



## Immunology shines in the dark

Immunology has illuminated the darkness of the COVID-19 pandemic — but what has been the impact of the pandemic on the immunology community?

You need dark skies to see stars, and immunologists have burned brightly in the darkness of the COVID-19 pandemic. At the start of 2020, it is unlikely that anyone with an interest in the field of immunology could have predicted that antibodies and T cells would soon dominate media headlines around the world. Yet in the past year, immunological jargon has become a staple of everyday life — members of the public freely discuss antibody tests, immunosuppressive drugs and the relative merits of the various COVID-19 vaccines that now exist. But in the eyes of the immunologists themselves, how did the COVID-19 pandemic change their scientific lives, for better or for worse?

At the end of 2020, *Nature Reviews Immunology* invited a number of immunologists who had recently written articles for our journal to share their personal views on the impact of the pandemic. From their feedback, several key themes emerged. First, the pandemic was incredibly disruptive for most immunologists. Many labs had to close and even when they did reopen, they were only accessible to those who were working on COVID-19. One respondent lamented “...all other research has been left on the side.” Another expressed concern that the cancellation of in-person networking and conferences had “greatly impeded the scientific dialogue.” Changes to teaching practices caused major headaches for those with lecturing responsibilities and lab staff suffered both emotionally and financially. One principal investigator told us that their technicians were not entitled to unemployment support from the government, which put huge pressure on their lab’s finances. Others were concerned about the effects of lab shutdowns on junior researchers; “I feel deeply for our research trainees who have been at a loss ... limiting face-to-face interactions has diminished their learning.” The uneven burden of the pandemic on female scientists has previously been documented<sup>1</sup>, and in this regard the field of immunology is no different. Going forwards, it will be imperative to put in place robust measures to help re-energize the careers of trainee immunologists and those with caring responsibilities.

However, in the face of all of these challenges, a positive common response was a sense of awe at the speed at which immunologists were able to pivot their research to respond to the pandemic. Most were struck by the powerful sense of collaboration fostered in 2020, following unprecedented levels of international cooperation

between academia, pharmaceutical companies, governments and non-governmental organizations. As one immunologist put it, “nearly the entire community of biologists came together”, with another predicting “this will lead to a new era for biotechnology research.” It is clear that conducting research related to COVID-19 also provided immunologists with a sense of purpose during a difficult year. One scientist told us, “All of us wanted to feel meaningful in the fight against COVID” and another that “in these challenging times, research has been an anchor for so many of my colleagues.” In addition, members of the global immunology community organized virtual conferences that were attended by far more individuals than any traditional in-person conference could hope to attract. Other pursuits also successfully transitioned to the virtual space; one respondent told us that “we now know scientists can contribute to clinical problems via remote research activities” and another that “2020 has taught us that many educational and research activities can be carried out online or remotely ... after the pandemic is over, this is expected to continue.”

The immunologists we contacted shared their views on the positive and negative aspects of communicating science to the public in the era of COVID-19. Many were active on social media and had participated in interviews or documentaries for radio, television and other media throughout 2020. “This was a chance to show the crucial role that science plays every day,” said one, while another expressed their view that the broader public interest in immunology “increased the likelihood of translational work being funded.” One immunologist believed that the pandemic had taught the public that “science is not always linear, but can be controversial, data can be interpreted differently — there are more ways than one towards the same end.” However, respondents also commented on the depressing levels of trolling and abuse that scientists encountered this year, particularly through social media channels; “People have wished that I would get COVID and die.” Some felt that anti-vaccine groups had expanded into “anti-science disinformation groups linked to political extremism.” Yet, there were concerns that attempts to silence such voices on social media could do more harm than good; “It fuels conspiracy theories ... the censoring frightens me more than the virus.”

There was similar despair at the politicization of science; one immunologist commented on the difficulty

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of communicating science “in an era where the White House has made everything political.” Another spoke of the dangers of “the emergence of ‘populism’ into science ... telling people what they want to hear regardless of the scientific grounds.” Several immunologists stated that public trust in science had been severely undermined but felt the best way to overcome this would be for as many scientists as possible to participate in communicating to the public, “not just depending on a few key figureheads.” One respondent cited the importance of bona fide immunologists being given a platform to communicate, “...the public debate in my country is dominated by virologists and epidemiologists who mostly lack a deep understanding of immunology ... most think that antiviral immunity equals antibodies.”

What key lessons emerged from the research that was conducted by immunologists over the past year? According to several respondents, there is one crucial lesson: we do not know enough about human immunology. In the past, perhaps we never considered deeply enough why different patients can manifest such diverse courses of disease in response to a single infectious pathogen — this is not a phenomenon that is unique to SARS-CoV-2, but it has definitely become more apparent as a result of the virus. Another fear expressed was that many immunologists have a poor understanding of human immunology; “we need to improve human immunology education of immunologists ... it is striking how many published papers on SARS-CoV-2 just described regular effector immune responses against viruses.” Several scientists mentioned that they intend to focus more on human immunology as a result of the pandemic. Vaccines aside, some expressed disappointment at an apparent lack of success in developing new clinical interventions; “In the end we are still doing quarantine like in the Middle ages, while we wait for a vaccine, and only corticosteroids have shown benefits in severe cases — this is not new and not specific.” One scientist believed some researchers were more preoccupied with publishing papers than actually tackling the pandemic and suggested: “this could have been avoided if publications were not at the centre of academic advancement or at least if COVID research had been excluded from the metrics.”

With regards to publishing practices, there was a mixed response to the shift to preprints. Some immunologists have whole-heartedly embraced preprints; “It’s a welcome development, especially when fighting a public health crisis when information sharing can become life-saving”, but others felt the explosion of preprints has

led to confusion and shared concerns regarding the way some preprints that “created a lot of public attention and were spread by the media never made it through peer review.” For more on preprints, see our recent editorial<sup>2</sup>. In terms of traditional publishing, one respondent felt that “2020 overwhelmed the journals, editors and reviewers” — we can confirm this is true! Another serious issue raised was that the peer review system is now “seriously handicapped by expert reviewers not having the time or motivation to review all of the manuscripts ... based on time spent, if they were paid as consultants they would be paid hundreds or thousands of dollars per manuscript ... scientists’ time is so heavily committed nowadays.” Of course, this is not a new concern but the heavy burden the pandemic placed on immunologists has undoubtedly exacerbated the issue for the community.

Not surprisingly, most immunologists cited the development of highly effective vaccines in less than a year since the identification of SARS-CoV-2 as being a highlight of 2020. Indeed, this is undoubtedly one of the most remarkable scientific achievements of all time. With countries currently squabbling over vaccine deployment, perhaps it has been overlooked how remarkable it is that we even have a single effective vaccine already, never mind half a dozen<sup>3</sup>. This wasn’t a given a year ago. In their feedback, many immunologists stressed the importance of remembering that the vaccines have come from decades of research on many aspects of immunology, not from a sole year of research on a single virus. As one immunologist put it, “The knowledge built in other fields of immunology and infectious diseases could be immediately used and tested in research on COVID-19.” A number of immunologists commented on the importance of ensuring that we have strong infrastructure and research funding in place in the better times so that we are well placed to respond to any new challenges that emerge. The immunology researchers who came to our rescue in 2020 had always been there in the lighter times, they were just less visible. When the sun rises after the COVID-19 pandemic it will be vital for governments to maintain funding to fuel the future stars of immunology.

1. Myers, K. R. et al. Unequal effects of the COVID-19 pandemic on scientists. *Nat. Hum. Behav.* **4**, 880–883 (2020).
2. Watching preprints evolve. *Nat. Rev. Immunol.* **21**, 65–66 (2021).
3. Carvalho, T., Krammer, F. & Iwasaki, A. The first 12 months of COVID-19: a timeline of immunological insights. *Nat. Rev. Immunol.* <https://doi.org/10.1038/s41577-021-00522-1> (2021).

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