

## **Protein Products from Plants and Pichia: Novel Manufacturing of Analgesics and Cannabinoids**

Cannabinoids and opiates are widely used classes of pharmaceuticals; unfortunately, these drugs have strong psychoactive effects or can be addictive. Our project consists of two ideas, both revolving around utilizing bioengineered microorganisms to create non-psychoactive cannabinoids and non-addictive analgesics. To achieve this, we developed two projects: (1) Manufacturing a protein expression system to produce CBDA synthase in tobacco plants using *Agrobacterium*, (2) Engineering the pGAP $\alpha$  vector system to express the mambalgin in *Pichia Pastoris* as a continuation of the 2014 GSU iGEM project. Simultaneously, we developed a proof of concept using horseradish peroxidase. By the end of this project, we hope to have produced a synthetic biological system to manufacture pharmaceutical alternatives for patients that suffer from diseases such as epilepsy, cancer, or severe chronic pain.