► the Ukrainian outbreak, now under control after authorities culled 208 pigs and instituted quarantine measures, did not come as a surprise, says Juan Lubroth, the chief veterinary officer at the Food and Agriculture Organization of the United Nations (FAO) in Rome, who is in charge of the organization's response to the outbreak.

Nearby countries, such as Moldova, Belarus and the Baltic states, could be next. To the east, the disease has been detected on the doorstep of Kazakhstan, which shares a long border with China, home to more than 1 billion pigs. China also risks importing the virus through its growing trade with African nations.

Europe's large pig farms are buffered by better biosecurity and hygiene practices. But agencies such as the UK Department of Environment, Food and Rural Affairs in London are nevertheless watching the situation closely. "How this will pan out, we don't really know," Lubroth says. "You're asking me to look into a crystal ball."

The variety of ways in which African swine fever spreads only increases the uncertainty. Pigs can leave virus particles on transport vehicles, for example, exposing whole shipments of uninfected animals. Biosecurity measures, such as scrubbing trucks and decontaminating farmers before they enter and leave pig pens, can help to contain outbreaks. But infected wild boar, whose populations stretch across Russia and Europe, pose a transmission threat that is harder to control. "Boars don't require visas to move across borders," says Lubroth.

The pigs' food can also carry the virus if it includes contaminated pork products. Swill feeding, in which pigs are fed scraps of human

food waste, is popular among small-scale farmers. Limiting this practice (which is banned in the European Union) or heat-sterilizing the food scraps can prevent disease transmission, says Dixon. "I remember being taken to

a little backyard farm near Nairobi, and that farmer was doing everything correctly. He had a cooker with a big pan of entrails that he was feeding to pigs and he had a little tray of disinfectant outside the pig pens."

The FAO warns that continued spread of

African swine fever could be very costly. Russia does not export its pork, but trade restrictions could prove expensive for other countries where the disease becomes endemic.

Denis Kolbasov, director of the National Research Institute for Veterinary Virology and Microbiology of Russia in Pokrov, says that officials often have little appetite for expensive countermeasures such as widespread culling and quarantine that could disrupt Russia's billion-dollar pork industry. Meanwhile, backyard farmers often do not report suspected cases for fear of losing their livelihood.

"If you are a small producer, and you lose all your five pigs, that is devastating to the family," says Lubroth. "That is the situation I see in many parts of Europe and Africa." African swine fever was especially costly in South Ossetia during a 2008 conflict with Georgia, because many farmers there could not grow crops and relied on livestock for food and income.

While animal-health officials focus on containing the spread of African swine fever, scientists believe that it should be possible to develop a vaccine to eradicate the disease. The lucky few pigs that survive infection are rendered immune, so Dixon's lab and others are working to identify which of the virus's 175 or so genes trigger the immune system. In principle, researchers could engineer these genes into the genome of a harmless virus to create a vaccine. Alternatively, identifying and switching off the disease-causing genes in the virus could lead to an attenuated vaccine. In the longer term, these options offer the best chance of halting the march of the virus, says Lubroth. "I wish I had a vaccine." ■

SOURCE: C. NETHERTON/VOIE

PHYSICS

US colliders jostle for funds

Heavy-ion facility at risk of premature closure as committee sets budget priorities.

BY EUGENIE SAMUEL REICH

When the Large Hadron Collider (LHC) in Switzerland seized the world record for the highest-energy collisions in 2010, it also sealed the fate of the leading US particle collider. The Tevatron, at Fermi National Accelerator Laboratory in Batavia, Illinois, was closed the following year to save money.

Now, physicists at another US physics facility, the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory in Upton, New York, are trying to avoid a similar end. On 13 August, researchers at the ALICE heavy-ion experiment at the LHC at CERN, Europe's particle-physics lab near

Geneva, announced that they had created the hottest-ever man-made plasma of quarks and gluons. This eclipsed the record temperature achieved at RHIC two years earlier by 38%, and raised uncomfortable questions about RHIC's future.

This European achievement comes as a nuclear-science advisory committee to the US Department of Energy and the National Science Foundation prepares to meet on 7–9 September to start a prioritization process. The discussions will pit RHIC against two other US facilities: the Continuous Electron Beam Accelerator Facility (CEBAF) at the Jefferson National Laboratory in Newport News, Virginia, and the Facility for Rare Isotope Beams (FRIB), to be built at Michigan State University in

East Lansing (see 'Competing for survival').

The committee has been charged with prioritizing the facilities within various scenarios of flat and slightly rising physics budgets. Nuclear physicist Robert Tribble of Texas A&M University in College Station, who is chairman of the advisory committee, says that in the flat scenario, there is only enough funding to support two of the three facilities. "It doesn't all fit," he says.

Steven Vigdor, who oversees RHIC as associate laboratory director for particle and nuclear physics at Brookhaven, naturally hopes that the committee will decide to scale back plans for another facility. But he admits that the Brookhaven team is already on the back foot because RHIC was ranked lower than the other

The STAR detector at the Relativistic Heavy Ion Collider looks for signs of quark–gluon plasmas.

COMPETING FOR SURVIVAL

Flat budgets are forcing US nuclear physicists to plan for a future with just two of three desired facilities.

Name	Cost and location	Status	Purpose
Relativistic Heavy Ion Collider (RHIC)	\$649 million; Upton, New York	Operating since 2000.	Explore the properties of quark–gluon plasmas.
Continuous Electron Beam Accelerator Facility (CEBAF)	\$310 million; Newport News, Virginia	Upgrade is 60% complete.	Study the arrangement of quarks and gluons in protons and neutrons.
Facility for Rare Isotope Beams (FRIB)	\$680 million; East Lansing, Michigan	Construction has not yet begun.	Create new nuclear isotopes and study their properties.

two facilities in a 2007 prioritization effort, also headed by Tribble.

A plan to increase the energy of CEBAF, by contrast, came out on top in the 2007 report, and with the upgrade now 60% complete, the facility looks to be on the safest ground for the latest ranking process. With beams of electrons reaching 12 gigaelectronvolts, the upgraded CEBAF will make further studies of the arrangement of the quarks and gluons that make up protons and neutrons. It will also look for exotic particles, made up of quarks,

that are predicted by quantum chromodynamics — the theory that describes how quarks and gluons interact.

Next comes FRIB, which promises to advance the study of nuclear structure by colliding beams of heavy ions to produce hundreds of nuclear isotopes that have never been created before. But the facility is vulnerable because it has not yet been built. Scientists at FRIB have won political support by obtaining US\$94.5 million of its \$680-million cost from Michigan State University, and by

promising to discover isotopes with medical, energy and national-security applications. “The country will get the benefits of the new isotopes,” says FRIB director Konrad Gelbke.

To keep CEBAF and FRIB on schedule, however, it is likely that US funding agencies would have to close RHIC prematurely. Vigdor says that would be a mistake. Despite ALICE now generating plasmas at higher temperatures, he says, theorists testing quantum chromodynamics will still want to use RHIC’s lower energies and temperatures to map the phase transitions between quark–gluon plasmas and ordinary matter under various conditions.

Vigdor also points out that RHIC’s construction is a past investment that is now bearing fruit. Closing it would not necessarily guarantee the funding of a facility such as FRIB. He says that it is “naïve” to think that closing RHIC or CEBAF would free up funds for a new machine. “When you terminate a facility, those funds tend to move away from the field.”

The trade-off between CEBAF and RHIC could have other important implications for their respective host labs. Nuclear physicists hope eventually

to build an even higher-energy, polarized electron–ion collider that would be able to image the gluons that hold together quarks in the proton.

Both the Brookhaven and Jefferson labs are eager to host that machine, says Robert McKeown, deputy director for science at Jefferson. But he says that if the effort moves forward, the lab that prevails in the current showdown is likely to win the future collider as well.

Tribble still hopes to avoid having to close any of the three facilities. In 2005, he notes, a similar crisis was averted after an advisory committee laid out the dire consequences of flat funding for the future of US nuclear science. In the end, Congress came through with the budgetary increases required. “What we want to do here is to spell out what will be lost under different budgets,” he says. His committee is planning to hold a final meeting in November, in time to influence the budget requests from US funding agencies for the next fiscal year. ■

“When you terminate a facility, those funds tend to move away from the field.”

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