



Comunidad
de Madrid

Dirección General
de Investigación
e Innovación Tecnológica

CONSEJERÍA DE EDUCACIÓN,
CIENCIA Y UNIVERSIDADES

UNIÓN EUROPEA
Fondos Estructurales
Invertimos en su futuro



PROGRAMAS DE I+D EN TECNOLOGÍAS 2018

ACRONIMO: Tec4Bio **REF:** S2018/NMT-4443

TITULO PROGRAMA: Nuevas Tecnologías Aplicadas al Estudio de
Nanomáquinas Biológicas

PRESUPUESTO CONCEDIDO: 809.600€



<https://tec4bio.es/>

Madrid, 17 y 18 de abril de 2024



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¿Quiénes participamos?

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Fernando **MORENO-HERRERO**. Centro nacional de Biotecnología, CSIC (COORD)
Molecular Biophysics. DNA-protein interactions.



Ricardo **GARCÍA**. Instituto de Ciencias de Materiales de Madrid, CSIC
Atomic Force Microscopy. Cellular mechano-biology.



Gustavo **PLAZA**. Universidad Politécnica de Madrid
Engineering methods in micro-rheology.



UNIVERSIDAD
POLITÉCNICA
DE MADRID



Miguel Angel **DEL POZO**. Spanish National Center for Cardiovascular Research. CNIC
Mechano-transduction and mechano-adaptation at the cellular level.



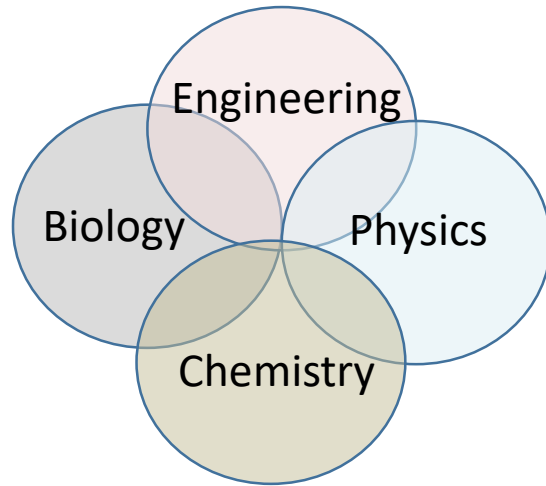
Oscar **LLORCA**. Spanish National Center for Cancer Research. CNIO
Structural biology. Cryo-EM methods.



Jorge **ALEGRE-CEBOLLADA**. Spanish National Center for Cardiovascular Research. CNIC
Molecular mechano-biology of proteins.



Tec4Bio consolidates a team of *engineers, physicists, and biologists* to develop and apply **new biophysical technologies** to answer key questions in **cardiovascular disease** and **organization and repair of DNA**



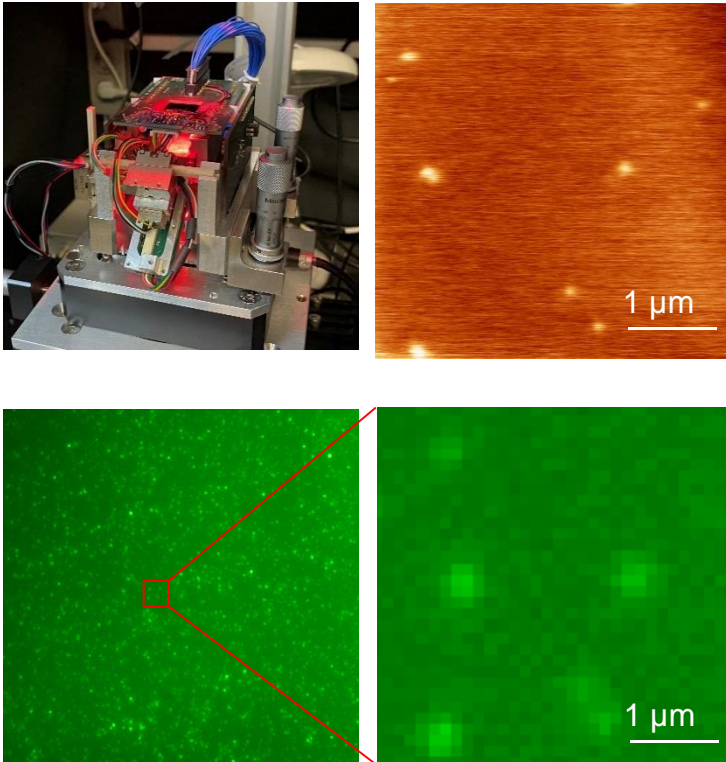
How physical forces and mechanical properties of cells and macromolecular complexes contribute to cell development, physiology and disease

A. **Development** of instruments and new methodologies in molecular and cellular mechanobiology

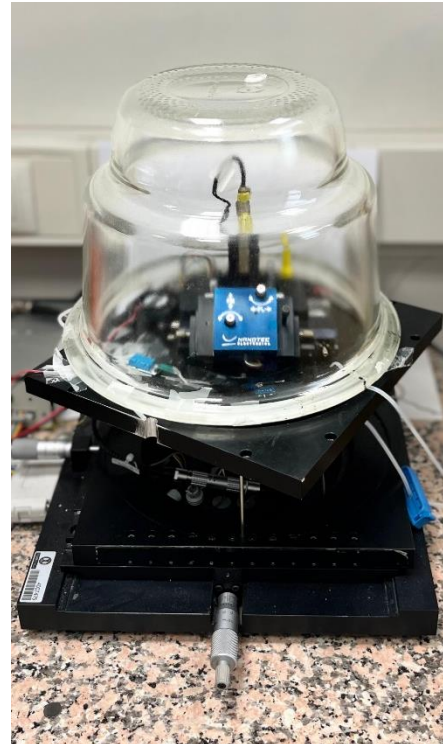
B. **Application** of new technologies to the study of biological nanomachines at the multiscale level

A. **Development** of instruments and new methodologies in molecular and cellular mechanobiology

A combined AFM-TIRF setup

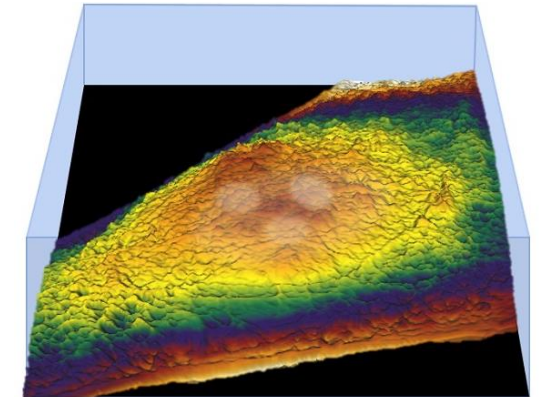


A micro-incubator for cell mechanical studies

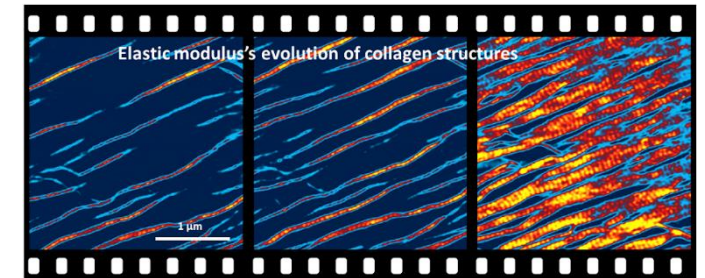


High-resolution AFM force spectroscopy

Cells



Collagen structures



...and other SM methodologies.

González-Bermudez et al *Inmunology* 2022

Gisbert et al *ACS Nano* 2021

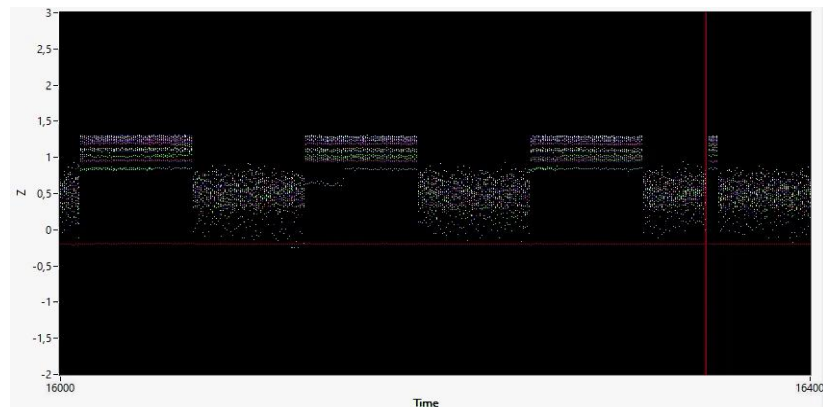
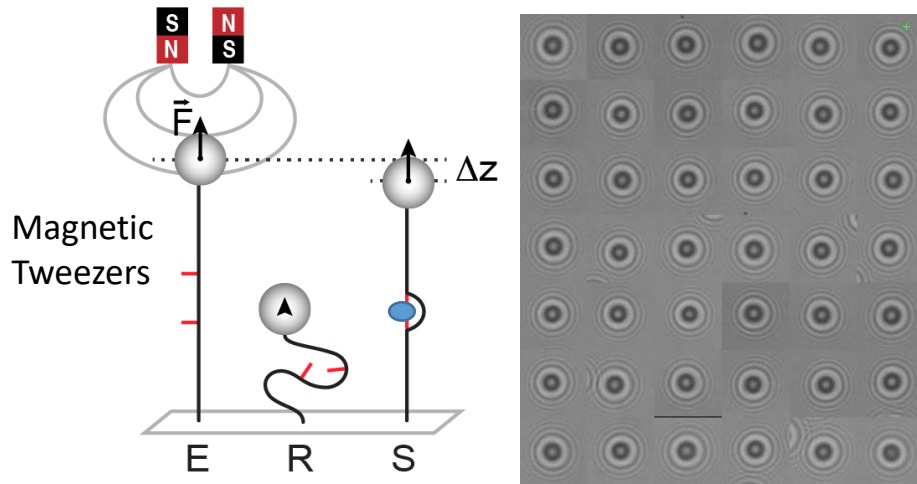
Gisbert et al *Small* 2023 ★ ★ ★ ★ ★ ★

Labs involved: Moreno-Herrero, Plaza, García, Alegre-Cebollada

B. **Application** of new technologies to the study of biological nanomachines at the multiscale level

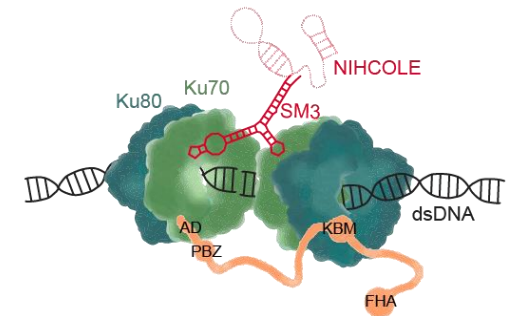
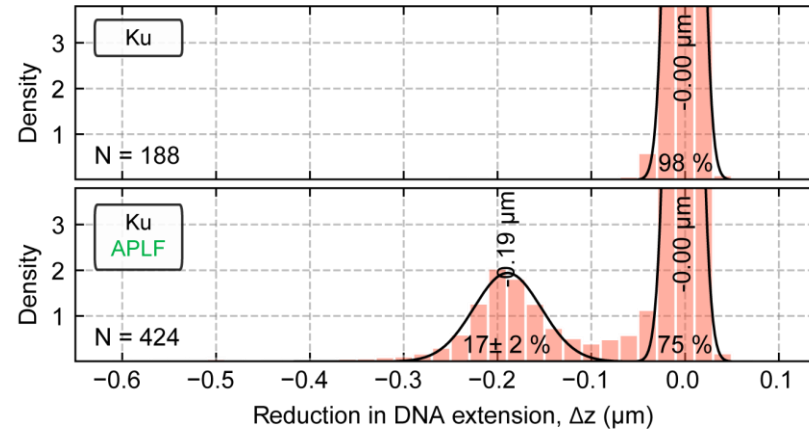
Biophysical studies of NHEJ complexes

Mimicking a DSB to study the DNA repair pathways



APLF, Ku and NIHCOLE in NHEJ

- In NHEJ, the Ku-APLF complex supports DNA end synopsis for several minutes under piconewton forces
- lncRNA NIHCOLE fortifies the DNA synopsis



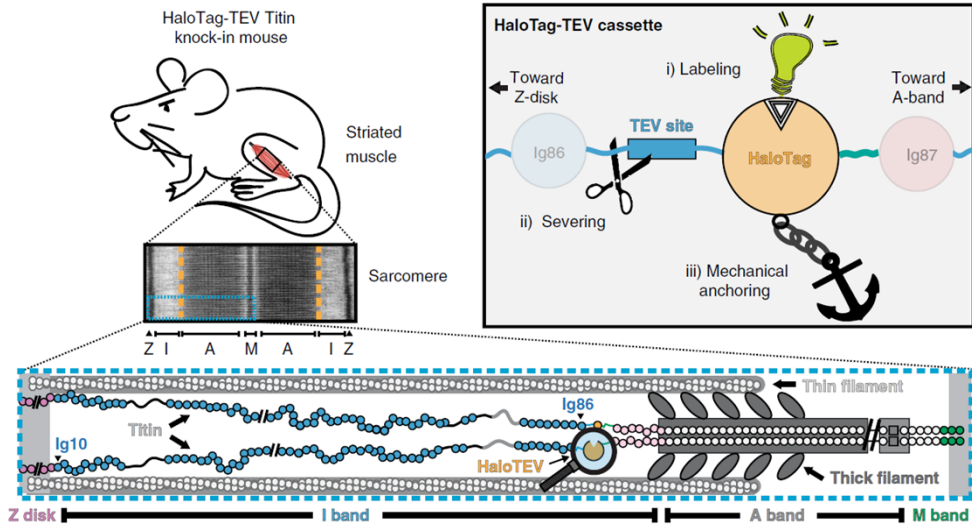
Unfried et al. *Cancer Research* 2021 De Bragança et al *Cell reports* 2023
 Coloma et al *Nucleic Acids. Res.* 2023

Labs involved: Moreno-Herrero and Llorca

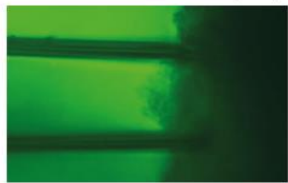


B. **Application** of new technologies to the study of biological nanomachines at the multiscale level

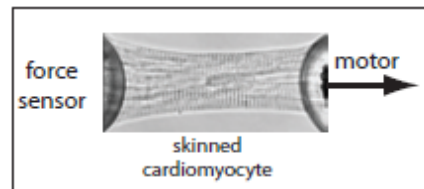
Mechanical studies of cells and proteins



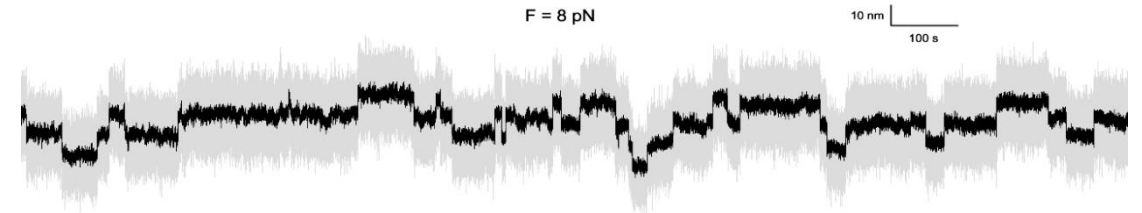
Micropipette cell aspiration:



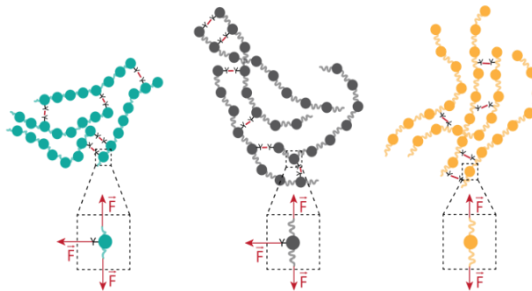
AURORA Cell stretcher:



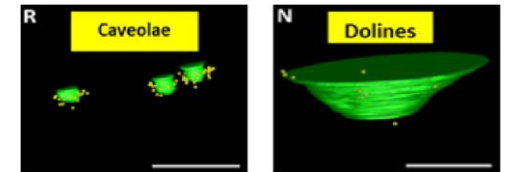
Magnetic Tweezers:



Protein hydrogels:



Modelado 3D de estructuras caveolares:



Rivas-Pardo et al. *Nature Comm* 2020

Huerta-López et al. *Sci. Adv.* (under review)

Sen-Martin et al. *bioRxiv* 2024

Garcia-Garcia et al *Nature Comm.* 2022

Lolo et al *Nature Cell Biol* 2023



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¿Qué resultados hemos obtenido?

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Tec4Bio in numbers

- More than **63 publications** from the 6 groups involved in the consortium.
- >94% of them in open Access.

Famelis et al **Nature** 2019 Wilkinson et al **Nucleic Acids Res.** 2020 Zimmermann et al **Science Adv.** 2020 Perez-Rigueiro et al **Molecules** 2021
Suay-Corredera et al **ACS Nano** 2021 Garcia-Garcia et al **Nature Comm.** 2022 Rivas-Pardo et al **Nature Comm.** 2022 Hormeño et al **PNAS** 2022
Unfried et al. **Cancer Research** 2021 Lolo et al **Nature Cell Biol** 2023 De Bragança et al **Cell reports** 2023 Coloma et al **Nucleic Acids. Res.** 2023

- More than **360 presentations in conferences, meetings and invited talks.**
- **17 Master Thesis** and **26 PhD Thesis.**
- Numerous awards and recognitions to the PIs.
 - **J. Alegre-Cebollada.** Michele Auger Award. ERC-CoG Awardee. Academia Joven member.
 - **F. Moreno-Herrero.** Bruker Prize. CEDACT member. Promoted to CSIC Professor. ERC-SyG finalist.
 - **M.A. del Pozo.** EMBO member. Member of Faculty Opinions, SAB Member F. GADEA-Ciencia
 - **R. Garcia.** CAM Miguel Catalán Prize to the scientific career.
 - **O. Llorca.** Panel member ERC, ICREA, Boehringer, AECC, RyC program. ERC-SyG finalist.
 - **G. Plaza.** Vocal ANECA. Subdirector Alumnos y Extensión Univ.





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Tec4Bio in numbers

- **Human resources**

- 45 undergrads and master students.
- 14 predoctoral researchers.
- 7 postdoctoral researchers.
- 1 visiting profesor.
- 6 technicians.
- SAB (Scientific Advisory Board) made of 3 recognized professors.
- 18 internships from lab members (adding up to 30 months).
- 23 activities in postgraduate courses and degrees.
- 36 seminars and/or conferences organized by Tec4Bio members.

- **Funding**

- Up to **10M€** secured by Tec4Bio Principal Investigators.
 - **ERC CoG 2020.** J. Alegre-Cebollada
 - **La Caixa Health Research.** O. Llorca, F. Moreno-Herrero, M.A. del Pozo.
 - **CAM. Sinergicos 2018.** O. Llorca & F. Moreno-Herrero.
 - **MICINN-AEI.** All PIs have secured grants from the National Research System.



European Research Council
Established by the European Commission



”laCaixa” Foundation



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This was a new consortium in 2019

Now – consolidated and aiming for a **new proposal** in 2024!

- ➔ Novel methodologies
- ➔ To tackle key problems in DNA repair, Cardiovascular diseases and mechanobiology
- ➔ New member. Prof. Cristina Flors (IMDEA Nanociencia). Superresolution Microscopy



Tec4Bio Meeting May 2022

