



### Science Meeting – Scientific Report

**Scientific report (one single document in WORD or PDF file) should be submitted online within two months of the event. It should not exceed seven A4 pages.**

**Proposal Title:** *Computational approaches to networks, cells and tissues*

**Application Reference N°:** 4759

#### 1) Summary (up to one page)

On 10 and 11 April 2013 the Workshop on Computational Approaches to networks, cells and tissues took place in Barcelona. The venue of this 2 day event was the PRBB Auditorium (Dr.Aiguader 88, 08003 Barcelona). The total number of participants was 175 and 26 of them presented also a poster.

The aim of this meeting was to bring together leader scientists working on data-driven computational modelling, with a common interest in unravelling the fundamental mechanisms that govern cell and tissue biology. Our 13 speakers, pioneers from Europe, Japan and the US, were researchers that combine quantitative data and modeling, and in some cases pursuing projects which are already combining the different levels into unified models. This balance is also complemented by a balance between researchers operating at a more theoretical level, with those focusing on large quantitative data-sets. The resulting mix of perspectives provided for a lively and fascinating interactions to help identify where this field is moving over the next few years

Another goal was to promote the exchange of ideas among the participating scientists and between speakers and junior attendants. Thus, we organised a poster session from selected abstracts presented by participants. Also, the chairs of the sessions ensured an interesting debate after each lecture, between speakers and participants.

## **2) Description of the scientific content of and discussions at the event (up to four pages)**

Over the last few years it has become evident that studies on tissue morphogenesis and homeostasis that involve the generation and handling of very large data sets necessitate an intimate complement between classical approaches from biology, and the power of computational modelling. Because this field of research is still budding, it is essential to exchange ideas and train the next generation of researchers to join the field. With this workshop, we gathered leading international scientists with different backgrounds that have pioneered research at the interface between biology and mathematics. The main goal of the workshop was therefore to promote the exchange of ideas among the participating scientists and between speakers and junior attendants.

A key challenge within this new field is to cope with multiscale systems. In other words, it is increasingly recognized that many levels of organization must be treated as equally important. In particular there are 3 key levels that must be integrated: the molecular, cellular and tissue levels. We thus selected speakers working at each of these different levels. These pioneers, from Europe, Japan and the US, are each combining quantitative data and modeling, and in some cases pursuing projects which are already combining the different levels into unified models. This balance is also complemented by a balance between researchers operating at a more theoretical level, with those focusing on large quantitative data-sets.

The topics that were discussed are all very interconnected, but there was a progression throughout the meeting from more cell-based modelling, which dealt with molecular details, to more tissue-based analysis and modelling.

Molecular feedback was an important topic throughout the meeting. Bistability as a result of dynamical feedback was a recurring theme discussed by a number of researchers, occurring in quite different biological contexts. Examples were given of simple cell-fate systems, to more complex pattern-formation examples. Another related phenomenon arising from dynamical feedback – temporal oscillations – was also found across more than one system, again highlighting the search for underlying principles.

Two spatial phenomena which were particularly discussed on the second day were directional polarity (for example cell polarity, or tissue level polarity) in defining shapes changes for tissues, and Turing patterns (for fish stripes and the mouse palate). Both of these were discussed in connection to tissue mechanics, and how they influence growth patterns.

The majority of talks elicited a healthy discussion with questions from the audience, and in a number of occasions which feedback relating to a previous talk – thereby extending to a wider discussion about underlying questions which are important to the whole field.

**3) Assessment of the results and impact of the event on the future directions of the field (up to two pages)**

The symposium was a very successful event. In the first place, the number of attendees was increased on last year's event (175 attendees as compared with 120 last year).

Secondly, there was plenty of time for discussion, both between the speakers and with the attendees. Speakers had been chosen for having a common overlap in scientific themes, but for not all being part of a well-established community. Many of the speakers had never met each other before, and at this meeting they were able to make connections that are useful for future collaborations.

Since most invited speakers were from abroad, this helped the interaction, as they spent the whole time of the 2-day meeting within each other's company. Two dinners were organised, to which most speakers attended, and which helped the researchers get to know each other.

Informal feedback from the attendees was very positive, with many asking whether this event will be run again next year.

The application of modelling and quantitative approaches to cells and tissues, is still very much a developing field. This QuanTissue-sponsored meeting, has thus been an important extra step in helping the relevant community identify themselves, which helps to mature the field for the future.

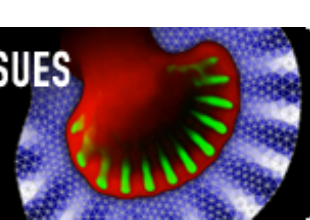
**4) Annexes 4a) and 4b): Programme of the meeting and full list of speakers and participants**

**Annex 4a: Programme of the meeting**

- Attached

**Annex 4b: Full list of speakers and participants**

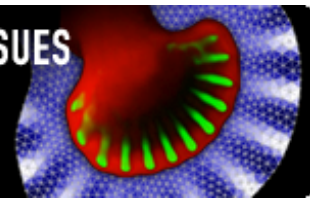
- Attached



## PROGRAM

### Wednesday April 10

- 08:30-09:00 Registration
- 09:00-09:10 **Hernán LÓPEZ-SCHIER**  
*Research Unit Sensory Biology and Organogenesis, Helmholtz Zentrum München, Neuherberg DE*  
 Opening remarks and QuanTissue presentation
- 09:10-10:00 **Stanislav SHVARTSMAN**  
*The Department of Chemical and Biological Engineering, Princeton University, Princeton (NJ) US*  
 "From signals to shapes in tissue morphogenesis"
- 10:00-10:50 **Alexander AULEHLA**  
*Developmental Biology, European Molecular Biology Laboratory (EMBL), Heidelberg DE*  
 "A quantitative approach to study phase-dynamics of genetic oscillators during mouse embryo patterning and scaling"
- 10:50-11:20 Coffee break
- 11:20-12:10 **Miki EBISUYA**  
*Career-Path Promotion Unit for Young Life Scientists, Kyoto University, Kyoto JP*  
 "Genesis of asymmetry through synthetic cell-cell positive feedback"
- 12:10-13:00 **Javier BUCETA**  
*Theoretical and In Silico Modeling of Biological Systems Group (The.Si.M.Bio.Sys.), Parc Científic de Barcelona, Barcelona ES*  
 "Sonic hedgehog signaling switches the mode of division in the developing nervous system"
- 13:00-14:00 Lunch
- 14:00-14:50 **Juan Manuel PEDRAZA**  
*Physics Department, University of the Andes, Bogotá CO*  
 "Bacterial persistence as a stochastic-inducible phenomenon"
- 14:50-15:40 **Fabian THEIS**  
*Institute of Bioinformatics and Systems Biology, Helmholtz Zentrum München and Institute of Mathematical Sciences, Technische Universität München, Munich DE*  
 "Modeling blood stem cell differentiation on multiple scales"
- 15:40-16:30 **Lucia MARUCCI**  
*Gene Regulation, Stem Cells and Cancer Programme, Centre for Genomic Regulation (CRG), Barcelona ES*  
 "Mathematical modelling of Wnt/ $\beta$ -catenin dependent somatic cell reprogramming"
- 16:30-17:30 Pica-pica & Poster Session



**Thursday April 11**

- 09:30-10:20 **Veronica GRIENEISEN**  
*Computational & Systems Biology, John Innes Centre, Norwich Research Park, Norwich UK*  
 “Computational Approaches to Unraveld Cell & Tissue Polarity”
- 10:20-11:10 **Jerome SOLON**  
*Biomechanics of Morphogenesis Group, Cell and Developmental Biology Programme, Centre for Genomic Regulation (CRG), Barcelona ES*  
 “Closing the gap: mechanisms regulating tissue constriction during drosophila dorsal closure”
- 11:10-11:40 Coffee break
- 11:40-12:30 **Rico COEN**  
*John Innes Centre, Norwich Research Park, Norwich UK*  
 “A Framework for Tissue Cell Polarity in Plants and Animals”
- 12:30-13:20 **Shigeru KONDO**  
*Graduate School of Frontier Biosciences, Osaka University, Osaka JP*  
 “Turing Pattern Formation in the Real Biological System”
- 13:20-14:30 Lunch
- 14:30-15:20 **Niels GRABE**  
*Hamamatsu Tissue Imaging and Analysis (TIGA) Center, BIOQUANT, University Heidelberg, Heidelberg DE*  
 "Systems-biological analysis of human wound closure using organotypic skin cultures"
- 15:20-16:10 **Jeremy GREEN**  
*Department of Craniofacial Development & Stem Cell Biology, King's College London, London UK*  
 “Patterning and growth in the mouse palate: a periodic Turing system with multiple tissue elongation mechanisms”
- 16:10-16:30 **James SHARPE**  
*Systems Biology Programme, Centre for Genomic Regulation (CRG), Barcelona ES*  
 Closing remarks

### List of Delegates - Computational approaches to networks, cells and tissues

Type	Name	Surnames	Entity
participant	Katie	<b>Abley</b>	John Innes Centre
participant	Eva	<b>Alloza</b>	CIPF
participant	Sergio	<b>Alonso</b>	IMPPC
participant	Berta	<b>Alsina</b>	Universitat Pompeu Fabra
participant	Albert	<b>Antolin</b>	IMIM - UPF - Biomedical Informatics
participant	Irantzu	<b>Anzar</b>	Centre for Genomic Regulation (CRG)
participant	Josep M.	<b>Aran</b>	IDIBELL
participant	Carlos G.	<b>Arques</b>	Spanish National Center for Molecular Biology. CBM
participant	Javier	<b>Arranz Trullén</b>	IBB Sant Pau
participant	Nina	<b>Asadipour</b>	Universitat Politècnica de Catalunya
participant	Amir	<b>Asgharsharghi Bonab</b>	Helmholtz Zentrum Munchen
speaker	Alexander	<b>Aulehla</b>	European Molecular Biology Laboratory (EMBL)
participant	Diego	<b>Barcena Menendez</b>	Centre for Genomic Regulation (CRG)
participant	Elisa	<b>Beltrán Sáez</b>	Universitat de Barcelona, Facultat de Física
participant	Marta	<b>Bleda</b>	Centro de Investigación Príncipe Felipe (CIPF)
participant	Victòria	<b>Brugada</b>	Centre for Genomic Regulation (CRG)
participant	Agustí	<b>Brugués</b>	IBEC
participant	Miguel Angel	<b>Brun Usan</b>	Universitat Autònoma Barcelona
speaker	Javier	<b>Buceta</b>	Parc Científic de Barcelona
participant	Pau	<b>Buch</b>	ICFO
participant	Cesar	<b>Caparrós</b>	(no affiliation)
participant	Montserrat	<b>Cases</b>	FIMIM
participant	Silvina	<b>Catuara</b>	Centre for Genomic Regulation (CRG)
participant	Tommaso	<b>Cavazza</b>	Centre for Genomic Regulation (CRG)
participant	Julián	<b>Cerón</b>	
participant	Cristina	<b>Clavería</b>	Spanish National Cardiovascular Research Centre
participant	Héctor	<b>Climente</b>	UPF
speaker	Rico	<b>Coen</b>	John Innes Centre, Norwich Research Park
participant	Kathryn	<b>Collinet</b>	Thomson Reuters
participant	Vito	<b>Conte</b>	Institute for Bioengineering of Catalonia (IBEC)
participant	Alexandra	<b>Contreras Jodar</b>	Centre de Recerca en Agrigenòmica
participant	Jordi	<b>Corominas Galbany</b>	CRAG
participant	James	<b>Cotterell</b>	Centre for Genomic Regulation (CRG)
participant	Anton	<b>Crombach</b>	Centre for Genomic Regulation (CRG)

**List of Delegates - Computational approaches to networks, cells and tissues**

Type	Name	Surnames	Entity
participant	Natalia	<b>Czerniak</b>	Centre for Genomic Regulation (CRG)
participant	Arturo	<b>d'Angelo</b>	Centre for Genomic Regulation (CRG)
participant	Claudia	<b>Di Guglielmo</b>	IBEC Institute for bioengineering of Catalonia
participant	Luis	<b>Diambra</b>	Universidad Nacional de La Plata
participant	Xavier	<b>Diego</b>	Centre for Genomic Regulation (CRG)
participant	Kai	<b>Dierkes</b>	Centre for Genomic Regulation (CRG)
participant	Mara	<b>Dierssen</b>	Centre for Genomic Regulation (CRG)
participant	Sylvia	<b>Dyballa</b>	Universitat Pompeu Fabra
speaker	Miki	<b>Ebisuya</b>	Graduate School of Medicines, Kyoto University
participant	Andrew	<b>Economou</b>	King's College London
participant	Jose Antonio	<b>Espinosa Carrasco</b>	Centre for Genomic Regulation (CRG)
participant	Nona	<b>Farbehi</b>	UPC
participant	Francesc	<b>Fernandez-Albert</b>	SisBio/Universitat Politècnica de Catalunya
participant	Ana	<b>Ferreira</b>	Institute for Research in Biomedicine
participant	Pau	<b>Formosa-Jordan</b>	Physics building, University of Barcelona
participant	Juanjo	<b>Fraire-Zamora</b>	Centre for Genomic Regulation (CRG)
participant	Mirko	<b>Francesconi</b>	Centre for Genomic Regulation (CRG)
participant	Ruth	<b>Freixes</b>	Centre for Genomic Regulation (CRG)
participant	Marc	<b>Friedlander</b>	Centre for Genomic Regulation (CRG)
participant	David	<b>Frigola</b>	Dept. ECM, University of Barcelona
participant	Marta	<b>Fructuoso</b>	Centre for Genomic Regulation (CRG)
participant	Paula Maria	<b>Fuertes</b>	Psychology
participant	Raquel	<b>Fueyo Arévalo</b>	IBMB-CSIC
participant	Hironobu	<b>Fujiwara</b>	RIKEN Center for Developmental Biology
participant	Laura I.	<b>Furlong</b>	GRIB-IMIM-UPF
participant	Marçal	<b>Gabalda</b>	Universitat Pompeu Fabra
participant	Simon	<b>Garcia</b>	IBEC
participant	Jordi	<b>Garcia-Ojalvo</b>	Universitat Pompeu Fabra
participant	Mireia	<b>Garriga</b>	Centre for Genomic Regulation (CRG)
participant	Tomas	<b>Gener</b>	Centre for Genomic Regulation (CRG)
participant	Fernando	<b>Giráldez</b>	UPF
participant	Jakob	<b>Goldmann</b>	Centre for Genomic Regulation (CRG)
participant	Nilton Cesar	<b>Gomez Urviola</b>	UNIVERSIDAD AUTONOMA DE BARCELONA
speaker	Niels	<b>Grabe</b>	Tissue Imaging and Analysis (TIGA) Center, University of Heidelberg

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Type	Name	Surnames	Entity
speaker	Jeremy	<b>Green</b>	King's College London
participant	Laia	<b>Gregori Gonzalo</b>	IBEC
speaker	Veronica	<b>Grieneisen</b>	John Innes Centre, Norwich Research Park
participant	Nara	<b>Guisoni</b>	Universitat Pompeu Fabra / CONICET
participant	Shigeo	<b>Hayashi</b>	RIKEN Center for Developmental Biology
participant	Peran	<b>Hayes</b>	Centre for Genomic Regulation (CRG)
participant	Katharina	<b>Heil</b>	UPF/UAB Barcelona
participant	Rosa Divina	<b>Hernansaiz</b>	Centro de Investigación Príncipe Felipe (CIPF)
participant	Astrid	<b>Hoermann</b>	Centre for Genomic Regulation (CRG)
participant	Raquel	<b>Horrillo Saura</b>	DAJO
participant	Marta	<b>Ibanes</b>	University of Barcelona
participant	Alan	<b>Itakura</b>	King Abdullah University of Science and Technology
participant	Emiliano	<b>Izquierdo-Rangel</b>	University of Heidelberg
participant	Yogi	<b>Jaeger</b>	Centre for Genomic Regulation (CRG)
participant	Hilde	<b>Janssens</b>	Centre for Genomic Regulation (CRG)
participant	Rob	<b>Jelier</b>	Centre for Genomic Regulation (CRG)
participant	Alba	<b>Jimenez</b>	Centre for Genomic Regulation (CRG)
participant	Gerardo	<b>Jiménez</b>	Parc Científic de Barcelona
participant	Antonina	<b>Khoruzhenko</b>	Institute of Molecular Biology and Genetics, NASU
participant	Tomoya	<b>Kitajima</b>	RIKEN CDB
speaker	Shigeru	<b>Kondo</b>	Graduate School of Frontier Biosciences, Osaka University
participant	Anita	<b>Kosmalska</b>	IBEC
participant	Raj	<b>Ladher</b>	RIKEN CDB
participant	Karen	<b>Lee</b>	John Innes Centre
participant	Marcel	<b>Leyton Jaimes</b>	IBEC
organizer	Hernán	<b>López-Schier</b>	Helmholtz Zentrum München
participant	Jordina	<b>Loubat Casanovas</b>	IMIM
participant	Pierre	<b>Luisi</b>	IBE (UPF-CSIC)
participant	Juan Camilo	<b>Luna Escalante</b>	Universitat de Barcelona
participant	Oksana	<b>Malanchuk</b>	Institute of Molecular Biology and Genetics
participant	Andrea	<b>Malandrino</b>	Institute for Bioengineering of Catalonia
participant	Ilaria	<b>Mannelli</b>	ICFO-The Institute of Photonic Sciences
participant	Luciano	<b>Marcon</b>	Centre for Genomic Regulation (CRG)
participant	Miquel	<b>Marín Riera</b>	Universitat Autònoma de Barcelona



### List of Delegates - Computational approaches to networks, cells and tissues

Type	Name	Surnames	Entity
participant	Rene	<b>Markovič</b>	Faculty of Natural Sciences and Mathematics
participant	Rosa	<b>Martínez</b>	UPF
speaker	Lucia	<b>Marucci</b>	Centre for Genomic Regulation (CRG)
participant	Alexis	<b>Matamoro-Vidal</b>	Univ. Aut. de Barcelona / Florida State Univ.
participant	Juergen	<b>Mayer</b>	Centre for Genomic Regulation (CRG)
participant	Joan	<b>Maynou</b>	UPC
participant	Arvind Singh	<b>Mer</b>	MDC, Berlin
participant	Marco	<b>Milan</b>	IRB Barcelona
participant	Andre	<b>Minoche</b>	Centre for Genomic Regulation (CRG)
participant	Jordi	<b>Morales-Dalmau</b>	ICFO
participant	Francisco David	<b>Morón</b>	UAB
participant	Andreea	<b>Munteanu</b>	Centre for Genomic Regulation (CRG)
participant	Jose	<b>Muñoz</b>	Universitat Politècnica de Catalunya
participant	Marco	<b>Musy</b>	Centre for Genomic Regulation (CRG)
participant	Nikolina	<b>Nakic</b>	IDIBAPS
participant	Bàrbara	<b>Negre</b>	Centre for Genomic Regulation (CRG)
participant	Jerome	<b>Noailly</b>	Institute for Bioengineering of Catalonia (IBEC)
participant	Andy	<b>Olivares</b>	Institute for Bioengineering of Catalonia (IBEC)
participant	Joaquim	<b>Olivés Farrés</b>	IMIM
participant	Koh	<b>Onimaru</b>	Tokyo Institute of Technology
participant	David	<b>Palau-Ortín</b>	Dept. Structure and Constituents of Matter (UB)
participant	Vera	<b>Pancaldi</b>	CNIO, Madrid
participant	Irina	<b>Pavelescu</b>	Centre de Recerca en Agrigenomica (CRAG)
speaker	Juan	<b>Pedraza</b>	Physics Department, University of the Andes
participant	Simón	<b>Perera del Rosario</b>	UAB
participant	Alexandre	<b>Perera Lluna</b>	Universitat Politecnica de Barcelona
participant	Gael	<b>Pérez</b>	UPF-IMIM
participant	David	<b>Piedra</b>	IMIM
participant	Ville	<b>Pimenoff</b>	Catalan Institute of Oncology / IDIBELL
participant	Janet	<b>Piñero</b>	IMIM (Hospital del Mar Medical Research Institute)
participant	Antonio Javier	<b>Pons Rivero</b>	Universitat Politècnica de Catalunya
participant	Carla	<b>Prat Rojo</b>	IBMB-CSIC
participant	Rayner	<b>Prendes</b>	CRAG
participant	Rosa	<b>Prieto</b>	Vall d'Hebron Institut de Recerca

**List of Delegates - Computational approaches to networks, cells and tissues**

Type	Name	Surnames	Entity
participant	Anna	<b>Puig Oliveras</b>	Centre de Recerca en Agrigenómica (CRAG)
participant	Cristina	<b>Pujades</b>	DCEXS-UPF
participant	Núria	<b>Queralt Rosinach</b>	GRIB/IMIM/UPF
participant	Jelena	<b>Raspopovic</b>	Centre for Genomic Regulation (CRG)
participant	Manuel	<b>Revilla Sánchez</b>	CRAG
participant	Àlex	<b>Robert Moreno</b>	CRG-PRBB
participant	Pilar	<b>Rodríguez Franco</b>	IBEC
participant	Rosa	<b>Romero</b>	VHIR
participant	Lucia	<b>Russo</b>	Centre for Genomic Regulation (CRG)
participant	Eduard	<b>Sabidó</b>	Centre de Regulació Genòmica
participant	Jordi	<b>Saladrigues Vila</b>	ERA Biotech
participant	José M.	<b>Sancho</b>	University of Barcelona
participant	Yolanda	<b>Schaerli</b>	Centre for Genomic Regulation (CRG)
participant	Patricia	<b>Sebastián</b>	Centro de Investigación Príncipe Felipe (CIPF)
participant	Jennifer	<b>Semple</b>	Centre for Genomic Regulation (CRG)
participant	Vivekraj	<b>Senthivel</b>	Centre for Genomic Regulation (CRG)
organizer	James	<b>Sharpe</b>	Centre for Genomic Regulation (CRG)
participant	Tatsuo	<b>Shibata</b>	RIKEN Center for Developmental Biology
speaker	Stas	<b>Shvartsman</b>	Princeton University
participant	Babita	<b>Singh</b>	PRBB, Barcelona
participant	Andreas	<b>Spitzmüller</b>	IMIM/GRIB
participant	Petra	<b>Stockinger</b>	Centre for Genomic Regulation (CRG)
speaker	Gürol	<b>Süel</b>	UC San Diego
participant	Angughail	<b>Sumi</b>	Centre for Genomic Regulation (CRG)
participant	Raimon	<b>Sunyer</b>	Institute for the Bioengineering of Catalonia
participant	Jim	<b>Swoger</b>	Centre for Genomic Regulation (CRG)
participant	Isil	<b>Tekeli</b>	IBEC
speaker	Fabian	<b>Theis</b>	Helmholtz Zentrum München and Technische Universität München
participant	Ilda	<b>Theka</b>	Centre for Genomic Regulation (CRG)
participant	Xavier	<b>Trepap</b>	Institute for Bioengineering of Catalonia
participant	Evrin Besray	<b>Unal</b>	Centre for Genomic Regulation (CRG)
participant	Marina	<b>Uroz Marimon</b>	IBEC
participant	Manu	<b>Uzkudun</b>	Centre for Genomic Regulation (CRG)
participant	Berta	<b>Verd</b>	Centre for Genomic Regulation (CRG)

**List of Delegates - Computational approaches to networks, cells and tissues**

Type	Name	Surnames	Entity
participant	Romariç	<b>Vincent</b>	IBEC (Barcelona)
participant	Roni	<b>Wright</b>	Centre for Genomic Regulation (CRG)
organizer	Blanka	<b>Wysocka</b>	Centre for Genomic Regulation (CRG)
participant	Laura I.	<b>Xicota Vila</b>	Centre for Genomic Regulation (CRG)
participant	Andrey	<b>Ziyatdinov</b>	UPC