Editorial
Health Engineering for Combating CVD and COVID-19

THE steady increases in cardiovascular disease (CVD) and the continuing spread of coronavirus disease (COVID-19) remain unprecedented public health crises of international concerns. The multiple crises are causing catastrophic human losses and tremendous health and economic burdens worldwide [in item 1) of the Appendix]. According to the most recent Global Health Estimates from 2000 to 2019 released by the World Health Organization (WHO) on 9 December 2020, CVD has remained the global leading cause of death for the last 20 years. However, it is now killing more people than ever before [in item 2) of the Appendix]. Besides the CVD crisis, COVID-19 continues widely spread affecting more than 210 countries throughout the world with nearly 70 million confirmed cases and 1.6 million deaths as of 12 December 2020 [in item 3) of the Appendix]. It is projected that the total global deaths from CVDs and the total cases of COVID-19 infection will all continue to rise if no timely effective and preventive measures are taken.

The success of fighting against both deadly diseases will only come from a paradigm shift transforming the current reactive medicine focusing on the last stage of treatment to proactive health focusing on the early prediction, early diagnosis and prevention of diseases. Health engineering is emerging as a new interdisciplinary field for the implementation of proactive health.

To call for urgent actions addressing the society's most press health challenges, the President of IEEE-EMBS Dr. Shankar Subramaniam and the President-Elect Dr. Metin Akay led the COVID-19 initiative early this year and had some extensive strategic discussions with different stakeholders including Dr. Paolo Bonato the EiC of IEEE OPEN JOURNAL OF ENGINEERING IN MEDICINE AND BIOLOGY (OJEMB), Dr. Edward H. Livingston the Deputy Editor of JAMA, and myself as the EiC of IEEE REVIEWS IN BIOMEDICAL ENGINEERING (R-BME) in March 2020. A framework on COVID-19 initiative was proposed with some specific areas such as

- Low cost, effective and high throughput detection systems.
- Safety medical devices for health care personnel dealing with the crises.
- Modeling of infection, progression, spreading and population dynamics processes.
- Development of sensors and mHealth for tracking and follow-up of elderly patients.
- Immune engineering and scaling of vaccine development processes, etc.

Subsequently, among many activities under the initiative, R-BME through a super-fast-track process published several invited papers on COVID-19 on IEEE Xplore in April 2020, all of which are included in this volume 14 as a Special Section on technologies for the management of COVID-19. This special section presents a snapshot of recent developments in some core areas of biomedical and health engineering with their applications for the management of COVID-19.

The paper by Shi *et al.* reviews artificial intelligence techniques in imaging data acquisition and diagnosis for COVID-19. The paper by Dong *et al.* presents the role of imaging in the detection and management of COVID-19. Gharizadeh *et al.* examine the issues on molecular diagnostics and immunoassays in the context of COVID-19 management. Finally, wearable sensing and mobile health technologies with potential applications in COVID-19 and CVD is considered in the paper by Ding *et al.*

I would like to take this opportunity to thank all the authors in this volume for their submissions. I am also indebted to a small army of referees who have put in their hard work to review each paper in a timely and professional way. I hope that the contents presented here will stimulate new contributors to make future submissions to R-BME and address the public health emergencies of international concerns in a timely and effective manner.

YUAN-TING ZHANG, *Editor-in-Chief*
Director of Hong Kong Centre for Cerebro-cardiovascular Health Engineering
Chair Professor of Biomedical Engineering
CityU of Hong Kong

APPENDIX
RELATED WORK

1) The IEEE EMBS Grand Challenges Forum on COVID-19, 2020. [Online]. Available: https://grand-challenges.embs.org/2020covid/
2) "WHO reveals leading causes of death and disability worldwide:2000–2019," World Health Organization, Geneva, Switzerland. Accessed Dec. 9, 2020. [Online]. Available: https://www.who.int/news/item/09-12-2020-who-reveals-leading-causes-of-death-and-disability-worldwide-2000--2019
3) WHO Coronavirus Disease (COVID-19) Dashboard. Accessed Dec. 12, 2020. [Online]. Available: https://covid19.who.int/

Digital Object Identifier 10.1109/RBME.2020.3046348