Physics of Cells: From Soft to Living Matter

Hyères, France, September 2-8 2012

Final Report

P. Ziherl (University of Ljubljana & Jožef Stefan Institute)
on behalf of Organizing committee

Summary

The scientific meeting “Physics of Cells: From Soft to Living Matter” held in Hyères, France, September 2-8 2012 was the second event in the series Physics of Cells initiated in 2009 at the conference “Physics of Cells: From the Edge to the Heart” held in Primošten, Croatia. The success of the 2009 conference was a motivation to provide a continuing platform for the cell biophysics community. The feedback of the participants of the 2009 conference suggested that the research-oriented should be complemented by an educational component.

The meeting “Physics of Cells: From Soft to Living Matter” thus consisted of two back-to-back events: the Pierre-Gilles de Gennes Advanced School of Cellular Biophysics and the EMBO conference “Physics of Cells”. The **Pierre-Gilles de Gennes Advanced School of Cellular Biophysics** comprised 14 pedagogical lectures delivered by pioneers of biophysics. The lectures covered the field of cellular biophysics from biopolymers and membranes to cell adhesion and mechanics to tissues. The distinctive feature of the school was ample time set aside for discussions. The school was aimed at graduate students and postdoctoral fellows as well as at senior researchers. The second **EMBO conference "Physics of Cells"** comprised 40 invited and 28 contributed talks. It covered roughly the same topics as the advanced school and had sessions on advances in basic biophysics issues like mechanosensing and morphogenesis as well as a session on emerging techniques and concepts. Two poster sessions provided opportunities for one-to-one discussions.

The meeting was truly international, with the 250 participants coming from Europe, USA, Japan, India and elsewhere. The School and the Conference were supported by the Pierre-Gilles de Gennes Foundation, the European Molecular Biology Organisation (EMBO), the German Research Foundation (DFG), the European Science Foundation under the program INTELBIOMAT, the Institute for Complex Adaptive Matter (ICAM/NSF), the French National Institute of Health and Medical Research (Inserm), and SoftComp. The main administrative and organizational support came from the Provence CNRS staff and from the staff of the Interdisciplinary Centre for Nano-sciences in Marseille (CINaM) and Laboratory for Adhesion and Inflammation (LAI). We established a successful partnership with scientific journals Nature Physics, Nature Materials, Soft Matter, and European Physical Journal.

Description of Scientific Content

The scientific meeting "Physics of Cells: From Soft to Living Matter" held in Hyères, France, September 2-8 2012 (http://www.physcell2012.com) is the second event in the series Physics of Cells initiated in 2009 at the conference "Physics of Cells: From the Edge to the Heart" held in Primošten, Croatia. The success of the 2009 conference served as a very strong motivation to organize a series of conferences which will provide a platform for the cell biophysics community where the very best minds in chemistry, biology, physics, and medicine meet for a fruitful exchange of ideas with the final aim of understanding the mechanisms important for cell function in a quantitative manner. In particular, our intent was and remains to bring together eminent researchers from interdisciplinary fields working on various aspects of cell and tissue biophysics, including adhesion, mechanics, mechanosensing, morphogenesis, transport, single molecules etc., viewed from conceptual, theoretical, experimental, and technological perspectives. In addition, the feedback of the participants of the 2009 conference led us think of **complementing research-oriented meeting by educational component** aimed primarily at students. The meeting "Physics of Cells: From Soft to Living Matter" thus consisted of two back-to-back events: the Pierre-Gilles de Gennes Advanced School of Cellular Biophysics and the EMBO conference "Physics of Cells".

The **Pierre-Gilles de Gennes Advanced School of Cellular Biophysics** (September 2-4 2012) comprised 14 pedagogical lectures delivered by pioneers of biophysics. The lectures covered the field of cellular biophysics from biopolymers and membranes to cell adhesion and mechanics to tissues, thus providing a background to the cutting-edge research results presented at the conference. The duration of the lectures was 80 minutes, of which 60 minutes were allocated for the talks themselves and the remaining 20 minutes were allocated for the discussion. A distinctive feature of the school was the considerable amount of time set aside for discussion both within and outside the formal lecture hours. In particular, we organized dedicated office hours where the students could directly talk to the lecturers. These events were very successful and extremely well-received by the students. Also organized was a poster session where the students presented their work to the lecturers as well as to the fellow students and other participants. Three best-poster prizes sponsored by Soft Matter journal were selected and presented by a jury chaired by F. Brochard-Wyart, the winners being C. Hyland, P. Khuc Troung, and R. Sandmann (http://blogs.rsc.org/sm/2012/09/12/soft-matter-poster-prize-winners-at-physcell2012/).

The school was aimed at graduate students and postdoctoral fellows as well as at senior researchers exploring the cell at the interface of physical and biological sciences. The total number of participants at the school including lecturers and organizers was 150. The principal sponsors of the advanced school were the Pierre-Gilles de Gennes Foundation and the French National Center for Scientific

Research (CNRS) who supported the event financially and also proved to be a source of encouragement and technical guidance.

The second **conference in the EMBO series "Physics of Cells"** (September 5-8 2012), planned in partnership with the de Gennes Foundation, comprised 40 invited and 28 contributed talks delivered by eminent senior scientists as well as by upcoming talents. The scope of the conference was roughly the same as the scope of the school but the focus was on the most recent advances rather than on concepts. The two poster sessions organized within the conference provided an opportunity for one-to-one discussion and contributed to establishing a closer contact between the participants, thereby initiating new collaborations and strengthening existing ones.

The **lecture sessions** covered virtually all aspects of cellular biophysics and included: membranes, adhesion and mechanics, migration and motility, cytoskeleton, genes and nucleus, tissues and morphogenesis, imaging tools, cellular transport etc. The format of the conference was designed such that it combined the long 30 minutes lectures by prominent scientists were intermixed with the 20 minutes talks delivered by younger but already established scientists who were either invited or were selected from about 70 researchers who submitted abstracts for contributed talks. In addition, several short 10 minutes poster talks were also integrated into the sessions.

The first lecture of the conference on “Spatial organization and the mechanics of signal transduction” was delivered by J. T. Groves – a scientist who typifies the journey from soft to living matter and is on the way to becoming a recognized name in immunology. M. Gardel delivered a very stimulating lecture on self-organization of contractile matter. The day continued with lectures by senior scientists like S. Bershadsky, G. V. Shivasankar, and J. Rädler, intermingled with shorter talks and ended with a lecture on spatially and temporally coordinated processes of cells by J. Spatz that summarized the pioneering experiments carried out by his group in the past decade that has allowed us a nano-scale understanding of cell adhesion. The lectures were again followed by an open-ended after-dinner poster session.

The highlights of the second day of the conference included the lectures on actin by E. Frey and C. Sykes, on active matter by N. Gov and S. Ramaswamy, on hydrodynamics at the micrometer scale by R. Goldstein, and a beautiful presentation by S. Veatch on phase separation in natural membranes. A young PhD student G. Teo chosen on the basis of her poster abstract to deliver a short lecture impressed everybody with her scientific maturity – she later went on to win a poster prize.

The scientific program of the third day of the conference consisted of two stimulating session on morphogenesis bracketed an excursion to a nearby island. The shorter early evening session featured the lecture by J. Prost who showed how cells could organize into different tissue-types simply by tuning their viscoelastic properties. Two young experimental biologists, N. Borghi and J.-L. Maître, followed with new unpublished interesting results on the physics of

tissues e.g. in the context of the developing embryo. The conference dinner gathered the young and senior scientists in a very relaxed ambient appreciated by everybody.

The last day of the conference again featured lectures by eminent as well as emerging scientists including U. Schwartz, A. Ben Shaul, R. Dimova etc. Arguably, the highlight of the conference was the last session where three senior female professors presented truly outstanding results from their respective fields. After scintillating presentations by B. Baird on controlling cell responses though physical means and by A. Ulrich on careful experiments with NMR, J. Lippincott-Schwartz delivered a lecture where she presented data that were aptly described as "fireworks" by a young PhD student and that have the potential to revolutionize the way we think of the cytoskeletal organization in migrating cells. In his closing remarks, the president of executive advisory board of the series E. Sackmann said that this lecture sets the stage for the next conference and indeed we shall be very proud to live up to the standard set by J. Lippincott-Schwartz.

The **poster sessions** were very lively events. About 80 % of participants presented posters, which were put up in two batches of about 70 each. The posters were intentionally mixed topic-wise so as to encourage cross-talk between the various subdisciplines. This strategy worked and many participants eventually discussed their work and future projects well after the official end of the poster sessions. The posters were put up in a large hall situated next to the main lecture hall. The formal sessions took place on September 5 and 6 after dinner with refreshments served. The sessions were open-ended and extended over three to four hours. Posters were available for viewing throughout and often students could be found deep in discussion with an expert of the field in front of their posters during coffee breaks, the lunch break or at dinner time. To emphasize the best poster contributions, 10 minutes poster talks were integrated into the lecture sessions. This worked very well both for the audience and for the authors. A jury consisting of 7 senior scientists [J. Prost (chair), B. Maier, M. Gardel, A. Viallat, S. Ramaswamy, M. Sheetz, and D. Discher] chose the best posters. Three poster prizes were presented: The first prize sponsored by Nature Physics presented by their representative (who was very enthusiastic about our effort to stage such an event spanning biology and physics) went to E. Tjhung and two equivalent runners-up cash prizes offered by Physics of Cells went to G. Teo and R. Vincent.

The **organization** of the events was in the hands of the organizing committee, a group of 5 researchers based in France (the Core Committee) and 8 researchers based elsewhere (the International Committee). Essential for the scientific and the organizational preparatory work were the Executive Advisory Board chaired by E. Sackmann, the Local Advisory Board consisting of eminent biophysicists from France, and the International Advisory Board of 19 researchers from all over the world. Most administrative and technical support was provided by the Provence staff of CNRS as well as by the staff of the Interdisciplinary Centre for Nano-sciences in Marseille (CINaM) and Laboratory for Adhesion and Inflammation (LAI).

After the great success of the 2009 conference, the Physics of Cells series was expected to become an important event in the biophysics calendar. This was indeed reflected in the number of registrations for the 2012 meeting. The organizers tried hard to accommodate as many participants as possible. The funding secured allowed us to invite a large number of speakers including about 10 young emerging female scientists. We were also able to subsidize all students, thereby making the fee affordable in spite of the prestigious venue, and to support about 30 students with full or partial grants.

The School and the Conference were supported by several French and international sponsors, including Pierre-Gilles de Gennes Foundation, the European Molecular Biology Organisation (EMBO), the German Research Foundation (DFG), the European Science Foundation under the program INTELBIOMAT, the Institute for Complex Adaptive Matter (ICAM/NSF), the French National Institute of Health and Medical Research (Inserm), and SoftComp. Scientific journals Nature Physics and Soft Matter provided best poster prizes and helped us in advertising the meeting. Journals Nature Materials and European Physical Journal also participated at the meeting.

Assessment of Results and Impact

It is our firm belief that the School and the Conference provided a top-level, high-impact international forum for scientific communication in the field of biophysics of cells. This view is supported by the willingness of the most eminent researchers to speak at the event, by their commitment to present their recent results, by the big interest of the community to participate, by the analysis of the questionnaires filled out by the participants, and finally by the support of the various research and funding organizations.

The **feedback** from the participants for both the school and the conference has been overwhelmingly positive. While we cannot quantify the opinions expressed by the participants in private discussions, the questionnaires filled out by them are very clear. More than 75 % of the researchers rated the conference as *excellent* and the rest of them thought that it was *very good*. Very encouraging was the general appreciation of the concentration of excellence that makes the series Physics of Cells special. The presence of the most outstanding researchers in the field in the same venue for the whole duration of the conference is essential for the synergy that makes the event very productive, and this should remain the goal of the future meetings in the series.

As per the students' opinion, almost 70 % of them found the conference *very good* whereas 10 % found it *excellent* and 20 % rated it as *good*. The slight discrepancy between the opinions of the researchers and the students probably reflects the fact that the transition between the more pedagogical school and the much more intense fast-paced conference focused on new results proved somewhat challenging for the younger students. Yet we conclude that participation of the students at the conference did contribute towards their scientific maturity, partly by the direct contact with the established researchers and partly by allowing them to participate in the rapid exchange of ideas. We are certain that the young and emerging scientists have benefited considerably from the exposure to this eclectic and dense gathering.

In informal discussions with the members of the organizing committee, scientists at all levels – students, postdoctoral fellows, junior researchers, and group leaders alike – expressed a high degree of satisfaction with the school and the conference both in terms of scientific excellence and of social and human interactions. Equally unanimous were their expectations from the future events in the series.

At this time, it is difficult to quantitatively measure of the **impact** of the school and the conference quantitatively but we are certain that the meeting has stimulated a vivid exchange of ideas and initiated many new collaborations. We believe that the series Physics of Cells is becoming a recognized event in the field of biophysics. Characteristic for the 2012 meeting was the participation of sizable numbers of researchers from overseas (especially from USA, Japan, India, and Singapore) and a strong participation of the laboratories from the best universities and institutes worldwide. At the same time, the meeting also helped

to promote new initiatives such as the Centre for Interdisciplinary Sciences at the Tata Institute for Fundamental Research headed by S. Ramaswamy. In all, the school and the conference achieved a lasting global impact.

Given the success of the meeting, we are considering organizing the next one in two rather than three years' time as originally planned. The next meeting will take place in Germany and it will be organized by the biophysicists from Göttingen; the venue will be selected shortly.

With the **future** events in the series we will do our best to re-create the atmosphere of the 2012 meeting. In view of the extremely positive responses, it is our desire to transform the Physics of Cells into an ongoing series beyond the initial three-conference mandate of the current EMBO-supported series. The current momentum of the field is truly impressive and given the experience accumulated during the 2009 and the 2012 conferences, this should be possible. We are convinced that the extended series of the meetings will serve the field and that it will be accepted and appreciated by the scientific community.

Final Programme

Advanced School on Cellular Biophysics

Sunday September 2 2012

14:45:15:00 Opening/Organising committee

15:00-15:30 P. Pincus Opening remarks

15:30-16:50 E. Sackmann: Thermoelasticity of the self-organisation and biological function of composite cell membranes *(discussion moderators P. Pincus and A. S. Smith)*

16:50:17:10 Coffee break

17:10-18:30 P. Bongrand: Cell adhesion *(discussion moderators A. ben-Shaul and L. Vonna)*

18:30:18:40 Short break

18:40-20:00 R. Merkel: Strained cells: Experiments on mechanosensing *(discussion moderators S. Gabriele and P.-H. Puech)*

20:00-21:00 Dinner

Monday September 3 2012

9:00-10:20 F. Brochard-Wyart: Crossing boundaries from mesoscopic physics to biological functions: Tissue dynamics, aspiration and spreading *(discussion moderators R. Merkel and P. Ziherl)*

10:20:10:40 Coffee break

10:40:11:10 Office hours 1 (E. Sackmann, P. Bongrand, R. Merkel)

11:10-12:30 F. C. MacKintosh: Cytoskeletal networks: Mechanics and non-equilibrium effects *(discussion moderators R. Bruinsma and L. Limozin)*

12:30:14:00 Lunch

14:00-15:20 B. Geiger: The dynamic nano-architecture of integrin adhesions: From structure to function *(discussion moderators F. Brochard Wyart and P.-H. Puech)*

15:20:15:40 Coffee break

15:40-17:00 R. Bruinsma: Physics of chromatin *(discussion moderators F. MacKintosh and A. S. Smith)*

17:00:17:40 Office hours 2 (F. Brochard-Wyart, F. C. MacKintosh, R. Bruinsma)

17:40-19:00 D. Bensimon: Optical control of developmental processes in zebrafish *(discussion moderators E. Scakmann and Y. Jie)*

19:00-21:00 Dinner

21:00- **School poster session** (open-ended with refreshments)

Tuesday September 4 2012

9:00-10:20 D. E. Discher: Physics of stem cell fate decisions *(discussion moderators D. Bensomin and D. Heinrich)*

10:20-10:40 Coffee break

10:40-11:10 Office hours 3 (D. Bensimon, D. E. Discher, S. A. Safran)

11:10-12:30 S. A. Safran: Elastic interactions and cytoskeletal ordering in biological cells *(discussion moderators P. Bongrand and A. S. Smith)*

12:30-14:00 Lunch

14:00-15:20 T. Lecuit: The subcellular mechanics of tissue morphogenesis *(discussion moderators J. Porst and S. Gabriele)*

15:20-15:40 Coffee break

15:40-17:00 E. Bodenschatz: Physics of eucaryotic chemotaxis *(discussion moderators E. Sackmann and P. Sens)*

17:00-17:40 Office hours 4 (T. Lecuit, E. Bodenschatz, M. Sheetz)

17:40-19:00 M. Sheetz: Cellular mechanosensing of the microenvironment by actin-dependent stretch-relaxation cycles *(discussion moderators D. E. Discher and F. Rehfeldt)*

19:00-21:00 Dinner

Conference Physics of Cells: From Soft to Living Matter

Tuesday September 4 2012

17:00- Registration

19:00-21:00 Dinner

Wednesday September 5 2012

8:45- 9:00 Opening words (Organising Committee)

9:00-10:40 Mechanics of cells I (chairs: S. A. Safran & D. Navajas)
9:00- 9:30 J. T. Groves: Spatial organization and the mechanics of signal transduction in cell membranes
9:30- 9:50 A. Nicolas: Physical approaches of cell sensitivity to mechanical cues
9:50-10:10 A. Manninen: The interplay between αV- and β1-integrins during maturation of focal adhesions in epithelial cells
10:10-10:40 M. Gardel: Mechanics of the actomyosin cytoskeleton in cell adhesion and migration

10:40:11:00 Coffee break

11:00-12:30 Signalling and activation (chairs: B. Geiger & J. Rädler)
11:00-11:30 A. Bershadsky: Self-organization and signalling in formation of actin cytoskeleton and focal adhesions
11:30-11:50 A. Upadhaya: Forcing it on: Cytoskeletal dynamics during lymphocyte activation
11:50-12:20 T. Schmidt: Watching cell signalling one molecule at a time
12:20-12:30 P. Robert: Use of laminar flow chamber to measure kinetics and mechanics of two-dimensional interactions between T cell receptors and different activating ligands

12:30-14:00 Lunch

14:00-15:30 Cytoskeleton I (chairs: F. C. MacKintosh & H. Delanoë-Ayari)
14:00-14:20 L. Blanchoin: Actin network architecture determines myosin motor activity
14:20-14:30 D. Mizuno: Anisotropic stiffening of cytoskeletons by local force transmission
14:30-14:50 A. Zemel: Implications of force balance in the determination of cell size, shape and internal structure
14:50-15:10 M. Balland: Spatial correlation between actin generated forces and centrosome positioning
15:10-15:30 S. Köster: Biopolymer mechanics in living cells

15:30:16:00 Coffee break

16:00-17:20 Gene expression and nucleus I (chairs: D. Bensimon & E. Farge)
16:00-16:30 J. Rädler: Single-cell time-lapse studies - gene expression dynamics, phenotype heterogeneity and microenvironments
16:30-17:00 G. V. Shivashankar: Nuclear mechanics and genome regulation
17:00-17:20 A. Zidovska: Polymer physics approaches to interphase chromatin dynamics

17:20:17:30 Short break

17:30-19:20 Mechanics of cells II (chairs: D. E. Discher & P. Bongrand)
17:30-17:50 D. Navajas: Nanomechanics of pulmonary cells
18:00-18:20 A. Asnacios: Towards an integrated model of rigidity-sensing
18:20-18:30 C. Monzel: From model systems to cells: Using a novel approach to explore bio-membrane dynamics
18:30-18:40 G. Salbreux: Physics of the actin cortex in cell shape oscillations
18:40-18:50 S. Tzlil: Strain propagation within artificial extracellular matrix proteins accelerates cell spreading and polarization
18:20-18:50 J. Spatz: Spatially and temporally coordinated processes of cells at molecular to cellular scales

19:20-21:00 Dinner

21:00- Poster session II/presenters with names from A to Mee (open-ended with refreshments)

Thursday September 6 2012

9:00-10:00 Cytoskeleton II (chairs: R. Goldstein & O. Theodoly)
9:00- 9:30 E. Frey: Molecular traffic and length regulation of microtubules
9:30-10:00 C. Sykes: Artificial systems of cell shape changes

10:00-11:50 Active matter (chairs: R. Goldstein & D. Das)
10:00-10:20 N. Gov: Effective temperature in biology: from fluctuating membranes, active gels to cellular clusters
10:20-11:50 S. Ramaswamy: Active matter in the cell: membrane, cytoskeleton and nucleus

10:50:11:10 Coffee break

11:10-12:30 Migration and motility I (chairs: E. Bodenschatz & R. Padinhateeri)
11:10-11:40 B. Fabry: Physical determinants of cell migration in a 3-D matrix
11:40:11:50 G. Teo: Mesenchymal stem cells migrate between and directly through activated endothelial cells via a blebbing-associated mechanism
11:50-12:10 J. Casademunt: Shape and motion of actin fragments: morphological instability as a mechanism of motility
12:10-12:30 D. Vignjevic: Actin bundles determine the turnover of focal adhesions

12:30-14:00 Lunch

14:00-15:30 Advanced imaging tools (chairs: C. Schmidt & K. Anselme)
14:00-14:30 Y. Dufrêne: Measuring the structure, properties and interactions of living cells to molecular resolution using AFM
14:30-14:40 F. Rico: Mechanical heterogeneity of the plasma membrane
14:40-15:00 A. Radenovic: Photonics tools for single molecule biophysics
15:00-15:30 D. Choquet: Nanoscale imaging of brain function

15:30-16:00 Coffee break

16:00-17:10 Migration and motility II (chairs: E. Perez & N. Gov)
16:00-16:30 R. Goldstein: Synchronization of eukaryotic flagella
16:30-17:00 B. Maier: Controlling bacterial motors
17:00-17:10 A. D. Lieber: Membrane tension in rapidly moving cells is determined by cytoskeletal forces rather than membrane area

17:10-17:20 Short break

17:20-19:00 Membrane structure, function and dynamics I (chairs: R. Dimova & S. Ramaswamy)
17:20-17:50 D. Andelman: Domains, phase transitions and rafts in membranes
17:50-18:10 D. Frankel: Unfolding disease one molecule at a time
18:10-18:20 D. Schmidt: Quantitative understanding of the nonspecific vesicle-substrate adhesion
18:20-18:30 T. Bihr: Dynamics of specific adhesion
18:30-19:00 S. Veatch: Stabilizing membrane fluctuations through adhesion and immobilized proteins.

19:00-21:00 Dinner

21:00- Poster session II/presenters with names from Mez to Z (open-ended with refreshments)

Friday September 7 2012

9:00-10:40 Tissue dynamics and morphogenesis I (chairs: F. Brochard-Wyart & A. Parmeggiani)
9:00- 9:30 F. Jülicher: Self-organized growth of epithelia
9:30- 9:40 B. Guirao: Multiscale quantitative analysis of morphogenesis: Mechanical control by planar cell polarity pathway
9:40- 9:50 N. Borghi: Direct measurement of E-cadherin mechanical tension in epithelial cells reveals possible mechanosensory function throughout the cell surface
9:50-10:10 J.-L. Mâitre: Adhesion functions in cell sorting by mechanically coupling the cortices of adhering cells
10:10-10:40 E. Farge: Mechanogenetic reciprocal coupling in embryonic development and evolution

10:40-11:10 Coffee break

11:10-12:10 Cellular transport and traffic (chair: D. Vignjevic & I. Weiss)
11:10-11:40 T. Saif: Biophysics of neuronal transport and synaptic clustering
11:40-12:10 E. Perez: Membrane fusion in intercellular traffic and fertilisation: molecules, forces and energies involved

12:30-18:00 Excursion

19:00:20:00 Tissue dynamics and morphogenesis II (chairs: E. Sackmann & F. Jülicher)
19:00-19:30 J. Prost: On tissue growth
19:30-19:40 B.-A. Truong Quang: Quantitative analysis of E-cadherin supramolecular organization in a whole epithelium by superresolution microscopy
19:40-20:00 M. Paszek: From equations to the clinic - a new perspective on cancer

21:00- Conference dinner

Saturday September 8 2012

9:00-10:50 Mechanics of cells III (chairs: R. Merkel & A. Viallat)
9:00- 9:30 C. Schmidt: High-resolution detection of force generation in cells
9:30-10:00 U. Schwarz: Spatial organisation of actin filaments in the lamellipodium
10:00-10:20 I. Weiss: Myosin chitin synthases and cell mechanics in molluscs
10:20-10:50 A. Ben-Shaul: Cis-trans coupling in cell-cell adhesion and junction formation

10:50:11:10 Coffee break

11:10-12:30 Emerging methods and approaches (chairs: T. Saif & E. Frey)
11:10 -11:40 M. Elbaum: A thermodynamic approach to transport at the nuclear pore
11:40-12:00 Y. Rabin: Molecular mean-field modeling of biomimetic nanopores and the yeast nuclear pore complex
12:00-12:20 R. Endres: Precision of sensing with memory in fluctuating environments
12:20-12:30 S. Fenz: Tailored cell models

12:30-14:00 Lunch

14:00-15:30 Membrane structure, function and dynamics II (chair: A. Bershadsky & D. Lacoste)
14:00-14:30 M. Kozlov: Mechanism of membrane fission by hydrophobic protein insertions
14:30-14:40 M. Bally: Probing virus/membrane interactions with artificial cell membranes
14:40-14:50 A. Yamada: Single-headed, non-processive myosin 1b pulls out a membrane tubule along actin filaments in a reconstituted minimal system
14:50-15:20 R. Dimova: Membrane wetting, budding and tube formation in vesicles enclosing two phases
15:20-15:30 M. Yanagisawa: Orientation control of the potassium channel KcsA and spatial arrangement of DNA in a cell-sized vesicle

15:30:16:00 Coffee break

16:00-17:20 Membrane proteins (chair: E. Sackmann)
16:00-16:20 B. Baird: Zooming in on spatial control of receptor mediated cellular responses
16:20-16:50 A. Ulrich: Folding and self-assembly of membrane proteins
16:50-17:20 J. Lippincott-Schwartz: Nanoscopic investigation of plasma membrane proteins using super-resolution microscopy

17:20-17:30 Closing (E. Sackmann & A. S. Smith)

18:00- Departure