Campisi Lab

Our laboratory studies cell fate decisions, with an emphasis on cellular senescence, that drive the phenotypes and pathologies of aging. Cells constantly assess their functional state and tissue microenvironment to repair or overcome molecular and cellular damage. While these responses often benefit young organisms, they can become maladaptive during aging, such as when senescent cells accumulate with age. Many diseases are driven by senescent cells, which cause age-related chronic inflammation, including cancer, arthritis and osteoporosis, dementia and frailty, among others. To study cell fate decisions, we primarily use human and mouse cells and organoids *in culture* as well as mouse models.

Selected research projects (we are always open to new proposals too!):

One defining feature of senescent cells is the senescence-associated secretory phenotype (SASP). Although the SASP can be attenuated in different ways under specific circumstances, it is generally characterized by the secretion of a plethora of inflammatory and other factors, including growth factors, inflammatory cytokines, extracellular matrix (ECM) components and ECM degrading enzymes. These factors can promote cancer and contribute to cancer relapse, as well as affect the surrounding environment in specific organs. Recent reports of senescence accumulation in the eye have captivated the lab to study the pathology of senescence-related eye diseases, as aging can manipulate the ocular microenvironment possibly through a deleterious arm of the SASP. In addition to the eye, the lab is extensively profiling senescence in the brain. Using induced pluripotent stem cells as well as direct differentiation to derive various cell types of the brain, we aim to understand how senescent cells of one brain cell type affect neighboring non-senescent cells of various other brain cell types. Along with *in culture* models, the Campisi lab is also developing a new mouse model to enable the selective identification and elimination of senescent cells of specific cell types. The combination of current, human *in culture* methods and state-of-the-art *in vivo* models positions us to paint a more complete picture of senescence in the brain. This then allows us to pursue interventions to treat many neurodegenerative diseases associated with senescence, such as Alzheimer's, Parkinson's, and multiple sclerosis, to name a few.

An emerging concept in the field of senescence is that senescence is extremely heterogeneous. The senescence inducer, cell type, and cell state, to name only a few variables possibly contributing to the heterogeneity of senescence, may all play a role in the cell's fate after senescence induction and SASP composition. Some ways the lab is investigating this concept is through mutational burden prior to senescence induction, as well as how chromatin states affect senescence. The goal is to gain a better mechanistic and functional understanding of initial and senescent cell states to determine why these states are noticeably heterogenous in relatively similar environments.

Desired Skills or Experience: Cell culture, Western blot, qRT-PCR, and ELISA

To learn more about the Campisi lab, click HERE.
To apply to the Campisi lab, return to the Internships Homepage.