



FORTH

Synergy Grants



IMBB-FORTH

**Developmental Morphogenesis
Laboratory**

Anastasios Pavlopoulos

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Animal Limb Morphogenesis



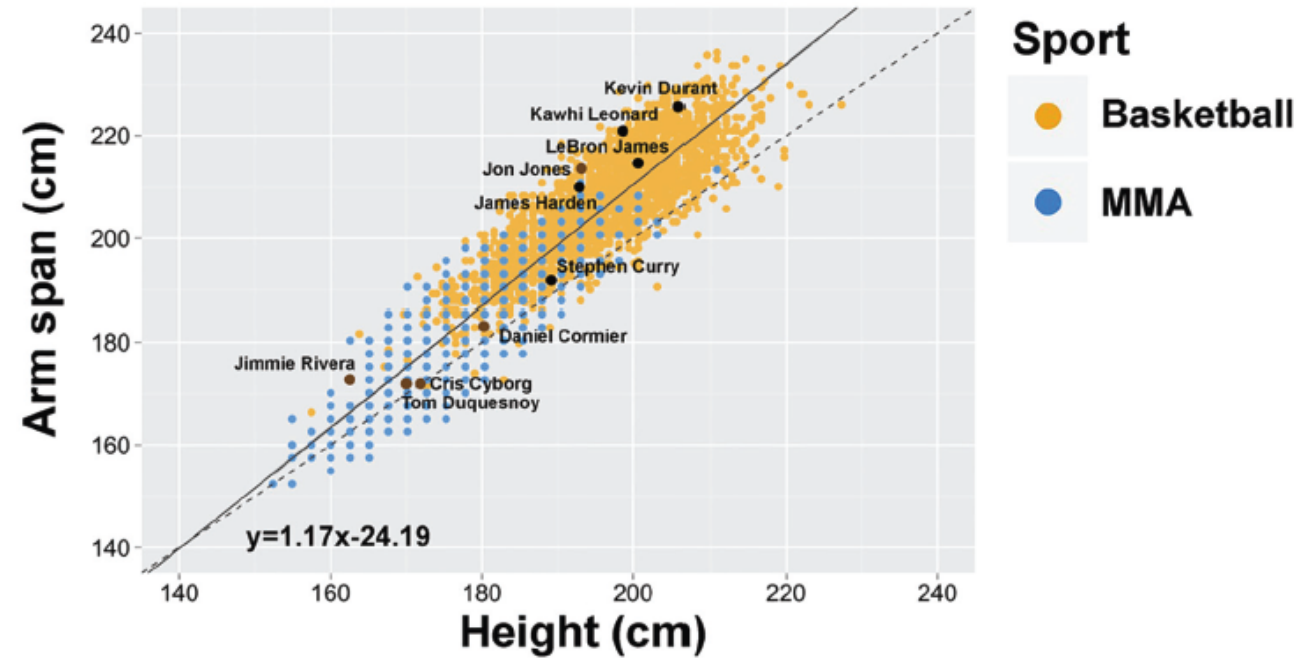
IESL-FORTH

**Laboratory for Biophotonics
and Molecular Imaging**

Giannis Zacharakis

zahari@iesl.forth.gr

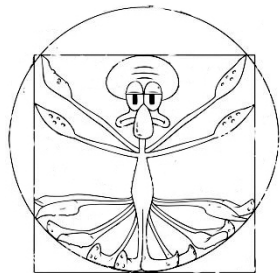
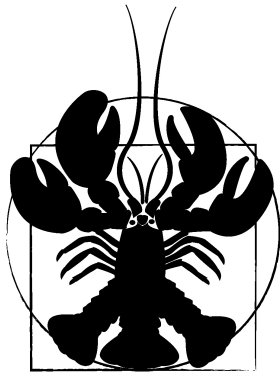
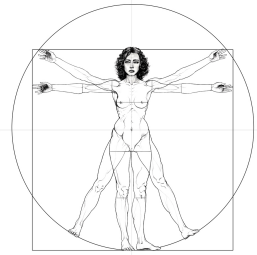
Athletic success and relative body proportions (allometry)



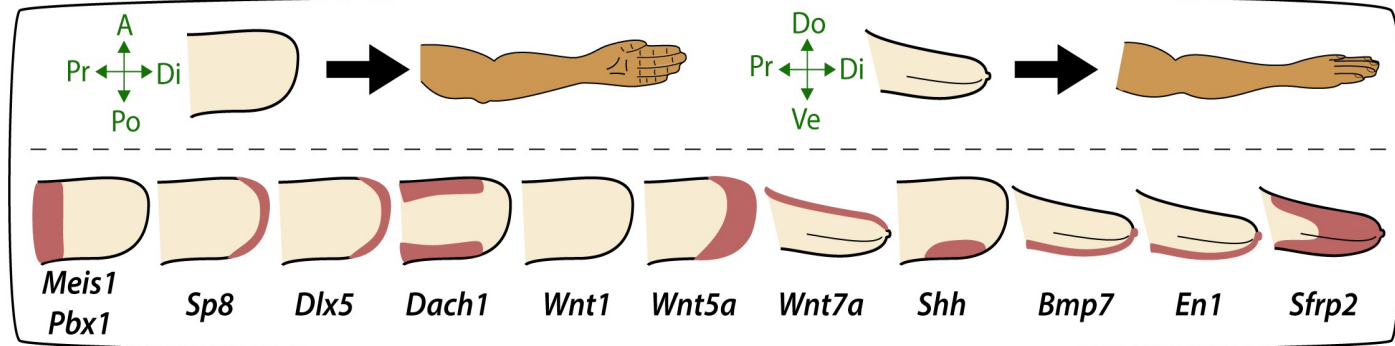
Developmental Biology in 21st century

- Established and emerging model organisms
- Genome-wide assessment of regulatory states with single-cell resolution
- Integrate molecular genetic with cellular dynamics
- Probe cell and tissue mechanics
- Hypothesis testing with experimental perturbations

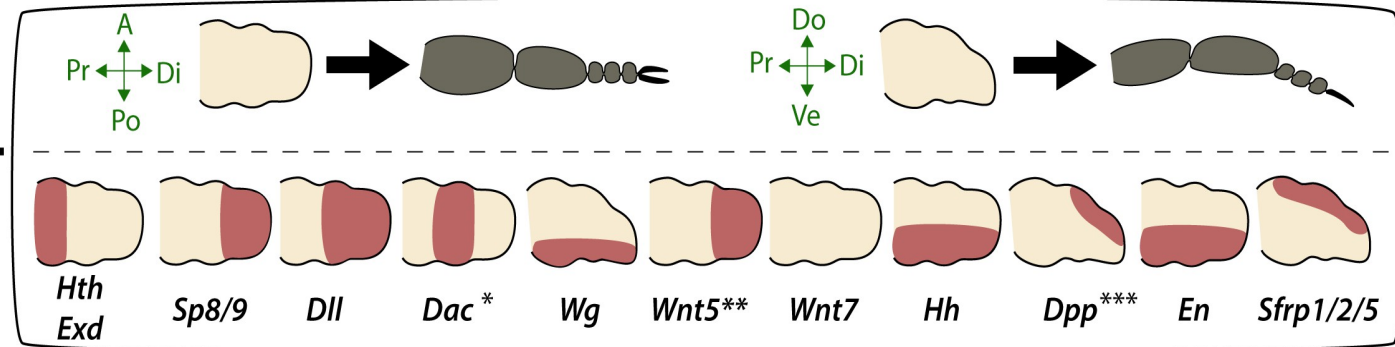
Common genetic instructions for animal limb development



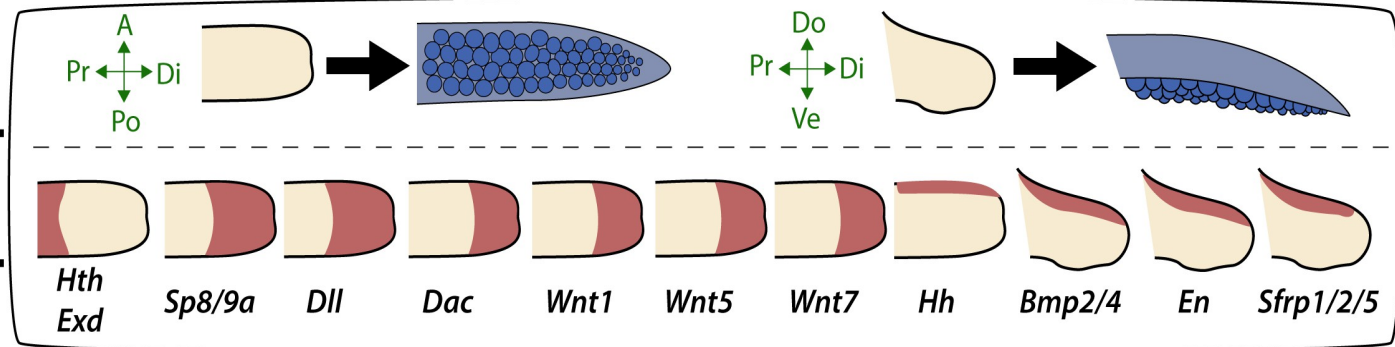
Vertebrates



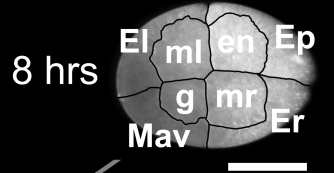
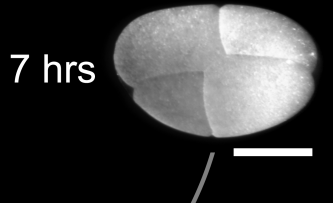
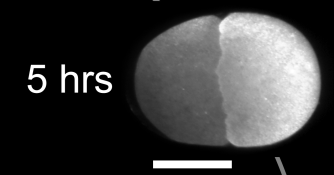
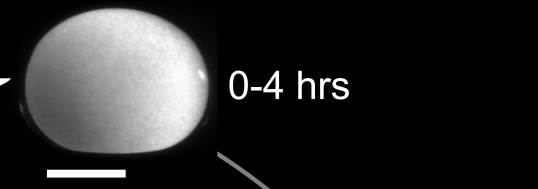
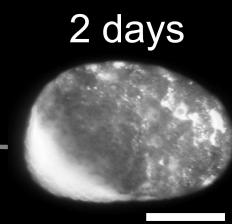
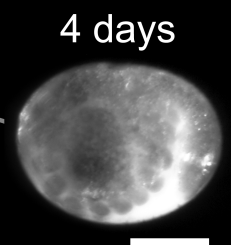
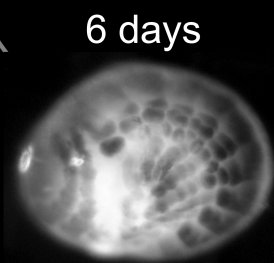
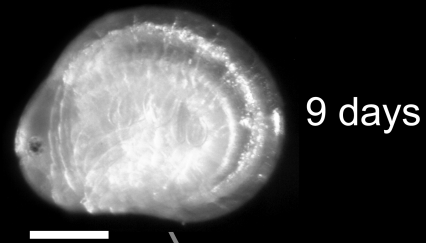
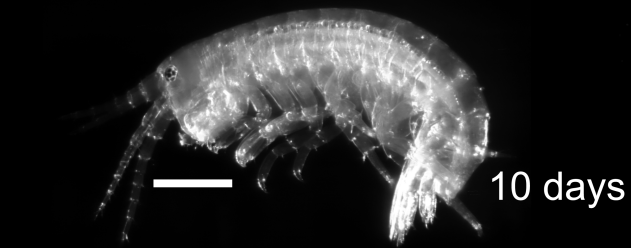
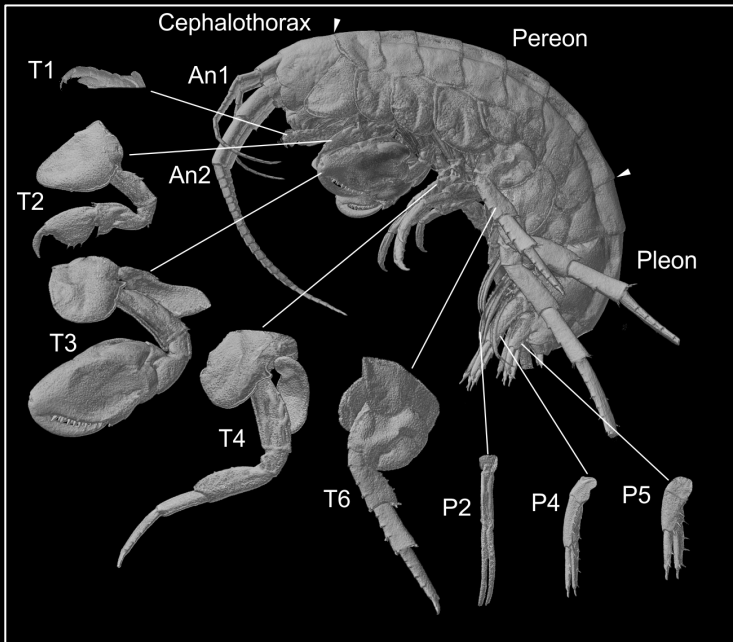
Arthropods



Cephalopods



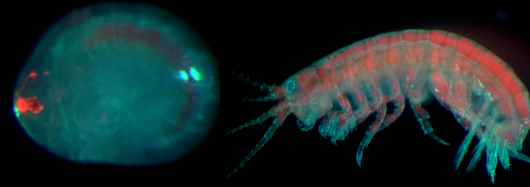
The crustacean model *Parhyale hawaiiensis*



Expansion of *Parhyale* experimental resources

Transgenesis

- Transposon-based
- **Integrase-based**



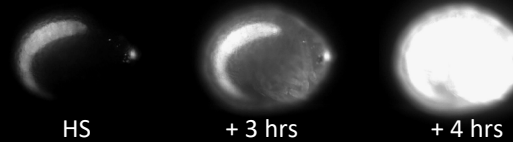
Gene mis-expression

- heat-inducible
- **binary (UAS/GAL4)**



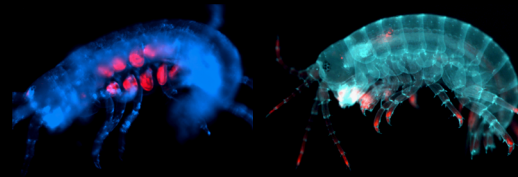
Gene trapping

- exon trapping
- enhancer trapping



Gene knock-down -out -in

- RNAi or morpholinos
- **CRISPR/Cas-based**



Mosaic analysis

- transposon-based
- recombinase-based



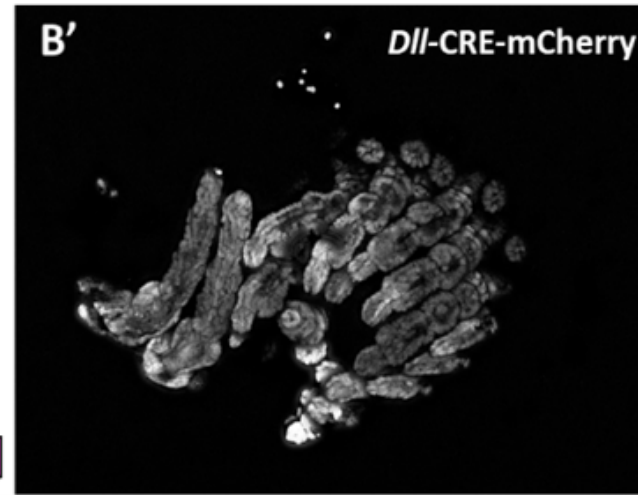
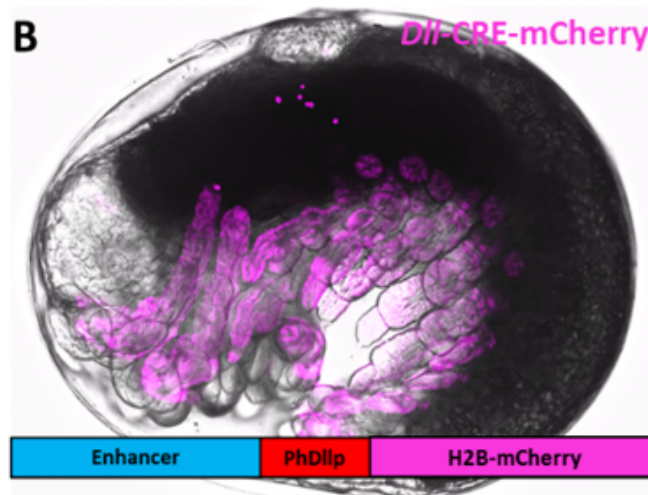
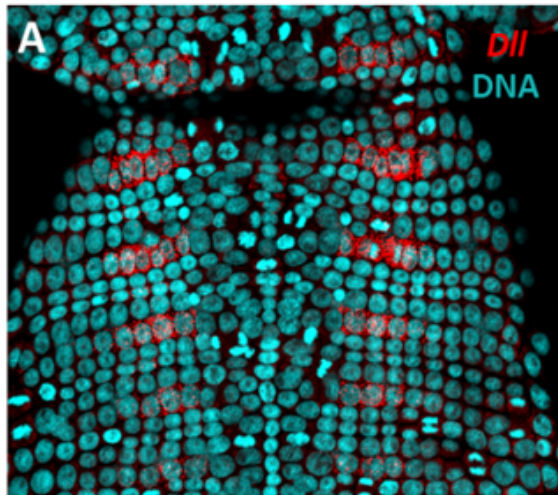
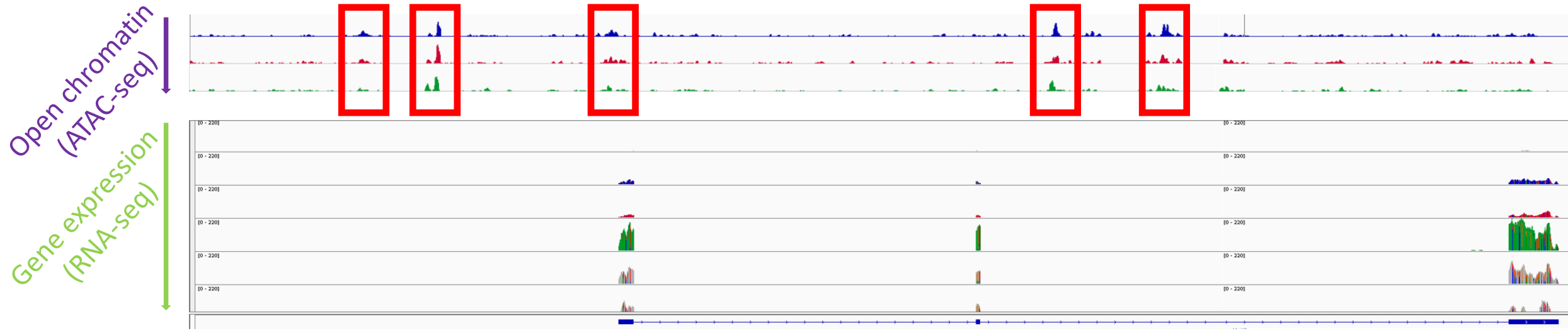
Genome-wide resources

- well-annotated genome
- **RNA-seq, ATAC-seq etc.**



Irene Daskalaki
Themis Archontidis
Maria Kalogeridi
John Rallis
Marina Ioannou

Genome-wide profiling of open chromatin and gene expression



John Rallis
Valia Stamatakis
Mat Lavigne
Panagiotis Ioannidis
Evelina Papagrigoraki

Fluorescence live imaging

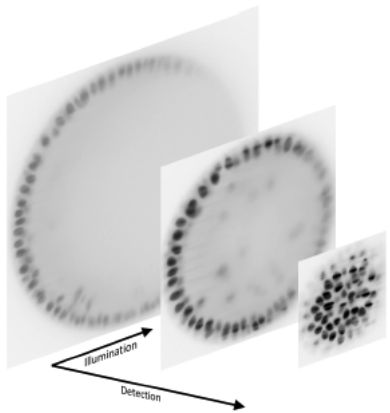
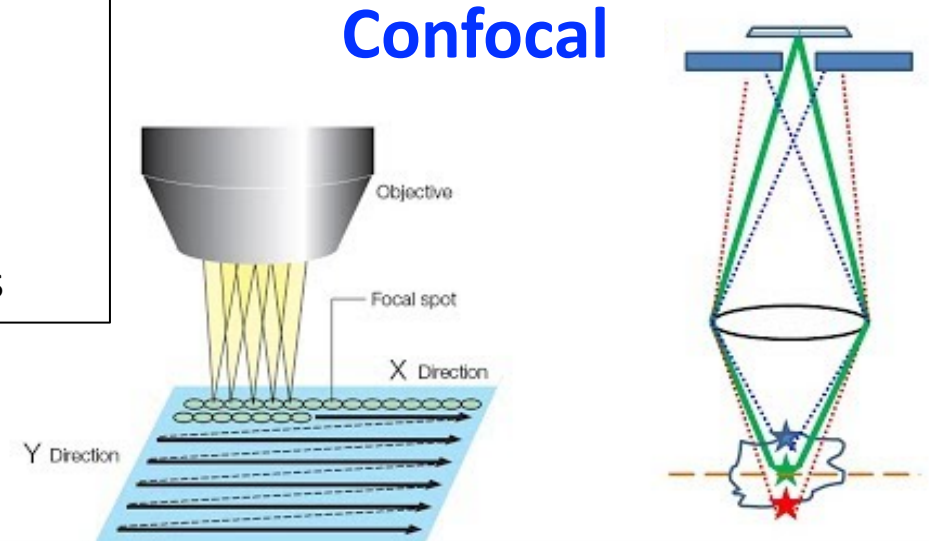
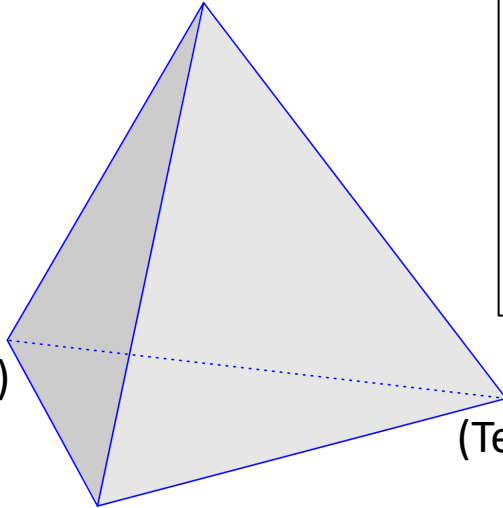
Health of specimen

- Light-sheet vs. Confocal**
- Much faster
 - Less photo-damaging
 - Longer acquisitions
 - Imaging from multiple views

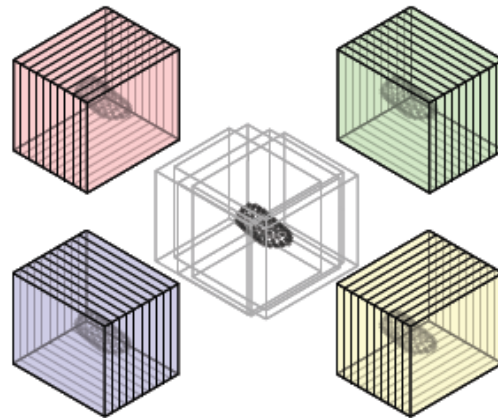
Imaging speed
(Temporal Resolution)

Sensitivity
(Signal-to-Noise)

Resolved detail
(Spatial Resolution)

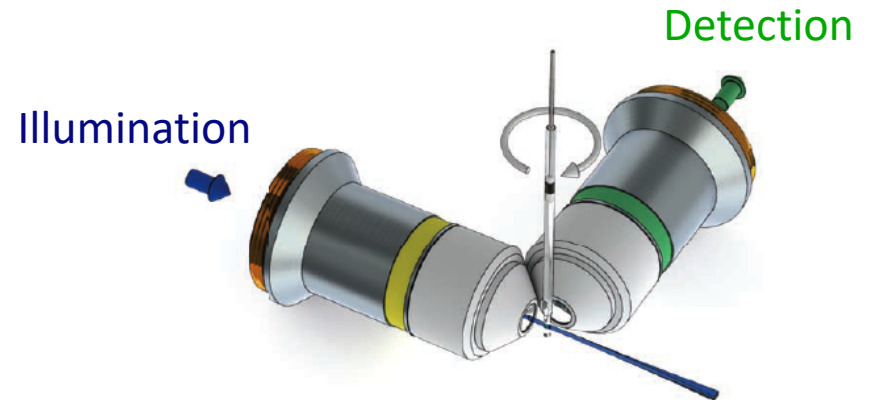


Optical Sectioning

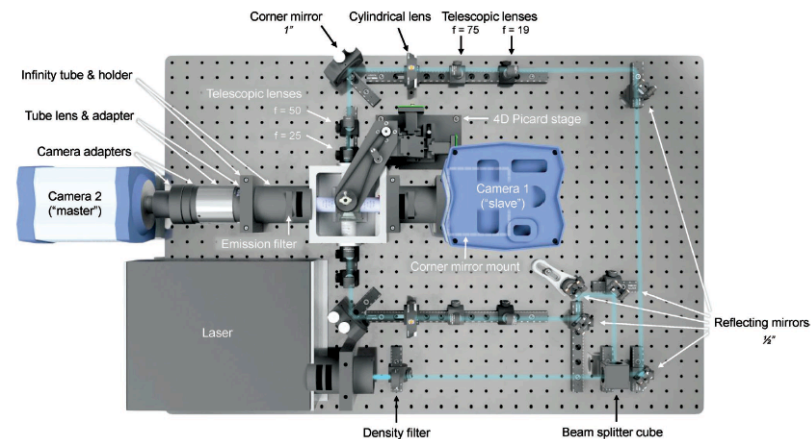
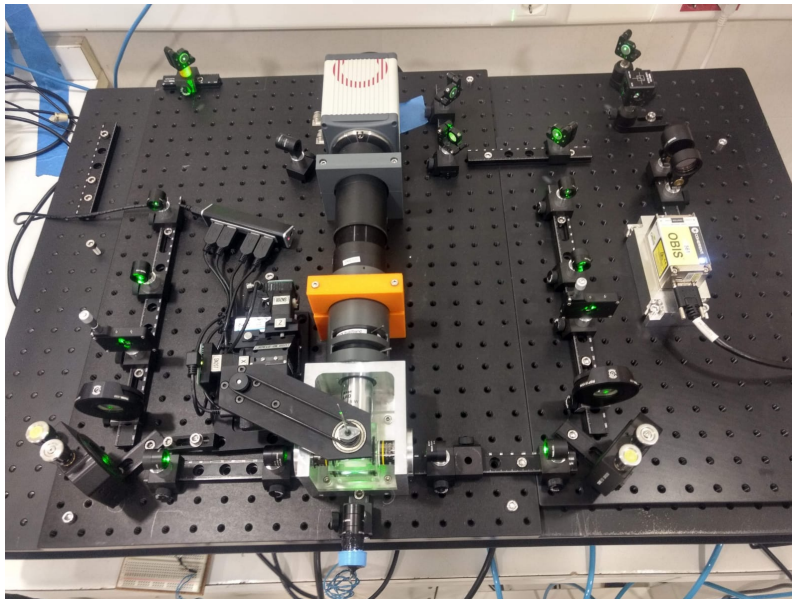
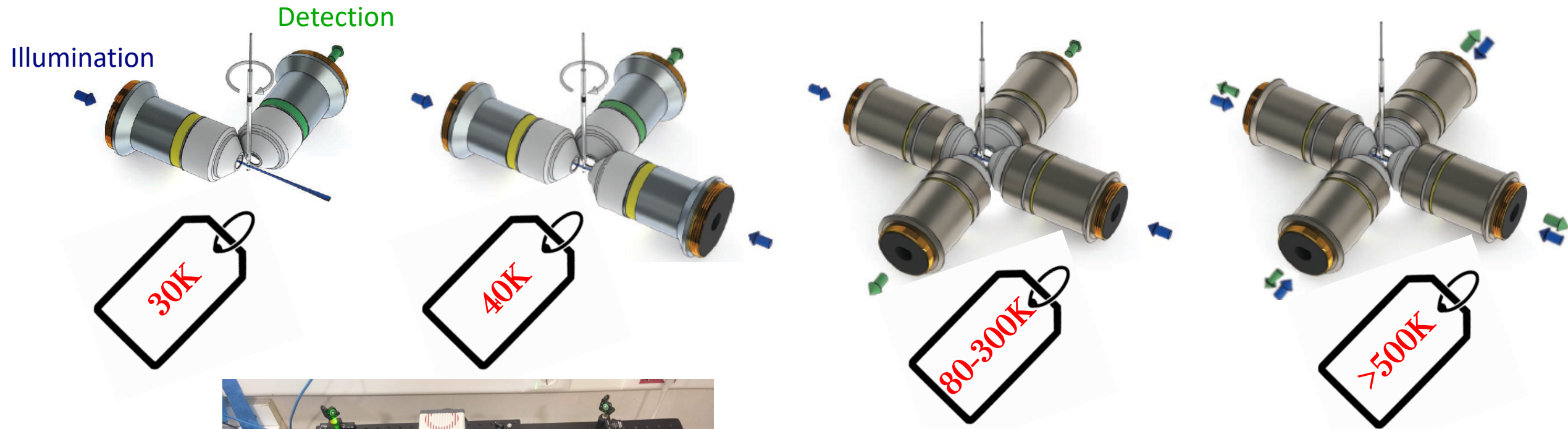


Multi-view acquisition, registration and fusion

Light-sheet



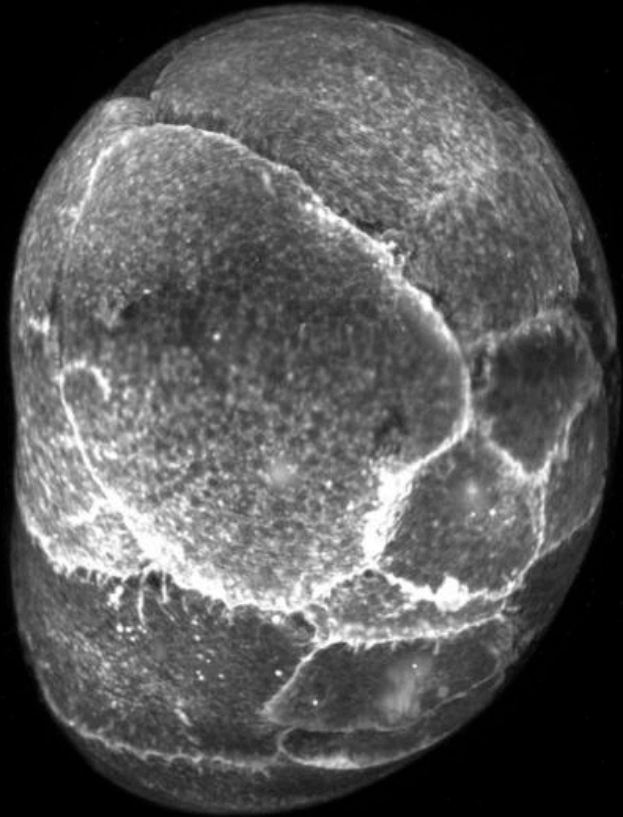
Custom-built light-sheet fluorescence microscopes



Girstmair et al., 2022

Mikis Mylonakis
Stylianos Psycharakis
Ioannis Liaskas

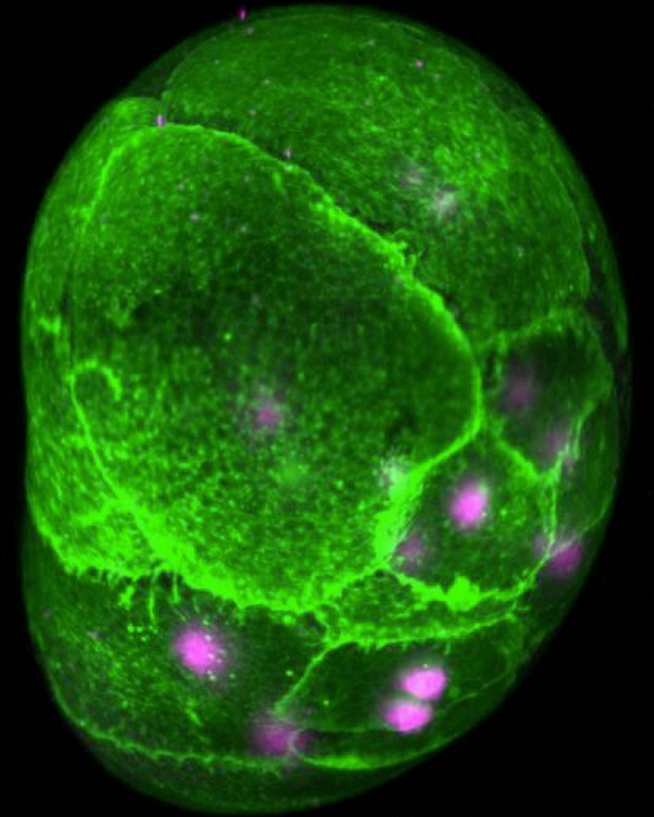
LSFM of *Parhyale* early embryogenesis (x18000 speed)



Membranes



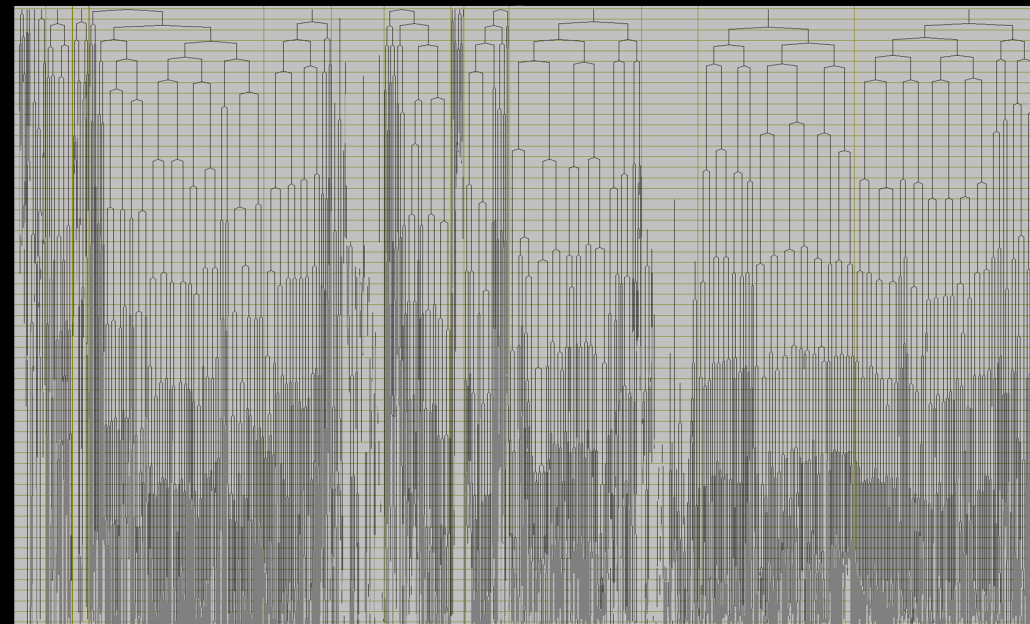
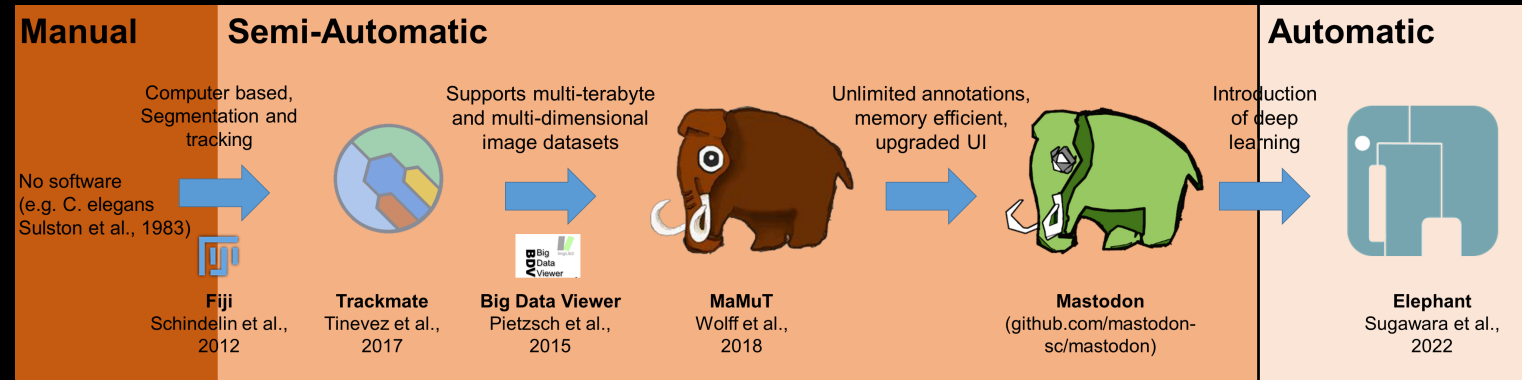
Nuclei



00h 00m

Composite

Comprehensive reconstruction of cell lineages

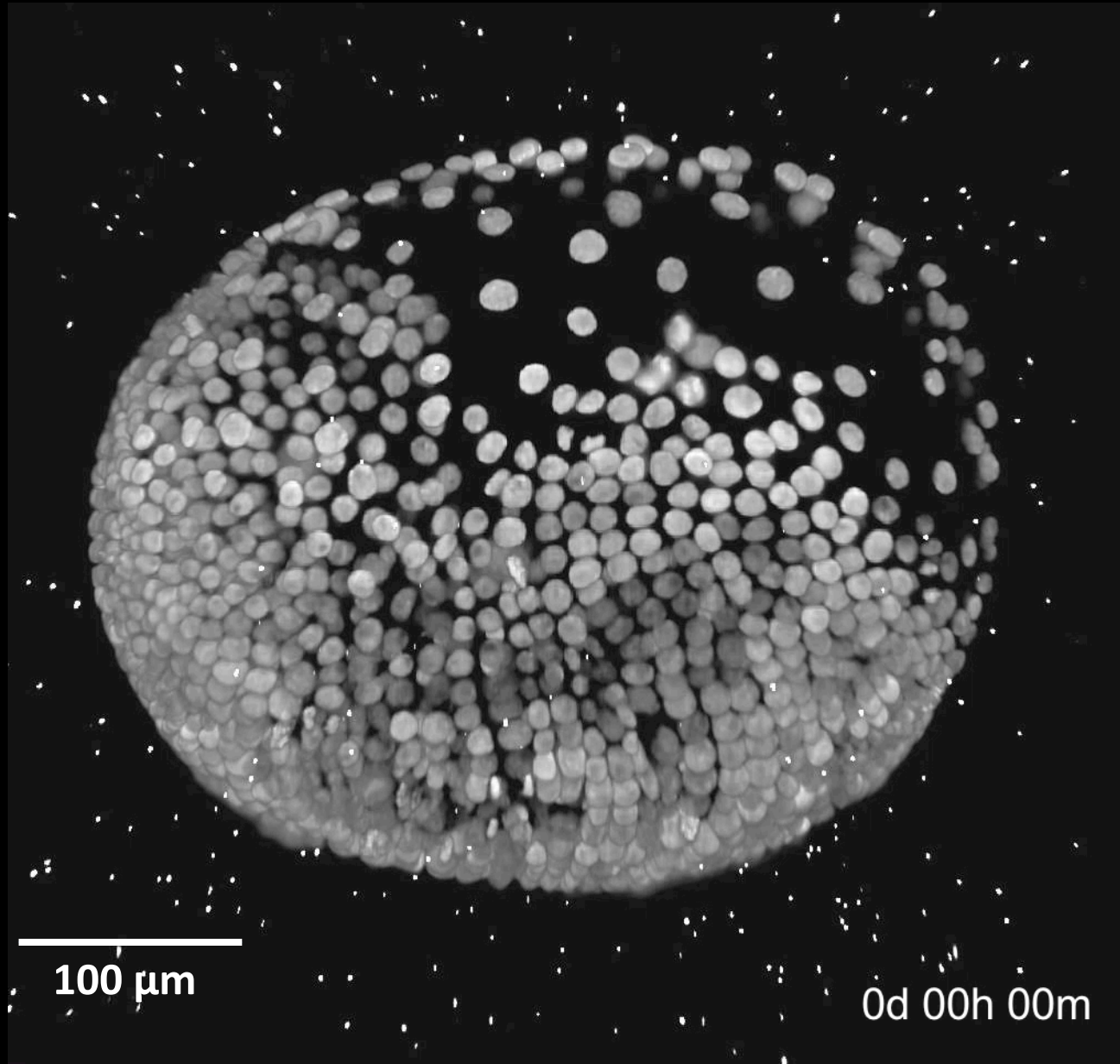


Time

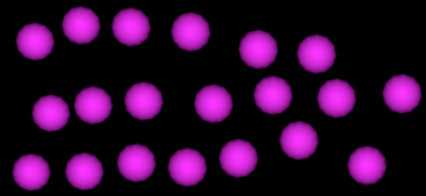
Cells

LSFM of *Parhyale* limb development (x10800 speed)

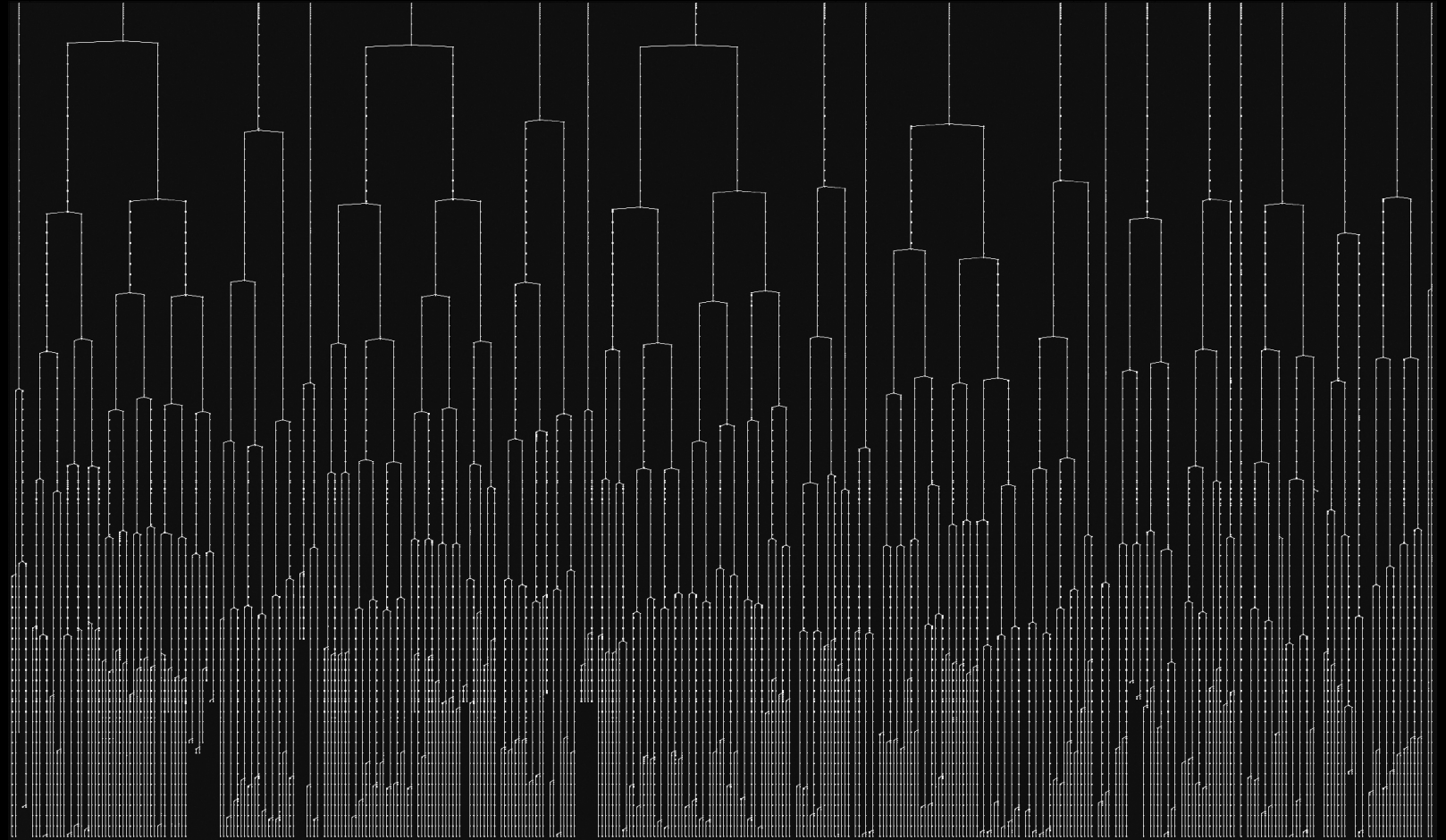
Nuclei



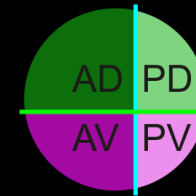
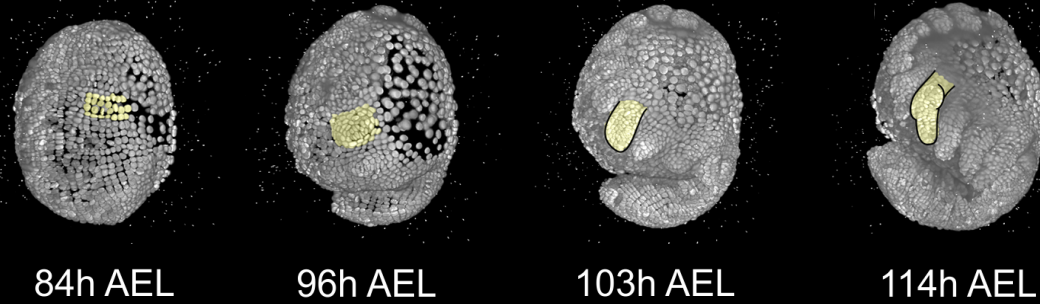
Cell lineaging of *Parhyale* limbs



0d 00h 00m



Cellular basis of limb outgrowth



Compartments and compartment boundaries

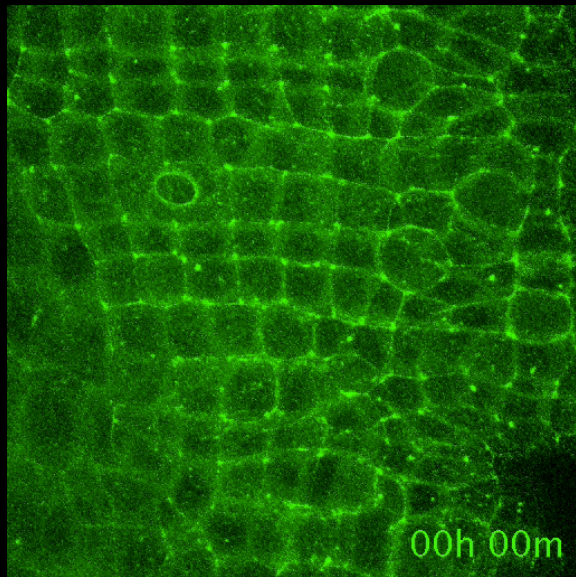


Cell cycle length (hours)

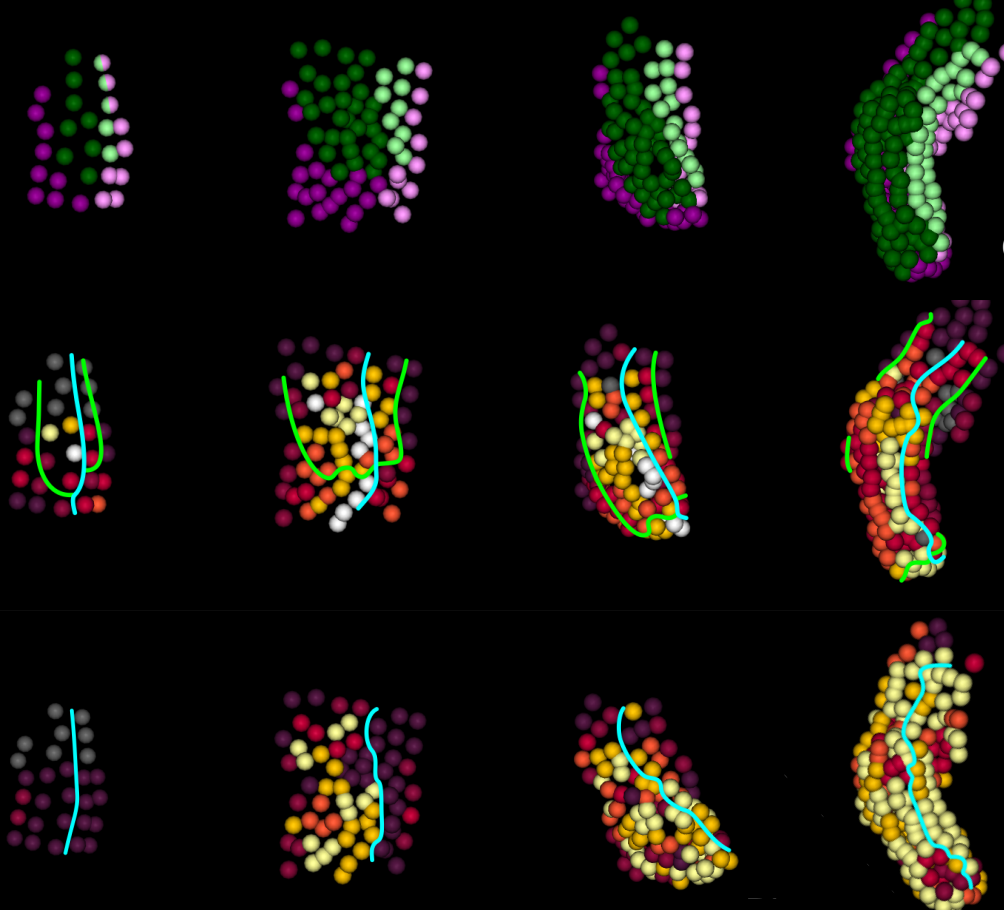


Division angle (°)

Wolff et al., 2018



Myosin II



Maria Kalogeridi
John Rallis
Marina Ioannou

Training of FORTH researchers at the interface of physics and biology

Biophotonics and Molecular Imaging
Laboratory - IESL

Developmental Morphogenesis
Laboratory - IMBB

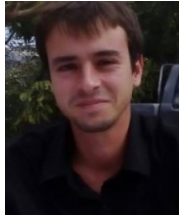
Dr. George Tserevelakis



Mr. Stylianos Psycharakis



Mr. Mikis Mylonakis



Ms. Maira Tampakaki



Mr. John Rallis



Ms. Maria Kalogeridi



Mr. Ioannis Liaskas



Mr. Themis Archontides

New seminar series on bioimage acquisition and analysis



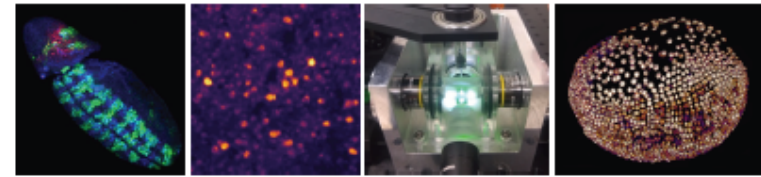
Anastasios Pavlopoulos
IMBB-FORTH



Giannis Zacharakis
IESL-FORTH



Yannis Dalezios
School of Medicine



BIOIMAGING THEMATIC CLUB



- 6 May** Going deeper than microscopy: modern tools in Bioimaging
Giannis Zacharakis
Laboratory for Biophotonics and Molecular Imaging, IESL-FORTH, Crete.
- 27 May** Illuminating Medicine and Biology with advanced photonic sensing
Vasilis Ntziachristos
Director of Institute of Biological and Medical Imaging at Helmholtz Zentrum & Chair of Biological Imaging at Technical University, Munich, Germany.
- 30 May** Imaging pioneer neurons and astroglia in interactions driving the emergence and maintenance of circuit architecture
Georgia Rapti
Nervous System Assembly Laboratory, European Molecular Biology Laboratory, Germany
- 3 June** Non-linear microscopy and applications
Sotiris Psilodimitrakopoulos
Ultrafast Laser Micro and Nano Processing Laboratory, IESL-FORTH, Crete.
- 17 June** Dissecting cortical computations with calcium microscopy
Emmanouil Froudarakis
Systems Neuroscience Laboratory, IMBB-FORTH, Crete.

Marina Ioannou, Valia Stamataki, John Rallis, Maria Kalogeridi,
Themis Archontidis, Ioannis Liaskas, Vassilis Flouris,
Evelina Papagrigoraki (Lab Members IMBB-FORTH)

Giannis Zacharakis (IESL-FORTH)

Philipp Keller (JRC)

Pavel Tomancak (MPI-CBG)

Tobias Pietzsch (MPI-CBG)

Jean-Yves Tinevez (Pasteur Institute)

Jan Funke (JRC)

Sebastian Streichan (UCSB)

Michalis Averof (IGFL Lyon)

Panagiotis Ioannidis (IMBB-FORTH)

Mat Lavigne (IMBB-FORTH)

Genomics and Proteomics Facilities (IMBB-FORTH)

