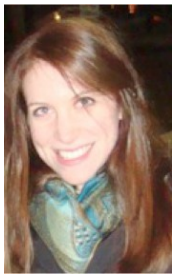
Are We Programmed to Age?

October 19, 2011

Potential anti-aging remedies are popular topics in the news and in advertising, playing on notion that aging is a biological mistake. But what if aging is instead a "necessary evil?" In this week's lecture, our speakers explore the theory that aging is programmed into all living and aging organisms and present evidence for and against this hypothesis.

Speakers:

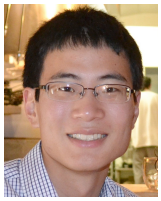


Sara Leiman is a second-year student in the Molecular and Cellular Biology graduate program at Harvard University. Her current research in Richard Losick's lab focuses on the complex communities of bacteria that underlay many bacterial infections, and aims to exploit normal bacterial functioning to address the growing need for new and improved antibiotics. Outside of the laboratory, Sara enjoys musical theater, playing the clarinet, and cheering on her alma mater's basketball team (Go Blue Devils!).

Sara will present the theory of programmed aging and explore the apparent contradiction between the universality of aging and the widely accepted concept in biology that processes limiting survival should *not* be universal.

Nick Weir is a Ph. D. student in Dr. Vladimir Denic's lab at Harvard University. He is interested in how proteins arrive at their destination within the cell and how difficult-to-fold proteins achieve their functional three-dimensional shape. In the Denic lab, his research focuses on protein targeting to different areas in the cell.

Nick will discuss the role that proteins, the small machines within our cells that perform most of its functions, play in the process of aging. He will cover how proteins are synthesized as long, linear chains, and then folded into three-dimensional shapes that are functional within the cell. This folding process can go wrong and contribute to aging and many diseases, but also provides a potential means to remedy the dysfunction.



Philip Shiu is a second year graduate student in the department of molecular and cellular biology at Harvard, where he studies how cells turn off genes in the worm *C. elegans*. He grew up in Iowa City and went to Stanford University and enjoys frisbee and reading.

Philip will explore the question of whether aging can be controlled by the cell through examples of animals that are 'programmed' by their genes to live longer. This indicates that the rate of aging can be regulated and that particular drugs may be able to extend lifespan.

Glossary

Cell: At least 50 (and up to 500) times smaller than the period at the end of this sentence, cells are the smallest *independently-living* units of an organism.

Genes: The blueprints within a cell that determine that cell's identity and interactions with other cells. Also known as "DNA."

The Theory of Programmed Aging: The genes within cells determine the lifespan of these cells, and by extension determine the lifespan of the organism (such as humans) made of these cells.

Natural Selection: Genes, and organisms, persist over long periods of time because they possess crucial or beneficial traits to be passed forward to future generations.

Fitness: In an evolutionary or biological sense, fitness refers to the ability to survive to reproductive age and successfully reproduce. Such fitness permits crucial or beneficial genes and traits to outlast disadvantageous genes and traits.

Proteins: Molecules, made of chains of "amino acids," which are the machines that perform most functions in cells.

Folding chaperones: Proteins that help fold some proteins into their functional three-dimensional shape.

Misfolding: A failed folding process of proteins, usually due to lack of folding chaperones, that results in a non-functional protein.

Protein aggregates: Clumps of misfolded proteins that form when they collect in the cell. These can grow quickly by misfolding other properly folded proteins, which then stick to the aggregate.

Neuron: The name for the cells of the brain and the nervous system that control our movements and senses.

Mutation: a mutation is a heritable change to an organism's DNA; mutations can change many aspects of an organism, such as behavior, appearance, size, etc.

Insulin: a hormone that signals the presence of food.

Helpful Links

National Institute on Aging: http://www.nia.nih.gov/

Aging by Design, by Theodore Goldsmith:
http://www.azinet.com/aging/aging_by_design.pdf