Developmental Genetics for Conservation (Gen 677) – Fall 2016

Overview

Human-induced factors such as changes in land use and global climate are causing rapid worldwide biodiversity loss. Can modern molecular genetics contribute to species preservation? In this course, we will first explore the challenges and potential of molecular genetic methods based on biobanking, gene editing and nuclear transfer for animal biodiversity preservation. The course will consist of weekly lectures/discussions based on primary research literature. Topic covered will include: i) maternal factors and early animal development, ii) interspecies nuclear transfer and oocyte-mediated reprogramming in animal cloning, iii) developmental, phylogenetic and ecological considerations for biobanking, iv) gene editing and synthetic biology as potential tools to recapture biodiversity. Students will use knowledge in animal population status, developmental genetics and phylogeny to address real-life problems involving the conservation of threatened animal populations.

Prerequisites: General Genetics (Gen 466) and consent of instructor. Animal Developmental Genetics (Gen 627) recommended but not required. 1 credit.

Instructors

Dr. Francisco Pelegri

Genetics/Biotechnology Addition, Rm 2424

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Office hours: Fridays 11 am – 12 or by appointment

Class time: **Tuesdays and Thursdays** 2:30 – 3:45 pm in 1408 Genetics/Biotechnology Addition.

Tuesday: Background information on the week's topic.

Thursday Discussion/workshop: roughly equally distributed on primary literature discussion and in-class development of student's projects.

Class Website at Learn@UW: Most of the course will be based on reviews and research articles, which will be posted on the course website. The Website contains pdf copies of all of the required reading, the background review articles, assignments, answer keys and presentations.

Grading:

Journal club presentation	20%
Student project:	
Written report	20%
Presentation	20%
Class assignments (2)	30%
Class participation	10%

Journal club presentation: Each student will make a presentation of a primary literature article. Please confirm suitability of article with instructors ahead of time. Sample journal club presentations will be provided by the instructors earlier in the course

Project: Each student will pursue a Project (see below), which will be presented at the end of the course. The presentation will be supplemented by a written report (suggested upper limit of 5 double-sided pages, excluding references). Both presentations and written report will be kept in the course records for future students to read and possibly pursue. Ongoing participation on student project will be based on participation in student project during allocated in-class times. *

Assignments: These may be given as an in-class or take-home exercise, and will be based on the readings/lecture/presentation material of the week. There will be either web-based or paper copies of any relevant materials. Succinct answers are encouraged. When appropriate, answer keys will be posted on the web after homework assignments have been handed in.

In-group class participation: Participation in group discussions as assessed by your questions or comments during lectures or discussions, on weeks other than the week you are presenting. (Full attendance is expected. Please let us know if you have difficulties attending the class periods.)

Tentative Schedule

Week	Topic/assignments (Tuesdays)	(Thursdays)
1. Sept 6, 8	DGC introduction introduction Antropogenic extinction	Antropogenic extinction and isSCNT cloning case studies DGC Project examples
2. Sept 13 15	Cloning and reprogramming I	Article/Project workshop
3. Sept 20 22	Cloning and reprogramming II	Discussion
4. Sept 27 29	Inheritance of paternal factors - maternal factors - paternal factors	Discussion Project workshop
5 Oct 4 6	Egg to embryo and midblastula transition Epigenetic marks in development	Discussion Project workshop
6. Oct 11 13	Phylogeny, speciation and cloning Cytoplasmic incompatibilities	Discussion Project workshop
7. Oct 18 20	Student-led Journal club: 1-4	Student-led journal club: 5-6
8. Oct 25 27	In-class assignment 1	Effects of inbreeding on developmental processes (Waller seminar)
9. Nov 1 3	Mid-term project report discussion (student-led discussion of potential course project)	Self generating biological systems: gene regulatory networks, morphogens and reaction-diffusion mechanisms /Project workshop
10. Nov 8 10	Cloning and intergenerational effects	Effects of inbreeding on developmental processes (continued) /Project workshop
11. Nov 15 17	Germ cells: development and uses. Control of transposons in germ line	Discussion/Project workshop
12. Nov 22 24	Biobanking and recovery: methods and resources Assignment 2 handed out	Thanksgiving recess
13. Nov 29	Ancient DNA Assessing and re-introducing genetic	Discussion/Project workshop Assignment 2 due

Dec 1	variation	
14. Dec 6 8	(Student-led) Term projects 1-3	(Student-led) Term projects 4-6
15. Dec 13 15	Synthetic Biology	Course recap/update

Project outline (students will pursue one project from i, iia or iib):

i) Identification of a Feasibility Group (FG)*

* We define a "Feasibility Group" as a set of lineages (species, sub-species or genetically distinct populations) which are sufficiently related such that inter-species/populations nuclear transfer within group would be expected to be successful. Feasibility Groups would consist of one or more endangered lineages (potential nuclear hosts) and a non-endangered related lineage (potential egg donor). Feasibility groups would be expected to expand to cover more distantly related lineages in the future as biological advances in oocyte-mediate reprogramming allow a greater range of successful interspecies/populations nuclear transfer.

- At least one endangered species/endangered population with appropriate host species.

- Rationale for donor choice:

    - environment: critical numbers, predicted environmental or anthropogenic pressure

    - phylogeny/developmental: phylogenetic distance to host (comparison to success cases), other developmental considerations/ background

    - other: presence of extant variation sources, key ecosystem/interspecies interactions, expected geopolitical developments

- Rationale for host species

    - basic reproductive biology

    - related precedents

    - other (epigenetics, predicted knowledge in field, etc)

- Biobanking

    - previous and ongoing efforts

    - potential sources: populations, tissues, NGOs

iia) Previously proposed FG: continuation (in the Spring '15 pilot course, this will be substituted by a report on ongoing project elsewhere (e.g. LongNow Foundation, Smithsonian, Church group at Harvard)

- Sources: contact, update
- Update UWGenetics database
- Request/safeguard samples

or

iib) Develop/upgrade course web site and/or main biobanking database