Canadian Men of Science

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FEW AMERICANS are conscious that Canada provides any significant contribution to North American science. On the other hand, it has always been a source of concern to Canadians that their best brains emigrated to the United States. Actually, the whole question of the place of Canadian science in North America stands in need of appraisal. If one considers only the field of higher education, little evidence has been produced to show that Canadian universities occupy a significant place in North American scientific activity. In this paper, which is a study of that group of distinguished men of science who have received their prebaccalaureate university training in Canada, the contribution of these universities will be set forth quantitatively. The paper also describes the geographic distribution of Canadian-trained scientists, where they obtain their graduate training, and their ultimate occupations.

Many studies of science and scientists in the United States have been based upon the different editions of the carefully compiled *American Men of Science.* (This work, which might well be called "North American Men of Science," includes the names of scientists in Canada selected on the same broad basis as those in the United States.) In particular, the study made under the direction of a Committee of the Faculty of Wesleyan University and published as *Origins of American Scientists,* by Knapp and Goodrich (hereinafter called the Wesleyan Report), was based on the seventh edition of *American Men of Science* (1944). Although the eighth edition (1949) is now available, the former was preferred as a basis of comparison.

The preliminary work for the Wesleyan Report involved the sifting of the 34,000 names in the seventh edition of *American Men of Science* to include only those receiving their first degrees in the United States. One important segment so excluded was made up of those receiving their first degrees in Canada. The abstracted pertinent information on these Canadian-trained American men of science (1669 out of 34,000) has provided the basic data for the present study. Because of the small size of this group, it was not deemed expedient (except where indicated) to follow the Wesleyan procedure of limiting the study to those scientists who had Ph.D.'s or were starred as outstanding.

The criterion for selection, then, was that the first degree, representing in general not more than four years of college work, should be taken at a Canadian university. The only possible error in selection was in missing a Canadian-trained scientist in the search. An error of this nature was avoided, in so far as was humanly possible, by the direct procedure of reading every individual biography in *American Men of Science* until the origin of the first degree was ascertained. It was obviously impossible to abstract the information on a scientist whose first recorded degree was not at a Canadian university.

The information abstracted for the study included name and sex, field of science, place and date of birth, university and date of first degree, university and date of highest degree, type of occupation, and location as of 1944. In view of the care taken in compiling *American Men of Science,* it is felt that this gives a comprehensive list of distinguished Canadian-trained scientists based on a significant contribution to new knowledge in some field of science by each individual involved. It is in contrast to various other lists of Canadian scientists based not upon a contribution to knowledge but upon such criteria as scholarships and graduate degrees.

The Origins of Canadian-Trained Scientists. The basic population of the 1669 Canadian-trained scientists is first classified according to university of origin, field of science, and decade of first degree (Table 1). By university of origin is meant that Canadian university where the scientist obtained his first degree. All scientists were classified under the seven fields of astronomy, biology, chemistry, geology, mathematics, physics, and psychology. In most cases the biography furnished a clear-cut statement of the individual's field of science. The many medical scientists were assigned to biology, and the few engineers, with the exception of chemical engineers, to physics. In the case of borderline fields, such as astrophysics and biochemistry, the individual biography was read for research interests and a decision made; biochemistry gave the most trouble and some errors in the choice of major emphasis were undoubtedly made. The date of the first degree presented little difficulty. In the rare event of its not being given, a probable date was assigned on the basis of date of birth, higher degrees, and so forth.

The gross figures of Table 1 show the contribution of Canadian undergraduate training to North American science. The total production of individual universities can be seen. The areas of strength and weakness in particular sciences and universities are exhibited through five decades. The decade 1920–29 is probably the most comprehensive. That is, scientists graduating in this decade have had time to produce significant work. The earlier decades are truncated by death and

TABLE 1. Numbers of scientists by universities of origin and fields and decades.

	DK	Ac	FX	NB	MA	MG	B	L	Mo	To	WO	Q	O	MM	Ma	S	Ab	BC	*al.*
Astronomy																			
–99	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—
00–09	—	—	—	—	—	—	—	—	—	4	—	1	—	—	—	—	—	—	—
10–19	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—
20–29	—	—	—	—	—	2	—	—	—	4	1	—	—	—	1	—	—	2	—
30–39	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—
Biology																			
–99	—	—	—	—	1	11	—	—	1	26	—	3	—	1	1	—	—	—	5
00–09	2	1	2	—	2	18	—	2	—	30	2	4	—	3	2	—	—	—	5
10–19	8	6	—	1	1	33	1	4	—	52	2	9	1	5	6	6	3	3	5
20–29	10	13	—	1	2	50	—	6	7	85	7	19	—	4	15	25	16	31	13
30–39	1	5	—	5	—	20	—	1	6	39	4	5	1	7	9	16	17	19	8
Chemistry																			
–99	1	—	—	—	—	3	—	—	—	10	—	2	1	1	—	—	—	—	—
00–09	2	2	—	2	1	6	—	—	—	8	—	3	—	4	1	—	—	—	—
10–19	2	—	—	1	1	6	2	—	1	13	—	4	1	7	1	2	3	4	1
20–29	9	4	—	1	5	17	—	3	2	21	2	18	—	3	8	20	12	29	2
30–39	8	2	2	5	10	22	2	2	—	23	8	11	—	5	9	14	12	14	1
Geology																			
–99	—	1	—	—	—	5	—	1	—	5	—	—	—	2	1	—	—	—	—
00–09	1	2	—	—	—	5	—	—	—	8	—	7	—	—	1	—	—	—	—
10–19	—	3	1	—	—	4	—	1	1	8	—	5	—	1	2	—	2	3	—
20–29	—	2	—	1	—	10	—	2	—	7	2	6	—	—	14	—	6	16	1
30–39	1	1	2	1	—	—	—	—	—	7	—	2	—	—	3	2	6	10	—
Mathematics																			
–99	—	1	1	1	1	1	—	—	—	8	—	—	—	1	—	—	—	—	—
00–09	—	2	—	2	—	—	—	—	—	4	—	3	—	2	—	—	—	—	—
10–19	—	1	1	1	1	—	—	1	—	—	—	2	—	—	—	—	1	—	—
20–29	1	6	—	—	4	2	1	1	—	6	1	1	—	—	4	3	1	3	—
30–39	1	—	—	—	—	—	—	—	—	8	3	1	—	2	—	—	1	4	—
Physics																			
–99	2	—	—	4	1	3	—	—	—	7	—	—	—	—	—	—	—	—	—
00–09	2	3	1	2	—	8	—	—	—	11	—	2	—	—	—	—	—	—	—
10–19	4	3	—	1	1	4	—	—	—	11	—	4	—	3	—	3	1	—	2
20–29	6	3	1	2	—	6	—	—	—	14	4	8	—	2	4	6	4	11	1
30–39	1	—	—	1	2	7	—	—	—	7	—	3	—	3	1	5	3	10	—
Psychology																			
–99	—	1	—	—	—	—	—	—	—	4	—	—	—	1	—	—	—	—	—
00–09	2	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—
10–19	—	1	—	—	—	3	—	—	—	4	1	—	—	—	1	—	1	1	—
20–29	1	2	—	—	1	4	—	—	—	4	—	1	—	—	1	—	—	2	2
30–39	—	—	—	—	—	1	—	—	1	6	—	2	—	—	—	—	1	—	—
Totals	65	65	11	32	34	251	6	24	19	451	37	127	4	58	85	102	90	162	46

Symbols represent universities: DK, Dalhousie-Kings; Ac, Acadia; FX, St. Francis Xavier; NB, New Brunswick; MA, Mount Allison; MG, McGill; B, Bishop's; L, Laval; Mo, Montreal; To, Toronto; WO, Western Ontario; Q, Queens; O, Ottawa; MM, McMaster; Ma, Manitoba; S, Saskatchewan; Ab, Alberta; BC, British Columbia; *al.*, others.

a tapering off of scientific activity. The decade 1930–39 is inadequately represented, as later editions of *American Men of Science* should show, since many graduates in those years had yet to gain recognition.

Table 2 is a condensation of Table 1 and shows the number of Canadian men of science classified according to subject and decade. The figures in the right-hand column under each decade gave the percentages of scientists produced in particular fields during the decade in question. For example, 46 percent of the

TABLE 2. Numbers and percentages of scientists by fields and decades.

	–99		00–09		10–19		20–29		30–39		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Astronomy	2	2	5	3	3	1	10	1.5	2	0.5	22	1.3
Biology	49	41	73	42	146	51	304	46	163	39	735	44
Chemistry	18	15	29	16	49	17	156	24	150	35	402	24
Geology	15	12	24	14	31	11	67	10	35	8	172	10
Mathematics	14	12	13	7	8	3	34	5	20	5	89	5
Physics	17	14	29	16	37	13	72	11	43	10	198	12
Psychology	6	5	4	2	12	4	18	3	11	2.5	51	3
Totals	121		177		286		661		424		1669	

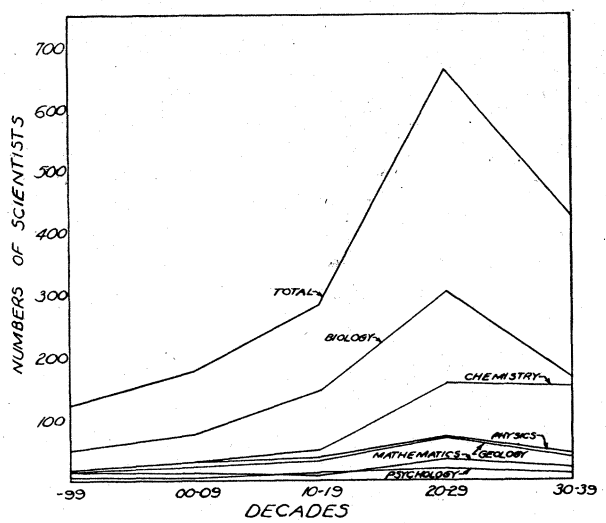

FIG. 1. Gross numbers of scientists in different fields according to decades of bachelor's degrees.

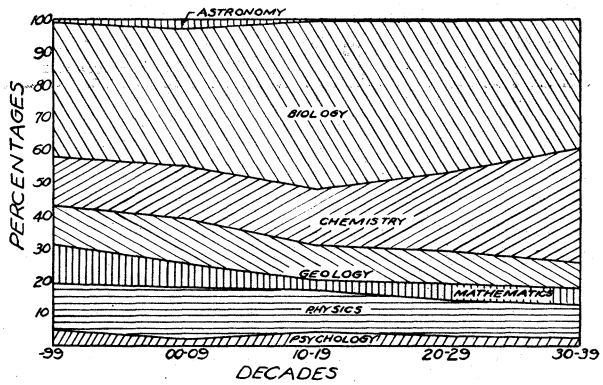

FIG. 2. Percentages of scientists in different fields according to decades of bachelor's degrees.

scientists produced in the decade 1920–29 were biologists. The table is represented in graphical form in Figs. 1 and 2. Table 2 and Figs. 1 and 2 are counterparts of those for the United States universities in the Wesleyan Report. The results are strikingly similar. Both in Canada and the United States, chemistry is growing percentage-wise in the later decades at the expense of all other fields. In Canada, the field of biology plays a much more dominant role than in the United States, where it is, in fact, slightly overshadowed by chemistry. In all other fields, the similarity between Canada and the United States is so close that probably any differences noted would not be valid.

The Productivity of Canadian Universities. Totals for the different universities are not directly comparable in assessing productivities. The four western universities made a negligible contribution before the decade 1910–19, and the enrollments of all the universities have changed greatly through the decades. The widely different achievements can be compared with each other, and with the United States figures, by following the procedure of the Wesleyan Report and calculating productivity indices for a particular period, which, here as in the Wesleyan Report, covers the eleven years from 1924 to 1934, inclusive. This was a peacetime period beginning at the end of the Canadian university expansion following World War I and ending well before World War II so that the graduates of 1934 would have completed their training and made a representative showing in the 1944 edition of *American Men of Science*. The span of eleven years covers an economic cycle of boom and depression. The numbers of scientists concerned are sufficient to give statistical validity to the index.

TABLE 3. Productivity indices of Canadian universities.

University	Scientists in period	Estimated male graduates	Productivity index	North American rank
British Columbia	97	1536	63	4
Saskatchewan	61	1184	52	8
Acadia	19	503	38	21
Mount Allison	12	373	32	30
Alberta	44	1451	30	39
New Brunswick	11	461	24	63
McMaster	14	596	24	64
Queens	46	2122	22	74
Manitoba	46	2508	18	120
Dalhousie-Kings	21	1250	17	136
McGill	59	3653	16	150
Western Ontario	17	1179	14	179
Bishop's	3	258	12	224
Toronto	99	8774	11.3	231
St. Francis Xavier	3	267	11	238
Laval	9	3620	2.5	434
Montreal	5	5160	1.0	460

TABLE 4. Ranks and productivity indices of North American universities.

Name	P.I.	Name	P.I.
1. Reed	132	26. St. Olaf	34
2. Calif. Inst. of Tech.	70	27. Montana State	34
3. Kalamazoo	66	28. Utah State Agr.	33
4. British Columbia	63	29. Beloit	33
5. Earlham	58	30. Mount Allison	32
6. Oberlin	56	31. Bluffton	32
7. Massachusetts State	56	32. Carleton	32
8. Saskatchewan	52	33. Charleston	32
9. Hope	51	34. Wooster	31
10. DePauw	48	35. Willamette	31
11. Nebraska Wesleyan	47	36. Brigham Young	30
12. Iowa Wesleyan	46	37. Swarthmore	30
13. Antioch	45	38. Southwestern	30
14. Marietta	45	39. Alberta	30
15. Colorado	44	40. Lawrence	30
16. Cornell (Iowa)	41	41. Wabash	30
17. Central	40	42. W. Va. Wesleyan	30
18. Chicago	40	43. Rochester	28
19. Haverford	39	44. Westminister	28
20. Clark	39	45. Simpson	28
21. Acadia	38	46. Hiram	27
22. Johns Hopkins	37	47. Grinnell	27
23. Emporia	37	48. Brury	27
24. Pomona	36	49. Miami	26
25. Wesleyan	34	50. Wisconsin	26

TABLE 5. Numbers and percentages of scientists by origins and ultimate locations.

	Maritime		Quebec		Ontario		Toronto		Prairies		Brit. Col.		Others		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Maritime	35	17	7	2	5	2	11	2	6	2	5	3	—	—	69	4
Quebec	27	13	106	35	10	4	25	6	14	5	12	7	4	40	198	12
Ontario	34	16	52	17	111	42	214	47	48	17	23	14	2	20	484	29
Prairies	5	2	22	7	15	6	25	6	74	27	2	1	1	10	144	9
British Columbia	5	2	8	3	9	3	17	4	9	3	45	28	—	—	93	6
Subtotals	106	51	195	65	150	57	292	65	151	55	87	54	7	70	988	59
New England	22	11	14	5	14	5	9	2	9	3	9	6	—	—	77	5
Atlantic	41	20	41	14	40	15	53	12	39	14	22	13	—	—	236	14
South	15	7	15	5	14	5	24	5	21	8	6	4	1	10	96	6
Midwest	18	9	23	8	32	12	48	11	36	13	14	9	2	20	173	10
Pacific	4	2	8	3	8	3	19	4	19	7	22	13	—	—	80	5
Others	1	—	4	1	4	2	6	1	2	1	2	1	—	—	19	1
Subtotals	101	49	105	35	112	43	159	35	126	45	75	46	3	30	681	41

The productivity index is computed in the following way. We consider the Canadian-trained scientists abstracted from *American Men of Science* who have obtained their first degrees from a particular university during the period. Of these we consider only males who either have Ph.D.'s or are starred as being outstanding. This last number multiplied by a thousand forms the numerator of the index. For the denominator we consider the total number of male graduates of the given university over the eleven-year period. The index is thus a measure of the scientific productivity of a university undergraduate school, the number of distinguished scientists per thousand graduates. By using this ratio, all variations of size of university are eliminated, and universities may be compared directly as to how much of the brain power flowing through is channelled into productive scientific activity.

Table 3 gives the number of scientists produced in the period 1924–34, under the qualifications explained earlier, and estimated total numbers of male graduates in the same period, which were obtained from the *Annual Survey of Education in Canada* in so far as possible. As in the *Annual Survey,* the bachelor's degree was here taken to include medical, dental, and veterinary doctor's degrees. A small error comes from the presence of those who take the bachelor's degree in arts or science before proceeding to the degree in medicine. In any event, the four leading universities, British Columbia, Saskatchewan, Acadia, and Mount Allison, are in no way affected as they do not grant medical degrees. It is interesting to note that the ranking of the Canadian universities in the total group for North America is quite parallel with the general findings in the case of the United States universities. That is, the smaller liberal arts institutions are most productive, the Far West dominates the field, and Roman Catholic universities have very low productivities.

Table 4 shows the productivity indices of the fifty leading North American universities. It is, except for the inclusion of five Canadian universities, a reproduction of the table in the Wesleyan Report showing the leading United States institutions.

Geographic Distribution. For a generation, the Canadian popular press has been loud in its complaint that Canada has been exporting its best brains to the United States. Here we are provided with a concrete answer, at least in the field of science, as to whether the complaint is justified.

Table 5 shows the ultimate destination of scientists who received their initial training in the sections of

TABLE 6. Geographic distribution of scientists by fields.

	Astronomy		Biology		Chemistry		Geology		Mathematics		Physics		Psychology	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Maritime	—	—	31	4	17	4	6	3	5	6	9	5	1	2
Quebec	—	—	100	14	59	15	17	10	5	6	15	8	2	4
Ontario	15	68	204	28	113	28	70	41	17	19	50	25	15	29
Prairies	—	—	86	12	24	6	14	8	4	4	14	7	2	4
British Columbia	3	14	43	6	15	4	18	10	5	6	8	4	1	2
Subtotals	18	82	464	63	228	57	125	73	36	40	96	48	21	41
New England	—	—	22	3	17	4	7	4	11	12	15	8	5	10
Atlantic	—	—	79	11	79	20	8	5	14	16	45	23	11	22
South	1	5	47	6	18	4	8	5	7	8	10	5	5	10
Midwest	1	5	71	10	40	10	11	6	15	17	26	13	9	18
Pacific	1	5	39	5	18	4	10	6	6	7	6	3	—	—
Others	1	5	13	2	2	1	3	2	—	—	—	—	—	—
Subtotals	4	18	271	37	174	43	47	27	53	60	102	52	30	59

TABLE 7. Occupations of scientists by decades.

	-99		00–09		10–19		20–29		30–39		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Government	11	9	29	16	62	22	170	26	111	26	383	23
Industry	20	17	21	12	40	14	152	23	149	35	382	23
Teaching	90	74	127	72	184	64	340	51	163	39	904	54
Totals	121		177		286		662		423		1669	

Canada indicated. The overall percentage shows that 59 percent of the top scientists chose to remain in Canada, while 41 percent emigrated. The maritime and far western scientists tend to emigrate more than those from the central provinces. Of those who stay in Canada, the majority are found in the central provinces, nearly half in Ontario alone. Thus, we see the peculiar phenomenon that just in those areas of lowest scientific productivity is to be found the greatest amount of scientific activity. Of those emigrating to the United States, the New England states and the Atlantic seaboard states of New York, Pennsylvania, New Jersey, and Delaware take nearly half. Nearly a quarter of the emigrants go to midwestern states, due probably to the influence of the large midwestern universities. The results say nothing as to how many United States and European scientists have migrated to Canada. However, it is unlikely that Canada has gained commensurately from these sources.

Another analysis, not shown here, was to break the table down into separate decades in an effort to establish migratory trends. In each decade the percentages are very nearly the same as those for the overall picture. Thus, of scientists who graduated before 1900, 47 percent stayed in Canada, 53 percent emigrated. In successive decades 58, 65, 59, and 59 percent stayed

TABLE 8. Numbers of Ph.D.'s by universities of origin and universities of graduate study.

	DK	Ac	FX	NB	MA	MG	B	L	Mo	To	WO	Q	MM	Ma	S	Ab	BC	*al.*	Totals
Brown	1	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Cambridge	3	—	—	—	—	4	—	—	—	5	—	5	—	2	—	—	—	1	20
California	—	—	—	—	—	4	—	—	—	6	—	2	—	—	9	5	14	—	40
Cal. Tech.	—	—	—	—	—	1	—	—	—	1	—	1	—	1	1	3	7	—	15
Chicago	1	6	—	2	2	1	—	—	—	27	1	9	9	7	4	7	5	—	81
Clark	1	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	5
Columbia	—	2	—	—	3	3	—	—	—	3	2	6	2	1	1	—	2	—	25
Cornell	2	5	—	3	—	9	—	2	3	12	1	5	2	1	1	3	7	8	64
Georgia State	—	—	—	—	—	—	—	—	—	2	—	—	—	1	2	—	2	—	7
Harvard-Radcliffe	8	8	—	2	1	9	—	—	—	19	—	8	2	2	3	3	3	—	68
Johns Hopkins	1	—	2	—	—	1	—	—	—	6	—	1	1	2	—	—	2	—	16
Illinois	—	—	—	—	—	1	—	—	—	4	1	—	7	1	1	2	6	—	23
Iowa State	—	—	—	—	—	1	—	—	—	2	1	—	1	1	3	1	—	2	12
Laval	—	—	—	—	—	—	—	4	1	—	—	—	—	—	—	—	—	1	6
Leipzig	—	—	—	—	—	—	—	—	—	3	—	1	—	—	—	—	—	—	4
London	—	1	—	—	2	1	—	—	1	4	1	—	—	1	1	1	3	—	16
Manchester	—	—	—	—	—	—	—	—	—	1	—	3	—	—	—	—	—	—	4
Mass. Inst. Tech.	1	—	—	—	1	7	—	1	—	2	—	4	—	3	1	2	10	—	32
McGill	18	5	3	4	11	73	4	3	—	9	6	7	1	11	18	16	16	3	208
Michigan	—	3	—	—	—	3	—	—	—	2	2	1	—	1	1	—	2	—	15
Minnesota	—	1	—	—	1	4	—	—	—	9	—	1	—	10	15	12	3	—	56
Montreal	—	—	—	—	—	—	—	2	2	1	—	—	—	—	—	—	—	—	5
New York	—	—	—	—	—	2	—	—	—	—	—	4	—	1	—	—	—	—	7
Northwestern	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	1	1	—	5
Oxford	—	—	—	1	—	1	—	—	—	—	—	2	—	—	1	1	1	1	8
Paris	—	—	—	—	—	1	—	1	3	—	—	—	—	—	—	—	—	1	6
Pennsylvania	—	—	—	—	—	2	—	—	—	1	—	—	1	—	—	—	—	—	4
Princeton	6	1	2	1	—	7	—	—	—	5	—	6	—	2	1	3	7	—	41
Purdue	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	4	—	6
Rochester	—	—	—	—	—	—	—	—	—	—	—	3	—	—	2	—	—	—	5
Rutgers	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	—	2	1	6
Stanford	—	—	—	—	—	—	—	—	—	—	—	2	—	1	2	1	3	1	10
Toronto	5	4	—	4	—	7	—	—	—	156	8	9	15	10	10	5	15	4	252
Wisconsin	—	1	—	2	—	5	—	—	—	8	3	4	3	2	9	10	10	1	58
Yale	4	16	—	2	—	4	1	—	—	4	—	5	—	—	1	1	—	—	38
Others	2	1	2	3	3	7	—	2	2	14	—	2	2	4	7	5	4	3	63
Totals	53	55	9	25	28	158	5	15	12	311	27	93	46	66	94	82	129	27	1235

Symbols represent universities: DK, Dalhousie-Kings; Ac, Acadia; FX, St. Francis Xavier; NB, New Brunswick; MA, Mount Allison; MG, McGill; B, Bishop's; L, Laval; Mo, Montreal; To, Toronto; WO, Western Ontario; Q, Queens; MM, McMaster; Ma, Manitoba; S, Saskatchewan; Ab, Alberta; BC, British Columbia; *al.*, others.

and 42, 35, 41, and 41 percent emigrated. Other percentages of location in each decade are also strikingly close to those in Table 5.

Table 6 shows the geographic distribution of scientists according to subject. A glance shows that Canadian scientists are spread rather evenly across the continent of North America, perhaps more sparsely in the regions of the Pacific coast and the Maritime Provinces of Canada. We can see that mathematicians, physicists, and psychologists emigrate more than scientists from the other fields. Geologists stay in Canada more than any other group. This table again points up the fact that Ontario leads as a center of Canadian scientific activity in all fields. The data, when broken down into decades to try to establish migratory trends, revealed none that was discernible. The pattern of scientific migration has been stable over the past seventy years.

Occupations of Canadian-Trained Scientists. Table 7 shows all the Canadian-trained scientists classified as in government service, in industrial research, or in teaching. Government classification presented the least difficulty. Industry was a broad classification which included such things as the private practice of medicine and research in private foundations, as well as research for industrial corporations. Teaching presented little difficulty, although in some cases where a person might be both teaching and engaged in research a rather arbitrary decision had to be made as to the major field of activity.

The last column in Table 7 shows that more Canadian scientists are teaching than are engaged in government and industry together. Comparing decades, the trend of the times is very clear. There is an increasing pull toward industry and government. It must be remembered, however, that the seventh edition of *American Men of Science* was published in 1944 and that the effect of the war has distorted the picture, particularly in the decade of the thirties. Even so, teaching remains the leading profession for top-grade scientists.

The Canadian Graduate Student. After graduation from a Canadian university, where does the future scientist carry his training further? To answer this question, we have considered only those who went on to obtain the Ph.D. degree or its equivalent. Table 8 shows that of the original 1669 Canadian men of science, 1235 went on to a doctorate. If a university turned out less than four Canadian Ph.D.'s, it was included in the "others" category. Of the 1235 Ph.D.'s, only 63 (5%) were obtained at universities other than the 35 named.

Table 8 shows that only two Canadian universities have held any significant place in the field of graduate study; 460 (37%) of the 1235 Ph.D.'s were turned out by McGill and Toronto; 79 (6%) received their doctorates in European universities. These included, in addition to those named, Aberdeen, Berlin, Edinburgh, Freiburg, Geneva, Glasgow, Heidelberg, Leeds, Lille, Liverpool, Louvain, Munich, Strasbourg, Wales, and Zürich. The largest group (57%) went to graduate schools in the United States. Of these schools, Chicago leads, with Harvard, Cornell, Wisconsin, Minnesota, Princeton, California, Yale, and Massachusetts Institute of Technology each producing over 30 Canadian Ph.D.'s listed in *American Men of Science.* These results, combined with the fact shown earlier that teaching is the preponderant profession for distinguished men of science, may shed some light on the root cause of Canada's devastating loss of 41 percent of her trained scientific personnel (Table 5). That is, lack of graduate training facilities in Canada requires Canadian scientists to go elsewhere.

Summary. Even by American standards, the far western universities of British Columbia and Saskatchewan have been outstanding producers of scientists. Next have been the small Maritime Province universities of Acadia and Mount Allison. The larger universities in Ontario and Quebec were much lower in scientific productivity, and the Roman Catholic schools lowest of all. Nearly half of the Canadian scientists have migrated to the United States, and, of those remaining in Canada, nearly half went to Ontario. Of the mathematicians, physicists, and psychologists, considerably more than half emigrated to the United States, whereas of the biologists, geologists, and chemists, considerably more than half remained in Canada. Two-thirds of Canada's future scientists go abroad for graduate training. Teaching remains the dominant profession for the top scientists, with some trend in evidence toward government and industry.