institute of Technology
William V. Houston, California Institute of Technology
J. C. Hubbard, Johns Hopkins University
Thomas H. Johnson, Bartol Research Foundation
Alfred Landé, Ohio State University
Otto Laporte, University of Michigan
Ernest O. Lawrence, University of California
Alfred L. Loomis, Tuxedo Park, N. Y.
F. W. Loomis, University of Illinois
Philip M. Morse, Massachusetts Institute of Technology
Otto Oldenberg, Harvard University
J. R. Oppenheimer, California Institute of Technology
A. G. Shenstone, Princeton University
Lewi Tonks, General Electric Company
L. B. Tuckerman, U. S. Bureau of Standards
Louis A. Turner, Princeton University
M. A. Tuve, Dept. Terrestrial Magnetism, Carnegie Inst.
G. E. Uhlenbeck, University of Michigan
H. C. Urey, Columbia University
William W. Watson, Yale University
Fritz Zwicky, California Institute of Technology

Physiologists

H. C. Bazett, University of Pennsylvania
G. H. Bishop, Washington University (St. Louis)
McKeen Cattell, Cornell University Medical College
Carl F. Cori, Washington University (St. Louis)
Edward A. Doisy, St. Louis University
J. G. Dusser de Barenne, Yale University
Wallace O. Fenn, University of Rochester
John F. Fulton, Yale University
Frank A. Hartman, University of Buffalo
Harry Steenbock, University of Wisconsin

Psychologists

John E. Anderson, University of Minnesota
Karl M. Dallenbach, Cornell University
J. F. Dashiell, University of North Carolina
Samuel W. Fernberger, University of Pennsylvania
Frank N. Freeman, University of Chicago
Clark L. Hull, Yale University
H. M. Johnson, Mellon Institute [American Univ.]
K. Koffka, Smith College
Mark Arthur May, Yale University
Donald G. Paterson, University of Minnesota
Edward Stevens Robinson, Yale University
Calvin P. Stone, Stanford University
Edward C. Tolman, University of California

Zoologists

Leslie B. Arey, Northwestern University
Robert A. Budington, Oberlin College
Asa C. Chandler, Rice Institute
Royal N. Chapman, University of Hawaii
C. H. Danforth, Stanford University
J. Frank Daniel, University of California
A. B. Dawson, Harvard University
L. V. Domm, University of Chicago
L. C. Dunn, Columbia University
Paul S. Galtsoff, U. S. Bureau of Fisheries
H. B. Goodrich, Wesleyan University
Frank Blair Hanson, Washington Univ. (St. Louis)
Selig Hecht, Columbia University
Leigh Hoadley, Harvard University
Davenport Hooker, University of Pittsburgh
Carl L. Hubbs, Museum of Zoology, Univ. of Michigan
Libbie H. Hyman, University of Chicago
W. A. Kepner, University of Virginia
George R. La Rue, University of Michigan
E. Carleton MacDowell, Sta. Exp. Evolution, Carnegie Inst.
James W. Mavor, Union College
A. L. Melander, College of the City of New York
Dwight E. Minnich, University of Minnesota
Ann Haven Morgan, Mt. Holyoke College
Charles Packard, Crocker Inst. Cancer Research, Columbia
Bradley M. Patten, Western Reserve University
Harold H. Plough, Amherst College
Alfred C. Redfield, Harvard University
W. A. Riley, University of Minnesota
Franz Schrader, Columbia University
C. C. Speidel, University of Virginia
H. W. Stunkard, New York University
C. V. Taylor, Stanford University
H. J. Van Cleave, University of Illinois
B. H. Willier, University of Chicago
Emil Witschi, University of Iowa
A. H. Wright, Cornell University

The 250 individuals whose names are given above have been selected from more than 20,000; consequently each of them stands first among more than eighty research workers, a somewhat severe selection. It is not feasible to give at this time the number and distribution of the some 22,000 entries in the edition of the directory now in press. 12,877 names in the fourth edition were distributed, according to the sections of the American Association for the Advancement of Science, as shown in the table.

TABLE I. DISTRIBUTION AMONG THE SCIENCES

Mathematics	756
Physics	991
Chemistry	2,561
Astronomy	239
Geology and Geography	903
Zoology	1,435
Botanical Sciences	1,187
Anthropology	111
Psychology	539
Social and Economic Sciences	23
Historical and Philological Sciences	37
Engineering	1,245
Medical Sciences	2,027
Agriculture	769
Education	54
Total	12,877

If the applied sciences are omitted (though all those included in the book were understood to have advanced science by research) and the classification adopted in these studies is used, the number is 9,785 and the distribution is as shown in the first column of Table II.

TABLE II. DISTRIBUTION AMONG THE FUNDAMENTAL SCIENCES

	All	Women	Per cent. women
Mathematics	756	61	8.0
Physics	991	28	2.1
Chemistry	2561	117	4.6
Astronomy	239	23	9.6
Geology	903	32	3.5
Botany	1187	119	10.0
Zoology	1436	130	9.0
Physiology	460	48	10.4
Anatomy	206	11	5.4
Pathology	396	28	7.1
Anthropology	111	11	9.9
Psychology	539	117	22.0
Total	9785	725	7.4

In the group of 250 there are three women. There are two in the National Academy of Sciences with about the same number of members. There are 725 women included in the book distributed (all of them being assigned to the twelve sciences) as shown in Table II. The percentage of women in each science is also given. It ranges from 2.1 per cent. in physics to 22 per cent. in psychology. The preponderance in the latter subject is due in the main to the large number of teaching and clinical positions open to women.

The average age of the 250 in the group is 42.9 years. Distinction is attained at an earlier age in mathematics and the exact sciences than in the natural sciences, the average age in the different sciences being as shown.

TABLE III. AVERAGE AGE IN THE DIFFERENT SCIENCES

Mathematicians	36.1
Physicists	36.0
Chemists	41.1
Astronomers	42.9
Geologists	49.4
Botanists	47.0
Zoologists	45.3
Physiologists	42.0
Anatomists	47.7
Pathologists	48.3
Anthropologists	41.8
Psychologists	44.0

In Table IV there is given under 1932 the distribution by states of the birthplace and residence of the 250 scientific men now added to the list. The numbers are multiplied by four in order to show comparisons with the earlier selections. There were 1,000 in 1903. The additions in 1910 were 269; in 1921 (the interval having been prolonged by the war) 351; in 1927, 250. The 601 names of 1921 and 1927 were considered together in the fourth edition of the directory. In the table all the figures are placed on the basis of a thousand entries, decimals being omitted.

While the numbers for most of the states are so small that they have only a limited validity, the general distribution of the scientific population in 1903 and its subsequent movements are clearly shown. Of the thousand scientific men of 1903, 134 were born in Massachusetts and 40 in Connecticut. This represents a birth rate of 108.8 per million population in Massachusetts, and of 86.9 in Connecticut, the population being based on the census of 1860. The birth rate is then reduced to about half in the surrounding states, being 47.2 in New York. There is a further reduction to one half in Pennsylvania, where it is 22.7, and this continues southward, the rate being 8.8 in Virginia, 5 in North Carolina, 2.8 in Georgia, 2.1 in Alabama, 1.3 in Mississippi and 1.4 in Louisiana. In the north central states the conditions are intermediate between New York and Pennsylvania and decrease southward.

The change in distribution of the birthplaces in the later selections is very significant for such a short period in the history of the nation. New England has lost its supremacy in the production of scientific men, the numbers from Massachusetts on the basis of a thousand, decreasing from 134 in 1906 to 100 in 1910, 80 in 1921–27, 72 in 1932. The corresponding figures for Connecticut are 40, 22, 27 and 16. The rural New England states fail even more in productivity. New York, New Jersey, Pennsylvania and Maryland also decrease. The gains are especially in the central

TABLE IV. BIRTHPLACE AND RESIDENCE OF SCIENTIFIC MEN SELECTED AT FOUR PERIODS

	Birthplace				Residence			
	1903	1910	1921–27	1932	1903	1910	1921–27	1932
North Atlantic								
Maine	29	22	10	8	4	7	2	4
New Hampshire	15	11	12	.....	8	4	5	.....
Vermont	18	11	10	8	2	.....	.....	.....
Massachusetts	134	100	80	72	144	160	95	100
Rhode Island	5	15	2	4	8	11	7	8
Connecticut	40	22	27	16	43	60	33	56
New York	183	134	111	128	192	141	203	164
New Jersey	28	15	13	12	35	19	30	44
Pennsylvania	66	52	68	48	65	48	63	28
South Atlantic								
Delaware	2	.....	3	.....	1	.....	2	8
Maryland	26	7	22	4	47	48	38	32
District of Columbia	3	4	5	8	119	97	128	76
Virginia	13	26	13	4	10	.....	5	12
West Virginia	1	7	7	4	3	4	3	.....
North Carolina	5	.....	8	4	6	11	3	4
South Carolina	5	11	7	4	.....	.....	2	.....
Georgia	3	4	5	8	1	.....	.....	.....
Florida	.....	4	.....	.....	.....	.....	.....	.....
South Central								
Kentucky	8	7	8	4	3	.....	2	.....
Tennessee	6	7	7	4	3	.....	5	.....
Alabama	2	7	3	4	2	.....	.....	.....
Mississippi	1	4	3	.....	.....	.....	.....	.....
Louisiana	1	.....	2	8	1	4	2	.....
Texas	3	7	2	4	7	7	13	20
Oklahoma	.....	.....	2	.....	.....	.....	2	.....
Arkansas	.....	.....	3	.....	.....	.....	.....	.....
North Central								
Ohio	75	86	81	72	34	37	33	40
Indiana	28	45	30	36	12	19	8	4
Illinois	42	52	75	88	63	104	86	96
Michigan	27	63	22	16	27	19	30	48
Wisconsin	35	41	40	20	23	48	18	28
Minnesota	4	19	23	32	13	11	30	36
Iowa	20	33	45	32	7	4	7	20
Missouri	14	19	35	40	21	22	13	40
North Dakota	.....	.....	2	.....	2	.....	.....	.....
South Dakota	.....	.....	5	8	2	4	.....	.....
Nebraska	2	4	10	20	9	15	3	4
Kansas	7	.....	18	32	5	7	8	4
Western								
Montana	.....	.....	3	.....	2	.....	.....	.....
Wyoming	.....	.....	3	4	1	.....	3	.....
Colorado	3	.....	2	16	8	7	3	.....
New Mexico	.....	.....	.....	8	2	.....	.....	.....
Arizona	.....	.....	.....	4	2	4	7	4
Utah	.....	.....	5	.....	.....	.....	.....	.....
Nevada	.....	.....	.....	.....	.....	.....	.....	.....
Idaho	.....	.....	.....	.....	.....	.....	.....	.....
Washington	1	.....	.....	12	.....	.....	2	.....
Oregon	.....	4	2	4	.....	4	.....	.....
California	11	15	18	20	53	56	78	116
Territories and Dependencies								
Porto Rico	.....	.....	.....	.....	1	.....	2	.....
Alaska	.....	.....	.....	.....	1	.....	.....	.....
Hawaii	1	4	.....	.....	.....	4	.....	4
Philippines	.....	4	.....	.....	3	7	.....	.....
Panama	.....	.....	.....	.....	.....	4	.....	.....
Foreign								
Canada	34	33	30	36	2	.....	5	.....
Brazil	.....	.....	.....	.....	1	.....	.....	.....
Cuba	.....	.....	.....	.....	1	.....	.....	.....
West Indies	1	.....	.....	.....	.....	.....	.....	.....
England	25	.....	35	8	1	.....	.....	.....
Scotland	9	15	7	12	.....	.....	.....	.....
Wales	1	.....	.....	.....	.....	.....	.....	.....
Ireland	3	4	2	.....	.....	.....	.....	.....
Germany	19	22	12	36	.....	.....	.....	.....
Austria-Hungary	6	.....	.....	.....	.....	.....	.....	.....
Austria	.....	.....	7	4	.....	.....	.....	.....
Hungary	.....	.....	.....	8	.....	.....	.....	.....
Norway	1	4	.....	4	.....	.....	.....	.....
Sweden	3	7	5	8	.....	.....	.....	.....
Denmark	2	.....	2	.....	.....	.....	.....	.....
Holland	.....	.....	5	16	.....	.....	.....	.....
Belgium	.....	.....	2	4	.....	.....	.....	.....
Poland	.....	.....	3	.....	.....	.....	.....	.....
Bulgaria	.....	.....	.....	4	.....	.....	.....	.....
Czecho-Slovakia	.....	.....	.....	4	.....	.....	.....	.....
Switzerland	8	.....	8	8	.....	4	.....	.....
Italy	1	.....	.....	.....	.....	.....	.....	.....
Spain	1	.....	.....	.....	.....	.....	.....	.....
Russia	6	11	13	12	.....	.....	.....	.....
Turkey	.....	.....	3	.....	.....	.....	.....	.....
Syria	.....	.....	3	.....	.....	.....	.....	.....
India	4	.....	.....	.....	.....	.....	.....	.....
Mongolia	.....	.....	.....	4	.....	.....	.....	.....
China	2	.....	.....	.....	.....	.....	.....	.....
Japan	.....	7	3	4	.....	.....	.....	.....
Siam	.....	.....	.....	.....	.....	.....	2	.....
Dutch E. Indies	.....	.....	.....	4	.....	.....	.....	.....
Australia	.....	.....	2	.....	.....	.....	.....	.....
South Africa	.....	.....	2	.....	.....	.....	2	.....

west, the record for Illinois being 42, 52, 75 and 88. There are also large increases in other north central states: Minnesota, 4 to 32; Iowa, 20 to 32; Missouri, 14 to 40; Nebraska, 2 to 20; Kansas, 7 to 32. The more easterly states of Ohio and Indiana remain about stationary. Twelve states south of Virginia supplied only 35 men to the list of 1903; they show some improvement in the subsequent selections, 58, 57 and 44.

The residence[2] of leading scientific men in the different states follows in general their production, but certain regions produce more than they retain or obtain, while in others the reverse is the case. Massachusetts and Connecticut have had in residence even more scientific men than they have produced. This holds also for New York and of course in the greatest measure for the District of Columbia. Ohio and Indiana, on the other hand, have in residence less than half as many leading scientific men as they have produced. California gained greatly in the last arrangement, being surpassed only by New York and having a much larger percentage per million population.

On the list of 1903 there were 126 scientific men born in foreign countries, contributed in very unequal

[2] The scientific men were selected in 1903; the residence is of January 1, 1906, as given in the first edition of the directory.

measure by different nationalities, the number per million foreign-born population being: Switzerland, 68.9; England, 29.6; Germany, 7.1; Italy, 2.1; France, 0. The relative numbers of scientific men born abroad in the subsequent selections were 103, 144 and 172. There have been in the selections following the war a large percentage of scientific men who migrated to this country after having attained distinction at home.

Table V gives the institutions from which the 250 scientific men received their academic degrees. Harvard is still in the lead by a wide margin, having granted 19 bachelor's degrees, 39 doctorates of philosophy or science and 4 doctorates of medicine. Chicago comes next with a total of 42 degrees, followed by Columbia with 29. There then follows a group coming close together, Cornell, Princeton, the Johns Hopkins, Yale, Illinois, and California, with a drop to about half as many at Michigan and Wisconsin. These figures represent the situation for those who received their degrees on the average some twenty years ago. Since then the number of advanced degrees conferred by the state universities has increased with great rapidity. The 27 not recorded as having had a bachelor's degree had in practically all cases an equivalent education, in most cases abroad. Two men hold doctorates of both philosophy and medicine, leaving only 17 who do not hold one of these degrees.

TABLE V. THE INSTITUTIONS WHICH GRANTED THREE OR MORE OF THE DEGREES

	A.B. or B.S.	Ph.D. or Sc.D	M.D.	Total
Harvard	19	39	4	62
Chicago	13	28	1	42
Columbia	7	19	3	29
Cornell	9	11	.....	20
Princeton	6	13	.....	19
Johns Hopkins	2	10	6	18
Yale	5	12	.....	17
Illinois	7	10	.....	17
California	4	12	.....	16
Michigan	8	1	.....	9
Wisconsin	1	8	.....	9
Minnesota	5	3	.....	8
Brown	5	1	.....	6
Virginia	2	4	.....	6
Amherst	5	.....	.....	5
Ohio State	3	2	.....	5
Washington (St. L.)	3	2	.....	5
Kansas	4	.....	.....	4
Pennsylvania	2	2	.....	4
Stanford	3	1	.....	4
Texas	2	2	.....	4
Dennison	3	.....	.....	3
Iowa	1	2	.....	3
Missouri	3	.....	.....	3
Nebraska	2	1	.....	3
Swarthmore	3	.....	.....	3
Elsewhere	82	4	2	88
Total	209	187	16	412
Berlin	.....	3	1	4
Toronto	4	.....	.....	4
Edinburgh	2	.....	1	3
Leiden	.....	3	.....	3
Munich	.....	3	.....	3
Zurich	1	2	.....	3
Elsewhere	7	16	3	26
Total	14	27	5	46
Grand Total	223	214	21	458

In Table VI are given the institutions with which three or more of the scientific men are connected. Harvard has sixteen and California 15, followed by Chicago, Yale, Michigan, Columbia and Princeton. Seven of the men are connected with the Rockefeller Institute for Medical Research and six with the Carnegie Institution of Washington.

TABLE VI. INSTITUTIONS WITH WHICH THREE OR MORE ARE CONNECTED

Harvard	16
California	15
Chicago	13
Yale	13
Michigan	11
Columbia	10
Princeton	10
Minnesota	9
Illinois	8
Johns Hopkins	8
Cornell	7
Rockefeller Institute	7
Stanford	7
Carnegie Institution	6
Washington (St. Louis)	6
Massachusetts Institute	5
U. S. Geol. Survey	5
Wisconsin	5
California Institute	4
Ohio State	4
Bell Tel. Labs.	3
Iowa	3
Pennsylvania	3
Virginia	3
Elsewhere	69
Total	250

The movement from the universities to the research institutions, industrial laboratories and government service, which was notable shortly after the war, has apparently now ceased. In the list of 1927 fifteen of the 250 men were connected with the Carnegie Institution; nine with the Geological Survey; seven with the Bell Telephone Laboratories; six with the Department of Agriculture; five each with the Rockefeller

Institute, the Bureau of Standards and the American Museum of Natural History; four with the Eastman Kodak Company and three with the U. S. Health Service.

There have been selected by the average space allotted to sketches in biographical directories and encyclopedias the leading scientific men of the United States who died prior to the present century. There are not as many as a thousand reaching the standard of the 22,000 in the present edition of the directory; it is necessary to include large numbers of physicians and inventors. Preparations have also been made to select the thousand leading scientific men of the world now living and the thousand most eminent who are no longer living. A study of distribution among the sciences, in different nations and at different periods, supplies the beginning of a quantitative study of history. It is also proposed to print biographical sketches in a subsequent edition of the directory. Some further study has been given to family relationship among scientific workers. It is of interest to note the considerable number of sons of scientific men who have attained high standing in the course of the past twenty years.

The change in standing of a scientific man after a period of years gives in quantitative units (with a probable error attached) his gain or loss in the judgment of his colleagues. The efforts of a lifetime are condensed into a single informing and dramatic figure. Data have been published showing that men under forty years of age are likely to gain in reputation; between forty and forty-five to remain about stationary; after that age to lose and increasingly as they grow older. The average gains or losses yield information concerning the effects of different situations, for example, at one university or another, at large or small institutions, in research institutions, in industrial laboratories, in the government service, with much or little administrative work or teaching, etc. The data may ultimately give information concerning individual differences in relation to heredity and social influences. But this is one of many studies that the present writer has been unable to complete.

When the scientific men were arranged in 1903 in order of merit it was stated that the lists would not be published within twenty years. Nearly thirty years having now elapsed it may be useful to make public a list that has considerable historical interest. The order gives no information concerning the contemporary position, some of those near the bottom of the selection in 1903 having now risen to the top and some of those then at the top having dropped. In the fifth edition of the directory, to be published this month, the list will be given in full. There are here printed in the order of merit for each science the hundred men of science regarded in 1903 by their colleagues as the most distinguished, the number in each science being approximately proportional to the total number of workers. The names of those no longer living are given in italics with the years of birth and death.

MATHEMATICS: *Eliakim Hastings Moore*, 62–32; *George William Hill*, 38–14; W. F. Osgood; *Maxime Bôcher*, 67–18; Oskar Bolza; F. Morley; Ernest W. Brown; H. S. White.

PHYSICS: *Albert Abraham Michelson*, 52–31; Carl Barus; Edward L. Nichols; *Arthur Gordon Webster*, 63–23; *John Trowbridge*, 43–23; M. I. Pupin; *Ernest Fox Nichols*, 69–24; *Samuel Pierpont Langley*, 34–06; *DeWitt Bristol Brace*, 58–05; Elihu Thomson; *Robert Simpson Woodward*, 49–24; *Charles Proteus Steinmetz*, 65–23; *Henry Smith Carhart*, 44–20; Edwin H. Hall; J. S. Ames.

CHEMISTRY: *Ira Remsen*, 46–27; *Edward Williams Morley*, 38–23; *Oliver Wolcott Gibbs*, 22–08; *Theodore William Richards*, 68–28; *Edgar Fahs Smith*, 54–28; *John William Mallet*, 32–12; Russell H. Chittenden; Arthur Michael; *John Ulric Nef*, 62–15; *Harvey Washington Wiley*, 44–30; *James Mason Crafts*, 39–17; *F. A. Gooch*, 52–29; C. L. Jackson; *William Francis Hillebrand*, 53–25; *William Olin Atwater*, 44–07; Arthur A. Noyes; *Albert Benjamin Prescott*, 32–05.

ASTRONOMY: *Simon Newcomb*, 35–09; *Edward Charles Pickering*, 46–19; *Lewis Boss*, 46–12; W. W. Campbell; *Seth Carlo Chandler*, 46–13.

GEOLOGY: *Thomas Chrowder Chamberlin*, 43–28; *Grove Carl Gilbert*, 43–18; *Charles Doolittle Walcott*, 50–27; *Charles Richard Van Hise*, 57–18; *Samuel Franklin Emmons*, 41–11; W. M. Davis; *John Casper Branner*, 50–22; *Nathaniel Southgate Shaler*, 41–06; *Clarence Edward Dutton*, 41–12; *Raphael Pumpelly*, 37–23.

BOTANY: *William Gilson Farlow*, 44–19; N. L. Britton; *John Merle Coulter*, 51–28; W. Trelease; *Charles Edwin Bessey*, 45–15; *Lucien Marcus Underwood*, 53–07; L. H. Bailey; *Roland Thaxter*, 58–32; D. T. MacDougal; B. L. Robinson.

ZOOLOGY: *William Keith Brooks*, 48–08; *Charles Otis Whitman*, 42–10; *Alexander Agassiz*, 35–10; E. B. Wilson; H. F. Osborn; *Charles Sedgwick Minot*, 52–14; E. L. Mark; T. H. Morgan; W. M. Wheeler; *Samuel Hubbard Scudder*, 37–11; Chas. B. Davenport; *David Starr Jordan*, 51–31; Edwin G. Conklin; C. Hart Merriam; *William Healey Dall*, 45–27.

PHYSIOLOGY: *Henry Pickering Bowditch*, 40–11; W. H. Howell; W. T. Porter; *Samuel James Meltzer*, 51–20.

ANATOMY: *Franklin Paine Mall*, 62–17; *George Sumner Huntington*, 61–27; H. H. Donaldson.

PATHOLOGY: William H. Welch; W. T. Councilman; Simon Flexner; *William Osler*, 49–19; Theobald Smith; *Theophil Mitchell Prudden*, 49–24.

ANTHROPOLOGY: Franz Boas; *Otis Tufton Mason*, 38–08.

PSYCHOLOGY: *William James*, 42–10; J. McKeen Cattell; *Hugo Münsterberg*, 63–16; *Granville Stanley Hall*, 46–24; J. Mark Baldwin.

J. MCKEEN CATTELL