

Position title: Thesis Research Opportunity / Dana-Farber Cancer Institute/Harvard Medical School, Boston (for Spring 2027/ Fall 2027)

Project description and duties: Developing novel immunotherapies to treat cancer

Immunotherapy has transformed cancer treatment, yet a substantial proportion of patients still fail to respond effectively. In our research, we leverage protein engineering to develop innovative immunotherapeutics, diagnostics, and prognostic tools that enable more effective treatment, precise detection, improved characterization, and ultimately, the prevention of cancer.

A central focus of our lab is enhancing the activity and persistence of **CAR-T cells**. Although CAR T-cell therapy has revolutionized the management of several hematologic malignancies, many patients relapse due to limited durability of response. To address this, we are developing novel immunotherapeutics and engineering next-generation CAR constructs that promote a memory-like phenotype in CAR T and TCR-T cells.

We recently published a novel approach, demonstrating a strategy to significantly improve CAR T-cell efficacy and persistence: (<https://www.nature.com/articles/s41587-024-02339-4>, and <https://jitc.bmj.com/content/jitc/14/2/e013665.full.pdf>). In parallel, our lab is exploring strategies to improve CAR T and TCR-T cell trafficking in solid tumors and mitigate T-cell exhaustion, key barriers to success in solid tumor settings. By overcoming these challenges, our goal is to enable longer-lasting responses and reduce relapse rates for patients across cancer types.

We are also interested to leverage protein engineering to develop novel whole-body immune-imaging probes that can inform about immunotherapy responses or guide making informed decisions with inflammatory diseases. We have recently developed a new PET imaging approach to noninvasively detect CAR-T cells (<https://www.science.org/doi/10.1126/sciadv.adn3816>); and developed a breakthrough PET imaging approach to detect inflammation (*Nature*, 2025, <https://www.nature.com/articles/s41586-024-08441-6>).

These advancements have opened several exciting new directions for our lab, which we aim to explore in the coming years: **a)** Can we develop novel immunotherapeutics to prevent T-cell exhaustion and address the challenges of solid tumors? **b)** Can we enhance trafficking of T-cells? **c)** Can we develop imaging probes to reliably detect heart inflammatory conditions, such as myocarditis and cardiac sarcoidosis? Can we establish reliable methods for the early detection of difficult-to-diagnose cancers, such as pancreatic cancer, or conditions like endometriosis? **d)** Can we create precision immunotherapeutics for autoimmune diseases that specifically target and deplete pathogenic B or T cells?

Skills required: Students with basic biology lab skillsets are encouraged to apply. Students will have the opportunity to work with senior scientists in the lab who will provide training in various lab techniques.

Learning outcomes: developing research skills such as study design, data analysis methods, presentations, scientific writing, and attending seminars/conferences at Dana-Farber/Harvard, as well as lab skillsets such as CAR T-cell production, various T-cell characterization assays, protein engineering, protein expression and purification, ELISA analysis, generating stable cell lines, cell culture, western blot analyses, protein labeling, and working with instruments such as FPLC, microscopy, and flow cytometry.

Note: We have hosted several master's students in our lab, including from EPFL, who have gone on to pursue PhD or MD programs at prestigious institutions such as EPFL, ETH Zurich, LMU, Johns Hopkins, the University of Pennsylvania, and others.

Mentoring: senior graduate students and postdocs in the lab will be mentoring students. The PI will have regular weekly meetings with students as well.

Student stipend: positions are volunteer positions; however, partial funding will be available from the PI laboratory based on the applicant's prior lab experience; additionally, the PI will work with students to apply for available fellowship programs.

Application information: motivated students should contact Dr. Rashidian at mohammad_rashidian@dfci.harvard.edu

Contact information: Mohammad Rashidian, Ph.D.
Associate Professor, Department of Cancer Immunology, Dana-Farber Cancer Institute,
Associate Professor, Harvard Medical School