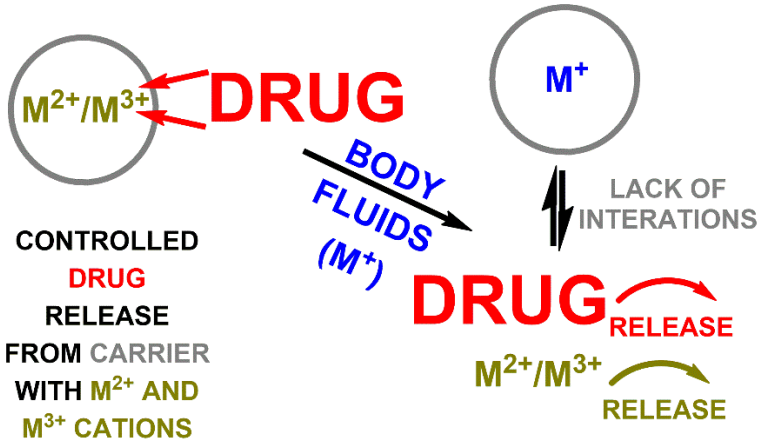
The development of new drugs is costly and time-consuming. An alternative is to improve the properties of well-known substances through various methods of modifying their delivery. For this purpose, drug delivery system that employ "smart" drug carriers can be used. Such carriers allow to release of the drugs only under certain conditions. This can reduce dosing frequency while maintaining the therapeutic concentration of the drugs for a longer time.

This project proposes a new approach of the controlled drugs release based on preparation of "smart" drug carriers in which drug is bound to a carrier by divalent or trivalent cations. New carriers will be used for drugs from the following groups of compounds: polyphenols, purines, anthracyclines, quinolones. The drug will be adsorbed onto the drug carrier only if a suitable di- or trivalent cation is present in the carrier structure. Drugs will be retained on the surface of the carriers due to strong interactions of functional groups in the drug with the metal cations in the drug carrier. These interactions will disappear after replacement of divalent or trivalent cations with monovalent cations derived from the body fluids. Local slow drug delivery will increase the bioavailability of the drug. As the release of the drug will be controlled and gradual, local inflammation will not occur. The scheme of how the smart carrier works is presented below.



Scheme of drug release from new materials.

The main aim of the project is to develop new way of delivery of several drugs depending of the potential application of the drug:

- Delivery of drug directly from the surface of the carrier in the form of powder (potential use as intravenous drug delivery);
- Delivery of drug from implants:
  - composites that include a carrier as a filler (potential use as an implant that releases drug into the body);
  - titanium alloy modified with carrier layer (potential use in endoprostheses to improve osseointegration or antibacterial properties);
  - 3D printed alloy filled with a composite containing a carrier (potential use in endoprostheses to improve their osseointegration and antibacterial properties).

The obtained materials, can be used in the treatment of many diseases, they can improve the osseointegration of implants and create antibacterial layers on them. The prepared materials will be investigated in terms of their influence on the bacterial cells that colonize the human body. Their biocompatibility, effect on cancer cells or osseointegration will also be examined.

The expected effects of the project are:

- Drug release from new carriers will be more controlled than from systems described in the literature,
- New drug carriers will only affect undesirable microorganisms,
- New drug carriers will be biocompatible and will only act on cancer cells,
- The proposed materials will improve the osseointegration of implants.