Sham Tlili, PhD, CNRS Research Investigator (CRCN)

Biophysics of embryonic organoids self-organization

Born on 16 July 1989, one child
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Position: I am a CNRS Research Investigator (CRCN) since October 2020 at the Developmental Biology Institute of Marseille working in the team "Physical approaches to cell dynamics and tissue morphogenesis". Together with Pierre-François Lenne, we coordinate the group activity on embryonic organoids (mainly gastruloids) morphogenesis.

Who Am I

The main focus of my current research is to understand the self-organization of embryonic organoids, and more broadly how collective cell behaviors, arising from coupled mechanical and signaling interactions, drive organ formation and remodeling. This interdisciplinary program bridges developmental and stem cell biology, biophysics, image processing, and statistical physics, and combines quantitative 3D live microscopy with mechanical perturbations, immunostaining and sequencing, advanced image analysis (deep learning, segmentation, tracking), and physical modeling that spans coarse-grained tissue descriptions (active/complex materials, reaction–diffusion patterning) and single-cell dynamics in 3D microenvironments.

This program spans five themes: (1) biophysical mechanisms of early, universal gastruloid self-organization and symmetry breaking; (2) late-stage gastruloid morphogenesis and multi-tissue coordination, including cardiac, vascular, endodermal, and extraembryonic mesodermal structures; (3) quantitative deep 3D live microscopy and image-analysis pipelines (deep learning, segmentation, tracking) to connect single-cell behaviors to tissue-scale dynamics; (4) physics-based inference of rheology and effective material properties of complex biological tissues; and (5) the role of extra-embryonic mechanics and biomimetic microenvironments, including emerging in vitro models of placenta morphogenesis using trophoblast organoids.

Past Research Experience

2019–2020	**Post-Doctoral Researcher, Turing Center for Living Systems, IBDM, LAI, Aix-Marseille University.** Biophysical mechanisms of embryonic organoids early symmetry breaking. *Project with P.F. Lenne and O. Theodoly.*
2015–2019	**Post-Doctoral Researcher, Mechanobiology Institute, NUS Singapore.** Quantifying and modeling organ and pattern formation during Zebrafish, Drosophila and Butterfly morphogenesis. *Project with T. Saunders.*
2011–2015	**PhD student, Laboratoire Matière et Systèmes Complexes, University Paris 7.** Biorheology *in vitro*: from cells to tissues: theory and experiments on the rheology of cell monolayers and cell aggregates. *PhD with F. Graner and H. Delanoe-Ayari.*
2011	**Master 2, Institut Curie, Paris.** Mechanical role of the Dachs protein: quantitative analysis in the Drosophila thorax during the pupal stage. *Project with I. Bonnet, F. Graner and Y. Bellaiche.*
2010	**Master 1, Columbia University, New York**. Neural networks connectivity inference using combining *in vitro* culture, fluorescent imaging and Bayesian inference. *Project with R. Yuste.*

Education

2015	**PhD in Biophysics**, Paris 7 University, France.
2011	**Soft matter and biological physics Master (ICFP)**, ENS Paris.
2009	**Bachelor's Degree in Physics**, Paris VI University, France.
2008–2012	**Elève at École Normale Supérieure Paris**, Physics Department, France.

Teaching, Mentoring, and Administration

PhD Supervision: I am currently co-supervising 3 PhD students

A.Gros	21-25	Quantitative characterization of cell division in gastruloids morphogenesis.	*with PF. Lenne and L. Guignard*
J.Vanaret	21-25	Advanced cell tracking methods for organoids dynamic characteristation at the single cell scale.	*with P. Roudot*
M.Lardy	23-26	Infering material rheological properties with Physics Informed Neural Networks.	*with S. Gsell*
J.Cao	24-27	Biophysical and signaling role of cell-cell adhesion in gastruloids morphogenesis.	*with PF. Lenne*
O.Clara	25-28	Biophysics of organogenesis in Cardiovascular–Endoderm gastruloids.	*with PF. Lenne*

Postdocoral Mentorship: I am currently supervising 2 postdoctoral researchers

D. El Arawi	23-25	Characterizing tissue rheology in gastruloids
S. Vaswandanha	24-27	Cardiac tissues morphogenesis in gastruloids
S. Landiech	26-28	Rheological properties changes during gastruloids early morphogenesis

Master students Supervision: I have until now supervised more than 20 interns at the master level.

Teaching activities: Teaching assistant in mechanics (IUT Paris 7, 2012-2015). Continuum mechanics classes to PhD student biophysicists (National University of Singapore, 2016-2018). Practical teaching in optics (Turing Center for Living Systems, 2022-2024). Scientific outreach activity (Apprentis Chercheurs, Déclics).

Institutional Responsibilities: Since 2021, member of the Steering and PhD education committees of the Turing Center (Aix-Marseille). Member of the laboratory council of IBDM since 2024.

Reviewing activities: Journals: *Nature Physics, Nature Cell Biology, Physical Review Letters, Royal Society Open Science, Plos Computational Biology, Soft Matter, Physical Review Letters.* Grants: Reviewer for the French National Research Agency. Examiner for six PhD thesis until now.

Research Fundings and Awards

2026	**MITI InfOkaeFATE:** With O.Theodoly 30k€
2026	**ANR PRC CRAC Tensor Flows:** With JF. Rupprecht and M. Saadaoui 160k€
2025	**Bronze Medal CNRS**
2022	**ANR JCJC Rhembo:** 350k€
2022	**MITI Rheodaco:** With Hélène Delanoë-Ayari 40k€
2022	**MecaCell3D:** With Pierre-François Lenne and Fabienne Lescroart 150k€

Recent Conferences and Talks

Conference Organization:

- **Sept 2023:** Co-organizer of *CellMech 2023*, Marseille. *CELLMECH* is a biennial European conference bringing together biologists, mathematicians, physicists, and engineers to discuss various aspects of cell mechanics.
- **Nov 2023:** Co-organizer of the first *Biophysics of Gastruloids Workshop*, Marseille.

Recent Talks:

- **Sept 2022:** Talk at the *Physics of Living Matter* conference, Marseille.
- **Oct 2022:** Talk on gastruloids symmetry breaking at the session *"From Gastruloids to Organoids"* at the *International Congress of Developmental Biology*, Portugal.
- **Nov 2023:** Invited talk on the biophysics of embryonic organoids and 3D imaging at *MiFoBio*, Giens. *MiFoBio* is a thematic school focused on biological imaging, renowned for its interdisciplinary approach and high-level training, attracting leading experts and researchers globally.
- **June 2024:** Invited talk on the biophysics of embryonic organoids at the *Summer School "Concepts and Methods in Mechanobiology"*, Paris.
- **Oct 2024:** Invited talk at the *60th Anniversary of the Groupe Français de Rhéologie* on the rheological properties of biological tissues, Marseille.
- **Nov 2024:** Talk at the *GDR Organoides* meeting, Paris.
- **June 2025:** Invited talk at the *PCC seminar* Institut Curie, Paris.
- **Sep 2025:** Invited talk at the *Coarse-Graining Tissue Mechanics 2025* Ljubljana.
- **Feb 2026:** Invited talk at the *Tec 21 Winter School on biomechanics* Laboratory LEGI, Grenoble.