Academic Origins of Members of the Genetics Society of America

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Abstract

The academic and geographic origins of current members of the Genetics Society of America who received their undergraduate degrees from U. S. institutions and who are listed in the 1965 edition of *American Men of Science* were investigated. The 1019 geneticists included in this study received their baccalaureate degrees from 281 different institutions of higher education. The 999 who have earned doctorates were awarded these degrees by 93 different institutions. Land-grant and state colleges and universities were productive of geneticists at both the baccalaureate and doctoral levels; e.g., eight of the ten leading institutions granting baccalaureates to the geneticists were state institutions, and over 60% of the geneticists' doctorates were awarded by such schools. Over 45% of the geneticists were born in eight states in the Middle Atlantic and East North Central United States. Of these eight states, Indiana was the least productive, only 20 of the 460 geneticists from these states having been born in Indiana. Currently 36 of the 1019 individuals in this study are employed in the state of Indiana. The states in Southeastern United States failed to produce as many geneticists as they employ. Only one state, Mississippi, failed to produce any of the 1019 geneticists.

Introduction

A study of members of the Genetics Society of America was conducted to reveal the geneticists' academic and geographical backgrounds, which institutions graduate the greatest numbers of geneticists, and the types of institutions in which geneticists find employment. Only the 1019 members of the Genetics Society of America who earned baccalaureate degrees at U.S. institutions and who were listed in the eleventh edition of *American Men of Science* (1) were included in this study. Using this procedure may be expected to result in the inclusion of active researchers and contributors to the discipline of genetics, and it eliminated the need for sending questionnaires to the individuals who are the subjects of this investigation, since all pertinent data were directly obtained from *American Men of Science.*

The growing need for highly trained scientists has been especially recognized since the early 1950's. Since that time there have been several studies of the academic backgrounds of scientists in general, the most extensive having been conducted by Lindsey R. Harmon, Director of Research for the Office of Scientific Personnel of the National Academy of Sciences. In his 1965 study, Harmon stressed the importance of research dealing with the academic origins of scientists:

> Advancement of the public welfare and development of all aspects of a modern technological society are intimately bound up with the education of an adequate number of the society's members to the highest levels of which they are capable. . . . Comparatively little is known, of a quantitative nature, regarding the career patterns of the most highly-trained segment of the populace, and but little more is known about the backgrounds from which it comes. (5)

Lyon studied the origins of American botanists, and also stressed the importance of researching the academic origins of scientists:

> Scientists should learn more about themselves than is possible through personal observations. As a basis for maintaining the proper supply of trained men in each of the special fields, we should have accurate information about the number, ages, and professional preparation of the workers in each area. (8)

The research most closely related to the present investigation is Chiscon's "The Academic Origin of *Drosophila* Workers in the United States" (2). In his study, Chiscon determined the academic origins of 471 *Drosophila* workers. As sources of data, he utilized the volumes of *American Men of Science* and *Drosophilia Information Service.*

The present study of 1019 members of the Genetics Society of America identifies those institutions which have provided instruction in the field of genetics, the genticists' areas of research specialization, the types of academic backgrounds the geneticists have, the types of institutions in which the geneticists find employment, and the regions of the U.S. which have been the most productive of geneticists.

Materials and Methods

The names and current addresses of the geneticists were taken from the 1967 membership list of the Genetics Society of America (3). The 1965 edition of *American Men of Science* was used as a source for the following additional information which was recorded on a 5" x 7" card for each geneticist: age, sex, date and place of birth, degrees earned, institutions where degrees were earned, years in which degrees were earned, age when degrees were earned, post-doctoral experience, current institution of employment, and field of specialization.

The geneticists' ages were determined from the birth date and were calculated as of May, 1968—the anticipated completion date of this investigation. *The World Almanac* (10) was used to determine whether the institutions which granted the degrees were state, land-grant, denominational, private, etc. These data were then analyzed in order to obtain generalizations about geneticists in the United States.

Data and Discussion

Academic origins. The baccalaureate origins of the geneticists were more varied than the doctoral origins. There were three times as many baccalaureate institutions as there were doctorate institutions. The 1019 baccalaureates earned by the geneticists were awarded by 281 different undergraduate institutions. One hundred forty institutions awarded only one baccalaureate, while 53 each awarded two such degrees. The remaining 88 institutions granted the balance of 773 baccalaureate degrees.

Both state and private institutions were productive of geneticists at the baccalaureate level. Land-grant institutions awarded 35.7% of the baccalaureate degrees in the present investigation. In Chiscon's study of the academic origin of *Drosophila* workers, 23% of the baccalaureate degrees were awarded by land-grant institutions (2). In the present investigation, land-grant and state colleges and universities together

granted 595 baccalaureates, 58.4% of the total, while private and denominational institutions awarded 36.8% of the total, or 375 baccalaureates. Kiefler observed that the nation's liberal arts colleges have played an important role in producing scientists and have produced more than half the science doctorates in the past (7). In the present study, however, only 36.8% of the baccalaureates were awarded by liberal arts colleges.

In the top-ten institutions granting baccalaureate degrees were eight state and two private universities (Table 1). Concerning the productivity of institutions in relation to the natural sciences, Thistlewaite stated:

> Natural science productivity is associated with large freshman enrollments, graduate programs offering the Ph.D., public support, and absence of religious affiliation. These characteristics are typical of the state university, which . . . tends to be outstandingly effective in stimulating achievement in the natural sciences. (9)

The present study supports Thistlewaite's generalization in two ways: *1*) land-grant and state colleges and universities awarded 58.4% of the baccalaureates and *2*) eight of the ten leading institutions granting baccalaureates were state universities.

Comparing the ten leading baccalaureate institutions in the present investigation with the ten leading institutions in Chiscon's study of *Drosophila* workers and with Lyon's study of botanists revealed that many of the institutions which appeared in the top-ten in this study were also in the top-ten in Chiscon's and Lyon's studies. California and Illinois were among the ten leading universities in all three studies. Harvard and Texas were among the ten leading universities granting baccalaureates to the members of the Genetics Society of America and also to the *Drosophila* workers in Chiscon's study (2). Cornell University and the universities of Minnesota, Nebraska, and Wisconsin were among the ten leading institutions granting baccalaureates to the members of the

TABLE 1. *Top Ten Institutions Granting Baccalaureate Degrees to Members of the Genetics Society of America*

University	Number of Baccalaureate Degrees Granted
Cornell	38
California (Berkeley)	36
Illinois	35
Iowa State (Ames)	31
Minnesota	29
Nebraska	24
Wisconsin	21
Harvard	20
Chicago	18
Texas	18

Genetics Society of America and also to the botanists in Lyon's study (8).

In the present study, 999 of the 1019 geneticists completed doctoral degrees; 954 earned the Ph.D. degree. Ninety-three institutions awarded these doctorates. Among the ten leading institutions granting doctorate degrees were six state and four private universities (Table 2). In general, the top-ten baccalaureate institutions were also the top-ten doctorate institutions. However, Columbia and Yale, which were among the ten leading doctorate universities, replaced the universities of Nebraska and Illinois, which were among the ten leading baccalaureate institutions.

TABLE 2. *Top Ten Institutions Granting Doctoral Degrees to Members of the Genetics Society of America*

University	Number of Doctoral Degrees Awarded
California (Berkeley)	83
Columbia	79
Wisconsin	68
Harvard	56
Texas	53
Iowa State (Ames)	51
Cornell	50
Yale	43
Minnesota	38
Chicago	35

Land-grant institutions awarded 38.7% of the geneticists' doctoral degrees. Land-grant and state institutions together granted 605 doctorates or 60.5% of the total, while private and denominational institutions awarded 381 doctorates, or 38.1% of the total.

Geographic Origins. To reveal which areas of the U.S. were the most productive of geneticists, the geneticists were divided according to the nine regions of the U.S. in which they were born (Table 3). These nine regions were used in Harmon's 1961 study (4). The total number of geneticists produced by all the regions is slightly less than the number employed, because the places of birth for six of the geneticists were not listed in *American Men of Science.*

Together the Middle Atlantic and East North Central states produced 45.5% of the geneticists. Indiana was the least productive of the five states included in the latter region (Table 3). Only 20 of the geneticists included in this investigation were born in Indiana and of these six retain their Indiana residences. Thirteen of the 20 obtained baccalaureate degrees from institutions in the state, while only six earned their doctorates within the state. A total of 27 geneticists (Table 4) earned

TABLE 3. *Productivity of Regions of the United States: Comparison Between Number of Members of the Genetics Society of America Born and Employed in Each Region*

Regions		Number Born in Region		Number Employed in Region
New England		76		95
Middle Atlantic		256		156
East North Central		204		197
Ohio	52		33	
Indiana	20		36	
Illinois	75		60	
Michigan	31		45	
Wisconsin	26		23	
West North Central		148		86
East South Central		13		51
South Atlantic		73		149
West South Central		70		61
Mountain		49		44
Pacific		69		159
Foreign		55		21
	Totals	1013		1019

baccalaureate degrees from Indiana schools. Indiana and Purdue Universities ranked thirteenth and fourteenth, respectively, in the nation in granting doctoral degrees to geneticists in this study, Indiana having granted 27 and Purdue 23.

Harmon and Soldz' 1960 study (6) showed that the regions producing the greatest number of science doctorates are the Middle Atlantic, East North Central, and Pacific. The latter, however, has not been highly productive of geneticists (Table 3). Among the states New York was the

TABLE 4. *Indiana Institutions Granting Baccalaureate Degrees to Members of Genetics Society of America*

Names of Institutions		Number of Degrees
Indiana University		13
Purdue University		9
Wabash College		3
Ball State University		1
Indiana Central College		1
	Total	27

most productive (173 geneticists) and Mississippi the least productive (no geneticists). Mississippi is included in the East South Central states, which generally have been low producers of scientists.

Comparisons of Data Concerning Male and Female Geneticists

In Harmon's study of Ph.D.'s in the sciences, slightly over 10% of the doctorate holders were women (5). In the present investigation of 1019 geneticists, 12.5% or 127 were women.

Thirty-eight percent of the men but only fifteen percent of the women earned baccalaureates at land-grant colleges and universities. The women, however, were more frequently graduated from private colleges and universities than were the men. Land-grant institutions awarded 30.6% of the women's doctoral degrees and 39.8% of the men's doctorates. Private colleges and universities awarded 45.4% of the women's doctoral degrees and 36.6% of the men's doctorates. Institutions outside the United States granted 1.2% of the men's doctoral degrees, but none of the women earned doctorates from foreign universities.

A higher percentage of women are employed by private colleges and universities, while a higher percent of the men find employment in state colleges and universities. Colleges and universities employ 77.2% of the women and 78.6% of the men. In Harmon's 1965 study (5) a higher percentage of men than women found employment in business and industry. Among the geneticists, however, no difference between the sexes is apparent with 6.0% of the men and 6.3% of the women finding employment in business and industry.

In general, the men completed the doctorate in fewer years following completion of the baccalaureate than did the women. Five years after the baccalaureate, 47.2% of the men had earned the doctorate; but only 26.5% of the women had completed the doctoral requirement. The average time beyond the baccalaureate for the male to complete the doctorate was 6.7 years, while the 121 women completing that degree required

TABLE 5. *Areas of Research Specialization of Members of the Genetics Society of America*

Area of Genetics	No. of Women	% of Women	No. of Men	% of Men
Plant	18	14.2%	258	28.9%
Animal	64	50.4	428	48.0
Microbial	31	24.4	136	15.2
Radiation	3	2.3	10	1.1
Biochemical	11	8.7	46	5.2
Statistics	0	0.0	11	1.2
Biophysics	0	0.0	3	0.4
Totals	127	100.0%	892	100.0%

an average of just under 9 years. Only 9.7% of the men but 20.7% of the women earned doctorates after age 34. None of the 121 women earned a Sc.D. degree, but 1.8% of the men earned that degree. The M.D. degree was earned by 3.0% of the men and almost 3.0% of the women. The majority of both sexes earned the Ph.D. degree. Certain areas of research were more attractive to men than to women (Table 5). Men more frequently specialized in plant genetics, statistics, and biophysics than did the women; whereas, women more frequently entered the fields of microbial and biochemical genetics than did the men. About 50% of both men and women have specialized in some aspect of animal genetics.

Conclusions

The data obtained in this study justify the following conclusions:

1. The baccalaureate origins of the geneticists were more varied than their doctoral origins, the baccalaureate degrees having been awarded by 281 different institutions and the doctorates having been granted by 93 institutions.

2. Private colleges and universities produced over one-third of the geneticists, while state and land-grant institutions granted over 50% of their baccalaureates and over 60% of their doctorate degrees. Eight of the ten leading institutions granting baccalaureates were state institutions; six of the ten leading doctorate institutions were state-supported.

3. Many of the ten leading institutions granting baccalaureates to the geneticists also were included in the leading institutions granting baccalaureates to botanists and *Drosophila* workers. This may be indicative that certain institutions are generally productive of life scientists.

4. The Middle Atlantic and East North Central states constituted regions in the U.S. that were most productive of geneticists. Indiana produced only 20 of the 1019 geneticists in this study.

5. At both the baccalaureate and doctorate level, women geneticists were more frequently graduated from private colleges and universities than were men. The men more frequently earned degrees from land-grant colleges and universities. Geneticists tended to find employment in the kinds of institutions from which they earned their degrees; a higher percentage of women were employed by private colleges and universities, whereas a higher percent of the men found employment in state colleges and universities.

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