

DNA Computing: Thinking with Biological Molecules Instead of Microchips

Dr. Andy Ellington introduced a fascinating scientific discipline during his April 2013 *Hot Science – Cool Talks* outreach lecture¹ on the University of Texas Campus: DNA Computing. The very molecules that provide instructions for how cells are made and function can be used by humans as a computing system instead of microchips!

DNA computing, like traditional computing that uses silicon microchips, is useful because it can perform many different calculations at the same time to determine the outcome of many different mathematical possibilities². The key difference from traditional computing is that DNA computing uses the many different molecules of DNA as its circuit board instead of a microchip. In some cases, DNA computers are faster and smaller than any other type of computer humans have built²! These computers are programmable, and can be made of DNA molecules and enzymes³!

Dr. Ellington discussed the origins of DNA computing (see webcast minute mark 11:47¹, and image below) because members of his lab used it to make significant progress in developing an inexpensive test to detect a deadly strain of tuberculosis in humans. The details of how DNA computing was used are very complex. The key principle behind how Dr. Ellington's Lab used the method was that their computer could get DNA molecules to interact and copy a huge number of gene sequences that allowed the tuberculosis strain to be detectable. The gene sequence copying was a way of "amplifying" the presence of a tiny amount of tuberculosis that would ordinarily be very hard (and very expensive) to detect.

The human mind can certainly be thought of as a computer – it performs vast numbers of operations and calculations within a single moment. Through science, the human mind has created traditional computers that are made of silicon (a metalloid element found in dust and sand) as well as biological molecules such as DNA (made from nucleic acids) and enzymes (which are mostly proteins). Both types of computers serve important roles in society. We carry computers everywhere we go in our cell phones, and DNA computation is helping scientists diagnose deadly diseases. It is very likely that humans will witness an exponential increase in the computing power and diversity of applications within both computer types for years to come!

Sources (including featured imagery):

¹*Hot Science Cool Talks* Lecture: "Diagnosing Ourselves: Take Two Assays and Don't Call Me in the Morning" by Dr. Andrew Ellington, April 4, 2013:

<http://www.esi.utexas.edu/k-12-a-the-community/hot-science-cool-talks/diagnosing-ourselves-biotechnology-in-your-back-pocket>

² *DNA Computing*: *Wikipedia.org*: http://en.wikipedia.org/wiki/DNA_computing

³ Lovgren, Stefan (2003). "[Computer Made from DNA and Enzymes](#)". *National Geographic*. Retrieved 2009

