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The conduct of science in times of war

The invasion of Ukraine has prompted a wave of measures to isolate Russia's scientific establishment. As geopolitical tensions mount, we must seek global agreement on how researchers can continue to operate, without aiding an aggressor or hampering science.

A Science|Business discussion paper
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About this report
This is a discussion paper prepared for presentation at the 7 September 2022 conference of the Science|Business Network and its Technology Strategy Board. It is a publication of Science|Business and does not necessarily represent views of Network or Board members.

We welcome your own suggestions – and especially your participation in the online survey we are conducting on these issues: Science|Business survey: Science & the Ukraine War | Science|Business (sciencebusiness.net). The survey is short, with six questions, and entirely anonymous. It is part of our ongoing effort to consult the international science community, and through our publications help foster informed debate. You may also write us directly at news@sciencebusiness.net.

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Summary

In the wake of Russia's 24 February 2022 invasion of Ukraine, allied governments rushed out a series of "science sanctions", restricting scientific collaboration as part of a broad campaign of economic and trade penalties designed to deter Russia. While there are some historical antecedents, the nature and breadth of these measures were unprecedented in the scientific community. Now, many ask: how have they affected Russia and Belarus? What impact might they have on current or future science, globally? With geopolitical tensions rising on many fronts, does the world now need some standard, guiding principles for the conduct of science in future conflicts?

This paper, based on reporting by the Science|Business news service, proposes a global effort to answer these questions. Amidst the chaotic launch of the Ukraine war measures, clear divisions of opinion within the European research community emerged over the design and scope of policy for the scientific community. Eventually, a kind of consensus gradually emerged – at least among developed-world governments: focus penalties on Russia's scientific institutions, rather than individual researchers. But in parts of the developing world, attitudes differed: What good, to poorer nations or humanity generally, would come from what some call a scientific "iron curtain"? Now, with the prospect of conflict rising elsewhere, between China and the US or Iran and Israel, we must think through these issues carefully and systematically. We propose a few simple steps to develop some guiding principles on the proper conduct of science in wartime:

1. Allied governments should mobilise the international research community to monitor – publicly – the impact of measures to isolate the Russian and Belarussian science establishments, as well the impact on science around the world. This could begin with a call for research proposals by the European Commission, preferably in a co-funding initiative with like-minded governments.

2. Leading academic and scientific associations should collaborate in a broad, open and visible effort to solicit opinions on these measures from thousands of researchers in all disciplines, public and private. Though governmental organisations will make the ultimate decisions, these public consultations would help inform them and increase the odds that the scientific community accepts whatever science policies emerge.

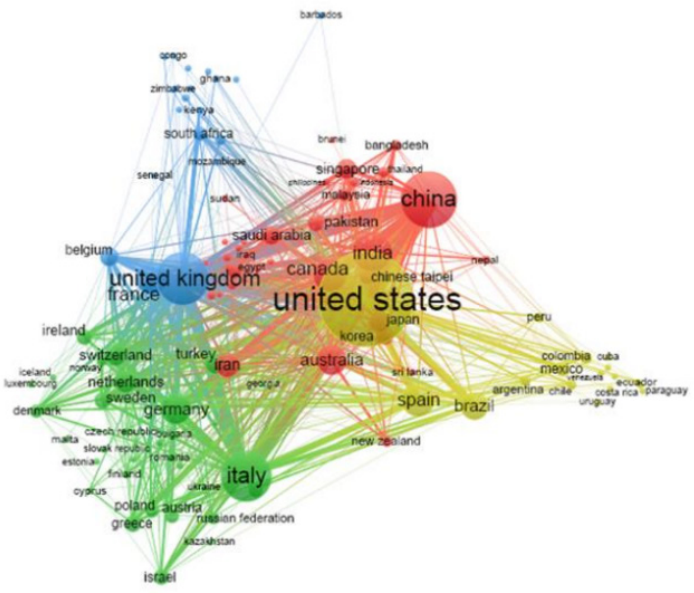
3. These activities should feed into an international effort to develop standard, evidence-based policies for the conduct of science in future conflicts. The ongoing effort by G7 science ministers is a good start, but it should be conducted publicly, involve more countries, and work towards the ultimate goal: a global protocol for the conduct of science in wartime.

Action on these points is made more urgent by the historic growth of open science, which has transformed the conduct of research across the globe. In just the past few years, we have seen the dramatic benefits of openness for the development of COVID-19 vaccines, the understanding of climate and biodiversity change, and the spread of green, equitable environmental and social policies. War can halt or reverse such progress. Together, we must find a way to keep the benefits of scientific collaboration and openness, without condoning or aiding aggression.

I. Introduction

Since Russia's invasion of Ukraine, the global research community has been caught in a conflict between two widely held ethical principles: international collaboration in science is good, and unprovoked war is bad. Across many democratic capitals, what some have called "science sanctions" quickly appeared against Russia and Belarus. Longstanding research collaborations were halted, conferences and grant payments canceled, joint programmes suspended. For the first time in many years, an idealistic mandate to pursue scientific cooperation wherever it led – whether understanding global climate change, or developing COVID-19 vaccines – suddenly encountered political limits. To many in the research community, especially in European countries closest to the fighting, these limits seemed inevitable given the atrocities they could see Russia committing daily in Ukraine. But to others, more distant from the war or more concerned about long-term implications, the measures appeared short-sighted and more likely to harm global science than deter Russian aggression. Now, more than six months into a war without end in sight, many ask: what next? Are these measures to isolate Russian science working? Are there collateral, harmful effects on science globally? And most importantly, how should the research community respond the next time an unjust war breaks out?

The context for all this is an historic rise in science cooperation. Never before have so many researchers worked with so many colleagues across borders and cultures. By 2019, 23.5% of all scientific publications were internationally co-authored, according to UNESCO. In part, this is just another aspect of globalisation. But it also reflects the growing economic and social importance of science and technology. To solve the world's mounting problems of climate, health, and social stability, researchers must work together across borders and sectors. The most dramatic example came in 2020, with the world-wide collaborations to produce effective COVID-19 vaccines in less than one year. OECD data (see chart) demonstrates just how interconnected the world's biomedical research communities were in the first year of the pandemic (though it is noteworthy that Russia even then was only a minor player in this global dance.)



International scientific collaboration on COVID-19 biomedical research from January to 30 November 2020, based on co-authorship data. Source: OECD.

Climate science, of course, was born global. And today a kind of global science council – the Intergovernmental Panel on Climate Change – stands as a model of how internationally accepted scientific evidence can spur at least some governments to act. Over the past few decades, the entire scientific enterprise has been rewired for global cooperation, with open-access scientific publishing, data sharing, researcher mobility and student exchanges the norm world-wide. At the same time, these trends have reinforced the importance of openness, research integrity and academic freedom as guiding principles for global science.

II. The sequence of events

And then came Russia's 24 February 2022 invasion of Ukraine. Within days, western governments began cancelling or restricting scientific collaboration with Russia and its junior partner, Belarus. In the first 24 hours, Germany moved to suspend formal, institutional cooperation by its research organisations. Most other EU members followed within days – either at the direct prodding of governments or by individual universities and associations acting on their own. The European Commission halted payments to Russian researchers involved in its Horizon Europe projects. Major research infrastructure such as CERN and X-FEL suspended Russian participation. Here, just from the pages of Science|Business in the first two weeks of the war, is a chronology of European government steps to isolate Russian science (based on date of publication.)

The rollout of European sanctions, in the headlines

24 February: German government recommends a freeze on academic relations, projects with Russia.

25 February: German Research Foundation and nine other German research organisations say their funding can no longer benefit Russia, and no joint scientific and educational events can take place.

28 February: Lithuania orders halt to all scientific and academic cooperation with Russia or Belarus, and urges suspension from the European Higher Education Area.

1 March: Danish government tells universities to suspend R&I cooperation with Russian and Belarussian institutions, and refrain from new exchanges.

2 March: European Commission suspends payments to Russian research institutions, and bars new cooperative projects. European University Association, Polish Rectors' Conference and other academic organisations urge all universities and research institutes to cease cooperation with government organisations in Russia and in countries that support the Ukraine invasion.

3 March: Estonian universities halt cooperation with Russian and Belarussian education and research organisations.

4 March: Dutch and Slovenian governments suspend all research and education ties with Russia and Belarus. The European Federation of Academies of Sciences and Humanities (ALLEA) suspends its Russian and Belarussian members. The Arctic Council, representing eight nations with Artic territories, suspends meetings with Russia.

7 March: European University Association suspends membership of 12 Russian universities, after their rectors signed a pro-war statement. The Norwegian government suspends all research partnerships with Russian institutions.

8 March: CERN suspends Russia's observer status in the high-energy physics lab, and the X-Ray Free Electron lab says it won't enter new agreements with Russian partners. Following government instructions, several Dutch and Norwegian education and research organisations announce a suspension of partnerships with Russian institutions.

10 March: Despite government inaction, a growing number of UK universities announce suspending or ending formal Russian research partnerships. Meanwhile, France's CNRS and ANR research agencies have suspended their own institutional agreements with Russia.

The list is not exhaustive, but even so it shows how quickly all this happened - especially given the normally glacial pace of academic and institutional deliberations. It also shows the lack of any coordinated, public policy debate – within any EU or neighbouring member state, or by the European Commission. There was, of course, a great deal of private communication between various ministries, much of it in concert with US officials coordinating a NATO-wide response to the war. And many individual legislators from Brussels to Bucharest spoke out on the issue. But so diverse and decentralised is the research community – and, in some countries like Germany, protected by law from government diktat – that the policies that emerged did so in a disordered, mounting wave of action.

Outside Europe, responses were more varied. In Canada, after two weeks of private consultation, the government announced a halt to federal science cooperation with Russia, and urged many grant-holders to avoid collaboration with Russian industry. In Japan, the government strongly condemned the invasion but let each research institution chart its own course. In many developing nations, including India and South Africa, the government attitude towards Russia was generally less strident than in the developed world. In the US, the research community's response was cautious. While there were many private discussions, in faculty meetings or association boardrooms, there was for several weeks no formal, public policy guidance from Washington. Individual universities acted unilaterally. For instance, MIT announced an end to its 11-year partnership with Russia's tech hub in Skolkovo. And individual intergovernmental organisations, such as the Arctic Council, suspended Russian participation. But it was not until 10 June – more than three months after the war began – that Washington announced plans to "wind down" government research ties with Russian institutions. Shortly after, it embarked on a much broader review of research integrity and security generally – more aimed at China than Russia, and conducted in concert with its Group of 7 partner-nations.

In many countries – especially in Europe – some common themes run through most actions taken. First, the primary focus has been on suspending or ending formal research alliances with the Russian government and its state universities, and halting negotiations on any new alliances. Second, many research funders halted payments or suspended contracts with Russian grantees – many of whom are partners in EU research projects. And most announced support schemes for Ukrainian researchers forced to flee, and for Ukrainian research organisations still struggling to operate. But generally, governments and institutions decided against penalising individual Russian or Belarussian researchers for the behaviour of their governments. Consequently, individual Russian students and researchers at Western institutions were not ordered to go home. Individual researchers were left to decide on their own whether to continue correspondence or share data with Russian colleagues. In sum, personal ties were allowed, official ties cut.

III. The ongoing debate

As these various measures were announced, the rationales varied. In general, governments saw them as an extra lever, along with economic and trade sanctions, to pressure Russia into changing course. Cutting formal research ties could push Russia's own scientific community to exert pressure on the Kremlin, so the argument went. Indeed, the broader economic and trade sanctions have already disrupted ongoing Russian R&D. Some urged more punitive action, such as banning Russian co-authorship of scientific papers or exclusion of Russian papers from international publication databases. Some, especially in Ukraine, urged an outright ban on all scientific cooperation, institutional or individual. After all, the reasoning goes, if the West is sanctioning Russian bankers, industrialists and athletes, why should Russian scientists be exempt?

There were equally loud counter-arguments. Wielding science as a weapon, many said, is a terrible idea. Science is about gaining knowledge, not waging wars. Isolating Russia and possible allies could disrupt collaboration on vaccines or climate that the world needs. It could disproportionately harm the developing world, which has benefited from a free flow of ideas and researchers. It would penalise the very Russian researchers who might pressure Moscow. It would impede the free movement of information, students and scholars needed to break through the Kremlin's censorship. It would undercut such tenets of the modern university as freedom of research, teaching and association, and erode universities' autonomy from political interference. And it would cause irreparable harm to the whole system of scientific cooperation, and the tools of science diplomacy.

This debate continues today. In an online survey Science|Business launched with its readers on 28 June, the range of opinion in the scientific community has been shown to be broad, and passionate. Here are some of the comments from readers – promised anonymity.

Anonymous survey comments:
Opposed to isolating Russian science

"Science brings nations together."

"Science should be above politics if it is not used for military purposes."

"Science has always been a bridge, and it is important to keep the scientific and research cooperations alive in all circumstances."

"My opinion is that Science and Research (as Arts, Culture, Sports, Space, etc.) never should be used as 'tools' to punish a country! On the contrary, all these are instruments of peace and collaboration. How will Europe, the European continent, be won if relations with neighbours are blocked and broken? What kind of progress are we heading for? To the one where we will be all alone?"

"Artistic and scientific collaborations should continue, because they are above territorial disputes between gangs of primates."

"The Iron Curtain again? No, thanks."

Anonymous survey comments:
In support of sharp restrictions on Russian scientific relations

"Don't be naive. Autocracies and mafia states should not be treated as countries ruled according to the principle of separation of powers."

"Science cannot be apolitical."

"It is naïve to think that we can disagree on a political level and continue to cooperate on R&D."

"Academic freedom doesn't mean that science exists outside of social and political contexts. Scientific cooperation can and should be used as leverage in international negotiations. That is also a part of 'science diplomacy.'"

"Russia is a terrorist state and Russians support the war. Because of them, Ukrainian scientists were forced to freeze their research, abandon their work, which they devoted many years to. Therefore, there should be no scientific contacts and connections with Russian researchers until they plead guilty and are punished for the horror inflicted on Ukrainians."

Anonymous survey comments:
In support of nuanced restrictions on Russian relations

"I think it would be important to sanction the state, but at the same time Europe should try to support the Russian researchers who are in danger at their home country."

"Try to avoid backlash on innocent scientists in response to criminal acts of their governments."

"I would argue that individual scientists can decide to keep interactions with Russian scientists going if/because they know the Russian scientist is against the war, but institutions/businesses can't make that distinction."

"Sanctions should be limited in time and re-evaluated on a regular basis."

Science|Business is continuing the survey online, which as of this report has attracted 395 responses from 38 nations. Researchers anywhere in the world, in any discipline or career stage, are invited to offer their opinions. Responses will be kept anonymous, and will, we hope, advance the international debate.

IV. Policy principles

This debate continues, of course. But now, six months into the war, Kieron Flanagan, professor of science and technology policy at Manchester University, asks: "When do you stop doing this? What's the exit strategy for scientific isolation?"

These aren't questions for which we have any answers yet. In history, war and conflict have imposed limitations on science, but they have tended to do so ad hoc, based on the specific circumstances. In World War II, scientific collaboration between Axis and Allied researchers was off limits. The war was direct and existential, and aiding the enemy was illegal (though in the run-up to the war, collaboration could and often did continue.) In the Cold War, export controls limited the range of scientific exchange between East and West – specifically in fields understood by each side's security services as related to military or strategic industrial capability. But even then, some fundamental research – if published – was fair game for discussion and even collaboration; it was on that basis that high-energy physics labs like CERN, international mathematical congresses, and space research grew across the East-West divide. But Ukraine, many argue, is different: a hot, proxy war in the heart of Europe, without direct fighting (yet) between Russia and NATO members. And, along with mounting tensions over Taiwan, Uighurs, Palestine, Iran and other global hot spots, it marks the start of a volatile, frightening phase in world history – one in which many scientific domains, with dual civilian and military uses, are inevitably implicated.

So it is time to think ahead, rationally. Can a better way be devised to keep science functioning in wartime? We are not the first to raise this question. There have been several conferences and reports about it, such as a policy paper issued by the International Science Council. In examining the issue, one can start by simply observing the government actions and social media debate so far, and inferring the operation of some basic precepts. Rightly or wrongly, there is clearly some kind of practical moral philosophy in operation. We summarise it in a few simple principles – at least, as we observe them in action in many countries.

Principle I. Whether in war or peace, we should aim to keep science functioning as openly and collaboratively as possible. It is essential for human knowledge and shared progress.

It may seem obvious, but it is important for governments to acknowledge: open scientific collaboration promotes the global public welfare. It is not just another form of economic activity that can be wielded as a diplomatic weapon. It is needed for the advancement of human knowledge, and the solution of global challenges. Certain fields of inquiry – many covered in the United Nations Sustainable Development Goals – are clearly of benefit to all humanity, at war or peace. Climate research, environmental protection, healthcare, education and training, social and political science to inform policy, humanities to understand our global commonalities and differences – all are fields that gain by broad, cross-border and cross-disciplinary collaboration. So, the default position of any government examining crisis-related sanctions should be not to interrupt useful scientific exchange. This principle applies as well to all the instruments of open science: open-access scientific publication, access to publicly funded scientific databases, participation in international scholarly metrics and assessments, access to international research infrastructure, freedom of movement for researchers and students to attend conferences or instruction, freedom of association for researchers to collaborate with whomever they think appropriate, and freedom to teach and research.

Principle II. In wartime, some limitations on scientific openness and cooperation are necessary, so as not to aid an enemy. At question is how much, and in what domains.

Despite our default principle of open science, not even the most ardent advocate of academic freedom would argue against certain commonly accepted ethical limitations to scientific behaviour. For instance, thou shalt not clone human beings, or experiment without subjects' informed consent. Thou shalt not plagiarise or invent data. In wartime, this informal list of commandments broadens: though shalt not aid the enemy. The problem is defining what kind of research could fall under that prohibition – and in the practical details so far, we have seen at least three approaches emerge.

One answer could come by examining the discipline or sector involved. For instance, an obvious point on which most scientists would agree: in wartime, there can be no collaboration on research that directly contributes to an aggressor's military strength. Rocketry, munitions, cyber-warfare and the military applications of GPS, communications and other technologies fit into this proscribed area – though their dual, civilian-military, applications make a clear definition difficult. One could also argue that scientific collaboration should not inadvertently strengthen an aggressor's political stability. What Western AI specialist today would want to collaborate with Russian colleagues on new techniques that the Kremlin could use to track, identify and prosecute citizens voicing criticism in social media? Less clear, perhaps, is how to handle research that could aid an aggressor's economic or social stability. What about R&D on electric batteries, autonomous vehicles or medical diagnostics?

Another approach to defining science sanctions is to examine the technology readiness involved in any proposed collaboration. An emerging technology, like quantum computing, has enormous potential to disrupt global security and privacy; but it will be some years before that potential can be realised. So should early-stage quantum collaboration proceed, while closer-to-market partnerships are halted? That is, in fact, the approach that the European Commission is taking with quantum collaboration generally. It will accept UK and Swiss participation in its Horizon Europe quantum work, provided the projects are not close to market. The motivation is entirely different, of course. Here, the EU aims to preserve its technological autonomy in a strategic discipline. But the case demonstrates how easily even political disputes among friendly nations can affect scientific funding. How much easier to impose restrictions with unfriendly nations?

Yet a third approach is to focus on the institutions, not the individuals, involved in any collaboration. As described already, that has been the most common policy so far in the war. It was fairly simple to enforce: most research institutions are dependent on government funding, and institutional agreements are well documented. But institutions are made up of individuals; and Russia's military transport industry could get just as much help from an individual Western expert on autonomous vehicles as it could from a formal supply or cooperation agreement with a Western university.

Our discussion is focused on a wartime situation – hopefully, short-lived. But the longer-term problem is the mounting evidence of science being dragged into endless trade and economic conflicts. Until the Trump Administration, scientific co-publication between US and Chinese researchers had been booming; now, notwithstanding the change in government, researchers think twice about it – and in the EU and UK, governments are stepping up scrutiny their own academic links to China. At the same time, even nominally friendly nations are throwing up new obstacles to scientific and technological cooperation. In just the past two years, the US and EU have started squabbling over COVID-19 vaccine patents, electric

battery technology, and artificial intelligence regulation. In such a world, is open science even possible? Our mounting political conflicts over emerging technologies may break the very scientific machinery that has produced these technologies. Ultimately, what we need is not a list of proscribed forms of scientific collaboration, but a positive code of conduct for open science, a baseline allowing scientists to do science. In short, we must collectively devise a "to-do" list for open science, not a "to-don't" list.

V. Recommendations

There are several possible policies a government could adopt when considering the conduct of science in wartime – and in the case of Russia, we have seen every one of them tried to greater or lesser extent. But surely, with global tensions rising, it is time for a more systematic, reasoned approach. If nothing else, advance knowledge of the likely scientific penalties of unprovoked aggression could be one small, extra deterrent to warfare. That is, after all, the rationale behind most international protocols on war, from the use of land mines to chemical weapons. In this paper, we suggest a way to arrive at a more coherent policy, applicable to future crises.

1. **Start with the evidence. Systematically monitor the impact of science sanctions on Russia and the rest of the world. And do it publicly. Begin with a Horizon Europe call for proposals.**

The impact of these limitations on science will be a hot research topic in years to come – but it needs funding support now, and international coordination. Anecdotally, we know that technology and trade embargoes on Russia have already disrupted lab supply chains in the country, and demotivated thousands of brilliant Russian researchers. But how much? And have the measures specifically targeting Russian science, on their own, had any effect? Of course, intelligence on such questions is being gathered by NATO governments, and various organisations are starting to monitor it. But we urge a very public, coordinated, international effort; the problem must be studied from every possible perspective, with multiple sources and methodologies so as to get comprehensive, apolitical data on so politicised a topic.

Thus, as part of its ongoing review of Horizon Europe priorities in the wake of the war, we urge the European Commission this autumn to launch a call for proposals for multiple consortia to study the impact of the science sanctions. The EU should act first, because of its proximity to the fighting, the political cohesion most of its members (notably barring Hungary) have mustered, and its well-oiled and generally well-respected machinery for managing international research partnerships in Horizon Europe. But its efforts should be coordinated with other allied governments – perhaps in a formal co-funding initiative with some, so that coherent, international answers result.

2. **Engage the global research community. Begin a broad, open and visible effort to ask researchers what they think a viable policy should be. Start with coordinated action by leading scientific organisations.**

In their haste to respond to the invasion, allied governments skipped over a crucial step: asking the people directly involved what they think about it. With a few exceptions, there was no formal, public government consultation of the research community. Yes, there was a lot of private consultation between government officials and university administrators, between learned societies and their institutional members. But there was no broad, public forum for discussion. What we need, now, is new ideas, more-radical approaches – and the scientific community is abuzz with creative suggestions. For instance, rather than restricting visas for Russian researchers, allied nations could deliberately entice them, encouraging them to leave Russia and continue their research in other, non-combatant countries. This is, in fact, what the Biden Administration proposed to Congress earlier this year, without success. But a moment of crisis like this should be an opportunity for new ideas to bubble up directly from the scientific community.

We urge governments to fund an effort by leading scientific and academic organisations to solicit opinion now – across the world, across disciplines, across career stages. While the results of such a broad survey of community opinion would have no legal standing, they would be an important step in our democratic societies moving towards a consensus on how such crisis situations should be handled in future. This effort should be coordinated internationally, perhaps through the international, umbrella organisations of national academic and scientific societies. We are pleased to see the start of this kind of activity already, with the International Science Council and the European Federation of Academies of Sciences and Humanities. But there cannot be too many voices, organisations and countries participating in such an effort.

3. Governments should work collectively to agree on a long-term strategy for the conduct of science in this or any future conflict.

Science and technology are global, and so should be any policies for science in wartime. Many governments did confer with one another as the Ukraine war began, and ended up with broadly similar positions (though many nations, particularly in the developing world, disagreed.) But they each acted and announced policies on their own, magnifying confusion in the global science community. How much more effective would they have been had they spoken with one voice? Or if the announced measures did not bear the hallmark of improvisation, under the pressure of war? This need for consultation and agreement will be even greater in the event of a new war, cold or hot.

We are gratified to see the beginnings of such a coordinated effort. For some months, a special working committee of the Group of 7 leading industrialised nations has been discussing some new approaches – specifically, developing broad principles to ensure research security and integrity, in war or peace. This brings together varied ideas: The EU's mantra that science should be "as open as possible and as closed as necessary", and a new White House initiative to revise funding guidelines so any possible conflicts in a grant proposal are adequately disclosed. At the same time, the OECD has been gathering data on research integrity and security for the past few years. But these efforts should be enlarged, to include more nations and views.

The ultimate goal should be a global agreement defining universally acceptable norms for the conduct of science in war. That agreement should include Russia, China and other nations on the opposite side of the growing geopolitical divide, as well as developing nations that risk being caught between the two poles. Such an international agreement would take years to reach, but the step-wise effort to achieve it would be valuable in itself, forcing politicians to focus on the problem and understand global cultural and ethical differences.

We urge these measures, in particular, because we have tasted the fruits of open science: open-access publishing, open sharing of data and data platforms, open research infrastructure and openness to visiting scholars and students. It has transformed the conduct of research across the globe. In just the past few years, it has helped us develop COVID-19 vaccines, model climate and biodiversity change, and in many countries encourage greener, more equitable environmental and social policies. Together, we must find a way to keep the benefits of scientific collaboration and openness, without condoning or aiding aggression.

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