What Genes Cannot Tell:

The role of epigenetics in determining who we are

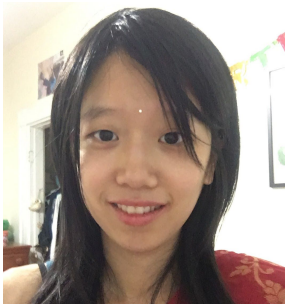
November 1, 2017

Introduction

All the cells in our body have the same DNA, yet a stomach cell is able to digest food while a heart cell pumps blood. Our cell's diverse functions reveal that there is more to us than just our DNA, and epigenetics is the field of biology that contributes to many of these differences. Our lecture will begin with Kalki highlighting a few examples of when genetics cannot explain the differences between people, and she will introduce the role epigenetics plays in our bodies. Next, Jenny will define epigenetics and describe the different biological changes that happen to our DNA that helped define epigenetics as a field of biology. Finally, Nava will conclude by giving several examples of how epigenetics impacts health and disease and a few examples of scientific research that demonstrate epigenetics at work. Following the talk, there will be a tour of the Klein lab where they research stem cells and the choices stem cells make to determine their fate.

Speakers

Kalki Kukreja is from India, and she moved to the United States last year for graduate school. She is a PhD student in biology and is studying how cells make decisions and how cell fate is determined. Outside of lab and her classes, Kalki enjoys music and travelling.



Jenny Zheng is from Livingston, New Jersey. She received her B.S. from Cornell University in Biology with a focus in microbiology. Currently, she is a second year PhD student in the Molecules, Cells, and Organisms (MCO) program studying biology at Harvard. Jenny is a member of Ethan Garner's lab where she works with archaea to determine the mechanism for cell shape formation. In her free time, she likes to play video games, play piano, and rock climb.

Nava Gharaei grew up in a small city in Iran with a passion for science. She received her Bachelor and Master degrees in Molecular Biotechnology from the University of Tehran. Currently, Nava is a PhD student in Molecules, Cells and Organisms (MCO) graduate program at Harvard. In her research, she takes advantage of a unique experimental system that is made of African clawed frog, Xenopus laevis, egg extracts to study how DNA is repaired inside cells.

Glossary of Important Terms

Epigenetics: the study of stable, heritable changes in gene expression that do not involve changes in the DNA sequence.

DNA: a molecule in every cell that contains the instructions for the growth, development, functioning, and reproduction of all known living things.

Gene: the part of our DNA that gives instructions for how to make a particular protein.

Proteins: large molecules made in our cells that carry out a wide range of functions (e.g. a protein is why your eyes are a particular color).

Expression: how much of a protein is made from its respective gene (e.g. high gene expression means a lot of protein is being made).

Heritability: the ability of information to be passed down to either our descendants or to two new cells when a cell makes copies of itself.

Histones: are proteins that DNA wraps around in our cells so that our DNA can fit into the small space of our cells (i.e. the beads in the "beads on a string" metaphor).

Chromatin: is the combination of DNA and histones (i.e. "the beads **and** the string").

DNA methylation: is the process of adding a methyl group to a part of DNA. If methylation occurs on the part of DNA that is a gene then the gene is typically expressed less.

Resources to learn more

Epigenetics: Genetic Control Beyond DNA Sequence, http://sitn.hms.harvard.edu/flash/2012/issue112/
Lick Your Rats, http://learn.genetics.utah.edu/content/epigenetics/rats/

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