

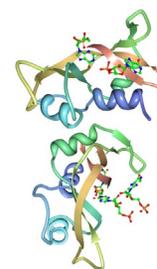
Journey to Biochemical & Toxicological Research: Dr. Kim's Lab

Life! It is constantly bombarded with biological events which may be harmful or essential for our body. To better understand these events and hopefully improve the quality of our life, our lab focuses on investigating the interactions of small molecules and macromolecules such as proteins and nucleic acids.

Project Summary: Protein modifications induced by PAH quinones

Quinones come in many forms around us such as metabolites of Tylenol/other medicines, poison ivy, water treatment byproduct, or food preservatives. Have you ever wondered why Tylenol exhibits side-effects? How does poison ivy make us feel itchy and give us blisters? Is there any correlation between quinones and certain diseases such as Alzheimer disease which involves protein-misfolding?

A group of small molecules called polycyclic aromatic hydrocarbons (PAHs) can be found everywhere from grilled meats to cosmetics, medicine, or even from poison ivy. Bad news is that PAHs and their metabolites such as PAH quinones are harmful to us [1]. For this project, PAH quinones are the center of interest since they are known to be involved in causing toxic abnormal cell/tissue behavior, therefore leading to cancer. As to how PAH quinones exhibit their activities, it is not clearly understood. Previously, our lab found out that substituted benzoquinones can induce protein modifications in a complex manner [2-4]. In order to examine if PAH quinones can modify proteins, the student will utilize various biotechnologies such as electrophoresis, UV-Vis, fluorescence spectroscopy, microscopy. For more information, check out the published papers of my former research students (posted outside my office). You will find out the many things quinones can do in such biological processes through this research, while achieving hands-on skills in biotechnology that are essential in many professional worlds.



Project 2: Interactions of metal complexes and DNA

Heard of Cisplatin (*cis*-PtCl₂(NH₃)₂)? It is a metal-based anticancer drug treating various types of cancers. Downside of this drug is its toxicity as well as resistance. Therefore, it is urgent to develop a new series of anticancer drugs. In this project, we do collaboration with Drs. Albu and Lisic (Tennessee Tech), and our group evaluates the biological activities of these compounds utilizing fundamentally important biotechnologies such as DNA gel electrophoresis and fluorescence spectroscopy.

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- [1]. J.Kim, "Biological implications of benzoquinones" (Book Chapter) in the book "Quinone: Occurrence, Medicinal Uses and Physiological Importance", Nova Science Publishers, Inc., 2013, ISBN 978-1-62618-323-0.
 - [2]. A. R. Vaughn; C. B. Redman; S. M. Kang; J. Kim, "Biological implications of 2-chlorocyclohexa-2,5-diene-1,4-dione toward ribonulcease A", *Advances in Biocscience and Biotechnology*, 4, (2013), 22-28.
 - [3]. J. Kim; T. V. Albu; A. R. Vaughn; S. M. Kang; E. A. Carver; D. M. Stickle "A comparison study on ribonuclease A modifications induced by substituted p-benzoquinones", *Bioorganic Chemistry*, 2015, 59, 106.
 - [4]. J. Kim; A. D. Cardenal*; H. J. Greve*; W. Chen*; H. Vashi*; G. Grant; T. V. Albu "Interaction with Calf-thymus DNA and Photoinduced Cleavage of pBR322 by Rhodium(III) and Iridium(III) Complexes Containing Crown Thioether Ligands", *Inorganica Chimica Acta*, 2018, 469, 484.
 - [5]. Kim, J., Thomas, C. A., Ewald, J. M., Kurien, N. M., Booker, M. E., Greve, H. J., & Albu, Titus, V. (2019). Studies on lysozyme modifications induced by substituted p-benzoquinones. *Bioorganic Chemistry*, 85, 386–398.