Research Projects in the
Molecular Immunotherapeutics Research (MIR) Lab

The Molecular Immunotherapeutics Research (MIR) lab is at the forefront of developing innovative solutions for autoimmune diseases, cancer, and neurological disorders. By using in silico techniques, molecular docking, homology modeling, and other biochemistry computational tools, the MIR lab accelerates the discovery of promising drug candidates to combat current and emerging health issues, develop bio-tools that help us to understand structure function relationships, and expand computational methods and tools for structure analysis and prediction.

Current research initiatives which post-baccalaureates can pursue include:

1. Protein Engineering for Autoimmune Disorders
The MIR lab is designing targeted therapeutic proteins to treat autoimmune diseases such as primary membranous nephropathy and systemic lupus erythematosus. These engineered proteins aim to modulate the immune system precisely, reducing reliance on broad-spectrum immunosuppressants and minimizing side effects.

2. Structural Modeling of Uncharacterized Proteins
To advance understanding of autoimmune diseases, cancers, and neurological disorders, the MIR lab is developing 3D models of previously uncharacterized proteins. A notable achievement includes the homology modeling of the thrombospondin type-1 domain 7A (THSD7A) antigen, associated with PMN. These models help elucidate protein functions and guide the development of targeted therapies.

3. Development of Novel Therapeutic Compounds
Focusing on histone deacetylases (HDACs), the MIR lab is designing selective inhibitors to treat various cancers and neurological conditions. Efforts include developing HDAC8 inhibitors for neuroblastoma and HDAC4 inhibitors for disorders like Huntington's disease and glioblastoma. These compounds aim to offer more effective and less toxic treatment options.

4. Computational Design of Therapeutic Agents for Coronaviruses
The MIR Lab also employs computational methods to design and develop therapeutic agents, including biotools, proteins, and pharmaceutical compounds which could treat coronaviruses. This research focuses on identifying small molecule inhibitors and protein-based therapies that can interfere with key viral mechanisms, such as spike protein binding and viral replication disrupting the viral impact. Through these projects, the MIR lab is contributing to the advancement of targeted therapies, with the goal of improving treatment for viral diseases.