Editorial for the Special Issue of Biophysical Reviews focused on the Biophysical Society of Japan with select scientific content from the 57th BSJ annual meeting, Miyazaki, Japan

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Introduction to the BSJ

This is the first Special Issue of Biophysical Reviews devoted to a single nation's biophysical society, and as such, our efforts should be seen as a first draft of how to do this for other countries' national societies in the coming years. Nevertheless, we have tried to do our best and believe we have come up with a selection of articles that should better inform the reader on the state of biophysical science in Japan. To achieve this, we have commissioned Commentary articles from a selection of prominent members of the BSJ including the President (Harada 2020), the Treasurer (Akiyama 2020), Website Liaison Officer (Miyata 2020), Chief Editors of the two official journals of the BSJ—Seibutsu Butsuri (Sako 2020) and Biophysics and Physicobiology (Ishiwata 2020), a younger member (Okamoto 2020), and a senior member (Kataoka 2020). Also, included in this section is an informative letter on a Japanese government special funding initiative known as AMED-BINDS (Nakamura 2020) that is facilitating information science and drug development. To provide the reader with an idea of some of the places to

perform biophysical research in Japan, we invited various institutes and centers throughout Japan to provide a summary of their facilities and opportunities available for study, work, or collaboration in the field of biophysical science. We received five such descriptive reports about biophysics at Kanazawa University (Ando 2020), Waseda University (Takano et al. 2020), Kyushu University (Akiyama et al. 2020a), Okazaki Institutes (Akiyama et al. 2020b), and Hokkaido University (Aizawa et al. 2020) that might provide scientists located outside of Japan with a starting point of reference when making inquiries.

BSJ2019, Miyazaki, Kyushu

The majority of the scientific Commentaries and review articles commissioned for this Special Issue were derived from contributions made at the most recent BSJ annual meeting held in Miyazaki Japan. In this section, we first briefly describe the conference itself before going on to provide information on the scientific sessions. The conference venue was the Phoenix Seagaia resort, which combines a hot spring and a zoo, among

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other attractions, with miles of beaches. At a latitude similar to that of Cairo in Egypt or Austin, TX, there is often plenty of sunshine to enjoy Miyazaki outside. Delegates to BSJ2019 however had much else on their minds, as novel techniques in nanotechnology, from single molecule to ecosystem scale, were being showcased by groups from across Japan and beyond. The 57th annual meeting of the BSJ was held from September 24 to 26, 2019, and chaired by one of the Special Issue Editors, Takeharu Nagai. The 1447 attendees came from diverse backgrounds, including company researchers, students of regional high schools, and foreign participants from the USA (8 delegates), Taiwan (5), Australia (3), Italy (2), Sweden (2), Singapore (2), France (1), Israel (1), and the UK (1). The BSJ2019 also featured speakers from Australia, Taiwan, and the USA as well as the home country.

Scientific Commentaries and review articles included within this Special Issue were selected from the presentations of

the various sessions. Each session featured between 4 and 10 individual speakers who presented talks ranging from 20 min to 1 h in length. We separately commissioned session Commentaries (which are written by the session chairs to describe a summary of the science presented within the session) and individual Reviews (which are written by individual contributors to the sessions). Invitations were made to all session Chairs and selected presenters based on the judgment of the Special Issue Editors attending the Meeting. Due to a limit on the maximum number of articles that could be included within this Issue and a responsibility to try and achieve the widest coverage of topics as possible, we apologize to the presenters not chosen within this group. We sincerely hope that we have achieved a fair coverage of the work presented at the meeting. In total, there were about 35 different separate sessions at the meeting (Table 1).

Table 1 Symposium session names and organizers

Session topic	Session chairpersons
ISBA Integrative approaches towards understanding of gene expression	Takaharu Mori and Shun-ichi Sekine
ISCA Utilization of soft compartments/interfaces from nano to macroscale: Exploring the potential of living systems	Yusuke Sato, Masamune Morita and Yuki Suzuki
ISDA What we can or cannot do by cryo-EM? The forefront of Structural Life Science	Masahide Kikkawa and Atsushi Nakagawa
ISEA Physics of chromatin dynamics – towards understanding the regulation of gene expression	Yuma Ito and Akatsuki Kimura
ISFA Toward “Ari-No-Mama” visualization to reveal biological functions - Resonance between life science and optical technology	Atsushi Miyawaki and Tomomi Nemoto
ISGA Frontiers in multi-scale mechanobiology of muscle and vascular system	Mitsuhiro Iwaki and Yuji Hara
ISHA Control of biological functions with hydrostatic pressure stimulation	Hiroaki Hata and Masayoshi Nishiyama
ISBP ASB-BSJ Joint Symposium: Current challenges in biophysics centering on biomolecular interactions and the underlying forces	Takayuki Nishizaka and Marc Kvalsakul
ISCP Cutting-edge brain research from a biophysical perspective	Takashi Tominaga and Bernd Kuhn
ISDP Current status and issues of protein solution biophysics	Susumu Uchiyama and Saeko Yanaka
ISEP What is “Single-cell PRESTO” doing?	Katsuyuki Shiroguchi and Madoka Suzuki
ISFP Toward the chemical reaction control in biological environment by high-sensitive hydrogen detection	Ichiro Tanaka and Hiroshi Ishikita
ISGP New horizon in molecular observation through high-dimensional data-driven and measurement informatics approaches	Takanori Kigawa and Yasuhiro Matsunaga
ISHP Frontier of structure-function studies to unveil diverse GPCR signaling	Kota Katayama and Ryoji Suno
2SBA Invitation to multimolecular crowding	Kazuhito Tabata and Daisuke Miyoshi
2SCA Challenges of bioinformatics for the era of molecular structure big-data	Tsuyoshi Shirai and Tohru Terada
2SDA Nonequilibrium Energetics of Biological Molecular Machines	Chun-Biu Li and Shoichi Toyabe
2SEA Frontiers of Synchrotron Radiation Biophysics	Hirofumi Iwamoto and Hiroshi Sekiguchi
2SFA Elucidation of biological functions by optical control	Yoshinori Shichida and Hisao Tsukamoto
2SGA How is ‘ENERGY’ generated/transferred across the cellular systems?	Kei Wada and Yoichi Sakakibara
2SHA Challenges to get insight into unsolved problems of dynamic response in proteins	Yu Takano and Yasushige Yonezawa
2SBP Measure x Analyze Metabolic Adaptation of Biological Systems	Mariko Okada and Takeshi Bamba
2SCP Singularity Biology: Small elements change the function of the whole systems	Tamiki Komatsuzaki and Kazuki Horikawa
2SDP Taiwan-Japan joint symposium on structural biology using X-ray crystallography and cryo-EM	Takeshi Murata and Ken Yokoyama
2SEP Understanding biological systems with quantum science and technology	Taro Ichimura and Mutsuo Nuriya
2SFP Constructive Approaches for Evolution: Toward Understanding of Directionality and Constraints	Chikara Furusawa and Naoki Irie
2SGP New horizon of in-silico drug discovery toward launching post-K computer	Mitsugu Araki and Mitsunori Ikeguchi
2SHP Decoding intracellular architecture using visualizing device development and mathematical modeling	Akira Kitamura and Kazuya Kabayama
3SBA Structure, Dynamics and Energy Flow that Govern Heme Protein Functions: Theory and Experiments	Takahisa Yamato and David Leitner
3SCA Diversity and universality of motile mechanism of living things: From intracellular dynamics to collective motion	Shuichi Nakamura and Azusa Kage
3SDA Optogenetics: Applying photoreceptor for understanding biological phenomena	Satoshi Tsunoda and Keiichi Inoue
3SEA Thermal Biology	Yoshie Harada and Kohki Okabe
3SFA Biophysics in Nano-space	Hisashi Tadakuma and Daiju Kitagawa
3SGA Biophysical Physiology and Pathology by the Application of Super-resolution Microscopy	Taka A. Tsunoyama and Rinshi S. Kasai
3SHA The Quality of Proteins - Multiple Approaches for Protein Evaluation	Tadayuki Ogawa and Takayuki Uchihashi

Topic sessions were many and varied. Among the topics covered included those dealing with fundamental aspects of physics that affect energy flow and other processes within and between macromolecules in the crowded environment of the cell. One joint symposium, with the Australian Society of Biophysics (ASB), was organized by Takayuki Nishizaka of Gakushuin University and Marc Kvanakul of La Trobe University centered on challenges to understanding biomolecular interactions and forces. Topics of other sessions included photophysics and the working of light-driven pumps and ATP-driven motors. Chromatin dynamics and CRISPR were also described, as well as the fundamental principles behind phase separation, a phenomenon underlying much of cell physics. Physical forces can now be studied at the cell level, by methods such as nano-thermometry which has become possible through recent advances.

Super-resolution microscopy is now a widely used method, and several sessions covered the use of light not only to observe structures but also to control biological systems. Two separate sessions were dedicated to optogenetics and related methods, and a further one to recent developments in optical technology such as nonlinear optics.

More traditional structure-determining methods such as NMR and single-crystal crystallography have largely given way to newer techniques such as XFEL, which can be used to observe molecular changes on sub-nanosecond timescales. CryoEM has also become hugely popular for solving the structure of large macromolecule complexes to high resolution without the struggle to obtain crystals. Both synchrotrons and cryoEM were the topic of dedicated sessions, one being a joint Taiwan-Japan session on structural biology using both cryoEM and X-ray crystallography. There was also a discussion on how useful neutrons are for looking at hydrogen atoms in macromolecules, and what we can learn from them. Never far from anyone's mind, new methods for analysis that come under headings such as “deep learning,” “machine learning,” or “AI” were also on display. High-dimensional data and brain information processing formed two separate sessions. Bioinformatics talks included discussion of results from the AMED-BINDS project, while supercomputer-based drug design and developments in the field of *in silico* drug discovery filled a separate session.

Lastly, the BSJ2019 held a commemorative symposium for one of the founders of BSJ, Prof. Fumio Oosawa (deceased on March 4, 2019, at the age of 96). The attendees discussed what the next 50 years of biophysical research could bring, following the spirit of Prof. Oosawa: “Biophysics should be exciting not only for physicists but also for biologists.” All of us are excited to dream about where biophysics will take us in the next few decades.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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