DESCRIPTION FOR THE GENERAL PUBLIC

Cancer is now included in the so-called diseases of affluence that are related to economic and social development. The incidence rate of this type of diseases increases every year and according to the World Health Organization cancers are currently the second cause of death in Europe. Thus, it is not surprising that the interest of physicians and scientists is focused on finding effective methods for their treatment. One of the most important methods, and for some cancers still the only one, is chemotherapy. Chemotherapeutic agents should have a cytotoxic effect, largely through interaction with DNA. Consequently, the DNA-drug interaction mechanism is of the primary interest when new anti-tumor compounds are studied. The development of new anticancer drugs is forced by the strong side-effects and chemoresistance, both being induced when commonly used platinum-based chemotherapeutics are applied. Among the potential candidates, copper complexes are regarded as promising and have attracted considerable attention owing to their capability of interacting directly with DNA. The aim of the project is direct *in situ* studies of binding different copper compounds to DNA within support of the X-ray laboratory-based experimental setup. Proposed experimental techniques are X-ray absorption spectroscopy (XAS) and X-ray emission spectroscopy (XES). Both methods are based on the interaction of X-rays with atoms and help to gather information about the electronic and geometric structure of the studied system. X-ray spectroscopies are atom-specific techniques and permit to study heterogeneous samples. Furthermore, because of the hard X-ray light penetration, XAS and XES can be performed in ambient environments, thus the experimental conditions can be easily changed and controlled. The possibility of *in situ* experiments provides information about electronic structure under ambient/operational conditions, i.e., direct observation of species at the molecular level in low (biological) concentrations without the need for preconcentration, extraction or crystallization. X-ray studies will be complemented with other methods that will provide additional information on studied samples by means of infrared spectroscopy, atomic force microscopy or cytotoxic tests.

X-ray spectroscopy studies are usually performed on synchrotron radiation sources, however, comparing to aspect of the infrequent and not guaranteed *a priori* access to the central synchrotron facilities, the laboratory X-ray setup can be fully employed to dedicated scientific projects and used on a daily basis over entire year. Moreover, the laboratory XAS/XES spectroscopy allows for development of dedicated and sophisticated sample environment setups. Very often such a sample environment may include other experimental measures or conditions (temperature, gas environment, UV spectroscopy, mass spectroscopy) that are being hard, or sometimes even impossible, to be transferred and/or implemented at the beamline of synchrotron facility.

The known mode of action of the representatives of Cu-complex family, associated with chemical structure of the complexes, will help in the further design of more effective metallodrugs. The proposed laboratory X-ray spectrometer setup will be the first of such type instrument being built in Polish laboratory and only among few being developed world-wide. After project completion, the developed experimental setup could be easily adapted, to study other biological systems being investigated in IFJ PAN and therefore will be efficiently used in the future.