

PROFILE HUSSAIN AL-SHAHRISTANI

The Very Model of a Modern Iraqi Dissident

Once Iraq's chief nuclear chemist, Hussain Al-Shahristani endured torture and 10 years of solitary confinement after refusing to work on the bomb

LONDON—In the autumn of 1979, nuclear chemist Hussain Al-Shahristani made a decision that would rob him of his freedom and imperil his life, transforming him into one of the world's highest-profile dissident scientists. Twenty-three years later, United Nations weapons inspectors are hoping to find more scientists like him as they return to Baghdad after a 4-year hiatus.

Shahristani's principled journey began shortly after Saddam Hussein ascended to the presidency and ordered the Iraqi Atomic Energy Commission to shift from peaceful research into "strategic applications," a euphemism for work on an atomic bomb. It was also a time when the Iraqi government, unsettled by the revolution in neighboring Iran, had begun arresting thousands of people. The result, recalls Shahristani, was "mass executions and serious violations of human rights."

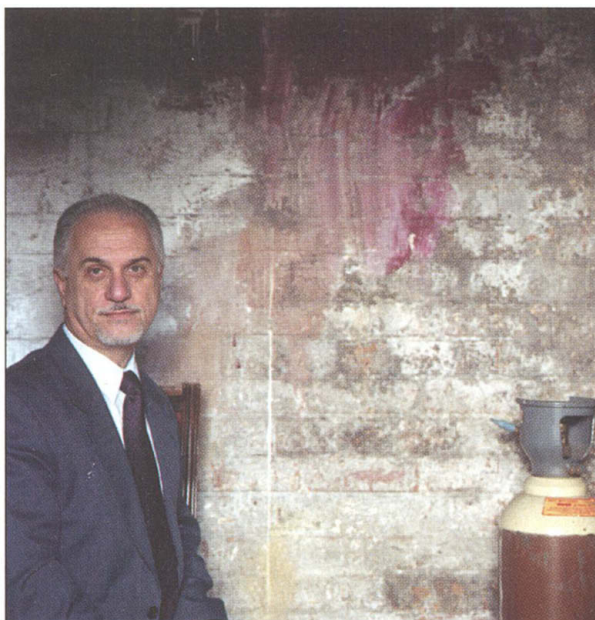
Shahristani was then one of two chief scientific advisers to Iraq's nuclear program. He and his fellow chief adviser, nuclear physicist Jaafar Jaafar, confided their misgivings to each other, but only Shahristani spoke out publicly against the program and the human rights violations. Soon he was arrested and tortured, then jailed for more than a decade. Jaafar, who was imprisoned briefly after suing for leniency for his colleague, went on to mastermind a nuclear program that has brought a cold sweat to the brows of Western leaders.

In the decade since his daring escape from prison during the Gulf War, Shahristani has become a formidable nemesis of the Iraqi government. He spoke recently with *Science* from his office above a furniture store in North London, where he lives in exile. "He's a great scientist, and he should be honored for resisting Saddam Hussein's demands to work on nuclear weapons," says David Albright, a physicist who heads the Institute for Science and International Security in Washington, D.C.

Shahristani is also precisely the sort of individual whom United Nations weapons

inspectors hope to contact now that they are back in Baghdad. The inspectors are empowered to bring willing scientists out of Iraq for debriefings, along with their families to avoid retribution from the Iraqi government. The hope is that such individuals will provide independent and credible information that will help inspectors better assess the full disclosure of its weapons of mass destruction programs that Iraq must deliver to the United Nations by 8 December.

A solitary hero. Shahristani's career began like those of other young Iraqis in the scien-



A road less traveled. Since fleeing Iraq 11 years ago, Hussain Al-Shahristani has devoted his life to helping fellow refugees.

tific elite: He was singled out for a scholarship in Moscow and then at Imperial College in London, where he graduated in chemical engineering in 1965. Nuclear science was "fashionable" then, he says, and he jumped at the chance to work at the research reactor at the University of Toronto, where he earned a Ph.D. in nuclear chemistry. There he also wooed and married the typist of his dissertation, Bernice Holtom, who would be his pillar in the harrowing years to come.

In 1970 Shahristani joined the Nuclear Research Centre at Tuwaitha, south of Baghdad, home to a newly supplied French

research reactor, and introduced neutron activation analysis to Iraq. This technique is useful for measuring trace elements at sub-parts per million by flooding a sample with neutrons. Shahristani used it successfully to respond to an epidemic of mercury poisoning in Iraq from imported grain treated with a mercury-based pesticide. "The country was desperate to find out what was safe to eat," he says. His analyses provided a means of assessing food safety.

Such work marked him as a leading figure in the Iraqi scientific establishment. In 1978 he was appointed chief scientific adviser to the Iraqi Atomic Energy Commission, the most senior scientific post in the country. Shahristani claims that until the end of the 1970s the nuclear program was strictly peaceful—an assertion that "puzzles" Albright, who says the French reactor, which used highly enriched uranium, was "ideally suited" to a nuclear weapons program. He speculates that Shahristani may have been deliberately kept in the dark until 1979, when Hussein, who had been involved in negotiations with French nuclear officials, became president and signaled that his aim was to produce weapons. At a meeting of the commission attended by Ba'ath Party members, Shahristani denounced the nuclear aspirations and human rights violations. He says he thought that such a statement would encourage the government to simply move him out of the nuclear program. "I thought our scientific status would basically protect us from being arrested," he says. He was wrong.

"His arrest made him a national hero," says Adel Sharif, a chemical engineer at the University of Surrey, U.K., who was a student in Iraq at the time. In the academic world "he was a source of inspiration," Sharif says. "Everybody was talking about him privately." Shahristani says he was tortured for 3 weeks, during which time he was suspended upside down from the ceiling for hours at a stretch and subjected to electric shocks. He counts himself lucky compared to other prisoners who had holes drilled into their bones and their hands dissolved in acid. Jaafar attempted to come to his rescue by petitioning Hussein for Shahristani's release, but that backfired: He too was arrested. "Jaafar was not tortured himself, but they brought other prisoners and tortured them in front of him until they died," Shahristani says. He claims that broke Jaafar, who eventually became the scientific linchpin of Iraq's nuclear weapons program.

While in prison, Shahristani says he was visited by Hussein's stepbrother and head of



Desert chemistry. U.N. inspectors in early 1998 prepare to destroy Iraqi missiles that reportedly had been filled with sarin.

security, who tried to persuade him to recant. Shahrستاني refused. That rejection earned him 10 years in solitary confinement, in a room with no windows, no reading or writing material, and a single 15-minute chaperoned visit per month from his wife. He did not want to give the regime the pleasure of seeing him go crazy. "It sounds silly now, but I tried to make puzzles and then solve the puzzles that I'd just made myself," Shahrستاني says. A devout Muslim, he prayed and recited sections of the Koran from memory to have "conversations."

Shahrستاني eventually was moved out of solitary confinement, and during the Gulf War in 1991, he seized an opportunity for escape: During a nighttime bombing raid, he stole a car and uniform of the prison's chief security officer and simply drove out past the guards. He and his family, along with a million other Iraqis, fled over the border that March into Iran.

Iconoclastic views. Shahrستاني's refugee experience has shaped his activities ever since. In 1995 he set up the Iraqi Refugee Aid Council, which has helped tens of thousands of Iraqis in camps in Iran by setting up clinics, schools, and self-help programs. Two years ago he moved from Iran to London, the center of Iraqi political opposition and a focal point for the United Kingdom's estimated 250,000 ethnic Iraqis, where he has continued his work with refugees. "Unlike others who defected, he risked his life to continue to try and do something, to stay as close as he could to Iraq, to help the refugees, to document the abuses," says Shelley Saywell, who in 1995 directed a Canadian documentary of Shahrستاني's life.

What also sets Shahrستاني apart are his views on Iraq's weapons programs. He downplays concerns that Iraq is on the verge of acquiring a nuclear bomb. "Iraq basically has the know-how to assemble a crude nuclear device, but it lacks the fissile material," he says, basing that conclusion on information from resistance cells

and well-placed scientists in Iraq as well as his contacts with recent defectors. He discounts the recent revelation by the U.K. government that Iraq has been trying to purchase uranium ore from Africa, claiming that the regime lacks centrifuges and other equipment to enrich it.

Others are more cautious. Albright, a longtime Iraq analyst, says Shahrستاني may be underestimating his former employer. "You have to worry that Iraq is reconstituting its uranium-enrichment program or even dabbling in plutonium," he says. "It's very hard to detect these activities."

But Shahrستاني is far from dismissive of Hussein's biological and chemical ambitions. Concerns are running high about possible covert work on botulinum, anthrax, gas gangrene, and aflatoxin (*Science*, 16 August, p. 1110), and Shahrستاني says that his own sources suggest such concerns are justified. He has also raised disturbing new questions about Iraq's chemical weapons program. U.N. inspectors know that Iraq started working on mustard gas in 1982, followed by sarin and tabun. Shahrستاني backs claims from defectors that prisoners were used as guinea pigs. "Thousands of people were taken from prisons for experiments," he alleges. He also asserts that much of the R&D on chemical and biological weapons has ended: Most scientists in these programs

"were sent back to the universities. The regime has decided it has enough know-how to use its inner core of security officers to do the production work."

His most explosive allegation, however, is that the Iraqi military has placed tons of chemical weapons, including the devastating nerve gas VX, in Shiite villages in the southern half of the country and intends to detonate the stocks in the event of a U.S.-led invasion. Based on its suspected covert precursor stocks and available equipment, Iraq has the capability of producing "tens of tons" of VX, notes a former U.N. chemical weapons inspector.

However, no experts have corroborated this scenario, and a few are dubious. The booby-trap scenario is "unlikely," argues Kelly Motz, an analyst on Iraq at the Wisconsin Project on Nuclear Arms Control in Washington, D.C. It "would undermine [Hussein] in the eyes of Arabs and help justify the U.S. position." Shahrستاني strongly disagrees, noting that Hussein has already used poison gas on his citizens, against Iraqi Kurds in the late 1980s. Sensing a coming confrontation, Shahrستاني fears "a potentially very serious human catastrophe" facing the Iraqi people—a suffering that he knows all too well.

—ANDREW WATSON

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NUCLEAR PHYSICS

Accelerator Aims to Find The Source of All Elements

Nuclear physicists hope that an expensive atom smasher will reveal the secrets of stellar alchemy, but first they have to secure funding

We are all made of starstuff. The big bang created hydrogen, helium, and a little bit of lithium and other light atoms. But everything else—the carbon, oxygen, and other elements that make up animals, plants, and Earth itself—was made by stars. The problem is that physicists aren't quite sure how stars did it.

The answer, they hope, will be revealed by an \$840 million machine called the Rare Isotope Accelerator. RIA will smash stable atoms into fragments, producing rare, unstable nuclei that play a brief but crucial role in the creation of heavy elements. By studying these unstable nuclei—analyzing their half-lives, their ability to capture neutrons, and other properties—scientists believe they will finally be able to figure out where all the heavy elements are born. "RIA's the machine that will nail the entire issue," says

Claus-Konrad Gelbke, a nuclear physicist at Michigan State University in East Lansing.

If RIA is a nail, then the Department of Energy (DOE) seems to be a reluctant hammer. Although the agency's Nuclear Science Advisory Council recommends building RIA—at either Michigan State or Argonne National Laboratory in Illinois—its other committees covering fusion energy and high-energy physics are each pushing strongly for even more expensive projects. And that stiff competition is likely to produce losers as well as winners. "In times of tight budgets, you have to make tough decisions," says James Decker, principal deputy director of DOE's Office of Science. In an effort to sway DOE, RIA's supporters point to growing European interest in building a rival facility in Darmstadt, Germany (see p. 1534). "They're moving on a very aggres-

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