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EDITORIAL

Researching the pandemic and research during the pandemic

While 1918–20 has several landmarks in the history, in the past 18 months, we remember it as the period of Spanish Flu pandemic. The first World War ended in 1919 and even those who claimed victory desired a more peaceful world. During that time, research in sciences had a major leap with the evidence-based confirmation of general relativity in 1919, theory of evolution, etc. However, nothing was known about viruses and thus pandemics such as Spanish flu caused massive deaths across the world. Other than wearing masks and maintaining isolation/quarantine, there was nothing much the public health system anywhere in the world could do about it.

Since then, there have been many outbreaks of infectious diseases, but the truly global pandemic is the one we are experiencing now. However, not only we know so much about viruses, but we also have considerable knowledge of our immune system that fights infections. Within days of the first report of a new flu-like disease, scientists discovered which virus, how to diagnose for its infection and how it enters human lung cells and causes the disease. This enabled wide deployment of RT-PCR based diagnostics across the world and interventions such as inhibitors of cytokine storm, viral entry and its replication, and rapid development of vaccines. Most important among these are molecular diagnostics that helped to identify even those who do not show symptoms and thereby isolating them to contain the spread of the virus. If the pandemic has grown larger and creating havocs to lives and livelihood, it is the modern lifestyle, our extreme mobility and the way we run our economy. This is not to claim that we know all about the virus and the way we respond to this infection. There is much to learn, discover and innovate to deal with a pandemic such as COVID-19. First time since the deep understanding of the molecular basis of life, we have an opportunity to study evolution of viral genomes as they spread across diverse human populations, our response to infection and the influence of our genetics, nutrition and geoclimatic conditions. For example, we could follow impact of vaccination, not by only measuring levels of protective antibodies, but also by studying vaccine breakthroughs.

Are we doing enough research on the pandemic? Except a handful of serosurveys, epidemiological analysis of cases/trends/modelling, we hardly taken up deep dive into COVID-19 research. Why is that we in India are not using all the talents of molecular biology, biochemistry, immunology, physiology, biophysics/structural biology in addressing a once-in-a-century calamity such as COVID-19 pandemic. Notwithstanding a few anti-science votaries, the whole humanity is looking up to scientists to provide relief from COVID-19. Except a few scientists working under constrained conditions, most basic and applied biologists in India have kept themselves away from research on COVID-19. We need to introspect. Our scientists did not see this as an opportunity to relate their expertise and skills to address a real-life problem. Our funding agencies not doing enough to attract and incentivize best minds in India to work on COVID-19. Testing and clinical data collected since the beginning of this pandemic would be a goldmine for scientists to discover more and to provide evidence-based recommendations to improve public health. The government should make all the data on the pandemic freely accessible, increase budget for science, ease the process of procurement of needs of the laboratories and involve practising virologists, immunologists and epidemiologists in dealing with the pandemic. Here are some of the immediate steps that the entire S&T ecosystem should take up to help the society to reduce its public health burden and to provide an opportunity to scientists to discover more, specifically, on viruses, human biology, ecology and evolutionary biology.

- The manifestation of COVID-19 is influenced by population density, economic/social activities, genetic and nutritional differences among people, geoclimatic conditions, etc. It is no surprise that dynamics of the pandemic is very different in different parts of the country. Even within a city, different locations have been showing different trends. In this context, all funding agencies, institutions/universities and corporates funding research through CSR should encourage large number of small budget projects on epidemiology (including serosurveys) so that every district in India is studied in greater details.
- The GenomeIndia project should be fast-tracked by providing more resources and connecting the outcome to understand differential manifestation of COVID-19 among people of India.
- We need large number of long-term follow up studies across the country to understand immune response to

infections and vaccinations. As the pandemic is 18-month-old and the virus is still evolving and spreading, this is the best time to study the impact of host–pathogen interactions at the population, ecological and evolutionary biology level.

- Central, state and city governments should make all granular data on the pandemic accessible for epidemiological analysis to derive maximum information that is valuable for further strategies to deal with the pandemic and at the same time to revive livelihoods and the economy.
- As the variants are emerging in large numbers, we need to enhance our capacity to sequence samples from across the country. Based on epidemiological studies on testing and clinical data, we need to identify potential bottlenecks and selection pressures that may provide platforms for new variants to emerge and sequence more samples corresponding to those contexts.
- We need to establish more BSL-3 facilities to fast-track live virus protection assays to understand to what extent antibodies produced in human hosts again by natural infection and/or vaccinations would prove protective against new variants being reported in large numbers. Such studies too should consider host-level variations such that vaccination strategies may be modified to make them more comprehensive to eliminate the virus and end the pandemic.
- All institutions/universities with required expertise in structural biology, biochemistry and cell and organismal biology and access to necessary facilities should collaborate with pharma companies to develop new therapeutics, drug repurposing, etc.

Ironically, although science has gained unprecedented public attention and confidence, the pandemic caused movement restrictions, lockdowns, reduced funding for research – all are affecting our scientific community, demoralizing both young faculty and students. Two years of no progress in research is a huge blow to the career progression of young scientists. Institution/university management, senior scientists, academies and various organizations working for the promotion of science should come together to mentor our young minds and boost their confidence. We should mentor young scientists to sail through this period by innovative means. This is the time for collaborations and for team science. As teaching moved online out of compulsion, pursuit of scientific research should come out of four walls of single PI labs. If not voluntarily, by adapting to new culture out of compulsion. The system should stand up to the challenge and create new opportunities for scientists and enable science to take quantum leaps the way physics progressed between the first and the second World War. Here are a few action points for our institutions and scientists, which are within our own reach and no major policy intervention is needed from the government.

- The current pandemic, which has disrupted every aspect of our life and society, is the crisis of sufficient severity for our institutions and universities to unlock their so called ‘reserve/corpus funds’. What is the use of maintaining large ‘reserve/corpus funds’ if organizations suffer with irreparable loss of confidence and expertise? Use the funds to provide necessary cash flow needed to keep the research going through this pandemic. Many PhD students are out of fellowship and faculty cannot purchase consumable/small equipment for research. Provide them funds to meet these expenses and stay afloat. The senior management of the organizations should see this as an investment for the future.
- Institutions/universities should seed-fund novel interdisciplinary and multi-PI science projects within their own campuses and between campuses. A certain fraction of projects, thus initiated, may grow to full-fledged large projects (a few may eventually become mega science projects) with sufficient preliminary data and attract grants from funding agencies.
- The pandemic also has seen large amount of funds being infused for scientific research in India through CSR and other forms of donations. Much of this, understandably, is for research on COVID-19. However, the trend is expected to continue after the pandemic and will expand to all areas of scientific research. Receiving funds under CSR or by endowments needs change in our culture of how we write grant applications, how we adhere to our commitment on timely deliverables and improving our ability to deploy ideas for public good or to monetize wherever opportunities exist.
- Scientists and students should use the free time to review their work, recalibrate/redesign experiments, write reviews consolidating state-of-the-art knowledge and identifying gaps in our understanding in a given field of research.
- The pandemic has seen the importance of open data sharing policy. All the information on the virus and the disease were openly shared with the global community in real time thus enabling larger populations to benefit from scientific discoveries. This trend should continue beyond the pandemic and should expand to all areas of science.
- Our scientific community should collectively influence policy makers to take the problems of climate change and loss of biodiversity more seriously and help them frame policies to reverse and mitigate the same.
- The entire scientific community should work in unison to promote public awareness of science and to fight pseudoscience and obscurantism.

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