

A lower bound for the viscosity of liquids in terms of fundamental physical constants has been calculated by Kostya Trachenko and Vadim Brazhkin. Follow the full story here: <https://physicsworld.com/a/fluids-only-get-so-runny-as-physicists-put-a-universal-lower-limit-on-viscosity/>

For further details of the Liquids and Complex Fluids Group, see: <https://www.iop.org/physics-community/special-interest-groups/liquids-complex-fluids-group#ref>

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Group News

*Lorenzo di Michele (Secretary),
Liquids and Complex Fluids Group*

2022 has seen the group's activities resume in full after the pandemic, with events re-starting in person, including the annual Advanced School, which took place in December in Sheffield, and other group-supported activities, and you can read the exciting reports of all these meetings in this newsletter.

We would also like to highlight to all members that the group can help organise meetings as well as provide sponsorship for meetings planned by external parties. Please get in touch if you have an idea for an event that is likely to be of interest to the community. Contact details of committee members can be found at the end of this Newsletter.

Chair's Address

Happy New Year to each and every one of you, with lots of happiness and opportunity through the Year. 2022 was a good year for LCFG as we put the pandemic behind us and have been active across all fronts in the remit of the group, such as

conferences and schools, in terms of organization but also sponsorship.

Going forward in 2023, we will continue our activities and at the same time we aim to expand our portfolio. In addition to meetings, awards and training, we see a number of significant opportunities and worthwhile goals: collaboration within LCFG to explore research opportunities and initiatives; connect with other IoP groups, such as Soft Condensed Matter and Non-linear and Complex Physics; and expand public appreciation of CLCF and its many contributions.

I wish you all the very best for the New Year.



Serafim Kalliadasis, Chair, Liquids and Complex Fluids Group

Reports from previous events

Advanced School in Soft Condensed Matter “Solutions in the Snow”, 5 – 8 December 2022, Sheffield Hallam University, Sheffield

Report by Rammile Ettelaie, Guido Bolognesi and Sergey Lishchuk (Organisers)



Group photo of participants

The 15th annual Advanced school in Liquids and Complex Fluids was attended by 19 PhD students engaged in various aspect of soft-matter research. It was very pleasing to note the truly multi-dispersary nature of the school, reflected in students from a range of different departments, including Physics, Mathematics, Chemistry and Engineering. Though most students were from UK universities, there were also a few from abroad. This was also the first time in three years (since 2019) that the school was being held in person, despite corona pandemic still impacting various aspects of its organisation, not least the attendance of some speakers (and organisers). The organisers are particularly grateful to speakers who managed to deliver their full set of lectures

online, despite contracting covid just before the conference.

The First and the welcome talk of the School was delivered by Professor Tony Ryan OBE, from University of Sheffield. In his talk Professor Ryan provided vivid examples of how Soft-Matter and Complex fluid research can have a true bearing on solving some of the most pressing issues faced by humanity in 21st century. Taking examples from his own research into using discarded and disposed materials from refugee camps, and turning them to create materials optimised for use in Hydroponics, he demonstrated the real and significant impact that this work had made to the life of refugees, in camps in Jordan.

Professor Ryan’s talk was followed by a set of lectures by Dr. Gregory Smith from Rutherford Appleton laboratories. Neutron scattering has become one of the most effective experimental probes in the study of the behaviour and structure of soft materials. Dr. Smith’s lectures addressed the application of Neutron Scattering to various soft matter related problems, in particular emphasising techniques for its use on a wide and diverse range of length scales. Towards the end of his lectures, he also provided a very useful presentation on currently available Neutron scattering capabilities available in Rutherford Appleton and how future researchers in the field may apply to gain access for using them in their own research.

Density functional theory has played a leading role in our theoretical understanding of the behaviour of liquids. Therefore, it was particularly welcome to have Professor Andrew Archer from Loughborough University introduce this important subject area, starting from basic statistical mechanics and building up to DFT, demonstrating fascinating and increasingly more complex applications to real examples taken from his own research.

Our fourth speaker was Dr. Job Thijssen from Edinburgh University who provided a comprehensive overview of some of the fundamental principles underpinning the broad subject of colloids and emulsion science, including their flow and rheological properties. There was a particular emphasis on more recent developments in the field, demonstrated by discussing the behaviour of nano-particles at interfaces, Pickering emulsions and Bijels.

The speakers for the final day were Professors Nigel Mottram from Glasgow University and Professor Mike Allen from Bristol. Professor Mottram introduced both the equilibrium and kinetic theories for liquid crystals in two separate lectures, finishing with some fascinating examples of recent applications of liquid crystals and the role that the theoretical developments have or are likely to play in further advances.

Professor Mike Allen give the concluding talk of the School, providing an overview of the historical advancement of liquid state theory. In particular, he presented various important contributions that computer simulations have made to settling some of the rather divisive questions in liquid state theory throughout its various stages of development. He concluded with various open questions in the field and speculated on likely ways in which computer simulations conducted on future powerful computers can provide answers to these challenging questions.

Professor Mike Allen also announced our two poster prize winners and awarded them with their prizes. Altogether six posters were presented by students at the School. Though a relatively small number, the posters were all of exceptional scientific quality. Two poster prizes were awarded, one for the winner chosen by the attending students themselves, and one by a panel of judges consisting of some of the lecturers and organisers. The poster chosen by the judges was “The role of lubricant ridge size on drop dynamics in Slippery Liquid Infused Porous Surfaces (SLIPS)” by Hossein Abdolnezhad Northumbria University. The poster chosen by student participants was “Classical quantum friction at water-carbon interfaces” by Anna Bui, University Of Cambridge.



Enjoying the School social event

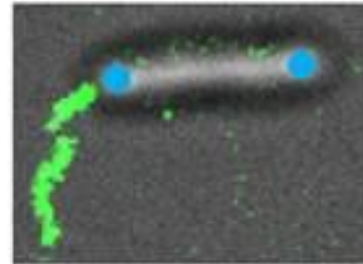
The social event of the School consisted of a visit to Kellam Island museum dedicated to charting the history of the rise of Sheffield as a major international centre for steel manufacturing. This was followed by a pleasant conference dinner at Piccolino restaurant in Sheffield town centre. Many students remarked on how much they enjoyed the social evening, and more generally the chance to once again participate, meet in person, interact and exchange ideas with their fellow PhD students.

The organisers would like to thank IOP, and in particular Mrs. Vivien Thomas, for her tireless assistance in organising and in the smooth running of the conference, in what had continued to be difficult and adverse conditions due to the effects of Covid.

Mechanics and Motility of Cells

7 December 2022, University of Bristol, Bristol

*Report by Rachel Bennett
(Organiser)*



*Image of swimming bacterium
(courtesy Calvin Lee, UCLA)*

Mechanics and Motility of Cells was a one-day meeting in Bristol, which I organised (two years later than originally intended) as recipient of the 2019 Liquids and Complex Fluids Early Career Prize. It was a great atmosphere to have everyone together in-person, which led to plenty of lively discussions.

Various aspects of biofilm structure and cell movement within biofilms were presented during the first part of the day, including Aidan Brown, Philip Pearce and Mack Durham as invited speakers. PhD students Charlotte Benney, Mehrana Nejad and Nathan Costin presented work on the mechanics and migration of active colonies.

In the afternoon, there were several talks on cilia beating. Invited speakers Eric Keaveny and Kirsty Wan described computational and experimental work on collective behaviour of cilia, and PhD students Paul Fitcher and James

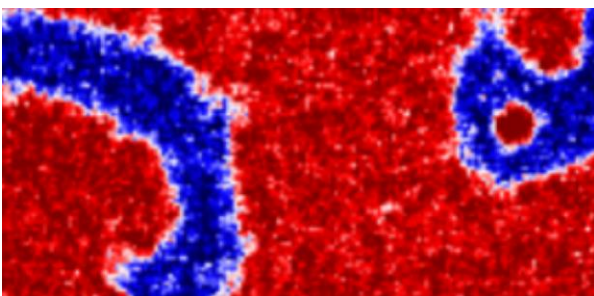
Cass presented models focussed on the beating dynamics of a single cilium.

There were posters on a range of topics presented during the tea breaks and over lunch which generated lots of stimulating conversations. Following the meeting, the conference dinner at Goldney Hall was enjoyed by many participants.

I would like to thank the Liquids and Complex Fluids Group and the University of Bristol Vice-Chancellor's Fellowship Scheme for funding this event, and Annalise Machin and Louisa Bartoszewicz for admin support.

6th Edwards Symposium – Soft Matter for the 21st Century
7 – 9 September 2022, Isaac Newton Institute, Cambridge

Report by Claire Bonner (Newton Gateway to Mathematics)



The [Edwards Symposium Series](#) reached its sixth year in 2022, having begun in 2016 and with a gap in 2020 due to COVID. In 2021 the Symposium ran in a hybrid format. In 2022, the Symposium was an in-person event, with some

virtual elements and we welcomed participants back to the [Centre of Mathematical Sciences](#), Cambridge.

The 6th Edwards Symposium was organised jointly by the [Newton Gateway to Mathematics](#) and the [Edwards Centre for Soft Matter](#). The latter is a virtual laboratory, encompassing staff from six Cambridge University Departments, whose role is to promote academic collaborations in Soft Matter Science across the University.

The *Edwards Symposium Series* continued to highlight the latest developments in soft matter science with a particular (but not exclusive) emphasis on theoretical and mathematical models, and on how these models can inform industrial processes, materials, and design. Leading academic speakers conveyed their latest scientific work, with the aim to foster collaborative and interdisciplinary discussions across the industry/academia boundary.

This event was attended by 105 delegates, with 91 academic related attendees and 14 from the public sector or industry.

In 2022, the workshop focused on the following soft matter areas:

- Cellular assemblies
- Geophysical soft matter
- Nonequilibrium phase transitions

- Liquid crystals and LC elastomers (Mark Warner Memorial)
- Soft matter for health

In keeping with previous symposiums, these themes posed fundamental questions in basic science that were addressed by distinguished academic speakers. Their industrial relevance was reflected by the prominence at the Symposium of industrial participants whose oral presentations, posters and informal discussions informed the discussions and led to possible future collaborations, of benefit to both sides. Participants were invited to present a poster for display throughout the workshop on a soft matter related research area. There was also an accompanying elevator pitch session (for early career researchers), to deliver short presentations.

The session on liquid crystals and liquid crystalline elastomers was dedicated to the memory of Professor Mark Warner FRS, who died in late 2021. Mark had served on the organizing committee for several previous Edwards Symposia and was internationally distinguished for his theories of liquid crystalline elastomers.

We had the opportunity to hear from industry related speakers, including:

- **James Cosby** (Unilever), Characterisation Challenges for

- Microstructures in Complex Personal Care Formulations
- **Owain Parri** (Merck), Liquid Crystal Materials for AR/VR Applications
- **Jamie Walters (Calyxia)**, Industrial Challenges of the Agriculture Sector

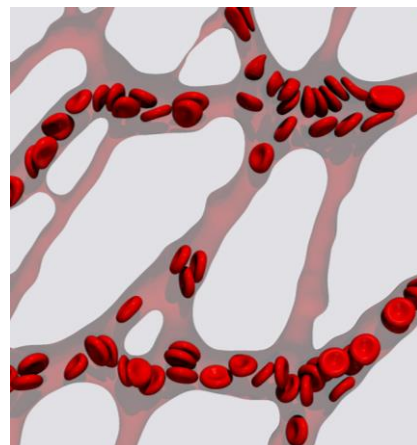
The IOP Liquids & Complex Fluids Group make an annual award to the Symposium for an outstanding early career speaker. The award goes towards meeting the travel costs of the recipient. Congratulations to Kasia Warburton of Dartmouth College on winning the 2022 *Institute of Physics (IOP) Early Career Lecturer Award* for her talk on Subglacial Soft Matter.

The organisers would like to thank IOP for their generous financial support.

Microrheology and Transport in Complex Biological Media

16–18 May 2022 (online event, <https://iop.eventsair.com/cbm2022/>)

Report by Timm Krüger (Organiser)



The transport of nutrients, wastes and signalling molecules in complex biological systems is affected by various physical mechanisms, such as fluid flow, diffusion and active transport. An open problem is the relationship between the structure and the function of these systems, such as organs. To understand these general relationships, the characterisation of the relative importance of the physical processes and the systems' geometries is essential. Our aims were the organisation of a workshop that would bring together experimental and numerical scientists across the research field, discussing the state of the art, and defining challenges and future endeavours.

The workshop ran for three half-days on 16–18 May 2022 as an IOP online event. Each day included a keynote presentation, several invited presentations, a number of contributed talks – mostly from early-career researchers – and an open discussion to distil open challenges and research ideas. Between 35 and 40 participants attended the workshop each day.

In the first keynote, Rebecca Shipley (UCL) presented her group's work on imaging-guided modelling of blood flow and mass transport in real-world tissues. Prosenjit Bagchi (Rutgers), the second keynote speaker, discussed the prediction of blood cell trafficking in capillary vessel

networks in silico, including new machine-learning perspectives. On the third day, Sylvie Lorthois (Toulouse) talked about the spatial distribution of red blood cells in periodic microfluidic networks.

The invited speakers covered a wide range of problems related to microrheology and transport in complex biological media. During the first day, Alys Clark (Auckland) talked about blood delivery in the placenta and the interpretation of placental function from tissue imaging. Philip Pearce (UCL) presented his approach to describing transport in blood with one-dimensional models. On the second day, Karen Alim (TU Munich) explained how network architecture can be shaped by the flow inside. Gábor Závorszky (Amsterdam) presented the role of platelet margination in healthy and diabetic microcirculation. On the last day of the workshop, Franca Schmid (ETH) showed how alterations of capillary diameters can affect blood flow in health and disease. Finally, Yohsuke Imai (Kobe) presented his model of gastric mixing and emptying of the human stomach.

The eight contributed talks covered various topics, such as focused-light-induced cytoplasmic streaming for the measurement of media transport within cells, positron imaging for flow characterisation, liquid flow through nanoporous media, artificial capsules as red blood cell model, and network effects on the distribution of red

blood cells in tumours. Viktor Skultety (Edinburgh) won the award for the best contributed talk for his presentation titled “Collective motion in two-dimensional microswimmer suspensions”.

The open discussions on each day aimed at identifying challenges and opportunities for young researchers in the broad research field of microrheology and transport in complex biological media. The outcomes of the workshops were captured on a Padlet board openly available at

<https://padlet.com/clairegarland/institute-of-physics-92s105iphziraj8r>.

The identified challenges and opportunities include, among others, the relationship between local and global dynamics, machine learning for vascular network simulations, imaging techniques for structure-function relationships, robustness analyses of existing empirical law, and the problem of boundary conditions in vascularised tissues.

We followed up the workshop with a data survey on existing or planned datasets relevant to microrheology and transport modelling. The aim is to facilitate data sharing, collaboration and long-term sustainability in this emerging field. The data survey is still open for participants at <https://forms.gle/3arrWuw7aAKZGUte9>.

We thank the IOP for their fantastic support throughout the workshop planning and delivery phases. We

also thank the UK’s Engineering and Physical Sciences Research Council for funding the project “Novel Models for Haemodynamics and Transport in Complex Media” (EP/T008725/1 and EP/T008806/1) that sparked the idea of the workshop.

Understanding the Structure of Liquids: Celebrating John Enderby’s Scientific Legacy

5 – 6 September 2022, University of Bristol, Bristol

Report by Anita Zeidler (organiser)



On the 3rd of August 2021 the scientific community lost in Sir John Enderby FRS one of its pioneers. We took the earliest possible opportunity to celebrate his contributions and his legacy to science and the larger scientific community by organising a meeting in Bristol in early September of 2022.

The meeting was attended by his family, friends, former colleagues, and scientific offspring. On the first day we heard talks about Sir John’s scientific life and achievements from some of his former PhD

students (Phil Salmon (Bath), Alan Soper (RAL), Adrian Barnes (Bristol), Bob Newport (Kent)), and university colleagues and friends (George Neilson (Bristol), John Finney (UCL), Sir John Kingman (Bristol)), but we also learned a lot about his other work in publishing (Antonia Seymore (IOP publishing)) and invention (Dawood Parker (Melys Diagnostics)) that many of us hadn't appreciated. Much is written about Sir John, so I will not go into detail. Suffice to say that this first day of the meeting left a profound impression on many younger members of the audience.

The second day was devoted to present day challenges and developments in the science of liquid and disordered materials, many arising as a direct consequence of Sir John's work. Talks were presented by, amongst others, his scientific children (PhD students), grand-children and even a great-grand-child. We learned about the latest high-quality neutron diffraction work using isotope substitution (Hesameddin Mohammadi, Bath), the container-less investigation and manipulation of high temperature liquids (James Drewitt, Bristol), and the structure of complex organic liquids (Tom Headen, RAL). We also learned about the science of chocolate (Hugh Powell, Nestle) and, bizarrely, the taste of heavy water (Phil Mason, Prague)!

The meeting was supported generously by both the Liquids and Complex Fluids Group and the Neutron Scattering Group of the Institute of Physics as well as the School of Physics and the Faculty of Science of the University of Bristol. It was attended by around 60 people. It is clear that Sir John is missed by many and that his legacy will live on in future generations.



Early Career Researchers Fund

Financial support is available for Early Career Researchers to attend international meetings and visit international facilities. Bursaries up to the value of £300 are available. Applications are considered on a quarterly basis. For information on eligibility and to apply, see: <https://www.iop.org/research-student-conference-fund#gref>.

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Members of the committee
welcome your suggestions and
comments to help facilitate the
running and development of the
group at any time.

Dr Timm Krueger

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This newsletter is also available on the web and in larger print sizes

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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