# 2025 Summer Scholar Profile: Chaeli Place

My name is Chaeli Place, and I am a rising senior at Northwestern University studying Cell and Developmental Biology with minors in Data Science and German. My research journey started at Northwestern in the lab of Professor Christian P. Petersen, where we use regenerative flatworms called planaria to investigate the process of replacing missing or damaged tissue. My current project involves studying the genes that allow these worms to regenerate their eyes in the correct place and with the proper cellular composition to function properly. This summer at the Buck Institute, Professor Malene Hansen hosted me in her lab, where I worked with Dr. Laurel Koch to study a different type of worm called *C. elegans*. These roundworms are much smaller than planaria and do not regenerate, but they are a great model for studying aging biology. The Hansen Lab investigates a cellular waste recycling process called autophagy, which cells use to prevent waste buildup and recycle raw materials. Cells collect waste in structures called autophagosomes, which are like the trash cans of the cell, and enzymes from another structure called the lysosome then break down the waste into smaller, reusable units. We know that older cells and some diseased cells, such as neurons in neurodegenerative diseases, accumulate waste, drawing a potential link between a decline in autophagy and a decline in health during aging and disease.

Reproductive aging occurs decades before the rest of the body ages, and staying healthy after the end of reproductive years is a prevalent challenge to women's health. The onset of menopause is not just about the end of reproductive years; it is also marked by a significant change in hormones that affects overall health, resulting in not only symptoms like changes in mood or sleep but also an increased risk of more serious health conditions, like osteoporosis, stroke, and even Alzheimer's disease. This decline in overall health occurs on average thirty years before the end of a woman's life. As human lifespan increases yet the onset of menopause is fixed around 50 years of age, women are spending more years at increased risk for disease. During my time in the Hansen Lab, I was asking whether a decline in autophagy in the reproductive system could cause not just a decline in reproductive health but also send signals to the rest of the body that lead to a decline in overall health.

*C. elegans* allow us to ask questions about how a process like autophagy in one tissue affects other parts of the body and the organism as a whole. My summer project involved studying autophagy in the germline. Autophagy has been studied and characterized in other somatic tissues of *C. elegans*, like the intestine and neurons, and we also know that autophagy in specific tissues like these is required for lifespan extension by various longevity paradigms, indicating that tissue-specific autophagy plays roles in keeping *C. elegans* alive for longer. My research goals were to 1) characterize autophagy in the *C. elegans* germline, asking how it responds to stress and aging, and 2) determine whether germline autophagy is involved in maintaining overall health, asking whether it is required for stress resilience and longevity.

In order to visualize autophagy in the germline, the Hansen Lab developed a new reporter strain with a fluorescently-tagged autophagy protein. When we tag this protein and monitor the animals under a microscope, we can quantify the number of autophagosomes ("trash cans") and extrapolate how much autophagy is occurring. I used this strain to observe germline autophagy for the very first time!

I then was able to use it in various ways to characterize germline autophagy. For example, I counted the number of autophagosomes in response to a mild stress called heat shock, which is subjecting the worms to a higher-than-comfortable temperature. I found that heat shock increases the number of autophagosomes in the germline, indicating that the germline, like other tissues, responds to mild stress through autophagy. I also looked at the effect of reducing autophagy in the germline on the worm's lifespan and ability to withstand heat stress, and the lab will continue studying potential connections between germline autophagy and overall health. Finding such links between germline autophagy and health during aging may inspire interventions in the reproductive system that could extend healthspan beyond reproductive years.