

# Islamic Women in Science

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A thousand years ago, the Muslim World made remarkable contributions to science. Muslims introduced new methods of experiment, observation, and measurement. To name but a few: Al-Khwarizmi (born in 825 A.D.) invented algebra (an Arabic word) and the word algorithm is derived from his name; Ibn al-Haytham (born in 1039 A.D.) wrote the laws of the reflection and refraction of light and expounded the principles of inertia (long before Isaac Newton formulated his theories); Ibn Sina (born in 980 A.D. in what is now modern-day Uzbekistan) wrote the Canon of Medicine (*al-Qanun fi'l-Tibb*), a 318-page medical text that was the basis for all medical teaching in Europe and the Middle East for hundreds of years. In the words of the science historian George Sarton, "the main, as well as the least obvious, achievement of the Middle Ages was the creation of the experimental spirit, and this was primarily due to the Muslims down to the 12th century."<sup>\*</sup>

Yet today, the number of original research papers published by scientists in Muslim countries is 0.1% of the number published by scientists in Europe and the USA. It is to be hoped that this trend is set to change, with many Muslim countries opening new universities and introducing a variety of educational and training programs to improve their capabilities in science and technology. For example, of Egypt's 18 universities, which together enroll a total of 1,187,926 students, five have opened within the past 4 years. But even with these developments, there is still disparity between Muslim men and women when it comes to an education in science and technology subjects.

In many Muslim countries, gender-based discrimination, coupled with social

and cultural barriers, limits access and participation of women in higher education. Some people attribute these barriers to the teachings of Islam, but this is false. The teachings of the Holy Prophet of Islam emphasize "the acquiring of knowledge as bounden duties of each Muslim from the cradle to the grave" and that "the quest for knowledge and science is obligatory upon every Muslim man and woman."<sup>\*\*</sup> One-eighth (that is, 750 verses) of the Quraan (the Muslim Holy Book) exhort believers to study nature, to reflect, and to make the best use of reason in their search for the ultimate truth.

Science education in most Muslim countries begins between 6 and 7 years of age and is taught as an integrated compulsory subject to both boys and girls until the age of 15. The major science disciplines are then studied separately in the last 2 or 3 years of high school education. Fewer girls than boys are enrolled in high school science curricula because of a bias in the existing education structure that encourages girls to study the arts and humanities. There are various reasons for this related to gender stereotyping, misleading perceptions that science and technology are subjects more suitable for boys, and the failure of curricula to relate science and technology to the everyday life of women. Thus, there is self-inhibition among school girls that affects not only the number of young women entering university to study science and technology subjects, but also results in the reluctance of talented women to introduce their own values and visions into a working world dominated by men.

Muslim countries vary greatly in their culture, traditions, and social systems, and there is a wide range of attitudes toward educating women at the university level. For example, in Egypt, women have attended university since the 1920s, whereas in other Muslim countries a university education for women is a recent phenomenon. Although women in many Muslim countries have the right to a university education, those in more traditional rural areas often do not exercise that right, whether for social, economic, or family reasons.

The percentage of females enrolled in science and technology university courses ranges from 70% in the United Arab Emi-



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rates to 8% in Djibouti; in Egypt, 35% of science undergraduates are women (Table 1). In certain disciplines, such as public health at The Lebanese University, chemistry in universities in Iraq, and pharmacy in Syrian universities, there are more female than male undergraduate students.<sup>†</sup> Women tend preferentially to enroll in the life sciences and chemistry, with far fewer studying physics, mathematics, and engineering. This seems to be more the result of female students choosing these subjects than active discrimination by the education system. This trend is also seen among U.S. and European female students—for example, in the EU, women constitute 40% of natural science undergraduates, 28% of mathematics and computer undergraduates, and 20% of engineering undergraduates.<sup>‡</sup>

Recently, there has been a small but noticeable shift in the type of scientific disciplines chosen by Muslim women, with more female students selecting courses in engineering, physics, mathematics, com-

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<sup>\*</sup>A. Salam, *Ideals and Realities*. C. H. Lai, Ed. (World Scientific, Singapore, 1987).

<sup>†</sup>Supplementary Web material is available to *Science* Online subscribers [www.sciencemag.org/feature/data/1055893.shl](http://www.sciencemag.org/feature/data/1055893.shl).

<sup>‡</sup>A Report from the European Technology Assessment Network (ETAN) Expert Working Group on Women and Science (European Commission, Luxembourg, 1999).

<sup>§</sup>*Digest of Education Statistics*. (U.S. Department of Education, 1999).

<sup>||</sup>See [www.ictp.trieste.it/~twas/TWOWS.html](http://www.ictp.trieste.it/~twas/TWOWS.html).

<sup>¶</sup>K. Annan, *The Guardian*, 29 February 2000, p. 12.

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puter sciences, and the geosciences. For example, at The Lebanese University, the percentage of women studying engineering increased from 16% in 1992–93 to 20% in 1996–97, and in Syria, the total percentage of women studying civil engineering increased from 14.4% in 1980 to 30.5% in 1994.<sup>†</sup> Encouraging though this trend may be, it does not necessarily mean that greater career opportunities await women graduating in science subjects.

In Muslim countries, career opportunities for female science graduates in univer-

sities, research institutes,<sup>†</sup> and scientific organizations are considerably more limited than those for men particularly in senior positions, although accurate statistics are scarce. Available published literature mainly discusses how technological changes have affected the household duties of women or the work environment where automation has led to their displacement. In Egypt, a survey by the Supreme Council of Universities for 1995–96 reports that in disciplines such as pharmacy and dentistry, more than 40% of the faculty are women; in the sciences, 25% of the faculty are women, but this decreases to less than 10% in departments of engineering and technology (Table 2). Perhaps surprisingly, these statistics are very similar to those for U.S. universities, where women constitute 50% of health sciences faculty, 23.8% of biological sciences faculty, and 6.1% of engineering faculty.<sup>§</sup>

There has been a tendency for female scientists with Ph.D. degrees to concentrate on teaching and research in a university setting.<sup>†</sup> However, this trend may be shifting because, according to a 1995–96 survey by the Egyptian Academy of Scientific Research and Technology, women constitute 43% of the workforce in nonuniversity research institutes (such as the National Research Center, Petroleum Research Institute, and National Institute of Astronomical and Geophysical Research).<sup>†</sup>

There are a number of sociocultural factors that limit career advancement opportu-

nities in science and technology for Muslim women. Women are raised and educated in a male-dominated society with very traditional attitudes and constraints. These vary greatly not only from one Muslim country to the next, but also between, for example, urban and rural areas of the same country. Other factors, well-known to Western women, also exist, such as the challenges of combining responsibilities for a household and family (usually extended family) with a professional career. In addition, because scientific communities are highly resistant to change and science itself advances at a remarkable pace, it is extremely difficult for a woman to re-enter the scientific workforce once she has put her career on hold to raise a family.

A look at female scientists in different fields in most Islamic countries indicates that the more powerful the scientific institution, the less open it is to having women in senior positions. As in many other developed and developing countries, women are notably absent from

TABLE 2. PERCENT FEMALE FACULTY MEMBERS IN EGYPT

Faculty	Faculty members			
	Males	Females	Total	Percent female
Medicine	4717	1913	6630	28.9
Veterinary medicine	730	118	848	13.9
Dentistry	372	253	625	40.5
Pharmacy	357	273	630	43.3
Sciences	2767	941	3708	25.4
Engineering and technology	2727	283	3010	9.4
Agriculture	2525	402	2927	13.7

Source: Egyptian Supreme Council of Universities (1995–96).

leadership roles and positions of responsibility in institutions concerned with science policy and administration. In a few Muslim countries, the percentage of female scientists in managerial and policy-making positions has been increasing, but at a considerably lower rate than the increase in numbers of women qualified to hold such positions.

Despite all the constraints and obstacles in Islamic countries, women scientists have achieved considerable professional progress within a short period of time. Although there is an increasing pool of highly qualified women scientists in some Islamic countries, few women in universities and research institutes are presidents, deans, departmental chairs, directors of institutes, or heads of divisions or laboratories. Very few women scientists are involved in the political life of their countries, although those who are involved have proved to be strong advocates for science and technological development and for protecting the environment. It is important that more Muslim women scientists are encouraged to enter politics where their voices will be heard.

A few female scientists from Muslim countries serve on national and international committees where they have the opportunity to promote science and technology at both the national and global level. In Egypt, Venice Gouda, a Ph.D. chemist, was minister for scientific research from 1994 to 1997. The Executive Board of the Third World Organization for Women in Science (TWOWS)<sup>||</sup> includes Muslim women scientists from Nigeria, Jordan, Kuwait, and Egypt.

There has been progress in the education of women from Muslim countries in science and technology but there is still a long way to go. In the words of Kofi Annan, as he launched a U.N. global initiative earlier this year to educate girls, "Let us prove that a society which empowers its women is a society sure to succeed."<sup>¶</sup>

TABLE 1. PERCENT FEMALE STUDENTS ENROLLED IN B.Sc. COURSES 1990–1991

Country	Total enrollment	Percent female
Algeria	182,282	44
Bahrain	3,785	68
Djibouti	1,068	8
Egypt	525,931	35
Iraq	124,142	40
Jordan	34,984	45
Kuwait	14,412	67
Lebanon	75,525	48
Libya	53,611	31
Mauritania	5,339	14
Morocco	200,429	37
Oman	3,258	50
Palestine	16,422	38
Qatar	4,515	69
Saudi Arabia	124,886	27
Somalia	4,641	15
Sudan	59,459	45
Syria	169,913	37
Tunisia	56,392	38
U.A.E.	10,462	70
Yemen	42,165	17
Total/average	1,713,621	35

Source: UNESCO, The Higher Education System in the Arab States (1993).



Muslim girls attending high school in Nigeria.