

Title: Dynamics of RNA-degrading complexes in bacteria (NCN/SONATA BIS)

Promotor: Dr Ewelina Małecka

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Laboratory: Laboratory of Prokaryotic Gene Regulation

www: <https://shorturl.at/IUluS>

Project description:

How do bacterial cells coordinate the recognition and degradation of mRNA in real time? This project tackles that question using single-molecule total internal reflection fluorescence microscopy (smTIRF) a technique that allows direct observation of individual molecular machines in action.

Hundreds of bacterial mRNAs are subject to post-transcriptional regulation by small RNAs (sRNAs), with the assistance of the RNA chaperone protein Hfq. Upon pairing of an sRNA with its target mRNA, both molecules are typically degraded by the degradosome—an enzymatic complex organized around ribonuclease E (RNase E). RNase E interacts with both sRNA and Hfq, raising several key questions: is the full RNase E–sRNA–Hfq complex more efficient than the simpler sRNA–Hfq assembly? Does the helicase RhlB, a component of the degradosome, facilitate the unwinding of mRNA structures? And does the order in which these components assemble influence the outcome?

Aim:

The project aims to investigate how the complexes responsible for mRNA targeting and degradation assemble and cooperate. Using TIRF microscopy combined with biochemical reconstitution, you will simultaneously observe sRNA–mRNA annealing, Hfq binding, and degradosome recruitment in real time. The results will reveal the assembly logic of one of the most important regulatory machineries in bacterial gene expression.

Requirements:

- Master's degree in biology, biochemistry, or related fields.
- Solid knowledge of fundamental molecular biology and biochemistry.
- Hands-on laboratory experience and familiarity with basic molecular biology techniques.
- Proficiency in spoken and written English.
- Strong interpersonal skills, initiative, and good organizational abilities.
- Willingness to learn and take on new challenges, ability to work independently, and analytical thinking skills.
- Additional asset: experience in recombinant protein purification and/or microscopy.

Number of positions available: 1

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