

Advances in engineering and technology have played an indispensable role in shaping social and economic development. A host of new global challenges have appeared, though, that must be addressed through engineering education, research, and solutions.

To address such challenges, the national academies of engineering of China, the United Kingdom, and the United States have jointly sponsored four Global Grand Challenges Summits (GGCS) since 2013. The GGCS were launched to accelerate global engagement on the Grand Challenges for Engineering—14 goals for improving life on the planet—and encourage international collaborations to achieve them.

Coming together in the spirit of the Grand Challenges initiative, the Chinese Academy of Engineering (CAE), Royal Academy of Engineering (RAEng), and US National Academy of Engineering (NAE) jointly affirm our commitment to foster and facilitate international action to respond to the global COVID-19 pandemic through engineering approaches.

Three Grand Challenges are specifically relevant to the engineering response to the pandemic.

As computers have become available for all aspects of human endeavors, there is now a consensus that a systematic approach to health informatics—the acquisition, management, and use of information in health—can greatly enhance the quality and efficiency of medical care and the response to widespread public health emergencies. Health and biomedical informatics encompass issues from the personal to global, ranging from thorough medical records for individual patients to the sharing of data about disease outbreaks among governments and international health organizations.

Robust health informatics systems enable health professionals to detect, track, and mitigate public health emergencies. Recent events underline the importance of developing and implementing such systems and of openly disseminating their data.

The three academies affirm the importance of international cooperation in sharing public health information in response to the pandemic.

Engineers are at the forefront of developing new systems and technologies to use genetic information, sense small changes in the body, assess new drugs, and manufacture and deliver vaccines. All of these are important in the face of a global pandemic. Scientists and clinicians depend on engineers to provide them with the instruments and analytical and quantitative methods they need to perform cutting-edge work.

One recent example of this vital dependence was the collaboration between research scientists and engineers to quickly determine the viral sequence of SARS-CoV-2 and make it freely available online in early 2020. This required a very broad array of engineering input and coordination: bioengineers designed the biochemical sequencing steps used to characterize the virus, mechanical engineers developed the fluidic system to move material accurately through instrumentation, optical and electrical engineers provided the sensors needed to detect the sequencing reactions, material engineers created circuitry that worked in aqueous environments, and computer engineers developed the hardware and software needed to extract necessary information from the resulting terabytes of data.

Conquering the pandemic—and preventing future ones—will require advances in devices, diagnostics, vaccine development and production, and data analytics. The three academies jointly recommend that international collaboration, rather than competition, be a driving force in developing them.

The fact that the world is facing the challenge of COVID-19 further validates the need for the three academies' continued collaboration to address global grand challenges. International cooperation in response to the pandemic is one of the obvious examples of our efforts to address the Grand Challenges for Engineering. The three academies stand ready to work with the global engineering, science, and technology communities to strengthen innovation and cooperation, promote more open, inclusive, and mutually beneficial international exchanges, and contribute to global economic recovery and a more robust public health system.

As long as the global engineering community stands together and helps each other in this difficult time, we will be able to overcome the pandemic and usher in a better shared future. To that end, the CAE, RAEng, and NAE will organize and webcast a three-seminar series in 2021—one organized by each academy—on the pandemic-related engineering advances each country has achieved and

A handwritten signature in black ink, appearing to read "James P. Jewell". The signature is fluid and cursive, with a large initial "J" and "P".