

Cannabinoids, opiates, and venoms are used in the production of pharmaceuticals; unfortunately, these drugs can have adverse side effects or be costly to manufacture. With our project we aim to produce biological systems that manufacture the conjugates of these pharmaceuticals that have less adverse side-effects, lack addictive properties, and are inexpensive. To achieve this, three protein expression systems were designed: (1) An Agrobacterium based system in tobacco plants for the synthesis of CBDA synthase, (2) Engineering the pGAPz alpha vector system to express mambalgin in *Pichia pastoris*, (3) and Manufacturing the constructs of Lethal Toxin-Neutralizing Factor LNTF-10 and LNTF-15 which are serum derivatives of the *Didelphis virginiana* (opossum) in the pSBC13 vector for assembly in *Escherichia coli*. By the end of this project, our goal is to have designed systems that produce cheap pharmaceutical derivatives for patients who suffer from chronic pain, epilepsy, or the misfortune of a snake bite.