



A 2013 protest against the Syrian government pays tribute to those who died in explosions at the University of Aleppo earlier that year.

After the ARAB SPRING

Four years after revolutions shook governments in North Africa and the Middle East, scientists face an uncertain future.

BY MOHAMMED YAHIA AND DECLAN BUTLER

As a young physicist in Tunisia, Imen Sfar gave little thought to politics until March 2010, when a street vendor set himself on fire to protest about corruption in the city of Monastir, where Sfar worked.

Two months later, an influential blogger and close friend of Sfar's was arrested and interrogated for helping to organize a demonstration opposing Internet censorship in Tunisia. His detention gave Sfar the "courage factor", she says, to join the revolution that erupted in December 2010, after another

street vendor set himself aflame in Sidi Bouzid to protest against harassment by local officials. That act unleashed years of pent-up frustrations against the repressive government of President Zine al-Abidine Ben Ali, who had ruled the country for almost a quarter of a century (see *Nature* **469**, 453–454; 2011). "Events unfolded very quickly, with people taking to social media and the streets," recalls Sfar. "It was what I call the abolition of fear; we no longer were scared of anything."

The uprising triggered a wave of unrest that swept across North Africa and the Arabian

Peninsula. Demonstrations and revolts destabilized long-standing regimes, ultimately toppling rulers in Tunisia, Libya, Egypt and Yemen.

Nearly five years after the Arab Spring, the political situation in most of those countries remains volatile and many scientists are struggling more than they did before. This week, *Nature* profiles how researchers' situations have changed in Tunisia, Egypt and Syria, which have followed starkly different political trajectories.

In Tunisia, scientists are celebrating the

MUZAFFAR SALMAN/REUTERS/CORBIS

country's successful transition to democracy, although the hard-won political freedoms have not yet translated into changes in the research system. In nearby Egypt, many of the freedoms won through the revolution have been reversed and the status of scientists has improved little. Syria has deteriorated the most, spiralling into an all-out civil war that has driven most scientists to flee the country. Yet even amid the chaos, some researchers have remained in Syria, where they struggle to teach students and carry on their research in any way possible.

"I do not fear death, it will happen anywhere you go — but many students in Syria need our help," says Ahmad Almansour, a materials engineer at the University of Aleppo.

TUNISIA

Before the Arab Spring, Tunisia had a long tradition of support for education and research, unlike many of its neighbours. It produced more papers, relative to the size of its population, than any other Arab nation apart from Saudi Arabia, and it was the only one to invest more than 1% of its gross domestic product (GDP) in research and development.

But the repressive government kept tight control of university policies and stifled academic freedom, especially in disciplines that delve into potentially controversial territory, such as the social sciences. Faouzia Charfi, a retired physicist and veteran opponent of the regime's human-rights restrictions, tells how researchers needed permission for almost everything, even organizing academic conferences and collaborating with foreign peers.

The regime feared people acting on their own initiative, says Charfi, who became junior minister for higher education in the first post-revolution transition government. Universities and researchers had little freedom to develop their own policies or strategies. And regime bureaucrats blocked attempts to build links between universities and industry, stifling the kind of innovation that builds economies and creates jobs, she says.

The police state established by Ben Ali affected most aspects of everyday life. Few dared to criticize the government or even to discuss politics, and people could never be sure that neighbours or friends were not part of the regime's web of informers, says Sfar. Instead, they took refuge in the safe subject of sport. "Before the revolution, Tunisians discussed nothing but football," she says.

After Ben Ali fled Tunisia in January 2011, freedom of expression exploded overnight, says Sfar. But the euphoria soon dimmed as the country went through four years of successive governments and political turmoil, including the assassination of leading opposition politicians. At times, many feared that the democratic gains of the revolution would be reversed. But Tunisia's robust civil society



Physicist Imen Sfar is optimistic that newfound freedoms will translate into better research in Tunisia.

kept the revolution on track, with huge street demonstrations and strikes. After the moderate Islamist party Ennahda reached a compromise with secular parties, Tunisia last year became the first and only Arab Spring country to successfully transition to democracy.

In a historic moment, parliament overwhelmingly passed a constitution that guaranteed free speech, freedom of expression, religious freedom and equality between the sexes. The constitution also explicitly protects scientific and academic freedom, and mandates that the state "supply the means necessary for the development of scientific research and technology". In October, a secularist party won the parliamentary elections, and in December its candidate Beji Caid Essebsi was elected as the nation's president.

The biggest change since the revolution, says Sfar, "is this kind of feeling of freedom to say what we think about politics and the administration without fearing serious repercussions". At the professional level, she says that the revolution has had little impact on her field of condensed-matter physics and she has been preoccupied with starting her career and a family. She has taken a position at the University of Tunis El Manar, and is contemplating switching to theoretical work on materials with unusual electrical and magnetic properties because she lacks access to the kind of equipment she used while completing her PhD in France.

More broadly, the dramatic changes in Tunisian society have yet to permeate the research and higher-education systems. The past quarter of a century of authoritarian rule has left a system that is far from realizing its potential, says Hechmi Louzir, director of the Pasteur Institute in Tunis. The regime's tight grip on free thinking stifled creativity, he says.

"People didn't stray from the beaten path," says Louzir. Sfar says that even now, many of her students do not seem keen to think for themselves, and they expect lecturers "to show them one, and only one, road to the truth".

And Charfi is disappointed that researchers have not yet taken advantage of their new freedoms to bring in sweeping reforms, attributing the reticence to the highly conservative culture of the country's scientific community.

Educational reform and innovation in science are important, say researchers, because they will help Tunisia to create wealth and jobs — a priority given the country's dismal economic state and high unemployment. And Tunisians are ever mindful of local threats; just last month radical Islamist militants killed 22 people in a terrorist attack on the Bardo National Museum in Tunis.

Still, Tunisian researchers point to some positive changes. In the past, political nepotism and influence often determined who held key university posts, but democratic elections now decide, they say.

As Sfar looks back over the changes, she sees grounds for optimism. “There is now freedom of expression and thought, and an extraordinarily active civil society,” she says.

EGYPT

After a citizen uprising toppled the regime of President Hosni Mubarak in February 2011, microbiologist Ramy Aziz returned to Egypt full of hope for change.

“I had wanted to come back to Egypt to bring the scientific experience I gained in bioinformatics back to Cairo University,” says Aziz, who was at San Diego State University in California at the time. “The revolution was the spark that changed everything overnight.”

Students, researchers and professors took part in the uprising and their expectations soared in the months that followed. The government promised to increase science funding and many expatriate researchers vowed to return home.

Researchers called for reforming outdated policies — such as requirements that slowed down the transfer of samples across borders or limited interactions with industry. Such changes, they said, would help Egypt to target its most pressing problems: water and energy insecurity, poverty and mounting unemployment.

But the high hopes of Aziz and others have yet to be fulfilled. The government approved a doubling in science funding in 2012, but there was no clear agenda on how to use those funds and the research ministry failed to spend more than 80% of its budget. “On the ground we did not feel any change in the budget really,” says Aziz, who is now at Cairo University.

Then, on 3 July 2013, a popularly backed coup removed the first democratically elected president, Mohamed Morsi, who represented the Muslim Brotherhood. Several of the gains that researchers won after the uprising have since been reversed. In June last year, for example, newly elected president Abdel Fattah al-Sisi scrapped the law introduced after the uprising that allowed professors to choose their university’s leaders. The positions are now appointed by the president (see *Nature* **511**, 5; 2014).

“From a scientific point of view, I can’t see any change in Egypt,” says Aziz. He does feel that university students and postgraduates have become bolder and more willing to challenge their professors and ask for their rights — a positive outcome. But he does not expect that to make a big difference in Egypt’s science.

The biggest win for scientists is constitutional, says Alaa-Eldin Adris, who chairs the department of petroleum and energy engineering at the American University in Cairo. The new constitution, passed in January 2014, states that 1% of GDP should be spent on scientific research, and that this can be increased up to international standards. “On paper this looks good,” Adris says. But

he cautions that the constitutional change is only the first step. “It is worthless unless it creates laws that are enforced.”

According to the World Bank, science spending in Egypt rose from 0.24% of GDP in 2009 before the uprising to 0.43% in 2011. But most of the increase goes to salaries rather than to funding research. In the *Global Competitiveness Report 2014–2015*, produced by the World Economic Forum, Egypt ranks among the worst ten countries in the world in the quality of its scientific research institutes.

“We have many researchers, which is good, but when it comes to using science to solve problems or drive economic growth, we are almost at zero,” says Adris.

Aziz says that working life in Egypt today is a continuous battle in a stilted system, where he lacks access to core facilities and an environment that supports research. In Egypt, he focuses on teaching and mentoring post-graduates, but he returns to the United States for a few months a year to conduct most of his experiments. When he works there, primers for DNA synthesis arrive a day after he orders them. “In Egypt, you get primers in three weeks. If they don’t work well, you will need another three weeks,” he says.

Aziz thinks that the current political leadership is sincere in its goals to support science but has done little to actually help researchers. Others, however, accuse the regime of taking a strong stand against freedom of expression within universities. Students have been arrested during protests on the campuses of Cairo’s Al-Azhar University and at Cairo University and security forces have frequently stormed the university gates, leading to violent confrontations with protesters.

Many young people who might otherwise have helped to build up Egyptian science are being driven out. Islam Kotb left after he lost many friends in a violent dispersal of protesters in August 2013. “Leaving the country became my ultimate aim at that time and I accepted the first job offer I got,” he says. Now working as a critical-care specialist in Jeddah, Saudi Arabia, he hopes to return to Egypt one day, but stresses “that scientific research can never succeed and flourish in such an environment”.

For Aziz and Adris, the real threats to research in Egypt are the bureaucracy (buying chemicals can take several months, for example) and the government’s failure to engage in serious reform, such as overhauling education in ailing public schools and universities. None of these problems has been addressed by any of the successive ruling regimes, they say.

“I personally expect that by 2020 there will be little change, if any, in scientific research and output,” says Aziz.

Yet even with all these problems, he still

Ramy Aziz had hoped that the ousting of President Mubarak would make science easier to do in Egypt.



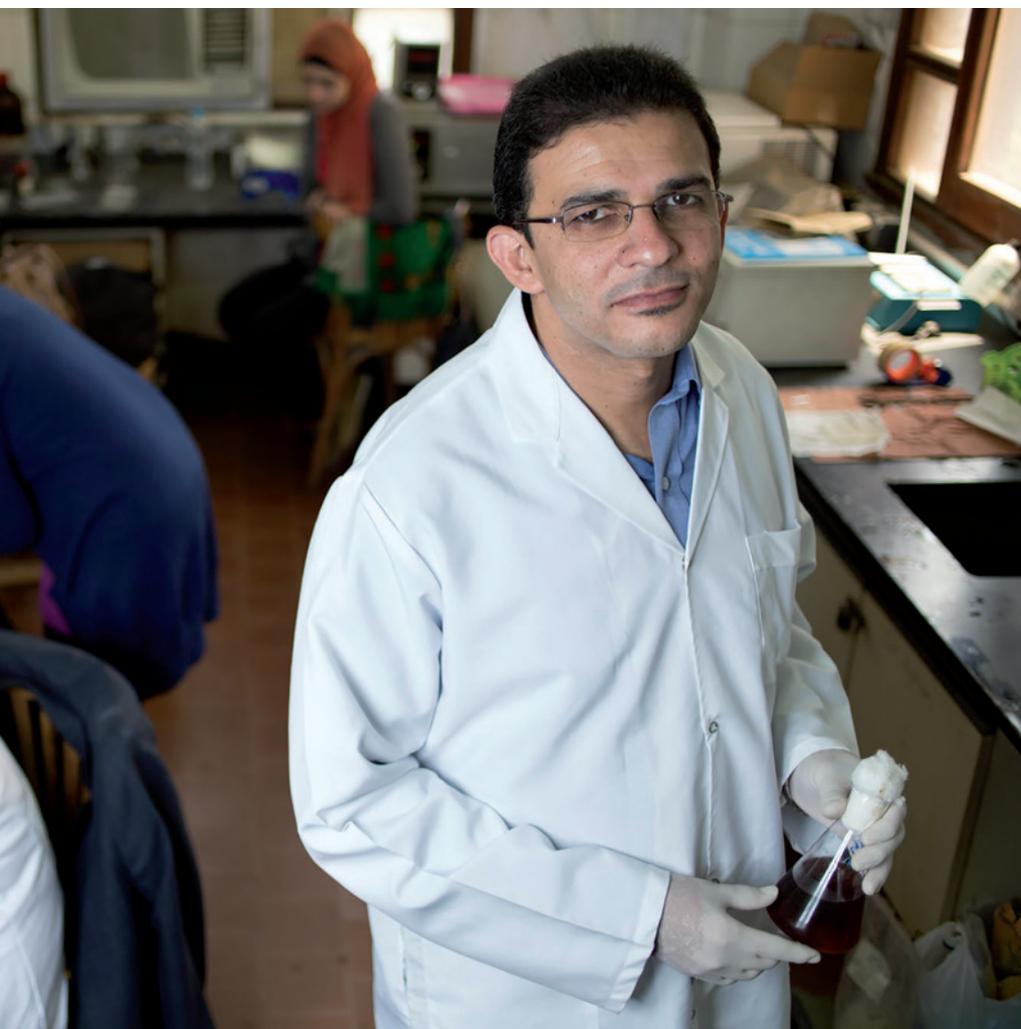
finds hope. “I see excellent students trying to learn against insurmountable odds,” he says. “You need to create a new generation with a different mindset and proper education that will eventually replace the current people in control, with their outdated vision.”

SABRY KHALED

SYRIA

In January 2013, students were gathering for their mid-year examinations at the University of Aleppo when a series of rockets hit residence halls and other buildings. Smoke billowed across the campus and people ran in panic to find shelter. The attack killed at least 82 people, including students and refugees who had sought protection at the university. The rebels and the government blamed each other for the bombing.

Materials engineer Almansour was lucky that day. The blast blew out the windows of the building where he was working, 300 metres from the centre of the explosion, but he and his family were unharmed. Although most Syrian scientists have fled the country to escape the ongoing civil war, Almansour feels an obligation to his students



“THE REVOLUTION WAS THE SPARK THAT CHANGED EVERYTHING OVERNIGHT.”

two choices, either join the military and be on the front lines to kill or be killed by my countrymen, or get out of Syria.”

Most international researchers in Syria have also fled the violence, and that has impaired research in the country. The International Center for Agricultural Research in the Dry Areas (ICARDA), one of the biggest research centres in Syria, struggled for almost two years to keep its doors open before leaving the country for neighbouring Lebanon in late 2012. Mahmoud Solh, a geneticist and director-general of ICARDA, says that looters had repeatedly attacked the facilities and stolen vehicles, computers and other equipment. But the centre managed to save its agricultural gene bank, one of the most important such collections, before it relocated.

Researchers who remain in Syria say that the working conditions there are extremely difficult. “Students in the medical and engineering school need equipment and materials that they cannot get,” says Zeina Al-Ahmad, a finance specialist at Tishreen University in Latakia. “We cannot participate in conferences as we used to either, which has also affected the quality of research in Syria.” The high inflation rate, which peaked at 121% in August 2013, has hit everyone hard, making it nearly impossible for scientists to fund their research and publishing activities.

And security remains a major concern for students and faculty members, who must often pass through dangerous war zones to reach their universities. Almansour lives close to his university’s campus, but many students have had to drop out for fear of their safety. “The number of students attending classes is about 35–40% of the registered number,” he says. “I am most worried about the possible destruction of the infrastructure. It took us a long time to build campuses, but if the fighting spares universities and schools then we will be able to go on in spite of the terrible circumstances.”

As bad as conditions are in Aleppo and other areas controlled by the government, the situation can be even worse for those elsewhere. The extremist group ISIS has taken control of large areas of eastern Syria, where it has closed schools and universities and is forcing teachers to work in its newly founded schools or lose their lives, impelling many professors and teachers to flee. There are few signs that things are likely to improve, with ISIS and other groups now involved in the civil war.

Given all the problems, Rahal plans to move to Europe as soon as he can. Many other researchers are also leaving, says al-Ahmad. “The young generation is trying to finish university and find a job abroad.” ■

Mohammed Yahia is chief editor of *Nature Middle East*. **Declan Butler** is a senior reporter for *Nature in France*.

and is staying put. “If we all leave the country, who is going to teach them?” he asks.

Whereas Tunisia and Egypt have started to stabilize politically, the situation in Syria has grown steadily worse. What started as an uprising against lack of freedom and an oppressive autocratic regime has turned into a civil war with many factions and little hope of resolution.

Throughout the four years of turmoil, however, some education and research have continued. When Michel Rahal graduated in 2013 from Damascus University with a bachelor’s in applied chemistry, he had hoped to pursue a postgraduate degree in Europe. But the government eliminated almost all scholarships for overseas education, and in any case, Rahal felt a responsibility to stay in his country during these challenging times. He

is now studying for a master’s degree at the Higher Institute of Applied Science and Technology in Damascus, although he feels that his options are limited while in Syria.

Some of those who have left say that it was impossible for them to remain in the country. Ahmad Salman, who asked to have his real name changed for fear of retribution against his family still in Syria, is one of those who tried to stay as long as possible. “Despite the difficulties of life in Syria during the war with the lack of security, access to water or fuel and the huge inflation, I lived with the hope that the revolution would end in favour of the people,” he says. But when the regime passed a law drafting all men into the army, he left his position at Al-Baath University and fled to Turkey, where he is now jobless. “I only had