REPORTS

DOCTORATES IN SCIENCE

FOR many years Dr. Clarence J. West, then of the National Research Council, edited an annual list of doctoral dissertations in the various fields of the sciences, most of which lists were published in the *Reprint and Circular Series* of that council.[1] During the 1933–34 academic year the National Research Council, the Social Science Research Council and the American Council of Learned Societies agreed to join in providing subsidies to the Association of Research Libraries in order to enable it to publish a complete list of all doctoral dissertations accepted in the United States and Canada each year. Dr. West generously surrendered his series to Mr. Donald Gilchrist, who began the new series under the title "Doctoral Dissertations Accepted by American Universities."[2] Mr. Gilchrist died suddenly, from a heart attack, just as No. 6 was going to press. The present writer was elected editor in December, 1939, and has edited three annuals bringing the series to nine.

The editor of SCIENCE has asked him to prepare this report regarding dissertations in the sciences. It is a study of what the nine annual volumes group as five physical sciences, seven earth sciences, fourteen biological sciences and anthropology, which is included here because it appeared in Dr. West's list of sciences and also because it is on the border line between the biological and the social sciences.

Table I herewith shows these twenty-seven fields of science arranged in order of the total number of dissertations accepted in the last nine years in each field. This table is unfair to just one field—biochemistry. In only five years it has attained eighth place in the table though all other totals cover nine years. If all the sciences were ranked on the basis of the last five years only, biochemistry would be in third place, well above psychology. And this leads to a word of caution to any one who would draw conclusions from this table. In general, the editor enters the dissertations under the particular science specified by the university reporting. Many institutions report many theses under "agriculture," which might well be classified in such fields as horticulture, entomology, etc. We allow the institutional designation to stand. In like manner, several dissertations which are obviously entomology were reported as "zoology." We allowed that to stand. However several institutions report blocks of dissertations as, "biology." The editor is forced to classify these on the basis of his understanding of the titles. Further, there are several overlapping fields such as geology and paleontology; anatomy, physiology and medicine and surgery. Different institutions vary in their classification of dis-

TABLE I

DOCTORAL DISSERTATIONS ACCEPTED IN THE SCIENCES

Rank	1934	1935	1936	1937	1938	1939	1940	1941	1942	Totals
1 Chemistry	500	470	482	497	426	482	527	672	588	4644
2 Physics	121	150	147	158	148	165	148	191	146	1374
3 Psychology	104	101	118	112	108	123	120	117	125	1028
4 Zoology	111	113	132	98	102	102	112	125	110	1005
5 Botany	117	110	108	88	106	108	112	102	120	971
6 Mathematics	82	77	84	76	62	91	103	95	85	755
7 Physiology	68	76	83	103	66	59	70	77	66	668
8 Biochemistry*	...	...	...	...	101	127	130	116	138	612
9 Engineering	97	63	48	70	59	44	77	76	47	581
10 Agriculture	62	77	53	48	37	40	58	78	55	508
11 Geology	55	62	64	42	58	49	55	53	56	494
12 Bacteriology and Microbiology	51	38	41	46	40	56	59	71	69	471
13 Entomology	34	34	30	51	33	47	48	46	44	367
14 Genetics	16	10	21	13	31	32	26	31	23	203
15 Pharmacology	15	10	18	14	19	23	23	31	31	184
16 Horticulture	9	24	14	21	16	11	20	23	21	159
17 Anatomy	10	25	15	14	20	17	21	18	16	156
18 Anthropology	10	13	20	15	18	11	26	19	14	146
19 Geography	17	15	8	13	13	17	18	16	16	133
20 Public Health	10	4	13	9	15	8	15	15	14	103
21 Metallurgy	13	11	16	7	7	9	11	17	11	102
22 Medicine and Surgery	18	14	12	1	7	9	10	13	15	99
23 Paleontology	8	12	10	8	9	13	11	11	6	88
24 Astronomy	11	11	5	9	12	5	6	11	7	77
25 Mineralogy	6	1	5	3	5	1	4	3	6	34
26 Meteorology	2	1	0	1	4	2	0	1	3	14
27 Seismology	3	2	0	0	0	0	2	1	1	9
Totals	1,550	1,524	1,547	1,517	1,522	1,651	1,812	2,029	1,833	14,985

* Biochemistry was introduced into our tabulations as a separate science in 1938. Before that date all biochemistry dissertations were grouped with chemistry.

[1] For a complete list of these reports, see "Doctoral Dissertations Accepted by American Universities," No. 1, 1933–34, p. iii.

[2] No. 1, 1933–34 (N. Y., H. W. Wilson Co., 1934).

TABLE II

NUMBER OF DOCTORAL DISSERTATIONS ACCEPTED

Rank		1942	Totals
1	Chicago	114	799
2	Wisconsin	97	795
3	Cornell	82	769
4	Michigan	66	685
5	Illinois	79	684
6	Columbia	74	684
7	California	88	649
8	Minnesota	86	619
9	Ohio	75	586
10	Harvard	58	534
11	Mass. Inst. Tech.	59	502
12	Yale	52	471
13	Iowa St. Coll.	60	454
14	Iowa	53	446
15	Johns Hopkins	43	411
16	New York	38	307
17	Calif. Inst. Tech.	28	266
18	McGill	36	257
19	Princeton	21	248
20	Toronto	26	243
21	Northwestern	27	231
22	Penn. St. Coll.	29	227
23	Pennsylvania	37	222
24	Stanford	24	214
25	Purdue	41	206
26	Maryland	28	175
27	Pittsburgh	23	160
28	Texas	19	146
29	Washington (Seattle)	11	145
30	Duke	14	136
31	Virginia	11	133
32	Brown	17	124
33	Nebraska	19	121
34	Indiana	16	121
35	Missouri	11	115
36	Cincinnati	11	114
37	Rochester	13	109
38	North Carolina	18	108
39	Rutgers	16	104
40	Catholic	22	101
41	Colorado	12	96
42	Western Reserve	8	86
43	Michigan St. Coll.	8	83
44	Kansas	3	82
45	Notre Dame	12	78
46	Washington (St. Louis)	9	75
47	Clark	10	64
48	Southern California	9	63
49	Lawrence (Inst. Paper Chem.)	8	60
50	Fordham	7	52
51	Rensselaer	5	50
52	Massachusetts	6	48
53	Louisiana	6	46
54	St. Louis	6	44
55	Boston	3	40
56	Rice	3	39
57	Florida	5	38
58	Carnegie Tech.	6	35
59	Brooklyn Polytech.	10	34
60	George Washington	2	34
61	Syracuse	0	34
62	Bryn Mawr	7	33
63	Radcliffe	5	33
64	Oregon St. Coll.	6	32
65	George Peabody	4	32
66	West Virginia	3	32
67	Georgetown	1	25
68	Kentucky	2	22
69	Washington St. Coll.	0	22
70	Vanderbilt	1	19
71	Tulane	3	16
72	Oklahoma	1	16
73	Kansas St. Coll.	6	15
74	Arizona	1	15
75	California (L. A.)	7	14
76	American	0	12
77	Colorado Mines	0	9
78	Marquette	1	8
79	Oregon	1	4
80	North Dakota	0	4
81	Temple	2	3
82	Hartford	1	2
83	Niagara	0	2
84	Tennessee	0	2
85	Smith	0	1
86	Georgia	0	1
87	Dropsie	1	1
88	Loyola (Chicago)	0	1
		1,833	14,985

sertations in physical chemistry, also in mathematical physics.

Table II shows from whence came these 14,985 dissertations in the sciences. It shows eighty-eight institutions which have accepted such dissertations arranged in order of the total numbers accepted by each in the last nine years. Some, such as Tennessee, no longer grant any doctorates. Others, like Hartford and Dropsie, are primarily theological but appear here because of one or more dissertations in psychology or in anthropology.

The order would be quite different if doctorates in the social sciences and the humanities were included. Space forbids the printing of the entire table showing the number of dissertations accepted in each subject each year. That number does not vary much from year to year, so we show only the numbers accepted in 1942 and the totals for the nine years.

Table III is not complete. The figures shown are the number of different fields of science in which each accepted one or more dissertations in each year. It is arranged by averages for the nine years and shows only those eighteen institutions which accepted dissertations in an average of approximately ten different sciences each year. These figures are interesting only upon the assumption that the various institutions have strong faculties in the various scientific fields in which they accept doctoral dissertations. In the cases of the schools omitted from Table III, the number of fields is so small and varies so much that the figures have no significance.

It is interesting to observe in Table III how great state universities outrank Chicago, Columbia, Yale, Harvard and Johns Hopkins in the number of science fields in which they accept doctoral dissertations. This would not be true if the social science and the humanities fields were included in the tabulations. It is also interesting to observe how close the University

TABLE III

NUMBER OF DIFFERENT SCIENCES IN WHICH DOCTORAL DISSERTATIONS WERE ACCEPTED

		1934	1935	1936	1937	1938	1939	1940	1941	1942	Average
1	California	16	17	15	15	17	15	20	21	18	17+
2	Michigan	16	16	16	16	18	16	18	17	19	17−
3	Wisconsin	14	14	16	15	16	19	16	18	19	16+
4	Minnesota	17	14	13	16	15	17	19	17	17	16+
5	Cornell	13	12	15	15	18	17	17	17	16	16−
6	Chicago	15	15	13	14	15	15	16	16	16	15
7	Columbia	13	12	12	16	14	14	18	15	13	14+
8	Yale	13	16	12	12	14	15	14	14	16	14
9	Illinois	15	13	13	14	12	15	14	16	12	14−
10	Ohio	14	10	12	12	12	12	13	17	14	13−
11	Harvard	13	11	11	13	12	13	12	10	14	12+
12	Johns Hopkins	13	9	9	12	14	15	11	9	12	12−
13	Iowa	11	9	10	12	12	10	12	11	13	11+
14	Iowa St. Coll.	8	10	11	11	10	13	12	13	12	11+
15	Toronto	11	8	10	12	8	11	13	13	7	10+
16	New York	9	10	8	8	9	11	13	9	13	10
17	Pennsylvania	9	10	10	11	9	9	12	11	9	10
18	Stanford	8	8	12	9	10	11	9	12	9	10−

of Iowa and Iowa State College stand in both Table II and Table III, while Pennsylvania State and Michigan State with an average of about five fields each per year are so far behind their respective state universities that they are excluded from Table III.

Perhaps the most interesting observation from all the tables is that of the entire 14,985 dissertations almost one third were written in the field of chemistry, or well over one third if we include those in biochemistry. Another observation is that well over one third of all the dissertations (5,684 out of 14,985) were accepted by the first eight institutions in Table No. II. Verily we are in an age of chemistry which is dominated by a few great universities.

Any one interested in seeing the titles of these dissertations should consult a file of the nine annuals. These titles reveal the particular lines along which research is being pressed to-day.

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SPECIAL ARTICLES

THE INTEGRATION OF GENETIC AND EPIDEMIOLOGICAL METHODS OF ANALYSIS IN RHEUMATIC FEVER[1,2,3]

IN previous genetic and epidemiological studies of a series of rheumatic families, it was concluded that hereditary factors are primarily responsible for the familial concentration of rheumatic fever. It was postulated that genetic susceptibility for rheumatic fever is transmitted as a single autosomal recessive gene. It was also indicated that age susceptibility must be considered in the study of the familial epidemiology of rheumatic fever.[4,5]

In order to analyze the interaction of the genetic and epidemiological aspects of rheumatic fever, analytical techniques were developed which permit a numerical description of the sequence of events in a group of rheumatic families.

In classical genetic analysis, the final number of cases is estimated by the application of appropriate genetic formulae. In this study, the methods were extended by predicting the final number of cases in the families prior to the time when all the children present who could eventually become cases had an opportunity to be realized. Such a prediction represents an average estimate of the number of genetic susceptibles present in the families at the time of analysis.

This procedure permits the expression in numerical terms of the genetic risk for a group of families, an individual family, or for members within a family group at any time during their life experience. Within a family, the genetic risk or factor may be divided equally among all siblings, or apportioned unequally with respect to any specific variable such as age, sex or exposure.

It is obvious that in rheumatic fever, where the peak age of onset in children occurs at about 6 years of age, the current age risk for a two-year-old child or a twelve-year-old child is less than that for his six-year-old sibling. In order to apportion the genetic risk with respect to this age risk, a numerical measure of the age expression of rheumatic fever was obtained.

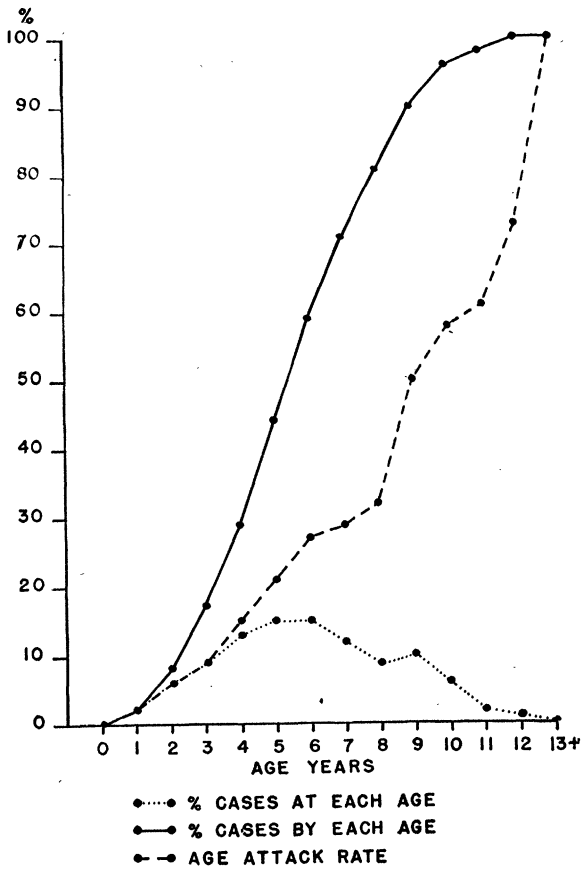

FIG. 1. Age factors derived from a rheumatic series of 688 case onsets.

[1] From the New York Hospital and the Department of Pediatrics, Cornell University Medical College.

[2] This work was aided by a special grant from the Commonwealth Fund.

[3] We gratefully acknowledge our indebtedness to Dr. Lowell J. Reed for his continued interest and constructive criticism during the progress of these studies.

[4] M. G. Wilson and M. D. Schweitzer, *Jour. Clin. Invest.*, 16: 555, 1937.

[5] M. G. Wilson, "Rheumatic Fever." New York: The Commonwealth Fund, 1940. Chapter III, pp. 21–65.