

CHEMICAL ENGINEERING

UNIVERSITY of WASHINGTON

SEMINAR



Jessica C. Stark
American Cancer Society Postdoctoral Fellow
Stanford University

Engineering (Glyco)immunology

Monday August 8th

Lecture 4:00-5:00 p.m. | Physics/Astronomy
Auditorium (PAA) A118

Reception 5:00-6:00 p.m. | Benson Hall Lobby



Bio

Dr. Jessica Stark is currently an American Cancer Society Postdoctoral Fellow with Prof. Carolyn Bertozzi at Stanford University. Her postdoctoral work focuses on identifying and targeting glyco-immune checkpoints for cancer immunotherapy. As an NSF Graduate Research Fellow with Prof. Michael Jewett at Northwestern University, Jessica developed new, portable technologies for glycoprotein therapeutic and vaccine biomanufacturing. Previously, she received her B.S. in Chemical and Biomolecular Engineering from Cornell University, supported by an Irwin and Joan Jacobs Engineering Scholarship. Jessica's work has been recognized with multiple awards and honors, including an NIH/NCI Postdoctoral Fellowship, a Hanna H. Gray Fellow Finalist Award, a Clare Boothe Luce Graduate Fellowship, an NIH Biotechnology Training Program Fellowship, induction to the Sigma Xi Scientific Research Honor Society, and the Northwestern Chemical Engineering Department's Distinguished Graduate Researcher Award. Jessica is committed to enhancing diversity, equity, and inclusion in STEM through mentoring, outreach, and service activities, most recently as a selected member of the Stanford Chemistry Department's Equity and Inclusion committee. To support this work, Jessica co-developed and launched commercial BioBits® educational kits that promise to increase access to high-quality biology education by facilitating hands-on learning.

DYSS2022

Abstract

Engineering the immune system has resulted in some of the greatest successes in modern medicine: from vaccines that can prevent or even eradicate infectious disease, to cancer immunotherapies that have resulted in decades-long remission in select patients. Looking forward, immunoengineering promises to yield the next generation of therapies for unmet medical needs in infectious disease, autoimmunity, and cancer. However, a key challenge facing the field is our limited understanding of how the immune system recognizes and responds to glycoconjugates. Glycoconjugates – biopolymers decorated with sugars, or glycans – coat the surface of every cell. The chemical structures of appended glycans are often altered in disease states and can contribute to pathogenesis by modulating immune responses. Thus, glycoconjugates represent a vast set of attractive, yet mostly untapped, disease specific antigens and immunotherapy targets.

My work has resulted in a suite of technologies for elucidating and engineering the immune response to glycoconjugates. I engineered a cell-free, or in vitro, technology for on-demand and portable production of conjugate vaccines (iVAX; **Fig 1a**). Conjugate vaccines are a class of glycoprotein vaccines that use bacterial cell-surface glycans to elicit immunological memory of bacterial pathogens. I showed that cell-free synthesized vaccines elicited glycan-specific immune memory that protected against lethal pathogen challenge, the first demonstration of efficacy for a molecule produced in a decentralized biomanufacturing platform (**Fig 1b**; Stark & Jaroentomeechai et al 2021). The cell-free approach can further be used for rapid and facile biosynthesis of glycoproteins bearing a variety of user-specified glycan structures, which promises to accelerate interrogation of their immunomodulatory properties (Jaroentomeechai & Stark, et al 2018; Kightlinger, ..., Stark, 2019; Stark, et al, in press).

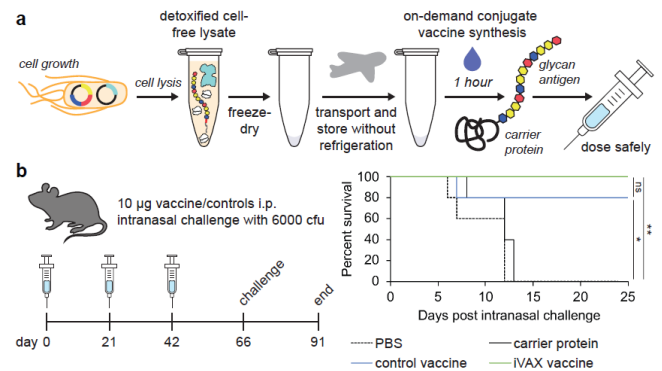


Figure 1. (a) The iVAX platform enables on-demand and portable production of conjugate vaccines. (b) Conjugate vaccines against *F. tularensis* completely protected mice from lethal pathogen challenge, providing protection equivalent to a vaccine produced using current state of the art technology.

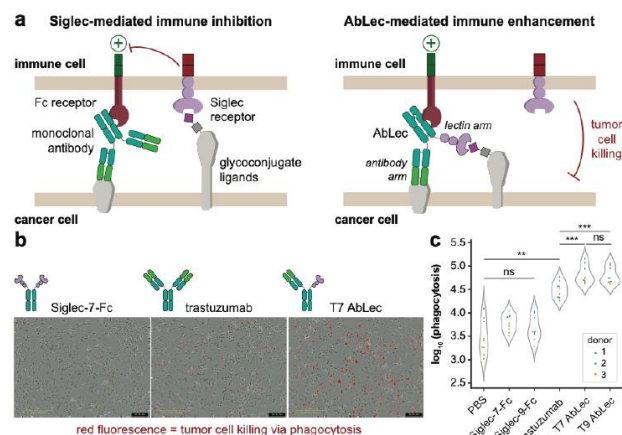


Figure 2. (a) AbLecs potentiate enhanced anti-tumor immune responses by blocking engagement of inhibitory glycan-binding receptors (e.g., Siglecs). Treatment with AbLecs enhanced tumor cell killing by human donor-derived macrophages compared to monospecific controls (b), and this effect was significant across 3 distinct donors (c).

2022). This approach has resulted in the identification of previously unknown immunomodulatory glycoconjugate antigens that represent potential targets for immunotherapy (Stark, et al in prep; Biering, ..., Stark, et al in press).

Collectively, my work has helped elucidate the roles of glycoconjugates in disease and resulted in new technologies for glycan-targeted vaccines and immunotherapies. My independent research group will champion DEI while continuing to study and engineer the immune response to glycoconjugates, yielding next-generation immunotherapies for infectious disease, autoimmunity, and cancer.