

Doctorate of National Interest

RNA THERAPEUTICS AND GENE THERAPY

SELECT ONE OF THE FOLLOWING RESEARCH AREA:

- ☐ **Mechanisms of Diseases and Drug Target Identification**
- ☒ **Design and Delivery of New Gene Therapy and RNA-Based Medicines**
- ☐ **Validation and Safety in Preclinical and Clinical Studies**

LOCATION OF THE RESEARCH ACTIVITY (INSTITUTION/DEPARTMENT):

Istituto Italiano di Tecnologia, CCT (Centre for Convergent Technologies), Genova; Laboratory of Polymers and Biomaterials

TUTOR:

Prof. Nicola Tirelli

PROPOSED RESEARCH ACTIVITIES (max 300 words):

The PhD project will focus on nanoparticles, which are used as carriers for mRNA.

The defining features of these nanoparticles are:

A) the capacity to target cell surface receptors overexpressed in many solid tumours and inflammatory pathologies, and to use them as entry points to deliver their RNA payload intracellularly. In particular, the nanoparticles will be designed to interact with combinations of receptors (i.e. at least two different receptors at the same time), in order to achieve higher targeting specificity. Building on the top of existing expertise of the group, one of these receptors is CD44, which is targeted by using nanoparticles displaying hyaluronic acid (HA) on their surface.

B) the potential to control intracellular (innate immunity) reactions to RNA delivery, by introducing groups capable of anti-inflammatory action in the nanoparticle structure.

C) the amenability to nanomanufacturing via (scalable, computer-controlled) microfluidic-assisted preparative processes.

The skills that the student will develop in this project range from chemical (polymer) synthesis to advanced colloidal characterization and nanomanufacturing, and from the study of endocytic/cellular trafficking processes to the understanding of and control over intracellular inflammatory activation.