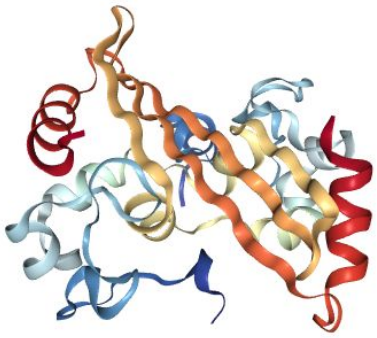
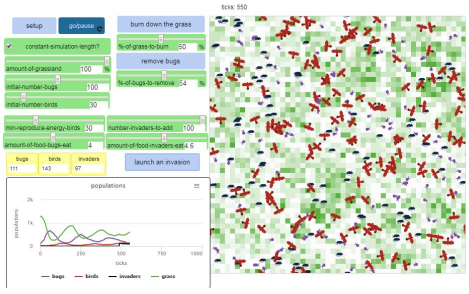
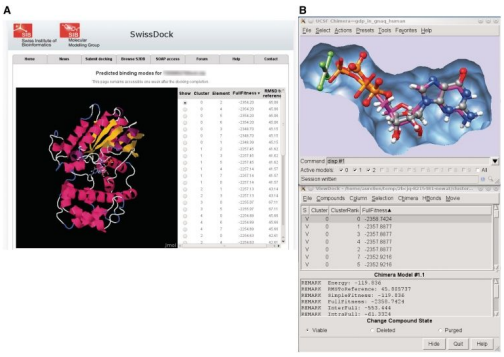
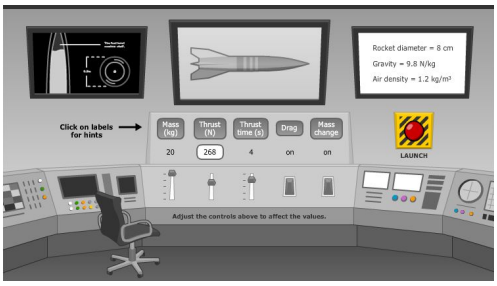
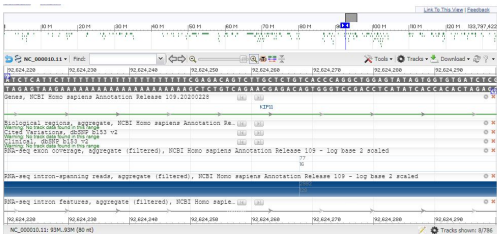
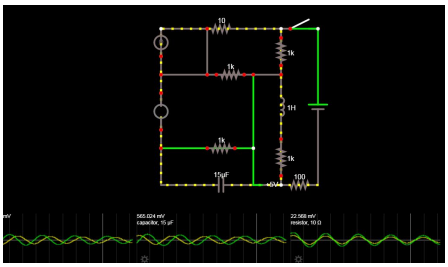
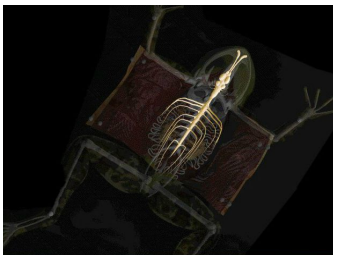
Virtual Science for Kids

Objective: *How does one combine computer skills with the natural sciences? How do biologists, chemists, and physicists use modeling and computational analysis to solve real-world problems? How can computer models be applied to medicine, environmental studies, and systems engineering?* **These are all pressing questions that every modern scientist must answer,** and this course is aimed to give kids a glimpse of the many ways in which computation and modeling can be applied to almost every arena of science.

Course format: 20 minute mini-lecture + 55 minute activity

Session	***Topic***	***Objectives***
1	**Biochemistry** The Twirly World of Proteins 	• Students understand the molecular basis for protein folding and function • Students are able to find and analyze protein structures from the Protein Data Bank • Students identify different classes and functional classifications of proteins
2	**Systems Biology** Agent-Based Modeling for Population Analysis 	• Students used agent-based modeling to monitor population systems • Students are able to understand the use of mathematical population modeling on understanding complex biological systems • Students are introduced into NetLOGO scripting
3	**Medicinal Chemistry** Engineering a Cure with Molecular Medicines 	• Students are introduced into the role of small molecule therapeutics in modern medicine • Students gain skills in submitting docking jobs to an external server • Students work on an individual project describing the putative biological activity of a small molecule drug candidate

4	**Physics & Engineering** Your Own SpaceX - The Physics Behind Rockets 	• Students gain background in thrust, lift, and projectile motion • Students gain an understanding of the mathematical basis behind physical parameters.
5	**Environmental Science** Saving the Day in Smog City 	• Students are introduced to systems engineering models that describe multivariate dependencies • Students gain an appreciation for the application of modeling in environmental studies
6	**Genetics** *BLASTing the Genetic Code* 	• Students gain experience using large genetic databases to probe biological systems • Students are introduced into introductory bioinformatics and sequence alignment • Students use BLAST to understand genetic similarity between species.
7	**Electrical Engineering** Circuit Circus 	• Students gain hands-on experience in building circuits and understanding the relationship between voltage, resistance, and current in electrical systems • Students understand the utility of predictive modeling in electrical systems.
8	**Anatomy & Physiology** *Digital Surgeon - Virtual Frog Dissection* 	• Students are introduced into the world of digital dissections, and the bioethical motivation behind such programs • Students gain an in-depth understanding of vertebrate anatomy and physiology, including a survey of most internal organ systems.