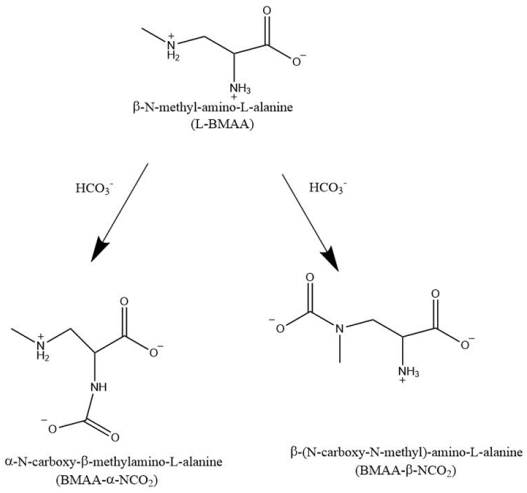
Bridges Scholar: **Pedro Diaz-Parga** Mentor: **Dr. Joy Goto, Chemistry**

On the Mechanism of BMAA

The environmental neurotoxin beta-Methylamino-L-alanine (BMAA) is considered an etiologic factor in the development of amyotrophic lateral sclerosis (ALS) and ALS-parkinsonism-dementia complex (ALS/PD). The structural moiety of the non-protein BMAA alone is not able to decisively produce neurotoxicity within the neuronal environment. However, in the presence of bicarbonate (HCO_3) BMAA undergoes structural alterations to give two different compounds known as the α-carbamate adduct and the β -carbamate adduct. Of the two adducts formed, the β-carbamate adduct contains the greatest structural similarity to the primary excitatory neurotransmitter, glutamate. Both compounds are elongated chains with an acidic carboxyl group at the opposite end. Based on the similarities of both structures and the ability of the glutamate to bind to the ionotropic receptors (iGluRs) it is highly likely that BMAA and its adducts are also able to affect the iGluR as either partial, full, or biased agonist. Considering the onset of ALS/PD does not occur acutely, but rather, over an extended period, the mechanism by which BMAA exhibits its excitotoxicity effects must be through continual neuronal stress in the neuronal milieu. The lack of acute neurotoxicity suggests the dynamic equilibria between BMAA and its respective adducts are variable during periods of metabolic and neuronal stress. Identification of the primary adduct formed, as well as, how it is affected by various conditions such as pH, metals, and regulatory compounds are important in order to identify a possible mode of action for BMAA in the neuronal environment.

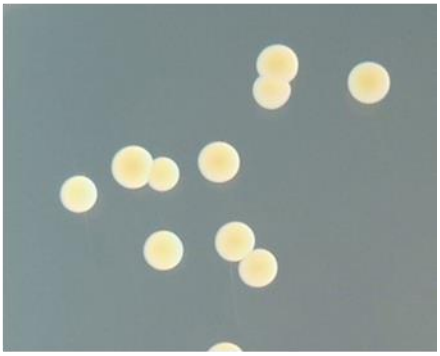


Bridges Scholar: **Leslie Dominguez** Mentor: **Dr. Mamta Rawat, Biology**

On Biofilm Formation

We are investigating how DTT a reductant and Diamide an oxidation affects biofilm formation on three species of interest, Mycobacterium smegmatis, Candida albicans and Staphylococcus auresus. This study will allow for further understanding of different biofilms and the effects of environmental stresses and provide potential drug targets.





Bridges Scholar: **Maria Mendoza** Mentor: **Dr. Jason Bush, Biology**

Neural Stem Cells and Irradiation

Cranial radiotherapy is often used to treat brain tumors; however, cognitive decline has been observed as a consequence of this therapy and there are currently no preventative measures that can be taken to avoid this side effect. Much attention has been centered on functions that are dependent on the hippocampus since multipotent stem cells are concentrated here (Gage 2000). Recent studies show a reduction in the number of neurogenic cells (Monje ML. et al. 2007) and mature neuronal loss in the dentate gyrus portion of the hippocampus (Raber J. et al. 2004; Fan & Weinstein 2007). It has been demonstrated that MNPs that received varying levels of irradiation exert acute and chronic levels of oxidative stress (Limoli CL et al. 2004;2004;2006;2006;2007; Giedzinski E. et al. 2005). I propose to differentiate neural stem cells (NSCs) into neurons, astrocytes, and oligodendrocytes. I will then irradiate the 3 differentiated cell types in addition to the undifferentiated cells at varying levels of irradiation. I will then proceed to evaluate the damage with NMR and various fluorescence microscopy assays.

The purpose of my project is to address a current gap in scientific knowledge pertaining to how multipotent neural precursor (MNPs) cells are affected after receiving varying levels of irradiation. I believe that the use of mitochondrial protectants might help reduce the damage to both NSCs and differentiated cells after irradiation. The objectives are (a) Grow and differentiate NSCs into neurons, oligodendrocytes and astrocytes, (b) Irradiate the 4 cell types without neuroprotectants and evaluate the damage with a variety of fluorescence microscopy assays and NMR and (c) Administer neuroprotectants to the 4 cell types and irradiate them and evaluate the damage in the same way as objective 2.

Bridges Scholar: **Randy Espinoza** Mentor: **Dr. Jai-Pil Choi, Chemistry**

Colorimetric Detection of Alkali and Heavy Metals by Crown Ether Functionalized Au_{25} Clusters

Gold nanoparticles have been well studied over the past century garnering attention within many disciplines finding wide use in applications such as drug delivery, catalysis, and as chemicals sensors. Gold nanoparticles <3 nm like Au_{25} are a whole new class of nanoparticles which possess rich optical and electrical properties different from their larger cousins. Since their discovery have been under constant investigation. Our work focuses on studying fundamental electronic and optical properties of Au_{25} functionalized with crown ethers and doped with heavy metals. Crown ethers are well known to chelate cations in solution potentially serving as interactive extensions of Au_{25}. Recent findings have led to an unexpected reaction between Au_{25} and Hg^{2+}. When mercury is introduced to a solution of Au_{25}, a change in its electronic features are observed, which might suggest alterations within the gold core. Our focus is to study the electrical, optical, and physical properties of crown ether functionalized Au_{25} and Au_xHg_y clusters by cyclic voltammetry, UV-Vis spectroscopy, and fluorescence.

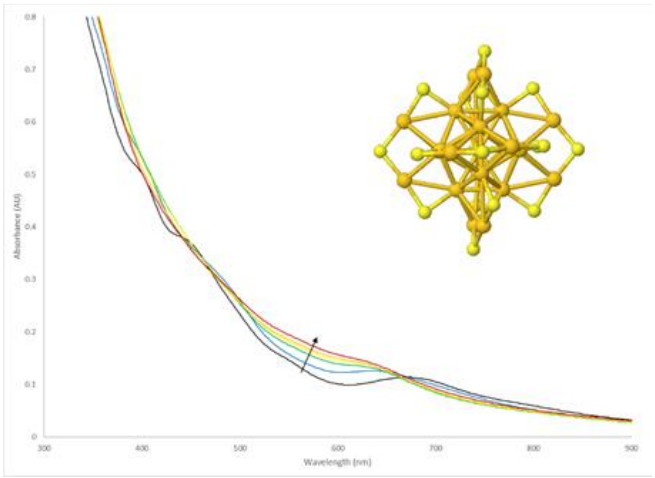


Figure: UV-Vis of Au_{25} (black) as Hg^{2+} is introduce into the solution and a model of the thiolate-stabilized gold core in its native form prior to mercury substitution.

Bridges Scholar: ***Catalina A Olea*** Mentor : **Dr. Laurent Dejean, Chemistry**

There is an imbalance of cell death observed in cancer such as in lymphomas. In other words, there is variation in the anti-apoptotic and pro-apoptotic expression levels. The B-cell lymphoma 2 (Bcl-2) family proteins that regulate cell death, it can have a pro-apoptotic or an anti-apoptotic effect. Current studies show that Bcl-2 is overexpressed in cancer patients. Patients that have high levels of Bcl-2 tend to have a resistance to chemotherapy. Monitoring the express levels of Bcl-2 in cancer patients is important to provide the most optimal treatment for the patient. The Bcl-2 family protein is localized in the outer membrane of mitochondria. They can be identified by their four domains: BH1, BH2, BH3, and BH4. Members of the Bcl-2 that have an anti-apoptotic response include Bcl-2, Bcl-xL, and Bcl-w. Cancer cells need the energy to survive, their metabolism can be explained by the Warburg effect.

The Warburg effect shows that there is an increase in anaerobic glycolysis vs mitochondrial oxidative phosphorylation. In the 1920s, Otto Warburg observed that cancer cells tend to uptake glucose at high rates compared to normal cells. The consumed glucose is then secreted as lactate instead of being oxidized completely. Tracking the metabolic pathway using the stable isotope Carbon-13 (C-13) will provide a better understanding of cell metabolism. The in vivo labeling of cancer cells (Bcl-2, Bcl-xL) with C-13 glucose will help keep track of the glucose consumption and lactate production. Gas Chromatography Mass Spectrometry will be used to study changes in the cell metabolic pathway.

Bridges Scholar: ***Fatima Hidalgo*** Mentor: **Dr. Ulrike Muller, Biology**

On Biomechanics of Suction Feeding

My research project is about the suction feeding of small organisms. I will build a robotic model of a bladderwort which will aid in studying the suction feeding off that organism. This model will allow us to see the feeding event at a more reasonable time frame, and also how small the gap can get and still have a successful feeding event. To better understand the actual feeding event, I have done high-speed filming of a few feeding events of Utricularia praelonga. Plants in the genus Utricularia are carnivorous plants.

Bridges Scholar: ***Anthony Waterston*** Mentor: Dr**. Laurent Dejean, Chemistry**

A Method to Assess Reactive Oxygen Species Production in Alveolar Macrophages Exposed to Particulate Matter

There is a well-established link between atmospheric particulate matter with a diameter smaller than 2.5 □m ($PM_{2.5}$) and adverse health effects. $PM_{2.5}$ exposure has been associated with reactive oxygen species (ROS)-linked oxidative stress. For the investigation of PM-associated ROS generation, the dichlorofluorescein-diacetate (DCFH-DA) fluorescent probe is applied in a 96-well microplate format to measure relative ROS levels induced in alveolar macrophages. The objective of this study is to establish a method for the detection of ROS production induced in alveolar macrophages in response to $PM_{2.5}$ samples collected in the areas of Fresno and Claremont, California.

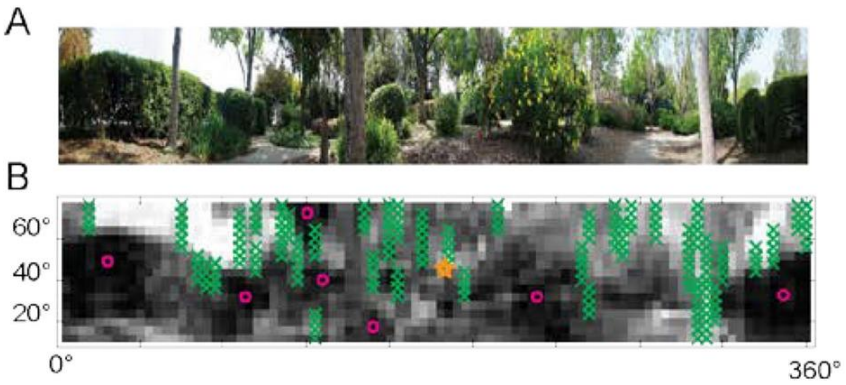
The macrophage-based ROS detection assay standardized in this study is a part of an integrated approach, which involves the chemical characterization of a unique set of $PM_{2.5}$ samples and the analysis of these $PM_{2.5}$ samples in both cell-based and cell-free models. The goal of this project is to analyze a collection of 15 $PM_{2.5}$ samples with the bioassay and to compare the ROS measurements obtained to the chemical composition of the samples.

Bridges Scholar: **Reo Maynard** Mentor: **Dr. David Lent, Biology**

On Short-range and Long-range Visual Navigation of Insects

Wood ants (*Formica rufa L.*) are minuscule creatures, yet navigate in a very large world. They are among the many ant species that rely chiefly on their sense of vision for navigation in their environment. Studies have shown that wood ants use the skyline panorama to obtain long-range navigation cues for both returning to a previously-identified location, such as a food source, and for returning to their nest upon completion of the trip.

For short-range navigation, the chief visual cues to the ant come from images that present a relatively unstable image on its retina. These objects generally are closer to the ant. As such, as the ant travels past such objects, their orientation changes with respect to the ant's position.



My current research will determine which features in the wood ant's visual panorama are the most useful for both short-range and long-range visual navigation. To determine this, I will be analyzing the ants' abilities to separate stable and unstable visual cues by using a virtual environment where both skyline (long-range) and oriented-edge (short-range) visual cues can be manipulated, and animal output can be measured and recorded. These findings will elucidate how the animal utilizes short-range (i.e. unstable) navigation cues when necessary (generally for obstacle avoidance), and how these short-range course adjustments can be corrected over long distances with a high degree of accuracy through the inherent stability of the skyline panorama.

The overall subfield of Biology is Neurobiology (sometimes called Neuroscience - the study of the anatomy and physiology of the central and peripheral nervous systems). I plan to transition species to *Drosophila melanogaster*, the common fruit fly, at UC Merced. There I will investigate ways in which fruit flies interact with alcohol and how their thirst reflex can be manipulated for possible therapeutic remedies into various illnesses.