REGENERATIVE MEDICINE AND BIOMATERIALS:

1. Stickiness of hydrogels to cartilage: functionalization and testing (in the context of the ADMAIORA project). **Expertise**: design, synthesis and characterization of biomaterials, chemical functionalization, engineered set-ups for in vitro/ex vivo tests;

2. Development of an ultrasonic stimulation system allowing real-time imaging (in the context of the ADMAIORA project). **Expertise**: study of ultrasound technologies, mechanical design, design and fabrication of a new set-up, FEM simulations of ultrasound wave propagation;

3. Bioeffects of ultrasound on cells of the articular joint (e.g. tendon/ligaments) (in the context of the ADMAIORA project). **Expertise**: human cell manipulation and culture, stimulation of cells by low-intensity ultrasound, molecular biology assays for quantifying gene and protein expression, data analysis;

4. Other possible theses in the context of the ADMAIORA project – to be concerted with the project partners (possible theses abroad). **Expertise**: to be concerted with the partners;

5. Responsive nanoparticles and ultrasound for the treatment of amyotrophic lateral sclerosis – in collaboration with Istituto Auxologico Italiano, Milano. **Expertise**: nanoparticle functionalization and characterization, ultrasonic stimulation of nanoparticles, manipulation and culture of human stem cells, assessment of the biological effects in vitro produced by the stimulation, through biological assays (this part will be performed in Milano);

6. Measurement and modeling of electrical stimuli produced by ultrasound-nanoparticle interactions. **Expertise**: nanoparticle functionalization, design of ad hoc electronic devices for measuring nanoparticle potential, ultrasonic stimulation, mathematical modeling of physical phenomena;

7. Analysis of cell membrane fluidity due to combined ultrasound and nanoparticle stimulation – in collaboration with Giuseppe Maulucci (Istituto di Fisica, Roma). **Expertise**: nanoparticle functionalization, ultrasonic stimulation, cell imaging, image processing techniques and biophysical analysis of stimulated cells (this part will be performed in Roma).

ARTIFICIAL/BIOARTIFICIAL ORGANS

1. New materials for an artificial kidney. **Expertise**: analysis of clinical needs, analysis of materials available in the state-of-the-art, selection/synthesis and characterization of new materials suitable for an artificial kidney, testing of the device functions;

2. Design of a self-folding structure for artificial bladder. **Expertise**: selection/synthesis and characterization of materials suitable for an artificial bladder, smart fabrication techniques for achieving a self-folding architecture, testing of the device functions;

3. Nanocomposite patch for the treatment of myocardial infarction – in collaboration with the Centro Cardiologico Monzino, Milano. **Expertise**: analysis of clinical needs, selection/synthesis and characterization of materials suitable to build the patch,

development of an electronic circuit for passive stimulation, in vitro analysis of system performances, ex vivo tests.

DRUG DELIVERY SYSTEMS

1. Multi-layer thin film for triggerable drug delivery; **Expertise**: micro-nano fabrication techniques, polymer and nanoparticle selection and assembly, drug embodiment strategies and drug delivery measurements in vitro, management of drug delivery triggering by physical inputs (e.g. optical, ultrasonic or magnetic stimulation.

BIO-HYBRID ROBOTICS

1. Design of a miniaturized bio-hybrid device for in-body applications; **Expertise**: analysis of clinical needs, design of a miniaturized medical device, development and characterization of magnetic materials, FEM simulations to predict device mechanical behavior; coupling of the device with contractile muscle cells, in vitro testing of the system performances.