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Editorial

Update of the Journal "Aims & Scope"

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Almost four years have passed since I was appointed editor of the journal *Macromol*. I quickly learned that running the journal is about teamwork, and I feel very lucky to have found a great editorial team. My main tasks as editor are mainly to decide on submissions on the basis of reviews, to tune the general orientation of the journal, to search for novel subjects in order to set up new Special Issues and topical collections, and to make the final decision about the journal awards. In all tasks, I have sought and received continuous support and advice from members of our Editorial Board.

When the journal was launched, we met to decide the general scope of the journal. The scope was set to be quite broad. This open access journal provides an advanced forum for studies on all aspects of macromolecular research. In this regard, it covers all aspects on macromolecular modelling, analysis, characterization, and applications. The terms "polymers" and "polymer composites" were also included. However, concerns regarding the scope overlapping between the journals *Polymers* (https://www.mdpi.com/journal/polymers/about), accessed on 17 November 2023, and *Macromol* arose.

First of all, I would like to clarify that there is a clear difference between the concept of a macromolecule and a polymer. A macromolecule is a giant molecule which may or may not contain monomer units. For example, chlorophyll is a macromolecule, but it is not a polymer as it does not contain monomers, whereas polythene is a polymer as well as a macromolecule as it contains a large number of repeating monomers. Thus, all polymers are macromolecules, but the reverse is not true. In order to avoid overlapping between the two journals, the journal scope should be modified to highlight the field of biomacromolecules (which do not fall within the scope of polymers), such as proteins, lipids, carbohydrates, and nucleic acids. The journal should focus more on the chemical and biological aspects of natural macromolecules and biofibres, including their biological activities and interactions, molecular associations, chemical and biological modifications, functional properties, and characterization. It will also cover macromolecular carbohydrates, glycoproteins, proteoglycans, chitins, lignins, tannins, and biological polyacids. Further, theoretical papers dealing with the physics, theory, and modelling of biomacromolecules, including biomolecular simulation and conformational studies, as well as novel analytical techniques for their characterization, are within the scope of the journal.

The main purpose of this editorial is to make sure that authors are clearly informed about the update to the journal "Aims & Scope" and that they are advised about our expectations regarding new submissions. We expect novelty, quality, and relevance from contributions and do hope that we can help to foster new, interdisciplinary research in the field of macromolecular science. Thinking about biomacromolecules as green materials that could substitute petroleum-based plastics in the future is a crucial point and could promote the economy worldwide. Thus, they can contribute to the circular economy, which ensures sustainable growth over time by applying three basic principles: reduce, reuse, and recycle. In this regard, it is crucial to find ground-breaking biomaterials for special applications that could become a key element of circular economy production [1]. Measures to lessen the manufacture of industrial materials whose waste is hard to recycle are more appealing to manufacturers, especially when dealing with the new financial situation in the EU, since one of its priorities is to implement the principles of a circular economy.

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The worldwide demand for sustainability and green economy leads to significant research interest in the field of biomacromolecular technology in different directions. These include the replacement of fossil-derived polymers with neat biomacromolecules or their derivatives, the use of green synthesis processes in order to recover and/or synthesize monomers derived from renewable resources, and the production of novel eco-friendly, biodegradable polymers based on these monomers [2]. Eco-friendly processes to recover bio-based monomers from biomass and bio-based polymer recycling methods are also of great interest.

On the other hand, within the frame of green biomaterials and sustainable development, novel technologies have been developed for the treatment of basic natural biopolymer waste from the agro-food or manufacturing industries. Physical, chemical, or a combination of methods for attaining natural macromolecules can be used for the preparation of mixtures and/or green composites. In chemical treatments, the use of solvents that can be easily regenerated and reused and from which the macromolecule of interest can be produced is preferred. Physical methods include the use of microwaves or ultrasound, which are able to disaggregate natural structures. Combined methods can be used especially in cases where the natural biopolymer is sensitive to certain parameters such as pH and temperature.

Machine learning is a subset of the artificial intelligence (AI) that enables a machine to automatically learn from data, improve performance from past experiences, and make predictions. ML improves efficiency and reliability and reduces costs in computational processes. ML has dramatically advanced in various industries, especially medicine [3]. Recently, Kumar et al. [4] applied ML methods to optimize polymer composition for the co-delivery of nucleic acid payloads, leading to higher transfection rates and cellular uptake. At the University of Minnesota, scientists have explored the application of ML to screen a multiparametric library of macromolecules to investigate the relationship between the macromolecule attributes, payload type, and biological outcomes [5]. Other researchers have developed unique and versatile modelling tools capable of handling precise predictions and intricate manipulations of microstructural features of complex macromolecules via ML techniques. These can be used by both academic and industrial experts to model and optimize all types of macromolecular reactions [6]. They can guide polymer chemists and engineers towards the development of advanced ‘living and thinking’ biomaterials.

Moving to the biomedical field, numerous articles have been reported on how biomacromolecules play a key role in this arena. The synergistic union of nanomaterials with biomaterials has revolutionized synthetic chemistry, enabling the creation of nanomaterial-based biohybrids with different properties for biomedical applications. Novel approaches to coupling biomacromolecules such as nucleic acids, proteins, and enzymes and complex living organisms (such as bacteria and viruses) with nanoparticles, peptides, hydrogels, metal–organic frameworks (MOFs), and metal–phenolic networks (MPNs) have been recently reported [7]. Thus, it is feasible to develop nanomaterial-based biohybrids with a rational design and high controllability over the resulting biohybrid properties. The synergistic coupling of the advantageous properties of both biomaterials is crucial for emerging biomedical applications such as drug or gene delivery, diagnosis, and cancer treatment. Although significant efforts have been made in this research field, there is still a lot to do in order to improve the biohybrid characteristics, including improving on-targeting to the infected cells and their penetration, attaining higher transfection efficiency as well as preservation of the bioactivity and higher survivability under hostile conditions. The detailed design of the next generation of advanced biohybrids holds great promise for solving current challenges in the biomedical field and extending the applications of these biomaterials from the laboratory level to the clinical scale.

Conflicts of Interest: The author declares no conflict of interest.

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