

**Longitudinal Data Analysis**  
**Spring 2011**

Monday/Wednesday 2:30–3:45 in LeConte College 210A

- **Instructor:** Prof. Tim Hanson  
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Office hours: Monday & Wednesday 1:30-2:30, Tuesday 1:00-2:00
- **Description:** 3 credits; prerequisite Stat 701 or Stat 705 or Bios 757. This course provides an overview of statistical models for analyzing longitudinal data. Longitudinal data are comprised of repeated measurements (e.g. armadillos captured, legume yield, weight) on the same unit (human hunter, bean plant, mouse) over time. Emphasis is placed on *understanding* the models, and obtaining, interpreting, and coherently writing up inference from SAS within the context of the models.
- **Learning objectives:** After completion of the course, the successful student will be able to (a) develop appropriate longitudinal models for a given data set, (b) fit the models in SAS or another statistical package, and (c) interpret the relevant output, including common tests for differences in trends arising from longitudinal studies. As concrete by-products, along the way, a successful student will (a) strengthen their knowledge of the matrix representation of mixed models and associated multivariate normal distribution, estimation techniques common to mixed (Laird-Ware) models, (b) understand common repeated measures designs both classical and more recent, (c) understand and be able to use extensions to non-normal data including Bernoulli and Poisson, including associated generalized estimating equations, (d) become acquainted with the SAS procedures GLM, REG, ANOVA, MIXED, and GENMOD.

- **Course materials:** Prof. Marie Davidian's lecture notes will be posted on the course webpage as we proceed through the course; we will work through them in class, including computing examples. Course outline:
  - Chapters 1 & 2: Motivating examples, matrix algebra review.
  - Chapter 3: Random vectors, multivariate normal distribution, linear regression.
  - Chapter 4: Statistical modeling for longitudinal data: mean and covariance.
  - Chapter 5: Repeated measures ANOVA (analysis of variance).
  - Chapter 6: MANOVA (multivariate ANOVA).
  - Chapters 7 & 8: General linear models, covariance structures, implementation in SAS.
  - Chapter 9: Random coefficient models. If time: nonlinear random coefficient models.
  - Chapter 10: Linear mixed models.
  - Chapters 11 & 12: Generalized linear models for nonnormal longitudinal data, generalized estimating equations.
  - Chapter 13: Generalized linear mixed models (if there's time).
- **Computing:** Statistical methodology will be carried out primarily in SAS, possibly augmented with R. You need to have access to SAS.
- **Homework:** Approximately 5 to 7 homework assignments will be posted on the course website, roughly one assignment per two chapters. These assignments will be a mix of applications and theory, and your final grade will be computed solely on the homework assignments.