Surgery, other medical procedures, as well as well as cosmetology desires the discovery of an implantable materiel that would serve as a scaffold for tissues to grow. Our team and others, have observed that after the thermal decomposition, plant fragments retain their unique biomorfous structure that is difficult to obtain using conventional techniques. It is possible to cut monolithic carbon materials of desired shapes using traditional, simple methods. These biomorfous materials appear to fulfil at least the basic requirements for the support of cell growth and micro-blood vessels development. Such materials have not been extensively studied to date. We aim to gain further knowledge on the required parameters that would make it possible to pre-machine fragments of organic matter and subsequently to convert them into material that could support tissue growth and could be used as a precursor for regenerative medicine purposes. Before such adaptation of materials could happen, significant amount of basic knowledge needs to be accumulated.

Our preliminary data indicate that slow decomposition of organic matter by heat, or pyrolysis, leads to increase of carbon element in products (carbonisation). During this process, the thermal decomposition of organic substance and removal of volatile compounds take place (wood is composed mainly by three polymers: cellulose, hemicellulose and lignin) resulting in highly porous product (carbonisation product). With removal of low-molecular volatile compounds, concentration of carbon in product of thermal decomposition increases, simultaneously, primary porous structure is created, mechanical strength increases. Carbonisation at very high temperatures creates secondary porosity and orders structure of continuous carbon matter, that transforms to graphite-like or turbostratic structure. Both factors, i.e. ordering of structure and porosity strongly affect reactivity: the higher the porosity and the lower the ordering, the higher the chemical reactivity. The proper knowledge on the heating conditions and gaseous atmosphere (pyrolysis) needs to be accumulated. Especially, it is important to know how such conditions affect strain-stress, wettability, other biophysical properties, and biocompatibility of the obtained structures.

Our previous researches on carbonised vascular plants did not include detailed analyses of stress and strain of structure under expected loads, such as physiological ones, for the purpose of using, in the future, derivates of the material in trauma surgery. Hence also these aspects will be systematically investigated and the obtained data will be feed into mathematical models for *ex-silico* data mining. Specifically, we would like to model how such structures obtained by carbonization would interact i.e. with bony structures, under the application of typical physiologic forces.

We will also test various treatments of such structures, like i.e. treatment with carbon dioxide to expand the internal surface area, or immersion with precursor material that results in the deposition of hydroxyapatite molecules on the biomorfous structures to enhance their biocompatibility with bone-forming cells called osteoblasts.

Finally, the most promising biomaterials arising form the outlined above experiments will be tested for the support of transdifferentiation of fat-tissue derived mesenchymal stem cell. Transdifferentiation is a fast, safe and very promising procedure of direct conversion of one cell type into another one. Since several protocols exist that allow for conducting the transdifferentiation without the application of genetic material, it holds great promise as a source of large quantities of safe cells for biomedical procedures.