Department of Epidemiology and Biostatistics
College of Public Health
University of Georgia

BIOS 8100
Case Studies in Nonlinear Biostatistics
Syllabus – Spring 2008

Course Information

Instructor: Stephen Rathbun
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Office Hours: T,Th 1:00-2:00

Course Meeting Time and Location

Room: 2102 Plant Sciences
Time: MWF, 12:20-1:10

Textbooks and Other Required Course Material

Bonate, P.L. 2006. *Pharmacokinetic-Pharmocodynamic Modeling and Simulation.* New York: Springer.

SAS shall be used for all in-class demonstrations of statistical analyses, homework assignments, and exams. Students are encouraged to seek out computers with SAS in their own departments. However, SAS is available in computer labs located in 167 Coverdell Center and 104 Environmental Health Science. In addition, students may lease SAS from MSD; see http://www.msd.uga.edu. You are encouraged to use a flash card to store your work.

Course Description

Case studies of nonlinear biostatistical methods in public health and the biological sciences. Nonlinear regression, nonparametric regression, generalized linear models, and survival analysis are considered. Applications include the modeling of growth curves, dose-response functions, risk assessment, and pharmacokinetic functions.

Course Learning Objectives

Students completing this course should be able to use statistical software to estimate model parameters, understand statistical inference for model parameters, apply appropriate diagnostic procedures, and describe salient features of fitted models such as asymptotes, critical points in the curves, and effective doses.

Grades and Exams

Grades will be based on four projects and about 10 homework assignments. The projects will comprise 60% of the grade, while the homework 40% of the grade. There will be no in-class examinations.

Homework assignments are designed to give you an opportunity to assimilate the course material, to understand statistical software required for statistical analyses, and to demonstrate your understanding of the results of those analyses. For all assignments requiring the use of the computer, attach a copy of your Minitab output to the end of those assignments. **However, all answers are to be given on a separate sheet of paper.** All homework assignments are due at the beginning of the class period on the date on which they are due.

The projects will give you the opportunity to apply nonlinear modeling techniques learned in class to real-world problems in toxicology, pharmacokinetics, and the biological sciences. For each project, a written report will be prepared giving the background for the problem, describing the available data, models to be fit to the data, the statistical methods, and the results including appropriate tables and graphical displays, and drawing appropriate conclusions.

Homework and Project data sets will be available on WebCT.

Topical Outline

1. Introduction
2. Review of Linear Regression
    a. Linear Regression Model
    b. Method of Least Squares
    c. Statistical Inference
    d. Model Diagnostics
    e. Multiple Regression and Model Selection
3. Nonlinear Models
    a. Examples
    b. Model Description: Asymptotes, Minima and Maxima, Inflection Points
    c. Effective Concentrations
    d. Reparameterization
4. Nonlinear Regression
    a. Method of Least Squares
    b. Computational Algorithms
    c. Statistical Inference
    d. Model Diagnostics
    e. Heteroskedasticity and Variance Modeling
5. Linear Mixed Effects Models
    a. Fixed and Random Effects
    b. Model Fitting
    c. Statistical Inference and Prediction

6. Nonlinear Mixed Effects Models
    a. Modeling Subject Effects and Effects of Study Replication
    b. Covariate Effects
    c. Estimation and Statistical Inference
7. Binary Outcomes and Logistic Regression
    a. Maximum Likelihood Estimation of Model Parameters
    b. Statistical Inference
    c. Model Selection
    d. Mixed Effects Models
8. Survival Analysis
    a. Hazard and Survival Functions
    b. Censoring
    c. Kaplan-Meier Estimate of Survival Function
    d. Cox Proportional Hazards Model

Make-Up Policy

Although late homework assignments may be accepted, there is no guarantee that they will be graded in a timely manner.

University Honor Code and Academic Honesty Policy

All academic work must meet the standards contained in "A Culture of Honesty." All students are responsible to inform themselves about those standards before performing any academic work.

Students with Disabilities

Students with disabilities who require reasonable accommodations in order to participate in course activities or meet course requirements should contact the instructor or designate during regular office hours or by appointment.

General Disclaimers

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.