



## REBUILDING UKRAINIAN SCIENCE

Russia's war has shattered Ukraine's research system. Building it back presents an opportunity to modernize and could be crucial to the country's recovery. **By Nisha Gaiind and Layal Liverpool**

Radiation scientist Galyna Tolstolutska stands in the ruins of the Kharkov Institute of Physics and Technology in Kharkiv, Ukraine.

**B**y this time next year, biochemist Uliana Semaniuk hopes to pack up her laboratory work in Finland and head home to Ukraine to restart her life and her science.

The evening before Russia invaded Ukraine on 24 February 2022, Semaniuk and her husband were in western Ukraine, getting ready for their son's sixth birthday. "We prepared sweet gifts for his classmates and discussed his birthday party, and the next day we woke up because of explosions outside," she says.

As for many of Ukraine's scientists, the war halted Semaniuk's work. Later that year, after defending her PhD thesis on the effect of nutrition on fruit-fly ageing, she moved with her son to pursue a postdoctoral position at the Helsinki Institute of Life Science, with the help of a programme called Scientists for Scientists.

There is still no sure end in sight for the war, which is in its 16th month and has killed tens of thousands of Ukrainians. Another 14 million people have been displaced. But as the Ukrainian government looks towards rebuilding its country, one of its goals will be to encourage more scientists such as Semaniuk to return.

"Currently we are in the situation where over 10% of scientists – probably the best scientists – have left the country," said Denys Kurbatov, the country's deputy minister of

education and science, at Science Day in Ukraine, a hybrid meeting in Kyiv on 19 May. The National Research Foundation of Ukraine (NRFU) in Kyiv hosts the yearly celebration with the education and science ministry.

Bringing scientists home is one of many challenges that Ukrainian science leaders face. The war has damaged about 120 research institutions, costing the research sector about US\$500 million, according to Kurbatov. Historic universities are among those harmed. Meanwhile, the fighting continues. A renewed Russian offensive is under way. Ukraine has started a counter-offensive and says it has liberated some occupied villages, but Russian shelling persists across the country.

Amid the conflict, Ukraine's government is planning how to regenerate the nation after a hoped-for victory. There are many immediate priorities, such as security, education and health care. Rebuilding the research system is less urgent. But the opportunities – to overhaul a Soviet-era system and to position research as a driver of Ukraine's recovery and future – are huge, say people involved with the science renewal plans. A strong research and development sphere could also help Ukraine to achieve its major development goal – joining the European Union.

"Without science, Ukraine would be just another mainly agricultural country, and with all the war damage to our ecology, we can't even





hope to come to pre-war export quantities,” says theoretical physicist Oleksiy Kolezhuk, one of the key advisers to the government on reshaping the research system. “How on earth are we going to support ourselves and prosper, if we continue to neglect science?”

Rebuilding Ukraine’s research infrastructure is a process that should start immediately, argues Kolezhuk, who is head of the scientific committee of the National Council of Ukraine on Science and Technology Development, which advises the government’s cabinet. People say that “war is the time for survival and reforms should happen later”, Kolezhuk told the Science Day meeting. “This approach is wrong and we need to be thinking about reforms now.”

## Soviet legacy

Many problems with Ukraine’s research system pre-date the war, says Kolezhuk. Investment in research and development was already low compared with similar economies, and had long been in decline relative to gross domestic product, while a 2016 science-law reform that sought to raise spending and address systemic problems was floundering. Kolezhuk’s priorities are to free the system from its Soviet-era structure, which gives little power to working scientists, and to align it more closely with the EU’s research infrastructure.

The current research system is composed largely of the Soviet-style national science academy – for which the research agenda was historically set by state officials – and a university sector in which research is funded by the science ministry. The modern National Academy of Sciences of Ukraine now lacks top-down instruction, which often leaves scientists rudderless but restricted in how they can spend their budgets. Even raising salaries or spending to repair equipment is difficult in this aged bureaucracy. “The people who really do science, like the scientific groups who are producing science, they have nearly no rights or influence on the process,” says Kolezhuk.

Entirely lacking is a modern, performance-based grant-giving system – one of Kolezhuk’s key wishes. “There is no system of individual grants for scientists,” he says. The centrepiece of a new system would include funding streams for basic research, competitive grants and defence-related projects. Ukraine’s research strengths include agricultural technology, energy and planetary science, but Kolezhuk would like to see an evolution towards higher-tech disciplines.

Last December, Kolezhuk and his colleague Yuliia Bezvershenko at Stanford University in California expressed these ideas in a chapter of the ‘Paris Report’, a book that outlines recovery plans for all major sectors of Ukrainian society, from trade and energy to EU integration and research (see [go.nature.com/42e9fja](https://go.nature.com/42e9fja)). Kolezhuk says that some of those ideas are being used to shape proposals that will soon be

presented to Ukrainian President Volodymyr Zelenskyy. “But it’s hard at the moment to say what will be accepted.”

The timeline for reform is unclear, agrees George Gamota, a Ukraine-born US physicist who helped Ukraine to develop its scientific system after it gained independence in 1991. “The war is just overwhelming everything,” he says. “But there is some good news.”

In March, Ukraine appointed a new education and science minister, Oksen Lisovyi, who Gamota hopes will advocate for Ukrainian research on the world stage. By the end of the year, the science ministry might be settled enough to begin making changes, Gamota says. “There’s been a lot of talk about reorganization and restructuring of the academy.”

## European ties

Most agree that closer research integration with the EU is essential. “Ukraine sees its future in the European community,” said Oleksandr Bilyi, head of communications and international cooperation at the NRFU, at the Science Day meeting.

Signe Ratso, deputy director-general of the European Commission’s directorate-general for research and innovation, says that faster integration into European research will depend on stronger cooperation under Horizon Europe, the EU’s flagship research-funding programme, and on effective policy reforms.

The NRFU is working with the European Commission to establish this year a Kyiv office for Horizon Europe, of which Ukraine is an associate member (the nation had been an associate member of the predecessor programme, Horizon 2020, since 2016). “This means that soon Ukrainian scientists will have an opportunity to learn more about the opportunities provided by the Horizon programme,” said Bilyi.

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Reshaping the system is difficult during wartime, so Kolezhuk recommends that initiatives begin gradually. Setting an example is the Virtual Ukraine Institute for Advanced Study, founded this April in collaboration with the Institute for Advanced Study in Berlin and funded by the Volkswagen Foundation. The plan is for a real-life institute in Kyiv to follow. “This is the way to reshape our system because it’s big and old, and you cannot reshape it all at once,” says Kolezhuk.

## Protecting researchers

Among the most pressing practical needs is to protect Ukraine’s existing researchers – and ensure that the war does not drive them away

from research permanently. “The biggest loss that we are suffering is the human capital, of course,” Kurbatov told the meeting.

Many researchers continue to work in profoundly difficult circumstances. For instance, scientists who conduct studies in the field, such as on food security, are limited because vast areas now contain landmines. Even researchers who do mostly computer work have been severely set back because of lost data and power outages.

In March 2022, linguist Viktoriia Lemeshchenko-Lagoda was forced to leave most of her PhD work on minority languages behind in Russian-occupied Melitopol in southeastern Ukraine. Russian soldiers seized equipment such as computers and hard drives from her institute. Now, in the city of Zaporizhzhia on the war’s front line, she has been gradually trying to repeat the work she lost, all while teaching her students remotely. But frequent shelling and power outages pose a major challenge.

“It’s really difficult to concentrate. It’s difficult to try to find any materials,” says Lemeshchenko-Lagoda, who is doing a PhD at the National Pedagogical Dragomanov University in Kyiv, and is a senior teacher at Dmytro Motornyi Tavria State Agrotechnological University, which moved from Melitopol to Zaporizhzhia because of the war. “We even give the lectures to our students at the supermarkets and the post offices where there are these huge generators, and we can just connect to the WiFi network and to continue our work,” she says.

Lemeshchenko-Lagoda is hoping to influence the future of Ukrainian research through her work as a member of the Council of Young Scientists at Ukraine’s ministry of education and science. “We made a big list of all the needs of the scholars in Ukraine, and the ones who are abroad,” she says. “For example, in Ukraine right now, a lot of our scholars say that they feel that they are underpaid.” That means scientists are finding other kinds of work, and might not return to research.

Semaniuk wants to return to Ukraine in early 2024 and help to drive change. Her family is there, and she has the opportunity to take with her the multicellular yeast model she’s been working on in Finland.

“Some people will stay abroad forever,” she says. “But there are also people like me who will return with new knowledge, with a new vision of science in Ukraine, and we definitely will try to change something.” Semaniuk draws a comparison with her research on the evolution of multicellular yeast. “Ukrainian science must do the same thing. We must evolve into something new.”

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