



Guest Editorial

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Materials are the back bone of human evolution from the stone ages to the current silicon age. Materials have played a major role at every step of human history, be it in establishing new technologies to revolutionize progress or solving an existing problem. The same is very much true for healthcare domain also. The materials and the materials scientists are playing an increasingly important role, alongside the biological scientists and medical professionals, to develop novel tissue engineering approaches or new biomedical devices, for human healthcare. Be it external biomedical devices, such as artificial limb, catheters, contact lenses, hearing aid, disease sensors, etc., or internal devices, such as different implants and synthetic grafts, pace makers, in vivo stimulators and so on; the role of biomaterials is critical towards the success of these technologies. Apart from these direct applications to human being, there are other interesting domains of drug screening and drug delivery, being thoroughly pursued in pharmaceutical industries, or Lab-on-Chip technology, being developed to revolutionize the field of medical diagnosis, by making it less cumbersome, fast, and affordable. Biomaterials and related technologies, again, play a pivotal role in all these developments and many others in this domain. The advancement in biomaterials science clearly has a significant impact on the quality of life.

Against the above backdrop, this issue of the Journal of Indian Institute of Science makes an attempt to capture the recent advancements in the field of biomaterials research, while aiming to get a flavor of the upcoming related progresses in healthcare domain. The collection of 14 review articles had been categorized into four major domains, e.g., (1) Biomaterials for musculoskeletal applications; (2) 3D (Bio) printing of biomaterials; (3) Electrical Stimulation and Tissue Engineering for neural and cartilage regeneration; and (4) Biomaterials for General Healthcare.

Musculoskeletal disease treatment involves a number of lot of permanent implants, not only

meant for support, but for regeneration also. These are mainly degradable scaffolds or prosthesis, being used to heal bone defects, or as support for fracture fixation with advanced functionalities. Five articles, in this section, cover bioceramics, metal matrix and ceramic matrix composites, and polymer-based constructs, together with evaluation of their biocompatibility for the intended applications.

3D bioprinting is another promising technology, coming up at a fast pace with the potential to solve many existing problems in tissue engineering. The technology allows us to print grafts for regeneration by mimicking the architecture of the native extracellular matrix. Going further, 3D bioprinting has also shown promise of printing even complicated organs, such as heart or kidney, to replace the diseased ones and thus, saving lives. The technology applies different degradable polymers and gels, along with the stem cells, ready to proliferate into their required lineage, corresponding to intended tissue structure, to make the printed tissue/organ very efficient. Three articles in this category discuss many such innovative scaffolds and their potential, along with the recent developments and major challenges.

One of the relatively less explored topics is the biophysical stimulation for implants and scaffolds. Three articles in this category discuss the development of strategies and scaffolds for the neural and cartilage regeneration. Cartilages are the tissues that either grow very slowly or not at all. On the other hand, neural tissues involve very organized regeneration, requiring the presence of topographical cues and electrical stimulation. These articles discuss in detail the recent innovations in the field, showing potential to tackle all these problems.

The last section of this issue presents a very interesting collection of articles, covering the significant potential of materials science in solving various technical and socio-economic problems in the healthcare domain. These articles cover a vast area spanning across the fields of cochlear

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implant to auxetic foams, which has application in ENT surgery, as well as sports safety equipment. This section also includes an article on biodegradable and affordable sanitary napkins, to cater to the requirements of the larger cross-section of Indians.

We believe that this issue will be a very interesting one to the broad readerships of this journal and to have an update about the recent highlights and the significant achievements in the fields of biomaterials research and also to the scientists, already working in the field, to pursue the unexplored areas for further investigation.

During the process of reviewing of the submitted papers, we have received significant support from our reviewers for their time and efforts to ensure the quality of the published papers. We also received significant support from the staff of the IISc Press and the Springer, as well as from Dr. Nandita Keshavan, IISc, Bangalore.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Published online: 14 October 2019



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