

Optics, Forces and Development

In vivo 3-D microscopy for the analysis of cell behavior in developing embryos

Santiago, Chile, January 14-28th, 2012

FINAL PROGRAM: FIRST WEEK 14- 18.01.2013

Student Groups:

a Verónica Akle, Verónica Bahamondes, Abigail Díaz, Magdalena Esparza

b1 Ricardo Figueroa, Álvaro Glavic

b2 Paola Lepanto, Patricio Olguín

c Rodolfo Ortiz, Talita Pereira, Ana Cecilia Plavan, Juan Ulloa

Monday 14.01

9:00-10:30 Welcome and Introduction to the Course. **Dr Miguel Concha / Dr Steffen Härtel**

Coffee Break

11:00-12:30 *Theoretical Session 1:* Introduction to cell labeling for *in vivo* imaging. Approaches. Pros & Cons. **Dr Germán Reig**

Lunch

14:00-15:30 *Theoretical Session 2:* Introduction to microscopy for *in vitro* and *in vivo* imaging. Approaches. Pros & Cons. **Dr Steffen Härtel**

Coffee Break

16:00-17:30 *Theoretical Session 3:* Meeting the biological models: zebrafish and killifish. **Dr Miguel Concha**

Coffee Break

18.00-20:00 *Practical / Tutorial Session 1:* Manipulation of embryos: zebrafish (**Dr Janina Borgonovo, Dr Néstor Guerrero**) and killifish (**Lic Valeria Larenas**)

Tuesday 15.01

9:00-10:30 *Practical / Tutorial Session 2: Microinjection of embryos - zebrafish (Dr Janina Borgonovo, Dr Néstor Guerrero)*

Group a

Practical / Tutorial Session 6: Fluorescent Recovery After Photobleaching - FRAP (Dr Omar Ramírez)

Group b

Coffee Break

11:00-12:30 *Practical / Tutorial Session 2: Microinjection of embryos - killifish (Dr Germán Reig)*

Group a

Practical / Tutorial Session 6: Fluorescent Recovery After Photobleaching - FRAP (Dr Omar Ramírez)

Group c

Lunch

14:00-15:30 *Theoretical Session 4: Microscopy Theory: Theory of fluorescence. Diffraction theory & diffraction limited resolution. Point Spread Function and convolution. Dr Steffen Härtel*

Coffee Break

16:00-17:30 *Lectures on Applications of Advanced Biological Imaging 1: Analysis of molecular mobility by microscopy Dr Ulrich Kubitscheck*

Coffee Break

18.00-20:00 *Theoretical Session 5: Microscopy Acquisition: Nyquist / Sampling Theorem. Signal/noise ratio. Deconvolution Dr Steffen Härtel*

Wednesday 16.01

9:00-10:30 *Practical / Tutorial Session 2: Microinjection of embryos - zebrafish (Dr Janina Borgonovo, Dr Néstor Guerrero)*

Group b

Practical / Tutorial Session 4: Photoconversion of fluorescent proteins (Lic Carmen Lemus)

Group c

Practical / Tutorial Session 6: Fluorescent Recovery After Photobleaching - FRAP (Dr Omar Ramírez)

Group a

Coffee Break

11:00-12:30

Practical / Tutorial Session 3: Microinjection of embryos - killifish (Dr Germán Reig)

Group b

Practical / Tutorial Session 4: Photoconversion of fluorescent proteins (Lic Carmen Lemus)

Group a

Practical / Tutorial Session 5: In vivo electroporation (MSc Margarita Meynard)

Group c

Lunch

14:00-15:30

Theoretical Session 6: Digital image formation and restoring: digital images, deconvolution, thresholding, pixel-level filters. Lic Jorge Jara

Coffee Break

16:00-17:30

Lectures on Applications of Advanced Biological Imaging 2: Application of Light Sheet Microscopy Dipl Phys Jan Spille

Coffee Break

18.00-20:00

Practical / Tutorial Session 7: Confocal microscopy Image Acquisition: Spinning disc (PPo: Lic Carmen Lemus, Dr Mauricio Cerda); Leica LSI (DCs: Dr German Reig, Lic Felipe Santibáñez)

Groups a and b1

Image restoring - deconvolution (PPo and ER: Dr Omar Ramírez)

Groups b2 and c

Thursday 17.01

9:00-10:30

Practical / Tutorial Session 2: Microinjection of embryos - zebrafish. (Dr Janina Borgonovo, Dr Néstor Guerrero)

Group C

Practical / Tutorial Session 4: Photoconversion of fluorescent proteins. (Lic Carmen Lemus)

Group b

Practical / Tutorial Session 5: In vivo electroporation. (MSc Margarita Meynard).
Group a

Coffee Break

11:00-12:30 *Practical / Tutorial Session 3: Microinjection of embryos - killfish. (Dr Germán Reig)*
Group C
Practical / Tutorial Session 5: In vivo electroporation. (MSc Margarita Meynard).
Group b

Lunch

14:00-15:30 *Lectures on Applications of Advanced Biological Imaging 3: Practical aspects of confocal laser scanning microscopy. Ulrich Kubitscheck*

Coffee Break

16:00-17:30 *Seminar presentations by participants / Discussion of papers 1: Super-Resolution Microscopy. Dr Mauricio Cerda, Lic Felipe Santibañez. / Participants: Akle, Bahamondes, Díaz.*

Coffee Break

18.00-20:00 *Practical / Tutorial Session 7: Confocal microscopy Image Acquisition: Spinning disc (PPo: Lic Carmen Lemus, Dr Mauricio Cerda); Leica LSI (DCs: Dr German Reig, Lic Felipe Santibañez)*
Groups b2 and c
Image restoring - deconvolution (PPo and ER: Dr Omar Ramírez)
Groups a and b1

Friday 18.01

14:00-15:30 *Lectures on Applications of Advanced Biological Imaging 4: Biophysics at the microscale: Optical trapping and applications. Juan Pablo Staforelli*

Coffee Break

16:00-17:30 *Mini-seminars of student projects (15 min talks): Students a -b1*

Coffee Break

18.00-20:00

Mini-seminars of student projects (15 min talks): Students b2-c

20:00

Social activity: Dinner at "Los Buenos Muchachos"

FINAL PROGRAM: SECOND WEEK 21- 25.01.2013

Student Groups:

a Verónica Akle, Verónica Bahamondes, Abigail Díaz, Magdalena Esparza

b1 Ricardo Figueroa, Álvaro Glavic

b2 Paola Lepanto, Patricio Olguín

c Rodolfo Ortiz, Talita Pereira, Ana Cecilia Plavan, Juan Ulloa

Monday 21.01

9:00-10:30 *Theoretical Session 7: In vitro and in vivo approaches to cell migration.*
Dr Germán Reig

Coffee Break

11:00-12:30 *Theoretical Session 8: Image Analysis 1: Registration, segmentation, object representation .* **Lic Jorge Jara**

Lunch

14:00-15:30 *Practical / Tutorial Session 9: Mechanics and estimation of forces in cell biology.* **Roberto Bernal**

Coffee Break

16:00-17:30 *Lectures on Applications of Advanced Biological Imaging 5: Cell mechanics in Cell Biology.* **Roberto Bernal**

Coffee Break

Tuesday 22.01

9:00-12:30 *Practical / Tutorial Session 10: Laser mediated cell ablation & estimation of forces in developmental biology.* **C.P. Heisenberg, Lic Eduardo Pulgar, Dr Germán Reig.**

Lunch

14:00-15:30 *Theoretical Session 9: Image Analysis 2: Shape and topology description.* **Dr Mauricio Cerda**

Coffee Break

16:00-17:30 *Lectures on Applications of Advanced Biological Imaging 6:* Measurement of cell adhesion in zebrafish gastrulation. **Carl-Phillip Heisenberg**

Coffee Break

18.00-20:00 *Seminar presentations by participants / Discussion of papers 2:* Forces and microscopy. **Carl-Phillipp Heisenberg.** / Participants: **Esparza, Figuieroa Glavic**

Wednesday 23.01

9:00-12:30 *Practical / Tutorial Session 11:* Shape and topology description (Segmented cells of PPO and DCs.) **Dr Mauricio Cerda**

Lunch

14:00-15:30 *Theoretical Session 10:* Optical approaches to measure forces in development. **Carl-Philipp Heisenberg**

Coffee Break

16:00-17:30 *Lectures on Applications of Advanced Biological Imaging 7:* Image analysis to study structure and dynamics of the cytoskeleton. **Florian Rehfeldt**

Coffee Break

18.00-20:00 *Seminar presentations by participants / Discussion of papers 3:* Differentiation of adult stem cells guided by matrix mechanics. **Froilan Rehfeldt** / Participants: **Lepanto, Olguin, Ortiz**

Thursday 24.01

9:00-12:30 *Practical / Tutorial Session 12:* Motion estimation (Tracking and optical flow for sperm motion and light sheet microscopy) **Dr Víctor Castañeda**

Lunch

14:00-15:30 *Theoretical Session 11:* Image Analysis 3: motion estimation: diffusion (FRAP), optical flow, tracking. **Dr Mauricio Cerda, Lic Felipe Santibáñez**

Coffee Break

16:00-17:30 Seminar presentations by participants / Discussion of papers 4: Image Processing. **Lic Jorge Jara, Dr Mauricio Cerda, Lic Felipe Santibañez** / Participants: Pereira, Plavan, Ulloa

Friday 25.01

9:00-12:30 Evaluation seminar of participants / Discussion of integrative papers: Integrative Seminars. **Dr Miguel Concha, Dr Steffen Hartel.** / Participants: All divided in 4 groups

Lunch **Course Evaluation**

14:00-Blck-out Social activity: **Trip and BBQ in "Cajón del Maipo"**

Monday 28.01

10:00-16:00 *BNI NETWORKS SYMPOSIUM on Advanced Microscopy*

- Tutorial on Super-Resolution fluorescence Microscopy. **Jorg Enderlein**
- Strategies for the analysis of cell dynamics. **Steffen Härtel**
- Carbon nanotubes reveal single and collective dynamics of proteins in cells and in whole organisms. **Nikta Fakhri**
- ER dynamics. **Andrés Couve**
- **LUNCH**
- Structure and dynamics of the stem cell cytoskeleton - mechanics matters. **Florian Rehfeldt**
- Collective cell migration and tissue morphogenesis. **Micuel Concha**
- Cell and tissue mechanics in zebrafish gastrulacion. **Carl -Philip Heinsenberg**
- Mechanosensing with primary cilia. **Christoph Schmidt**

Coffee Break

18.00-20:00 Closing Event of BNI Symposium