

Department of Biological Sciences Darwin Day Blog

Seminar Date: 2/21/17

Speaker: Dr. Nick Lane, University College London

Title: *“Why is life the way it is”*

Tackling Duquesne’s Darwin Day and the origin of life

By: Charlotte Hacker

Darwin Day is the largest seminar event of the year for Duquesne University’s Biology department. In its 15th year, the event serves to honor Charles Darwin’s theory of evolution and to engage the community in science education and critical thinking. Dr. Nick Lane of University College London (www.nick-lane.net) was the selected speaker for Darwin Day 2017. I was immediately drawn to the talk as he was taking on challenging and often controversial questions surrounding the origin of life. Dr. Lane is a biochemist by trade, but has made a name for himself as a scientific writer with catchy book titles such as, “Power, Sex, Suicide: Mitochondria and the Meaning of Life”, and article titles such as, “Why Sex Is Worth Losing Your Head For”, and “Reading the Book of Death”.

One great thing about the biology department at Duquesne is that graduate students are often given opportunities to meet with seminar speakers in relaxed and unintimidating settings. This provides a chance for us to introduce ourselves, our research, and to ask the speaker any unconventional questions. Dr. Lane was casual and honest in his conversation. He alluded to his career path as a writer and how fortunate he was to get back into research after years away from the lab bench. He also spoke about the science

community in general, challenging its traditional form in thought provoking ways. For example, he discussed how scientists generally corner themselves and don't explore other areas of their discipline, or feel as if they can be experts on more than one concept. He emphasized the importance of trying new things and how it aided him in exploring the complex and often contentious topic of how life began. When questioned on how he takes criticism for his ideas, he stated that you need to stick up for your thoughts and hypotheses but understand that criticism and doubt equally, if not more, drive science forward. He left the group with the overarching importance of having confidence in your science, and last commented that you have to believe the way you see the world is good, relevant, and important, otherwise, what's the point?

As anticipated based on the earlier lunch discussion, Dr. Lane's public talk was the perfect mixture of humor and science with a touch of philosophy. The seminar opened up with Charles Darwin accompanied by discussion of phylogeny and a central question, if the bacteria and archaea domains have been around longer, then why haven't they evolved further like eukaryotes? What forces constrain their evolution? This led into slides highlighting some of the greatest scientists of all time, and their seminal hypotheses. Dr. Lane then curved towards his ideas surrounding the origin of life. He explained that the mechanism for generating energy in cells is conserved across life (Lane and Martin, 2012). This energy generation, called chemiosmotic coupling, is an electrochemical reaction with proton gradients across a membrane. The answer to identifying where, when, and how this started may lie in hydrothermal vents, which have natural proton gradients (an excellent explanation of this can be found in Lane, 2015). An

electrochemical reactor to mimic conditions in alkaline hydrothermal events allow for continued investigation into the origins of chemiosmotic coupling (Herschy et al., 2014). Dr. Lane next redirected his talk to the significance of mitochondria in eukaryotic cells. Energy in the form of many mitochondria may hold the answer as to why eukaryotes were able to establish and form complex life. Mitochondria in eukaryotic cells allow for more energy per gene than what is seen in bacteria, and this power is required for eukaryote complexity (Lane and Martin, 2010). The endosymbiotic event resulting in mitochondria and giving rise to eukaryotes happened once and only once in 4 billion years. Why? Dr. Lane responded that two bacteria successfully living together is unlikely as they both have different needs. The mere chances and likelihood of eukaryotic evolution happening the way it did appear staggeringly low.

Dr. Lane had an excellent why of marrying science and philosophical ideas. He wrapped up the talk using the Pale Blue Dot photograph taken 3.7 billion miles from earth by Voyager 1. Dr. Lane reminded the audience of astronomer and author Carl Sagan's powerful commentary regarding how small our place in the universe truly is (for more information, check out Sagan, 1994). Additionally, Dr. Lane's comparison of the scientific method to natural selection was thoughtful, and an excellent way to tie his talk back into Duquesne's Darwin Day. He clarified that you remember the science, what worked in that past and what didn't, and you build on that. Random processes may happen but those that are successful are not random. A lot of hypotheses need to be wrong for those successful processes to be realized. Having a wrong hypothesis is okay, and is a part of scientific endeavor and discovery. Keep in

mind that every renowned scientist known for a great idea with seminal publications had plenty of not so great ideas too.

Works Cited

Herschy, B., Whicher, A., Camprubi, E., Watson, C., Dartnell, L., Ward, J., Evans, J.R.G., Lane, N. 2014. An origin-of-life reactor to simulate alkaline hydrothermal vents. *Journal of Molecular Evolution* 79, 213-227.

Lane, N. *Power, sex, suicide: mitochondria and the meaning of life*. Oxford University Press, 2006.

Lane, N. 2007. Reading the book of death. *Nature* 448, 122-125.

Lane, N. 2009. Why sex is worth losing your head for. *New Scientist* 13, 40-43.

Lane, N. 2015. Life force: why energy shapes evolution. *Biochemist* 37, 6-11.

Lane, N., Martin, W.F. 2010. The energetics of genome complexity. *Nature* 467, 929-934.

Lane, N., Martin, W.F. 2012. The origin of membrane bioenergetics. *Cell* 151, 1406-1416.

Sagan, C. *Pale Blue Dot*: