

GBS 701 – Core Concepts in Research: Critical Thinking & Error Analysis

1 Credit Hour | Fall 2020 | September 21-November 8, 2020 | Online

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GBS Vision Statement:

“Demonstrating world-class excellence in all areas of biomedical research through the achievements of our students.”

GBS Mission Statement:

“Driving biomedical discovery through interdisciplinary training and innovative research.”

GBS Core Competencies:

GBS offers a wide array of courses, seminars, journal clubs, research opportunities, and professional development that are designed to support the growth and development of our students. The following list consists of desirable competencies for our students to achieve while in this course:

- Critical Thinking and Data Evaluation
- Research-Skill Development
- Career Exploration and Preparation
- Personal Development
- Responsible Conduct of Research

Course Objectives:

The purpose of the first half of this course is to examine the nature and philosophical foundations of science using an interdisciplinary approach that emphasizes critical thinking; discusses the principles of good scientific practice - rigor, reproducibility and responsibility (the 3 R's) – by exploring revolutionary discoveries in the life, biomedical, and natural sciences; elaborates the relationship between theory, practice and serendipity in scientific discovery, and concludes with a discussion of the role of scientists in society.

The purpose of the second half of the course is to examine sources of error in scientific practice (misconduct or honest mistakes, methodological or systematic errors). Real-world examples will be presented to analyze errors that cause problems in science across disciplines. The course introduces methodological and mathematical approaches to error and reduction, explores the review and retraction mechanisms for journal articles and grants as methods of science self-correction, and discuss the historic and contemporary cases where errors constitute sources of innovation.

Upon successfully completion of this course, students will be able to:

- Analyze the notions of “science”, “knowledge”, “paradigm”, and “truth”
- Appraise the impact of revolutionary discoveries on the evolution of scientific knowledge and beliefs
- Employ the norms of science – rigor, responsibility, and reproducibility (the 3 R's) – in scientific practice
- Demonstrate understanding of scientific core concepts and methods through effective communication with peer and lay audiences
- Evaluate the role of scientists in society

UAB GRADUATE BIOMEDICAL SCIENCES

- Define the current understanding of experimental rigor, the meaning of academic ethics, and the limits of reproducibility in an interdisciplinary context
- Describe the sources of error in scientific practice as well as approaches for reducing errors
- Formulate recommendations for avoiding mistakes and misconduct in scientific practice
- Explain the procedures, advantages, and disadvantages of review and retraction mechanisms for scientific journal articles
- Appraise the role of errors in discovery and innovation

Required Textbooks/Additional Course Readings:

The course is delivered fully online and follows a weekly session schedule, which includes:

- Brief, recorded presentations, background readings or media are to be completed during the first half of a week.
- Toward the second half of a week, the material is either synthesized through individual assignments or discussed in asynchronous, whole class discussions. Regular participation in discussions constitutes an essential part of the grade.
- Students will select a final project of their choice.

The course is not self-paced. While there is some flexibility with respect to the completion dates of individual assignments and discussions posts within a week, students are generally expected to adhere to the weekly session schedule and corresponding due dates. Module sessions will open at the beginning of the course and assignments will be due weekly by Sunday at 11:59 pm. Points will be deducted for late submitted assignments.

Grading:

Final grades are based on the following:

- Discussions: 60% (10 points per discussion; 6 in total)
- Final: 40% (40 points)
- **Note:** You must complete the post-assessment, course director evaluations, and final project to receive your final letter grade.

Course Outline:

**We will meet LIVE on September 23, 2020 from 3:30 to 5 pm using Zoom.
Remaining sessions will be on the UAB Canvas website.**

Session	Session Topics/Activities	Due Sunday 11:59 pm
1	What is Science? Revolution or Evolution	September 27, 2020
2	Research ERRoRs & Science Credibility	October 4, 2020
3	Reproducibility and Responsibility	October 11, 2020
4	Scientific Integrity and Ethics	October 18, 2020
5	Review & Retraction Mechanisms	October 25, 2020
6	Serendipity in Discovery & Innovation	November 1, 2020
FINAL PROJECTS DUE (Revolutionary Science)		November 8, 2020

Disability Support Services:

UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services (DSS) for information on accommodations, registration and required procedures. Requests for reasonable accommodations involve an interactive process and consists of a collaborative effort among the student, DSS, faculty and staff.

To Register for Disability Support Services - Contact DSS at (205) 934-4205 (voice) or (205) 934-4248 (TDD). You must present documentation verifying your disability status and the need for accommodations. After DSS receives your completed documentation, you will meet individually with a member of the DSS staff to discuss your accommodations. It is best to register with DSS when you apply to UAB, as it may take 2-3 weeks to review your request and complete the process. For more information about Disability Support Services or to make an appointment, please feel free to contact the office directly at the Hill Student Center, 1400 University Boulevard, Suite 409, Birmingham, AL 35294; via email: dss@uab.edu; or visit their [website](#) for more information.

If you are registered with Disability Support Services, **it is the student's responsibility to contact the course instructor** to discuss the accommodations that may be necessary in this course. Students with disabilities must be registered with DSS and provide an accommodation request letter before receiving academic adjustments. Reasonable and timely notification of accommodations for the course is encouraged and provided to the course instructor so that the accommodations can be arranged. Additional information about the process is available on the UAB [website](#).

Title IX:

The University of Alabama at Birmingham is committed to providing an environment that is free of bias, discrimination, and harassment. If you have been the victim of Sexual discrimination, harassment, misconduct, or assault we encourage you to report the incident. UAB provides several avenues for reporting. For more information about Title IX, policy, reporting, protections, resources and supports, please visit [UAB's Title IX Policy](#) and [UAB's Equal Opportunity and Anti-Harassment Policy](#).