for new proposals. For a few months, until TÜBİTAK announced in October that it would resume paying graduate stipends, some faculty members paid graduate students and staff out of their own pockets. For now, the researchers who are faring best are those who are in collaborations funded by the European Union.

Although R&D spending has been growing in Turkey, in the past few years it has stalled shy of 1% as a percentage of GDP. In 2005 the government announced a goal of investing 3% of GDP by 2013, but by 2010 the target had slid to 2023 (as the Turkish Republic's centenary, a symbolic date); in 2015 the R&D investment goal was revised down to 2%. But even that target seems elusive, says Alp. "The institutional mechanisms and a road map for implementing ambitious scientific and technological projects are lacking." Despite the fact that TÜBİTAK has increased money for research, the evaluation and distribution of funding has become biased and arbitrary "and finally paralyzed" by the attempted coup, says Sabancı astrophysicist Ali Alpar.

In 2011, when the government decided that members of the Turkish Academy of Sciences would be appointed rather than elected on their merits, a majority of members quit, including Alpar. The defectors founded the independent Science Academy, which is funded by member fees and private donors. The new academy's success has been a surprise, says Saçlıoğlu: "Each year we award some 40 young scientists with two-year research grants. That is one thing of which we are proud."

On 29 October, the government decreed that all university rectors will be appointed by Erdoğan. The Science Academy board responded with a statement saying the measure "is tantamount to the eradication of university autonomy."

Before the coup attempt, "Turkey was experiencing brain gain," says Ünal. In one program, TÜBİTAK promised $3000 a month for a year to returning early-career academics. Ünal warns that "after the attempted coup, Turkey again may see brain drain; many academicians are looking for positions in universities abroad."

"The most capable, the most easily employable, they are the ranks that will be depleted first," says Saçlıoğlu. Two decades ago he would tell his students, "Sure, you can do better science abroad, but you can do good things here too." Now he is more reluctant to encourage them to stay in the country, he says, although "I am not at the point where I would say, 'You are crazy to stay here.' "

MIDDLE EAST TECHNICAL UNIVERSITY

STUDENTS MEET OUTSIDE between classes at the Middle East Technical University in Ankara.

Staying connected

Over the past year or so, international conferences and workshops in Turkey have been canceled, mainly because speakers and participants are scared off by political events and terrorist attacks. "People who already know us, they come," says Aksoy, adding that he would say Turkey is not more dangerous than France or Germany. Serkant Çetin, a particle physicist at Istanbul Bilgi University, was the national organizer for a CERN accelerator school that was supposed to be held in Istanbul in September; the school was delayed and moved to Hungary. According to Çetin, such cancellations have a big impact on scientific life. "Scientists feel their relations to the world are at a lower level, that they are no longer in the loop. People have lost motivation. It's like a pause button has been pushed. The uncertainty is a shock."

"I am aware of people who were under investigation, and who were cleared 100%, but were not given back their positions," Çetin continues. "I have collaborators from other cities who had such cases. They cannot travel abroad. Their passports are deactivated. Even if they start their jobs again tomorrow, the psychological healing will be hard."

And worst of all, says Çetin, "is what I see in young people, those who recently finished their PhDs. They want to see a future. I see the hope getting lost in their eyes."

Toni Feder

Middle East synchrotron light source is set to start up

SESAME is intended to nurture good science and good relations.

Twenty years in the making, SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) finally began debugging in November. If all stays on track, the light source, located in Allan, Jordan, will open for experiments next year.

"Our fluffy dreams are becoming reality," says Eliezer Rabinovici, a theoretical particle physicist at Hebrew University in Jerusalem. "When I touched the magnets, it was unbelievable."

The 2.5 GeV SESAME will start with two beamlines, one for x-ray spectroscopic studies in the energy range of 3–30 keV and one for investigations in the range of 0.01–3 eV, which extends from the far-IR up to the visual. The machine can accommodate more than two dozen beamlines, some with wiggler and undulator insertion devices to increase the beam energy and flux.

Regional research

As at any synchrotron light source, the research program will be broad, spanning materials science, geology, biochemistry, industrial applications, and more. Some thrusts will be of regional interest, such as soil pollution, medicinal plants, archaeological studies that include ancient pottery and parchments, and investigation of a hepatitis C mutant that is prevalent in the Middle East.

In capability, SESAME will be comparable to other third-generation synchrotrons such as Soleil in France, the Canadian Light Source, and the Taiwan Photon Source. Some have higher energy or greater brightness, but SESAME will be competitive in many areas of research, says Chris Llewellyn Smith, director of energy research at Oxford University and president of the SESAME council. "And it will be the only light source in the Middle East."

The SESAME partners are Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority, and Turkey. Several other countries in the region are observers or have expressed interest in joining. A turning point in propelling the project forward, says Rabinovici, came in 2012 when Israel, Turkey, and Jordan each pitched in $5 million; Iran has pledged the same amount.

So far, construction costs for SESAME have run to $80 million, of which $49 million has come from the member countries. The largest outside contribution, $11 million, was from the European Union, and Italy ponied up $2.9 million. In addition to cash and in-kind contributions, Jordan has provided land and a building for the facility.

"Something real to work with"

The SESAME dream goes back to November 1995, when 100 or so scientists gathered in a Bedouin tent in the Sinai desert to brainstorm about ways to increase understanding among people in the region. It was about two years after the initial Oslo Accord—the first face-to-face agreement between Israel and the Palestinian Liberation Organization, for which PLO chairman Yasser Arafat, Israeli prime minister Yitzhak Rabin, and Israeli foreign minister Shimon Peres received the Nobel Peace Prize in 1994. Rabinovici, who was present at the desert meeting, recalls that at the time, "there were many discussions of Arab–Israeli collaborations."

THE MIDDLE EAST'S FIRST SYNCHROTRON LIGHT SOURCE, SESAME, is on track to open for experiments next summer. Housed in a new building in Allan, Jordan, the 2.5 GeV facility is a regional collaboration of nine partners and counting.

Zehra Sayers, chair of the SESAME science committee and a biophysicist at Sabancı University near Istanbul, Turkey, joined the project in 2000. "People get fed up with wars, tensions, and disagreements," she says. "I would hope that if they get to know each other, if they can talk to each other through science, they may someday be able to talk to each other about other things." SESAME has already contributed to building understanding, she adds. "Its existence demonstrates that it is possible to work across the many divisions in the region."

The project was seeded with a gift from Germany of a retired synchrotron, BESSY I. (See PHYSICS TODAY, August 2002, page 27.) "The German machine was a nucleus around which to build the administrative structure," says Rabinovici. "We had something real to work with. But we always planned to build a more powerful synchrotron." SESAME incorporates refurbished accelerators from the old machine, but the main storage ring is new.

Among the challenges still facing SESAME, says Llewellyn Smith, are to expand the user community in the region, raise money for the remaining beamlines, and provide workshops, labs, and a conference center. Perhaps the highest priority, he says, is to get a solar plant to power SESAME. Running the facility currently costs $375/MWh. At that rate, he says, SESAME members can't afford to run at full capacity—a desired annual 10 GWh would run up a power bill of $3.75 million. "Payment of their annual contributions"—this year about $500 000—"is already a big challenge for most members, who generally have tiny science budgets," he says. The estimate for a 6 MW solar power plant, not including land, is $8 million. For comparison, the cost of new beamlines is around $2 million to $5 million apiece.

The SESAME collaboration is modeled on CERN, which was started after World War II with the similar motivation of joining forces to build facilities beyond the means of individual member countries and using science as a means for forging good relations among former enemies. Like CERN, SESAME is under the umbrella of UNESCO.

"One must do a project where every side benefits and every side brings something to the project," says Rabinovici. "It should be important to everybody, and everybody should be important to the project. We managed to do that." The main thing, he says, "is you can't compromise on good science."

Toni Feder PT