that only two archeological explorations of any significance have been reported for the Campeche coast (*24*, *27*).

However, it appears evident to me that water controls in the lowland Maya area played an important role in the development of Preclassic and Classic civilizations and that we are only beginning to understand the adaptability of a remarkable people of the past.

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11. Chultuns are more successful when constructed in limestone than in soil. There is little exposed limestone at Edzna, thereby limiting the choice of where chultuns could be placed. Stephens (*7*) shows chultuns constructed of cut limestone blocks placed in soil which were plastered with stucco. See R. T. Matheny [*Am. Antiq.* **36**, 47 (1971)] for examples of modern chultuns constructed in soil.
12. The fortress is a defensive construction surrounded by a moat that is identical in size to the defensive dry ditch surrounding Becan. The Edzna fortress was built at about the same time as Becan. See R. T. Matheny [*Mem. Soc. Mex. Anthropol.* (1973)] for a description of Edzna defensive works.
13. The multiple films aid in interpreting differential vegetal growth. Plants in full chlorophyll process show up as white to gray on black-and-white infrared film and show a range of red to magenta (false colors) on color infrared film. Plants responding to the extra moisture in filled channels are usually ahead in growth of plants outside such areas and show as brighter hues of red. Open water is rendered black.
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Baccalaureate Origins of American Scientists and Scholars

The undergraduate institutions from which women have gone on to doctorates differ from those of men.

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Until the passage of federal antibias regulations pertaining to women in institutions of higher education, few of these institutions found it necessary or useful to examine themselves for evidence of policies or attitudes that affect women and men differentially. As a result there have been very few studies that would enable the characterization of colleges and universities with respect to their advancement of the status of women (*1*).

The present article is concerned with but one aspect of such a characterization: institutional productivity in terms of baccalaureate recipients who have subsequently earned research doctorates (*2*). The productivity of an institution is here measured in two ways: by the absolute number of its graduates of each sex who went on to attain the doctorate, and by the percentage of its graduates of each sex who did so. Both these productivities have been assessed also with respect to the decades when the baccalaureates were granted and to the various fields of doctoral study. Apart from their intrinsic historical interest, it is hoped that these data will suggest ways of characterizing educational institutions that will describe more fully their involvement in the higher education of women.

Historical Perspective

Early in the 17th century the first American colleges were founded—for men. Two hundred years later the notion that women were also educable found expression in the establishment by Emma Willard of Troy Female Seminary (1821) and by Mary Lyon of Mount Holyoke Female Seminary (1837). While neither institution was chartered to grant the baccalaureate degree, both offered two or more years of courses in all academic disciplines patterned after those available in the best men's colleges and universities (*3*). In 1837 Oberlin College became the first institution to admit women to a baccalaureate degree program, although full access to all courses and departments was not permitted until some time later. By the 1870's there were 97 major coeducational institutions (*4*) and some 28 women's colleges (*5*) in the United States.

Women were not admitted to graduate schools before the 1880's, and even after they had gained admission they were not necessarily permitted to receive advanced degrees (*6*). Nonetheless by 1920, the first year in which doctorate

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degrees were recorded by the National Research Council, 88, or 16 percent, of the recipients were women (*7*). Since that time the number of women receiving doctorates has grown rather steadily. The percentage of doctorates awarded to women also increased for a time, reaching a peak in 1945 of 21 percent. But after the years of World War II it declined to a low of 9 percent in 1954. Not until 1972 did the proportion again reach the level of the 1920's; and only in 1974 had it returned to the range recorded in the mid-1940's.

The baccalaureate origins of these women have not been investigated previously. Harmon and Soldz (*8*) have published an extensive survey of doctorate production in the United States which includes a rank ordering of baccalaureate institutions by number of doctorate recipients according to the decade of receiving the doctorate. A second study, carried out at the City University of New York (*9*), rank-orders 20 baccalaureate institutions by the number of graduates who received doctorates in each of 22 fields. A third study, by Hardy (*10*), rank-orders baccalaureate institutions according to the percentage of graduates who earned doctorates during the years 1920–1939 and 1950–1961. None of these studies has given results separately for women and for men.

Only a few studies have been published which focus on institutional productivities for women. In one (*11*), 1500 women randomly selected from all those cited for career achievement in *Who's Who of American Women* served as the data base. Their baccalaureate degrees had come from 59 women's colleges and 289 coeducational institutions. In proportion to the total number of women graduates in their respective graduating classes, the women's colleges had twice the representation in this sample that the coeducational institutions had. Approximately 80 percent of these women had advanced degrees. In other pilot studies (*12, 13*) a high proportional productivity of women's colleges with respect to attainment of the doctorate has been noted. But thus far there have been few data to suggest which among the other types of undergraduate institutions have been especially productive of women who attained the doctorate.

The Data Base

Sources of educational statistics on institutions and individuals present numerous difficulties. The items chosen for inclusion vary, as does the style of presentation; there are inconsistencies from one era to the next, and from one collecting agency to another.

Prior to 1917–18 very little information about baccalaureate degrees is available (*14*). From 1917–18 to 1937–38 the total number of baccalaureate and first professional degrees awarded by each institution to each sex is given for every second academic year in the *Biennial Survey of Education*, compiled by the Department of the Interior. During the early 1940's only very incomplete information was published (*5*). Since 1947–48 the total number of baccalaureate and first professional degrees awarded by each institution to each sex is given for each academic year in *Earned Degrees Conferred*, published by the Department of Health, Education, and Welfare (*15*). However, the separate identification of baccalaureate and first professional degrees from each institution was not accomplished until 1961–62. In the present study these data have been separated where necessary by means of a correction factor (*16*). Thus in addition to errors from reporting, recording, and retrieval, errors may arise from the approximations involved in the correction factor. The separation is necessary, however, to improve the comparability of the bases from which the doctorate population could be expected in the various colleges and universities. The lack of baccalaureate data prior to 1917 and the discontinuity between 1938 and 1947 have restricted the present calculations of percentage output to four decades—the 1920's, 1930's, 1950's, and 1960's.

By contrast, doctoral data are continuous and unambiguous. Since 1920 the Doctorate Records File has listed the number of doctorates received each year by sex, baccalaureate institution, year of baccalaureate, doctoral institution, and doctoral field. Errors arising from the use of these data are therefore restricted to those related to reporting, recording, or retrieval. The enumeration of baccalaureate recipients who later earned doctorates was accomplished by using data from the file from 1920 through 1973, the most recent year for which doctoral information was available at the time of the study. However, the baccalaureate years represented by this pop-

Table 1. Undergraduate institutions that ranked highest in number of graduates of each sex in the period 1910–1969 who obtained doctorates in the period 1920–1973.

Rank	Women		Men	
	Institution	Number	Institution	Number
1	Hunter College	1,110	University of California, Berkeley	6,619
2	University of California, Berkeley	926	University of Wisconsin	6,548
3	Barnard College	846	City College of New York	6,192
4	University of Wisconsin	808	University of Illinois	5,710
5	University of Michigan	773	Harvard University	5,465
6	Wellesley College	768	University of Michigan	4,703
7	University of Chicago	737	University of Minnesota	4,481
8	University of Minnesota	711	Massachusetts Institute of Technology	4,326
9	Brooklyn College	689	Cornell University	4,002
10	Radcliffe College	654	University of Chicago	3,671
11	New York University	651	University of California, Los Angeles	3,614
12	University of California, Los Angeles	642	Ohio State University	3,574
13	Smith College	638	Columbia University	3,559
14	Cornell University	622	New York University	3,266
15	Vassar College	597	Yale University	3,255
16	Mount Holyoke College	581	University of Texas	3,242
17	University of Illinois	577	Pennsylvania State University	3,189
18	University of Texas	570	Brooklyn College	3,042
19	Ohio State University	496	University of North Carolina	2,935
20	Bryn Mawr College	482	Purdue University	2,761
21	University of Florida	443	University of Washington	2,732
22	Stanford University	425	University of Missouri	2,720
23	Columbia University	423	Stanford University	2,610
24	University of North Carolina	408	University of Florida	2,594
25	Northwestern University	398	Princeton University	2,485
Number in ranked institutions		15,975		97,295
Number in 137 selected institutions		30,830		208,323
Number in all institutions		52,664		350,702

ulation extend over six decades, from 1910 through 1969 (*17*).

To complete the task, there remained the selection of institutions to be included in the study. There are at the present time approximately 1900 institutions in the United States which grant the baccalaureate degree, but only a small proportion have been considered important as sources of doctoral candidates (*8*). Provisionary calculations of percentage productivity were made on a substantial number of the 733 institutions reported in the Harmon and Soldz study of 1963 (*8*). In addition, a 5 percent random sample of all women doctorate recipients was available (*18*) which supplemented published information; and a review of several issues of *Earned Degrees Conferred* provided the names of institutions founded too recently to have been included in the Harmon and Soldz study. Institutions with large absolute numbers of graduates who had received doctorates, along with those appearing to have large percentages, constituted the list of 137 institutions selected for the present study.

Table 2. Undergraduate institutions that ranked highest over four decades (1920–1939 and 1950–1969) in percentage of graduates of each sex who obtained doctorates. Only institutions with at least 400 graduates of the given sex during the 40 years have been ranked in the list for that sex.

Women			Men		
Institution	Number	Percent	Institution	Number	Percent
Massachusetts Institute of Technology	46	11.0	Reed College	583	29
Reed College	111	9.7	California Institute of Technology	1287	28
Swarthmore College	260	8.2	Harvey Mudd College	111	26
Bryn Mawr College	367	7.9	Swarthmore College	713	21
Radcliffe College	516	6.4	Oberlin College	1406	20
Barnard College	664	6.3	Antioch College	456	16
Antioch College	103	5.0	University of Chicago	2416	16
Brandeis University	112	4.6	Haverford College	525	16
Mount Holyoke College	452	4.3	Carleton College	567	15
Oberlin College	306	4.1	Massachusetts Institute of Technology	3737	15
Wellesley College	592	4.1	Pomona College	613	15
Cornell University	507	3.8	College of Wooster	551	14
Vassar College	451	3.8	Grinnell College	416	13
University of Chicago	446	3.6	Kalamazoo College	286	13
University of Florida	354	3.4	Rice University	876	13
Rice University	100	3.4	Brandeis University	285	12
Carleton College	103	3.1	Earlham College	287	12
University of North Carolina	289	3.1	Amherst College	901	11
Pomona College	116	3.1	Cornell University	3188	11
Stanford University	348	3.1	Harvard University	4156	11
Brown University	169	2.9	Hope College	401	11
Goucher College	186	2.8	Wabash College	406	11
Johns Hopkins University	44	2.6	Catholic University of America	630	10
University of Rochester	194	2.6	Depauw University	713	10
Smith College	458	2.5	Juniata College	237	10
			Park College	164	10

Table 3. Undergraduate institutions that ranked among the top 25 in total number for each of six decades (1910–1969) or in percentage for each of four decades (1920–1939, 1950–1969) of graduates of each sex who obtained doctorates.

Women	Men
Number	
Barnard College	University of California, Berkeley
University of California, Berkeley	City College of New York
Cornell University	Columbia University
Hunter College	Cornell University
University of Illinois	Harvard University
University of Michigan	University of Illinois
University of Minnesota	University of Michigan
Radcliffe College	University of Minnesota
Smith College	University of Missouri
University of Texas	Ohio State University
Vassar College	Pennsylvania State University
Wellesley College	University of Texas
University of Wisconsin	University of Wisconsin
	Yale University
Percentage	
Barnard College	Haverford College
Bryn Mawr College	Kalamazoo College
Cornell University	Oberlin College
Mount Holyoke College	Pomona College
Radcliffe College	Reed College
Reed College	College of Wooster
Vassar College	
Wellesley College	

For each of the 137 institutions, the number of baccalaureate recipients of each sex was obtained for each decade starting with 1920, and the number who subsequently attained doctorates, with the doctoral field of study, was recorded beginning with those whose baccalaureates dated to 1910. From these data the 25 highest-ranking institutions with respect to each of the following criteria for each sex were identified: (i) the number of graduates of the entire period (1910–1969) who attained doctoral degrees; (ii) the percentage of graduates (1920–1939 and 1950–1969 combined) who attained doctoral degrees; (iii) the number for each of the six decades; (iv) the percentage for each of the four decades; and (v) the total number; and (vi) the percentage for each of five broad doctoral fields of study. The tables thus developed are the bases for the results presented (*19*).

The Most Productive Institutions

Table 1 shows the 25 undergraduate institutions that graduated in the period 1910–1969 the largest number of women who received doctorates between 1920 and 1973, and the comparable list for men. Also given are the total numbers of doctoral women and men from the 137 undergraduate institutions selected for this study and from all undergraduate institutions. Both for women and for men the top 25 institutions graduated about 30 percent of the individuals who went on to receive doctorates. The 137 institutions graduated about 60 percent although they constitute some 7 percent of the number of baccalaureate institutions. In the period 1920–1973 women received 13 percent of the doctorates.

Ten public and five private universities

appear on both lists, but one of the former, the University of North Carolina, maintained a separate campus for women students until 1964 and is properly counted as a women's college. Eight of the ten remaining institutions on the list for women, for essentially all the baccalaureate years encompassed by the study, admitted women only (*20*). There are no private coeducational colleges on the list for women, and all institutions on the list for men are universities or large public colleges. Thus, except for the women's colleges, all the institutions that appear on these lists enrolled relatively large numbers of students. Hence their standing in terms of absolute numbers of graduates in the ranks of doctoral recipients could result from size alone.

A more pertinent assessment of productivity, therefore, may be gained by determining the percentage of graduates who achieved doctorates. The highest ranking institutions by this criterion are shown in Table 2. Women's colleges and private universities dominate the list for women. By contrast, it is striking that the list for men includes 14 relatively small, private, coeducational colleges, none of which appears in Table 1.

Twelve institutions, eight that admitted women only and four universities, appear in the top 25 with respect both to the number and to the percentage of their women graduates who subsequently obtained doctorates. Four institutions are common to the two men's lists, all of them private universities. The University of Chicago and Cornell University are the only institutions that ranked high for both women and men in both numerical and percentage outputs. A few coeducational colleges appear on both the women's and the men's lists in Table 2, but their enrollment of either sex was sufficiently small that they do not appear in Table 1. It should be noted that coeducational colleges, which appear less frequently on the women's list of percentages than do the women's colleges, are approximately five times as numerous (*5*, *15*). The total number of private universities is about equal to that of the women's colleges, but there are only three such institutions on both lists for women and therefore this institutional type also has small relative representa-

Table 4. Within doctoral fields, undergraduate institutions that ranked highest in number of women graduates in 1910–1969 who obtained doctorates in 1920–1973.

Rank	Physical sciences and engineering	Life sciences	Social sciences	Arts and humanities	Education
1	Mount Holyoke College*	Cornell University*	Brooklyn College*	Barnard College*	Hunter College*
2	Barnard College*	University of California, Berkeley	Hunter College	Wellesley College*	University of Wisconsin*
3	Hunter College	Mount Holyoke College*	University of California, Berkeley	Hunter College	New York University*
4	University of California, Berkeley	Hunter College	Barnard College*	Smith College*	University of Minnesota
5	Vassar College*	University of Wisconsin	University of Chicago*	Radcliffe College*	Columbia University*
6	University of Michigan	Wellesley College*	University of Michigan	Bryn Mawr College*	University of Florida*
7	University of Chicago*	University of Michigan	Wellesley College*	Vassar College*	University of California, Berkeley
8	Wellesley College*	University of Chicago*	Radcliffe College*	University of California, Berkeley	University of California, Los Angeles
9	Cornell University*	Barnard College*	New York University	University of Chicago*	University of Michigan
10	Bryn Mawr College*	University of Illinois	University of Minnesota	University of Wisconsin	Boston University
11	Radcliffe College*	Smith College	University of California, Los Angeles	University of Michigan	Ohio State University
12	University of Illinois	University of Texas	Cornell University*	Mount Holyoke College*	University of North Carolina*
13	Smith College	Vassar College*	Vassar College*	University of California, Los Angeles	University of Illinois
14	Brooklyn College	University of Minnesota	University of Wisconsin	University of Texas	Brooklyn College
15	University of California, Los Angeles	Radcliffe College*	Stanford University*	University of Minnesota	University of Texas
16	New York University	Brooklyn College	Smith College*	Brooklyn College	Wayne State University
17	University of Texas	University of California, Los Angeles	Ohio State University	Stanford University*	University of Chicago*
18	University of Wisconsin	Oberlin College*	City College of New York*	New York University	University of Nebraska
19	Swarthmore College*	Goucher College*	University of Illinois	University of Illinois	University of Pittsburgh*
20	Goucher College*	University of Washington	Oberlin College*	Oberlin College*	Indiana University
21	University of Minnesota	Rutgers University	University of Texas	University of Pennsylvania*	University of Missouri
22	Massachusetts Institute of Technology*	University of North Carolina	Northwestern University	Cornell University	State University of Iowa
23	Northwestern University	Ohio State University	Swarthmore College*	Northwestern University	Northwestern University
24	Rutgers University	Bryn Mawr College*	University of Florida*	Swarthmore College*	University of Pennsylvania
25	Ohio State University	†	Bryn Mawr College*	University of North Carolina*	University of Washington
			Number in ranked institutions		
	1,484	2,575	3,948	4,422	3,878
			Number in 137 selected institutions		
	2,665	4,990	6,861	7,596	7,256
			Number in all institutions		
	4,168	7,826	10,008	13,038	15,462

*Also among top 25 for percent productivity by field. †More than one institution has the same number.

tion. Thus the relative frequency of appearance of women's colleges on these lists calls special attention to how important this institutional type has been as a source of women doctorate recipients.

Institutional productivity by any measure may vary with time, some institutions having been highly productive during certain periods but not others. Table 3 lists in alphabetical order the institutions that were consistently productive throughout the time observed, having ranked among the top 25 for each of the six or four decades, respectively. There are four women's colleges and one private university with long and continuous histories of graduating both large numbers and large percentages of women who have subsequently earned doctorates. The lists for men have quite a different character: the division between large universities for total output and small, private, coeducational colleges for percentage output is clearly evident. No institution appears on both lists for men.

Table 4 shows the ranking of baccalaureate institutions in five fields of learning with respect to numbers of women graduates who earned doctorates. Table 5 gives comparable information concerning men. In each of four fields the 137 institutions produced more than 58 percent of both women and men who subsequently received doctorates; in the fifth, education, they produced 47 and 42 percent respectively. Women's colleges and large public universities appear most frequently for women, the former in all fields except education, the latter in all fields. A similar pattern is not observed for men. The men's colleges number from one to four per field. In all fields it is the large public universities, many of which appear in Table 1, that occur with greatest frequency in the men's lists, a

Table 5. Within doctoral fields, undergraduate institutions that ranked highest in number of men graduates in 1910–1969 who obtained doctorates in 1920–1973.

Rank	Physical sciences and engineering	Life sciences	Social sciences	Arts and humanities	Education
1	Massachusetts Institute of Technology*	University of Wisconsin*	City College of New York*	Harvard University*	University of Wisconsin*
2	University of California, Berkeley	University of California, Berkeley	Harvard University*	Yale University*	City College of New York
3	University of Illinois	University of Illinois	University of California, Berkeley	Columbia University	New York University
4	City College of New York	University of Minnesota	University of Wisconsin	University of California, Berkeley	University of Minnesota
5	University of Michigan	Cornell University*	University of Chicago*	Princeton University*	University of Florida*
6	University of Wisconsin	Ohio State University	Brooklyn College*	University of Wisconsin	University of North Carolina*
7	Harvard University	Pennsylvania State University	University of California, Los Angeles	University of Michigan	Ohio State University
8	Cornell University*	Iowa State University*	University of Michigan	City College of New York	University of Illinois
9	Purdue University	Michigan State University	University of Illinois	University of Chicago*	University of California, Berkeley
10	University of Texas	Purdue University	University of Minnesota	University of California, Los Angeles	Brigham Young University*
11	California Institute of Technology*	City College of New York	New York University	Stanford University	University of Nebraska*
12	University of Minnesota	University of Michigan	Columbia University	University of Minnesota	University of California, Los Angeles
13	Rensselaer Polytechnic Institute*	Rutgers University	Cornell University	Brooklyn College	Pennsylvania State University
14	University of Chicago*	University of Missouri	Ohio State University	University of Texas	Indiana University
15	Pennsylvania State University	Oklahoma State University	Yale University	New York University	Wayne State University*
16	Columbia University	Utah State University	University of Texas	University of Illinois	University of Michigan
17	University of California, Los Angeles	University of Nebraska	Stanford University	Oberlin College*	University of Missouri
18	Carnegie-Mellon Institute*	Harvard University	University of Washington	University of North Carolina	University of Utah*
19	Yale University	University of Chicago*	University of Florida	Dartmouth College	Michigan State University
20	Ohio State University	University of North Carolina*	Pennsylvania State University	University of Pennsylvania	Columbia University
21	Iowa State University	University of Massachusetts*	University of Pennsylvania	University of Washington	State College of Iowa*
22	University of Washington	University of Maryland	Northwestern University	Northwestern University	Brooklyn College
23	Case-Western Reserve University*	University of Florida	State University of Iowa	Cornell University	North Texas State University*
24	Stanford University	Oregon State University	University of Missouri	Amherst College*	Temple University*
25	Princeton University	University of Washington	Oberlin College*	State University of Iowa	Boston University
			Number in ranked institutions		
	38,322	18,163	17,396	14,909	12,549
			Number in 137 selected institutions		
	73,116	34,829	34,523	28,791	26,059
			Number in all institutions		
	113,475	57,347	54,744	48,738	62,018

*Also among top 25 for percent productivity by field.

few scientific and technological institutions being added in physical sciences and engineering. Institutions marked with an asterisk also rank among the top 25 with respect to percentage output for each field. For women, the women's colleges predominate among these doubly productive institutions in four of the five fields; for men, private universities are the most frequent institutional type in three of the five, and large public universities in two.

The use of single-sex institutions by students to study in fields traditionally associated with the other sex has been documented previously in a study by Newcomer (*21*). In a selected group of 14 institutions she found that 7 percent of men undergraduates in the coeducational institutions majored in arts and humanities but 19 percent in the all-male institutions did so; and 10 percent of the women undergraduates in coeducational schools chose the natural sciences compared with 19 percent of the women in the women's colleges. The present study confirms and extends these findings. Twelve of the 25 institutions with the highest percentages of men who subsequently received doctorates in the arts and humanities are men's institutions; nine of the 24 institutions with the highest percentages of women who subsequently received doctorates in the physical sciences and engineering are women's colleges. Eight of the women's colleges were also highly productive in sex-traditional fields, but only one of the men's colleges was so. Instead, for men, the private, liberal arts, coeducational college was the most frequently represented type of institution in terms of percentage productivity in the social sciences and education as well as in the natural sciences.

The majority of institutions that have been highly productive of women doctoral recipients have been so in each of several fields, as is shown in Table 6. That is, institutions that offer strong preparation in more than one field are more likely to graduate women who proceed to the doctorate than are those strong in only one field. By contrast, 77 percent of the institutions listed for men contributed their graduates to only a single doctoral field. These data suggest that the identification of an institution with a particular specialty has been less useful to women of doctoral potential in their college selection than it has been for men. Douvan and Adelson have shown that, in general, a woman's career identity emerges later in life than does a man's (*22*); hence institutions that offer strengths in several fields would be more likely to provide women with the opportunity to develop a disciplinary identification after having started college without penalty for the delay. The data suggest, however, that women who took doctorates in education were the most likely to have identified themselves with their future area of study by the time they entered college: more than half the institutions listed for only one field appear by virtue of their productivity in the field of education.

Summary and Conclusions

Several studies of institutional productivity with respect to baccalaureate recipients who have attained doctorates have been published (*8–10*). However, since the number and percentage of women doctorate recipients are small, these studies reveal essentially only those institutions that have been important sources of men doctorate recipients. The tasks involved in separating sex-aggregated data are considerable but must be undertaken in order to identify those institutions that have been especially productive of women. Only when this has been accomplished is it possible to compare the patterns of institutional participation in the baccalaureate preparation of women and men doctoral degree recipients.

Analysis of the data developed indicates that more of the institutions ranked high for women on the aggregated lists (Tables 1 and 2) appear also on the lists by decade (Table 3) and by field (Tables 4 and 6) than is the case for institutions on the aggregated lists for men. The repeated appearance of the same institutions for women, along with the more diffuse pattern for men, leads to the conclusion that there has been a narrower range of institutions that have been supportive of the predoctoral preparation of women than is true for men. In particular, nine institutions, seven private women's colleges and two private universities (*23*), stand out as major contributors of women, only two of which

Table 6. Number of doctoral fields in which institutions ranked among the top 25 in both number (1910–1969) and percentage (1920–1939, 1950–1969) of graduates of either sex who obtained doctorates.

Women	Men
Five of the five fields	
University of Chicago	None
Four of the five fields	
Barnard College	University of Chicago
Bryn Mawr College	
Radcliffe College	
Vassar College	
Wellesley College	
Three of the five fields	
Cornell University	None
Mount Holyoke College	
Oberlin College	
Swarthmore College	
Two of the five fields	
University of Florida	Cornell University
Goucher College	Harvard University
University of North Carolina	University of North Carolina
Smith College	Oberlin College
Stanford University	University of Wisconsin
One of the five fields	
Brooklyn College	Amherst College
City College of New York	Brigham Young University
Columbia University	Brooklyn College
Hunter College	California Institute of Technology
Massachusetts Institute of Technology	Carnegie-Mellon University
New York University	Case-Western Reserve University
University of Pennsylvania	City College of New York
University of Pittsburgh	University of Florida
University of Wisconsin	State College of Iowa
	Iowa State University
	Massachusetts Institute of Technology
	University of Massachusetts
	University of Nebraska
	Princeton University
	Rensselaer Polytechnic Institute
	Temple University
	North Texas State University
	University of Utah
	Wayne State University
	Yale University

could be expected to be revealed in studies of total output of women and men combined. The majority of institutions ranked high for men, either in total output (principally large universities) or in percentage output (principally small, private, coeducational colleges), do not appear on the comparable lists for women. It may therefore be concluded that there are distinct differences in the baccalaureate origins of women and men who have earned doctorates.

In an attempt to identify characteristics that distinguish the institutions which are more productive of women from those chiefly productive of men, the following general observations emerge from the data developed for this study. Women who subsequently received doctorates were more likely to have graduated from institutions that enrolled large numbers of women students, had a long and continuous history of women graduates who attained doctorates, and offered strong academic preparation in several areas of study. Consistent with these observations is the suggestion that a favorable climate for women students who are intellectually motivated and capable is one that conveys to them a sense of being in an environment where there are many other women seriously involved in a variety of academic pursuits. The characteristics that distinguish highly productive institutions for men from those chiefly productive for women are also of interest. Men who subsequently received doctorates were more likely to have graduated from institutions that had a high proportion of men students and exhibited a strongly defined focus on a relatively narrow range of academic interests. Consistent with these observations is the suggestion that a favorable climate for men students who are intellectually motivated and capable is one that conveys to them a sense of being in a predominantly male environment dedicated to the field with which they have identified themselves.

References and Notes

1. In older studies of doctoral production in which data on women and men were aggregated, the principal undergraduate sources of women with doctorates are likely to have been obscured because of the small number and percentage of women who have received doctorates. In order to appreciate differentials in the institutional support of women and men it is therefore necessary to utilize sex-separated data. See, for example, M. E. Tidball, *J. Higher Educ.* **47**, 373 (July–August 1976), in which this point is supported by analysis of attitudinal data from the American Council on Education's survey of teaching faculty.
2. The term "research doctorate" refers to degrees which require a research component for their attainment (Ph.D., Ed.D., and so forth) as distinct from advanced doctoral degrees in course, such as the M.D. and J.D. For simplicity, the term "doctorate" will be used hereinafter instead of "research doctorate."
3. W. Goodsell, Ed., *Pioneers of Women's Education in the United States* (McGraw-Hill, New York, 1931).
4. F. Rudolph, *The American College and University, A History* (Knopf, New York, 1962), p. 322.
5. Department of the Interior, *Biennial Survey of Education* (Government Printing Office, Washington, D.C., 1918–1947). For 1917–18 through 1930–31 information on the combined number of baccalaureate and first professional degrees by sex, by broad field, and by institution is available for every second academic year. For 1930–31 through 1937–38 this information is available only by sex and institution. For 1939–40 and 1941–42 it is available only for land grant institutions.
6. M. W. Rossiter, *Am. Sci.* **62**, 312 (1974).
7. The Doctorate Records File is a continuously updated, computer-accessible record of responses to annual questionnaires to new doctoral recipients. It is maintained by the Commission on Human Resources of the National Research Council–National Academy of Sciences.
8. L. R. Harmon and H. Soldz, *Doctorate Production in United States Universities 1920–62*, NAS–NRC Publ. No. 1142 (1963).
9. Office of the Vice Chancellor for Budget and Planning, City University of New York, *Number of Doctorates by Institution of Baccalaureate by Field of Study, 1920–70 and 1965–70*. (City University of New York, New York, 1971).
10. K. R. Hardy, *Science* **185**, 497 (1974). The formula supplied there for calculating productivity is inappropriate for use with single-sex institutions. That is also the case with the revised formula [*ibid.* **188**, 311 (1975)].
11. M. E. Tidball, *Educ. Rec.* **54**, 130 (1973).
12. ———, *Change* **6**, 51 (1974).
13. Carnegie Commission on Higher Education, *Opportunities for Women in Higher Education* (McGraw-Hill, New York, 1973), p. 72.
14. *Annual Report of the Commissioner of Education, Department of the Interior* (Government Printing Office, Washington, D.C., 1900–1918). Published 1899–1900 through 1915–16, but only occasionally contains baccalaureate information by sex and by institution.
15. Office of Education, Department of Health, Education, and Welfare. *Earned Degrees Conferred* (Government Printing Office, Washington, D.C., 1948–1970). For 1947–48 through 1960–61 information on the combined number of baccalaureate and first professional degrees by sex, by field, and by institution is available for every academic year. For 1961–62 through the present this information is presented separately for baccalaureate and four-or-more-year first professional degrees. The baccalaureate data for Barnard College were obtained directly from Barnard, Office of the Registrar, since in many years they were published only in combination with those of Columbia University in the sources used.
16. First professional degrees as defined in the sources used include degrees in medicine and law and a number of other degrees requiring five or more years of higher education, as well as 4-year first professional degrees mainly in the sciences and engineering. Since recipients of the former do not contribute substantially to the pool of individuals who subsequently receive a research doctorate, it was necessary for the percentage calculations to correct the data for those years when baccalaureate and first professional degrees were combined in the listings. Individuals earning 4-year first professional degrees from the institutions in question do constitute a group from which doctoral candidates are drawn and they were therefore included with the baccalaureate degrees for the purposes of this study. It should be noted that Hardy (*10*) did not make this separation in his calculations; that accounts in part for the discrepancy between his findings and the ones reported here.

    Correction factors for five-or-more-year first professional degrees were calculated for all institutions from the data on baccalaureate and first professional degrees awarded by field. The factors, f, are defined by the equation $f = (N_T - N_F)/N_T$, where N_F is the number of five-or-more-year first professional degrees and N_T is the total number of baccalaureate and all first professional degrees. For the period 1961–62 to the present, information was given separately for the five-or-more-year degrees; hence the corrections, affecting only 1960–61, are small for the decade 1960–69. The separated data could also be used to verify that correction factors calculated for that decade were accurate within 5 percent. It is believed that the correction factors calculated by the same procedure for the decade 1950–59 have a similar accuracy. The correction factors for 1920–29 were calculated from a different categorization of data by field, and no direct estimate of accuracy is possible. For the decade 1930–39 data were not available to calculate corrections and those of 1920–29 were used. Comparison with undergraduate enrollment data and with the factors for 1950–59 indicated that this procedure gave a consistent pattern of results. For women the correction factor varied from $f = 0.62$ to $f = 1.00$ and approximately 25 percent of the institutions had $f < 0.95$. For men the factor varied from $f = 0.28$ to $f = 1.00$ and approximately 50 percent of the institutions had $f < 0.95$. The percentage, P, of baccalaureate degree recipients who continued to the doctorate is defined by the equation $P = 100\,N_D/fN_T$, where N_D is the number of individuals from a given baccalaureate institution subsequently receiving a doctorate and f and N_T are as defined above. Therefore, the uncertainty in P depends on the uncertainty in f, as well as the statistical uncertainties inherent in the absolute size of N_D.
17. Utilization of baccalaureate year rather than doctoral year permits comparisons between women and men to be made directly without the assignment of arbitrary and different rates of doctoral attainment for each sex.
18. These data have been provided to one of us (M.E.T.) by the Commission on Human Resources, for ongoing studies on undergraduate sources of women with doctorates.
19. Tables not included in their entirety in this paper may be obtained by written request to Dr. M. E. Tidball, Department of Physiology, The George Washington University Medical Center, 2300 Eye Street, NW, Washington, D.C. 20037.
20. Hunter College first admitted men to its Bronx campus (now Lehman College) in 1950 and to its Park Avenue campus in 1964.
21. M. Newcomer, *A Century of Higher Education for Women* (Harper, New York, 1959), p. 95.
22. E. Douvan and J. Adelson, *The Adolescent Experience* (Wiley, New York, 1966), chap. 7.
23. The nine institutions are Barnard College, Bryn Mawr College, University of Chicago, Cornell University, Mount Holyoke College, Radcliffe College, Smith College, Vassar College, and Wellesley College.

24. We thank the Commission on Human Resources of the National Research Council–National Academy of Sciences for providing us with the programming, computer time, and access to the Doctorate Records File which made this article possible, as well as the support provided to one of us (M.E.T.) during a sabbatical leave at the commission in 1974–75. We also thank Charles S. Tidball for reviewing and evaluating the manuscript, and Patricia T. Foley and Carolyn J. Wells, who assisted in compiling the baccalaureate data. One of us (V.K.) acknowledges a fellowship which partially supported this study from the Project on Women and Career Options supported by a Carnegie Corporation grant administered by the University of Massachusetts.