

NEW COURSE

Department: ORIGINS INSTITUTE  
Course Name: **ORIGINS 2FF3**  
**ORIGINS AND EVOLUTION OF ORGANISMS**  
To be offered first in 2005-06  
Date: November 2004

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Calendar copy description:

ORIGINS 2FF3 ORIGINS AND EVOLUTION OF ORGANISMS  
An introductory survey concerning the origin and evolution of organisms. A tree-of-life will be examined internally from the root to terminal branch tips, by evaluating critically the data and analytical techniques with which the tree was constructed.  
Three lectures, one tutorial; one term.  
Prerequisite: BIOLOGY 1AA3, CHEM 1A03, MATH 1A03, PHYSICS 1B03.

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Expected enrolment:

100

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Enrolment limited? If so, why?

No

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Other department(s) consulted.

Biochemistry, Biology, Chemistry, Geography and Geology, Mathematics and Statistics, Physics and Astronomy, Psychology, Associate Dean of Science, Dean of Science, Provost, President

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Is this course cross listed? If so indicate course(s).

Resource implications.

A \$7500 teaching buyout has been secured for this course. The course is designed in modular format, so that, in any academic year, different instructors could participate. Each instructor will contribute lecture sessions for approximately two weeks, providing the students with a survey over that part in the tree-of-life for which that instructor possesses expertise. Therefore, the time investment that will be required from each instructor will be minimal. In addition, the equivalent for one graduate teaching assistantship, valued at \$8650, has been provisioned for SCI 2B03 Big Questions and this course.

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Detailed course content and reasons for introduction of course.

This course will provide an opportunity for undergraduate students, perhaps the only opportunity for those who ultimately intend to enter graduate school and begin careers in research (and, therefore, must enrol in specialised courses in Level III or IV), to survey organisms from a 'tree-of-life' perspective. In addition to 'rounding-out' the biological background for students who plan to conduct research for Level IV thesis courses or in postgraduate programmes at McMaster University, graduates who continue their academic careers at other universities in Canada and abroad will carry with them a vital intellectual scope that has been diminishing from curricula for decades but is experiencing a resurgence (with advancements in molecular techniques, genome projects, and pharmaceutical technologies). This breadth will impress upon faculty and researchers at those institutions the quality education that we provide in our undergraduate curriculum.

#### Course Description

The course will involve a novel, non-traditional approach. From the outset, a 'tree of life' (*i.e.*, a published, reputable phylogenetic systematic classification) will be introduced and accepted as an hypothesis for the evolutionary relationships among all known phyla. This could be presented initially from the 'three domains' perspective (*i.e.*, Archaea, Eubacteria, and Eucaryota), with further divisions as the course progresses (*e.g.*, the phyla within Archaea, Eubacteria, and Eucaryota considered as comprising Eumycota, Plantae, and Metazoa). Familiarity with the phylogenetic tree will be developed through a variety of activities; students will utilise their well-developed memorisation skills to learn which organism types are classified in each phylum (and, perhaps, in classes for more-familiar phyla), by taking short quizzes. While this background information is being assimilated, the core and innovative aspect to the course will be implemented: the phylogenetic tree will be explored internally.

During primary lecture sessions (2 or 3 per week), an instructor will present information about the features from which the phylogenetic tree was constructed (*i.e.*, the characters that were analysed in deriving the phylogenetic systematic classification), starting at the root and proceeding toward the terminal branches (but always stopping just short from the 'tips'). During tutorial sessions (1 per week), students (working in groups) will present information (in a flexible conference-style format) about one terminal tip (*i.e.*, phylum) bearing relevance to the material that was covered during the

primary lecture sessions.

The first formal tutorial session will be held during the second week (*i.e.*, after the background information has begun to be assimilated). During that session, some students will present information about extremophile organisms that are classified in Crenarchaeota; these students might rely predominantly on genetic data and the seemingly inhospitable environmental conditions in which organisms that are classified in this group live. Later in the course, when phyla within the Metazoa are considered, for example, students might describe Porifera (*i.e.*, sponges, possibly even the classes that are classified therein); these students might present information about development, morphology, reproduction, life-history, or evolution, in addition to genetics and environment. This flexible format will provide a means for students to direct their own learning and explore topics that interest them. Students will be required to emphasise the features that have been discussed during lecture sessions (*e.g.*, collagen as a defining character for the metazoa and how it has been utilised differently as a feature among phyla). As the course transpires, tutorial session presentations could become more involved; however, students will have had more time to prepare, and the flexible format for the presentations will provide a mechanism for equalising workloads (*i.e.*, students who present early during the course could spend more time describing certain characters than including other perspectives – as can be gleaned from the Crenarchaeota and Porifera examples that were presented previously).

#### Logistics

This course will be offered as a Level 2 opportunity.

A preliminary evaluation scheme comprises quizzes (5 @ 10%), a presentation (25%), and a final examination (25%).

#### Special Considerations

As active participants in the Origins Institute, the Departments of Biology, Biochemistry, and Anthropology ought to mount a course that would contribute to the Origins Specialisation undergraduate curriculum. For this specialisation, two courses are planned as broad surveys that involve origins-related topics. One course already has been developed and offered by the Department of Physics and Astronomy (SCI 2B03, Big Questions 1). The contribution that the Departments of Biology, Biochemistry, and Anthropology will offer should adhere to one among the three research themes that the Origins Institute has recognised as falling under its life sciences mandate: the origin of life (evolutionary biology and astrobiology); the origin of species (biodiversity and ecosystem analyses); the origin of humans (consciousness and cultural research). The course also should prepare students for upper level ORIGINS courses in these areas.

The proposed course would suit well the origin of life or species theme. As the course explicitly concerns relationships among organisms, the origin of life or species are topics that are threaded through the material. Thus, ORIGINS 2FF3 will provide the aforementioned departments with the opportunity to 'kill two birds with one Stone' (literally, given the surname for this proposal's author), by enriching their undergraduate curricula and providing a contribution to the Origins Research Specialization.

Potential Contributors (only some among whom might participate during any academic term):

S. Dudley, Department of Biology – Plantae

B. Evans, Department of Biology – Amniota

M. Gunderman, Department of Biology – arthropods

R. Gupta, Department of Biochemistry – Archaea, Eubacteria, and Eucaryota

H. Poinar – Department of Anthropology – humans

J. Stone, Department of Biology – Metazoa excluding arthropods

J.P. Xu, Department of Biology – Eumycota