Tell us about your career path, how did you land in the lab?

I became interested in pediatric oncology at a very young age. In middle school, I volunteered at a local Ronald McDonald House and I was profoundly struck by watching kids my own age who were suffering to an extent I had never seen before.

I was pretty good at math and science, and I like biology. I wanted to translate those skills into helping these kids; and to better understand why this happens to them and not others.

I attended Princeton University prior to earning my M.D. at Columbia University, where I also did my pediatric residency. During my time at the Morgan Stanley Children's Hospital, I learned a great deal from the mentorship of Dr. Prakash Satwani in pediatric bone marrow transplant. I performed clinical research, focused on improving outcomes and reducing toxicity associated with transplant.

When it was time for my fellowship, I decided to work in Dr. Kevin Shannon's laboratory at University of California, San Francisco, because I'm interested in continuing and expanding my research into leukemia, in addition to treating young patients in clinic. My three-year fellowship included a commitment to spending roughly half of my time in the lab, and the other half treating kids. I now spend closer to 80% of my time in lab and 20% caring for patients.

Leukemia has really led the way for cancer research, in general. Can you share the difference between the large percentage of children who survive, and those who relapse? And if a child suffers relapse, how does that change the prognosis?

Leukemia is the most common cancer of childhood. If you look at mortality, mortality in leukemia has improved tremendously over the years – thanks to major advances in research – but because leukemia is relatively common, the 5 – 20% mortality rate is still a very significant problem.

At diagnosis, if you ignore the specific risk stratification markers that we have, which are good but not great, we're still losing too many patients. For me, getting to know the patients has added layers of personal and emotional ties to this research. Watching what these children go through and experiencing the loss of patients has only reinforced my passion for this important work. Though a lot of progress has been made, we need to continue to work on identifying which patients are most likely to do poorly, and then determine ways to improve their chances of survival.

In cases where a patient's leukemia comes back after an initial remission, it is such a roller coaster. The prognosis worsens, and the treatment becomes more complicated. We need to do better on that front.

Do you think relapse is caused by treatment effect?

There are certainly cases of treatment-induced leukemias, yes, but the vast majority of leukemia diagnoses, and probably all cases of relapse, are not caused by treatment.

You reminded me of another important reason I'm studying this disease. Despite the fact that over 50 years survival rates have improved tremendously, it's important to note that the standard treatment for leukemia is 2-3 years of toxic chemotherapy. That is *so* significant for a young, developing body. The children are impacted physically, psychosocially, emotionally and developmentally. The side effects from such harsh treatment at such a young age range from vastly reducing life expectancy, to short-term mortality.

I often think about how we, as clinicians, wear gloves to protect ourselves from making contact with the medications that we pump into these children. Yes, we are aiming to save their lives, but we need to continue to improve protocols to reduce the side effects and toxicities associated with therapy. This is directly related to my research into glucocorticoid resistance.

What happens if a child relapses?

My heart just breaks for these poor families who suffer relapse. Parents are first hit with the news that their child has leukemia. The children go through all of that difficult treatment, many suffer greatly, and then after all of that the disease returns.

Once a child relapses, all of a sudden the chances for survival become far lower. It is a profoundly emotional and difficult journey for patients and families. Recent advances have thankfully improved survival in some types of leukemia, particularly B-cell ALL.

My research may help to identify patients who are more likely to relapse at the onset of the disease. The ultimate goal here is to adjust treatment protocols to address those patients differently in an attempt to spare patients unnecessary harm and improve the likelihood of survival.

Please describe the research that is being funded by the Ty Louis Campbell Foundation?

All lymphoid malignancies, B-cell and T-cell, are treated with chemotherapy and steroids (glucocorticoids – these are ancient drugs – maybe 60 years old). When used to treat acute lymphoblastic leukemia (ALL), steroids happen to be really good at killing leukemia cells, but the method in which they do so is not very well understood.

A review of data from Europe, where they use slightly different protocols, piqued my interest in studying steroids in treatment for ALL. In Europe, ALL patients first receive 7 days of just steroids to bring down disease prior to chemotherapy (in the US, these medications are administered simultaneously). If we study patients' response to steroids in just that first week, we can really stratify how well these kids are going to respond to treatment in the long-run. This shows that some patients are inherently less responsive to steroids even as early as the time of diagnosis. Others, we know, acquire ways to resist steroids later on in treatment.

I aim to better understand what is different about the children who respond poorly to steroids and how to identify them. Some patients may not respond to steroids at all – yet, we still give them to these patients.

So, my vision ultimately drills down to personalized medicine. My goal is to identify the patients who will benefit from steroids, and those who won't, and potentially add another agent to steroid delivery to make them more effective for those who don't. Or, at a minimum, we could spare kids who won't respond unnecessary short- and long-term side effects of steroids.