



Biophysical Reviews: A goodbye to 2023

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Abstract

This Editorial for the IUPAB *Biophysical Reviews* journal (2023 volume 15 issue 6) first provides an overview of the contents of this “Regular Issue featuring an Issue Focus on the Computational Biophysics of Atomic Force Microscopy” before going on to highlight some of the notable work published in the journal throughout 2023. Highlights of the current Issue include the contributed review article by Antonio Benedetto, winner of the 2023 Michèle Auger Award for Young Scientists’ Independent Research, the latest installment of the “Biophysical Reviews Top 5 Series” authored by Angela Dulhunty, and an Issue Focus on the topic of computational aspects of atomic force microscopy generated from an IUPAB-sponsored workshop held in 2022.

Introduction

The *Biophysical Reviews* journal is the single publishing instrument of the International Union for Pure and Applied Biophysics (IUPAB) (IUPAB 2023). As an affiliated union of the International Science Council (ISC) (ISC 2023), IUPAB is tasked with promoting the development of the discipline of biophysics by supporting and fostering teaching, research, and publishing initiatives throughout the world; providing a cooperative forum for the international standardization and establishment of norms in biophysical teaching, procedures, and nomenclature; and promoting international cooperation between the existing and nascent national biophysical societies which are affiliated to it. One of the major tasks of IUPAB is to run an international congress every 3 years with the next scheduled to be held in Kyoto, Japan, in June of 2024 (Kyoto IUPAB Congress 2024). Publishing its first volume in 2009 (Garnier 2009), the *Biophysical Reviews* journal has constituted an important part of IUPAB’s mission for the promotion of biophysics by providing an inclusive forum for the publication of review articles on current topics in biophysics contributed by experts from a diverse international origin.

Precis of the current Issue

Each issue of *Biophysical Reviews* is generally constructed in two parts, the front matter and the main scientific body. The front matter contains non-scientific process articles (editorials, commentaries, and letters) that will be of interest to the wider biophysics community and which describe people, policy positions, and upcoming events. The main scientific body is composed of a collection of review articles, commentaries, and letters. On occasion, a separate section is included—known as an “Issue Focus” which constitutes around five articles on a single theme. Inclusive of this editorial (Hall 2023a), this final Issue of *Biophysical Reviews* contains 17 articles—with four front matter pieces, eight contributions within the main scientific body, and a further five articles within the separate Issue Focus. The first duty of this editorial is to provide a short description of the articles appearing in these three sections.

Following the current editorial, the next article within the front matter is the latest installment of the *Biophysical Reviews* “Meet the Editor Series,” with this one introducing the journal’s chief editor of the last 5 years (Hall 2023b). The third front matter piece is a short topical biographical commentary of Tony Jia, a researcher working in the origin of life field of at the Earth Life Science Institute (ELSI) in Tokyo, Japan (Jia 2023). In this brief article, Tony describes both his own contributions and those of others, in placing the role of liquid phase separation within the timeline of evolution. The final front matter article is a commentary describing an open call for contributions to an upcoming

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Biophysical Reviews special issue on the theoretical and computational description of nucleic acid (Olson et al. 2023). For those wishing to have an article considered for that special issue, please make contact with the guest editors whose contact details can be obtained from the commentary directly (Olson et al. 2023).

Leading off the articles in the main scientific body are two specially invited pieces (Dulhunty (2023) and Benedetto (2023)). The first of these is the latest in the *Biophysical Reviews* “Top Five” Commentary series in which a key academic figure is asked to introduce to the reader five historical publications that played a pivotal role in defining a research field. Building on the first contribution (Ando 2021), the current “Top Five” article looks at important discoveries in electrophysiology that helped to elucidate the molecular components of the nerve muscle transduction machinery (Dulhunty 2023). For this “Top Five” piece, the journal commissioned Angela Dulhunty, Emeritus Professor of the John Curtin School of Medical Research at the Australian National University and one of the pioneering figures in the muscle innervation field over the last 50 years (Dulhunty 2023). The second article is the invited contribution from Antonio Benedetto, the winner of the “2023 Michèle Auger Award for Young Scientists’ Independent Research” (Benedetto 2023). As the fourth winner of the Michèle Auger Award (see Table 1), Antonio has contributed a review piece that describes his work on the analysis of the interactions between ionic liquids and phospholipid membranes. Often touted as the next generation of designer solvents, room temperature ionic liquids (RTILs) have significant potential in biotechnology applications. However, achieving an understanding of the mechanisms by which they interact with cell membranes, causing potential cytotoxic effects, is key prior to their application (Benedetto 2023). As always, these award winners’ essays are concluded with two short biographies, with one concerning the awardee and the other describing the life and works of Prof. Michèle Auger, the former *Biophysical Reviews* Editorial Board Member to which this award is dedicated.

Contributed by researchers from Kings College London in the UK, the next invited review article examines the progress made, and that still required, in the use of cardiomyocytes derived from the differentiation of induced pluripotent stem cells (iPSC) as model systems in cardiac research (Ormrod

and Ehler 2023). The authors first describe methods for collecting iPSC and inducing them to differentiate and follow a cardiomyocyte lineage. They then provide an overview of the internal cellular anatomy of cardiomyocytes sufficient to understand how imperfect or incomplete differentiation of the iPSC can yield a less than perfect model system (Ormrod and Ehler 2023).

The fourth article in the main body section is a contribution from scientists at the University of Venda in South Africa (Luthuli and Shonhai 2023). Conducting a deep dive on the R2TP co-chaperone complex of the Hsp90 chaperone, the authors review everything from the three-dimensional structure of the two individual proteins (RPAP3 and P1H1DI) that constitute the essential R2TP heterodimer, the association of this heterodimer with diverse members of the AAA+ family of ATPase proteins (to form the complete R2TP co-chaperone), and the association of this functional R2TP complex with its Hsp90 chaperone partner to form a functional “bionanomachine” chaperone/co-chaperone complex that helps to facilitate the correct formation of many different macromolecular complexes involved in a wide range of normal and aberrant cellular functions (Luthuli and Shonhai 2023).

The next article, contributed by biophysical chemist Ronald Clarke from the University of Sydney in Australia, reviews a widely conserved biochemical mechanism for regulating the association of peripheral and integral membrane proteins with the cytosolic interior face of the cell membrane and, by doing so, acting as a control system for regulating these proteins’ enzymatic or allosteric function (Clarke 2023). Termed the “electrostatic switch” mechanism, the author first reviews how conserved disordered positively charged terminal regions of membrane proteins have a strong tendency to interact with the generally negatively charged cytosolic cell membrane surface. The disordered and positively charged nature of these conserved protein terminal regions are due to them containing high amounts of the amino acids lysine and arginine. However, as these regions also contain serine and tyrosine residues, the electrostatic forces directing this association can be diminished or reversed by their phosphorylation via serine or tyrosine kinase directed post-translational modification. Providing numerous examples from the literature (such as those involving sodium pumps and membrane-bound ATPases),

Table 1 The 2023 winner of the “Michèle Auger Award for Young Scientists’ Independent Research”

Year	Winner	Website	Reference
2023	Antonio Benedetto	https://people.ucd.ie/antonio.benedetto/	(Benedetto 2023)
2022	Miho Yanagisawa	https://sites.google.com/g.ecc.u-tokyo.ac.jp/yanagisawa-lab/	(Yanagisawa 2022)
2021	Jorge Alegre-Cebollada	https://www.cnice.es/en/jorge-alegre-cebollada/	(Alegre-Cebollada 2021)
2020	Alexandra Zidovska	https://physics.nyu.edu/zidovskalab/	(Zidovska 2020)

Table 2 Articles appearing in Issue Focus “Computational Biophysics of Atomic Force Microscopy – an IUPAB Sponsored Workshop”

Article type and title	Reference
Editorial: Computational biophysics of atomic force microscopy – an IUPAB sponsored workshop	(Hall et al. 2023)
Review: Technical advances in high-speed atomic force microscopy	(Fukuda and Ando 2023)
Letter: High-speed atomic force microscopy: extracting high-resolution information through image analysis	(Heath 2023)
Letter: Computation of topographic and three—dimensional atomic force microscopy images of biopolymers by calculating forces	(Sumikama 2023)
Letter: Simulating biological surface dynamics in high-speed atomic force microscopy experiments	(Hall 2023e)

the author emphasizes the importance of this mechanism of regulation and notes its potential as a site of, as yet, unexploited potential for pharmaceutical intervention (Clarke 2023).

Contributed by scientists based at the IBMB in Barcelona, Spain, the sixth article in the main section is a quite interesting modern take on old concepts in biological chemistry associated with the definite or indefinite self-association of proteins (Romero-Romero and Garcia-Seisdedos 2023). Applying the term agglomeration to the association of folded proteins (thereby signaling the distinction from the aggregation of unfolded proteins), the authors review the generic nature of self-association in the production of macromolecular components in the cell (such as the cytoskeleton) emphasizing the symmetry and energetic properties that determine the bounded or unbounded nature of the polymer product. The authors conclude with a discussion of the evolutionary advantages/disadvantages of specific protein complexation in terms of alteration of stability and potential gain of function from proximity factors (Romero-Romero and Garcia-Seisdedos 2023). This work could be read together with a previous submission to the journal (Park and Horton 2019) which provides a number of structural examples of the concepts discussed by the authors.

The next article in the lineup is contributed by researchers based at University College London in the UK and describes use of acoustofluidic separation principles in biomolecular purification (Hossein and Angeli 2023). Providing a quite easily digestible take on a relatively difficult topic in fluid mechanics, the authors describe how biomolecules will differentially accumulate at the varying regions of pressure amplitude upon establishment of an acoustic wave in a liquid (with heavier components more likely to exist at nodal regions of amplitude). Discussing both how acoustic waves can be generated in liquids using integrated piezoelectric devices, the design of microfluidic platforms suitable for achieving biomolecular separation, and the underlying physics of the phenomenon, this article is an excellent introduction for those interested in this relatively new purification methodology (Hossein and Angeli 2023).

The eighth and final article appearing in the main section of Issue 6 is a collaborative contribution from scientists

working at three different institutes of medical research across Iran (Alborz University of Medical Sciences, Hamadan University of Medical Sciences, and the Tabriz University of Medical Sciences) dealing with the subject of bone regeneration (Dibazar et al. 2023). In cases of accident, disease, or deformity, bone extension and bone repair can be encouraged by the use of biomimetic gels which create the right environment for osteocyte growth and mineral accumulation/deposition. The authors of this article review the important factors governing the safe and effective usage of biomimetic gels for such purposes with a focus on factors that can regulate gel porosity in situ (Dibazar et al. 2023).

The final five articles in this Issue 6 lineup are part of an Issue Focus on the topic of “Computational Biophysics of Atomic Force Microscopy.” Although described more fully in the Issue Focus Editorial, the list of articles appearing within the Issue Focus is provided in Table 2. After this short precis of the current issue contents, we finish with a brief look back at what happened in the journal in 2023.

Concluding remarks

After what were some tough years for everyone due to restrictions associated with the pandemic, 2023 was somewhat of a return to normalcy for much of the world and this was especially so for the journal. With the ability to plan with certainty, most events went ahead as scheduled and the year featured two special issues, the “Latin American Federation of Biophysics—LaFeBS Special Issue” (Peluffo et al. 2023) and the “VII Congress of Russian Biophysicists” (Anashkina et al. 2023), and two “Issue Focus” collections, which respectively provided a tribute to the 100th anniversary of the birth of the Nobel Prize winning scientist Har Gobind Khorana (Aradhyam and Jagannathan 2023) and an introduction to some of the problems extant in the field of computational biophysics of atomic force microscopy (Hall et al. 2023). The two open Issues for the year (Issues 2 and 3) were no less interesting with their respective descriptions given (Hall 2023c, 2023d). For those interested, new developments with the journal can be followed on social media at the following sites:

X (Twitter): Biophysical_Reviews @BiophysicalRev1
 YouTube: Biophysical Reviews @biophysicalreviews9844

On behalf of the journal and editorial board, I take this opportunity to wish readers all the best for the holiday period and a happy new year.

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Data availability As this is an editorial no original data was developed in the course of its preparation.

Declarations

No humans or animals were harmed during the writing of this article.

Conflict of interest The author declares no competing interests.

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