

2007 Ohio Student Research Forum

Wright State University
Dayton, OH

RESEARCH ABSTRACT FORM

TITLE: Synthesis and Evaluation of Nanoprobes for Cellular Signaling Pathways**AUTHOR:** Darwan Pursoo**MENTOR(S):** Elmo Blubaugh**DEPARTMENT(s):** Department of Biological Sciences, School of Engineering**INSTITUTION:** University of Dayton

We are interested in the exploration and understanding of the myriad number of cellular signaling pathways found in a cell. We have focused on one particular pathway, namely the Kinase family of proteins. The Kinase proteins as a family number in excess of a 100 individual proteins and they are responsible/implicated in cellular division/death and respond to both chemical and biochemical factors. We have decided to focus our attention on three specific members of the Kinase family, specifically Src, PI3K, and Ras. These three families of Kinase proteins are implicated in the growth and possibly the proliferation of cancer cells.

Our approach has been the synthesis and development of titanium dioxide nanoparticle based bioprobes, which are specific for each of the aboved mentioned Kinase family members. The design philosophy is to identify and synthesize specific inhibitors for each of the three Kinase family members. In turn, these inhibitors are attached to the surface of the titanium dioxide nanoparticles as a particle coating, containing a spacer group and a ruthenium metal complex/anchor. The objective is to expose cells to these nanoprobes and allow for the uptake across the cellular membrane. Once there is uptake, the nanoprobes will inhibit the specific Kinase protein that is dictated by the specific inhibitor contained in the coating of the nanoprobe. This effectively turns that cell signaling pathway off. With the subsequent exposure of the cells to a known range of ultraviolet or visible radiation, it is possible to excite the nanoprobes and in the process destroy the inhibition and allow the cell signaling pathway to be reactivated, via "remote control".

This project is very difficult, because we are dealing with the challenge of molecular design and synthesis of nanoparticles based chemical/biochemical probes and determining how these probes influence and dictate the behavior of cell signaling pathways. Nano-dimensioned material is difficult to characterize chemically and physically and combined with similar difficulties that we encounter in the characterization of the cells. Our present focus is the chemical synthesis of the inhibitor for the Src and PI3K Kinase families and the development of general analytical methods, such as HPLC-Mass spectroscopy, electrochemistry, and photochemistry to evaluate the nanoprobes in vitro and in vivo.

My specific role is to assemble a box that exposes a sample to different ranges of ultraviolet or visible radiation using a deuterium lamp, optical filters, filter wheel, double convex lens, sliding bench, shims and some power tools. When conducting the in vitro tests of different samples the main information I record is the conditions in which it undergoes a reaction, if the reaction reverses after the radiation is removed, and the time it takes for these processes to occur.