

# Biology Simulations

In 2012 Jon Darkow from Seneca East Local Schools in Attica, Ohio, received an educator's scholarship from the Creative Learning Exchange to attend the Systems Thinking and Dynamic Modeling Conference in Wellesley, MA. Since that time, he has been creating system dynamic models for his AP Biology, Anatomy and Physiology, and Biology students to investigate biological systems. Inquiry and investigation of cause and effect relationships are central goals for science education, but designing laboratory experiences that expose students to complex biological concepts can be unattainable. To circumvent this challenge of providing students with open-inquiry and rigorous content, Jon Darkow has designed many virtual laboratory simulations. Whether his students are manipulating the amount of thyroid stimulating hormone to investigate negative feedback loops in the endocrine system, or inducing and treating virtual cancer cells with Taxol, the simulations are designed to drive scientific curiosity.

Many of the simulations use random functions to produce variation in experiments, and allow students to analyze data using statistical tests. For each simulation a worksheet is included to help students guide their investigations. Many of the themes of system dynamics are woven throughout the simulations, like thresholds, feedback loops, nonlinearity, optimality, and leverage points. Darkow has his students run the simulations during class to answer questions, address misconceptions, and help stretch his students' inquiries. What his students enjoy the most is that they can run 50 experiments in an hour, manipulating several variables. "It is like a game," he has heard his students say.

To see Jon Darkow's models visit [tinyurl.com/darkow-models](http://tinyurl.com/darkow-models)

For an introductory video on using his models visit [youtu.be/LDH-F0ayDwI](http://youtu.be/LDH-F0ayDwI)