Undergraduate Summer Internship in Systems Biology

Internship Project Description: Summer 2018

Project Title: Dissecting the dark matter of cell death
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Project Description: All objects come to an end. So do the cells in our body. Two major ways for a cell to die are known: apoptosis and necrosis. Apoptosis is also known as "programmed cell death", because a protein expressed in cells triggers it in response to signals from the environment. For example, in most mammalian embryos the interdigital webbing between the fingers of the embryo is removed through apoptosis. Cells undergoing apoptosis enzymatically digest their contents and show rapid changes in shape. Apoptotic cells are eventually eaten up by adjacent cells, but have little effect on the surrounding environment. This "active" form of cell death is conserved through evolution.

The other form of cell death is necrosis. Unlike apoptosis, cells dying through necrosis change the environment significantly, bringing in immune cells from nearby blood vessels and triggering inflammation. Necrosis was originally considered a "passive" form of cell death, in contrast to the "active" death seen in apoptosis, because necrotic cells do not change shape a great deal while they are dying. Necrosis was originally not considered very interesting, because it was believed to take place when cells fail to adjust to environmental changes. However, this view has been changing over the last decade and biologists have gradually realized that necrosis can be an important warning signal for the body. For example, cells infected with viruses tend to die through necrosis. By "making a fuss", necrotic cells can effectively alert the body to the intruder – viruses. The association between necrosis and various human diseases has become an exciting area recently.

Our overall goal is to discover and characterize the physiological effects of necrotic cell death, particularly in normal liver and various cancer cell lines. We are using a combined chemical biology and systems biology approach, and students with a background (or interest) in either area are encouraged to apply. We have projects using both experimental and computational approaches, and if you join us we will adjust the project to suit your background and interests.