

Contents

- 3. *The committee*
- 3. *The Chair's Commentary*
- 4. *Opinion piece*
- 5. *Conference reports*
- 7. *Conference calendar*

Items for the newsletter should
be e-mailed to
r.endres@imperial.ac.uk

Editorial

The October edition is my final newsletter as I am leaving the committee. I enjoyed the work immensely, and also that the biophysics community has significantly developed over the last three years. In this newsletter Prof. Jamie Hobbs, the Chair of the committee, gives an update on funding and the Biological Physics Group. We are also extremely grateful to former committee member Martin Howard who reports on his experience of delivering the Tom Duke Lectures. Additionally, we report on exciting past and future conferences. Last but not least, the title image was generously provided by Paul Beales, University of Leeds, showing giant unilamellar lipid vesicles interacting with zinc oxide nanoparticles with fluorescent dextran (blue) in solution to monitor membrane permeability (note the fission events). Enjoy reading, and I hope to see you at one of the upcoming conferences!

*Dr. Robert Endres
Newsletter Editor*

The Committee

Chair

Prof Jamie Hobbs

Honorary Secretary

Dr Rosalind Allen

Honorary Treasurer

Dr Pietro Cicuta

Members

Dr Susan Cox

Dr Robert Endres

Dr Rhoda Hawkins

Prof Mark Leake

Prof Timothy Newman

Prof Michelle Peckham

Prof Daniel Robert

Prof Christian Soeller

Prof Peter Weightman

The Chair's commentary

Six months on since the last newsletter and the situation for UK science funding remains deeply uncertain. The spending review is nearly here, and the chance of a sensible increase in funding for science seems vanishingly small! It is time for last minute lobbying and for making the case that the UK's scientists' ability to do more with less can only be pushed so far.

I would like to take this opportunity to thank Robert Endres for all his hard work over the last few years in producing this newsletter. The establishment of a really strong biological physics community in the UK is vital, and Robert has made a real contribution to this, starting new features in the newsletter and introducing a more daring style. He has also been responsible for the emergence of a successful conference series, which I hope he will continue off the committee.



Over the next few months we have two more BPG conferences to look forward to – Quantitative Methods in Gene Regulation III and The Physics of Soft and Biological Matter II. These promise to be excellent events, so go along if you can, and see the adverts inside this issue for more details. We are always looking for new opportunities to provide conferences across the broad breadth of biological physics, so if you have ideas for an event you would like to organise, do get in touch – you do not have to be on the committee. Similarly, if you are organising an event that you feel might be

relevant to the biological physics community let us know and we can get IOP to use their mailing lists to help advertise it.

Opinion piece

It was a great honour to be appointed by the IOP Biological Physics Committee as the inaugural Tom Duke lecturer. As I knew Tom reasonably well, the prize was an honour but one which I accepted with a sense of responsibility, conscious of his great contribution to the development of the subject. I was asked to lecture at University College London, Tom's last employer, as well as at Nottingham and Heriot-Watt in Edinburgh. I chose as my subject plasmid segregation in bacteria and cell size control in fission yeast, disparate topics that are, I believe, related by a rather similar underlying biophysical mechanism. It was a particular pleasure that Tom's father was able to attend my first lecture at UCL, which I hope he enjoyed, with good turn-outs at all three seminars. It was great to see truly interdisciplinary biological physics thriving at each university. I found my visit to Heriot-Watt being particularly enjoyable, as it was my first visit and I was previously unaware of the great research being done there. Obviously I hope there will be many more Tom Duke lecturers to come, spreading the word about the excitement of our field, particularly to places that might be resistant, hesitant or simply not quite sure what to make of an unfamiliar brand of physics.

One point that I tried to make extensively during my lectures, was the importance of long-term, deep collaboration with biology experimentalists. If we as physicists want to make penetrating insights into a subject as nuanced as biology, then there is simply no substitute for this kind of interaction: parachuting in and expecting to make telling contributions after only weeks or months is not a viable strategy. Fortunately over the last 10 years, I have been lucky to work with several biologists who were also willing to share in long-term collaborations. I would particularly like to single out Fred Chang (Columbia University, USA, fission yeast morphogenesis) and Caroline Dean (John Innes Centre, UK, epigenetics in Arabidopsis). These and other collaborations have often had long gestation periods, and with subsequent multiyear gaps between publications. Indeed, I have found that it typically takes up to five years from first conversation to first publication. As you can imagine, funding these sorts of projects is problematic! My work on epigenetics has been funded by both the ERC and BBSRC, while the fission yeast work has, I'm afraid to say, not been funded at all up to now. Time has had to be taken from other projects that were temporarily stalled, or in one case, a former postdoc who had left the group worked on the problem, which was tolerated by his new and very lenient PI! Needless to say, this is hardly a

generally applicable strategy for funding long-term interdisciplinary work. Very recently, the fission yeast project has finally been funded (starting next year) through the BBSRC, which for the first time has permitted joint proposals with the USA to be properly assessed.

As you may have noticed by now, conspicuous by its absence from all of this, is any involvement by the EPSRC. Sadly this has been the one constant in the field over the last 10 years, dating back before my time on the IOP Biological Physics committee, where I was the first treasurer. Funding work where the primary goal is biological mechanism has not been part of the EPSRC's agenda. For my research, I have always been focused on teasing out such fundamental mechanisms. This was true in my first work in the field from 2001, when I was lucky enough to work on the beautiful MinCDE spatiotemporal oscillator that regulates cell division positioning in *E. coli*, and it remains true now. For me, physics has been the vehicle and the highway in my research, but the destination has always been mechanistic biological insight. This style of research, with long-term deep collaboration with experimentalists, is very time-consuming and requires great commitment, but in the end I believe it delivers the greatest insights. As a community, I think we need to work out how to encourage this style of research, to build a community that has deep expertise in statistical mechanics, but also doesn't shirk from the inherent messiness and imprecision of a Chromatin Immunoprecipitation experiment. That this community still barely exists is perhaps not all that surprising. It is an arduous journey and meets resistance from both sides: physicists who think you sold out and who are afraid that you're taking their funding away in a zero sum game. At the other end of the spectrum, many biologists still don't understand the quantitative agenda, though their number diminishes every year. I hope that the EPSRC wants to be involved in expanding the space of what is possible in interdisciplinary research, but in the end if their only interest is instrumentation and methodological development, then I think they need to tell us that definitively so that we can migrate elsewhere.

Prof. Martin Howard
John Innes Centre

Conference reports

Physics of emergent behaviour II

Science Museum, London, 9-10 July 2015

This two-day conference was the second edition of the Physics of Emergent Behaviour conference series, following the very successful gathering in 2013.

Similar to the first meeting, the aim was again to provide a highly multidisciplinary platform for physicists, biologists and mathematicians to come together to discuss experimental and theoretical approaches for studying emergent behaviour in living systems. The underlying idea is that unexpected behaviour can emerge in complex biological (and physical) systems, as a direct consequence of local interaction between individual units. Surprisingly, this behaviour is often rather irrespective of the system's microscopic details. For this reason, the conference covered topics spanning many length scales, from cells, to flocks and swarms of animals, to sand dunes and planetary climates. The program, which was purposefully unstructured to increase cross-pollination across topics, included 10 invited speakers, 14 contributed talks, and 25 posters. In the following we highlight some of the invited talks.

On 9th July, we heard talks about tissues, plants, and birds. Andrea Cavagna from the Institute for Complex Systems, Italy, talked about information transfer and behavioural inertia in starling flocks, using 3D data filmed in Rome. Criticality in collective biological systems such as flocks is a truly hot topic in biological physics. Anthony Bishopp from the University of Nottingham, UK, discussed the organisation of cellular pattern in plant roots. In a talk with philosophical content on emergence, Stephan Grill from the Technical University of Dresden, Germany, showed amazing video microscopy data and modeling on the actomyosin force generation and pattern formation in *C. elegans* embryos.

On 10th July, we heard about animal groups, bacteria, and planets. Specifically, Iain D. Couzin from Princeton University, USA, discussed collective sensing and decision-making in animal groups. His inspiring talk ranged from fish schools to primate societies, imaged by drones! A completely different topic was discussed by Ralph D. Lorenz from Johns Hopkins University, USA, who discussed the formation of sand dunes and sand devils on Mars, other emerging features on Titan's climate, and the recent fly-by mission to Pluto. Back to statistical mechanics, John Toner from University of Oregon, USA, described the mathematics of swarming in the dirt, specifically flocking in the presence of quenched disorder using acoustic modes. The conference ended with a fascinating talk by Robert H. Austin from Princeton University, USA, who went (way) beyond Darwin and explained the surprisingly fast emergence of antibiotic resistance in bacteria using his unusual 'death-galaxy' device.

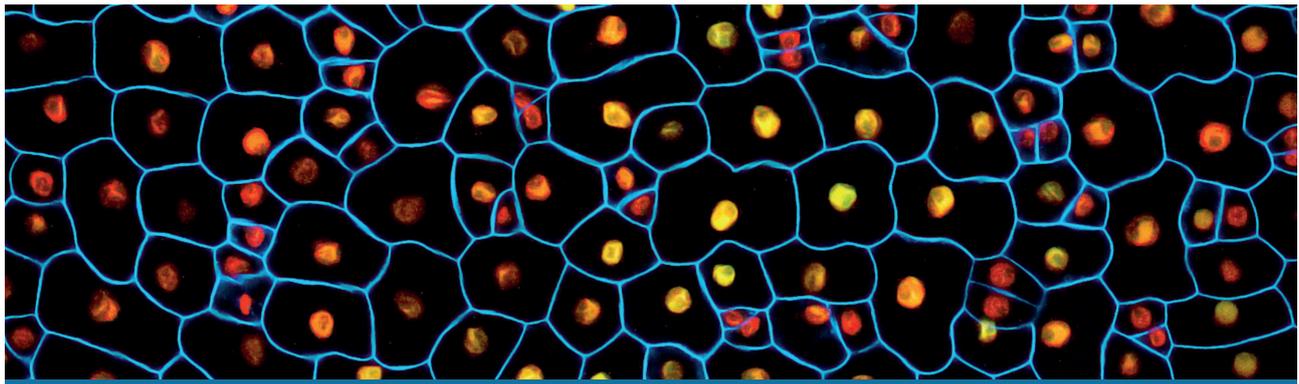
The conference was highly stimulating, refreshing and certainly timely, considering that the two EPSRC-funded networks covered related topics as relevant for future funding. Feedback from delegates showed that the broad range of topics presented at the meeting was viewed extremely positively, confirming a huge demand for nontechnical big-picture conferences. Indeed,

81% of post-conference survey participants rated their experience at the PEB II conference as excellent.

Conference organisers:

Drs. Robert Endres, Chiu Fan Lee, Giovanni Sena (Imperial College, London)

Conference calendar



**Quantitative Methods
in Gene Regulation III**

7–8 December 2015
Corpus Christi College, Cambridge, UK
<http://genereg.iopconfs.org>

*Organised by the IOP Biological Physics Group
Co-sponsored by the Society of Biology*

Quantitative Methods in Gene Regulation III

Corpus Christi College, Cambridge, 7-8 December 2015

This is the third edition of a biannual meeting, organised by the IOP Biological Physics Group. It has grown to be a reference event for a multidisciplinary set of researchers, meeting to showcase and discuss recent discoveries that are radically changing the picture of gene and chromatin regulation, as system-level organisational mechanisms emerge to play key roles.

Contributions aim to highlight new biological breakthroughs in this important research area, and the crucial role of quantitative approaches from both experiment and modelling. We provide a unique opportunity to bring together researchers working in such a vast, yet strategic, field, in disciplines ranging from biology and medicine to chemistry, computer science, engineering, mathematics and physics. Topics will include cellular decision-making (cell division, death, differentiation, plasticity), single cell and population physiology, chromatin & protein machines (molecular focus), stem cells, development (tissues and organism), high-throughput genomics, large-scale views of the regulatory code, chromatin and epigenetics.

Our lineup of confirmed invited speakers includes:

Julie Ahringer, University of Cambridge, UK

Asifa Akhtar, Max Planck Institute of Immunobiology and Epigenetics,
Germany

Tobias Bollenbach, Institute of Science and Technology, Austria

Kevin Chalut, University of Cambridge, UK

Peter Fraser, The Babraham Institute, UK

Doug Higgs, University of Oxford, UK

Sergei Maslov, University of Illinois, USA

Mario Nicodemi, University of Naples, Italy

Erik van Nimwegen, University of Basel, Switzerland

Wolf Reik, The Babraham Institute, UK

Kim Sneppen, University of Copenhagen, Denmark

Simon Tavare, University of Cambridge, UK

<http://genereg.iopconfs.org/home>

The organising committee:

Pietro Cicuta (Chair), University of Cambridge

Sarah Teichmann, EMBL-EBI

Marco Cosentino Lagomarsino, University Pierre and Marie CURIE & CNRS

Oliver Stegle, EMBL-EBI

The banner features a dark blue background on the left with white text. On the right, there is a blue square containing a microscopic image of red and white spherical particles. The text on the left reads: 'IOP Institute of Physics' in a smaller font, followed by 'The Physics of Soft and Biological Matter' in a large, bold font, and '6-8 April 2016, Homerton College, Cambridge, UK' in a smaller font at the bottom.

IOP Institute of Physics
The Physics of Soft and Biological Matter
6-8 April 2016, Homerton College, Cambridge, UK

Physics of Soft and Biological Matter

Cambridge, 6-8th April 2016

The conference will bring together the broad and diverse community interested in the physics of soft and biological matter, which includes liquid crystals, polymers, colloids, membranes, interfaces, cellular biophysics, and biological macromolecules.

The programme will span a number of key cross-cutting themes, including self-assembly and patterning, rheology, biomimetics, non-equilibrium phenomena, as well as molecular imaging, optical methods and spectroscopies, which are all relevant to the wide range of length- and time-scales present in these fascinating systems. This meeting follows the very successful conference on the same topic in 2014.

Organised by the IOP Biological Physics, Liquids and Complex Fluids,
Molecular Physics and Polymer Physics Groups

www.softbio2016.iopconfs.org