

Sabbatical Report for the Fall Semester of 2016

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The purpose of this sabbatical was to enrich my professional development and better my currency within my field of research. In the Fall of 2016, I performed research at UCSF, as well as in my own lab here at SSU. During this time, I learned several new techniques, created many novel reagents, and generated substantial amounts of data, some of which will have a direct impact on the curricular content at SSU.

Project

My lab studies the molecular, cellular, and biochemical effects of protein oxidation during the immune response. Specifically, my lab focuses on how oxidation within immune cells can lead to impaired immune responses and chronic immunologic disease states. One critical enzyme for the protection against oxidants is peroxiredoxin (Prdx1). Prdx1 breaks down hydrogen peroxide (H_2O_2), which can damage cells, and converts it into water (H_2O). While it is clear that Prdx1 is critical in regulating the immune response, several questions remain surrounding how Prdx1 can protect enzymes such as protein tyrosine phosphatases (PTPs) from oxidants (Ex. Fig 1).

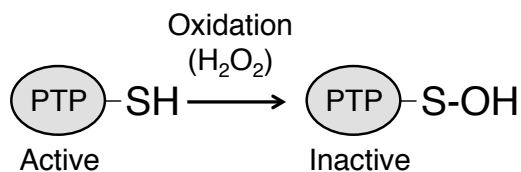


Figure 1: Inactivation of protein tyrosine phosphatases (PTP) by H_2O_2 : All PTPs utilize a cysteine residue to function. Oxidation of the catalytic cysteine residue from a thiol (R-SH) to a sulfenic acid (R-S-OH) renders the PTP inactive.

One of the most exciting advances in the past few years has been the utilization of CRISPR technology to alter the genome within cells (See Fig 2 below). In 2015, this technology was identified as the biggest breakthrough in science and therefore I felt it was important to familiarize myself and utilize this groundbreaking technology.

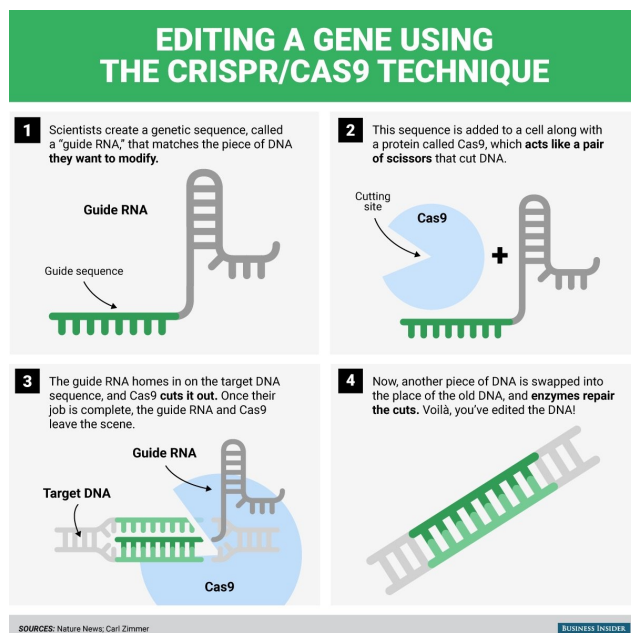


Figure 2: Summary of CRISPR technology. (From: Nature News, Zimmer, C. 2015)

During my sabbatical, I was able to learn and perform several experiments involving CRISPR technology. Ultimately, I generated multiple immune cell lines that are genetically deficient in Prdx1 and other genes thought to be involved immune cell regulation.

Although my sabbatical is now over, research in my lab will continue to be performed by undergraduate and graduate students. They will continue to characterize these unique cells. This sabbatical has generated countless projects for the students in my lab and several avenues of investigation for the future. Additionally, I will bring in some aspects of my sabbatical into the upper division courses I teach, especially Immunology (BIOL 480). This sabbatical has tremendously enhanced both my professional development and my currency within my field of research.