# Master 2 project 2022-2023

**Laboratory :** **Dpt « Physics and Engineering for Living Systems »**
Centre Interdisciplinaire de Nanoscience de Marseille (CINaM), Campus de Luminy, Marseille
**Lab website :** http://www.cinam.univ-mrs.fr/cinam/team/physique-et-nano-micro-ingenierie-pour-le-vivant/

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## Physics of red blood cell enucleation

**Keywords:** red blood cell mechanics, erythropoiesis, microfluidics, videomicroscopy, image analysis

Context. Erythropoiesis is the process of generating red blood cells. In mammals, red blood cells do not contain nuclei. **The project aims to describe the physical mechanisms at play in enucleation during mammalian erythropoiesis.** The objective is to elucidate the role of the mechanical constraints in the bone marrow on the extrusion and detachment of the nucleus from the red blood cell precursor. This role is currently poorly understood, which holds back progress in fundamental studies of erythropoiesis. The RedEnuc project will be the first to connect the internal and external forces that drive erythroid enucleation, and to incorporate mechanosensing of the cell.
This interdisciplinary project gathers a biophysicist in microfluidics (CINaM, Marseille), a biologist in erythropoiesis (Northwestern University, IL, USA), and an engineer in multiscale modeling (University of Illinois at Chicago (UIC), IL, USA). The master internship will take place in CINaM.

M2 project. Within the few months of the internship (in the 1st year of the project), the student will be involved in the development of a microfluidic device mimicking the bone marrow environment. The student will learn microfabrication techniques in the clean room facility of the CINaM laboratory, and produce microfluidic chips for the enucleation experiments. She/he will then perform microfluidic experiments with red blood cell precursors to determine the experimental parameters for efficient enucleation. The student will acquire videomicroscoy data and learn image analysis to extract the rate of extrusion.
There will be a possibility of continuing the project as a PhD student.

Expected profile: Preferentially a physicist keen to learn new technologies and with interest towards biological questions.

References

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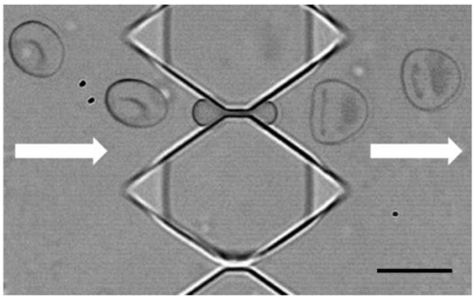

***Figure.*** *The device for the project will be designed based on the CINaM expertise previously acquired while developing a first device mimicking the narrow slits in the spleen, an organ which filters the red blood cells and eliminate them when too rigid. The image shows a deformable red blood cell passing through a biomimetic splenic slit (0.95 x 3 x 4.7 µm$^3$) under a controlled flow indicated by the white arrows. Scale bar: 10 µm.*

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