

ESR1 - Multiscale modeling of flagellar beating, from waveforms to swimming

Supervisor: Gerhard Gompper / +49 (0) 2461 61 4012/ g.gompper@fz-juelich.de

Institute: Theoretical Physics of Living Matter, Institute for Biological Information Processing, Forschungszentrum Jülich

Address: Leo-Brand-Strasse, 52428 Jülich

https://www.fz-juelich.de/ibi/ibi-5/EN/Home/home_node.html

PHYMOT website: <https://etn-phymot.eu>

Microbial motility is governed by biological micromotors, the cellular structures that generate propulsion, from rotating passive flagellar filaments in bacteria to active beating of eukaryotic cilia and flagella. Cilia and flagella consist of a filamentous structure composed of microtubules in a ring-like arrangement, with dynein molecular motors sliding them relative to each other. This leads to bending and beating of the filament, and propulsion in a viscous hydrodynamic medium. Our aim is to understand the origin of motor coordination in the self-organization of the beat pattern, in particular the contribution of filament flexibility, motor stall force, motor velocity, generated torques, and hydrodynamic drag. Based on this single cilium model, we will investigate the swimming response of flagellated microswimmers, e.g., algae, trypanosomes, and cilia synchronization, to external perturbations—like imposed flow, neighboring microswimmers, or confinement.

In this project the Early Stage Researcher (ESR) will establish a theoretical model for the autonomous beating of cilia and eukaryotic flagella. The simulation results for the beat pattern of single cilia will be tested with experimental observations to determine parameters for the description of a realistic beat. The ESR will study the emergent metachronal waves and (collective) swimming behavior of multi-ciliated microswimmers and compare with experimental results.

Salary: The PhD salary is based on the [regulations of appointment and remuneration](#) for Marie Skłodowska Curie Fellows in ITN networks. The successful candidate will also benefit from additional funding for several visiting trips (typically 1 month each) in the partner teams.

Requested profile: We welcome highly-motivated applicants holding a MSc and with excellent background in theoretical physics, biophysics, and/or soft matter physics.

Further obligations: The ESR is expected to travel to network partners for secondments and a mini-project for durations up to 2-3 months. In addition, the ESR participates in outreach activities (social media, participation in public events), as well as dissemination to popular press.

Funding conditions: Candidates must not have resided or carried out their activities - work, studies, etc. - in Germany for more than 12 months in the 3 years immediately before starting the PhD.

Hiring procedure: Applications (CV, transcript of studies, statement of motivation and at least one letter of recommendation) should be sent by email to Gerhard Gompper (g.gompper@fz-juelich.de). The recruitment is taking place following the [European Code of Conduct for Recruitment of Researchers](#), which all candidates are encouraged to study.

Selection process: PHYMOT is open to researchers regardless of gender, religion, ethnicity, disability, sexual orientation, political views, language, age and nationality. Applications from highly qualified applicants from outside the EU will thus be equally considered to other applicants. The integration of refugees is an EU priority and we will ensure equal opportunities to the researchers whose scientific careers have been interrupted. To ensure a gender balance in the project and work towards the Commission's own policies on narrowing the gap between the genders in research, should two applicants be found to be equally qualified the preference will be given to the one that will balance the gender distribution in the entire Network. All submitted applications will be checked against the defined admissibility and eligibility criteria (e.g. submitted electronically, readable, complete, in English, including grades and references), and applicants will be informed by email within two work weeks on the outcome. Evaluation criteria include: Scientific background (with particular focus on theoretical physics), previous publications, capacity for creativity and independent thinking and leadership, mentoring and presentation abilities.

Protection of personal data: The personal data of the applicants will be handled in compliance with applicable EU and national law on data protection (GDPR).

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