

Women in Science in Germany

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Argument

Science is more sex-segregated in Germany¹ than in other European countries or in the United States. Female students and faculty were admitted to German universities 30 to 50 years after they were admitted to universities elsewhere. This article analyzes why this was so. First, since the nineteenth century, science has enjoyed great prestige in Germany: German higher education was systematized at that time and has since then been run by the government. In addition, the early professionalization of science in Germany put in place demands for high levels of qualification and research, which made academic careers in science attractive to Germany's social elites. Germany lacked a strong feminist movement. For many years women were excluded from the academic labor market. Even after women were admitted to universities, female representation in faculty positions was sporadic. Exclusionary strategies, often demanded by male academics, were implemented throughout the interwar years, culminating in the anti-feminist policies of the Nazi regime, and the expulsion and persecution of "non-Aryans." After World War II this legacy of a conservative, often anti-feminist, faculty persisted. As a result, academic careers opened to women only after the tremendous expansion of universities in the 1970s. New feminist movements have finally motivated the government to introduce programs in the 1990s aimed at greater sexual equality.

1. Introduction

The systems and contents of science in developed countries have common roots and traditions; nevertheless, there are considerable differences in the rate of women's participation in science (European Commission 2000). Science in Germany, for example, remains one of the most sex-segregated systems. Women suffer both horizontal segregation, where they are excluded from the most prestigious, powerful, and profitable scientific disciplines, and vertical segregation, where they are excluded from the most prestigious positions within disciplines. Such segregation and

¹ Gender relations in science up to 1989 in East Germany (German Democratic Republic) cannot be discussed here. Due to a policy of gender equality, the imbalance of gender in science was much less than in West Germany, see Stein 1994. Figures between 1945 and 1988 refer only to West Germany.

marginalization of women can result in male-biased scientific knowledge, the consequences of which are well documented (Schiebinger 1999).

This paper will address a number of questions. First, what are the main factors affecting gender relations in German science? Why did German universities accept female students 30 to 50 years later than universities in other Western European countries and the United States? How did the characterization of certain disciplines as “masculine” or “feminine” serve to exclude women from prestigious scientific work? Surprisingly, historical analysis reveals that many women once studied and worked in what are today male-dominated disciplines. This paper will explore why participation rates for women in scientific fields have decreased in comparison to other fields. The academic labor market in Germany has had a highly cyclical pattern since the nineteenth century (Titze et al. 1990). Overproduction and/or shortages of university educated people led to devaluation, and then revaluation, of certain professions. We will examine which conditions of the labor market have favored the advancement of female scientists. The past decade has brought modest gains for female academics in Germany. What developments made these relatively small steps toward gender equality possible? The final section of this paper will discuss whether lessons learned from other countries about how to cultivate greater sexual equality can be applied to Germany. Given that a new generation is about to occupy the top positions in German science, the question becomes: What policies might aid in establishing equality for women within German science?

2. “The leaky pipeline” and the structure of the academic system in Germany

The image of a “leaky pipeline” has been used to describe the shrinking numbers of qualified women in science as one climbs the ladder of power and prestige (European Commission 2000, 12–14). An analysis of the German academic system will shed light on the specific conditions that have led to the poor representation of women in high academic positions. In Germany, academic institutions are almost entirely funded and administered by individual federal states. Federal law has standardized the system, allowing for reciprocal recognition of certificates between states and guaranteeing relatively high standards of education and research nation-wide. Within this overall framework, universities enjoy a large degree of academic autonomy.

Academic institutions do not compete for students; a high school diploma (*Abitur*) allows students free entrance to the university of their choice. However, demand for a place to study (*Studienplatz*) often exceeds university capacity in fields, such as medicine, psychology, economics, and biology, despite the tremendous expansion in the university system since the 1970s. For these disciplines, *Abitur* (discussed in further detail in part three) grades determine who gets a desired *Studienplatz*. Germany’s 348 universities and colleges had 1.8 million students, 44.5 per cent of whom were female, in the winter semester 1998/99. More than 1.1 million were studying at the

87 most popular universities. In addition to theological, educational, and technical schools, there are also more than 150 colleges (*Fachhochschulen*)² that do not award a doctorate degree.³

German universities are still guided by the Humboldtian ideal of the unity of research and teaching that was first formulated in 1810.⁴ The early establishment of scientific laboratories and seminars in the nineteenth century brought the German university system international acclaim, and this successful model was later exported to other countries, such as the United States (see Flexner 1930). The professionalization of science and sustained achievements in research have brought greater prestige to academic careers in German society than in many other countries (Ringer 1969). University careers have, thus, been more attractive to social elites in Germany than elsewhere, which has made the system highly competitive.

These traditional academic structures have had a decisive impact on gender relations. Because of the attractiveness of the science system, there was no shortage of qualified academics and hence no pressure to include women. In any case, women were considered to be intellectually inferior, a point that will be discussed in further detail in part three. In order to qualify for a professorship at a German university today, a student is required to complete a second thesis after the dissertation, the *Habilitation*, which is subjected to examination not only by his or her own faculty, but also by an external peer-review panel. University faculties consist mainly of two categories of professors both with tenure and fixed salaries: C 4, the highest category; and C 3, the second-highest category. There are relatively few C 2 positions at universities.⁵ Permanent positions are also held by senior lecturers. Assistants working on their theses or *Habilitationen* do not have tenure, and are employed for a limited time only, usually six years. After this time, they have to compete for a professorship. They are not allowed to accept a position at their own university, but must receive a “call” to another institution.⁶ In 2002 federal law introduced junior professorships. Instead of a *Habilitation*, young scientists with a Ph.D. may qualify for a tenured professorship through a successful program of research carried out during his or her six-year term as a junior professor. All academics in Germany are civil servants, and faculty positions are governed by a nationally recognized set of rules. These rules do

² The *Fachhochschulen* are not the same as colleges in the United States.

³ <http://www.statistik-bund.de/basis/d/biwiku/hoctab1.htm>, 23/05/2001, Statistisches Bundesamt Deutschland: Hochschulen; Statistisches Jahrbuch 2000 für die Bundesrepublik Deutschland, Stuttgart 2000, Tabelle 16.9, 378–380.

⁴ As is true world-wide, however, research performance (measured by publication and citation counts) has been valued over teaching.

⁵ These are the categories of professors since the 1970s. College faculties (*Fachhochschulen*) consist of permanent professors, where the highest rank available is the C 3, or lecturers, who are employed on an hourly basis and have no voting privileges. Due to age and seniority the salaries are “gross per month, with 13 monthly salaries per year (status 01.01.2002): C 2: minimum DM 6,210, maximum DM 8,650; C 3: minimum DM 6,880, maximum DM 9,643; C 4: minimum DM 8,333, maximum DM 11,110; pay can be increased by extras up to DM 17,933” (Hadulla-Kuhlmann and Hartung 2002, 3, n.5).

⁶ For professors it is possible to change universities.

not allow for an academic to remain at the same university on a series of short-term contracts; nor do they allow faculty to move laterally (within the same position) to another university. If, for example, an assistant's contract has expired, he or she cannot take a position as an assistant at another university. Though there are a few exceptions (for example, within the medical faculties), the general rule is "up or out."

This bureaucratic career system, based on state laws, can discriminate indirectly against women. For example, the average age for finishing the *Habilitation* is approximately forty.⁷ Before finishing the *Habilitation*, scholars remain under the tutelage of their professors in dependent positions; they are burdened with intense competition and a heavy workload. This comparatively prolonged qualification process includes finally a move to a new university and city. All this can be difficult for a mother at this decisive period of her career (Bund-Länder-Kommission 2000, 12).⁸

Important research work is also done at institutions outside the system of higher education. Germany has four large, state-funded science institutes devoted to basic research, mainly in the natural sciences and engineering: the Max-Planck-Institutes, the Fraunhofer-Gesellschaft, the Wilhelm Gottfried Leibniz Institutes, and the Hermann von Helmholtz-Gemeinschaft deutscher Forschungszentren. These institutes have large, well-equipped laboratories, and are run by professors who also hold university positions. Limited-term positions (usually 3–5 years) are held by leaders of junior research groups, post-graduates, and post-doctoral students. In the scientific community, these research institutes have an excellent reputation, and scientists who have held positions there have good career prospects. These institutes employ nearly 28,000 scientists, 1,755 of them in leading positions (Bund-Länder-Kommission 2000, Tabelle 8.1 and 11.1).

2.1. Representation of women in academic careers

The social-democratic-liberal government of the 1970s expanded the university system across Germany. Since then there has been a steady increase in the percentage of female students, from 25 per cent to 44.5 per cent (see Table 1). The percentage of first degrees awarded to women is 42.2 per cent, which is lower than in Australia, North America, and most European countries, where women constitute more than 50 per cent of university first-degree graduates (European Commission 2000, 8).⁹ Table 1 illustrates how the proportion of women achieving scientific degrees drops

⁷ <http://www.statistikbund.de/basis/d/biwiku/hochtab6.htm>, 23/05/2001, Statistisches Bundesamt: Hochschulen.

⁸ The full name of this commission is: Bund-Länder-Kommission for education planning and promotion of research, representing the federal government and the state governments.

⁹ The comparison of figures in the European Commission 2000 report refers to bachelor degrees. The first degrees at German universities, however, correspond approximately to an American master's degree (European Commission 2000, 8).

Table 1: Percentages of women at varying levels of university education, 1998

Degree Level	Percentage of Women
Students	44.5
Graduates	42.2
Doctoral degree	33.1
Habilitation	15.5

Source: <http://www.statistik-bund.de>, 23/05/2001, Statistisches Bundesamt Deutschland. Hochschulstatistik, Tabelle 10.1: Frauenanteile in verschiedenen Stadien der akademischen Laufbahn 1980 bis 1998.

dramatically with each advancing degree. The lack of equality between the sexes is even greater in scientific careers (see Table 2). While women constitute approximately 29 per cent of scholars employed by colleges and universities (winter semester 1999/2000), they hold only 9.5 per cent of professorships. Women's representation shrinks finally to 5.9 per cent at the top C 4 level.

It is often argued that the number of qualified women is still too small and that the poor showing of women in scientific positions is a product of insufficient supply. But this is not the case. At least over the last 15 years the rate of women with a *Habilitation* was always higher than the rate of female professors. For example, 15 per cent of qualified persons with a *Habilitation* are women. If the potential of women were realized, we would expect in the long run 15 per cent of the professors to be female. But instead we find that women account only for 9.5 per cent of the professorships, while men still hold 90.5 per cent.¹⁰ Men are overrepresented at every step on the career ladder, from the doctoral degree upwards.

Table 2: Percentages of women in academic careers in higher education, 1998

Career level	Percentage of Women
Academic employees (without professors)	28.9
All professors	9.5
C 4 professors (= top-level)	5.9

Source: <http://www.statistik-bund.de>, 23/05/2001, Statistisches Bundesamt Deutschland. Hochschulstatistik, Tabelle 10.1: Frauenanteile in verschiedenen Stadien der akademischen Laufbahn 1980 bis 1998.

¹⁰ <http://www.statistik-bund.de>, 23/05/2001, Statistisches Bundesamt Deutschland. Hochschulstatistik, Tabelle 10.1: Frauenanteile in verschiedenen Stadien der akademischen Laufbahn 1980 bis 1998.

Up to now we have considered the overall number of female and male professors. Let us take a look at the numbers of newly appointed professors. The ongoing loss of highly qualified women through the leaky pipeline is illustrated by the fact that only 12.6 per cent women were appointed as professors in 1998 at the university level (Bund-Länder-Kommission 2000, Tabelle 6.1.2). The European Commission 2000 report documents that the representation of women in the German academic system lags behind that found in North America, Australia, and most other European countries (European Commission 2000, Table 2.1,10). The rate of leakage from the scientific pipeline in Germany is among the highest. The documented differences between men and women in scientific career paths do not match what would be expected in a true meritocracy. Clearly something other than merit is functioning in scientific institutions. The low representation of women in top positions is even more pronounced in Germany's prestigious research institutions outside the university (see Table 3). Within the four big research organizations, men hold an astonishing 97.4 per cent of the C 4 positions.¹¹ Female representation in these highly attractive C 4 positions is 56 per cent lower than in universities. The number of women in these positions is also 50 per cent lower than in comparable institutes across Europe – again a strike against Germany and notions of fairness (European Commission 2000, 16).

Table 3: Women's participation in research organizations

Research organization	Scientists in leading C 4 positions in 1999					
	total	females	females in %	total	females	females in %
Max-Planck-Institutes	514	39	7.6	246	6	2.4
Wilhelm Gottfried Leibniz Institutes	349	26	7.4	75	6	8.0
Fraunhofer Gesellschaft	286	9	3.1	63	0	0
Hermann von Helmholtz- Gemeinschaft deutscher Forschungszentren	606	16	2.6	188	3	1.6
Σ	1,755	90	5.1	570	15	2.6

Source: Bund-Länder-Kommission 2000, Tabelle 8.1.

¹¹ For further information see Center of Excellence 2001, Informationen zur Chancengleichheitspolitik in den Forschungszentren.

It has long been argued that science is a social and cultural process that develops within various fields of power (Kuhn 1962; Foucault 1975, part 4). In this process, and within these power relations, statistical analysis shows that in Germany leadership in science is overwhelming male and that gender matters. Feminist scholars have drawn attention to gender bias in scientific concepts, in scientific methodology, in the choice of research fields, and in research results. While we cannot expect that women *qua* women will change science, it is likely that increasing the numbers of female scientists will bring more gender awareness into scientific work as a whole. The process that opens science to women also often opens science to new questions, approaches, and research fields (Schiebinger 1999; Harding 1987).

2.3. Horizontal segregation

The participation of women varies greatly both between scientific fields and between sub-disciplines within a particular field. Women account for 44.5 per cent of students within German universities (winter semester 1998/99, see Table 4). A strong

Table 4: Percentages of female students in two periods

Disciplines	Percentages of female students 1975/76	Percentages of female students 1998/99
Philology, Historical and Cultural Sciences	55.6	65.5
Law, Economics, and Social Sciences	27.2	43.4
Mathematics, Natural Sciences	32.9	34.3
Medicine	27.7	49.8
Engineering	7	
Other	47.3	57.2
Σ	33.7	44.5

Source: <http://www.statistik-bund.de>, 23/05/2001, Statistisches Bundesamt Deutschland: Hochschulstatistik, Schaubild 9.2.

deviation from this percentage suggests that culturally and socially produced gender bias operates within a discipline. Sex distribution across scientific disciplines is a complex process determined by many factors: cultural notions of gender-appropriate behavior, women's place in the labor market, and the social status of a field or profession as reflected in salaries.

More specific to academic disciplines, these factors include a set of values held by a community of practitioners or stereotypical characterizations of a field of research – both of which tend to attract a particular type of student. Let us look at the development of segregation by discipline over the past 25 years. In law, medicine, economics and the social sciences the proportion of women students nearly doubled from 1975 to 1999. In mathematics and the natural sciences, the proportion of women students remained constant (32.9 and 34.3 per cent). While the absolute number of female students in these fields, as in other fields, has increased, these figures also mean that the deviation from the average participation rate of women (44.5 per cent) was actually greater in 1998/99 than 25 years earlier. In engineering, the percentage of women students nearly tripled, but it is still very low. The liberal arts (philology, history and the cultural sciences) had since 1975 a preponderance of women students. Nearly half of all liberal arts students graduate as high school teachers. The oversupply of high school teachers has resulted in unemployment and in a fall in social status (Allensbacher Berichte Nr. 16, 2001).¹² This has made these disciplines unattractive to males.

If we break down further the figures in Table 4, we see how men and women cluster in specific fields:¹³ Women make up 76.7 per cent of students in English philology, 84.8 per cent in Romance philology, and 77.1 per cent in German philology. They represent, however, 44.8 per cent of students studying history. Women make up 56 per cent of students in biology, 41.98 per cent in mathematics, and 29.6 per cent in chemistry, but only 10.8 per cent in physics and astronomy. Women students' representation in engineering breaks down as follows: 10.8 per cent in mechanical engineering (the largest of the sub-disciplines), 3.4 per cent in electrical engineering, but 49.7 per cent (or near parity) in architecture. It is apparent that the increase in female participation in engineering between 1975 and 1999 is due largely to their increase in architecture. The number of women studying mechanical and electrical engineering (which includes computer science) has not changed significantly. Even in face of a current shortage of computer engineers, government recruiting has been focused outside Germany, not on German women.

The analysis above has detailed how the proportion of female students varies from field to field. We might expect that a high proportion of female students after a period

¹² Here the term "oversupply" refers to the relation between the number of positions offered by the state and the demand for these positions. Recently the labor market situation for high school teachers has begun to change, there is a shortage of science teachers.

¹³ The following figures are referring to percentages of women of all graduates in 1999 (Statistisches Bundesamt, Fachserie 11, Reihe 4.2., 4 bestandene Prüfungen 1999).

Table 5: The leaky pipeline in different scientific disciplines, percentages of females, 1998^{★1}

	Disciplines			
	Philology, History, other Liberal Arts	Medicine	Mathematics, Natural Sciences	Engineering
Students ^{★2}	65.5%	49.8%	34.3%	19.0%
Doctoral degree	41.7%	42.9%	27.1%	8.3%
Habilitation	28.5%	9.6%	13.5%	0.0%
C4-Professors	10.4%	3.8% ^{★3}	3.4% ^{★3}	2.4%

Sources: ^{★1}: Bund-Länder-Kommission 2000, Tabelle 1.5, 1.6, 2.3, 3.3 ; <http://www.statistik-bund.de>, 23/05/2001, Statistisches Bundesamt-Hochschulstatistik, Schaubild 9.2; Statistisches Bundesamt, Fachserie 11, Reihe 4.2. Prüfungsjahr 1998 und 1999.

^{★2}: Winter semester 1998/99.

^{★3}: Figures in 1999.

of time would lead to a high percentage of female professors in that discipline. This is, however, not the case (see Table 5). Even with 65.5 per cent students in the liberal arts (philology, history, and cultural sciences) only 10.4 of the professors in those fields are women. Here the pipeline is leaky in the extreme.

The high percentage of women with doctoral degrees in medicine (42.9 per cent) and in natural sciences (27.1 per cent) is not an indicator for a scientific career. In these fields the doctorate degree is more or less the final degree before starting a professional career even outside the system of science. The extremely low number of female C 4 professors in medicine (58 out of 1,528 positions) indicates the efficiency of the exclusionary practices in the system. This is true even in obstetrics and gynaecology! Only in 2000 was the first woman appointed as a C 4-professor for gynecology at a German University (in this case, at the Technical University in Munich). The high social status, power, and income associated with medicine, including the power to form influential images of female and male bodies, are at stake (Färber 1995).¹⁴ We should remember that the medical sciences played a central role in defining female nature as inferior.¹⁵ Additionally the system of internship in German university hospitals is dependent on full professors, thus opening a range of

¹⁴ In Germany in the university clinics mostly the C4-professors earn additional money for private patients, even if the professors do not treat these patients personally.

¹⁵ Professors of medicine gave expert opinions proving that women are unqualified to enter law professions (Bundesarchiv Potsdam, Reichsjustizministerium, Nr. 4181, Bl.120f).

exclusionary practices against women. A recent report from the Ministry of Health shows that among the negative consequences of excluding women from top positions in medical science in Germany is an under-emphasis of sexual differences in diseases and the neglect of female diseases in research and medical treatment.¹⁶ This can have fatal consequences.

Comparing horizontal segregation in Germany to other European countries, we see important variations. Italians, for example, have good representation of women (as both students and faculty) in mathematics. The same is true in Portugal for the natural sciences (European Commission 2000, 9, 136, table III.2). Thus, the traditional, gendered stereotypes of particular sciences are not insurmountable. Explanations for why women do not do well in particular fields must take into consideration the peculiarities of the systems of higher education in each country.

3. Why is the participation of women in scientific careers in Germany lower than in other countries?

3.1. Structural and cultural conditions in historical development (see Costas 1997; Costas 2000)

How do we account for the fact that the situation for women in Germany is worse than almost anywhere else in Europe? German women achieved access to institutions of higher education only in 1900 and 1908, nearly 50 years after women had been allowed to study at a number of colleges and universities in the US, the UK, and France.¹⁷ We can identify factors that can accelerate or hinder women's access to academic institutions, and these explain to a certain extent the differences in gender imbalances in science between countries: the political dynamics of the feminist movement and its discourses about gender; the structure of the academic system; the level of professionalization of academic occupations; and the social prestige of professions and academic careers.

After the unsuccessful revolution of 1848 in Germany, women's public political activities were suppressed for the next 50 years. This produced a timid women's movement that limited its demands to better training for girls and female teachers. These meek demands were expressed in the rhetoric of gender difference, as opposed to the rhetoric of equality voiced in other countries. In the 1890s, feminists became bolder and demanded access to universities, but not in all disciplines. Feminist reformers sought higher education for women, but only in disciplines perceived as

¹⁶ Die Tageszeitung, 30th of May 2001, 7; Süddeutsche Zeitung, 9th/10th June 2001, 1. Bericht zur gesundheitlichen Situation von Frauen in Deutschland. Eine Bestandsaufnahme unter Berücksichtigung der unterschiedlichen Entwicklung in West – und Ostdeutschland 2001, edited by Bundesministerium für Familie, Senioren, Frauen und Jugend. Berlin: Kohlhammer.

¹⁷ Some elite universities (e.g. Cambridge) allowed women students to graduate only after World War II (McWilliams-Tullberg 1975, 212).

“feminine,” such as those involving pedagogy, helping, and healing. The theoretical and technical sciences were defined as masculine, and feminists tended to leave well-enough alone (Lange 1928, vol. 2, 213).¹⁸ Concepts of gender as formulated by nineteenth-century German feminists provided no place for working mothers or wives. Until World War I, they advocated that female state employees remain unmarried. The women’s movement thus tended to support and strengthen the idea that men and women have different intellectual capacities that correspond to their different social roles. Traditional thought and social practices were not even questioned. The ideal of a non-working mother dominated (West-) German society and its gender related policies until the end of the twentieth century.

Already early in the nineteenth century, the German system of higher education, though not yet centralized, was well organized and run by individual German states. It had a standardized degree system regulating entrance into universities and academic professions. In this period, however, German universities were open to males only. Girls were excluded from public high schools and, consequently, from the state controlled *Abitur* – the gateway to universities and the professions. It is important to note that Germany had no countervailing powers like those found in France, where the Catholic church and the republican state struggled over the control of girls’ education. In contrast with Germany, the competition for control of the cultural and spiritual education of French women resulted in earlier and easier access to university study (since the 1860s). Germany also had no tradition of private, non-state universities and colleges to provide alternative educational pathways for women like those in the United States (e.g., Smith, Wellesley, and Bryn Mawr) and to some extent in Great Britain.

After becoming aware of Germany’s relative backwardness with regard to female education, the ministries of education finally opened German academic institutions to women in the early twentieth century.¹⁹ This move, however, was strongly opposed by a majority of university professors who refused to admit female students to their classes and voiced their opinions in surveys and public protests. Some years later, a majority of professors also opposed admitting women to the *Habilitation*. Only after the revolution of 1918 did the republican state allow women to enter scientific careers,²⁰ and eventually a small number succeeded in obtaining faculty positions. Until 1933, only one woman, Mathilde Vaerting, achieved the highest professorial rank at a university, i.e. *Ordinaria*.²¹ She was appointed in the field of pedagogy by the

¹⁸ Only a small minority of feminists sought equal access to high school education up to the *Abitur* and to university studies.

¹⁹ Due to different political constellations in the German states, universities admitted women first in the more liberal state of Baden (1900) and last in conservative Prussia (1908) and Mecklenburg.

²⁰ Vgl. Geheimes Preußisches Staatsarchiv, Abteilung Merseburg, Rep. 76, Kultusministerium, Va, Sektion 1, Titel VIII, Nr. 8, adhib III, vol. I. After the November Revolution in 1918 a new constitution declared equal rights for men and women.

²¹ Another woman, Margarethe von Wrangel, obtained the rank of an *Ordinaria* at a college of agriculture at Stuttgart-Hohenheim.

social-democratic/socialist government in the state of Thuringia, and expelled immediately in 1933 after the Nazis seized power (Wobbe 1994).

Exclusionary strategies and policies of discharge against women as state employees under the doctrine of the so-called double earners (i.e., women being provided for by their husbands or relatives) were on the agenda in every crisis in the interwar years, culminating in an anti-feminist law for female civil servants before the Nazis took power (30 May 1932). Under the Nazi regime all Jewish people were expelled from their positions and so were political opponents and left wing persons. It was calculated that 30 per cent of all professors and *Privatdozenten* (habilitated scientists) were expelled from their positions, whereas figures for women were going up to 50 per cent (in absolute numbers 32) (Häntzschel 2000, 62). In a decree concerning assistants at universities, salaried positions were provided for men only, while women were expected to work on a voluntary basis without salary, if at all. Thus, there was hardly a chance to establish a continuity for careers of women in academic positions. In 1937 a decree to exclude women from higher civil service positions including professorships and indirect discrimination against women through decrees for *Habilitation* further restricted chances to develop a new generation of female academics (Costas 2001, 28). With preparations for war and a shortage of faculty staff “Aryan” female scientists got more chances for an academic career, though not in the rank of fully paid professors.²² This provoked a debate against feminization of assistant positions by medical professors, in particular.

Women fared no better after World War II. There was the legacy of the conservative, often anti-feminist faculty, in addition to the more than 1,000 regime-supporting professors being appointed under Nazi rule to replace “non-Aryans” and left-wing political opponents. There were even renewed efforts by male professors to exclude women from university study (Bussche 1989, 215 f.). In the 1950s, more than one-third of university professors were convinced that women were intellectually incapable doing science (Anger 1960, 488–496). The percentage of female academics in postwar West Germany was one of the lowest in the world, 3.2 per cent, with only three female full-rank professors (Lorenz 1953, 30, 40, Tabelle XIV). Even up to the 1970s women scholars at universities rarely served as successful role models for a next generation of female scientists.

University-educated men in Germany could effectively pursue an exclusionary and anti-feminist policy largely because of the early professionalization of careers, including careers in science.²³ This can be explained starting from the sociological theory of professions and integrating in this theoretical approach longtime neglected gender issues (Witz 1992; Spencer and Podmore 1987, 1–11; Larson 1977). The

²² In 1933 there were 3246 positions of professors (*beamtete ordentliche and außerordentliche Professoren*). Because of expulsion from faculty 1231 were reappointed by 1939, among them no woman. Bundesarchiv Berlin, Reichswissenschaftsministerium R 4901 994, Blatt 154 – 156; R 21/10815, fol.1, Blatt 185 – 192.

²³ Strong opposition against academic education of women for professional careers was voiced by medical doctors, lawyers, judges, and high school teachers.

higher the level of professionalization, the greater the control of the profession over professional education, entrance into the profession, its labor markets²⁴ and services, often with the help of the state. Opportunities for exclusionary strategies against specific groups, in our case, women, can be organized. A high level of professionalization correlates with high social prestige, participation in power relations, and relatively high income. These factors make the professions very attractive to men and cause strong competition. The tendency is to exclude women as long as possible from professional careers, since they are conceived as additional competitors and defined as intellectually inferior. Even now, once these careers have been opened to women, they are guarded by a strategy of what I call “inclusion by exclusion,” or inclusion in science accompanied by vertical and horizontal segregation as described above. This theoretical approach to the role of gender in scientific professions also helps to explain the differences we find between countries and disciplines (Costas 1997 and 2000; Wetterer 1993).

In Germany, competition for university positions is high, due to a surplus of university trained people, bureaucratic regulations of the university system, and the slow turnover of permanent staff. This is true today and has been true for a long time. In some countries at some times, as for example in nineteenth-century United States, the low status of science made these careers less attractive to men (Shryock 1961). This, coupled with a strong ideology of equal opportunity and social mobility, allowed women to be integrated into these fields earlier and more easily than in Germany. However, exclusionary strategies against women intensified in the United States in the early twentieth century with the professionalization of scientific institutions along the German model (Glazer and Slater 1987; Hummer 1979; Rossiter 1982).

3.2. *Unexpected discontinuities in gender distribution by discipline*

Up to the 1930s, women studied in typically masculine fields, such as the natural sciences and mathematics, at relatively higher rates than today. At the universities of Göttingen and Berlin, for example, the majority of doctoral degrees awarded to women were in mathematics and the natural sciences (Vogt 1997; Costas and Ross 2002). The same was true for *Habilitationen* (Lorenz 1953, 10). Representation of women in these disciplines exceeded the overall percentage of female students.²⁵ Such is not the case today, however, where disciplines tend to be more sex-segregated. Gender stereotyping of disciplines was less pronounced during the early twentieth century when women first gained access to the academic world. There was little

²⁴ The relations between gender and the labor market are discussed by Barbara Reskin and Patricia Roos (1990) in their job queue theory.

²⁵ For example at the university of Göttingen the female rate in mathematics and natural sciences was between 12 to 14 per cent in the 1920s, whereas the whole percentage of female students amounted to 8 to 10 per cent (Costas et al.2000, 28).

gender stereotyping because there were no typically “female” disciplines – the educated elites in Germany defined all fields of study as masculine. Our present pattern of gender stereotyped professions and academic disciplines developed in response to economic developments and political policies.²⁶

3.3. *Gender and the academic labor market*

The cyclic economic development of Germany as a whole, and of the academic professions in particular, were important factors in this process (Titze et al. 1990). Because of the long period required to prepare for a professorship in Germany, the academic system was not able to respond quickly to the market need for university professors. As a result, the supply of qualified professors has been chronically either too late, too many, or both. The situation was particularly bad during the world economic crisis of 1929/30 (Costas 2001). The number of *Privatdozenten* doubled between 1900 and 1931, while the number of full-rank professorships increased by only 70 per cent (Ferber 1956, 195, Tabelle I; Ringer 1987 [German ed.], 50). A number of highly qualified *Privatdozenten* taught and conducted research without official university positions or proper salaries. In this situation, “newcomers,” such as women, were not welcome.

The Nazi regime responded to this crisis in higher education by creating new, salaried university positions for *Privatdozenten*. But it also took administrative measures to restrict women’s professional and academic career choices. Under pressure from professional organizations, the Nazi regime limited the fields considered appropriate for women to social welfare, nursing, and education.²⁷ Somewhat ironically, these were the same disciplines identified as feminine by the earlier women’s movement.

Following the students’ movement in the 1970s, there was a general expansion of the education system in Germany. New universities were founded and new positions were created. The number of female students began to increase at this time and has continued to do so. In addition, the second wave feminist movement stressed gender equality (not difference). Because women were new to the system, however, and very few were qualified for professorships, most professorships continued to be awarded to men. Because of the low turnover rate, these men still occupy these positions today. Soon, however, this cohort will be retiring, leaving approximately 50 per cent of faculty positions to be filled during the next ten years.²⁸ Meanwhile, on the supply side, more and more female scientists have completed their *Habilitationen* and will be available to fill them. Thus, there exists today an unparalleled opportunity to address women’s under-representation in academic positions on a large scale.

²⁶ The development of this pattern can be observed in the booklets of the careers guidance in the 1920s and 1930s, Costas et al. 2000, 42–47.

²⁷ Bundesarchiv Berlin, Reichskanzlei, R 43II/427, Blatt 10–48.

²⁸ Statistisches Bundesamt. Fachserie 11, Reihe 4.4, 1999, Hochschulpersonal 1999.

3.4. Improvements in recent years

The increased number of vacant professorships, together with affirmative action, has yielded positive results for women. Compared to 1985 the percentage of women completing their *Habilitation* has increased by 100 per cent; nearly 300 women finished their *Habilitation* in 1998 (Bund-Länder-Kommission 2000, Tabelle 3.1). Since 1985 female representation among all professors has nearly doubled from 5.1 per cent to 9.5 per cent; today there are approximately 3,600 female professors in Germany (Bund-Länder-Kommission 2000, Tabelle 4.1). Since 1985 the percentage of women at the C 4 level has more than doubled, increasing from 2.3 per cent to 5.9 per cent (<http://www.statistik-bund.de>, 23/05/2001, Statistisches Bundesamt, Hochschulstatistik, Tabelle 10.1). In 1998, 736 women held full professorships (Bund-Länder-Kommission 2000, Tabelle 4.1).

There are indications that the “leakage” of women from the scientific pipeline will be reduced as women come to fill newly vacant university positions. In 1998 the number of women awarded new professorships at all institutions (14.7 per cent) came close to the number of women completing *Habilitation* (15.5 per cent). Despite these promising numbers, however, German scientists’ commitment to reducing gender imbalance is weak, and the growing rates of female participation are still not sufficient to attain gender equality in the foreseeable future. Let us examine the gender policy in the sciences in some detail.

4. Some progress for equality in science policy

Over the last fifteen years, federal and state university policies, and even the (West) German constitution have been changed to promote gender equality in general, and in the university career system, in particular. It is well known that women fared better in universities in the German Democratic Republic (East Germany). East German universities were reorganized along West German lines after reunification in 1989. None of the East German advances for women were retained after unification.

Recent progress toward gender equality in the sciences is largely due to a set of policies, programs, and laws implemented to encourage equality. Gender equality has become one of the explicit goals of universities.²⁹

4.1. Programs for work contracts and scholarships

Since 1990, the state-financed Hochschulsonderprogramm (special programs for higher education) II and III have provided special funding to promote women in science. Interestingly, the predominantly male scientific community willingly

²⁹ See Hochschulrahmengesetz § 5 und 6 and the laws concerning universities on the level of the states.

accepted programs offered exclusively to women.³⁰ The funds support female scientists working towards the doctoral degree or *Habilitation*, or engaged in other research projects. Women were also awarded scholarships or salaried assistant positions in academic institutions. In 1998, these programs funded approximately 13,000 female scientists (Bund-Länder-Kommission 2000, 5). These promotional programs are aimed at increasing the number of academically qualified women. Other programs, financing research projects, are aimed at increasing the number of women in careers in the natural, medical, and engineering sciences.

4.2. *Plans and programs for gender equality on the university level*

During the past ten years, affirmative action has been implemented in the German university system, with the aim of achieving gender equality. As required by state law, almost every academic department has developed a plan to increase either the absolute number or proportion of women appointed to positions at each level within the university system. Commissioners for the promotion of women have also been appointed; they have the right to intervene in the hiring process, if necessary. Most of the laws provide these commissioners with power to veto a candidate if gender equality guidelines have been neglected or violated. These commissioners' involvement in decision-making processes has increased the general awareness of gender equality policies and procedures. This awareness will also be sharpened by the presentation of statistics that systematically document the gender imbalance in each faculty, institute, and research group (Bund-Länder-Kommission 2000, 5). As a result of these innovations, it has become difficult to neglect a qualified female applicant for a position, although the criteria of qualification and performance are often used in a biased way to favor men (Wennerås and Wold 1997; Brouns 1999). Affirmative action and related policies have led to an increase in the number of women who hold professorships in German universities. As might be expected, implementing these plans requires vigilance on the part of the equal rights commissioners. Merely setting goals is not enough; dedication and careful implementation are required.

4.3. *Institutionalization of gender studies*

Some universities have established special professorships and/or centers for gender studies. German universities are latecomers to this innovative field, especially in comparison to the United States. In the past three years, the Deutsche Forschungsgemeinschaft (German National Science Foundation, DFG) has funded a special program for research on gender in the social sciences which has now financed

³⁰ There was no devaluation of women supported by this program like it was reported about the positive action program from the Netherlands (European Commission 2000, 25).

15 to 20 new research groups. The DFG is also funding graduate colleges for gender studies to encourage preparation of doctoral degrees and *Habilitationen* in this area.

5. Lessons still to learn

The “Bund-Länder-Kommission (state commission) for education planning and promotion of research” has set the goal for women to hold 20 per cent of professorships by 2005 and to have completed 40 per cent of *Habilitationen*. To meet these targets, the following measures should be implemented:

- (1) The prestigious research institutions outside the university system should no longer be excluded from affirmative action programs. For the promotion of female scientists in these research organizations, affirmative action programs should have a legal basis similar to that in the universities.
- (2) Large funding agencies, such as the Deutsche Forschungsgemeinschaft and the Volkswagenstiftung (Volkswagen Foundation), should initiate affirmative action programs to promote female scientists. To support universities’ goals of achieving 20 per cent female professors and 40 per cent females with *Habilitationen*, these agencies need to devise appropriate systems so that women receive 40 per cent of the research funding by 2005.³¹ Funding agencies should also implement a “contract compliance clause” similar to that used by the U.S. National Science Foundation. According to this clause, funding is contingent on meeting gender equality requirements, e.g. employment of female staff in research groups at every level in proportion to the number of female Ph.Ds. in the field. Applications for funding, including renewals for projects underway, should be required to document the numbers of men and women employed under the contract. Non-compliance could result in funding cuts.³² From experience in the United States, we know that “a contract compliance clause is highly effective” (European Commission 2000, 82).
- (3) Funding agencies should also fund scientific conferences only when a representative number of women are included among the planned speakers; this is another measure that has been highly effective in the United States (European Commission 2000, 86).

The government recently began to restructure the German university system by replacing the *Habilitation* with a six-year junior professorship. It also plans to tie institutional funding increases to performance reviews (both innovations modeled on the U.S. system). Here affirmative action programs have to be integrated. Thus the

³¹ Additionally editorial boards of scientific journals should increase women’s participation, too.

³² Like this the constitutional right of gender equality and the aims of the laws for the education system could be fulfilled.

next few years as German universities are reorganized and restaffed are crucial for the future of academic women.

6. Conclusion

The traditional structure of the German academic system has prolonged women's poor showing in science. With so few women in positions of leadership, the development of gender studies and reform of university policies has been slow. The result is that Germany is lagging far behind its European counterparts. Today, conditions are favorable for initiating programs aimed at improving the situation for women in science. Laws, procedures, and staff have been put in place to encourage female success at each level within the university. However, the latest change in university law, instead of providing more flexibility, contains new age and time limits in academic work contracts, which will present obstacles especially to academic women, many of whom have non-traditional career paths.

It remains for the German scientific elite, who are still predominantly male and whose power is still decisive, to support the affirmative action programs. It is hoped that the various programs and collections of statistics will document the inequalities women suffer in such a way as to raise everyone's consciousness. But all these measures will be successful in changing the power structure of gender relations in science only if a political, economic, social, and cultural will for change prevails. Equality cannot be proclaimed; it must be achieved.

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