

## Standing on the shoulders of crowds

**A special issue on research collaboration highlights COVID-era lessons for working across borders, cultures and disciplines.**

**“T**he most important ingredient in making collaborations work is commitment: to producing research that is relevant, and to understanding many angles and perspectives.”

Yvonne Lewis and Richard Sadler make this point in a piece in this issue that describes how universities and community organizations worked in concert to find solutions to water contaminated with lead in Flint, Michigan (see page 326). Their advice: spend less time and attention meeting metrics of performance, such as papers published and grants procured, and more time nurturing relationships.

Yet that, as Anna Hatch at the San Francisco Declaration on Research Assessment explains (see page 459), is hard, because many of the structures and mechanisms that evaluate and reward science are still those of the age of the lone scientist.

Recognition – the naming of labs, and the awarding of national-academy fellowships and Nobel prizes – is still given to individuals, often on the basis of individual, rather than collective, performance measures. Few Nobels have explicitly rewarded scientific and technological collaboration. Two notable examples – for climate change and nuclear non-proliferation – have been Nobel peace prizes.

This special issue of *Nature* shines a spotlight on collaborations in science today, particularly in the wake of the coronavirus pandemic. It reveals that such cooperation, although complex, is thriving in many ways. It is clearly essential, both to the progress of research and for the betterment of society. But, at the same time, international collaboration is under pressure, partly as a result of geopolitical tensions. And science’s historical conventions continue to hinder such team-based working.

The pandemic has seen a host of inspiring stories of scientists stopping in their tracks and joining forces across borders and disciplines, whether to sequence viral genomes or describe protein structures and other features of SARS-CoV-2. In this issue, members of one of many such groups – those behind the COVID Moonshot project, which involves scientists scattered across continents – tell their story of pulling together to design antiviral drugs (see page 330). They write of juggling spectrometers, chemistry hoods, computer models, courier companies and Zoom calls, and of an “inexhaustible wellspring of goodwill”.

Analyses of bibliometric data reveal that international collaborations were less common on COVID-19-related papers in 2020 than they were for research on other

coronaviruses in previous years (see page 316). Moreover, as the pandemic has progressed, papers in which the authors are all in the same country have occupied a greater share of the COVID-19 literature. Looking at 2020 as a whole, the rate of international collaboration for COVID-19-related science was similar to that for all recorded research.

Indicators that some international collaboration is waning are evident when looking at data for China and the United States. The fraction of China’s international collaborations that involve US authors has been falling since 2017. Such trends are likely to continue if geopolitical tensions with the United States worsen.

That would be regrettable. Successful collaboration relies on trust and long-standing relationships, as researchers at Dunhuang Academy in China and the University of Oxford, UK, told *Nature* in a specially commissioned short film on their collaboration on heritage conservation. Team members at the two institutions are studying how climate and weather affect ancient structures at cultural heritage sites on the Silk Road route in northwest China, and how natural methods might be used to better protect such sites (J. Richards *et al. Sci. Rep.* **10**, 16419; 2020).

Among other things, the film explores how the team members approach and resolve differences of opinion, including the order of authors on joint publications, because China and the United Kingdom have different conventions. Qinglin Guo at Dunhuang Academy says that they were able to reach consensus “because we have the same goal – which is to protect the cultural heritages which belong to all of mankind”. (Authorship disputes and other risks to collaboration are discussed separately on pages 459 and 462.)

### Community partnerships

Some collaborations involve more than bridging countries and disciplines. We feature two projects in which communities work in close partnership with university researchers. One is between Jason Paliau, now at the Papua New Guinea University of Resources and Environment in Rabaul, and a senior-school student, Sammy. The pair worked together to identify and count ants in Papua New Guinea’s lowland rainforest (see page 466).

The other is the initiative created in Flint. Lewis is a community activist and now principal investigator at the Flint Center for Health Equity Solutions. Sadler is a geographer at Michigan State University. They draw lessons from how researchers and members of the community worked together to identify where diseases were concentrated. It’s a frank account that also flags the fact that some scientists discounted and overlooked ideas from communities, and raises the injustice of work that saves lives not necessarily meeting the ‘excellence’ criteria needed to progress in academic institutions.

These are clearly testing times for collaboration. The stories and data show that there is still some way to travel before all parts of the research enterprise recognize the true value of working across borders, cultures and disciplines.

Collaborations are essential – we need diverse teams

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to tackle global problems such as pandemics, and to help navigate social and geopolitical challenges. COVID-19 has provided a timely reminder that it can be done – and of the enormous rewards it can bring.

The metaphor ‘standing on the shoulders of giants’ has been much overused by scientists past and present. Today, such ‘giants’ are not only the investigators named on papers and project grants, but also every other participant in the research process. The future lies in standing on the shoulders of crowds.

## COVID-19 validates science–industry collaboration

**But a thriving relationship needs clearer rules around data ownership and intellectual property – and public trust in the process.**

**T**he pandemic has created a new kind of household name: AstraZeneca, BioNTech, Moderna and Pfizer are now as familiar as soap brands. But their life-saving vaccines would not have become a reality without remarkable and rapid collaboration with researchers at universities.

As part of this week’s special issue on research collaborations, *Nature* spoke to industry scientists about their experiences of collaborating with academic colleagues on vaccine development. Collaboration between academia and industry is well established in many parts of the world. But the speed and scale of achievement during the pandemic – globally, 16 vaccines have been approved so far, with a further 9 in full phase III clinical trials – is rare, if not unprecedented, and interviewees praised the energy, enthusiasm and can-do attitude that they found in universities. Moreover, collaborating in the face of relentless media scrutiny as the world waited for a vaccine breakthrough has not been easy, interviewees added.

Unsurprisingly, respondents noted the limitations that virtual communication and lockdown restrictions have imposed on collaboration. They also urged more clarity on ownership of data and of intellectual property (IP) – areas where discussions with academic colleagues have been difficult.

This isn’t new. Data ownership and intellectual property are sources of long-standing tensions in the academia–industry relationship. But there are ways these tensions can be eased.

The scientists *Nature* spoke to for this editorial say there have been robust exchanges with universities about how to apportion intellectual property when discussing collaborations. It’s clear that some were not expecting that

universities would also be thinking about monetizing their science; there remains a perception among some in industry that universities produce the science, and leave industry to commercialize it.

Universities do negotiate hard to maximize the returns on their science, effectively creating competition between universities and companies – something that did not exist in previous decades. And yet, there might be a silver lining. The campaign for time-limited IP relief on COVID-19 vaccines, backed by more than 100 countries, the World Health Organization and both China and, crucially, the United States, could help to reduce IP disputes with universities, at least when it comes to collaboration on COVID-19 vaccines. Industry is against the campaign, but if it drops its opposition, more knowledge will become public, and at least some barriers to collaboration will disappear.

Access to data is another area where collaboration could be improved. For example, there need to be better mechanisms for researchers to access industry data in emergencies. These were discussed ahead of last week’s meeting of the G7 group of some of the world’s biggest economies in Cornwall, UK, and might form part of a planned pandemic treaty. But solutions for data access also need to be found for collaborations to thrive outside of emergencies such as pandemics. Not all pharmaceutical-industry data that researchers can use is commercially sensitive. Other industries, such as finance and telecommunications, have similar challenges and experiences in data sharing, all of which need to be studied.

### Dismantling barriers

Clearly, industry and academic colleagues have worked together at speed to deliver vaccines, underpinned by public and charitable investment; one analysis of the Oxford–AstraZeneca COVID-19 vaccine that has not yet been peer reviewed showed that 98% of identified funding came from these sources (S. Cross *et al.* Preprint at medRxiv <https://doi.org/ghwh>; 2021).

Collaborations of this kind must continue beyond the pandemic. But, alongside goodwill, they will also require progress on ownership of data and IP.

The pandemic has boosted public awareness of science–industry partnerships. It has also led to greater public understanding of research, manufacturing and quality-assurance processes. “People are hearing scientists talk. Taking them out of the labs is a new and now-accepted thing,” one industry representative told *Nature*.

Researchers need to study how this happened, in part to build on successes, and also to learn lessons for future pandemics, and to nurture the collaborations needed to tackle them. Researchers in academia and industry – and not only those who study infectious diseases – should now be looking to expand collaborations beyond the pandemic.

Success has also created expectations, in particular that academia and industry will deliver when called on. But future successes are not guaranteed, as both university- and industry-based researchers know. That is why every lesson from this pandemic must be learnt, and barriers to collaboration must be dismantled as much as possible.

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