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EDITORIAL

Editorial: Immunoengineering—From Biologics to Biomaterials

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The immune system plays a vital role in maintaining health of an individual, and understanding its function has been an area of intense scientific study for over a century. Specifically, the last three decades have seen important progress made in our comprehension of immune components and function. Paralleling these advances are the developments in the fields of genetic and cellular engineering, and materials science, which upon application in immunology has given rise to the field of immunoengineering.

The term immunoengineering has meant different things to researchers from different backgrounds. Broadly, it may be defined as the utilization of engineering concepts and tools to modulate immune function, with a focus on developing new therapeutics. Importantly, the term 'engineering' is used in its more general sense to include tools of both biological and synthetic origins. Using this general definition, articles in the current issue introduce concepts and emerging ideas in immunoengineering.

Sujan Dhar and Manjula Das provide a comprehensive account of possibly the first ideas to engineer an immunotherapeutic. Their article discusses the need for antibody therapeutics, and describes the evolution of technology to engineer antibodies leading to their current applications in the treatment of cancer. Staying on the topic of cancer therapeutics, Ashwini Balakrishnan provides a broad summary on the design and development of chimeric antigen receptor (CAR) T cells. These are genetically engineered cells specifically developed to kill cancer cells with remarkable efficacy, and have been recently approved by the FDA as a cellular therapeutic for the treatment of blood cancers.

Another important application of immunoengineering is to improve our understanding of the immune system. Anmol Chandele elaborates on new technologies for deciphering the complexities of the human system, with a focus section on multi-parametric flow cytometry. These technological advances are discussed in the context of developing new vaccines against many prevalent pathogens. Emerging ideas in vaccine technologies shifts our focus to the world of biomaterials, with its many recent contributions to improving vaccine efficacy.

Biomaterials have the potential to overcome the shortcomings of traditional therapeutics, and hence their immunomodulatory capacity is currently being explored in the laboratory. Siddharth Jhunjhunwala summarizes many such biomaterial-based approaches for modulating immune responses, and provides details on technologies that are in advanced stages of development or already in clinical trials. Focusing on one specific biomaterial technology, Sahoo et al. examine the exciting developments in the field of supramolecular biomaterials and their applications in engineering immune responses. With their numerous advantages, these materials hold much promise in the clinical advancement of biomaterial-based immunotherapeutics.

Finally, it is hoped that articles in this issue highlight the interdisciplinary nature of immunoengineering research. This is specifically mentioned to stimulate an interest among early career scientists from diverse academic backgrounds to consider applying their expertise to solving problems in the field of immunoengineering.

The image on the cover page is a simplistic representation of the various technologies discussed in this issue. In conclusion, I thank the authors, the Chief Editor Prof. T. N. Guru Row, the team at the archives and publication cell of IISc, and the team at Springer for helping put this issue together.

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