

IUPAP Commission on Biological Physics (C6)

Report on Activities from October 2017 to March 2018

Ramin Golestanian, C6 Chair

Jeff Gore, C6 Vice Chair

Masaki Sasai, C6 Secretary

1. C6 Membership (2017-2020)

| Name | Country | Roles | Terms |
|--------------------------------|----------------|------------|--------------------|
| Ramin Golestanian | United Kingdom | Chair | (2017)(2014)(2011) |
| Jeff Gore | United States | Vice Chair | (2017)(2014) |
| Masaki Sasai | Japan | Secretary | (2017)(2014) |
| Marcia Barbosa | Brazil | Member | (2017) |
| Debashish Chowdhury | India | Member | (2017) |
| Mohammad Reza Ejtehadi | Iran | Member | (2017) |
| Hans-Joachim Galla | Germany | Member | (2017) |
| Ming Li | China | Member | (2017)(2014) |
| Suliana Manley | Switzerland | Member | (2017) |
| Vladimir Nekorkin | Russian | Member | (2017) |
| Juan Manuel Rodríguez Parrondo | Spain | Member | (2017) |
| Bryan Trevor Sewell | South Africa | Member | (2017)(2014) |
| Joanna Trylska | Poland | Member | (2017) |
| Francoise Brochard Wyart | France | Member | (2017)(2014) |

2. The IUPAP C6 Newsletter

The main purpose of the Newsletters is to promote and facilitate communications among biological physics communities worldwide and to foster international cooperation in biological physics. The second IUPAP C6 e-Newsletter was issued in December 2017 with editors being the former C6 Chair Aihua Xie (US) and Masaki Sasai (Japan). A copy of this second issue of Newsletter is attached to this report. A special article was on “The commissions on Medical Physics (AC4) and Biological Physics (C6) -strengthening the

cooperation between two neighbour sciences under the roof of the IUPAP” written by AC4 Chair Dr. Fridtjof Nüsslin.

3. ICBP2019 in Madrid, Spain

Preparation for the 10th IUPAP International Conference on Biological Physics (ICBP2019) was started. ICBP is the major event of the Commission on Biological Physics, covering the entire field of Biological Physics. The ICBP2019 is jointly organized with the European Biophysical Societies Association (EBSA) and will take place in 20-24th July 2019 in Madrid, Spain. More than 1000 participants from diverse world-wide areas are expected. The C6 member, Professor Juan Manuel Rodríguez Parrondo from Universidad Complutense in Madrid, is organizing ICBP2019, and the scientific program was started to be discussed through collaborative efforts of C6 Chair Ramin Golestanian and EBSA Vice President Prof. Jesus Perez-Gil. Plans for the satellite conferences were also discussed among C6 members. We are currently in the process of finalizing the symposia and finding representative members of both communities to act as chairs, to ensure a good synergy between the two organizations. This is a very exciting development as it is the first time that two historically separated communities that represent different parts of the spectrum of this interdisciplinary field join up forces to have an active participation in bridging the barriers amongst them.

IUPAP

International Union of Pure and Applied Physics

Commission on Biological Physics Newsletter

Editors: Masaki Sasai, Aihua Xie
 Guest Editor: Bramwell G. Lambrus

No. 2 – December 2017



ICBP2019 & EBSA2019 in Madrid, Spain



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IUPAP General Assembly and newly elected C6 Commission

by Aihua Xie, C6 Chair (2015-2017)

The first IUPAP Commission on Biological Physics (IUPAP C6) was formally created at the 20th IUPAP General Assembly, held in Dresden in 1990. Over the past 27 years, the field of biological physics has experienced tremendous growth. IUPAP C6 has been playing an active role in promoting the worldwide exchange in biological physics, including organizing International Conferences on Biological Physics and recognizing outstanding young scientists in biological physics with the prestigious IUPAP C6 Young Scientist Prizes (YSP).



2017 IUPAP C&C

In October, the IUPAP C&CC Meeting (Councils & Commission Chairs) (see the group photo) was first held in Sao Paulo, Brazil (October 9-10). Delegates from IUPAP member countries joined IUPAP councils and commission chairs to attend the triennial 29th IUPAP General Assembly also in Sao Paulo (October 11-13). Among many activities, one highlight was that Nobel Laureate William D. Phillips delivered a mesmerizing public lecture on laser cooling with really cool demonstrations to a large thrilled audience including hundreds of young students. Among many decisions, we discussed and voted for new Resolutions and elected new officers and members of 18 IUPAP commissions, including the new Commission on Biological Physics. Resolution 8 is closely related to C6 on establishing an IUPAP Working Group on Soft Matter. The new IUPAP President is Kennedy Reed from Lawrence Livermore National Laboratory (USA). (Please visit <http://iupap.org/> for further information on IUPAP GA.)

The newly elected 10th C6 commission (2018-2020) will be led by Ramin Golestanian as the Chair (United Kingdom), together with Jeff Gore (vice chair, United States) and Masaki Sasai (secretary, Japan). The new C6 members are: Marcia Barbosa (Brazil), Debashish Chowdhury (India), Reza Eftehadi (Iran), Hans-Joachim Galla (Germany), Ming Li (China), Suliana Manley (Switzerland), Vladimir Nekorkin (Russian), Juan Manuel Rodriguez (Spain), Bryan Trevor Sewell (South Africa), Joanna Trylska (Poland), Françoise Brochard Wyart (France).

ICBP2019 in Madrid, Spain

The joint EBSA-IUPAP
conference

July 20-24, 2019 in Madrid



ICBP2019, Madrid, Spain

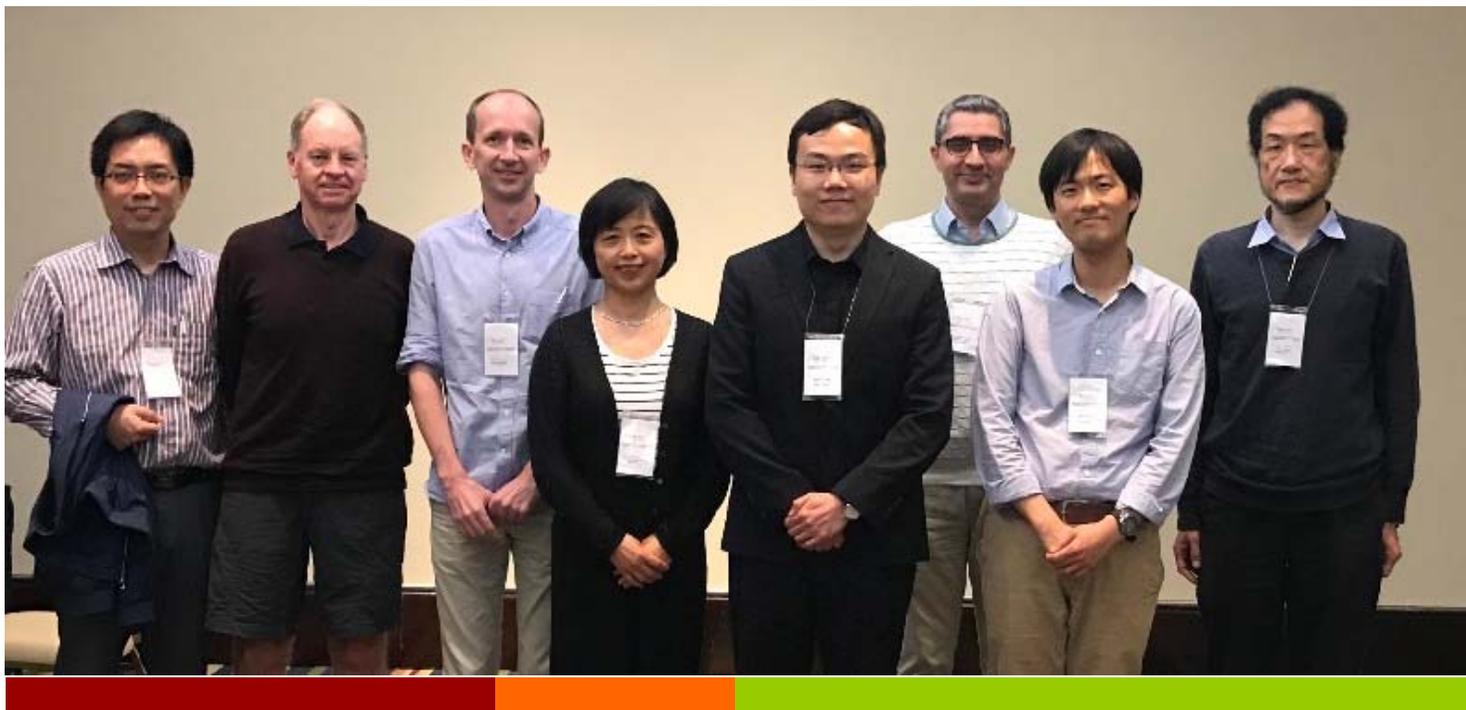
by Ramin Golestanian, C6 Chair (2018-2020)

After the successful organization of the ICBP2014 in Beijing and the ICBP2017 in Rio de Janeiro, it was felt by the C6 committee of IUPAP that the conference series has now reached the level of maturity that it needs in order to bring researchers from the field of biological physics together, and it might be a good time to start reaching out to other communities who are involved with similar type of interdisciplinary research. Therefore, it was decided to team up with the European Biophysical Societies' Association (EBSA) and hold the next conference jointly. The discussions between the two societies have been very positive and productive, and the joint conference is now planned for 2019.

The joint EBSA-IUPAP conference will be held during 20-24 July 2019 in Madrid, at the IFEMA congress centre

[http://www.ifema.es/Institucional_06/]. The venue is large enough to house 1000 delegates, which is our target number. The conference has an organizing committee, on which the C6 committee of IUPAP will be represented by Juan Parrondo (Madrid) and Felix Ritort (Barcelona), and a scientific committee, on which there is equal representation from the two societies (members have now been contacted and appointed). The scientific committee will discuss the topics of the Symposia and the Plenary speakers. It is envisaged that the conference will have 10 plenary speakers and around 30 Symposia.

We look forward to what promises to be a fantastic event for the field of biological physics. I hope to see you all in Madrid in July 2019.



IUPAP C6 Young Scientist Prize (2015-2017)

by Helmut Grubmüller (C6 Vice Chair) and Petra Kellers

In February 2017, the IUPAP C6 Commission invited nominations for the Young Scientist Prizes in Biological Physics (2015-2017) to recognize exceptional achievements of scientists in the field. The award is dedicated to scientists at a relatively junior stage of their career displaying a promising innovative future prospect. The collection of nominations and the selection process was coordinated by Helmut Grubmüller, vice chair of C6, Aihua Xie, Chair of C6, and Ria Maria Cunha de Almeida, Secretary of C6.

Nominations of strong candidates were received from all over the world, including USA, UK, Hungary, Italy, Germany, Canada, France, China, Australia, Ireland, the Netherlands, Portugal and Japan. The nomination documents were distributed to C6 commission members to collectively agree on the three YSP Recipients:

Dr. Jiajie Diao (the University of Cincinnati, USA) (2015 YSP)

“For his significant contributions to the area of single-molecule biophysics. He pioneered the development of single vesicle fusion assays based on FRET, which enables addressing many fundamental questions about biological systems involving membranes.”

Dr. Siyuan Steven Wang (Harvard University, USA) (2016 YSP)

“For his significant contributions to the development of novel methods for imaging the spatial organization of chromatin and to advancing the understanding of chromosome organization using these methods and for his significant contributions to bacterial cytoskeleton and cell wall research.”

Dr. Hyun Youk (the Delft University of Technology, NL) (2017 YSP)

“For his elegant demonstration of how statistical physics, dynamical systems theory and experiments can be combined to address fundamental questions in cell biology, and his recent work that shows how cell-cell communication can shape the spatio-temporal dynamics of living cells.”

A YSP Award Ceremony was held on June 8, 2017 at the 9th International Conference on Biological Physics (ICBP2017) in Rio de Janeiro. Above is a group photo of two YSP winners with six C6 members: Ming Li (China), Trevor Sewell (South Africa), Imre Derenyi (Hungary), Aihua Xie (USA), Siyuan S Wang (2016 YSP winner), Ramin Glostania (UK), Hyun Youk (2017 YSP winner, NL), and Masaki Sasai (Japan).

The commissions on Medical Physics (AC₄) and Biological Physics (C₆) – strengthening the cooperation between two neighbour sciences under the roof of the IUPAP

by Fridtjof Nüsslin, Technical University Munich,
Chair AC₄ “Medical Physics”



The International Organization for Medical Physics (IOMP) has been founded in 1963 and represents over 25,000 medical physicists worldwide and has 86 national member organizations. The mission of IOMP is to advance medical physics practice worldwide by disseminating scientific and technical information, fostering the educational and professional development of medical physicists, and promoting the highest quality medical services for patients. IOMP works together with international organizations such as IAEA, WHO and ILO to strengthen the role of Medical Physicists.

In the medical physics community there are two major groups of individuals; the first group is people mainly working as health care professionals. These medical physicists are typically found in hospitals with departments for Radiology, Nuclear Medicine, Radiation Oncology, Radiation Protection, Medical Imaging, Physiology, furthermore in many other clinical branches. The second group has a scope with major focus on the application of physics principles and methods in biosciences such as biomedicine, biology, and bioinformatics. This field is more generally termed Biomedical Physics. Of course, there are smooth transitions between both groups, mainly those persons who are working in academia with responsibilities both in patient care and research.

In order to advance medical physics science and practice worldwide, IOMP felt it essential to strengthen the interaction of medical physics with other branches of physics. Hence, in accordance with the mission of IUPAP (“...to help in the application of physics toward solving problems of concern to humanity”) the IOMP formed the International Committee on Medical Physics (ICoMMP)

which has been recognized by the IUPAP as the Affiliate Commission on Medical Physics (AC₄). It is a well-established tradition to invite the Chair of the C₆ Biological Physics to join AC₄ as an associate member.

We can illustrate the mutual relation and the potential of interaction of sciences with an example particularly relevant for Biomedical and Biological Physics, i.e. Cancer. From my own experience and involvement in cancer research, I want to address a few topics which challenge the physicists to look beyond the fences of their own playground (see **Box** in the next page). These examples are just a limited number of activities of Biomedical Physicists working in the large field of cancer research. I am sure that the colleagues from Biological Physics for instance relevant for the rather new field “Physics of Cancer” would find quite a few areas which might complement those examples of Biomedical Physics in Cancer.

Finally, as good neighbours we should think about some joined activities. In the past, Biomedical Physicists and Biological Physicists exchanged ideas at conferences (ICBP, IOMP) and organized three joint symposia, beginning 2007 in Montevideo (“*Cellular & Tissue Imaging: challenges for modern radiotherapy*”). Commissions AC₄ and C₆ may consider this kind of mutual exchange and look out for opportunities.

Box. Examples of Biomedical and Biological Physics Research on Cancer.

Biological aspects of laser based radiotherapy: Radiotherapy is together with surgery the most frequently used modality in cancer treatment. Medical electron linear accelerators deliver X-ray beams in the energy range up to about 20 MeV. To optimize the dose distribution, increasing interest arises in the use of particle beams, primarily protons with energies up to 250 MeV. Particle beam generation however is a rather complicated and expensive technology. As an alternative, laser driven ion acceleration is considered a potentially more compact and in the long run cheaper method. Questions arise on the biological response and molecular mechanism of such particle bunch dose rates of 10^{10} Gy/s compared to about 100 Gy/min in conventional medical linear accelerators.

Impact of hypoxia on cancer treatment: The impact of hypoxia on the outcome of cancer treatment is well established. As hypoxic tumor cells are resistant to radiotherapy and many anticancer drugs, it is essential for the treatment planning to precisely localize the hypoxic subvolumes of the tumor using radioisotope imaging and to modulate properly the dose distribution for the radiation treatment.

Biomedical and Biological Imaging: Medical Physicists are increasingly involved in all imaging methods used in cancer diagnosis. Beyond this health care aspect, Biomedical Physicists work in cancer research to advance imaging techniques such as optical and opto-acoustic imaging, nuclear magnetic resonance (NMR), MR-spectroscopy, photoacoustic and molecular ultrasonography, elastography and others.

Radiomics, Radiogenomics: The diagnosis, treatment and follow-up phases are based on an ever increasing number of images for each individual patient. Recently, a new approach has been introduced to convert these clinical images into minable data which are associated with patient demographic, outcome and gene expression databases. Deep learning may be applied to personalize. Optimization of the treatment and health care by means of comprehensive individual data analysis including genomic data is envisaged.

International and Multinational Conferences in Biological Physics

The 10th IUPAP International Conference on Biological Physics (ICBP2019), the joint EBSA-IUPAP conference
Madrid, Spain, July 20-24, 2019

The 3rd International Conference on Proton Coupled Electron Transfer
Blowing Rock, North Carolina, USA, June 10-14, 2018
<http://www.rsc.org/events/detail/29600/3rd-international-conference-on-proton-coupled-electron-transfer>

The 62nd Annual Meeting of Biophysical Society (USA)
San Francisco, USA, February 17-21, 2018.
<http://www.biophysics.org/2018meeting/GeneralInfo/Overview/tabid/7118/Default.aspx>

Genome Biophysics: Integrating Genomics and Biophysics to Understand Structural and Functional Aspects of Genomes
Santa Cruz, CA, USA, August 19-24, 2018
<http://www.biophysics.org/2018santacruz/Home/tabid/7386/Default.aspx>

The 2018 American Physical Society March Meeting (with a broad range of programs in biological physics)
Los Angeles, USA, March 5-9, 2018
<https://www.aps.org/meetings/meeting.cfm?name=MAR18>

The 56th Annual Meeting of the Biophysical Society of Japan
Okayama, Japan, September 15-17, 2018
<http://www2.aeplan.co.jp/bsj2018/english/index.html>

Gordon Research Conference — Lasers in Medicine and Biology
Bates College, Lewiston, ME, United States, July 8-13, 2018
<https://www.grc.org/lasers-in-medicine-and-biology-conference/2018/>

10th Edition of International Conference on Structural Biology 2018
Barcelona, Spain, March 15-16, 2018
<http://structuralbiology.euroscicon.com/>

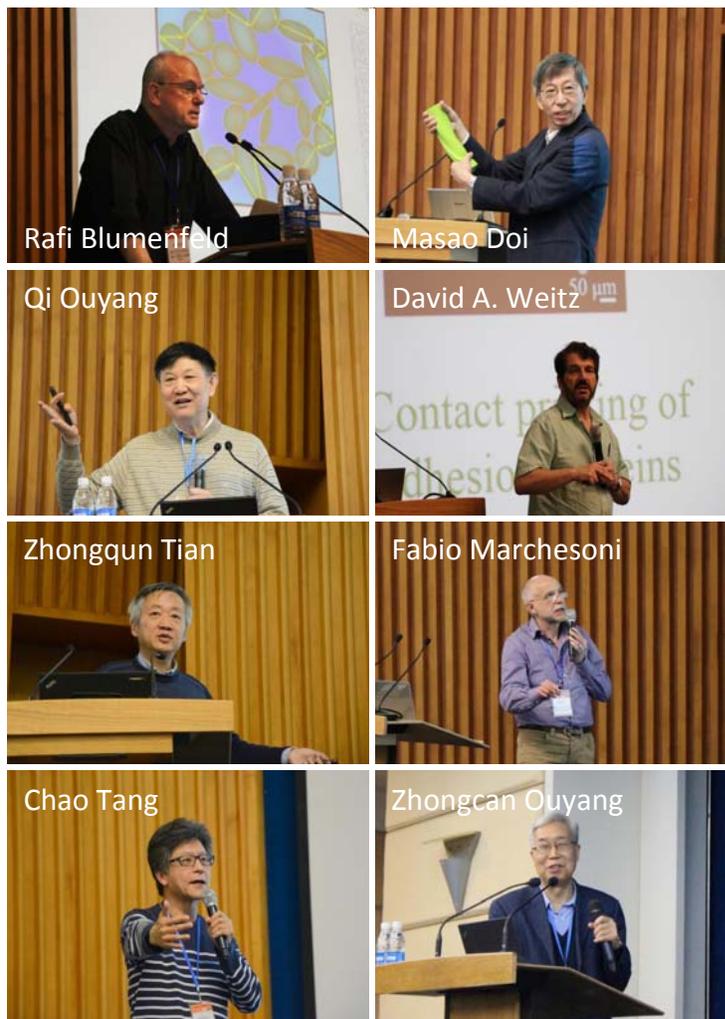
Conference Report: The 10th National Conference on Soft Matter and Biophysics Xiamen University

by Ming Li, C6 Member

Sponsored by the College of Physical Science and Technology and the Research Institute for Biomimetics and Soft Matter, Xiamen University, the 10th National Conference on Soft Matter and Biophysics was held from March 24th to 27th, 2017 in Xiamen. Prof. Zhongcan Ouyang served as the general chair, and Prof. Ming Li served as the conference secretary. The executive chairs were Prof. Chenxu Wu and Prof. Xiang Yang Liu from Xiamen University.

The conference attracted over 450 delegates from more than 100 universities and research institutes at home and abroad. Profs. Rafi Blumenfeld, Masao Doi, Qi Ouyang, David Weitz, Zhongqun Tian, Fabio Marchesoni and Chao Tang delivered keynote lectures. In four parallel sessions, 160 papers were reported in the areas of the soft matter, living matter, discrete particles, continuum systems and complex systems.

During the conference, the Organizing Committee have reached the agreement that the 11th National Conference on Soft Matter and Biophysics will be held in the Chongqing University in 2019.



News from APS:

New Honorees in Biological Physics from American Physical Society

by Yuhai Tu, Chair of APS Division of Biological Physics

2018 Max Delbruck Prize in Biological Physics Recipient

William S. Bialek (Princeton University)

Citation: *"for the application of general theoretical principles of physics and information theory to help understand and predict how biological systems function across a variety of scales, from molecules and cells, to brains and animal collectives."*

New DBIO APS Fellows (class of 2018)

Chris Adami (Michigan State University): For the development of novel methods to study evolution using digital experimentation, as well as contributions to the use of information theory to understand biological systems

Jun Song (University of Illinois): For the development of advanced signal processing methods to reveal patterns in genomic data and study chromatin structure

Paul A Janmey (UPenn): For pioneering work on fundamental properties of biopolymers and their implications for mechanobiology

Thomas T Perkins (JILA): For innovations in precision measurement of dynamic biological systems at the smallest scales.

William Ryu (University of Toronto): For establishing and advancing the field of the physics of behavior of microorganisms.

Wolfgang Losert (University of Maryland): For numerous contributions to understanding dynamical properties of complex systems at the convergence of physics, materials science, and biology.

Yang Xia (Oakland University): For his contributions to nuclear magnetic resonance microscopy, and particularly for his use of this and other techniques to study the structure of articular cartilage, with applications to osteoarthritis.

2017 Award for Outstanding Doctoral Thesis Research in Biological Physics Recipients

David Reid Jacobson (JILA, NIST/University of Colorado, Boulder)

Citation: *"for pioneering studies of the electrostatic, elastic, and conformational behavior of single-stranded nucleic acids."*

Pierre Alexandre Haas (DAMTP/University of Cambridge)

Citation: *"for outstanding theoretical work on the description of embryonic inversion in the alga Volvox, incorporating novel generalizations of elasticity theory and applied mathematics."*