

The brains trust of Tehran

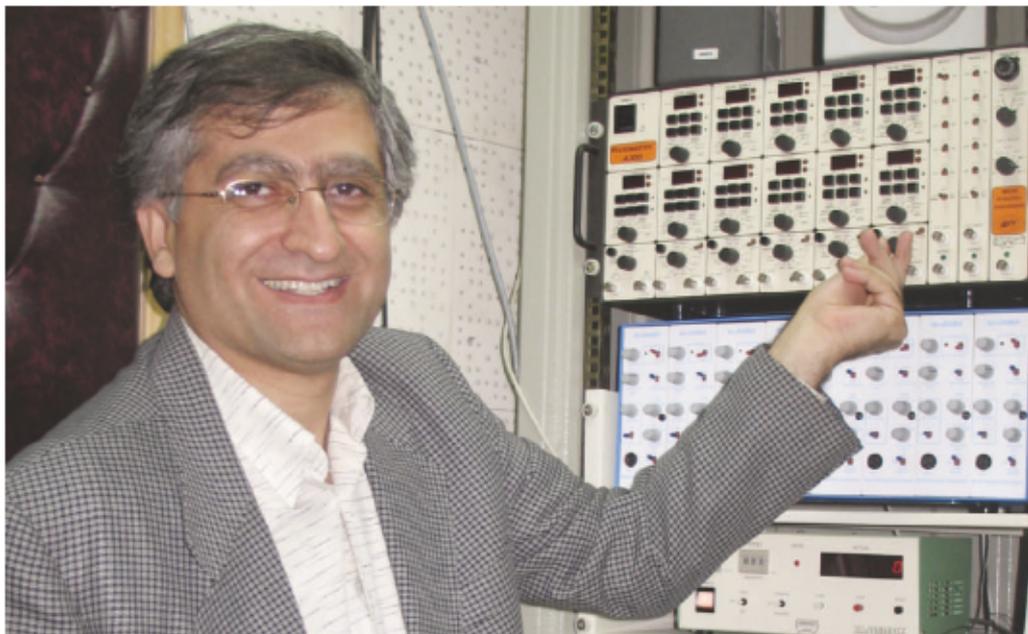
An Islamic theocracy ravaged by economic sanctions isn't an obvious place to seek a vibrant cognitive-neuroscience research group. Yet that's what **Alison Abbott** found on a recent trip to Iran.

In December 1996, 20 students gathered in a small candle-lit room in the north of Tehran. There they vowed to devote themselves to the study of the brain and mind, sealing their pledge in a document signed with their own blood. In a country with no textbooks or journals in cognitive neuroscience — and no teachers in the subject — this solemn ceremony symbolized extraordinary commitment.

At around the same time, Hossein Esteky abandoned a brief struggle to establish himself at the Tehran Medical School, where he had returned after completing a PhD in neurophysiology at the University of North Texas. He left for a two-year postdoc position at the RIKEN Brain Science Institute in Saitama, Japan, unsure if he'd ever be able to pursue his professional interests in his homeland.

Today, against the odds, Esteky heads a cognitive-neuroscience research group in Tehran that is beginning to make its mark internationally. Many of the team are former members of the 1996 study group, known as Niloufar — the Farsi word for lotus flower, and the street where its inaugural ceremony took place. Western scientists who have paid a visit to Esteky's group are effusive in their praise. "The laboratory is a wonder," says Patrick Cavanagh, a vision researcher at Harvard University.

Niloufar formed around a nucleus of three medical students, all coincidentally known as Arash, and each the product of the élite high schools run by NODET, the National Organization for Development of Exceptional Talents. NODET's extracurricular workshops, remembers one of the trio, Arash Yazdanbakhsh, "instilled in us the spirit of experimentation". The three have since vindicated NODET's



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backing — and proved themselves worthy bearers of the name of an ancient Iranian hero.

Iranian mythology tells of Arash the Archer, who accepted a challenge from the attacking armies of Turan in the north. Shooting from Mount Damavand, Iran's highest peak, the country's border would henceforth be drawn

where Arash's arrow fell. The Turans hoped to confine the Iranians to a narrow strip of land. But when Arash shot his bow, he turned into pure energy, propelling the arrow 2,250 kilometres to the Oxus River in Central Asia.

His three modern namesakes, working in a country devastated by the war with Iraq in the 1980s, and kept crippled by US-led sanctions, set to their neuroscience challenge with similar energy. Their first task was to expand the group, then locate suitable books to begin their studies.

Bookworms

Arash Fazl, a technical whiz, borrowed a computer in the Institute for Studies in Theoretical Physics and Mathematics (IPM), Iran's premier research centre, and set up a DOS-based Internet connection. The group used it to identify three books on cognitive neuroscience. NODET head Javad Ejei bought the texts for his protégés during a trip abroad. The arrow was in the bow.

As soon as their medical classes finished, Niloufar's members began their 'real' study, recalls Seyed Reza Afraz, who has been known as Arash since childhood, and today works in Esteky's group. "We divided the books among ourselves for efficiency," he says. "And each of us taught the others what we learnt from them."

To begin with, the going was tough. Afraz and his peers realized that they should have started with more fundamental textbooks. But within a year they were getting up to speed, and

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REASONS

Under the gun: US sanctions are a way of life in Iran, but they hamper scientific research.

started to hanker after primary research papers. Scouring journal contents on the Internet, they wrote e-mails to researchers whose work sounded intriguing. Cavanagh and Irving Biederman, a cognitive neuroscientist at the University of Southern California in Los Angeles, were among the first to send their papers.

"I was really moved by the requests that came from young people wanting to get out of the dark," says Biederman. He and Cavanagh each began an intense scientific correspondence with the Niloufar group. The students devoured every word and began to do basic experiments in psychophysics. They subjected human volunteers to simple visual stimuli displayed on a computer monitor, and drew inferences about cognitive processes from their responses.

The group's first results were published as an abstract submitted to a 1998 neuropsychology meeting in Montreal, Canada — which the Iranians could not afford to attend. By then, a spin-off study group had formed in Esfahan, an ancient city 400 km south of Tehran.

Meeting of minds

But it was back at the IPM where things really began to take off. One day in 1999, some Niloufar students were invited to work on a project with Abdolhossein Abbassian, an IPM mathematician who wanted to model the function of the thalamus, a key relay station for information in the brain. "He looked at us one evening," recalls Afraz, "and said: 'I am a mathematician. To me, the thalamus is a black box with input and output. I want to see the real thing, and touch it.'" So Afraz and his friends dissected a lamb thalamus for him. They were rewarded with a take-away pizza, a luxury in Tehran.

Having got a foothold in the IPM, the students began to haunt the place, borrowing computers and other facilities. It was a good time to get involved. Set up in 1989 to pursue Iranian strengths in theoretical physics, the IPM was trying to expand into experimental work. Esteky had returned from Japan in 1999 to take up a position at the Shaheed Beheshti University of Medical Sciences in Tehran. The IPM invited him to do some projects at the institute, where he and the Niloufar students immediately hit it off. "When I got there, I found these eager students hanging around, and naturally we hooked up," Esteky says.

Esteky invited those interested in his own field of visual perception to join his projects, and provided working space for others whose interests left them without a mentor in Iran. The austere corridors of the IPM were enlivened with music and chatter until after midnight, as the exuberant Niloufar gang

combined partying and work.

Even with such enthusiastic staff, it was hard for Esteky to establish his research. He wanted to continue the work he had been doing in Japan, trying to understand how monkeys categorize visual objects and recognize faces.

Happily, Keiji Tanaka, vice-president of the RIKEN Brain Science Institute, donated electrophysiological equipment. But getting monkeys was a challenge. Esteky toured around the zoos in Iran, and eventually built up a colony of 12 macaques. Finding no commercial source of feed, he had to contract a local baker to make the required biscuits.

Fishy tale

A much-told story is of Esteky's first operation on the brain of a monkey, done with some students at one in the morning. The power failed after the skull was opened, and panic erupted. The building was new and the emergency lights didn't work. One of the students rushed for a tin of tuna. He inserted a makeshift wick into its oil and the monkey was looked after by tuna-oil lamp until power was restored.

Today, Esteky heads the IPM School of Cognitive Neurosciences, and has a dozen PhD students, many from the Niloufar and Esfahan study groups. IPM funds have purchased additional infrastructure, including a visual neuroscience lab kitted out for about US\$500,000. But the problems of working in a country gripped by US sanctions continue. It took four years for Esteky to get one piece of equipment for analysing neuronal recordings, made by a single American company. Some journals have made it difficult for Iranian scientists to publish. And visas for travel to the United States are hard to come by.

Visitors are few — even though Esteky invites many foreign scientists. Those who

have been bold enough to fly to Tehran have been impressed. Cavanagh was the first to visit, in 2002. Sightseeing plans were soon abandoned, as he was mobbed by students who kept him occupied with high-level discussions until he left. "They had enthusiasm, creativity and a scientific fervour that matched or even surpassed any other group I have visited," says Cavanagh. "I left exhausted and inspired."

Nancy Kanwisher, a specialist in visual perception at the Massachusetts Institute of Technology, visited last year. "I nearly wept when I understood what they were doing," she says. "It is cutting-edge science, addressing extremely hot questions, against formidable odds." She was particularly impressed by the female students, who were as ambitious as their male counterparts. Iran's religious leaders may be conservative in their attitudes to women, but such views don't prevail in the lab.

Esteky's biggest concern is that his students' talent and ambition will drive many of them abroad. Each of the original Arash trio has already shot his arrow well beyond the borders of Iran. Yazdanbakhsh and Fazl are completing their PhDs at Boston University; Afraz will start his PhD with Cavanagh in September.

Esteky won't pressurize anyone to stay, and says his job is to create the best possible working conditions so that returning is a viable proposition. As a student during the war with Iraq, he volunteered for medical duty and treated civilians who were victims of Saddam Hussein's chemical weapons. The experience made him determined to strive for peace, stability and scientific progress in Iran. Between the ninth and sixteenth centuries, he notes, Iran was a world leader in science: who says it can't one day be so again? ■

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