Chapter 15
Comparative Insights into Biomaterials from Animal-based and Non-Animal Sources in Biomedical Applications

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ABSTRACT

The application of biomaterials in the biomedical field represents a major advancement, offering effective and sustainable alternative solutions. These materials stand out for their unique properties, particularly their biocompatibility and biodegrad-

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ability. However, the choice between animal or non-animal sources constitutes a primary challenge, directly influencing their use and effectiveness in various contexts. This chapter offers a comparative analysis of biomaterials of animal and non-animal origin, highlighting their distinct properties and adaptability to biomedical applications, while mentioning the limitations of each type of source. This multidimensional analysis thus provides a critical framework for guiding the choice of biomaterials based on the specific needs of biomedical applications and opens up perspectives on the development of hybrid or alternative materials capable of overcoming these limitations.

INTRODUCTION

In 1991, the most widely accepted definition of a biomaterial emerged from the Consensus Conference in Chester, UK, as any substance or combination of substances, other than drugs, of synthetic or natural origin, which can be used for any period of time, which partially or totally augments or replaces a tissue, organ or function of the body, in order to maintain or improve the quality of life of the individual. (Marin et al., 2020). Since then, biomaterials have been widely used in medical treatments such as cancer therapy, ligament and tendon repair, orthopedic applications, drug delivery, wound healing, and many others (Insuasti-Cruz et al., 2022). Biomaterials can be used to improve the function or complete replacement of organs and tissues in damaged or deteriorated parts (Marin et al., 2020). However, their interest lies in their ability to interact with biological systems in a controlled manner, enabling them to be used for therapeutic or diagnostic purposes (Alipour et al., 2020). Moreover, their unique properties, such as biodegradability, biocompatibility and non-toxicity, are highly demanding in the biomedical field (Festas et al., 2020). This makes biomaterials suitable candidates for various medical applications.

Except that, the major challenge remains to choose between biomaterials from animal and/or non-animal sources. Chitosan, collagen and silk are the main animal-sourced biomaterials widely discussed in the literature (Avila Rodríguez et al., 2018; Qi et al., 2017; Tian et al., 2022). Thanks to their qualities, these materials can adopt various forms such as films, hydrogels and sponges to respond to the needs of specific applications. (Fuchs et al., 2020). However, their availability and yields differ from source to source and remain an interesting point of discussion.

On the other hand, non-animal sources are gaining in popularity in the biomedical field due to their biodegradability, biocompatibility, and eco-friendly nature (L. Li et al., 2025). Biomaterials include polysaccharides, proteins and extracellular vesicles and can be adopted into various forms such as nanoparticles, nanofibers and hydrogels for application in wound healing, tissue engineering and drug delivery