

The DNA Effect: How Genes Impact Forensics, Agriculture, and COVID-19

Syllabus – Fall 2020 Humanities Seminars Program

This course will explore why the adage “it is in my DNA” is so true. Our experiences change our very DNA and affect how we react and behave, how small differences we never paid attention to turn out to make one person at high risk for disease, another not. We will discuss how forensics is now being powered to develop the use of DNA to construct an actual image of a suspect, and how small differences in DNA are routinely used to identify the best breeder animals. We will explore what we are learning about how RNA modulates DNA to regulate function of our cells, or can direct the modification of DNA to cure diseases. We will delve into how are we able to tell who transmitted Covid-19 to whom, and why it was not man made. Students will come away understanding science without having to be an expert, and be able to evaluate the reliability of news articles or online information to be informed rather than influenced.

Professor’s Bio

Bruce Seligmann, Ph.D., Associate Research Professor in the College of Pharmacy at the University of Arizona and the Co-founder and CSO of BioSpyder Technologies. Seligmann holds a BS in Chemistry from Davidson College and a PhD in Biochemistry from the University of Maryland. He has worked with John Gallin and Tony Fauci as Senior Staff Fellow at the NIH and NIAID and has founded several biotech companies.

Course Schedule

Week 1 and 2:

- DNA to RNA to protein as many of us learned it in school
- The building blocks of life are amorphous
- Inherited mutations
- mutations in cells that are not inherited
- What differences and changes to DNA mean for
 - Covid-19/Diseases/diagnostics - how we can identify it, how we can tell who gave Covid-19 to whom, and that it was not man made
 - Health/behavior – small changes provide a map to our ancestry and also add up to disease risk
 - Crime/forensics – What is actually used to identify a suspect, how those same small changes that add up to being able to predict disease risk can instead be used to construct an actual image of a suspect from crime scene DNA.

- Agriculture/food – how those small differences in DNA can be used to identify “power breeders” that produce the biggest, least fatty, and best tasting pigs, beef and chickens.
- *Suggested Readings:*
 - <https://www.discovermagazine.com/technology/just-based-on-dna-scientists-can-construct-an-image-of-your-face>
 - <https://www.smithsonianmag.com/innovation/how-accurately-can-scientists-reconstruct-persons-face-from-dna-180968951/>
 - <https://www.nature.com/articles/s41467-019-10617-y.pdf>
 - <https://www.nationalgeographic.com/science/2019/08/why-we-like-what-we-like-a-scientists-surprising-findings/>
 - <https://www.nature.com/scitable/topicpage/genetic-variation-and-disease-gwas-682/>
 - Ala-Korpela 2020 polygenic disease risk prediction - an opposing view
 - Seidel SNPs for selecting cattle for breeding

Week 3 and 4:

- DNA is not a rock, it is modified starting in the womb and from our verbal, emotional, physical environment over the years, modifying its function, changing your body and mind – A whole new aspect of our DNA called “epigenomics”
- New types of RNA and DNA that carry out functions
 - All types of RNA that direct function, it is not just a road map copied from DNA to make proteins.
 - The new age of CRISPR (molecular scissors that ablate targeted DNA and change function) and efforts to use it to cure diseases.
- *Suggested Readings*
 - “Epigenetics 101 – Nature, Nurture, Nutrition”
 - <https://blogs.scientificamerican.com/sa-visual/gene-regulation-illustrated/>
 - <https://www.scientificamerican.com/article/map-of-second-genetic-code-the-epigenome-is-unveiled/>
 - <https://blog.dana-farber.org/insight/2018/01/epigenetics-cancer-research/>
 - <https://www.smithsonianmag.com/science-nature/dads-pass-more-genetics-their-sperm-180969760/>

Week 5:

- Importance of RNA to minute-to-minute, day-to-day life
- What we have learned just in the last 10 to 5 years about regulation of RNA and production of proteins – that RNA can be changed transiently and its function changed for a period of time as a result – A new field of “epitranscriptomics”

- Concluding remarks to tie it all together and to the future: What all this could mean for health and disease and a whole lot more we are barely even able to investigate
- *Suggested Reading*
 - “Epitranscriptomics”
 - <https://cen.acs.org/business/start-ups/Epitranscriptomics-new-RNA-code-race/97/i7>