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A way forward for Islamic science

Muslim countries once led the world in scientific research. Iranian physicist Reza Mansouri tells Edwin Cartlidge why they now lag so far behind and what they can do about it

On a hill to the west of the city of Maragha in northern Iran lie the remains of an observatory. Built for astronomer Nasir al-Din al-Tusi in the 13th century, this observatory was home to a variety of instruments, a school of astronomy and a huge library. It attracted scholars from as far a field as China eager to learn how to set up astronomical facilities of their own. While the tables of planetary and stellar motion compiled from observations at Maragha remained popular for 200 years, even influencing Nicolaus Copernicus in his development of the heliocentric model of the solar system.



Reza Mansouri

Similar achievements took place throughout the Muslim world between the 7th and 14th centuries. From Asia and the Middle East to north Africa and the Iberian peninsula Islamic scholars made impressive contributions across a range of fields including mathematics, optics, medicine, alchemy and philosophy. But by the 15th century, Islamic science had all but dried up, and today Muslim countries remain near the bottom of the scientific pile. Not one of the world's top 200 universities, according to the *Times Higher Education Supplement*, is located in a Muslim country, despite the fact that together these countries contain more than a fifth of the world's population.

Reza Mansouri, a cosmologist at the Sharif University of Technology in Tehran, believes this situation is a "catastrophe". Mansouri is attempting to put his own country on the scientific map by stimulating exchanges between Iranian and Western scientists, and pressing the government for greater support. As a former deputy science minister of Iran who has also carried out research in Western universities, he is certainly well qualified to do this. But Mansouri thinks it will take at least 50 years for the country to fully embrace

the scientific research process and accept such research as essential for the country's economic development. The reason for such an apparently bleak forecast: what he sees as the failure of the Muslim mind to distinguish between science and theology.

Definitions of science

Mansouri, 59, grew up in Tehran, where the then clear views of the Milky Way stimulated an early interest in astronomy. His interest developed to the point where he was building his own small telescopes, but he realized that to make a career out of astronomy he would need to leave Iran.

In 1965 Mansouri secured a place to study the subject at the University of Vienna but changed to physics as this seemed to be stronger there (although he did then switch back to astronomy). He obtained his PhD in 1972 and stayed in Vienna until the cleric Ruhollah Khomeini overthrew the Shah in the Islamic revolution of 1979. Attempting to move back to the country before then could have been dangerous, his brother having been jailed and tortured by the Shah regime.

Since the revolution there has been a huge expansion of higher education in the country, with the number of university students having increased by more than a factor of 15 to nearly three million and the quantity of scholarly papers having risen some 20-fold, according to statistics by Thomson ISI. However, Mansouri says there is little actual research being done. There are only 500 or so PhD-educated physicists in Iran, some 25 of whom work in string theory. Mansouri himself leads a group of six cosmologists, which he hopes will grow to about 20 in the next 10–15 years. But these are exceptional examples – there is little research activity in most areas of physics, and indeed science as a whole, in Iran.

The problem, says Mansouri, is that Iran, like other Muslim countries, has a very distorted view of what science is – a problem that is rooted in culture and reflected in language. He points out that the Arabic term *elm* (which is used in almost all Muslim countries) is often taken to mean "science", but this word in fact refers to a deep knowledge of Islam. Indeed *ahl e elm* means "religious scholar". Consequently, he says, "there is no clear distinction between the meaning and purpose of science and the meaning and purpose of theology".

According to Mansouri, the rot set in during the 13th and 14th centuries when science, which had previously been carried out by enlightened individuals, became institutionalized in what were called *nezamyiehs* (universities). Leading scholars such as Al-Ghazali, with

the support of like-minded rulers such as the Mongols, developed the distinction between science that was "useful" for the life of a Muslim and that which was "harmful" (and therefore not pursued). The former was very narrow in scope, and included lunar astronomy, for example, only to the extent that it was needed to specify exactly when religious events such as Ramadan should occur. Dispassionate inquiry into the nature of the world for its own sake was out.

Iranian universities today do teach science beyond that required for practicing Islam, but Mansouri believes that the legacy of this narrow mindset means that students still learn a very prescribed curriculum by rote, rather than being encouraged to investigate subjects for themselves. Iran did in fact play host to the 38th International Physics Olympiad last month, a competition that involves some of the brightest physics students from across the world battling it out by sitting a number of extremely demanding papers in the subject. But for Mansouri this competition only serves to perpetuate the veneration of a received body of knowledge.

This view of science as a fixed body of knowledge then shapes the way politicians think of science and therefore how they fund it, he says. They view a scientist as an *ahl e elm* sitting in a small study who will at most need money for new books rather than the far greater resources needed for experiments, lab technicians and computers. The result is that Iran spends only about 0.5% of its gross domestic product on R&D.

Mansouri also believes that this static view of science leads to a distorted reverence of nuclear technology. He says that many politicians and ordinary people in Iran regard nuclear power and weapons as the pinnacle of technological achievement, resulting in the great national support for President Ahmadinejad's uranium-enrichment programme, which is causing such consternation in the West. In fact, he says, academic physicists have almost nothing to do with this programme and that it is sustained by chemists and engineers.

A two-pronged solution

To make scientific progress and improve their material prosperity, Islamic countries must do at least two things, says Mansouri. The first of these is to make a clear distinction between science and theology. To this end, he has proposed the new term *daneshgar* as a precise translation of the term "scientist", replacing *ahl e elm* as well as *daneshmand*, which is a 1000-year-old general term for a scholar. The other thing that must be done, he believes, is to build a handful of scientific institutes in Iran and the rest of the Muslim

world that are genuinely world class, allowing them to exchange scientists with other top centres worldwide.

Mansouri has already tried hard to stimulate collaboration between Iranian and Western physicists. Over the past two decades he and his colleagues have taken part in developing the Large Hadron Collider at CERN and have also participated in the Jordanian SESAME synchrotron source. Now he hopes to develop a genuinely world-class facility within Iran – a 2 m optical telescope at the Institute for Studies in Theoretical Physics and Mathematics in Tehran that was given government backing three years ago. Although small by the standards of today's leading observatories, Mansouri hopes that this telescope will allow high-quality research in very specific areas, such as studies of dark energy through weak lensing and supernovae surveys, one of Mansouri's own research areas, and investigations of gamma-ray bursts. The telescope should open within seven years.

Mansouri also hopes that Iranian scientists can set up internationally competitive research groups in experimental areas that will be useful to industry, such as solid-state physics, optics and laser physics. But he thinks it will be at least 2050 before Iran can produce the new generation of scientists, administrators and teachers that it needs to become a modern scientific nation. He believes that in other Muslim countries, such as Saudi Arabia or Egypt, this will take even longer. Not making such changes will prove a disaster for Muslim countries, he believes, both from the point of view of material prosperity and for relations with the West. He hopes that he can continue to play his role in this process, drawing on both his Muslim and Western experiences. "I hope to become a part of the solution by offering my unique perspective," he says.

In person

Born: Tehran, Iran, 1948

Education: Vienna University (degree and PhD in physics and astronomy)

Career: Vienna University (1972–1977); Cologne University, Germany (1978–1979); Sharif University of Technology, Iran (1979–present); plus secondments to Potsdam University, Germany and McGill University, Canada

Family: Married (to a poet and writer) with two children

About the author

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