

Medical devices: from design to production

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A medical device is an instrument, apparatus, implant, in vitro reagent, or similar or a related article that is used to diagnose, prevent, or treat diseases or other medical conditions and does not achieve its purposes through chemical actions within or on the body such as drugs.¹ The main goal of any medical device is to improve the patient's daily quality of life or well-being during diagnosis, treatment, and/or medication.¹ Over the last decade, the medical device industry is a fast-growing and demanding industry. Advances in design, materials, and technologies have increased the potential to develop improved solutions for all medical applications.² These advances have managed to supply the clinicians with new products, tools, and procedures, supporting them in their work by making surgery, diagnosis, or treatment processes easier than ever before.³ These advances have also aimed to reduce both lead times and costs in the production of existing medical devices, reducing global health-care costs.¹

Due to this fact, medical devices are a hot topic among the industrial and academic domains regarding issues such as design, materials, prototypes, or manufacturing processes. For instance, after performing a search on the SAGE Journals Publishing platform with the combination of both words “medical” and “devices” in the titles, a total of 129 results were obtained. Based on the results, between 1932 and 1989, 10% of the papers were published. Then the next two decades, the number of papers increased to 21% (1990–1999) and 27% (2000–2009). Since 2010, the number increased dramatically, reaching 42% of the papers being published. These results demonstrate increasing interest in research and development of medical devices within the industrial and academic communities. Not only the numbers of published papers have increased as demonstrated, but also the numbers in healthcare has also increased. According to Shih,⁴ the investment in healthcare is increasing at a very high rate and will continue to grow.

This special collection intends to bring together industrial and academic researchers willing to present new design methodologies, material selection and manufacturing processes, and medical device case studies, illustrating new developments in both product design

and prototype methods. Topics may include, but are not limited to the following:

- Medical device design and prototyping;
- Design for multi-scale manufacturing;
- Biomaterials and processing;
- Multi-scale material modeling and process simulations;
- Tissue engineering and regenerative medicine;
- Additive manufacturing processes;
- Machining, forming, electro-discharge machining (EDM) and electrochemical machining (ECM), laser-based processing, casting and molding, and others;
- Machines and equipment including tooling, fixturing, sensors systems, and control;
- Metrology, material handling, joining, and assembly;
- Prostheses and orthoses;
- Implants;
- Assistive technology;
- Robotics in medicine.

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