ABSTRACT
ALLOMETRY MODULE

The purpose of this module is to help students recognize allometric relationships as important patterns common to different biological, physical, and human systems as well as across natural and artificially engineered systems. These similarities result from the innate processes of evolution and design that give rise to the origins of the diverse systems. These fundamental similarities across dramatically different domains show that allometry integrates or synthesizes a wide range of knowledge and measurements from different biological specialties and even different disciplines beyond biology.

All SISGE multimedia modules begin with explicit and detailed description of the student learning objectives for the lesson presented as an interactive challenge and response section. The module also ends with an interaction that asks each student for his or her impressions of personal achievement for each of the SLO's.

The allometry module continues with a presentation of the axes, general appearance, and different functions of alternative modes (normal/normal, normal/log, log/log, etc.) of graph-based data presentation and analysis. Students choose which alternative graphic to explore at any one time until all are explored. Students then do two exercises or activity "games" whose responses are randomly generated to strengthen awareness and understanding of the graphing alternatives. They iterate these until they achieve a high score.

At this point the students go over pictures and graphs of historical figures in the history of allometry and their major contributions. Students choose which historical figure to next examine from a matrix of their photographs and names. Examination of each bio leads back to the choice matrix. In this way they are not forced into chronological or conceptual order as much as personal interest.

They next choose among several logo's for key "Identifying" Features and Functions for allometry as a systems process and integrative theme. They experience, in summary form, how these features and functions remain constant across a wide range of phenomena and types of systems. They are urged to use these "Identity" concepts in the future to "see" allometry in new places, and to understand its significance, especially in terms of understanding biological processes of development and evolution.

The next experience asks students to enter their own data from the immediately previous SISGE interdisciplinary lab and watch it fly to positions on different graph types and do the same for boxes of class and historical data (to expand the "n" number used). They then follow a rubric to derive the allometric equation from the data, and use an animated interaction to explore each part of the equation. They learn both power scale- and log- forms of the equation and explore interactively what changes to any part of the equation (of their choosing) does to the graph of the data.

One of the regular sections of all modules follows as an overview of the types, classes, and domains of allometry. For example, biology-based allometries are contrasted with geology-based allometries and these with engineering-based allometries, as well as with social systems allometries.

The next section allows them to choose from several in-depth case studies of biological allometry, engineering allometry, and systems allometry. This is the major portion of the module. Each of these case studies illustrates the similarity of the equation and constraints on structure and function of the system studies. Each also introduces a significant amount of specific knowledge about the particulars of the biological entities that are part of each particular case study. In this way they simultaneously learn a large amount about the major phenomena of the seven natural sciences while learning what is common to all of them and see significant similarities between science and human systems.

The last set of sections explores further the relationship between allometry as one type of power or scaling law and other examples of power or scaling laws that are known. There is an optional bonus section at the end on how all equations can be expressed in systems flow chart models or simulations, but not vice versa. It will present the pro's and con's of both modes of simulation of systems behaviors: equations versus systems models.

As in other multimedia modules, there is a "games" section at the end that gives more experiential and interactive "time" with allometry. For example, a Mah Jong derivative asks them to match representative pictures of specific case studies of allometry with particular power functions.