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In the last century, there has been a dramatic increase in the global population. There has also been an unprecedented improvement in the quality of life nearly everywhere, though the world's poorest have benefitted least from this. These deep changes in human society have had a significant impact on the biosphere, posing serious sustainability issues.

Several institutions, the United Nations among them, have identified key Global Grand Challenges in the areas of water supply, energy production, food supply and health care. The Grand Challenges are intrinsically of a multidisciplinary nature and chemical and biochemical engineering, which is itself multidisciplinary, has already been important. For example:

- Water supply: In the last 25 years, access to good quality water has gone up from 75% to 90% of the world population. Nevertheless, more than 1 billion people still do not have access to water of acceptable quality for home, agriculture and industrial uses and 2.5 billion people do not have adequate sanitation. The contribution of chemical and biochemical engineering, together with other related disciplines, to efficiently manage, treat, reclaim and distribute the needed water, including industrial water supply and utilization, is unquestionable.
- Energy production: The last two centuries of economic development have been based on the supply of abundant fossil fuel-based energy, though we now understand its contribution to climate change. Energy saving and the development of new renewable sources of primary energy have been subjects of research within the chemical and biochemical engineering communities for decades. For example, chemical and biochemical engineers have worked to reduce the environmental impact of conventional energy generation by limiting emissions of gases such as sulfur oxides, nitrogen oxides and carbon dioxide, and to develop renewable energies (photovoltaics, wind power, biofuels), biobased alternative fuels, and new generations of energy storage (lithium, sodium and vanadium batteries, power-to-X). They have also made efforts to find an integrated energy supply-demand solution.
- Food supply (production and conservation of food products): Estimates suggest that in the next 20 years we shall need to produce 30–40% more food than today. Although there have been great advances, nearly 1 billion people still suffer from hunger and more than 500 million children still see their development and prospects in life seriously diminished. The new concept of the Smart Farm (farms where multiple parameters are measured and controlled) gives hope for a huge and much needed increase in productivity. Improved crop seeds and targeted fertilizer use are also key to increases in production. Developments in aquaculture offer new possibilities of cheap and abundant proteins. Chemical and biochemical engineers are also investigating innovative processes as well as the use of new materials and additives for long shelf life foods.
- Health care: Chemical and biological products such as pharmaceuticals, therapeutic drugs, vaccines, diagnostics, and biomedical materials have all changed the world's health care. And further revolutions to come, for example, understand the multiple processes in cancer, personalized medication, gene therapy, regenerative medicine. All these breakthroughs will enhance human health while raising new ethical and social questions. There will be similar and important applications in veterinary science, improving animal welfare.

Chemical and biochemical engineering will be vital to addressing the Grand Challenges, for example through obtaining better commercial products, developing more sustainable industrial production systems, and reducing environmental impact through better use of energy sources. Chemical and biochemical engineering will also have a role to play in other emerging fields such as climate change mitigation, smart materials and electronic plastics, and biocompatible products.

We must rise to the challenge of educating students with appropriate skills and knowledge, recognizing that their careers

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will span the decades in which these novelties will become commonplace.

In this context, **WE DECLARE:**

An increasing world population, in a world of finite natural resources, requires ever more innovative engineering to solve problems and produce new and better products with a negligible environmental footprint. We, as chemical and biochemical engineers, renew our commitment to use our skills to improve the quality of life, foster employment, advance economic and social development and protect the planet through sustainable development. Chemical engineering and related sciences and technologies must play a key role in meeting future societal needs. This requires us to:

- Promote research and development as a fundamental pillar and encourage technology development to achieve a planet able to sustain a growing population, while improving quality of life.
- Facilitate global dissemination of chemical and biochemical engineering technical knowledge and industrial best practices, striving to bring together academia and industry worldwide.
- Promote conservation and care of global resources, health, safety, and the environment.
- Promote the highest standards of professional ethics and conduct for chemical engineers worldwide, to safeguard the public.

Therefore, **WE REQUEST:**

- That governments and organizations promote public and private investment in research, development and innovation, allowing freedom for research within ethical and safety boundaries.
- That governments consider all scientific views when making decisions about how to solve the great challenges facing humanity. There should be public support of scientists and engineers, funds should be allocated by competitive calls, and peer review should be standard practice.
- That chemical and biochemical engineering, which brings together many disciplines and technologies, should be considered essential and therefore be supported by public research, development and innovation programs.
- That resources and education are made the centre of all strategies for addressing the Grand Challenges. Educating coming generations is the key to adapting to the new and changing world. Thus, education must be cherished. New and appropriate education systems and content must be developed and promoted, and made accessible for everybody. In this way we will find, as we have in the past, that human skill, ingenuity and endeavor will enable us to succeed.

October 5, Barcelona, Spain

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