With the first clinical use of the artificial kidney over five decades ago, we entered into a new era of medicine, that of substitutive and replacement therapy. Even still, it took another 15 years until chronic treatment was possible and another 15 years until more widespread treatment was possible due to government support. The history of development and clinical use of other artificial organ technologies such as the artificial heart and heart valves, the artificial lung, artificial blood, joint replacements, the artificial liver, the artificial pancreas, immunologic, metabolic, and neurologic support, neurocontrol, and tissue substitutes have followed similar long development paths. Despite their time to be put into clinical use, the contributions of artificial organ technologies to the betterment of mankind have been unquestionably large. For example, modern day surgery would not be possible without heart-lung support and the technologies for heart support have led to the development of various minimally invasive technologies. The powerful impact that artificial organ technologies presently have on our lives is seen through the statistic that in the U.S. one in ten persons are living with implanted medical devices. With the aging of our population and the improvements in technologies these numbers will only increase.

Health technologies including artificial implants ranked as one of the top 20 engineering achievements of the 20th century even through their availability was not witnessed until the second half of the century. These achievements have come through the collective contributions of many and of various disciplines and from those from all parts of the world. Even still, these accomplishments will be dwarfed by the developments in their infancy today and those yet to be developed. While the earliest of artificial organ technologies were generally mechanical substitutes, not uncommon today are systems incorporating biological agents. The future growth for applications will be for organ failure prevention, improved quality of life, and therapies that are more cost-effective than their historical counterparts. These improvements will also increase the worldwide availability of these technologies.

To address the future needs, today’s organ system designers must bring together even more knowledge than was heretofore available from many diverse fields. Advances in the fields of nanotechnology and microelectronics, genetic engineering and stem cell science, bioinformatics and artificial intelligence, genomics and proteomics, and diagnostic and sensing technologies will play even larger roles in future organ designs. The focus will be more concentrated on organ repair and biological replacement that will incorporate feed-back control and system adaptability than on end-stage organ replacements. Such designs will also be more individualized to the patient’s changing needs. As we move forward we must embrace the changes and cross those boundaries that presently impede us to develop better organ systems.