

# Critical Thinking in Health Sciences Research

BIOM\*4210 – Fall Semester 2013

“Science is one of the very few human activities – perhaps the only one – in which errors are systematically criticized and fairly often, in time, corrected. This is why we can say that, in science, we often learn from our mistakes, and why we can speak clearly and sensibly about making progress there.”

– Karl Raimund Popper (1902-1994)

“No opinion should be held with fervour. No one holds with fervour that  $7 \times 8 = 56$  because it can be shown to be the case. Fervour is only necessary in commending an opinion which is doubtful or demonstrably false.”

– Voltaire (1694-1778)

## **Class location and meeting times**

Mon, Wed, & Fri: 1:30-2:20 pm, FS 241

## **Coordinator**

Dr. Brad Hanna, Department of Biomedical Sciences, OVC Main Building room 1646D  
Ext. 54534, e-mail: [bhanna@uoguelph.ca](mailto:bhanna@uoguelph.ca)

## **I. Rationale for the course:**

Avoidable errors in experimental design, methodology, analysis and interpretation are surprisingly common in the published medical literature. It has been estimated that only about 20% of the medical research articles published in the 1990s are free of important flaws, leaving the conclusions of the remaining 80% in doubt. The situation appears to be improving, but only gradually. Even when good scientific evidence is available regarding a specific health issue, it is not necessarily used to guide clinical decisions; the information may not be considered at all, or flawed reasoning may enter into the decision-making process. Estimates of the percentage of North American medical procedures and technologies that are evidence-based have improved from about 15% in the 1970s to about 20% today. This suggests that the majority of the medical procedures now employed are of uncertain value to patients. These numbers reflect the situation in human medicine; in veterinary medicine the scientific basis for what we do is even more limited. This course will address some of the major issues related to experimental design and methodology in the health sciences, and critical thinking as it relates to the use of medical knowledge. Selected issues that influence public perceptions of science in general will also be discussed.

## **II. Course Aims and Objectives**

The general aims of this course are: (1) to assist participants in becoming more critical readers of the medical literature, (2) to enhance participants' critical thinking abilities by exploring some of the most common errors of reasoning in everyday thought and in medicine in particular, and (3) to address selected issues related to scientific integrity and professionalism. Achievement of these aims will contribute to the ultimate goal of basing health sciences decisions, in research or in clinical practice, on the best available evidence.

This course is divided into three units. Specific Learning Objectives by Unit:

#### Critical Thinking: Logic & Reasoning

By the end of this unit, students will:

- know the criteria of a good argument and be able to develop good arguments
- recognize common errors of logic and tactics for avoiding a good argument

#### Critical Appraisal & the CONSORT Statement

By the end of this unit, students will:

- be able to assess the methodological quality of health sciences publications at an intermediate level
- be able to justify selected scientific procedures for the avoidance of bias
- understand that the systematic examination of a body of evidence provides the best estimate of the true effects of an intervention
- understand that errors can be made to appear scientifically sound by unsystematically selecting a subset of the available scientific evidence

#### Scientific Integrity & Professionalism

By the end of this unit, students will:

- develop informed opinions about ethical issues related to health sciences research, such as plagiarism, fabrication of data, selective citation of the literature, authorship, peer review, conflict of interest, etc.

### **III. Format and Procedures:**

This is a lecture- and discussion-based course, with some independent components. Students are expected to participate in discussions and to conduct themselves in a scholarly and professional manner at all times.

### **IV. Recommended Reference Texts:**

**(a)** Unit 1: *Attacking Faulty Reasoning* (5<sup>th</sup> edition), TE Damer, Thomson-Wadsworth, 2005 (better than the 6<sup>th</sup> edn.).

**(b)** Unit 2: *Critical Appraisal of Epidemiological Studies and Clinical Trials*, 3<sup>rd</sup> edn., Mark Elwood, Oxford University Press, Oxford, UK, 2007 (ISBN: 978-0-19-852955-2). Available electronically from the university library.

### **V. Calculation of Course Grades\***

First group written assignment:	10%
Second group written assignment:	10%
First group oral presentation:	20%
Second group oral presentation:	20%
Group critiques of the oral group presentations:	5%
Final essay or short-answer-type exam:	35%

**Note:** Students may submit one late assignment (up to 1 week past the due date) without penalty during the semester. Additional late submissions without acceptable cause will be penalized 5% per day. Assignments not submitted within one week of the due date (without acceptable cause) will be assigned a mark of zero.

\*Students must contribute their fair share to group work in order to earn marks associated with group activities (written assignments, oral presentations, and seminar critiques).

## **VI. Academic Integrity**

The University of Guelph takes a very serious view of Academic Misconduct. Included in this category are such activities as cheating on examinations, plagiarism, misrepresentation, and submitting the same material in two different courses without written permission. **Students are expected to be familiar with the section on Academic Misconduct in the Undergraduate Calendar** and should be aware that expulsion from the University is a possible penalty.

## **VII. Electronic Recording of Classes**

The electronic recording of classes is expressly forbidden without the prior written consent of the instructor. This prohibition extends to all components of the course, including, but not limited to, lectures and seminars, whether conducted by the instructor, a student, or any other designated person. When recordings are permitted they are permitted solely for the private use of the authorized student and may not be reproduced or disseminated in any manner without the express written consent of the instructor.

## **VIII. Accommodations for Students with Disabilities**

Students should register with the Centre for Students with Disabilities to verify their eligibility for appropriate accommodations, and contact the course coordinator at the beginning of the course to discuss specific needs.

## **IX. Course Schedule**

The schedule will vary as needed to accommodate discussions and guest lecturers. The first section of the term will focus on critical thinking and the second section on critical appraisal of clinical trials. Unit 3, the smallest section of the course, will consist of special lectures and discussions throughout the semester.

## **X. Course Evaluation**

Students will be asked to complete a questionnaire on the instructors' teaching abilities. This information is required by the university to evaluate faculty performance for purposes of tenure and promotion. Administered by a third party rather than the instructors, these evaluations will be delivered to the instructors only after the final grades have been submitted to the Registrar's Office. The numerical ratings from the form will be made available to the Chair for administrative purposes. If a student wishes the Chair to see his/her written comments in addition to the scores, he/she must include with those comments his/her name (legibly printed) and signature.

## **Additional Resources**

- Ten Golden Rules of Academic Integrity: [http://www.academicintegrity.uoguelph.ca/integrity\\_rules.cfm](http://www.academicintegrity.uoguelph.ca/integrity_rules.cfm)
- Vancouver Style for biomedical citations: <http://guides.lib.monash.edu/content.php?pid=346637&sid=3171016>
- Browner WS, Hiscock T. Publishing and presenting clinical research. Baltimore, Md: Williams & Wilkins, 1999.
- Day RA. Scientific English: a guide for scientists and other professionals. Phoenix, AZ: Oryx Press, 1992.
- Day RA, netLibrary I. How to write & publish a scientific paper. Phoenix, Az: Oryx Press, 1998.
- Dent NJ. Good research practices: a practical guide to the implementation of the GxPs. Oxford; Boston: Butterworth-Heinemann, 1997.
- Gilpin AA, Patchet-Golubev P. A guide to writing in the sciences. Toronto: University of Toronto Press, 2000.