CAPS 420 Course Syllabus

Human Disease Modeling and Therapeutics (3 Credits)

Academic Calendar Description:
Focusing primarily on stem cells and *in vitro* organoids as disease models, topics cover regenerative medicine, aging, tissue regeneration and repair, novel genetic diseases and therapy development. [3-0-0]

Prerequisites
CAPS 306 and 310.

Corequisites: None

Other Requirements
This course is open to CAPS Majors and Honours students. Other 4th year students with 3rd and 4year cell biology credits may be considered at the discretion of the Course Director

Instructional Schedule: 2 weekly 90 min sessions

Course Structure
2 SESSIONS PER WEEK (1.5 HOURS EACH) for a **total of 36 hours**. Each session comprises in-person classes. Classes will alternate between lecture-based and active learning-based instruction. Instructors will teach lecture-based classes. In active learning classes, groups of students will be assigned literature to present and lead discussions for the whole class. These classes will be guided by the instructor. All relevant literature and lecture materials will be provided on CANVAS at the start of term. An exam at midterm and at end of term will be in person and will examine the respective half of the course.

Student Expectations
Attend all classes and all exams in person. Read all assigned literature. Prepare requested materials for presentations in class. Actively contribute to all class discussions

Learning Activities
Each week, all students are expected to read and understand the assigned literature prior to each class. This understanding will be assessed in a short quiz at the start of each class, administered through CANVAS. For one class each year, each student will also be responsible for leading discussion and writing a report on the assigned literature.

Learning Materials
All learning and reading material will be provided in PDF format on Canvas prior to the start of term. This will include all assigned reading and instructor Session material.

Assigned literature comprises original research articles (maximum 2 per class) that are intended to be 'current', therefore these will be added before the start of each term. Prior to each session, students must have read these research articles.

Instructor Contacts
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Other Instructional Staff
TA's to be updated annually

Acknowledgement
UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓ əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on in their culture, history, and traditions from one generation to the next on this site.

Learning Outcomes

MODULE 1 – STEM CELLS IN AGING, REGENERATION AND TISSUE RENEWAL
- Analyze how genetic diseases impact stem cell function and ultimately impact human health.
- Provide an assessment of how various stem cells contribute to tissue renewal and regeneration, and also influence aging.
- Generate hypotheses regarding how stem cell dysfunction contributes to a variety of diseases
- Explain how some stem cells can be used to treat animal and human disease.
- Explain how manipulation of stem and/or progenitor cells can be used to treat animal and human disease.

MODULE 2 – STEM CELLS IN TUMORIGENESIS
- Explain the hematopoietic stem cell hierarchy and understand the contribution of cells within the hierarchy to blood cancers.
- Generate hypotheses regarding the relationship of stem and progenitor cells to cancer and the mechanisms that contribute to their transformation into cancer cells.
- Explain how our current understanding of cancer has informed new targeted therapeutic strategies for its treatment.

Schedule of Topics

For each week: Assigned literature comprises original research or review articles (maximum 2 per class) that are intended to be 'current', therefore these will be added before the start of each term. Prior to each session, students must have read these research articles.

MODULE 1 – STEM CELLS IN AGING, REGENERATION AND TISSUE RENEWAL

WEEK 1

Session 1. Accelerated aging conditions: Progeroid Syndromes
- Students will be able to describe the causes and aetiology of progeria and associated syndromes.

Session 2. Active Learning in Accelerated aging conditions: Progeroid Syndromes
- Students will interpret and discuss literature in progeroid syndromes.

WEEK 2

Session 3. Induced pluripotent stem cells (iPSC): Models for human disease
- Students will be able to describe how iPSCs are created and how they can be used in disease modeling.

Session 4. Active learning in Induced pluripotent stem cells (iPSC): Models for human disease
- Students will interpret and discuss literature in the use of iPSC in human disease modeling.

WEEK 3

Session 5. Tissue regeneration: Restoration of tissue/organ function
- Students will be able to describe major approaches for the use of stem cells in restoring tissue function.

Session 6. Active learning in Tissue regeneration: Restoration of tissue/organ function
- Students will interpret and discuss literature in restoration of tissue function using stem cell approaches.

WEEK 4

Session 7. Cellular basis of progeria and novel therapies: Defects in tissue homeostasis, renewal, and regeneration
- Students will be able to synthesize their knowledge of progeroid syndromes and tissue regeneration to describe approaches to treat related disorders.

Session 8. Active learning in Cellular basis of progeria and novel therapies: Defects in tissue homeostasis, renewal, and regeneration
- Students will interpret and discuss advances in therapeutic approaches to restore tissue function in disorders such as progeria.

WEEK 5

Session 9. Treatments for genetic diseases: Biology to therapeutics
- Students will be able to explain the nature of genetic disorders and current approaches to developing therapeutics.

Session 10. Active learning in Treatments for genetic diseases: Biology to therapeutics
- Students will explain modern approaches to treating genetic disorders, using stem cell

approaches.

WEEK 6

Session 11. Consolidation of stem cells in aging, regeneration and tissue renewal.
- Students will synthesize their knowledge of critical contributions of stem cells to aging and regeneration of tissues.

Session 12. Mid-term exam (covering material in module 1)

MODULE 2 – STEM CELLS IN TUMORIGENESIS

WEEK 7

Session 13. Hematopoietic stem cells, cancer stem cells, and ontogeny of blood cancers.
- Students will be able to explain the differentiation cascade underlying the production of blood cells and use this knowledge to interpret how common mutations in blood cancers affect this differentiation cascade.

Session 14. Active learning in Hematopoietic stem cells, cancer stem cells, and ontogeny of blood cancers
- Students will interpret and discuss literature in hematopoiesis and cancer.

WEEK 8

Session 15. Embryonal carcinomas and differentiation therapy
- Students will use knowledge of cues involved in development and stem cell maintenance and differentiation to describe how the treatment for germ cell derived tumors was developed and predict potential pathways that could be used to modulate tumors in other contexts.

Session 16. Active learning in embryonal carcinomas and differentiation therapy
- Students will interpret and discuss literature in stem cell maintenance and differentiation related to cancer.

WEEK 9

Session 17. Stem cells vs cellular plasticity in tumor initiation
- Students will be able to compare and contrast the classic models of stem cell driven cancer to tumors originating from organs without a known stem cell.

Session 18. Active learning in stem cells vs cellular plasticity in tumor initiation
- Students will interpret and discuss literature in stem cell driven cancers.

WEEK 10

Session 19. Extrinsic influences affecting initiation of cancer
- Students will recognize that tumor formation does not occur in isolation and identify common risk factors associated with cancer.

Session 20. Active learning in Extrinsic influences affecting initiation of cancer 1
- Students will interpret and discuss literature in extrinsic risk factors in cancer.

WEEK 11
Session 21. Stem cells and tumorigenesis consolidation
- Students will be able to synthesize the roles of stem cells in tumorigenesis.

Session 22. Active learning in stem cells and tumorigenesis consolidation
- Students will defend their synthesis of the roles of stem cells in tumorigenesis.

WEEK 12
Session 23. Consolidation of stem cells in tumorigenesis.
- Students will synthesize their knowledge of critical contributions of stem cells to aging and regeneration of tissues.

Session 24.
- Structured Review

Assessments of Learning
Assessment is in the following form:
1) A short quiz at the start of each active learning class will test the content of the assigned literature. These quizzes will be administered through CANVAS. The end of term mark for quizzes will be the mean of all quizzes and represent 10% of the final mark.
2) For each active learning class, a group of students will be responsible for preparing and leading a critical and thoughtful discussion of, and answering questions for, the assigned literature (no more than 4-5 slides). Each student will receive 15% of their final course mark based on instructor assessment of their performance. Each student will participate in one of these during the course.
3) For each active learning class, the group of students who lead discussion will also prepare a short summary of the paper (no more than 2 pages) including a general introduction to the subject, presentation of the selected paper, interpretation, conclusion and identification of weaknesses. Each student will receive 15% of their final course mark, based on instructor assessment of each student's clear understanding of the assigned literature and its relevance to the field, and will be evaluated on the overall clarity and quality, as well as their quality of literature critique. Each student will participate in one of these during the course.

4) Two invigilated exams. Exam 1 takes place after module 1 and will assess the content of module 1. Exam 2 takes place after module 2 and will assess the content of module 2.

Grading scheme:

Short quizzes on assigned literature(s) at beginning of active learning sessions	20%
Performance in leading discussion of assigned literature	10%
One short write-up on each student's presented paper	10%
Midterm exam (introductory content plus 3 papers from each of the 2 sections)	30%
End of term exam (introductory content plus 3 papers from each of the 2 sections)	30%

Grading Rubric for Leading Discussion of Assigned Literature (Graded out of 15 and worth 10% of grade)

Category	Outstanding	Meets Standards	Below Required Standards	Inc.*	Score
Introduction of research paper	5 • A clear presentation of the paper's hypothesis • A clear, concise and accurate verbal description of the rationale for the hypothesis	3 • A reasonable presentation of the hypothesis and its rationale	1 • The verbal description of either the hypothesis or its rationale are unclear.	0	5
Methods, Results and Conclusions	5 • The methods, results and conclusions are clearly presented	3 • An incomplete or partially unclear description of the methodology, results or conclusions.	1 • The methods, results or conclusions are unclear.	0	5
Critique of the Selected Paper	5 • Generated an engaging, thought provoking discussion about the interpretation and strengths and weaknesses of the study	3 • Generated a relevant discussion about the interpretation of and strengths/weaknesses of the study	1 • Generated a limited discussion about the interpretation and strengths and weaknesses of the study	0	5

Grading Rubric for short write-up on presented paper (Graded out of 15 and worth 10% of grade)

Category	Outstanding	Meets Standards	Below Required Standards	Inc.*	Score
Introduction	5 ● A clear presentation of the paper's hypothesis ● A clear, concise and accurate summary of the rationale for the hypothesis	3 ● A reasonable summary of the hypothesis and its rationale	1 ● Either the hypothesis or itsrationale are unclear.	0	5
Methods, Results and Conclusions	5 ● A clear, concise and accurate description of the methodology, results and conclusions.	3 ● An incomplete or partially unclear description of the methodology, results or conclusions.	1 ● The methods, results or conclusions areunclear.	0	5
Critique of the Selected Paper	5 ● Generated an engaging, thought provoking discussion about the interpretation, strengths and weaknesses of the study	3 ● Generated a relevant discussion about the interpretation about the strengths and weaknesses of the study	1 ● Generated a limited discussion about the interpretation andstrengths and weaknesses of thestudy	0	5

*Incomplete

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideasof all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic

freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and academic standards in all of their actions. Details of the policies and how to access support are available at the Policies and Resources section of the UBC Senate website.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed.For example, incidents of plagiarism or cheating may result in a mark of zero on the assignmentor exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Discipline for Academic Misconduct section of the UBCAcademic Calendar.

- No assignment may be submitted to any other instructor of any course for a grade.
- The minimum penalty for plagiarism in any assignment is a zero for the paper; themaximum penalty is a zero for the course.

UBC Grading Standards

Undergraduate Grading Scale

Percentage (%)	Letter Grade
90-100	A+
85-89	A
80-84	A-
76-79	B+
72-75	B
68-71	B-
64-67	C+
60-63	C
55-59	C-
50-54	D
0-49	F

Learning Resources

All learning resources will be accessible on CANVAS from the start of each term

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