



Biophysical Reviews: 2020—looking back, going forward

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Abstract

After first describing the issue contents (Biophysical Reviews—Volume 12 Issue 6), this Editorial goes on to provide a short round-up of the activities of the journal in 2020. Directly following this Editorial are two obituaries marking the recent deaths of Prof. Fumio Oosawa (Japan) and Dr. Herbert Tabor (USA)—two major figures in Biophysical/Biochemical science from the last 100 years.

With the outbreak of the COVID-19 pandemic, 2020 has been a testing year for all. Filled with a myriad combination of personal tragedies and work/life inconveniences, circumstances have required many difficult decisions to be made at the personal, family, organizational and society levels with the results of these difficult choices amplifying the general level of stress within communities. Scientists have certainly not been immune from such pressures. For working scientists, this year has presented a number of challenges. Those scientists heavily involved in teaching have had to engage with remote teaching methodologies and the necessarily rapid preparation of additional online teaching materials. Research-focused scientists have had to cope with the closing or restriction of work facilities and the loss of personnel, which has certainly impacted (and often disrupted) scientific progress. For the many itinerant working scientists living away from home and family, the restrictions on worldwide travel have caused additional dilemmas and necessitated difficult career decisions. Student scientists have had to deal with other problems. Oftentimes educational institutions have maintained the steep fee requirements associated with enrolment despite the year being a virtual write-off in terms of focusing on academic performance. Overseas students have also faced problems related to maintaining interdependent attendance and residence requirements.

Irrespective of the stage of their career progression, scientists (like all members of society) have tried their best to make the most of a bad situation. In 2020, the Biophysical Reviews'

Editorial Board and the specifically dedicated professional officers from Springer-Nature have similarly pushed on with our journal related duties. From 2018, Biophysical Reviews moved to a six Issue per year format. The current Issue (Issue 6) is the last for 2020, and as such, the first duty of this Editorial is to describe the contents of the twelve articles appearing within it. After providing a precis of these articles, we then move on to describe some of the highlights of this year and finish by welcoming some new members to the Editorial Board.

Precis of articles in Issue 6

Aside from the present Editorial (Hall 2020a), the front matter for this Issue consists of a sub-editorial, introducing Dr. Antonio Benedetto (one of the journal's Editorial Board Members) (Benedetto 2020) and two Commentaries (Maèda and Oda 2020; McPhie 2020), that respectively present obituaries for Dr. Fumio Oosawa and Dr. Herbert Tabor—two giants of the Biophysical/Biochemistry science scene. I had the good fortune to meet and spend some time with both of these scientists (about who these obituaries have been written) and highly recommend these interesting Commentaries written from both the scientific and human perspective. In my opinion, the authors do a remarkable job of providing the reader with a window into the lives of these very distinguished scientists, thereby providing worthy tributes.

Following the front material are eight topical review articles with the first two (Lavington and Watts 2020; Shechtman 2020) being requested contributions from the senior (Dr. Anthony Watts) and junior (Dr. Yoav Shechtman) winners of the IUPAB Investigator Awards for 2020. The article by Lavington and Watts (2020) describes how different membrane

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mimics can be used for the structural study of G protein-coupled receptors (GPCRs) using solid-state NMR methods. As perhaps the most important class of integral membrane proteins, GPCRs carry out a number of different biological functions associated with cell growth, death and division, and are therefore much studied as possible pharmaceutical targets. Lavington and Watts (2020) describe their (and others) research on GPCRs using membrane nanoparticles, such as lipid nanodiscs and styrene maleic acid lipid particles (SMALPs) as structurally well-defined membrane-like environments having tuneable properties. The contribution by Shechtman (2020) provides a very readable introduction to the subject of super-resolution microscopy before going on to detail the authors' contributions to the information processing aspects of this field of microscopy. Starting with a mathematical description of the point spread function the author details how suitable treatment of the signal can result in near nanometre level assignment of details present within biological specimens (2020).

Following these two award-related contributions are six invited reviews on a disparate range of topics. The first of these (Rajendra and Brahmajirao 2020) is concerned with the use of artificial intelligence (AI) and machine learning (ML) methods for the analysis of dynamical/time series data. Whilst the scientific community is becoming familiar with AI/ML for the processing of static information (such as image/structural analysis; face recognition), they are perhaps less aware of the use of such procedures for the processing of time series data. In this article, Rajendra and Brahmajirao (2020) do a good job of describing how coupling of intermediate numerical methods based on differential equations can be used to fill the static to dynamic AI/ML information processing 'gap'.

The next review article, contributed by Mizuguchi and Nuriya (2020), describes recent developments in second harmonic generation (SHG)/sum frequency generation (SFG) methodologies. Revolving around two-photon superposition/joint action principles, the authors utilize Jablonski-type diagrams to describe the optical physics, walking the reader through the history and recent developments in the field with an emphasis on the use of these techniques for characterization of biological events occurring within the cellular plasma membrane. This article by Mizuguchi and Nuriya (2020) serves both as an excellent primer on the optical phenomenon and a good survey of its recent application to create superior biological imaging techniques.

The following article by Kumar et al. (2020) is concerned with the pathogenically important calcium binding proteins of the amoeba, *E. histolytica*, associated with causing the human diseases of colitis and dysentery. The authors review three-dimensional structural information gained on the nearly thirty known *E. histolytica* calcium-binding proteins which show

some degree of acid sequence similarity to calmodulin (CaM).¹ Kumar et al. propose arguments tying the apparent structural diversity seen within the amoebic calcium-binding protein family to apparent functional diversity required for interaction with different partner proteins present across a range of signalling and regulatory pathways (Kumar et al. 2020).

The next Review, by Pratt et al. (2020), continues with the calcium theme by focusing on the role that this divalent cation plays in the regulation of breast cancer development. This well-written review article spends considerable effort on the scientific history of the discovery of calcium's role in cell signalling. Focusing on quantitative aspects, the authors discuss the action of calcium ions on various signalling pathways as a function of the amplitude, frequency and spatial characteristics of the calcium ion levels. Reviewing both the analytical methodology and the biological 'circuitry' affected by calcium, this article discusses how cancerous cells can exploit aberrant calcium regulation to direct cancer specific cell fates involving growth or metastases (Pratt et al. 2020).

The penultimate review deals with recent developments in the biophysics and biomechanics of the machine/muscle interface (Gohel and Mehendale 2020). Treating both the equipment required for recording electrical activity occurring within the muscle, and the algorithms required for signal deconvolution and subsequent completion of the transduction to electronic or mechanical output, the article by Gohel and Mehendale (2020) provides the reader with a very readable glimpse into human's ever closer relationship with machines, with such technology proffering both smoother machine control and hope for restoration of quality of life for those suffering injuries.

The final contribution to this last Issue of Biophysical Reviews for 2020 is a highly focused review article on the nucleic acid binding properties of the plant alkaloid chelerythrine (Basu and Suresh 2020). As a relatively small molecule, chelerythrine and its alkaloid derivatives/analogues, show intriguing binding specificity with regard to type (DNA vs RNA), strand (single vs. double vs. triple) and sequence (base vs. short sequence) and as such suggests itself for possible usage in the construction of molecular tools used in biology and medicine. After reviewing a large number of biophysical studies, Basu and Suresh (2020) explore this latter aspect, reviewing chelerythrine's potential as an anticancer drug candidate.

Highlights of 2020

The six Issues of Biophysical Reviews in 2020 consisted of two Special Issues and four regular Issues. This year saw over hundred and sixty articles published. Here I provide a (very) short flavour of some of the diverse set of topics covered in each Issue.

¹ Calmodulin (CaM) is a highly conserved protein existing throughout the eukary super-kingdom.

Issue 1 started off with equal parts hope and sadness with the respective announcement of the inaugural winner of the Michèle Auger winner (Dr. Alexandra Zidovska) (Hall 2020b) and the obituary for Dr. Christopher M. Dobson (Dumoulin 2020). Some of the interesting review articles in Issue 1 included those on the topics of hybrid biosynthetic strategies (Alissandratos 2020), dramatic effects of proline substitution on protein structural propensities (Ganguly and Basu 2020), computational studies of the interaction of urea with protein interfaces (Raghunathan et al. 2020) and the use of the differential scanning fluorimetry (DSF) for high throughput drug candidate screening (Gao et al. 2020).

Issue 2 saw the first instalment of the Biophysical Reviews partnership program with various countries' national biophysical societies that is aimed at providing readers with a closer look at the biophysical research and organizational structures in place within a particular country. In Issue 2, we explored the Biophysical Society of Japan (BSJ) (Komatsuzaki et al. 2020; Hall 2020c). The front matter contained within it numerous fascinating Commentaries about the BSJ's organizational units which included contributions by the executive officers (Harada 2020; Akiyama 2020; Miyata 2020; Nakamura 2020), Japanese biophysical journal Editors (Sako 2020; Ishiwata 2020a, b) and five consortiums describing biophysical research at various national centres and universities (Aizawa et al. 2020; Akiyama et al. 2020a, b; Ando 2020a, b; Takano et al. 2020). This section was further complemented by contributions from senior (Kataoka 2020) and junior members (Okamoto 2020).

The bulk of the Special Issue was composed of numerous review articles (forty-five) chosen from the nearly thirty separate sections of the BSJ's national society meeting. A short selection of these (many) interesting review articles includes those dealing with the biophysics of chromatin (Ashwin et al. 2020; Kumar and Kono 2020); optogenetics (Kandori 2020); computational structure prediction (Kinoshita and Hayashi 2020; Leitner and Yamamoto 2020; Tsuchiya and Tomii 2020); physical biochemistry (Tsumoto et al. 2020); molecular motors (Li and Toyabe 2020; Loutschko and Flechsig 2020; Noji et al. 2020); membrane protein interaction (Moghal et al. 2020); novel scattering, structural and imaging techniques (Nakasako et al. 2020; Uchihashi and Ganser 2020; Yamaoki et al. 2020; Yokoyama et al. 2020); cellular biophysics (Okazaki et al. 2020; Yasuda 2020); biophysical thermochemistry (Fukuyama and Maeda 2020; Suzuki and Plakhotnik 2020); and biophysical theory (Leitner and Yamamoto 2020; Uda 2020).

Volume 12 Issue 3 (Hall 2020d) was a regular Issue that contained eleven articles. With no set theme, the contributed articles covered a range of topics with some of the highlight review pieces dealing with Brillouin microscopy (Antonacci et al. 2020); cellular imaging using atomic force microscopy (Zapotoczny et al. 2020); and exploration of novel second

messenger systems (Petchiappan et al. 2020) and laboratory based studies of evolution (Horinouchi and Furusawa 2020).

Issue 4 was the second scheduled Special Issue for 2020 (Hall et al. 2020). Titled 'Biophysics of Human Anatomy and Physiology', this festschrift collected articles related to the biophysics of physiological processes (particularly related to the heart) for the occasion of the 80th birthday of Dr. Cristobal dos Remedios. A powerhouse of biophysical research, both in Australia and on the international stage, Cristobal dos Remedios was long active within IUPAB and was also a former Chief Editor of Biophysical Reviews (dos Remedios 2020). Over a fifty-five year career Cris made important breakthroughs in both the molecular understanding of muscle function (through his pioneering studies on Förster resonance energy transfer experiments of actin myosin structural relations) as well as the general design and execution of cardiac muscle biophysical research (through the establishment of the Sydney Heart Bank). This Special Issue saw over forty-two contributions from scientific collaborators and peers accrued over his long career. The front material of the Issue contained a number of personal and scientific Commentaries addressing various stages of Cris' life (Hall et al. 2020; Ishiwata 2020a, b; van Dijk 2020; Li 2020). The bulk of the scientific content of this Issue was constituted by twenty-two topical review articles that spanned different areas of cardiac research. Some particularly noteworthy examples dealt with growth factor directed therapy for cardiac muscle repair (White and Chong 2020); cardiomyocyte fluoresce-based microscopy methods (Janco et al. 2020; Pandzic et al. 2020; Hassan et al. 2020); cellular mechano-transduction and shape determinants on cell growth regulation (Esfahani and Knöll 2020; Pruna and Ehler 2020; Harley et al. 2020); synthetic biology approaches to the study of motor proteins (Linke et al. 2020); use of plasma technology in surgical equipment surface treatment (Harley et al. 2020); and the regulatory pathways and structural roles of profilin (Davey and Moens 2020).

Containing twenty articles, Volume 12, Issue 5, was the third regular-type Issue of 2020 for Biophysical Reviews (Hall, 2020-e). A feature of this Issue was the invited review article by Dr. Alexandra Zidovska, the inaugural winner of the Michèle Auger award for young scientists' independent research (Hall 2019a, b; IUPAB 2018). In her award article Alexandra reviewed salient material within her thematic topic of cytosol rheology (Zidovska 2020). In addition, her article carried two short personal biographies of both herself and Michele Auger—the scientist and former Biophysical Reviews Editorial Board Member for whom the award acts as a perpetual memorial. Issue 5 also included contributions on topics covering the evolution of the cellular unit (Kundu et al. 2020); theoretical constraints to evolution (Furusawa and Irie 2020); single particle approaches to the study of virus particles (Kiss et al. 2020); and cryo-preparation methods for electron and mixed microscopy imaging methodologies (Yusuf et al. 2020).

Table 1 2020 Biophysical Reviews Editorial Board

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Tamiki Komatsuzaki, Hokkaido University	Special Issue on the Biophysical Society of Japan (BSJ)—Miyazaki Meeting, September, 2019
Takeharu Nagai, Osaka University	
Haruki Nakamura, Osaka University	
Kuniaki Nagayama, Institute for Molecular Sciences, Okazaki	
Jeremy Tame, Yokohama City University	
Saeko Yanaka, Institute for Molecular Sciences, Okazaki	Biophysics of Human Anatomy and Physiology—a Special Issue in honour of Prof. Cristobal dos Remedios's 80 th birthday
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Table 1 (continued)

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Biophysical reviews' meet the editors series

In 2020 the journal started including within each Issue a short biographical sketch of members of the Editorial Board. The first five Issues of Volume 12 concentrated on introducing the five internationally based Executive Editors. Provided by Wilma Olson, based in the USA (Olson 2020), Kuniaki Nagayama (Japan) (Nagayama 2020), Naranamangalam Jagannathan (India) (Jagannathan 2020), Joshua Ho (Hong Kong, China) (Ho 2020) and Rosangela Itri (Brazil) (Itri, 2020), these articles can additionally serve the readership by providing an easy point of access to a senior Editor in your geographic location. In the final Issue of the year we started introducing regular members of the Editorial Board, with the first being Antonio Benedetto based in Ireland (Benedetto 2020). With over 40 international members constituting the Biophysical Reviews' Editorial Board, we envisage that this 'Meet the Editors Series' will continue for a number of years to come!

Social media

This year saw the continuing success of Biophysical Reviews social media program.² Consisting of a Twitter™ feed and a YouTube™ channel, Biophysical Reviews does its utmost to utilize its social media arm to provide authors with post-publication promotional opportunities. In doing so, we ask authors to exploit the Springer-Nature SharedIt™ tool—a device that enables free posting and sharing of published content across any internet platform (Hall 2017, 2019a, b). The journal's social media sites can be accessed at the following web addresses.

Biophysical reviews YouTube channel

https://www.youtube.com/channel/UCzG_5MWmnrB2UBibtxs2DuA

² Despite a two month hiatus of the Twitter feed due to a security 'incident'.

Biophysical reviews twitter account

[@BiophysicalRev1](https://twitter.com/BiophysicalRev1)

Concluding remarks and hopes for 2021

Developed by IUPAB as a vehicle to help promote biophysical research and education at the international, national and community levels, Biophysical Reviews has increased its published output and philanthropic activities during 2020. The many benefits of focusing on review content have been expounded upon within the journal (Hall 2019a, b). As evidenced by the latest journal metrics, Biophysical Reviews has continued to develop since its inception in 2009 (Scimago 2020). Now ranked 11th amongst journals in the biophysics section and having a Q1 rating in both the biophysics and structural biology groups, Biophysical Reviews is one of the top platforms for publishing biophysics-related content. A journal such as Biophysical Reviews (that operates on an invitation contribution model) is very much the sum of its Editorial Board Members. As such, I would like to thank the existing members of the Editorial Board (Table 1) for their efforts throughout the year. It is also my pleasure to welcome new members to the Board for 2021 (new members shown in bold in Table 1). It is with fervent hope that the situation in 2021 improves for the better, and on behalf of the journal, I would like to wish all readers and contributors the very best for the coming year.

Postscript *Prospective authors interested in submitting a review article to Biophysical Reviews are encouraged to first broach the matter with either the Chief Editor or their local Executive or Editorial Board Member. After discussion on the suitability of their article a timetable for their submission will be arranged in conjunction with the professional officers of the journal.*

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