

Project Title: BTK Inhibitor Subcutaneous Implant for the Prevention of Anaphylaxis

Millions of people experience severe allergic reactions every year, many which result from food or insect stings. When an allergic reaction becomes severe, and possibly life-threatening, it is called *anaphylaxis*. Anaphylaxis is characterized by swelling of the face, skin rashes, nausea, and difficulty breathing. The most common treatment is to inject epinephrine into the thigh of a person who is experiencing anaphylaxis. However, these injections are both expensive and inefficient. For example, the injector needs to be replaced every 12-18 months, which means that patients who avoid an allergic reaction will need to throw it away and replace it before it is even used. Our group proposes a solution that prevents life-threatening anaphylaxis from happening at all: a refillable implant which slowly releases a medical drug into the bloodstream that has been shown to prevent anaphylaxis. This drug is called a *BTK inhibitor* and prevents anaphylaxis by inhibiting a specific protein in our blood that is responsible for the allergic reactions. Because this type of drug is already FDA approved to treat certain blood cancers, we know that it can be safely administered to people with the approved dose. Our proposed implant design consists of a 5 cm long, 1 cm wide cylinder rod made out of a flexible plastic attached to a 2 cm long refill reservoir with a refill port. In our project, we developed computer models with to determine drug release parameters and implant strength. From our computer models, we found that the implant would release an average of 25 mg per day, and a refill would be necessary every 35 days. Though the implant is larger than similar implants on the market due to the required daily dose necessary to prevent anaphylaxis, our implant leverages the benefits of preventing a life-threatening anaphylactic shock against the inconvenience of its size. Our goal is to prevent anaphylaxis from occurring and eliminate the need for an emergency injection of epinephrine.