CANCER CELLS

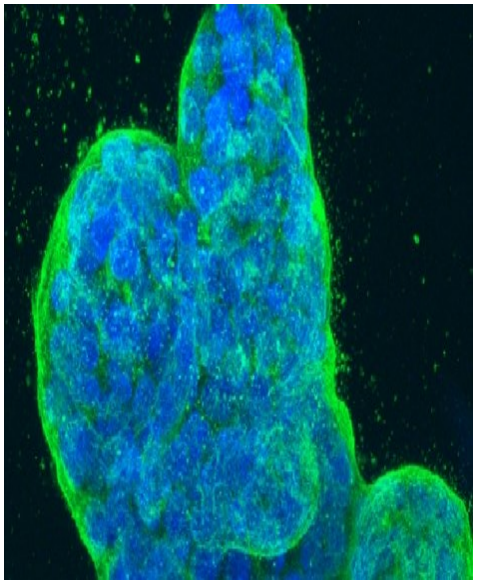


Image by NIH

DO YOU KNOW THAT:

Multidrug resistance (MDR) is responsible for over 90% of deaths in cancer patients treated with conventional chemotherapeutics. The mechanisms of MDR are complex and include elevated metabolism of xenobiotics, enhanced efflux of drugs, growth factors, increased DNA repair capacity, and genetic factors. Moreover, gastric cancer and intestine cancer are the most common malignant cancers and the third reason for cancer-related death worldwide.

WHAT'S THE PROBLEM?

There are many treatment options available for tumor removal by surgery or stem cell transplantation using precision medicines or performing therapies like immunotherapy, chemotherapy, radiotherapy, and hormone therapy. However, these therapies alone might not always be able to eradicate the cancerous cells, i.e. the success rate of monotherapy does not reach a good mark, and hence comes the need for introducing combinatorial therapy.

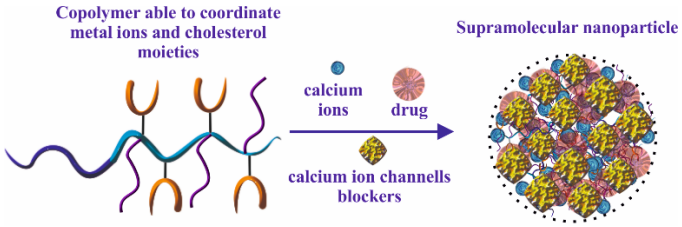
WHAT CAN WE DO ABOUT IT?

To tackle this challenge, combinatorial therapy should be used since it involves a complementary combination of two different therapies, like a combination of radio and immunotherapy or a combination of drugs that can target more than one pathway of cancer formation. In addition, the novel approach for the treatment of the resistance by combination of anticancer drugs with calcium channel blockers plays a pivotal role in tumour suppression and reverse drug resistance of cancer cells. It is anticipated that alteration in extracellular Ca^{2+} ions concentration synergizing with mild hyperthermia will cause efficient eradication of cancer cells.

HOW CAN THE PROJECT HELP TO SOLVE THIS PROBLEM?

The aim is to develop novel drug delivery systems which are resistant to gastric pH, efficiently penetrating the gastric and overcoming cancer cell drug resistance. The tunability of supramolecular nanomaterials will allow for the encapsulation of various therapeutics and the delivery of their cargo to tumour sites. It is planned to encapsulate anti-cancer drugs along with calcium channel blockers. The presence of calcium ions can change the distribution of intracellular and extracellular ions and greatly promote the therapeutic effect.

Nanoparticles (NPs) will consist of metallo-supramolecular polymers, which will be able to deliver drugs to the stomach and increase the effectiveness of oral anti-cancer therapy. Those NPs will be loaded with anticancer drugs along with calcium channel blockers.



WHAT TASKS DO WE HAVE TO COMPLETE?

The following activities are planned for the project:

- synthesis of tailor-made copolymers able to coordinate calcium ions
- designing and preparation of nanoparticles by nanoprecipitation, film casting, and microfluidics
- optimization of the size and stability of the obtained supramolecular carriers so that those nanocarriers are capable of delivering active substances to the stomach.
- selection of appropriate active substances, their various combinations, as well as appropriate doses effective in combating the MDR cancer cells
- analysis of the release of active substances at physiological and strongly acidic pH in the stomach
- exclusion of cytotoxicity of the designed carriers, both *in vitro* and *in vivo*
- testing the effectiveness of the obtained nanocarriers against reference cancer cells resistant to commonly used anticancer drugs