Healthy mitotic cells, or cells undergoing normal division and growth, are often damaged during human cancer treatments, leading to adverse side effects. This is because abnormally high mitotic rate is one of the hallmarks of cancer cells, and chemotherapy treatments that target this characteristic unfortunately get healthy mitotic cells caught in the fray, causing them to go through cell death, or apoptosis. One normal tissue this increased apoptosis damages is the bone marrow, since bone marrow tissue is hematopoietic, or bone cell-forming, and thus very mitotic. This effect on bone marrow tissue raises a vital question about the full range of unwanted chemotherapeutic effects on the immune system, which includes white blood cells produced by the bone marrow.

To target this question, I will use the tobacco hornworm Manduca sexta to study the effects of irradiation-induced apoptosis on immune cell response. Since M. sexta contains clusters of highly mitotic cells called imaginal discs, these clusters exhibit apoptosis following irradiation damage (Halme et al. 2010), mimicking the healthy tissues incidentally affected by chemotherapeutic treatment. In addition, there are conserved signaling molecules across invertebrates to vertebrates that play a role in immune cell response.

I hypothesize that irradiation damage to the mitotic imaginal disc tissue affects the proliferation of circulating hemocytes, which would suggest that there are chemical signals from the damaged tissue that target the insect’s immune cells. In addition, the characterization of this effect will be similar through manual as well as flow cytometry analysis. Characterizing the immune effects of these changes in the larval tobacco hornworm Manduca sexta is a holometabolous insect whose hemocyte population fluctuations — upon developmental or immune cues — have largely been documented using manual hemacytometry. Quantification of these changes has thus been honed through the use of flow cytometry, and in this method as well as a hemacytometry for validation, including hemocyte populations have been found to decrease upon X-ray irradiation damage.

ABSTRACT
Hemocytes, insect blood cells, are comprised of about five classes of cells which play key roles in the life cycle and immune response: the most numerous of which phagocytes invading microbes (Bazinet et al. 2008, Horovitz & Danis 1982) in similar fashion to human macrophages. Hemocytes of Drosophila melanogaster are a homoeologous insect whose hemocyte population fluctuations — upon developmental or immune cues — have largely been documented using manual hemacytometry. Quantification of these changes has thus been honed through the use of flow cytometry, and in this method as well as a hemacytometry for validation, including hemocyte populations have been found to decrease upon X-ray irradiation damage.

INTRODUCTION
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QUESTION
What is the link between mitotic cell damage and immune cell response?

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