Biotechnology Research

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Integrative Physiology

Dr. Allyson Hindle
Assistant Professor
School of Life Sciences
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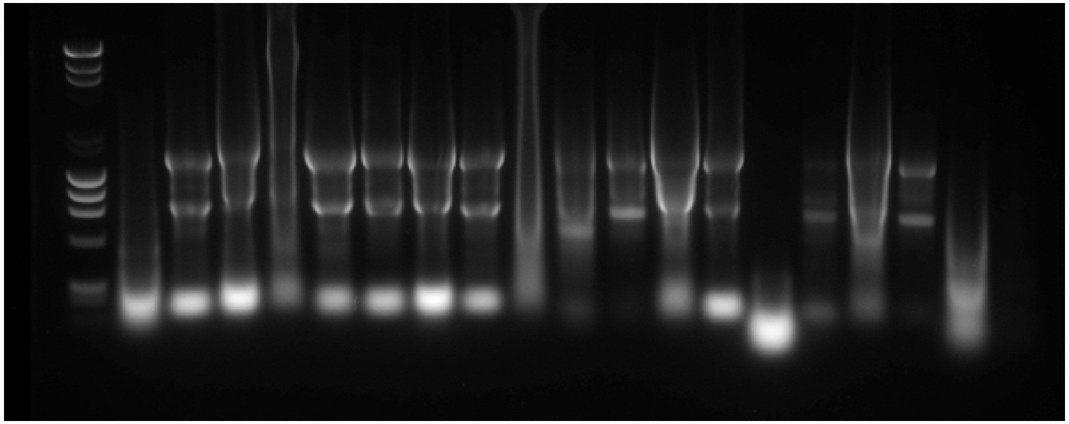
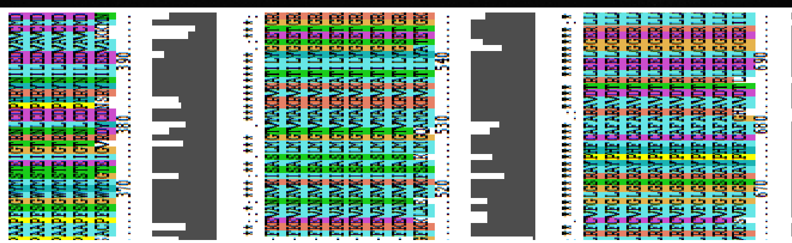
Email: allyson.hindle@unlv.edu

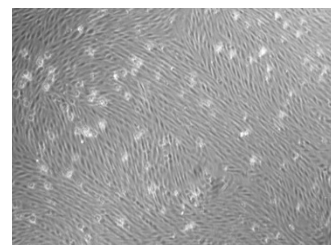
Expertise

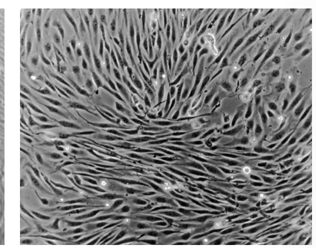
- molecular mechanisms of hypoxia tolerance in hibernating and diving mammals
- cardiovascular and blood pressure regulation
- comparative genomics, biomarker discovery and bioinformatics
- cell line resource development for non-model systems

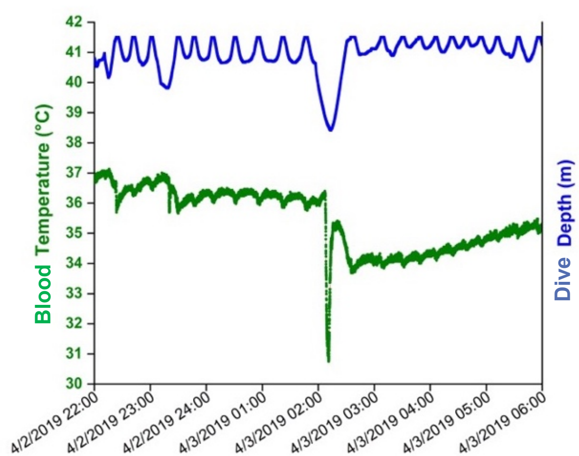
Cardiovascular protection of deep divers

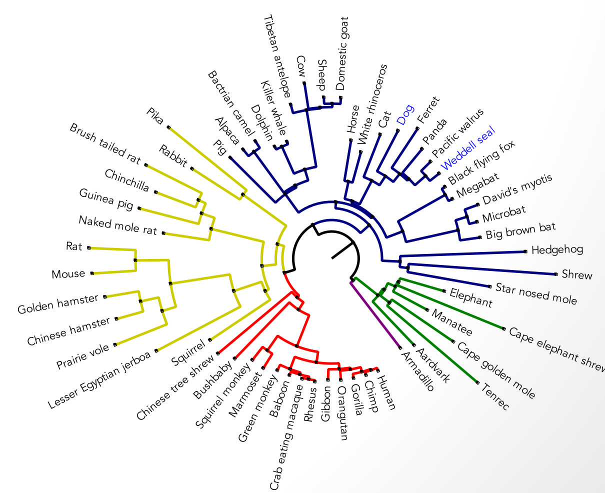




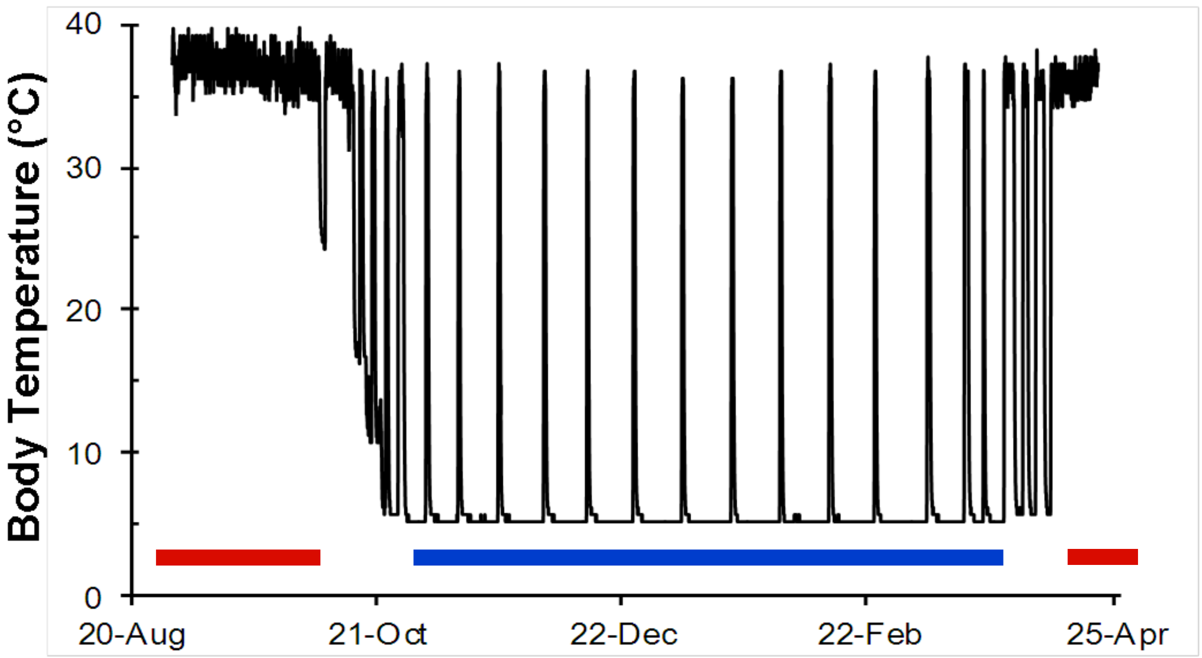


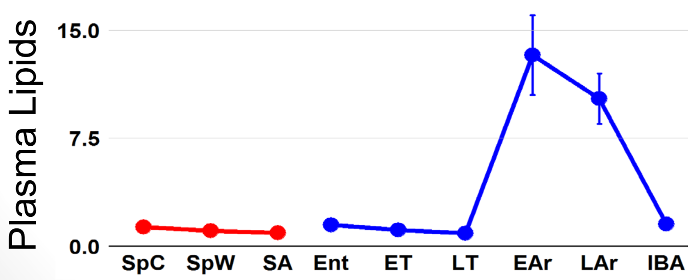


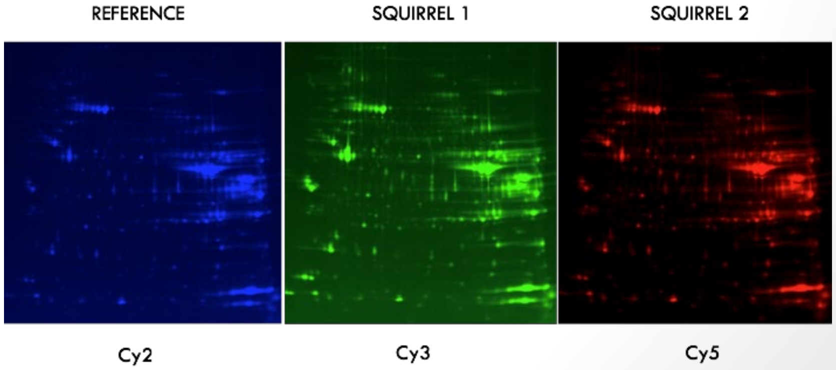




Metabolic control of small hibernators

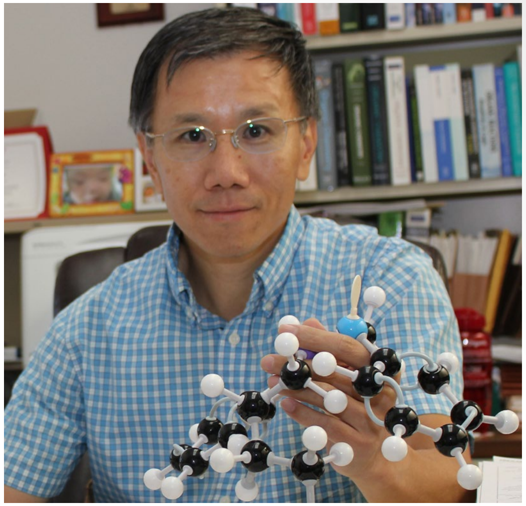






Jun Yong Kang

- Assistant Professor, Department of Chemistry and Biochemistry
- Ph.D., Chemistry, Texas A&M University, College Station, TX
- CHE 217B, junyong.kang@unlv.edu
- http://jkang.faculty.unlv.edu/?page_id=110



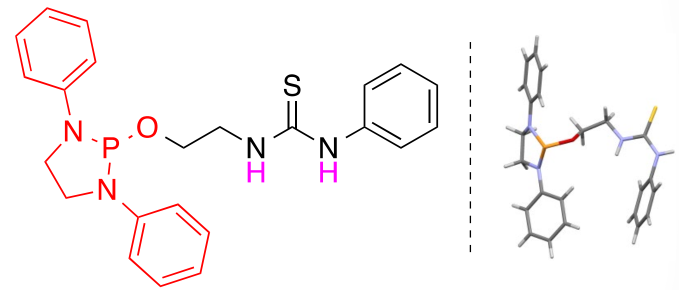
Areas of Expertise

- Synthetic organic chemistry
- Development of new synthetic methodology
- Asymmetric organocatalysis
- Organophosphorus chemistry
- Synthesis of bioactive small molecules

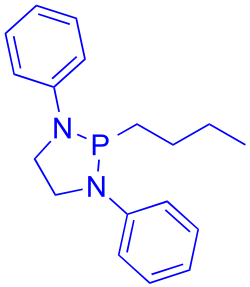
Research Summary:

The development of new synthetic methodologies plays a key role in medicinal chemistry, biochemistry, and materials chemistry. Professor Kang and his group have been developing novel synthetic transformation and new chemical reagents such as commercially available NHP-thiourea and NHP-butane to apply for pharmaceuticals and bioactive molecules.

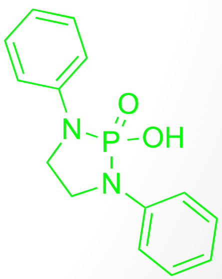
Kang's reagents-commercially available at Kerafast



NHP-thiourea
(phosphonylation reagent)



NHP-butane
(organocatalyst)



NHPA
(organocatalyst)

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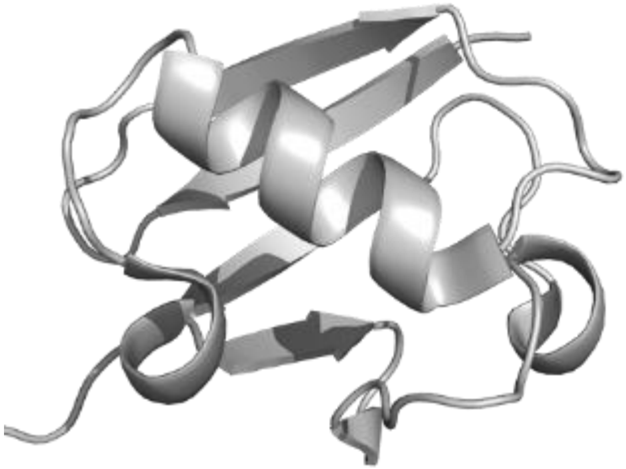
Ubiquitin-mediated protein degradation

Dr. Gary Kleiger
Professor and department Chair
Department of Chemistry and Biochemistry
gary.kleiger@unlv.edu
https://kleiger.faculty.unlv.edu



Expertise

- Structural biology
- Proteomics
- Enzyme kinetics and biophysical assays
- Cell biology

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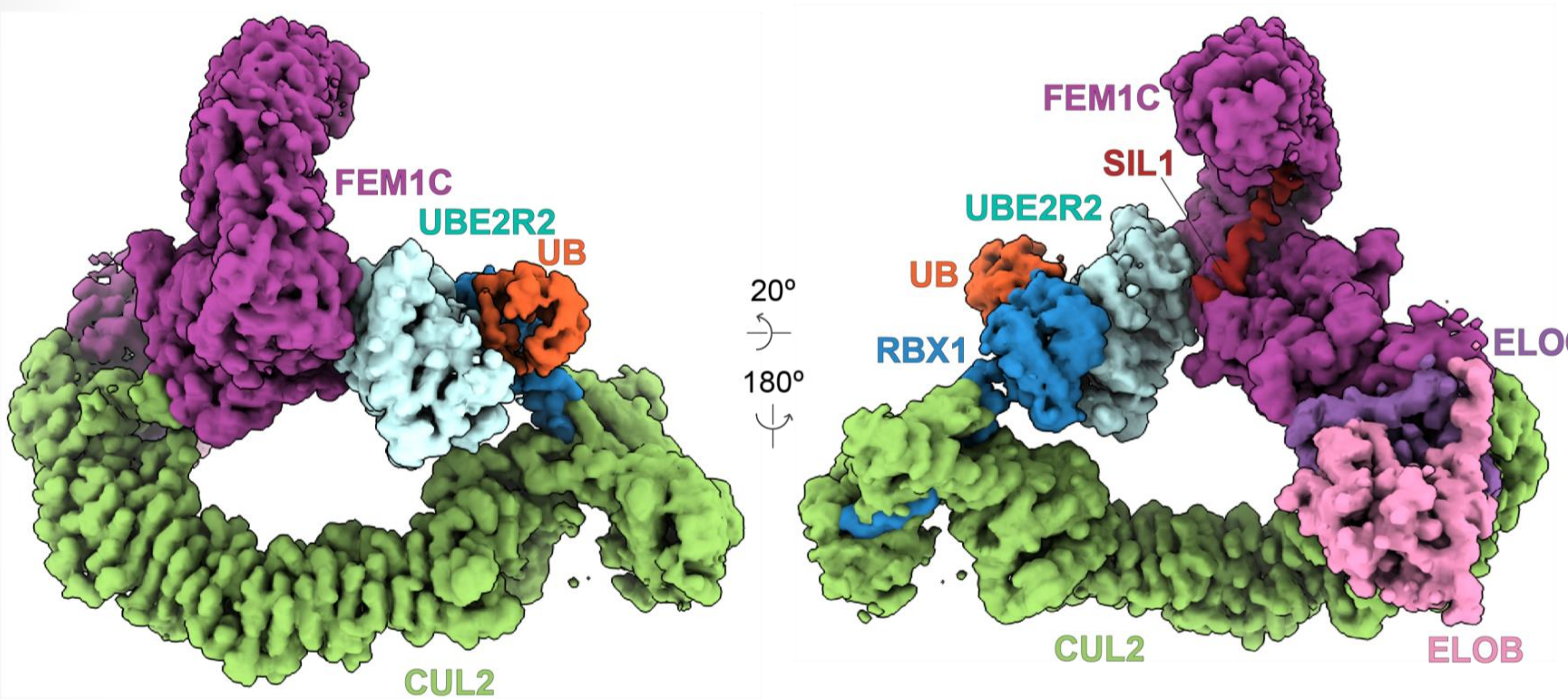
Determining the structures of enzymes that promote protein degradation by cryo-EM.



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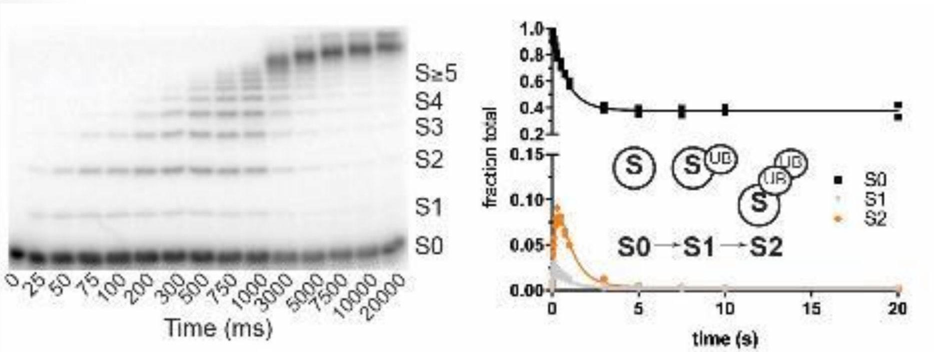
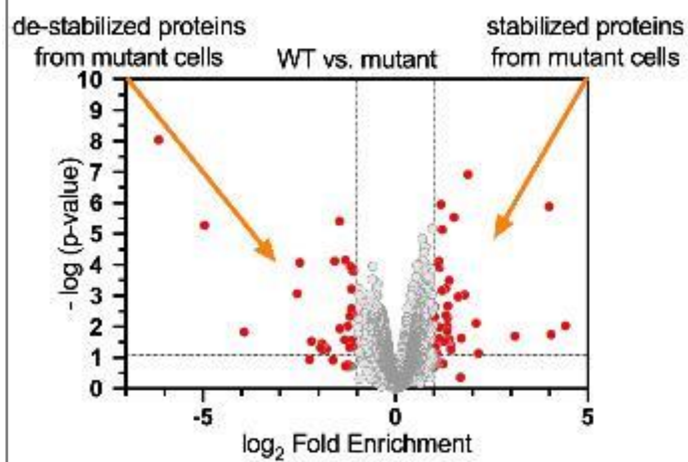
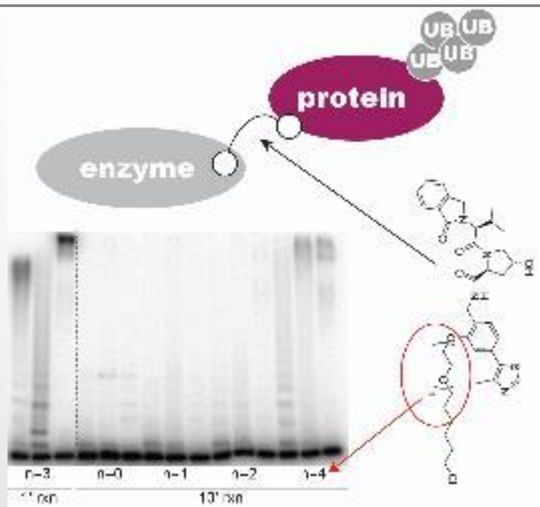
Uncovering how the enzymes that promote protein degradation function in human cells.

Kinetics help us understand how enzymes select protein targets for modification with ubiquitin.



High-resolution mass-spectrometry tells us how mutations in enzymes that lead to human disease affect the stabilities of key human cellular proteins.





Small molecule inducers of protein degradation can be used to treat human disease. We study the mechanism of how they function both in test tubes and cells.

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Novel chemistry and biology using highly ionizing radiation

Michael Pravica, Ph.D.
Professor of Physics
Department of Physics and Astronomy
Phone: (702)895-1723
Email: michael.Pravica@unlv.edu

Expertise:
Useful Hard X-ray photochemistry
High pressure
Spectroscopy
Ion Beam Nuclear Transmutation Doping
High quality synthesis of vaccines using tuned hard x-rays

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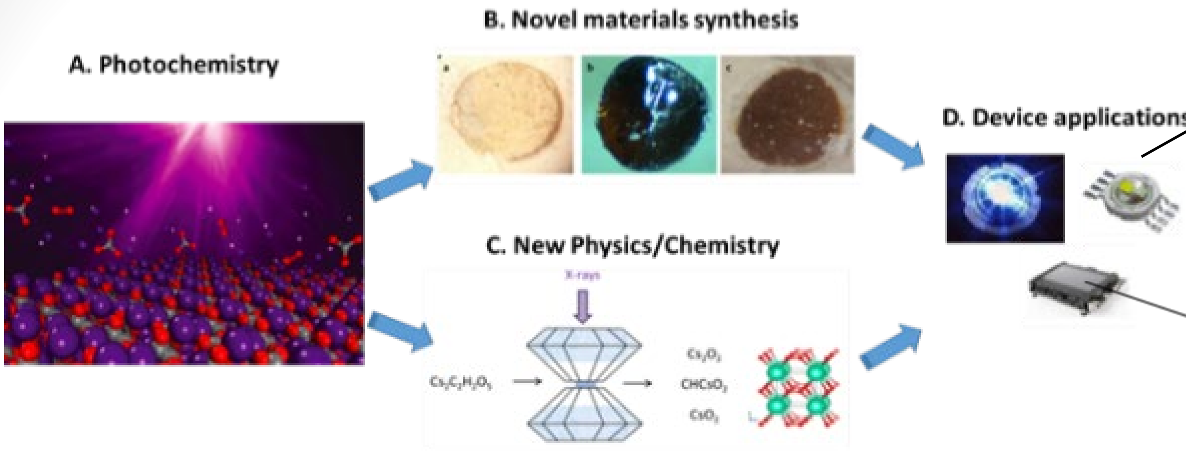
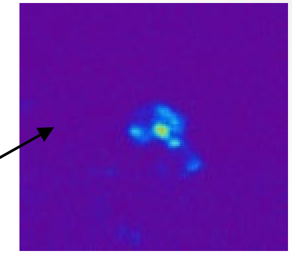
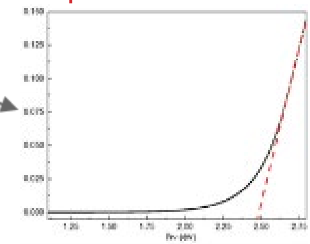
Pravica Group Research





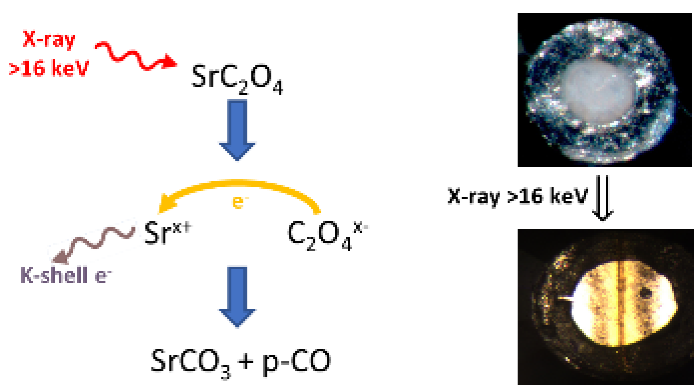
Optical mixer

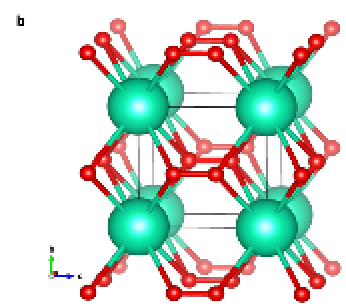


Wide bandgap semiconductor

Radiation-hardened sensors/direct energy conversion devices for EXTREME CONDITIONS or tuned solar materials

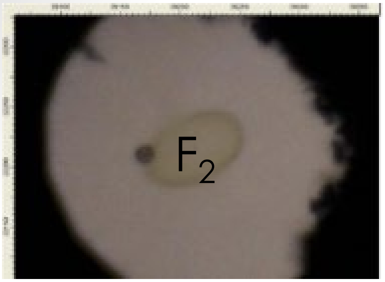
Useful hard x-ray photochemistry

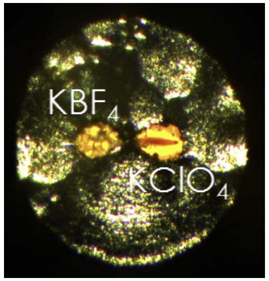




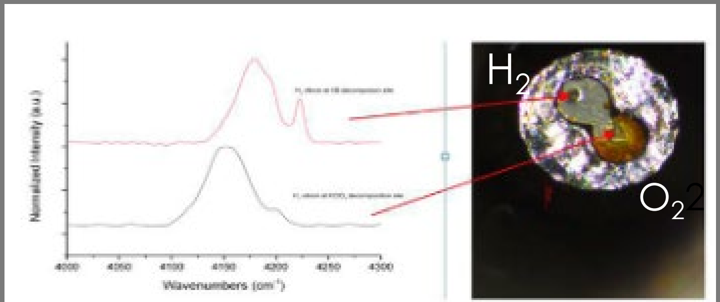
Novel structures of known materials produced With hard x-rays and high pressure (e.g. CsO_2)

High Pressure Fluorine Chemistry



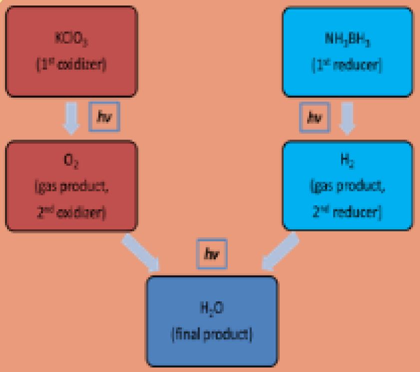


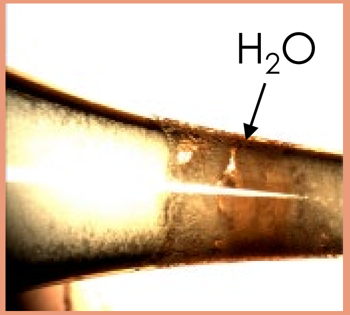
$$2F_2 + O_2 \xrightarrow{hv} 2OF_2 \ @\ 3\ \text{GPa}$$



5 GPa

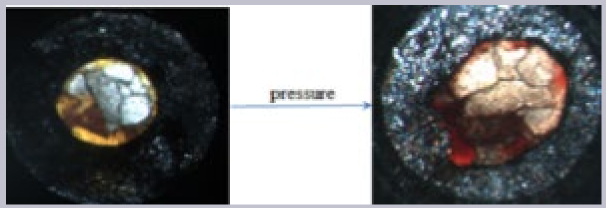
Molecular mixtures at high pressure





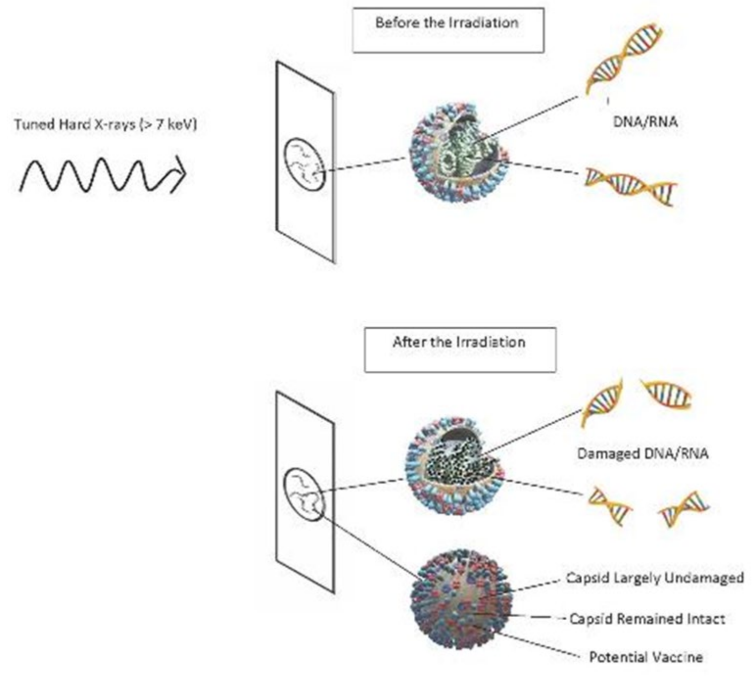
X-ray induced combustion

Inner shell chemistry at high pressure



$XeF_2 \xrightarrow{hv} Xe + F_2$ (*in situ* x-ray fluorination)

$HgF_2 + F_2 \xrightarrow{hv} HgF_4$



Using tuned hard x-rays to damage viruses to create high quality vaccines by targeting specific molecular groups/bonds that resonantly absorb x-ray energy leading to decomposition chemistry.

Advanced Numerical Methods for Moving Domain/Interface Multi-Physics Problems

Dr. Pengtao Sun
Professor
Department of Mathematical Sciences
Email: pengtao.sun@unlv.edu ; URL: https://faculty.unlv.edu/sun/

Expertise

- Numerical Solutions of Partial Differential Equations (PDE)
- Numerical Analysis (Well-posedness, Stability, Convergence)
- Finite Element/Volume/Difference Methods
- Scientific and Engineering Computing
- Fluid-Structure Interaction (FSI) Modeling and Simulation
- Fuel Cell Dynamics, Fluid Dynamics, Electrohydrodynamics

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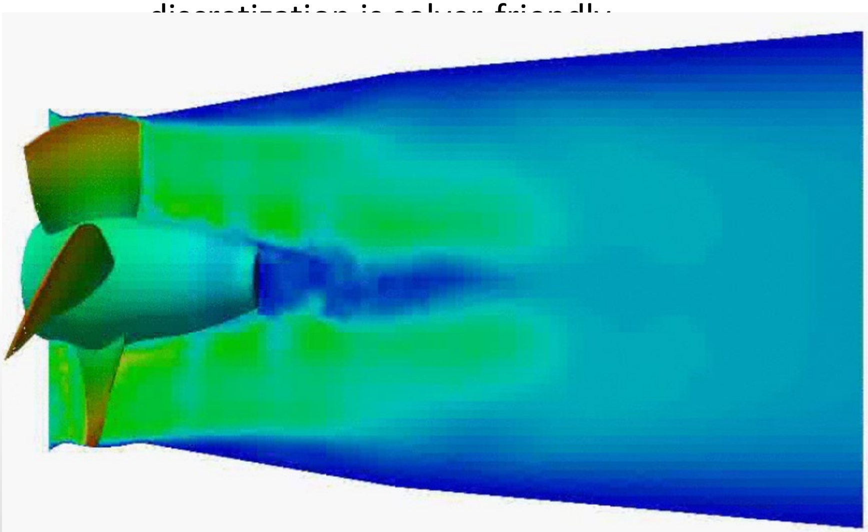
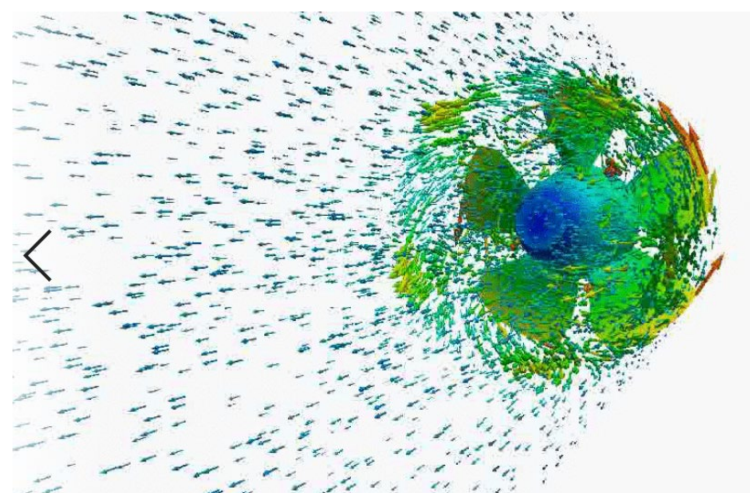
Fluid-Hydro Turbine Interaction Problems

- Hydroelectric power generating system produces renewable energy and remains crucial for society and industry. The most significant part of this system is the hydro turbine interacting with the water flow, which involves elastic solid materials and viscous fluids and belongs to the category of fluid-structure interaction (FSI). The developments of mathematical models and numerical methodologies are critical in practice for efficient simulations of the hydro turbine, which in turn guides the design and evaluation.
- We approach the challenges in different aspects. First, based on the observation that the hydro turbine, although exhibiting large rotations, has relatively small deformation, we develop linearized elasticity equations that alleviate the burden on nonlinear solver and improves the well-posedness of spatial discretization. Second, we propose a new approach to solve the arbitrary Lagrangian-Eulerian mesh motion for rotating structure. Moreover, we analyzed the well-posedness and convergence of the finite element discretization and demonstrated the discretization is solver friendly.





Hemodynamic Fluid-Structure Interaction (FSI) Problems

- FSI simulation has become the most promising solution method to solve the hemodynamic problem existing in the clinical cardiovascular system. However, the complexity of cardiovascular environment, the artificial heart pump model, the vascular rupture, the aneurysm progression and the aortic dissection cause the deficiency of the existing FSI simulation package towards the clinical demands.
- We devoted our research to the new modeling and numerical techniques for the bloodstream-vascular-stent graft/artificial heart pump interaction problems, aiming at overcoming numerical difficulties and challenges, and developed advanced numerical methodologies to improve the efficiency and accuracy of corresponding FSI simulations. and to deliver more instructive numerical results to medical professionals for helping out patients on an efficient and accurate diagnosis and treatment.