

Master's projects in:

# Single-molecule tracking of protein synthesis in live *E. coli* cells

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Ribosome catalyzed protein synthesis is one of the most fundamental processes in all life forms. From decades of research, the combination of traditional biochemistry; structural approaches including NMR, cryo-EM, x-ray crystallography; and more recently single-molecule fluorescence based *in vitro* techniques probing structure and dynamics at the same time, have led to a very detailed picture of the molecular mechanisms of ribosome catalyzed protein synthesis. However, we have very sparse information about the dynamics of protein synthesis, in particular inside living cells, one major problem being the vast number of ribosomes in the cell pursuing different tasks at any given moment. The sheer complexity of the translational system (do we know all the players yet?), and its interplay with other processes, make it very hard to connect the molecular details of protein synthesis with cell physiology and population biology. Our research aims at connecting all these dots, in space and time, to get a coherent picture of one of the most fundamental processes of life. This is done by studying key components of the protein machinery, one by one, performing their daily work inside the living cell (see e.g. Volkov et al., 2018, NatChemBiol).

The present projects consist of setting up new experimental systems to follow the dynamics of bacterial protein synthesis inside living *E. coli* cells using *in vitro* fluorescently labeled RNAs/proteins. In practice, this would require:

Purification and fluorescence labeling of translation components

In vitro single-molecule fluorescence microscopy using TIRF techniques

In vivo single-molecule tracking

... and could potentially answer fundamental questions such as:

Where and when are specific mRNAs translated inside the living cell?

How fast is translation in vivo, and how much does it vary between different mRNAs?

What is the timing of events during signaling and export of secretory and/or membrane proteins?

Interested candidates are kindly asked to send their CV to:

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