Tomorrow's Healthcare: Current Trends and Directions in Bioengineering and Biomaterials Science

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Current healthcare and diagnostics have many constraints today and there is a great demand to improve the current healthcare facilities by improving the existing methods and development new approaches. Bioengineering is one of the most viable options which has a potential to improve the existing healthcare scenario. Continuing research in the field of bioengineering has placed considerable demand on the versatility, variety and quality of available of biomaterials, reflected in the biomaterial industry's value.
Biomaterials play a fundamental role in the development of implants designed to replace or repair damaged tissues and offer innovative solutions in the fields of tissue engineering, regenerative medicine, artificial organs, and drug delivery systems.[1]
Biomaterials science has advanced from pioneering practices when engineers, chemists, and physicists made the rules on this field, to the present time when bioengineers are key players into the interdisciplinary teams.
This contribution explores key facts in biomaterials, their types along with their examples, advantages, disadvantages and their applications and what are the factors that we should keep in our mind before choosing any biomaterial. This systematic analysis offers a comprehensive overview of biomaterials, highlighting various types of materials used in clinical research, and bring a contribution to a deeper understanding of biomaterial applications in clinical settings. Emerging biomaterials, such as biodegradable metals, are at the forefront of biomedical research, promising transformative advances in health care treatments.[2]
The development of engineered biomaterials into clinically translated therapeutics relies heavily on effective clinical trials to demonstrate safety and efficacy, as well as to determine appropriate dosages and other parameters. Rigorous evaluation of these materials contributes substantially to advancements in patient care and treatment modalities.[3]
However, there is still a huge gap between applied basic research on biomaterials and their translational products - medical devices. Then based on clinical needs, market analysis, and relevant regulations, some ideas are proposed to integrate the two different mindsets to guide applied basic research and translation of biomaterial-based products, from the material and technical perspectives.
Whichever the nature of the materials used (synthetic or biological), for sure future biomaterial-based therapeutic approaches will be addressed towards the so-called "personalized medicine". It overcomes the traditional "one-size-fits-all" approach and considers each patient as an individual, tailoring the required therapy on the basis of the specific needs. This will be a real revolution in medical care, and it requires advances in biomaterials research that enable innovative biomaterials design to diagnose and treat patients' diseases. This approach looks to be more feasible in clinical practice than the idea of biological renaissance by "tissue and organ banks" that are available to any patient. Despite great advances in science and technology, there is still need a lot of interdisciplinary research work ahead, and numerous efforts are currently underway to improve the gap between research results and clinically successful trials of some commercial products.
Furthermore, the lecture will provide a comprehensive perspective on the future of bioengineering from biomaterials science perspective, offering information about new trends in biomaterials and strategic directions about biomaterials for clinical translation of medical devices.

1. I. Antoniac, Handbook of Bioceramics and Biocomposites, Springer, Switzerland, 2016.
2. I. Antoniac, V. Manescu, A. Antoniac, G. Paltanea, *Regenerative Biomaterials*, 2023, **10**, rbad095.
3. I. Antoniac, A. Antoniac, E. Vasile, C. Tecu, M. Fosca, V. Yankova, J. Rau, *Bioactive Materials*, 2021, **6 (10)**, 3383-3395.