Graduate course outline – The Emergence and Complexity of Life

The emergence and evolution of complex life raises profound scientific and philosophical questions that have broad significance to all members of our community. In this graduate course, students and faculty from a wide variety of disciplines will gather to explore these questions, through a combination of literature review, discussions, presentations and invited colloquia by internationally renowned thinkers. Through this strongly interdisciplinary approach, students will explore how answers to these questions are being sought, will develop an ability to critically address these undertakings, and will become equipped to communicate these methodologies and the significance of the findings to the broader community.

The course is designed around four themes which span the emergence of life and development of sentient beings on earth, address the physical requirements for these to occur, and frame the search for life elsewhere in the universe. Broadly defined, the four topics are

I. Origins of life on Earth
II. Evolving ever-increasing complexity
III. I think therefore I am
IV. Is there anybody else I can talk to?

These four topics will be explored through six invited seminars given by world-renowned leaders in these subjects and who have extensive experience communicating these leading-edge ideas and research to a broad audience. Graduate students enrolled in the course will have the opportunity to engage with these experts in post-seminar discussions. As preparation, students are expected to actively participate in pre-seminar faculty and student discussions, held the week before each seminar and covering both review and primary literature relevant to the topic and speaker of that seminar. At each pre-seminar, a team of students (comprising “specialists” – students in a field related to the topic – and “generalists” – students in an unrelated field) is responsible for presenting a critical review of the relevant literature, a list of which will be compiled by faculty in the field of the invited speaker. This includes review articles to give a broad introduction to the topic (at the level e.g. of Scientific American) and primary literature focused on the specialty of the current speaker. (Reading lists will be determined by the faculty oversight committee once the schedule of invited speakers has been arranged, to optimize the content of the pre-seminar discussion material for each topic, yet covering the desired breadth of topics.) All enrolled students are required to read the review articles prior to the pre-seminar, and specialist members of the team are responsible for reading and disseminating the findings in the primary literature to all faculty and students. Through these presentations and discussions, students hone their ability to read literature critically and to distill the essential points to a level accessible by interested people outside their specialty.

Each student will be primarily responsible for one topic within their own specialty (i.e. Physics, Biology, Biochemistry, Neurobiology, Philosophy, and Psychology) while serving as a generalist on another topic to provide critical review of the exposition of the research. Each team of students will furthermore be responsible for writing a summary of their readings, seminar and discussions in a manner appropriate for web posting. This can include hyperlinks to articles and media online, figures or videos to illustrate findings, and must include critical analysis of the findings and conclusions reached to date. Websites developed by each group of students are meant to convey to the general public the context for each seminar, and will be posted online shortly after each of the six invited seminars. In this way,
students again hone their critical thinking and communication skills, here, through adapting academic research presentations to the electronic age and to the public at large.

**Evaluation**
30% - Presentation of pre-seminar
30% - Participation in all pre-seminars (5% for each)
40% - Written component – web portal evaluated by all colloquium oversight committee members