

What is systems biology?

System biology is a discipline to understand complexity in biology. So let me tell you what complex systems are, and that will help me explain what systems biology does.

A complex system is a system that is made up of many interacting parts. We use complex systems in every day life - airplanes, television, cell phones. These are all examples of complex systems, and they're made up of many individual parts. None of the individual parts in and of themselves possessed properties of the whole system. When they come together, they give special properties which are called emergent properties.

And biology functions in many ways in a similar fashion. There's many genes, the genes interact with one another, and also the environment and what we see are the phenotypes. And we call them emergent properties.

So to understand complexity in biology, we need to understand not just how individual genes function, but we need to understand how they interact with one another, and the environment. That's what systems biology is.

ISB is the founding institution for systems biology. And it really paved the way for this whole new discipline, a whole new way of doing science. And it pioneered the integration of different disciplines such as mathematics, computer science, biology, and so on. And applied this integration towards solving very complicated problems. Maybe some of the most complex problems we will face in the 21st century. They range from complex diseases like cancer, all the way up to sustainable environment, to the fuel production.

And this is essentially what makes ISB unique is the complexity of biology drives the development of new technologies so we can make the right kinds of measurements of all the constituent parts, understand how they interact with one another. And the application of these technologies generates very large amounts of data.

And to analyze this data we invent completely new computational algorithms. And the analysis of the data then gives us fascinating insights. And of course, new questions which then drive the next cycle of systems biology.