

**2019-2020 TFM projects at the Moreno-Herrero Group
National Center of Biotechnology (CNB-CSIC). UAM campus, Madrid**

Single molecule approaches to study telomere replication and maintenance

Telomeres are DNA structures that act as protectors of the end of chromosomes. They get shorter in each replication cycle and this progressive shortening constitutes a barrier against cancer. Telomerase is an enzyme specialized in replication and maintenance of telomeres and its over-expression constitutes a hallmark for tumor progression. We aim to understand the molecular mechanism and dynamics of telomere C-strand replication. We will setup single molecule assays based on magnetic tweezers, AFM and fluorescence techniques to reconstitute *in vitro* the telomere c-strand synthesis reaction with the aim to understand how proteins such as CST and/or telomerase work at the single molecule level. The Moreno-Herrero lab is a highly multidisciplinary group that combines state of the art experimental and theoretical biophysical methods to study the repair and organization of the DNA. This project is funded by a Comunidad de Madrid Project, and there is a possibility to support the student along the project and beyond.

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Magnetic Tweezers approaches to study DNA repair by DNA-end joining

A major pathway of DNA repair is the Non-Homologous End Joining (NHEJ). This repair mechanism involves a bunch of enzymes, whose defects have been associated to inherited diseases and cancer predisposition. We aim to setup an assay to study DNA-end joining using magnetic tweezers. To do this, we have fabricated a DNA molecule with two DNA ends connected with a linker, so these ends can be placed in close proximity without losing the magnetic bead. We have already tested this kind of substrates, but have not included the purified proteins in the NHEJ reaction, yet. This approach will shed light on the NHEJ repair pathway but it will also open the possibility to study any protein with high affinity to DNA ends. The candidate will be in contact with multiple techniques such as molecular biology methods, structural characterization techniques, and Magnetic Tweezers. The Moreno-Herrero lab is a highly multidisciplinary group that combines state of the art experimental and theoretical biophysical methods to study the repair and organization of the DNA. This project is funded by a Comunidad de Madrid Project, and there is a possibility to support the student along the project and beyond.

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