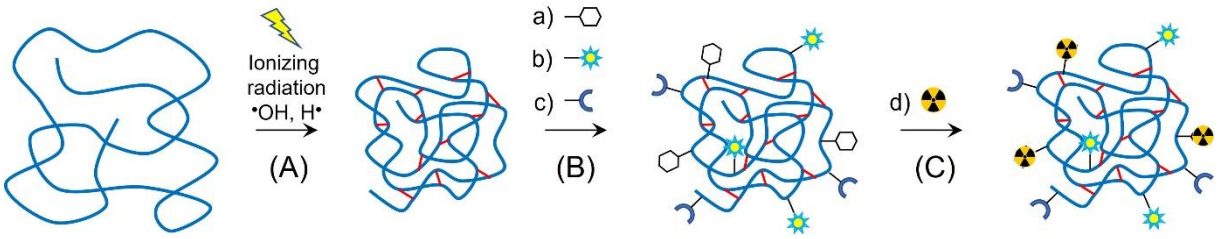
Applications of nanotechnology in oncology are becoming evident, bringing new hope for the patients suffering from various malignancies. Therefore there is big need for developing new nanomaterials which will operate inside the patient's body and will be able to diagnose tumors, kill cancer cells, specifically deliver drugs or other biologically active compounds to diseased site without causing harmful side effects. However, there are some obstacles on the way, that desperately call for addressing and in our project we would like to tackle them in order to facilitate the way of nanotechnology from the lab to the bed side.

One of the biggest issues of current situation is that despite substantial money and time invested in research, the progress in the field is still relatively slow, since most of the research focuses on developing brand new sophisticated nanomaterials overlooking the key aspect with is the proof of concept from the biological point of view. Our idea for improving this situation is to develop universal delivery platform for nanomedicines design, which can be adjusted to the particular need (i.e., given malignancy or mode of action- treatment or diagnosis) in a simple and robust way. Based on the generic functionalization protocols we will be able to combine our nanosystem with various drugs or therapeutic/diagnostic radioisotopes and target it to various malignancies, such as, for instance, melanoma. Our platform will be based on a functional biopolymer nanogels synthesized in sustainable and environmentally friendly process. This in turn tackles another challenge we are facing – synthesis of perfect nanomaterial needs to be simple and clean. This will be achieved in our project by use of ionizing radiation from electron accelerator. We have developed and intensively researched the unique one-step electron beam process, which we will further explore in this project. Using radiation makes possible to carry out the synthetic reactions in water and without harmful chemicals, which are usually difficult to remove and can easily contaminate ready product. Hereby we are simplifying the process, making it cleaner, faster, less labor-intensive and a result cheaper and more sustainable.



Another important issue which is frequently overlooked since we care the most about patient survival, is the fate of the nanosystems once they complete their tasks. It would be the best if the nanocarrier would simply disappear once its job is done. This is indeed possible – with the use of proper biocompatible and biodegradable starting materials, we can design the nanosystems that will degrade leaving behind only simple organic compounds, such as sugars. In our project we are going to exploit radiation synthesis of nanogels based on polymers of natural origin (e.g. from plants), which are not only biocompatible, but also biodegradable.

Our sustainable approach in combination with cutting-edge technology can lay the grounds to really make a difference for patients one day. We will broaden the knowledge about the radiation processing of polymers of natural origin and foster their applications in nanomedicine. Altogether, our idea stays in line with Sustainable Development Goals by United Nations, which are globally recognized, acknowledged and pursued.