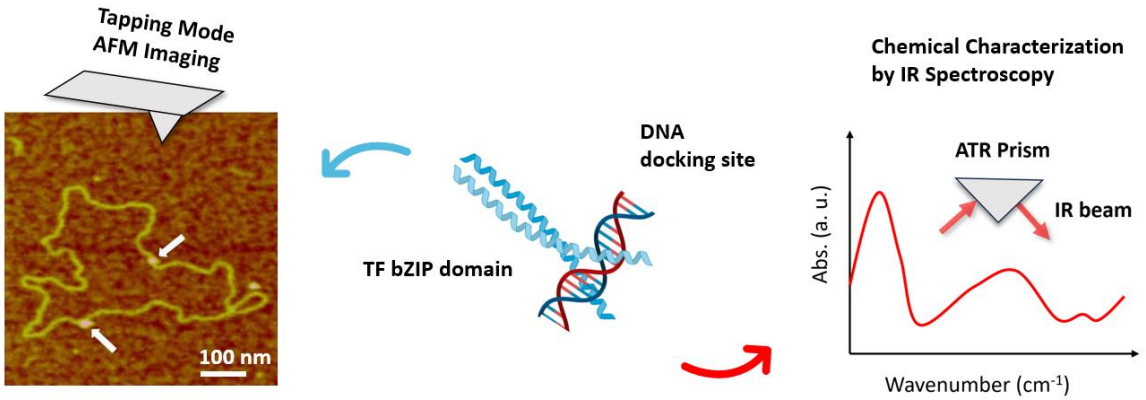
Group: Laboratory of Organic Chemistry/Nanoscale Microscopy and Spectroscopy Group

Project: ***Spectroscopic and Microscopic Analysis of DNA-Protein Interactions***

Supervisors: Giacomo Nisini, Francesco Simone Ruggeri

Introduction: Protein-DNA interactions control a variety of fundamental cellular processes, including transcriptional regulation, chromosome maintenance, replication and DNA repair. One of the most important families of DNA-binding proteins is the one of Transcription Factors (TFs), whose function is to promote or inhibit the DNA transcription in order to guarantee genetic expression and differentiation. In addition, DNA-TF interactions is considered extremely critical in development processes, in response to environmental stresses, and in the progression of various diseases. Despite our increasing knowledge on the DNA recognition and binding by TFs, we are still far from a thorough understanding of the underlying working mechanism. In fact, DNA-TF interactions are governed by a complex set of variables, such as DNA sequence, TFs and DNA local conformation, TFs and DNA flexibility, presence of cofactors, DNA methylation, epigenetic modifications etc. Our goal is to apply cutting-edge spectroscopy and microscopy techniques to unvavel the intrinsic complexity of the DNA-TF interaction.

Keywords: *Transcription Factors, DNA, DNA-protein interactions, Atomic Force Microscopy, IR spectroscopy*



Aim

- Cross-correlate information from advanced spectroscopic and microscopic techniques to further improve our understanding of DNA-TF interactions.

Objectives

- Optimize DNA-TF binding conditions and evaluate the results with standard biological assays.
- Perform chemical and morphological characterization of the analyte to infer the DNA-protein interaction mechanism.

What you will learn

- How to assess DNA-protein binding through Electrophoretic Mobility Shift Assay and Chromatin Immunoprecipitation.
- How to use a Fourier-Transform spectrometer and perform accurate analysis of spectral changes upon binding.
- How to use an Atomic Force Microscope and advanced computational tools to perform morphological analysis.

Contact Giacomo Nisini (*giacomo.nisini@wur.nl*) or Simone Ruggeri (*simone.ruggeri@wur.nl*) for more details.