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Scientific Life

Challenges and Opportunities for the Biotechnology Research Community during the Coronavirus Pandemic

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The coronavirus disease 2019 (COVID-19) pandemic has presented some significant challenges to the scientific community. However, this has also offered opportunities for the pursuit of new scientific activities, and in particular for the field of biotechnology.

The COVID-19 pandemic has dramatically affected the health, economy, and social mobility of people in countries around the world (<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>). Actions undertaken by health officials and agencies to slow down the infection rate have required imposition of extreme measures of limited mobility and social distancing. Almost all areas of our daily lives have been almost halted, and science has been no exception. Although biotechnology research is an essential activity to advance the development of key interventions to fight off this pandemic, including vaccine development and drug discovery, most academic research groups around the world have had to either stop or drastically modify their activities.

The daily work schedule of an academic involves multitasking. Under this current

environment, all teaching has been shifted from on-campus classrooms to online distance learning, and committee meetings have also been shifted to a variety of web-conferencing and/or video conferencing platforms, thereby dramatically changing our daily academic schedule. Yet, these changes have benefited some other research activities, particularly in critical areas of biotechnology research. This new and unusual environment could serve as a tremendous opportunity for highly motivated researchers. Under these unusual circumstances, academic researchers can work on pending manuscripts, analyze data, conduct experiments left behind on the back burner, and more importantly pursue new ideas for discovery: developing vaccines and monoclonal antibodies, and screening antiviral compounds, such as secondary metabolites and peptides; thereby, actively participating in finding solutions to ongoing real-time global human and economic crises.

However, this imposes some difficulties, such as limited research personnel present at the same time within the laboratory to maintain social distancing, absence of technical support personnel at core facilities – sequencing, NMR/mass spectrometry, scanning/transmission microscopy, and animal care facilities, among others – as well as those working in supply stores. Moreover, a principal investigator (PI) may also face loss of many skilled laboratory personnel that may fall within one of the risk groups, including pregnant women, those with children or elders living at home, those with immunocompromised systems, or those with comorbidity factors. In fact, this particular pandemic is forcing people to re-evaluate their roles as scientists. Often, we are fortunate enough to be able to delegate some of the family-related responsibilities to others (e.g., day-care system, schools, or other family members); however, social distancing policies have completely disrupted these

critical resources and jeopardized our work, as we cannot juggle between work and home environments. For example, currently, a large segment of PIs, researchers, and graduate students are engaged in supervising their underage at-home children for their daily education, as distance-learning has turned parents into full-time teachers. Sometimes, this is a dominant responsibility that even those who are fortunate have to put aside their research activities to deal with their new home or family routine. Unfortunately, in some societies, such as in Mexico and in other developing countries, these issues are shaped by gender roles. Therefore, research projects are most likely to be either downsized or limited, thereby adding some stress elements to the work environment. As with any obstacle or a difficult circumstance, a researcher will often be ready to tackle any unexpected problems and overcome such obstacles by improvising. In this new research reality, it is important to come up with alternative cost-effective experimental and technical protocols that guarantee success of biotechnology-related projects.

As mentioned previously, the role of a PI has undoubtedly changed during the COVID-19 pandemic, but so have the roles of other essential members of a research team, including technicians, graduate students, postdoctoral fellows, and research scientists. Perhaps with the exception of most technicians, these personnel can take advantage of the halt in bench work to analyze pending data, review literature, write articles or dissertations, or perhaps explore new avenues for research discovery, such as *in silico* studies, modeling, or bioinformatics. More research groups in academia and in private industry are now offering free webinars to share and demonstrate new technologies or experimental protocols. Thus, in some cases, young researchers will have valuable new opportunities to acquire and develop new skills and ideas to make the best out of this situation.

However, it would be wrong to assume that under current circumstances these work-related activities will be undertaken with the same level of dedication and efficiency. We ought to be cognizant, as PIs and mentors, that personal isolation and associated stress related to this new social paradigm that we are living in can have severe psychological consequences. On the one hand, we have to be highly self-motivated, and we have to motivate others to be productive so that no one falls into despair. On the other hand, we have to understand that it is impossible to ask of everyone to focus on work at the same level as one would under normal conditions. For example, some members of a research group might be worried about their (or their family's) financial situation, timeline for completing degree requirements, or future job prospects. In fact, the academic community will have to rethink most given aspects that serve as the cornerstone of our academic structure. Do we have to modify departmental or campus policies to allow for alternative means for graduate students to take exams or to defend their theses or dissertations? In some countries, such as Mexico, there are strict ceremonial PhD final exams, while others have quickly adapted and moved these to online platforms. The flexibility of each graduate program to adjust requirements and traditions will be key for positive outcomes. Yet, another important closely related issue that may arise is how to evaluate the performance of a graduate student or a post-doctoral fellow. Thus, we should seriously re-evaluate how we judge our new young scientists that are being trained during this time.

Another issue that comes to mind is to elevate science by asking scientific journals and editors to address issues of peer-reviewed research articles. Publishing scientific articles is of critical importance for pursuit of research discovery, as editorial boards of scientific journals

play important roles. For example, high-quality fast-track peer review processes should be more readily available to support expedited processing of research reports, especially in biotechnology research engaged in finding solutions to COVID-19. Are we in a position to afford waiting for a 4-month-long review process for studies on new vaccines, monoclonal antibodies, or diagnostics? This requires key support of the scientific community when serving as peer reviewers. Given the rapid evolution of COVID-19 and numerous associated knowledge gaps, access to new knowledge should be a priority, and in fact, other outlets of knowledge dissemination are also valuable, such as expert interviews, online World Health Organization guidelines, reports, and news. Furthermore, while researchers are uploading manuscript drafts onto platforms, such as bioRxiv, it is essential for editorial boards to step up during these times. Ethics and institutional review board committees are also paying special attention to evaluating laboratory protocols via videoconferencing meetings.

For those who find themselves lonely working from home; consider launching an online community with colleagues in your field of research. We are facing tough times along with an uncertain future. However, this also presents an opportunity to rethink how we interact with one another in ways that will benefit the larger scientific community for the long term. It also highlights that changes must be considered in managing laboratories, operation of funding agencies and scientific journals, and building cohesive scientific communities. It is remarkable to witness research groups and organizations all over the world that have been either donating reagents (e.g., plasmids) or sharing recent protocols for studying severe acute respiratory syndrome coronavirus (SARS-CoV)-2. In other words, we need to continue moving toward building a more cohesive scientific community, as we can

no longer afford the luxury of working alone or without considering the human aspect of biotechnology research.

What is the road ahead? In some countries, the peak of this pandemic has just been crossed over, and plans are underway to gradually move to 'normal' activities, albeit a 'new normal'. However, until there is an efficacious vaccine and an effective treatment, we should keep in mind that SARS-CoV-2 is likely to remain a seasonal pathogen. This current experience in mitigating a pandemic disease outbreak will be valuable in the event such an unprecedented lock-down is imposed in the future. Having acquired new skills and strategies to quickly adapt to a global disaster will allow us to better cope with such a situation in the future.

In conclusion, these new professional and human experiences gained through this global COVID-19 pandemic will serve without a doubt as an exceptional precedent of agility, innovation, and determination. Besides the technical aspects of conducting biotechnology research, improvisation, intelligence, good will, and generosity are key ingredients to fuel the research engine and of the human spirit, as we are both scientists and members of society.

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