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Editorial

The idea for a special issue, which collects highlights from the current state of membrane science, was conceived at the Membranes Beyond workshop, July 1–4, 2018 at McMaster University in Hamilton, Canada. This was intended to be a meeting of specialists working in the field, with a focus on structure and dynamics in biological and biomimetic membranes using various methods and approaches. It turned out to be a nucleation point for fruitful discussions, discussing new and revisiting old ideas and concepts of membrane science.

The workshop was also a timely opportunity to review the activities of John Katsaras and his group members over the last 25 years who were constant drivers to solving old problems in structure and hydration of model membrane systems towards new application and insights in membrane structure and dynamics. John and his coworkers have stimulated the field within the last decades based on outstanding contributions to the field by colleagues such as Richard Epand, John Nagle, Stephen White and Scott Prosser, who presented previous as well as current work during the workshop.

As a result of that, and in order to keep this spirit of discussion alive, this special issue tries to outline some of the results and considerations presented there.

A recurring theme is the overwhelming versatility of membranes in terms of detail and yet common application of fundamental concepts over the full range both in terms of specific membrane types as well as the technologies and approaches used for investigation. The review articles outline the high scientific activity during the last few years and underline the concepts of local and global structure and their interplay with biologic functions (Bozelli and Epand), the interaction with the most common medium, water (Kucerka et al.), and one of the most prominent problems in current membrane science, and perhaps pharmaceutical science in general, antibiotic interactions and the implications on antibiotics efficacy (Pinheiro et al.).

One experimental contribution addresses the question of transport of cholesterol in membranes. It finds a surprising change in the nature of the transport, being entropically dominated at low temperatures and enthalpically dominated at higher temperatures (Garg et al.). This effect may be linked to the physiologically very important density distribution of cholesterol in tissues.

In a close-to-application contribution, the topic of cortisone crystallization in membranes is elucidated (Khondker et al.). Also here, the influence of cholesterol in biological membranes and systems is underlined, as well as the immediate impact of membrane science on applications in areas such as pharmacology.

Looking into fundamental research based around biomimetic membranes another contribution is stressing the interplay between structure and inter- as well as intra membrane dynamics (Jaksch et al.). In this study, the existence of fundamental excitations as quasiparticles (smomons) is shown based on experimental data. This is a novel concept for membrane science, as well as soft-matter science in general.

One theoretical contribution is discussing the modelling of membrane patches in small-angle scattering experiments (Vinicinus et al.). The analytic expressions presented here may contribute significantly to the research on patched membranes.

Finally, there is a theoretical contribution which investigates the bending properties and pore forming tendency of membranes using AB and ABA block copolymers as model systems (Xu et al.).

This overview of the field of membrane science in the present special issue shows both, the bandwidth as well as scientific activity in the field. Moreover, it should also be understood as an invitation for discussion on the wide field and give ideas for new approaches and investigations. We hope the readers find the collected information interesting and helpful for their work.

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