For the roughly 40 percent of Americans who will develop cancer at some point in their lives, chimeric antigen receptor T cells (CAR-Ts) offer an exciting new avenue for treatment. CAR-Ts work by targeting a tumor-specific antigen to selectively destroy cancer cells without harming normal tissue. Although CAR-Ts have enjoyed some success in clinical trials, cancer cells can drop the targeted antigen to evade lysis, necessitating the non-trivial process of designing and testing a new CAR-T. Also, persistent CAR-T activity can be toxic to healthy tissue. To avoid these issues, we created a universal CAR-T system that maintains a high binding affinity for tumor cells while also offering greater control over toxicity and more nimble design adaptability for treating a wide array of cancers.

**Technology Description**

With our system, patients would receive two treatments. The first involves a biotin-tagged antibody that binds to tumor cells. The second involves CAR-Ts that react with the tagged antibodies on the tumor cells. By separating the tumor-associated antigen from the CAR T cell, this system is much easier to adapt to changes in tumor antigen expression. Furthermore, it offers the potential for lower toxicity because the CAR T cell potency is directly controlled by the concentration of tagged antibody. Compared to other biotin-binding CARs, our engineered affinity-enhanced monomeric streptavidin 2 (mSA2) biotin-binding protein domain has a 25-fold stronger affinity. When incubated together with target cells and various biotinylated tumor-specific antibodies, our adaptable mSA2-CARTs had comparable potency to traditional CARs.

**Advantages**
- A single population of CAR T cells can target multiple tumor antigens
- Potential for reduced toxicity
- Anti-tumor efficacy on par with single-antigen CAR-Ts
- Can be used with the ever-increasing list of FDA-approved tumor-targeting antibodies

**Applications**
- Treating a wide array of tumor types
- Screening antibody candidates for tumor antigen targeting drug development

**Stage of Development**

*In vitro data*

**IP Status**

Provisional patent application filed

Two types of mSA2-CAR T cells demonstrated biotinylated antibody dose-dependent tumor cell lysis.
Dr. Lohmueller is an American Cancer Society postdoctoral fellow in the lab of Dr. Olivera Finn, where he is using synthetic biology approaches to create novel cancer immunotherapeutics. His major research focus is the development of CAR T cell therapy to treat solid tumors. Toward this goal he has generated antibodies and CAR T cells targeting tumor-specific glycoforms of the MUCIN 1 (MUC1) glycoprotein, found on >40% of all cancer cases. He is also working to engineer CAR T cells to overcome the immunosuppressive solid tumor micro-environment by combining synthetic gene networks and chemical biology tools. Jason carried out his PhD studies in the laboratory of Dr. Pamela Silver at Harvard.

Education
PhD in Microbiology and Molecular Genetics
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Selected Publications


