Syllabus: PSYO 7711.03 Innovating Neurotechnology I — Concept Generation and Knowledge Translation

Instructor: Aaron J. Newman, PhD, with Ed Leach, PhD

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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 from 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 tenet of the RADIANT is to *produce HQP 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*.

This course is designed to give trainees the skills needed so that their great ideas and scientific discoveries can have the most positive impact on the world. Along with its partner course, Translational Neuroscience II, this course will train students in the process of innovation. This first course will focus on the early stages of innovation: needs finding and screening, and idea generation. It will also place heavy emphasis on building communication skills, which are core professional skills emphasized in the RADIANT curriculum. The second part of the course will focus on business concepts and commercialization. The class will be almost entirely project-based. Students will work in small teams (of 2–3 students) over the course of the term to develop a neurotechnology business venture, based on the identification of a need and a proposed solution to this need.

Successfully taking complex scientific discoveries and making them understandable and/or usable by the general public critically depends on the ability to communicate in many circumstances. It requires the ability to see the world from others' perspectives, and to communicate ideas and design products in the most effective ways. These communication skills will also be emphasized in this course.

Learning Objectives

PRIMARY OBJECTIVES: This course will build your skills in innovation and communication. At the end of this course and RADIANT Seminar II, you should be able to:

- Identify needs (of patients, clinicians, and/or consumers) that might be amenable to neurotechnology;
- Critically evaluate and screen needs according to criteria including importance to target audience, market size, IP space, and technical feasibility;
- Generate a wide variety of potential solutions (products and/or services), particularly emphasizing neurotechnology-related solutions, to previously-identified needs;
- Evaluate, screen, and refine potential solutions according to criteria including appropriateness to need, technical feasibility, financial feasibility, market feasibility, and intellectual property constraints;
- Communicate a potential solution clearly and convincingly in the form of a 90 second oral "elevator pitch"
- Write a business plan that clearly and convincingly explains the identified need and proposed solution, addressing the criteria of market size, financial feasibility, technical feasibility, intellectual property considerations, and timeline.

SECONDARY OBJECTIVES: Beyond innovation and communication skills, you will develop a number of other professional skills:

- Time management
- Project management
- Resource management
- Team-building
- Decision making
- Marketing

Textbook

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

- Other assigned readings will be made available through BLS or the Harvard Business School on-line library

Prerequisite

Instructor's permission is also required to register. While part of the RADIANT program curriculum, this course is open to graduate students in any discipline subject to instructor's approval.

Evaluation Components

Students will develop and be evaluated on their innovation and communication skills through practical application in developing a solution to the problem posed to them. While the solutions must be feasible and scientifically and technically meritorious, the emphasis of the evaluations will be on the process of innovation, and the effectiveness of the communication skills evidenced in the course of the project.

For all work prepared and submitted by groups of students, peer evaluations will be included as a component of this assignment (20%) in order to assess individuals' contributions. It will thus be important for members of the team to communicate amongst themselves and divide up the work and assign jobs. This should be done such that all team members get experience in all areas that are being developed. The percentage of the final grade that each component is worth is indicated in the margin aligned with the headings. Detailed instructions for each assignment will be provided during the course; they are merely summarized here.

Mini-Venture 15%

- In the first month of the course, students in teams or as individuals will undertake a small entrepreneurship venture. This will require attempting to market and sell a product. The primary learning objectives are to move each student outside of his or her "comfort zone" and provide valuable, personal experiences that can be drawn on in the rest of the course. As such, the product need not be in any way neurotechnology-related. Grades will not be based on the economic success of this venture but rather on a

verbal report to the class, which provides both a description of the venture and a detailed "post mortem" analysis.

Opportunity Identification 15%

- Students working in teams will prepare a brief written report and deliver in-class presentation detailing their proposed neurotechnology business opportunity. This will reflect having worked through the stages of needs-finding and needs-screening.

Elevator Pitch 15%

- Each individual will prepare a 90 second oral presentation (involving no visuals or other props) aimed at convincing people naïve to the project that the solution is a good one. These will be delivered to a number of individuals at a "speed networking" event held during the course. These individuals will assess the quality of delivery and convincingness of the pitch, which will determine the grade.

Business plan 40%

The Business Plan makes up the bulk of the final grade for this course. Teams will prepare a plan describing their proposed solution to the problem they are working on, its feasibility, and how it will be moved forward to prototyping and commercialization. This assignment is designed to allow students to demonstrate their mastery of all of the learning objectives set out above. Because many of the essential concepts of commercialization are not covered in this class but in its subsequent companion class Innovating Neurotechnology II, this business plan is not expected to be as comprehensive as a "real" plan. It should however address the following at a minimum:

- An outline of the problem and proposed solution, written in a form suitable for a business audience
- How the solution addresses the principles of human-centered design
- Intellectual property considerations of the solution
- Feasibility of the solution
- Projected expenses and proposed sources of funding
- A detailed work plan and timeline for developing and commercializing the solution

Final Project Presentation 15%

Each team will pitch their business plan publicly in a 10–20 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 meet once per week for 13 weeks. The topic of each class is described below.

1. Overview of the class
2. Needs finding[1]
3. Principles and ethics when working in a clinical environment
   - Needs finding practicum will be conducted outside of class time. This will involve clinical rotations coordinated and supervised by M. Bance and/or S. Johnson and/or D. Weaver
4. Needs screening and market analysis[2]
5. Measuring outcomes and efficacy
6. Principles of industrial design (guest lecture: Glen Hougan)
7. Concept generation and concept screening[3,4,5]
8. Brainstorming session
9. Intellectual property: Introduction to patents (patentability and freedom to operate) (Guest lecture: Dalhousie ILI)
10. Writing a Business Plan[6,7]
11. Streamlining communication
12. Networking and face-to-face communication[8]
    - Each individual will prepare a 90 second oral presentation (involving no visuals or other props) aimed at convincing people naïve to the project that the solution is a good one. These will be delivered to a number of individuals at a "speed networking" event held during the course. These individuals will assess the quality of delivery and convincingness of the pitch, which will determine the grade.
13. Final project presentations

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

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

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

[4]

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

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

[7] Fried, J. and Heinenmeier Hansson, D. (2010). *Rework*. Crown Business

[8] Kawasaki, G. (2011). *Enchantment: Art of Getting People to Do What You Want*. Penguin

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

Fried, J. and Heinenmeier Hansson, D. (2010). *Rework*. Crown Business.

Kawasaki, G. (2011). *Enchantment: Art of Getting People to Do What You Want*. Penguin.

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

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