



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Advances in Technology to Address COVID-19

Edward Kai-Hua Chow¹, Pak Kin Wong², and Xianting Ding³

This year has seen an unprecedented worldwide pandemic that has been brought on by the rise of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which results in COVID-19 (coronavirus 2019) infections. COVID-19 has impacted every aspect of our lives and has required the world to rapidly mobilize to address all aspects of diagnosis and treatment of this disease. COVID-19 has brought to light the challenges of managing a completely novel infectious disease with existing diagnostics and therapeutics that were insufficient to stem the spread of COVID-19. Thus, the resources allotted toward research and development and the global cooperation of governments, scientists, and clinicians to address COVID-19 required a pace of innovation in healthcare that has never before been observed in order to address this new disease. As a result of this effort, innovations in technology to better understand, detect, and treat COVID-19 continue to be reported every day. Here at *SLAS Technology*, we felt it was important to highlight these advances in technology that have been made to better address all aspects of COVID-19 detection and treatment. We present here a special issue that reports how technology has been used to address COVID-19.

The spread of COVID-19 across the world has shown that any hope for effective control of COVID-19 infection in the community requires the development of rapid and accurate methods for detecting COVID-19 infections. Applying existing and emerging viral detection technologies toward better COVID-19 diagnostics has resulted in incredible advances in pathogen detection innovations. Miniaturization assays that allowed for the accurate analysis and detection of SARS-CoV-2 viral nucleic acid detection or host antibody response to COVID-19 have proven to be critical.^{1–3} While diagnostics initially required clinical laboratory tests, these technological advances have proven critical for field testing in the community or in less well-equipped remote diagnostic testing sites. In addition to advances in detecting COVID-19 infections, leveraging technology to better understand COVID-19 disease progression and immune response is critical to developing better therapies to combat this pandemic. As a result, the molecular mechanisms of COVID-19 infection, as well as an understanding of the critical immune responses and overall biological responses to COVID-19, have been uncovered in an amazingly short amount of time. Much of this has been a result of the use of critical technologies such as single-cell analysis technologies and advances in mass cytometry.²

The last few years have seen a paradigm shift in the development and application of artificial intelligence (AI). This has been particularly true for life sciences and biomedical applications. In order to better understand and address COVID-19, AI has played a huge role in improving detection and therapeutic drug development. Of particular importance has been the development of multiple AI-based approaches toward improving COVID-19 detection through standard chest x-ray images.^{4,5} Applying AI toward COVID-19 diagnostics through existing standard medical imaging allows for more rapid diagnosis through telemedicine and automated tools. As AI begins to pervade every aspect of medicine, it is inevitable that advances in AI technology will be important to overcoming this pandemic.

It is now clear that COVID-19 is a unique infection that affects a wide range of biological systems. One of the most affected systems has been pulmonary function. The ability to treat COVID-19 patients has often required the use of ventilators, and the lack of sufficient ventilators has been linked to poorer outcomes. The paucity of ventilators available in comparison to COVID-19 infection rates led to a number of advances in ventilator technology to increase their production speed and portability while lowering their cost.⁶ These advances allow patients additional time to fight off infection as well as allow emerging therapies to work. This pandemic has adversely affected the lives of so many people in so many ways. But, it has also shown that when the global community comes together to collectively address a singular problem, amazing innovations in technology can happen that provide hope for a better future after the pandemic.

References

1. Zhu, N.; Wong, P. K. Advances in Viral Diagnostic Technologies for Combating COVID-19 and Future Pandemics. *SLAS Technol.* **2020**, *25*, 513–521.

¹Cancer Science Institute of Singapore, NUS, Singapore

²The Pennsylvania State University, University Park, PA, USA

³Shanghai Jiao Tong University, School of Biomedical Engineering, Shanghai, China

Corresponding Author:

Edward Kai-Hua Chow, Cancer Science Institute of Singapore, NUS, 14 Medical Dr., Singapore, 117599, Singapore.

Email: csikce@nus.edu.sg

2. Tan, A. S.; Nerurkar, S. N.; Tan, W. C. C.; et al. The Virological, Immunological, and Imaging Approaches for COVID-19 Diagnosis and Research. *SLAS Technol.* **2020**, *25*, 522-544.
3. Karp, D. G.; Cuda, D.; Tandel, D.; et al. Sensitive and Specific Detection of SARS-CoV-2 Antibodies Using a High-Throughput, Fully Automated Liquid-Handling Robotic System. *SLAS Technol.* **2020**, *25*, 545-552.
4. Sekeroglu, B.; Ozsahin, I. Detection of COVID-19 from Chest X-Ray Images Using Convolutional Neural Networks. *SLAS Technol.* **2020**, *25*, 553-565.
5. Echioui, A.; Zouch, W.; Ghorbel, M.; et al. Detection Methods of COVID-19. *SLAS Technol.* **2020**, *25*, 566-572.
6. Fang, Z.; Li, A. I.; Wang, H.; et al. Ambubox: A Fast-Deployable Low-Cost Ventilator for COVID-19 Emergent Care. *SLAS Technol.* **2020**, *25*, 573-584.