

# Émilien Dilly

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Website

Post doc : Laboratoire interdisciplinaire de Physique, Université Grenoble Alpes

## EDUCATION

### Université Paris Cité

Paris, 2021–2024

PhD Student

Laboratoire Matière et Système Complexe

Thesis : Helices, Perversions and Tendrils: from Plant-Inspired Rod Mechanics to Curvature Generation in Tendril-Bearing Plants

### École Normale Supérieure

Paris, 2016–2021

Bachelor in Physics

Masters in Physics : International Center of Fundamental Physics Master; Soft Matter and Biophysics

## EXPERIENCE

### Institut Pierre-Gilles de Gennes

Paris, Jun–Aug 2018

*Intern*

- Modeling and experiments on water droplet breakup bathed in oil in microchannels under heat.
- Reference : Marie-Caroline Julien
- Keywords: *image analysis, capillarity, surface tension, fluid mechanics*

### University of North Carolina

Chapel Hill USA, Feb.–Jul. 2018

*Graduate Intern*

- Guided shear waves and solitons in nonlinear viscoelastic materials such as the spine
- Reference : Gianmarco Pinton
- Keywords: *nonlinear materials, viscoelasticity, spectral numerical methods, finite elements, solitons*

### Institut Curie

Paris, Feb.–Jul. 2018

*Graduate Intern*

- Modeling of a Hopf bifurcation in the inner ear of mammals rationalizing spontaneous oscillations of hair cells. Linear stability analysis of a nonlinear dynamical system.
- Reference : Thomas Risler
- Keywords: *biomechanics, hair cells, mechanotransduction, linear stability analysis, Mathematics*

### Université de Paris MSC

Paris, Sept. 2020 – Jan. 2021

*Graduate Intern*

- Electric stimulation of chick embryos' guts, and its effect on development.
- Reference : Nicolas Chevalier
- Keywords: *morphogenesis, smooth muscle, electrophysiology*

## Université de Paris MSC

Paris, Sept. 2020 – Jan. 2021

PhD Student

- Helices, Perversions and Tendrils: from Plant-Inspired Rod Mechanics to Curvature Generation in Tendril-Bearing Plants
- Reference : Drazen Zanchi and Julien Derr
- Keywords: *rod mechanics, helical rods, perversions, plant morphogenesis, tendrils, Python, Abaqus, shooting methods, nonlinear physics, bifurcation analysis, kink-antikink structures and interaction*

## École Normale Supérieure de Lyon / Laboratoire Reproduction et Développement des Plantes

Lyon, Oct. 2024 – Dec. 2024

Postdoctoral Researcher

- Perversion stability in helical rods and critical phenomena in helical rods. Tendril curvature generation mechanics and dynamics.
- Reference : Julien Derr and Drazen Zanchi
- Keywords: *rod mechanics, helical rods, perversions, plant morphogenesis, tendrils, Python, Abaqus, shooting methods, nonlinear physics, bifurcation analysis, kink-antikink structures and interaction*

## Université Grenoble Alpes / LIPHY

Grenoble, Jan. 2025 – Today

Postdoctoral Researcher

- Instability and nonlinear mechanical behavior of beams with T-shaped sections.
- Mechanical instabilities of ribbons with geodesic curvature.
- Fluid-structure interaction in inflatable structures.
- Reference : Emmanuel Siéfert
- Keywords: *mechanics, instability, nonlinear, boundary layer, nonlinear analysis, ribbon*

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## PUBLICATIONS AND SCIENTIFIC PRODUCTION

- **Dilly, É.**, Neukirch, S., Derr, J., & Zanchi, D. (2024). Critical phenomena in helical rods with perversion. DOI : hal-04838602
- Github Package for perversion shape computation in helical rods. PyPerv
- **Dilly, É.**, Neukirch, S., Derr, J., & Zanchi, D. (2023). Traveling perversion as constant torque actuator. *Physical Review Letters*, 131(17), 177201. Editor Suggestion, DOI : 10.1103
- Gianoli, F., Hogan, B., **Dilly, É.**, Risler, T., & Kozlov, A. S. (2022). Fast adaptation of cooperative channels engenders Hopf bifurcations in auditory hair cells. *Biophysical Journal*, 121(6), 897-909. DOI : 10.1016

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## CONTRIBUTIONS

- APS March Meeting 2018: Kerdraon, M., **Dilly, E.**, Descroix, S., and Jullien, M.-C., *Droplet breakup with in situ Marangoni-induced elongational flow*, vol. 2018, 2018.
- GdR PhyP 2021, Carry le Rouet: **Dilly, E.**, J. Derr, S. Neukirch, D. Zanchi, *Biomechanics of Tendrils*.
- International Plant Biomechanics Day 2021: *Biomechanics of Tendrils*.

- Lab Seminar 2021 ENS Lyon: *Biomechanics of Tendrils*.
- Ein Gedi Workshop 2023 / Israel: **Dilly, E.**, T. Lacombe, T. Simonneau, S. Neukirch, L. Doualla, J. Derr, D. Zanchi, *Biomechanics of Tendrils: Force and Curvature Generation in Climbing Plants*.
- Lab Seminar MSC 2023: *Tendril writhing: a biomechanical description*.
- Nonlinear Physics Meeting 2023 (RNL) Paris: **Dilly, E.**, J. Derr, S. Neukirch, D. Zanchi, *Perversions in helices: phase transition and soliton crystallization*. Poster.
- GdR PhyP 2024, Carry le Rouet: **Dilly, E.**, J. Derr, S. Neukirch, D. Zanchi, *Biomechanics of Tendrils*.
- 27th Nonlinear Physics Meeting (RNL) 2024 Paris : March 18-20, 2024, Université Paris Cité, *Writhing instability and curvature generation in tendril-bearing plants*.
- Experimental Physics and Modelling Seminar, ENS Lyon : 12th November 2024 *Perversions in Helical Rods: From Plant-Inspired Rod Mechanics to Curvature Generation in Tendrils*.
- ELAN Seminar, INRIA Grenoble 2024: 14th November 2024 *Perversions in Helical Rods: From Plant-Inspired Rod Mechanics to Curvature Generation in Tendrils*.
- LIPHY Lab Seminar, Université Grenoble Alpes, : 18th November 2024 *Perversions in Helical Rods: From Plant-Inspired Rod Mechanics to Curvature Generation in Tendrils*.

## RESEARCH GRANTS AND SCHOLARSHIPS

- 2025 : Saint-Gobain PhD Thesis Prize laureate.
- 2021 : EDPIF, Doctoral School (Paris) PhD 3-year full scholarship.
- 2016 : École Normale Supérieure (Paris) 4-year full scholarship

## RESEARCH TRAINING

- 2024 : 10th CISM-AIMETA Advanced School; Mechanics of Active and Biological Structures: from Fundamentals to Recent Results; Professors Antonio De Simone and Pedro Miguel Reis
- Université Paris Cité : Science ouverte: webinaire introductif
- Université Paris Cité : Science ouverte. Gérer ses données de la recherche : quel intérêt pour un jeune chercheur ?
- Comprendre l'écosystème de la recherche en France - Organisation de la recherche à Université Paris Cité
- Impacts environnementaux du numérique (INRIA)
- Intelligence artificielle pour et par les enseignants (INRIA)
- Machine learning in Python with scikit-learn (INRIA)
- Intégrité scientifique dans les métiers de la recherche, Université de Bordeaux

## PROGRAMMING SKILLS

**Programming Languages**  
**Python Packages**  
**Software & Tools**

Python, Bash, MATLAB, Mathematica  
 Pandas, Matplotlib, Numpy, Scipy, OpenCV, Jupyter  
 HTML, LaTeX, Excel, Mathematica, Abaqus

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## TEACHING EXPERIENCE

- Undergraduate, second year, Thermodynamics Tutorial
- Graduate, Nonlinear Physics Tutorial
- Undergraduate, third year, Laboratory Teaching in Fluid Mechanics