This article reprinted from:

Niedzlek-Feaver, M. 2006. Interactive pedigrees: a web simulation. Pages 368-373, *in* Tested Studies for Laboratory Teaching, Volume 27 (M.A. O'Donnell, Editor). Proceedings of the 27th Workshop/Conference of the Association for Biology Laboratory Education (ABLE), 383 pages.

ISBN 1-890444-09-X

The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises.

Visit ABLE on the Web at:
http://www.ableweb.org

Interactive pedigrees: A web simulation

Marianne Niedzlek-Feaver
Box 7617, Zoology, North Carolina State University,
Raleigh, NC. 27695-7617. mnfeaver@unity.ncsu.edu, Ph. 919-515-9051

Introduction

This web site, http://www.ncsu.edu/project/interactivebiology/ will contain teaching resources that are being developed to benefit biology and zoology students at North Carolina State University. The web site is awaiting formal approval by the University units funding the initial simulations and should be accessible by Nov. 2005,

The first simulation to be developed generates pedigrees and serves as a model of the types of resources instructors can find on the interactive biology website. A simulation on DNA fingerprinting and various interactive animations on invertebrate biology should soon follow. Although initially developed for students, access to the website is open to all and instructors will be able to download all web pages with any java applets needed to run simulations available probably as zip files. We hope in this way instructors will be able to modify the material as needed for effortless incorporation into their own courses.

We will ask that web site users fill out an evaluation that will enable us to determine how the website is being used. This evaluation will be used to revise the web site material to better serve our audience in the future. We also add the customary disclaimer that North Carolina State University or the authors cannot assume any responsibility for any inappropriate use of the material provided on the website or any damages resulting from such.

History

We placed computers in all our introductory laboratories early in l990 (Funding provided by NSF and Apple Computer Inc.). Students initially used these computers to analyze data and share results, including digital images of experimental results. It was not long before faculty felt compelled to develop visual guides using HyperCard (Software at one time bundled with the Macintosh computers) for difficult procedures such as the dissection of salivary glands in *Drosophila*.

Several HyperCard stacks developed by the faculty and staff of the Biological Sciences program were once used by all our introductory courses to help students prepare for or extend the laboratory experience. These programs also provided for student review or application of difficult concept presented in lecture or laboratory. The program is outdated with regard to its ability to integrate rich visual illustration and more importantly, incompatible with our new computers' system (X). We are now in the process of converting these stacks and other material developed mainly for our laboratories into web-accessed resources. Our pedigree and DNA fingerprinting stacks, were the two simulations

that provided the most in the way of application and problem solving, in a way that not only engaged the student but promoted the importance of the basic science behind the application. These were also the two resources that our students commented on most positively. Students reported that the simulations "made the information entertaining and easier to understand" and that the field study scenarios allowed them chances "to experiment" with "lots of data". We decided then that these two stacks or simulations should be the first to be converted into web resources.

We were fortunate enough to obtain funds from the LITRE (Learning in a Technology-Rich Environment http://litre.ncsu.edu/) Initiative at North Carolina State University to develop web exercises to replace the outdated HyperCard stacks. The web exercises of course will be platform independent and available to students continually. The web equivalents can also incorporate more pleasing and elaborate visuals. At this point in time, one web exercise on pedigrees is complete. This simulation will be available when the web site http://www.ncsu.edu/project/interactivebiology/ becomes accessible at the end of October. By this time, the author and LITRE staff will complete templates that will serve to simplify navigation and insure some continuity in appearance among the web site resources. The DNA fingerprinting simulation as well as animations developed independently by the author and other Biological Sciences Faculty will be available by the middle of January.

The model: Interactive Pedigrees, http://www.ncsu.edu/project/interactivebiology/

Interactive Pedigrees, the first web simulation, generates multiple generation pedigrees to portray the inheritance of a genetic disease (Figure 1). Students must determine whether the trait is inherited as a recessive or dominant allele and whether the locus responsible is autosomal or sex linked. The simulation generates as many pedigrees as required to resolve the basis for inheritance. Students may submit their "hypothesis" regarding a particular trait at any time. If their hypothesis is rejected, students are prompted to consult resources that may help them better understand the concepts or how to critically examine pedigrees (Figure 2).

The advantage of a web simulation is that it may be linked to other material on the web site that will help students review any underlying concepts or simply provide the motivation to examine additional material in hopes of expanding understanding and building retention. For example, from the simulation web page students can access pages containing material on how to examine a pedigree for matings that reveal how a trait is inherited.

Other links on the main menu and the simulation page provide background information about Mendelian inheritance of common characteristics such as eye color and ear lobe shape (Figure 3) as well as human conditions such as Hemophilia. We hope to continue to expand this resource as well as provide links to web sites containing detailed information on the inheritance of certain characteristics. All material is available for download by other instructors including the java applets that control any simulation. This will enable instructors to modify and incorporate the material into their own courses or other non-profit activities. For example, the pedigree simulation since it simply generates pedigrees randomly of four inheritance types (autosomal or sex linked, and dominant or recessive) can be used in a course that examines inheritance in plants or domestic animals. The instructors can even download other material such as the web pages that explain how to analyze pedigrees or the report sheets used by our own students to submit their results to instructors. The instructors in these courses need only (and only if they choose) substitute a dictionary that details inheritance in the diploid organisms of their choice to reproduce the complete web experience found on our website for their students and on their own course web sites.

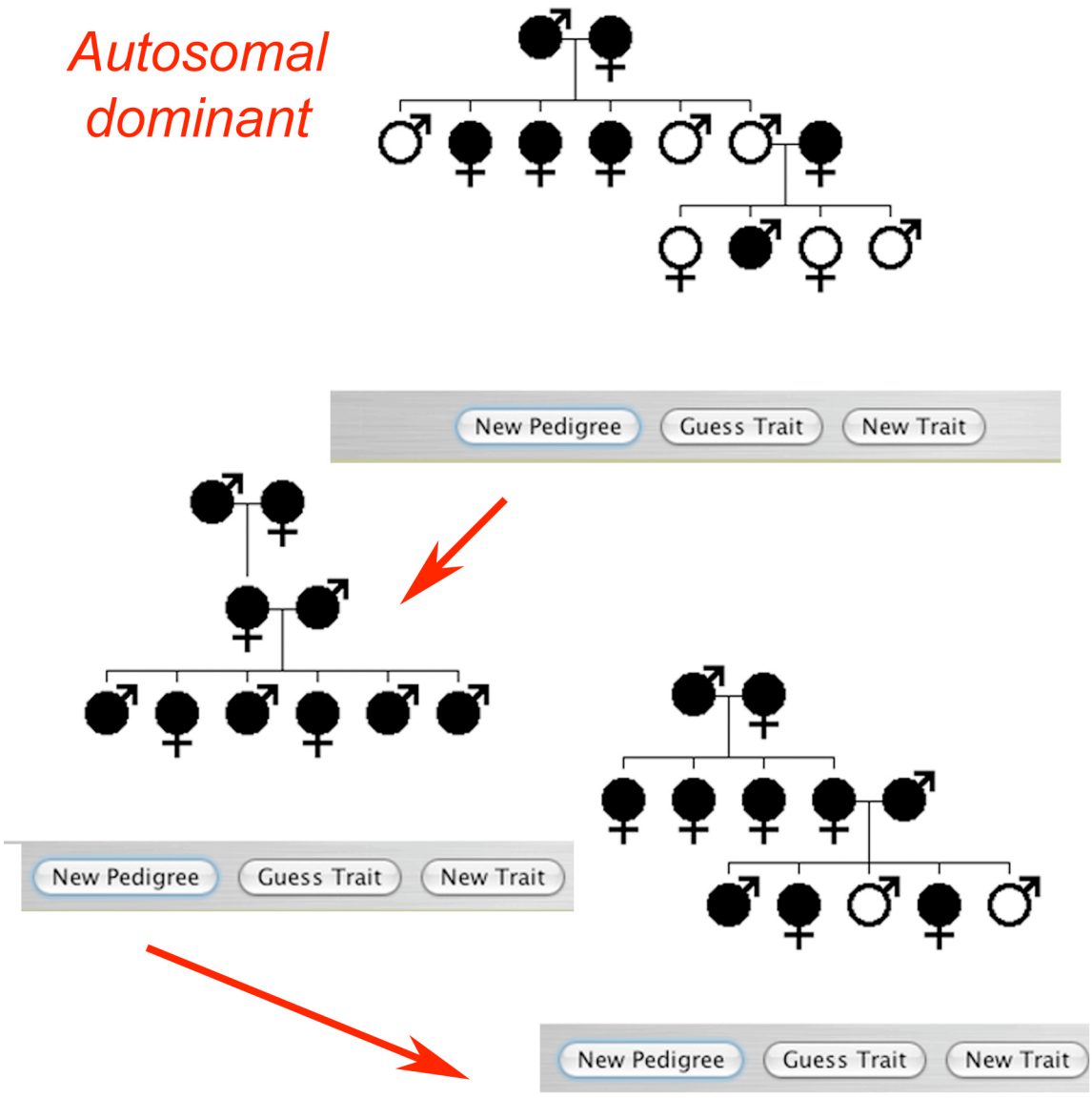

Figure 1. The type of data that will be generated for students in the web simulation on pedigrees. Note that some pedigrees, modeling reality, may not furnish the necessary data to establish the mode of inheritance.

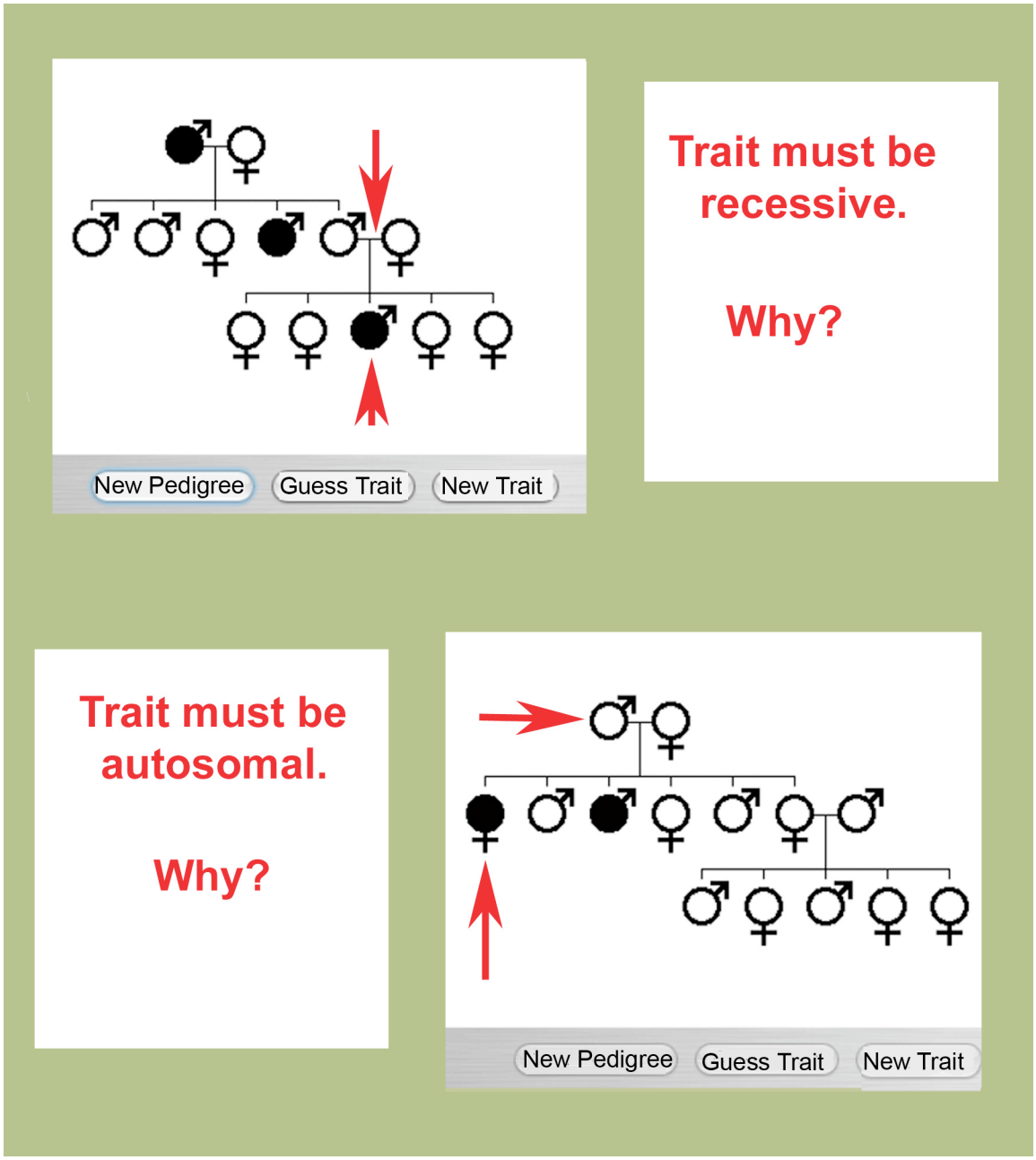

Figure 2. Students can at any time review important concepts or background or examine suggestions as to how to tackle needed analyses should they find solving the pedigree troublesome.

Figure 3. In addition, links will be provided to information and web sites that can further engage and stimulate self-inquiry. For example, a dictionary of common human traits will be available for access by students working with the interactive pedigree simulation.

Other teaching resources co-authored by the author and two other Zoology faculty, Drs. Betty L. Black and Hal Heatwole are available on the website http://www.ncsu.edu/biomovies/ . The resources here are movie clips. This website also contains the contents of three CDs containing longer and more interactive movie clips (containing moving arrows, hotspots for exploration, etc.) produced by these three authors. Please visit the website or contact Dr. Betty Black, betty_black@ncsu.edu , for more information on how to obtain these resources.

Conclusions

The model simulation, Interactive Pedigrees will be available to instructors by Nov. 2005, on the following web site http://www.ncsu.edu/project/interactivebiology/ . Instructors wishing the java code for the pedigree simulation or information on animations being developed before that time can contact the author, Marianne Niedzlek-Feaver, mnfeaver@unity.ncsu.edu.