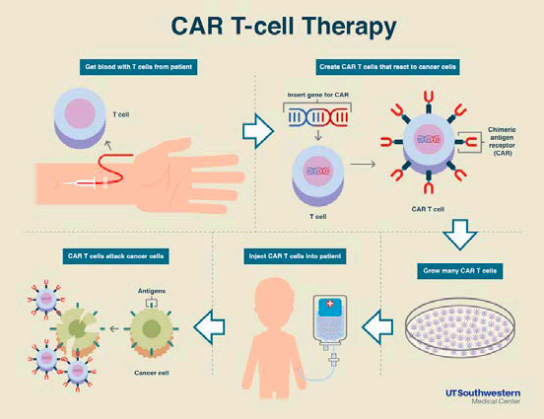
Project 3. CAR-T therapy

Background: In this project, we will study model calibration and therapy optimization of CAR-T therapy to glioma cancer. CAR-T therapy is a novel immunotherapy, an adoptive cell therapy, where the T cells are extracted from the patient's blood and then add an artificial receptor, called a 'chimeric antigen receptor', to their surface. When the modified cells are infused back into a patient's body, they begin multiplying and attacking tumor cells. However, despite the therapy's success in blood cancer, it has not shown the same degree of efficacy in solid tumors. Moreover, the patients suffer from serious side-effects.



Goal 1. Bayesian model calibration [3] for data using model in [2].
Goal 2. Study models in [4] (more complicated) whether they can capture more sophisticated dynamics! (also whether the model parameters are identifiable)
Goal 3. Optimize treatment dose and schedule.
Goal 4. Models in [4] are for general cancer cells. Model specific to glioma cancer.

Tentative schedule: Study papers [2,3] ([4] is also an option) and modify code from [3].
Either Goal 3. OR Goal 2 then Goal 4

Brief biology review of CAR-T
[1] 'CAR T cell immunotherapy for human cancer' C. June et al.

[2] 'A mathematical modeling approach to explore kinetics of Chimeric Antigen Receptor (CAR) T-cell Response in glioma: the CARRGO model' P. Sahoo et al.

[3] 'Bayesian calibration, validation and uncertainty quantification for predictive modeling of tumour growth: a tutorial', *J. Collis et al.*

Math modeling review of cancer and immune cell interaction
[4] 'Ordinary Differential Equation Models for Adoptive Immunotherapy' A. Talkington et al.

Future outlook: Think about how modeling/simulation can help overcome the challenges!!
'CAR T-cell therapy for glioblastoma: recent clinical advances and future challenges'
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6176794/pdf/noy032.pdf