



Computational Biology: the Future of Biomedical Research

"If I were a senior or first year graduate student interested in biology, I would migrate as fast as I could into the field of computational biology. ... There are vast quantities of high-quality data accessible to anybody who has the skills to find the nuggets of truth that are hiding in that information," said Francis Collins, MD, Director of the National Institutes of Health in 2012.

Computational biology is a relatively new discipline in the sciences, having been recognized for a little over 15 years. This discipline brings together biology and computer science to further medical research. While similar to bioinformatics, which focuses on applying mathematics and computational tools to manage research data, computational biology is focused on developing theoretical methods, mathematical modeling and computational simulations techniques to research biological systems. In today's research environment, computational biology provides significant time and cost savings by modeling proposed experiments before actually conducting them in the laboratory.

Computational biology uses modeling to add various inputs into a system (i.e. the cardiovascular system, the nervous system, etc.) instead of just focusing on one component or even one organ in the case of biomedical research. For example, by being able to tweak the amount of salt delivered to the kidneys, a researcher can see its impact on the heart and lungs using computer models.

This kind of computational modeling is especially critical in drug development, where scientists use models to predict the harmful side effects or the benefits of drugs before they even get to the clinical trial phase.

Having computational biologists as part of the research team increases experimental options and saves the team time in testing new theories. There is currently a high demand for computational biologists in areas across academic and industry, particularly in the pharmaceutical arena.

The Biotechnology and Bioengineering Center has a number of computational biology faculty in our group, they study a range of systems from the nervous system to better understand tremor disorders (ie Parkinson's disease) to the cardiovascular system to better understand how diabetes impacts the heart tissue. Faculty members in our Computational Biology group include: Chris Butson, PhD, Associate Professor in Neurology, Neurosurgery and Physical Rehabilitation; Ranjan Dash, PhD, Associate Professor in Physiology; Guilherme Garcia, PhD,

Assistant Professor in Otolaryngology; and Charles Welzig, MD, Associate Professor in Neurology and Physiology.