

Issue no. 2

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Items for the newsletter should be e-mailed to
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Editorial

Welcome to the second newsletter for the Biological Physics Group. It has been an exceptionally busy six months of conferences supported by our group, and we have reports from these inside. At just over three years since the Group started, a large number of committee members have finished their time, so we welcome new members and a new Chair. The growth and vibrancy of our community requires the acceptance of our discipline into physics teaching, and this is the subject of this issues Opinion Piece.

*Dr Jamie Hobbs
Newsletter editor*

The Committee

Chair

Prof Andrew Turberfield

Honorary Secretary

Dr Sarah Harris

Honorary Treasurer

Dr Beppe Battaglia

Members

Dr Jose Brandao-Neto

Dr Pietro Cicuta

Dr Andrea Jimenez Dalmaroni

Prof Ray Goldstein

Dr Jamie Hobbs

Dr Mark Leake

Dr Aline Miller

Prof Paul O Shea

Prof Clive Roberts



*Prof Andrew Turberfield,
Chair*

The Chair's commentary

The Biological Physics Group is lively, growing (291 members at the last count) and finding new ways to serve the community of Biological Physicists in the UK. On behalf of that community I wish to thank Athene Donald, our outgoing Chair, and Martin Howard, Rod Smallwood, Tom Waigh and Peter Winlove who all left the committee at the AGM and who helped to build the group up from a standing start.

Probably our most important function is to hold conferences and workshops. Since our last newsletter in June 2010 we have held our second international conference Physics Meets Biology, organized a meeting on Computational Biomedical Physics in association with the Medical Physics Group, and contributed to a new theme on Biological and Soft Matter Physics that ran through CMMP. Reports on all three are included later in the newsletter, with adverts for two meetings to come in 2011: Advanced Photonics Techniques in Biology and the Physics of Gene Regulation. The range of meetings is deliberately broad: they are intended to foster interdisciplinary research by promoting scientific exchange, creating new collaborations and exposing young researchers to new ideas and techniques. We are grateful to the IoP Conferences Department for their assistance. We would welcome ideas for other meetings, and volunteers to run them.

Several present and former committee members are keen to encourage the introduction of more Biological Physics into degree courses. Philip Diamond (Associate Director, IoP) and Athene Donald are leading an IoP project to develop teaching resources, as Philip describes in a separate article.

We have continued to encourage communication between the Biological Physics community and the Research Councils. We were very pleased that Andrew Bourne, Head of Physical Sciences Programme at EPSRC, and David McAllister, BBSRC Strategy and Policy Manager, attended Physics Meets Biology and gave presentations and answered questions before the group AGM.

As part of our mission to promote physics in biology the Biological Physics Group has become a full member of the Society of Biology, a new (one-year-old) umbrella organization that is intended to provide a single unified voice for biology, comparable to the IoP and RSC. This will make it easier for us to organize joint activities with other member societies (57 of them, from the Anatomical Society to the Zoological Society of London). It also gives us access to the facilities at Charles Darwin House, a newly converted centre for biosciences just off Gray's Inn Road.

I am looking forward to helping the Group to develop. Please make the most of the activities that we organize, and let us know what else you would like us to do.

Opinion Piece

Teaching Biological Physics: An IOP project

By Philip Diamond, Associate Director, IOP

Our project to develop material to support physics departments looking to teach biological physics to undergraduates, was a response to advice from an international panel of eminent physicists visiting the UK to report on the quality of physics research¹. The panel felt that undergraduate physics students did not have enough exposure to the field. Similar views were expressed in the recent Wakeham report, and our own Higher Education Group had started to discuss this area in their meetings.

We felt the best way we could encourage teaching in this area would be to develop support materials at an introductory level, aimed at lecturers who might be relatively unfamiliar with biological physics but interested in

¹ International Perceptions of UK Research in Physics and Astronomy 2005

incorporating some material into their programmes. Such material would be open to all through a specially designed website. We had secured some funding from HEFCE's HE STEM programme to do some curriculum innovation and felt that we could use it in this area to really good effect.

So, early in 2009, we circulated a survey to physics departments to ascertain the level of support for the proposed project and find out what material would be of most use, before we went any further. The response was broadly positive and so a meeting was organised in the summer of 2009 to discuss in more detail what kind of resources should be developed. Encouraged by the meeting we decided to go ahead with the project, the aim of which would be, to design and publish resources for undergraduate lecturers to use with students in the later years of their first degree. The material would be delivered electronically and would be open to everyone free of charge.

The department commissioned Kerry Hopkins (and her maternity cover) Liz Kalaugher, at IOP Publishing to publish the content on a bespoke web platform, which would be able to host video content, animations and applets as well as plain text. A project board, chaired by Professor Athene Donald (Cambridge) was created to oversee the project. Dr Liz Swinbank (York), was appointed as the production editor and a number of biological physicists were recruited to write the material: Ros Allen (Edinburgh), Richard Berry (Oxford), Pietro Cicutta, (Cambridge), Tom Duke (UCL) and Dr Alexandra Olaya-Castro (UCL). Athene Donald also agreed to produce some material.

The content is being produced as a series of independent 'modules', so lecturers will have the opportunity to 'pick and choose' topics with complete flexibility. Each module will contain two to three lectures' worth of material. Our aspiration is, over time, to develop enough material for a complete introductory course. In the shorter term we have prioritized essential introductory areas. These are: Biological Molecules, Thermodynamics, The Cell, Energy, Molecular Machines and Regulatory Networks. The writers have now started delivering lecture material. We aim to launch the website in May 2011.

Philip Diamond
Associate Director, IOP

Conference Calendar

Advanced Photonics Techniques in Biology

11 April 2011

Institute of Physics, London, UK

Photonics techniques developed in the physical sciences are rapidly finding applications in biology. This one day international meeting will address some of the advances made in photonics with respect to imaging and spectroscopy of single biological molecules, cells, tissues and organisms.

Contributions for poster presentations are invited. Abstracts should be a maximum of 250 words and submitted online by 4 March 2011. The posters will be on display during refreshment breaks and over lunch.

For further information see

<http://www.iop.org/events/scientific/conferences/y/11/photonic/>

Physics of Gene Regulation

22nd-23rd September 2011

Institute of Physics, London, UK.

For further information please contact Pietro Cicuta, University of Cambridge (pc245@cam.ac.uk).

Conference reports

Physics Meets Biology 2010

Physics Meets Biology, the second in the Biological Physics Group's main conference series, was held on 1 – 3 September 2010 at St. Catherine's College, Oxford. The programme was designed around invited talks from UK and international speakers, who covered the behaviour of systems on all scales from single molecular machines to trees and techniques ranging in delicacy from scanning probe microscopy to chain saws. A special session was devoted to teaching Biological Physics, with a keynote talk by Phil Nelson, author of 'Biological Physics: Energy, Information, Life'. Contributed talks and posters added a great deal to the depth and interest of the programme (next time, we will hold the poster sessions outside if the weather is as good). The quality of presentations was excellent, for which thanks are due to the speakers and to the committee who suggested them (Athene Donald, Ray Goldstein, Sarah Harris and Martin Howard). The conference provided a very good introduction to the field for students, including two undergraduates; we were pleased that additional sponsorship from the IoP allowed us to reduce student fees. We plan to run the conference again in 2012 – please come!

Prof. Andrew Turberfield (Oxford), Conference Chair.

The Third Mathematical Virology Workshop:

The third Mathematical Virology workshop, organized by Peter Stockley (Leeds) and Reidun Twarock (York), took place at Cumbria University in Ambleside in August 2010. It attracted 81 participants from the areas of Mathematics, Biophysics and Mathematical Physics, Chemistry and Biology, and covered the topics of virus structure, virus assembly and genome organization. It also included a session on applications of viral particles in medicine and nanotechnology. Besides the 34 invited and contributed talks, the workshop featured two "hot topic" debates that sparked discussions of the driving forces underlying genome ejection and the roles of the viral genome in virus assembly. In addition, 22 posters were presented at the poster session and displayed throughout the workshop.

Prof. Robijn Bruinsma from UCLA, who was sponsored by the IOP Biophysics group, gave one of the two opening plenary lectures on "Landau Theory of Viral Assembly Kinetics". The other opening lecture was given by Dr Alasdair Steven from the NIH on "Integrating Thermodynamics, Cryo-EM, and Molecular Modelling to Elucidate Capsid Maturation". The workshop has shown how theoretical approaches, such as biophysical modelling techniques, can make a real impact on research in virology, especially in understanding the virus assembly and the structural transitions important for infection. As a result of this workshop, a number of new collaborations were forged within and across discipline boundaries, and new experimental and theoretical approaches were inspired.

The workshop received funding from the EPSRC and the IOP without which it would not have been possible. The IOP Biophysics group sponsored the participation of Prof. Robijn Bruinsma from UCLA, with a grant of £500.

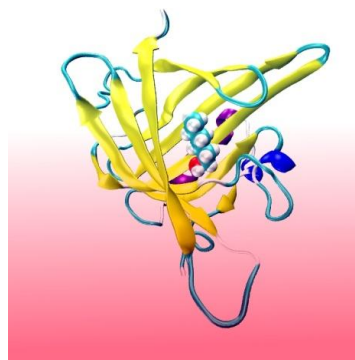
Prof Reidun Twarock, University of York.

Computational Biomedical Physics Meeting, Nottingham, 2010

This was a new one day meeting organised jointly between the Medical Physics Group (contact Martin Robinson, York) and the Biological Physics Group (contact Sarah Harris,

Leeds) on 14th September 2010. It was an extension to the Institute of Physics and Engineering in Medicine (IPEM) annual Medical Physics and Engineering Conference (MPEC) which was held in Nottingham this year. The aim of this computational section of the conference was to bring together researchers in Biological Physics and Medical Physics modelling to inspire new collaborations between the two fields. The meeting covered time and length scales from atomistic simulation to models of the whole body. There were between 30 and 40 attendees present at the meeting. They enjoyed talks by five invited speakers, who covered topics as diverse as simulations of individual biomolecules (Charlie Laughton, Nottingham), mesoscopic models of DNA and lipids for drug delivery (Syma Khalid, Southampton), heart modelling (Richard Clayton, Sheffield), modelling of solid cancerous tumours (Helen Byrne, Nottingham) and models of the activity of the brain (David Halliday, York). Contributed talks also covered a wide range of computational research projects, including modulating protein/protein interactions with drugs (Jon Fuller, Leeds), systems biology of cell death (Tongli Zhang, Oxford), fractal dimensions of cell growth (Jon Blackledge, Dublin), the dielectric response of tissues (Janet Clegg, York) and polarisation enhanced X-ray imaging (Zdenka Kuncic, Sydney). The poster presentations were similarly diverse.

The meeting also featured a questionnaire where delegates were asked for their opinions about the barriers to collaboration between “academic” and “clinical” modellers, their ideas as to how these might be overcome, and the potential scientific benefits to the two disciplines. This generated a lively debate, and many interesting ideas. The barriers to communication that were identified were the different languages and priorities of the two communities. Suggestions for overcoming these were future meetings involving the two communities, the standardisation of computer codes and computational methodologies, PhD studentships jointly supervised between the two disciplines, developing simple language for communication, and most importantly taking the time to effectively communicate with colleagues from the opposite discipline. The potential scientific benefits that were identified, however, indicated that this increased effort could be well worth the investment. Firstly, such collaboration would prevent one or the other discipline “reinventing the wheel”. It would also provide modellers with access to clinical data to validate their models. A common theme was achieving overlap between the various time and length scales (molecular, cellular networks, tissue modelling) that are vital to both Biological and Biomedical Physics. Clearly, this is an area in which further communication and collaboration should be strongly encouraged.



An atomistic model of the protein MUP, showing a bound ligand. Thank you to Steve Homans for providing the simulation data and Kate Howarth for making the picture.

Dr Sarah Harris, University of Leeds.

CMMP 2010

Biological Physics sessions, 14th December. University of Warwick, UK.

This year's Condensed Matter and Materials Physics (CMMP) conference included a theme on Biological and Soft Matter Physics running throughout the three days of the conference, with two Biological Physics sessions, two Polymer Physics sessions, and a session on Soft Matter in Action. There were also Plenary Talks by Prof Athene Donald on "Self-assembly of proteins" and Prof Marshall Stoneham on "Where quantum physics meets biology". The aim was to provide something that might be of interest to our community throughout the meeting, and this was broadly successful, with a good proportion of presenters on the first day staying for the whole conference.

The Biological Physics sessions were both on the first afternoon of the conference. The first session had a theoretical theme, with excellent invited talks from Ray Goldstein (University of Cambridge), combining experiment and theory on "Microfluidics of cytoplasmic streaming" and Ramin Golestanian (University of Oxford) who talked about "Fluctuation induced swimming at low Reynolds number". The second session, more experimental in emphasis, had invited talks from Suzi Jarvis (University College Dublin) on "Interactions at the membrane fluid interface" and Mark Leake (University of Oxford) on "Using bespoke fluorescence microscopy to study the soft condensed matter of living cells". With eight contributed talks covering areas from the interpretation of fluorescence resonance energy transfer to amyloid fibril formation, the diversity of biological physics research was well represented. Later on the same day there was a question and answer session with representatives from the EPSRC, BBSRC and STFC, with a focus on interdisciplinary research. Despite the difficult funding climate, it was heartening to see the research councils maintaining some focus on the interface between Physics and Biology.

Dr Jamie Hobbs, University of Sheffield