

# Open Postdoc or IR position: Digital Holography to uncover the Physics of Bacterial Biofilm Formation

Supervisor: Ashley L Nord

ashley.nord@cbs.cnrs.fr

Centre de Biologie Structurale (CBS), CNRS, Montpellier

## General Information

Location: Montpellier, France

Date of publication :

Type of contract: non-permanent

Workload: Full time

Degree required: PhD or equivalent

Desired experience: 0 - 4 years

## The position

We are looking for strong and motivated candidate to fill one postdoc position or one IR position (both 1 year renewable, multi-year funding) in the group 'Physics and mechanics of biological systems' at CBS Montpellier, France. Our project probes the physics of bacterial motility and biofilm formation from an experimental biophysics perspective.

## Activities

- digital inline holography and computational reconstruction of holograms
- light sheet microscopy, TIRF microscopy, fluorescent microscopy
- microscope design and construction
- machine learning, artificial intelligence
- image analysis, time series analysis
- single-molecule biophysics
- programming
- wetlab activities and cell/molecular biology (bacteria)

## Expertise sought

We seek an outstanding candidate who has (or will soon have) a PhD and who:

- has a strong background in physics, optics, biophysics, or a related discipline;
- has experience or is intimately familiar with digital holography and numerical reconstruction of holograms;
- has experience or is intimately familiar with light sheet microscopy or TIRF microscopy;
- has experience in advanced microscope design and construction;
- has experience or extensive knowledge in machine learning;
- has experience with image analysis, time series analysis, and quantitative data analysis;
- has experience with programming (our lab works primarily in Python);
- either has experience in a wet lab, or is eager to learn to work with bacteria;
- is innovative and enjoys troubleshooting and pushing the limits of custom optical microscopy setups;
- enjoys working in an interdisciplinary environment;
- is creative, enthusiastic, highly motivated, and able to work both independently and as a member of a team.

High level English communication skills are an asset; no knowledge of French is required. We strive for gender and diversity equality, and we welcome applications from all backgrounds.

## Context of the work

Most our knowledge of bacteria comes from studies of independent swimming cells. Yet, most bacteria on earth are found in non-motile aggregated communities, called biofilms, which bear little resemblance to their motile counterparts. Biofilms are acutely resistant to antibiotics, extremely difficult to eradicate, and are implicated in important global challenges, from deadly infections and antimicrobial resistance to food safety and water security.

Under the current paradigm, biofilms begin when a motile cell adheres and senses a surface, triggering a change in 'lifestyle'. But, this crucial nucleation step remains poorly understood: what mechanochemical signal underlies surface sensing? Moreover, many natural biofilms, including many that cause chronic infections, exist in absence of a substrate, suggesting that biofilms can nucleate via multiple mechanisms. Can nucleation be understood, not as a biochemical switch of an individual, but as an emergent behavior of active colloids?

By developing a unique setup which combines digital holographic microscopy and light sheet microscopy, this project seeks to capture and resolve rare nucleation events, and the resulting physiological response, thereby uncovering the physical mechanisms of biofilm initiation in various microenvironments.

This is a new project and new line of research led by a young PI, Ashley Nord, funded by the Foundation Bettencourt Shueller Impulscience award (for 5 years). Ashley is a part of the 'Physics and Mechanics of Biological Systems' team, comprised of three permanent CNRS researchers, all with a background in physics and biophysics. The team is highly interactive and dynamic, and the candidate will have the opportunity to collaborate on other ongoing projects within the team, depending on their interests. The Center for Structural Biology (CBS) is an interdisciplinary and international research institute located in Montpellier, France. It is comprised of 13 research teams with a mix of biophysics, bioengineering, and structural biology. Their expertise spans a vast range, including cutting-edge optical microscopy techniques, optical and magnetic tweezers, atomic force microscopy, NMR, X-ray crystallography, bioinformatics, bioengineering, and biomolecular modelling. It is home to many PhD students and postdocs of diverse backgrounds and nationalities.

Applications will be reviewed on a rolling basis until the position is filled. There is no deadline.