Cell therapy is a new area of regenerative medicine that has a great potential for repairing tissues and organs. It allows to restore health and functionality to people suffering from organ failure, with the severe burns to the skin and people with cardiovascular disease or diabetes. The development of cell therapy is essential to resolve the social problems associated with prolonged live expectancy and the increase of civilization diseases morbidity. Particular hope is the use of stem cells. The most serious limitation in the use of this technique is the very high number of apoptotic cells. The development of new materials that mimic the extracellular matrix which can protect proliferated cells and also allow their biodetection after application to the patient would cause a significant development of this branch of regenerative medicine.

The aim of this project is microwave-assisted synthesis of Quantum Dacron Dots (CQDs) from waste biomass / waste biomass fraction using the hydrocarbonisation process. The obtained CQDs, which will be characterized by lack of cytotoxicity, antioxidant properties and high fluorescence quantum yield. CQDs will be mixed with chitosan hydrogels. The use L-amino acids, hydroxycarboxylic acids, sulfur-containing amino acids, other simple inorganic molecules during synthesis of CQDs will increase the fluorescence quantum yields of this nanomaterial so that smaller amount of fluorescent nanomaterial will be required.

Carbon Quantum Dots (*CQD_s*), nanoscale objects (< 10 nm) were discovered almost 10 years ago. Since 5 years they have become very popular among scientists and in industry. Carbon dots, analogously to semiconductor nanoparticles, have the ability to emit electromagnetic radiation in the visible range from blue to red color depending from the excitation radiation used. Carbon Quantum Dots can be used in many industrial branches such as bioimaging of cellular structures, synthesis of opto-electronic materials, the formation of energy storage devices or biosensors. These extraordinary properties and applications which caused a boom to study classical quantum dots also today, prompts the scientific world to explore the nature of Carbon Quantum Dots as a new type of nanomaterials. Contrary to the classic nanoparticles built in the form of simple sulphides, selenides or metal tellurides CQDs are constructed of non-toxic, biocompatible carbon core, making it possible to use CQDs in bioimaging *in vitro or in vivo* of biological structures with minimal cytotoxic effect. Their synthesis in contrary to the classical quantum dots does not require use of toxic chemical reagents and expensive raw materials.

Chitosan is a raw material derived from biopolymer – chitin. During the Project it will be modified with natural substances and will form a scaffold with negative surface charge simulating cell grow and proliferation. Choosing chitosan as a matric for the synthesis of composites is dictated by the fact that it may create a lot of amide and ester bonds with other molecules, simulating the natural protein and lipid structures present in living organisms.

The obtained CQDs will be characterized by UV-Vis spectroscopy, UV-Vis fluorimetry, Scanning Electron Microscopy (SEM), Dynamic Light Scattering analysis (DLS) and infrared spectroscopy (FT-IR). Biological studies: cytotoxicity and cell proliferation will be performed on human stem cells. Proliferation observation and in vitro cell detection will be performed using a fluorescence microscope.

Dotted with CQDs cross-linked chitosan hydrogels with high quantum fluorescence efficiency and antioxidant properties will create a new class of biocompatible non toxic chitosan materials which will simultaneously play function as a cell culture medium for cell therapy with simultaneous bioimaging of cellular structures.