Master's projects in:

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

Ribosome catalyzed protein synthesis is one of the most fundamental processes in all life forms. From decades of research, the combination of traditional biochemistry and structural approaches have led to a very detailed picture of the molecular mechanisms of ribosome catalyzed protein synthesis. However, we have limited understanding of protein synthesis in its natural context, the living cell. 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. This is currently a severe bottleneck for the use of bacteria in large-scale recombinant protein production, but also for the development of new antibacterial drugs. 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 synthesis machinery, one by one, performing their daily work inside the living cell (see e.g. Volkov et al., 2018, *Nat Chem Biol*, https://doi.org/10.1038/s41589-018-0063-y).

The present projects consist of setting up new experimental systems to follow the dynamics of bacterial protein synthesis inside living *E. coli* cells using super-resolved single-molecule tracking approaches. In practice, this would require:

Fluorescence labeling of translation components

In vivo single-molecule tracking

Image analysis

Interpreting diffusional behavior of the molecule and building theoretical reaction-diffusion models

... 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 or different cells?

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

The projects thus require adequate training in *both* wet lab and theoretical work (i.e. skills in mathematics and programming). Interested candidates are kindly asked to send their CV to:

Magnus Johansson (m.johansson@icm.uu.se)
Department of Cell & Molecular Biology
https://www.icm.uu.se/molecular-systems-biology/johansson-lab/