FUSE Opinions

Quantum Entanglement Solved

The Nobel Prize in Physics of 2022 was awarded to Alain Aspect, John Clauser, and Anton Zeilinger. These physicists were able to experimentally prove the phenomenon of quantum entanglement, in which manipulating one quantum object affects another far away. This has exciting implications for the world of quantum computing, as these devices rely on the power of entanglement. Developments in this field may lead towards quantum encryption and quantum networks, and secure quantum communications. Read more about the history of this field and this exciting announcement here! – *Katerina Donahue, '23*

Novel Protein Function: Using Unnatural Amino Acids

One of the many questions that chemical biologists have been studying is how to develop novel proteins with specific functionalities. At the genomic scale, we have simple and accessible mutation mechanisms to change nucleotide sequences and amplify DNA by PCR. However, the proteomic level proves to be more challenging due to the complex machinery involved in translation. By compressing and reassigning the genetic code, it is now possible to incorporate unnatural amino acids for canonical heteropolymers. This will help in site-specific functionalization of proteins, adding post-translational modifications, and more! To learn more about how these advancements are leading to viral resistance and even therapeutic potentials, click here! – *Catherine Hazard, '23*

Electron beam - the new organic small molecule x-ray crystallography?

One analytical technique for elucidating the structure of a molecule is x-ray diffraction. This method would be largely relevant to organic and pharmaceutical chemists if it were not for x-ray diffraction requiring large, high-quality crystals. About one-third of the millions of small, organic molecules produced by the pharmaceutical industry are powders. Powders are crystals, but they are too small for x-ray diffraction to produce valuable information. Therefore, only about 10% of the millions of molecules produced can be analyzed using x-ray diffraction.

A new technique that uses electrons, rather than x-rays, is able to analyze the smaller crystals present in powders. This is due to the greater interaction that occurs between a molecule and an electron compared to a molecule and an x-ray. Tamir Gonen of UCLA says that he is "actually not aware of any other… method that is able to deliver atomic-resolution structures directly from mixtures." This new technique has the potential to change the way in which typical small molecules are analyzed in the pharmaceutical industry. Additionally, this method provides an analysis of the entire sample, rather than just one crystal, which is how x-ray crystallography is completed. Inherent in this advantage is the ability to detect and identify impurities within a sample. Want to read more about this analytical technique and some of its potential shortcomings? Check out this article! – *Haden Wikar, '23*