

Tentative: Mathematical Biology PhD Degree Track

by Donald A. French

This document provides general curriculum requirements and guidelines for Department of Mathematical Sciences PhD students wishing to concentrate on mathematical applications in the biosciences. At this time, their thesis research would be under one of the following Professors, French, Leung, Lim, or Pelikan.

Many of these offerings will be of interest to students in other disciplines such as engineering, chemistry, physics, bioengineering, the GRI's emerging graduate programs, Children's Hospital's computational programs, and the Neuroscience graduate program.

Prelim Courses:

1. **Numerical Analysis (514, 515, 516).**
2. **Partial Differential Equations (627, 628, 629).**
3. **Pure Mathematics or Statistics:** Students can take their third prelim in either a pure mathematics area choosing Complex Variables (601, 602, 603), Real Analysis (607, 608, 609), or Topology (604, 605, 606) or in Statistics/Probability choosing either Advanced Theory of Statistics (631, 632, 633) or Probability (634, 635, 636).

Breadth Requirement:

1. **Differential Equations (616, 617)** Two quarters. Also, one other 2-quarter 600-level sequence different from those chosen for prelim courses.
2. **Mathematical Biology Specialization:** (Four courses).
 - (a) **Applied Mathematics:** Students must take two of the following courses: Applied Mathematics Practicum (517) and Numerical Methods in Applied Mathematics (561).
 - (b) **Biology Component:** Students must take a topics course in Mathematical-Biology (599), and at least one course outside of the mathematics department that relates to biosciences research. Recommended electives come from Biology (German or Rogstadt), the College of Medicine (Gruenstein, Pun, Kleene or Menon), Bioengineering (Johnson), Philosophy (Bickle), and Computer Science (Chang or Minai). Examples include *Ecological Modeling (15-BIOL-626) Steve Matter*, *Neuroscience (20-BME-620) Jeff Johnson*, or *Complex Systems (20-ECECS-854) Ali Minai*.

Dissertation Research: The student's thesis would optimally involve a collaboration with a Professor outside of Mathematics in, for instance, the College of Medicine, Biology, the GRI, Philosophy and Bioengineering to accommodate this. Such collaborations have already taken place (e.g. Pelikan's work with Rogstadt, French's work with Gruenstein and Kleene, etc.).

Program of Study: (Sample course schedule).

First Year Courses:

| 1st Qtr | 2nd Qtr | 3rd Qtr |
|------------------|--------------|--------------|
| NA 514 | NA 515 | NA 516 |
| Adv Calc 504 | Adv Calc 505 | Adv Calc 506 |
| Appl Lin Alg 555 | PDE & FA 553 | PDE & FA 554 |

Second Year Courses:

| 1st Qtr | 2nd Qtr | 3rd Qtr |
|-----------------------|-------------------------|---------------------------|
| ODE 616 | ODE 617 | Biology Elective |
| Pure Math I or Stat I | Pure Math II or Stat II | Pure Math III or Stat III |
| PDE 627 | PDE 628 | PDE 629 |

Third Year Courses:

| 1st Qtr | 2nd Qtr | 3rd Qtr |
|----------------------------|------------------------------------|-------------------------|
| Applied Math Practicum 517 | Numerical Methods in Appl Math 561 | Topics Math-Biology 599 |
| 600-level breadth I | 600-level breadth II | |

The student would take the NA prelim after the first year and then the PDE and Pure Math or Statistics/Probability prelims after the second.