Credit: photograph by dorisj / Moment / Getty

2021: research and medical trends in a post-pandemic world

Goodbye 2020, a year of arguably too many challenges for the world. As tempting as it is to leave this year behind, the biomedical community is forever changed by the pandemic, while business as usual needs to carry on. Looking forward to a new year, experts share six trends for the biomedical community in 2021.

Mike May

Summing up 2020, Sharon Peacock, director of the COVID-19 Genomics UK Consortium, says “we’ve seen some excellent examples of people working together from academia, industry, and healthcare sectors...I’m hopeful that will stay with us going into 2021.” Nonetheless, we have lost ground and momentum in non-COVID research, she says. “This could have a profound effect on our ability to research other areas in the future.”

The coronavirus SARS-CoV-2 has already revealed weaknesses in medical research and clinical capabilities, as well as opportunities. Although it is too soon to know when countries around the world will control the COVID-19 pandemic, there is already much to be learned.

To explore trends for 2021, we talked to experts from around the world who specialize in medical research. Here is what we learned.

1. The new normal

Marion Koopman, head of the Erasmus MC Department of Viroscience, predicts that emerging-disease experts will overwhelmingly remain focused on SARS-CoV-2, at least for the coming year.

“I really hope we will not go back to life as we used to know it, because that would mean that the risk of emerging diseases and the need for an ambitious preparedness research agenda would go

to the back burner,” Koopman says. “That cannot happen.”

Scientists must stay prepared, because the virus keeps changing. Already, Koopman says, “We have seen spillback [of SARS-CoV-2] into mink in our country, and ongoing circulation with accumulation of mutations in the spike and other parts of the genome.”

Julen R. Zierath, an expert in the physiological mechanisms of metabolic diseases at the Karolinska Institute and the University of Copenhagen, points out that the pandemic “has raised attention to deleterious health consequences of metabolic diseases, including obesity and type 2 diabetes,” because people with these disorders have been “disproportionally affected by COVID-19.” She notes that the coupling of the immune system to metabolism at large probably deserves more attention.

2. Trial by fire for open repositories

The speed of SARS-CoV-2’s spread transformed how scientists disseminate information. “There is an increased use of open repositories such as bioRxiv and medRxiv, enabling faster dissemination of study and trial results,” says Alan Karthikesalingam, Research Lead at Google Health UK. “When paired with the complementary — though necessarily slower — approach of peer review that safeguards rigor and quality, this can result in faster innovation.”

“I suspect that the way in which we communicate ongoing scientific developments from our laboratories will change going forward,” Zierath says. That is already happening, with many meetings going to virtual formats.

Deborah Johnson, president and CEO of the Keystone Symposia on Molecular and Cellular Biology, notes that while virtual events cannot fully replace the networking opportunities that are created with in-person meetings, “virtual events have democratized access to biomedical research conferences, enabling greater participation from young investigators and those from low-and-middle-income countries.” Even when in-person conferences return, she says, “it will be important to continue to offer virtual components that engage these broader audiences.”

3. Leaps and bounds for immunology

Basic research on the immune system, catapulted to the frontlines of the COVID-19 response, has received a boost in attention this year, and more research in that field could pay off big going forward.

Immunobiologist Akiko Iwasaki at the Yale School of Medicine hopes that the

pandemic will drive a transformation in immunology. “It has become quite clear over decades of research that mucosal immunity against respiratory, gastrointestinal, and sexually transmitted infections is much more effective in thwarting off invading pathogens than systemic immunity,” she says. “Yet, the vast majority of vaccine efforts are put into parenteral vaccines.”

“It is time for the immunology field to do a deep dive in understanding fundamental mechanisms of protection at the mucosal surfaces, as well as to developing strategies that allow the immune response to be targeted to the mucosal surfaces,” she explains.

“We are discovering that the roles of immune cells extend far beyond what was previously thought, to play underlying roles in health and disease across all human systems, from cancer to mental health,” says Johnson.

She sees this knowledge leading to more engineered immune cells to treat diseases. “Cancer immunotherapies will likely serve as the proving ground for immune-mediated therapies against many other diseases that we are only starting to see through the lens of the immune system.”

4. Rewind time for neurodegeneration

Oskar Hansson, research team manager of Lund University’s Clinical Memory Research, expects the trend of attempting to intervene against neurodegenerative disease before widespread neurodegeneration, and even before symptom onset, to continue next year.

This approach has already shown potential. “Several promising disease-modifying therapies against Alzheimer’s disease are now planned to be evaluated in this early pre-symptomatic disease phase,” he says, “and I think we will have similar developments in other areas like Parkinson’s disease and [amyotrophic lateral sclerosis].”

Delving deeper into such treatments depends on better understanding of how neurodegeneration develops. As Hansson notes, the continued development of cohort studies from around the world will help scientists “study how different factors — genetics, development, lifestyle, etcetera — affect the initiation and evolution of even the pre-symptomatic stages of the disease, which most probably will result in a much deeper understanding of the disease as well as discovery of new drug targets.”

5. Digital still front and center

“As [artificial intelligence] algorithms around the world begin to be released more commonly in regulated medical device software, I think there will be an increasing trend toward prospective research examining algorithmic robustness, safety, credibility and fairness in real-world medical settings,”

says Karthikesalingam. “The opportunity for clinical and machine-learning research to improve patient outcomes in this setting is substantial.”

However, more trials are needed to prove which artificial intelligence works in medicine and which does not. Eric Topol, a cardiologist who combines genomic and digital medicine in his work at Scripps Research, says “there are not many big, annotated sets of data on, for example, scans, and you need big datasets to train new algorithms.” Otherwise, only unsupervised learning algorithms can be used, and “that’s trickier,” he says.

Despite today’s bottlenecks in advancing digital health, Topol remains very optimistic. “Over time, we’ll see tremendous progress across all modalities — imaging data, speech data, and text data — to gather important information through patient tests, research articles or reviewing patient chats,” he says.

He envisions that speech-recognition software could, for instance, capture physician–patient talks and turn them into notes. “Doctors will love this,” he says, “and patients will be able to look a doctor in the eye, which enhances the relationship.”

6. ‘Be better prepared’ — a new medical mantra

One trend that every expert interviewed has emphasized is the need for preparation. As Gabriel Leung, a specialist in public-health medicine at the University of Hong Kong, put it, “We need a readiness — not just in technology platforms but also business cases — to have a sustained pipeline of vaccines and therapies, so that we would not be scrambling for some of the solutions in the middle of a pandemic.”

Building social resilience ahead of a crisis is also important. “[SARS-CoV-2] and the resulting pandemic make up the single most important watershed in healthcare,” Leung explains. “The justice issue around infection risk, access to testing and treatment — thus outcomes — already make up the single gravest health inequity in the last century.”

One change that Peacock hopes for in the near future is the sequencing of pathogens on location, instead of more centrally. “For pathogen sequencing, you need to be able to apply it where the problem under investigation is happening,” she explains. “In the UK, COVID-19 has been the catalyst for us to develop a highly collaborative, distributed network of sequencing capabilities.” □

Mike May

Freelance writer and editor, Bradenton, FL, USA.

Published online: 7 December 2020

<https://doi.org/10.1038/s41591-020-01146-z>