Syllabus: PSYO 7705.06 & PSYO/NESC 4705.06 Summer Institute — Neurotechnology Innovation, Commercialization, and Entrepreneurship

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Rationale

This course is a component of the Rehabilitative and Diagnostic Innovation in Applied Neurotechnology (RADIANT) program at Dalhousie University. This program departs form traditional science training by placing a heavy emphasis on the process of *innovation* — identifying problems that represent real needs in society, and creating novel, neurotechnology-based solutions that not only work, but that can actually reach the people who can benefit from them, in a form they can use. The core goal of RADIANT is to *produce highly-qualified personnel who have proven skills in both neuroscience/neurotechnology, and the professional skills needed to work in clinical and industrial settings to design solutions that meet a real need and have the potential to be commercialized or otherwise make it into the hands of people who can benefit from the solutions*.

The RADIANT Summer Institute is a central piece of the curriculum. This course is designed to be offered in a short, intensive 2 week summer "institute" format. It is open to graduate and undergraduate students from Dalhousie University as well as students from other universities. The goals of the Summer Institute are to provide a stimulating and intensive environment in which students learn the principles of innovation and commercialization in the context of neurotechnology. Although the focus of RADIANT is on neurotechnology, students will find that the core principles taught in the Summer Institute can be applied in a wide range of scientific and technological applications.

In the context of the RADIANT curriculum, the Summer Institute serves to reinforce many of the ideas and professional skills taught in other components of the program. As well, the Summer Institute will provide unique training opportunities including workshops and guest lectures not offered elsewhere in the curriculum. For students not otherwise involved in a RADIANT training program, the Summer Institute will provide a unique perspective and new skills that are not typically offered in undergraduate or graduate programs in science or engineering.

Prerequisite

There are no specific prerequisites for this class. It is open to undergraduates who have completed at least two full years of university study, as well as to graduate students. Students already enrolled in the graduate certificate in Translational NeuroTechnology at Dalhousie University may register with permission of the instructor. Other prospective students should submit a 1 page letter of intent to the instructor, detailing their background, career goals, and reasons for wishing to attend the Summer Institute. Admission decisions will be made by the RADIANT Management Committee.

Learning Objectives

This course will build learners' skills in innovation and communication. At the end of this course, students should be able to:

- Demonstrate, orally and in written form, an integrated understanding of the current state-of-the art in neurotechnology (including neuroimaging technologies, brain-computer interfaces, neurotherapeutic software, neuroprosthetic devices, and drugs) and its applications to the diagnosis and treatment of nervous system disorders;
- Explain how an innovative idea in the neurotechnology field (or other area) can be developed (based on opportunity identification and prototyping);
- Undertake the process of innovation and product design, including needs finding, needs screening, brainstorming, and prototyping;
- Define and explain core principles of intellectual property such as different types of patents in the Canadian, U.S., and other systems, how patents are claimed and defended, and how intellectual property may be licensed;
- Understand and be able to explain core concepts of how a business operates, including sources of capital, market research, pricing, management.
- Analyze an ethical issue raised by the use of neurotechnology in research or applied contexts, with reference to relevant ethical guidelines (e.g, the TCPS) and important legal precedents;
- Demonstrate an understanding of how to effectively communicate with different audiences — including scientists, clinicians, patients,

journalists, lay people — by actually doing so in written and/or oral forms;

- Work productively with multidisciplinary teams

Evaluation Components

Capstone Business Simulation — 10%

Students will work in teams through the Capstone Business Simulation. *Graduate Students'* grades will be based 50% on the Comp-XM exam and 50% on a structured peer evaluation. *Undergraduate students'* grades will be based solely on the structured peer evaluation.

Oral Research Presentation — 10% — graduate students only

Graduate students will present a 10 minute summary of a research project they have conducted, in a format suitable for a lay audience. Grading will be according to the attached rubric.

Personal Introduction — 10% — undergraduate students only

Undergraduate students will present a 10 minute presentation about themselves, focusing on their achievements and career goals. Grading will be according to the attached rubric, but using only the "Oral Presentation", "Slides", and "Organization" components of the rubric.

Book Review — 20%

A summary and critical evaluation of a book on a topic related to innovation, entrepreneurship, and/or neurotechnology, presented to the class in a 10 minute oral format. Grading will be based on the attached rubric, but using only the "Oral Presentation", "Slides", "Organization", and "Understanding" components of the rubric.

Final Project Presentation — 60%

Students will be assigned to teams near the beginning of the course, with each team containing a mix of education levels and backgrounds. Each team will work to create a business venture proposal, using the information from the presentations and workshops in this course. At the end of the course, each team will pitch their business plan publicly in a 20 minute oral presentation. Grading will be based primarily on the quality of the presentation and communication, with 20% of the grade assigned by the audience (anonymously) and the other 80% by the instructor.

Outline and Schedule

The class will run from 9 AM – 5 PM Monday – Friday for 2 weeks, with a 3 hour break for lunch and group work from 12 – 3 PM each day, for a total of 60 in-class hours, plus 30 hours assigned to small group work. While the overall curriculum is described below, the schedule and assigned readings will vary somewhat from year to year according to availability and schedules of invited speakers. This course will place a heavy emphasis on recruiting high-profile guest speakers from across Canada and internationally, in particular through the network of partners working with the RADIANT program.

Topics to be covered will include:

1. Overview of the class
2. Neurotechnology, including
   - Neuroimaging hardware (including tours and demonstrations at local neuroimaging facilities)
   - Neuroimaging data analysis
   - Applications of neuroimaging in medical diagnosis, entertainment, education, marketing, and forensic settings
   - Software for cognitive enhancement and rehabilitation
   - Neuroprosthetic devices
   - Pharmacology
3. Clinical Neuroscience, covering one or more of the following topics:
   - Pathology and etiology
   - Principles of diagnosis
   - Principles of treatment and rehabilitation
   - Assessing outcomes
4. Innovation[1,2,3,4]
   - Needs finding
   - Needs screening and market analysis
   - Measuring outcomes and efficacy
   - Principles of industrial design
   - Concept generation and concept screening
   - Brainstorming

[1] Zenios, S., Makower, J., and Brinton, T. (2009). *Biodesign: The Process of Innovating Medical Technologies*. Cambridge University Press

[2] Kelley, T. (2001). *The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm*. Doubleday, New York

[3] Thomke, P. S. and Nimgade, A. (2000). *IDEO Product Development*. Harvard Business Publishing

[4] Dyer, J., Gergersen, H., and Christensen, C. M. (2011). *The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators*. Harvard Business Press, Boston, MA

- Concept selection
- Prototyping

5. Commercialization (featuring guest lectures from successful members of the business community, funding agencies, and industry development organizations)[5,6,7,8]
   - Regulatory environments
   - Quality and process management
   - Introduction to financial accounting
   - Raising capital
   - Personnel management
   - Marketing
   - Sales and distribution
   - Business development and strategy
   - Writing a business plan
6. Intellectual property[9] [10]
   - Understanding, protecting, and respecting IP in academia and industry
   - Forms of IP protection
   - IP strategy
7. Ethics
   - Ethical implications of neurotechnology[11]
   - Business ethics[12]
8. Communication
   - Designing and delivering effective presentations[13,14,15]
   - Graphic design for scientific communication[16,17,18,19]
   - Grant writing
   - In-class presentations: Oral presentations
   - Communicating with a non-scientific audiences, including journalists, businesspeople, and the general public
9. Professional Skills
   - Time management
   - Career coaching

[5] Zenios, S., Makower, J., and Brinton, T. (2009). *Biodesign: The Process of Innovating Medical Technologies*. Cambridge University Press

[6] Goldberg, L. G. (2011). Urban Decay: A Great Idea. *Harvard Business School*, (9-310-032)

[7] Sahlman, W. A. (1997). How to write a great business plan. *Harvard Business Review*, (July-August)

[8] Harvard Business School (2004). Writing a Business Plan: The Basics. In *Entrepreneur's Toolkit: Tools and Techniques to Launch and Grow Your Business*, number August, page 43. Harvard Business School Press, Boston, MA

[9] Bagley, C. E. (2008). Capturing the Value of Intellectual Capital. In *Winning Legally: How to Use the Law to Create Value, Marshal Resources, and Manage Risk*, number August, page 40. Harvard Business Press, Boston, MA

[10] Pisano, G. P. (2006). The Monetization of Intellectual Property: The Forces that Drive the Business of Biotechnology. In *Science Business: The Promise, the Reality, and the Future of Biotech*, number August, page 30. Harvard Business Press, Boston, MA

[11] Farah, M. J., editor (2010). *Neuroethics: An Introduction with Readings*. MIT Press, Cambridge MA US

[12] Howard, R. A. and Korver, C. D. (2008). *Ethics for the Real World: Creating a Personal Code to Guide Decisions in Work and Life*. Number August. Harvard Business Press, Boston, MA

[13] Reynolds, G. (2007). *Presentation Zen*. New Riders Press

[14] Reynolds, G. (2010). *The Naked Presenter*. New Riders Press

[15] Duarte, N. (2010). *Resonate: Present Visual Stories that Transform Audiences*. Wiley

[16] Reynolds, G. (2009). *Presentation Zen Design: Simple Design Principles and Techniques to Enhance Your Presentations*. New Riders Press

[17] Duarte, N. (2008). *Slide:ology: The Art and Science of Creating Great Presentations*. O'Reilly Media

[18] Tufte, E. (2001). *The visual display of quantitative information*. Graphics Press, Cheshire, CT

[19] Tufte, E. (2006). *Beautiful Evidence*. Graphics Press, Cheshire, CT

Academic Honesty & Plagiarism

Dalhousie University defines plagiarism as the presentation of the work of another author in such a way as to give one's reader reason to think it to be one's own. Plagiarism is a form of academic fraud. Plagiarism is considered a serious academic offense which may lead to the assignment of a failing grade, suspension or expulsion from the University, or even the withdrawal of a degree previously awarded. Some examples of plagiarism are:

- The use of a paper purchased from a commercial research corporation or prepared by any person other than the individual claiming to be the author;
- Copying another student's work. You are free and indeed, encouraged, to work in groups on course assignments. However, each student will be graded individually (unless you are explicitly told otherwise, as in group assignments) and therefore each student is expected to write his or her own answers;
- Copying, without giving credit to the author, from another's published or non-published works, another's computer codes/programs, another's artistic or architectural works, another's scientific project, including material found on the internet;
- Copying a direct quotation from another source without indicating that it is a direct quote through the use of quotation marks and source page numbers;
- Submitting a piece of work for credit in more than one course without written permission of both course instructors;
- Submitting the same piece of work more than once in the same class, including in different years.

Dalhousie University's policy on intellectual honesty can be viewed at: *www.registrar.dal.ca/calendar/ug/UREG.htm#12*. As well, the Faculty of Graduate Studies has regulations concerning intellectual property, which may be accessed at *dalgrad.dal.ca/regulations/v*. As per Dalhousie policy, any suspected cases of academic dishonesty will be reported to the Senate Disciplinary Committee for review. Please do not hesitate to ask your instructor or the Faculty of Graduate Studies if you have any questions concerning what might or might not be considered academic dishonesty.

Student Accessibility Services

Students with disabilities are encouraged to register as quickly as possible at the Student Accessibility Services if they wish to receive academic accommodations. To do so please phone 494-2836, email *access@dal.ca*, drop in at the Mark A. Hill Accessibility Centre or visit their website *www.studentaccessibility.dal.ca* All forms are now available on their website.

References

Bagley, C. E. (2008). Capturing the Value of Intellectual Capital. In *Winning Legally: How to Use the Law to Create Value, Marshal Resources, and Manage Risk*, number August, page 40. Harvard Business Press, Boston, MA.

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