The effects of nanoparticles on the structure and function of proteins luciferase and β-galactosidase

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Luciferase (Luc) and β-Galactosidase (β-gal) serve as model enzymes where we study the effects of physiologically relevant nanoparticles on the structure and function of proteins. The objective is to examine the extent to which each nanoparticle will enhance or deter the performance of β-gal and Luc. Two dimensional fluorescence difference spectroscopy (2D FDS) determined the optimal intensity per excitation and emission wavelengths to view a change in the intrinsic fluorescence of both enzymes in the presence of nanoparticles, indicative of protein conformation. The intrinsic fluorescence spectra were obtained for both enzymes in the presence of copper (Cu) and boron carbide (B₄C) nanoparticles revealing fluorescence quenching as result of interaction. Luc activity was measured by photoluminescence through the conversion D-Luciferin substrate to oxyluciferin, where Cu alters and B₄C eliminates this catalytic reaction. Limited proteolytic digestion experiments were conducted on Luc where Cu increased degradation and B₄C protected against it. Luc allows for rapid kinetic analysis where Cu showed delayed onset of the reaction and iron oxide was less inhibitory initially. β-gal activity was measured by absorbance as a result of cleaving the substrate ortho-nitrophenyl-β-galactoside (ONPG). The nanoparticles effect on both enzymes was compared to determine if the effect was specific or a general phenomenon.

Biography
Ashley Gasiorowski is currently pursuing her Bachelor of Science in Biology at Kansas State University. She is enrolled in the Veterinary Scholars Early Admission Program and Honors Program. She has previously worked as a Laboratory Assistant in the Department of Plant Pathology, as well as at Kansas State’s Olathe campus. She is continuing her passion for research as a student researcher under Dr. Rob DeLong in the Department of Anatomy and Physiology. Her research interests include veterinary science and medicine with hopes of becoming a veterinarian.

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