NEW COURSE

CONS 302: Issues in Genomics and the Environment

Fall 2015, Tues/Thus 11 am – 12:20 pm, FSC 1220

Instructor and facilitator: Prof. Kermit Ritland, Dept. Forest and Conservation Sciences

This is a new course but last year it was taught as a directed studies course

Synopsis

Genomics is the study the complete set of DNA of an organism or set of organisms. Knowledge about genomics and its applications will be essential for informed discussions and decisions involving genomics. This course will examine current and topical issues about genomics and the environment. This will enable a larger perspective beyond the technical aspects of genomics.

This course is explicitly designed for non-science majors who want a perspective of how the science of genomics might change society and environment.

We will use selected readings from the "lay" (non-science) literature such as articles from The New Yorker and Scientific American. Required readings are assigned for most topics. More sophistical topics derived from journal articles will be presented in class by the instructor. Also, this course will sometimes be taught in a "blended" format where students often are given assignments to complete before class, and the discussion in class will be in a "flipped" format.

This course is meant to appeal to Faculty of Arts students and students from other faculties especially L&FS and the CONS program. The approach will be similar to ASIC 200 (Arts and Science Integrated Course). Like FRST 303 (Principles of Forest Science) and BIOL 121 (Genetics, Evolution and Ecology), the only prerequisites will be 11th or 12th grade high school biology. Hence, this course may not qualify for credit for students from the Faculty of Science.

Learning Objectives --Students will
(a) Acquire basic knowledge of the science and technology of genomics
(b) Build a fundamental knowledge of issues related to genomics and the environment
(c) Develop skills to communicate this knowledge

Course grading (tentative) -- Students are responsible for material covered in lectures, group activities, labs, and class discussions as well as in the assigned readings listed in the outline. Course grades are tentatively assigned as

1. Group Problem Based Learning 20%
2. Class participation 10%
3. Term paper 20%
4. Midterm 20%
5. Final examination 30%

CONS 302 Course Outline (tentative)

The space of genomics (2 weeks)
What is a genome?
Genome size, the c-value paradox and Biology 2
Reading: The C-value paradox, junk DNA, and ENCODE (Current Biol. Nov. 2012)

Genomic determinism vs. the environment (2 weeks)
Genetic testing
Readings: HCI for personal genomics (ACM Interactions, Sept. 2014)
The FDS vs. personal genetic testing (The New Yorker, Nov. 2013)
23andMe is terrifying but not for the reasons the public thinks (Sci. Am. Nov. 2013)
Genetic determinism vs. the environment

Diversity of genomes (3 weeks)
Metagenomics (environmental sampling for species composition)
Barcoding
Reading: From barcoding single individuals to metabarcoding biological communities: towards an integrative approach to the study of global biodiversity (Cell Press, Oct. 2014)
Microbes in the human body – Bacteria, viruses
Reading: Germs are us. Bacteria make us sick. Do they also keep us alive? (The New Yorker, Oct. 2012)

Adaptation and climate change (3 weeks)
Adaptational genomics (ADEPTforest genome project)
Reading: Adaptation genomics: the next generation (Cell Press, Dec. 2010)
Landscape genomics with examples from trees
Reading: Putting the landscape into the genomics of trees: approaches for understanding local adaptation and population responses to changing climate (Tree Genetics and Genomes, 2013)
Adaptation via epigenomic mechanisms (methylation, histones…)
Reviving extinct species
Reading: The ethics of reviving long extinct species (Conservation Biology 2014)

Applications of genomics (3 weeks)
Biofuels (algae, bacteria)
Reading: Genetically engineered algae for biofuels: a key role for ecologists (BioScience Aug. 2012)
Genomic selection with examples from conifers (SMarTForesTs genome project)
Detection of invasive fungal pathogens of trees (TAIGI genome project)
Gene patents
Reading: Can we patent life? (The New Yorker, April 2013)
Genetically modified organisms (GMOs) in the environment
Reading: Unraveling the DNA myth: the spurious foundation of genetic engineering. (Harper's Magazine, Feb. 2002)
Reading: Modified stands: will genetically engineered trees help save the climate or will they alter forests forever? (Earth Island Journal, 2013)