Welcome to BB484/584 – Chromatin and Epigenetics!

Purpose and learner outcomes:

This is a combined lecture and seminar course. The purpose of this course is to:

A) Introduce students to the basic concepts of epigenetics through interactive lectures and reading of the current primary literature. Selected examples of epigenetic phenomena will be discussed in detail; these will change from year to year depending on exciting new discoveries in the field.

B) Give access to background information and older seminal studies that were important in shaping our understanding of epigenetics as a field of research.

C) Provide a setting in which students are trained in critically evaluating original research results through questions and extended discussions.

D) Build a “research resource”. Students will be exposed to various technologies and resources that “epigeneticists” utilize to conduct research. Their availability on campus will be discussed.

After attending this class, students will be able to:

A) Explain how heterochromatin and euchromatin differ from each other;

B) Explain how different chromatin regions are generated and maintained;

C) Describe what epigenetic modifications are and how they are controlled;

D) Explain how certain epigenetic phenomena, such as genomic imprinting and X chromosome inactivation, are initiated;

E) Apply genetic, cytological and biochemical tools that can be used to investigate epigenetic phenomena.
**Evaluations and grading:**
Learner outcomes are measured by evaluation of a term paper (34%), group presentations (30%), and assignments based on readings for discussions during presentations (36%).

All students will submit a full-length term paper in form of a research proposal. Term papers can be prepared individually or by students in their assigned groups. To mimic grant proposal deadlines, students will receive a failing grade if the paper does not reach the instructor on time (at the latest on March 10, 2017, 11:59 pm). Submitting the manuscript by e-mail in MS Word format is preferable; students are encouraged to send papers in early. The paper counts for 34% of the grade. See “Paper Requirements” below and see the instructor if there are questions about this assignment.

All students will participate during class presentations (“journal club” style) in which they lead discussions of a recent or “classic” primary paper. Pre-assigned groups of up to four students will present each paper (see schedule below and as separate file on Canvas; each group will present on three occasions; each presentation is equivalent to 10% of the final grade (individuals get group grade). Lectures and discussion sessions are intended to foster interactions and critical thinking. You are always encouraged to ask questions and make comments and most of all, to enjoy engaging in scientific discussion.

Homework assignments (all individually graded) are based on papers that are required reading (total 36% of grade). Assignments are due before the relevant discussion starts, preferably submitted as an MS Word file.

**Considerations for all participants in discussions:**
Please be always prepared by at the very least reading the paper to be discussed. Read the supplementary information and try to understand the methods.

**Considerations for discussion leaders:**
Please know the background of the paper you discuss. Go back to the older literature that is referred to in the paper if necessary. Know the methods and be able to explain them, read the supplementary information and make it part of your presentation. Be critical, especially when it comes to the discussion (“Does the title match the findings?”, “Do the authors over-interpret data?”, “Are there other/better valid methods?”). Evaluate how well the paper is written (style, clarity, citations). Try to encourage questions and discussion.

**Term paper requirements:**
The paper should take the form of a short research proposal (10-page limit, single-spaced, Arial 11 pt) in an area of epigenetics research that interests you. Use the “Freitag_MRF” proposal on Canvas as example (note that this is a sweeping proposal – it is better to be more focused).

Here are requirements:
1. The paper should have a paragraph each for summary, specific aims and significance. There will be different deadlines for sending these items in for review – we will discuss this in class.
2. Write an in-depth, critical introduction to the topic. Instead of “preliminary results”, review the most recent data in the field and identify the most obvious next experiments that need to be carried out.
3. Formulate a testable hypothesis (at the most two) that will drive the field forward.
4. Propose experiments that will test your hypothesis. Support your choices (i.e., propose experiments that will give you answers that in turn allow you to derive a new testable hypothesis). Think of potential pitfalls.
5. The paper needs to have complete citations (i.e., all author names, dates, full journal names, paper titles). Grading will be on content (90%) but also on presentation (10%).
BB584 Additional Paper Critiques for Graduate Students:

Graduate students are required to submit 2-3 page-long critiques of each assigned paper that they are not presenters for (total score 120 for 9 reports). Papers can take the form of a written “journal club” presentation, in which the student presents a clear summary and critical analysis of the paper. For example, the following questions should be considered: Is the paper a significant contribution to knowledge? If so, why? Are experimental methods clearly described? Do the authors adequately consider alternative models? Are the experiments convincing? Are the conclusions drawn justified based on the reported results? What are the most important future directions for the work? Please make sure to substantiate your opinions by citing from the literature as necessary.

Contact Information:

If you have any questions or problems, feel free to contact me. My office is located on the second floor of the Agricultural and Life Sciences building (ALS2045), my laboratory is in ALS2035. My phone number is 737-4845 and my e-mail address is freitagm@oregonstate.edu.

University Policies – A reminder:

Please note: “Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later than the first week of the term. In order to arrange alternative testing, the student should make the request at least one week in advance of the test. Students seeking accommodations should be registered with the Office of Services for Students with Disabilities.”

The University rules on civility and honesty can be found at: http://oregonstate.edu/admin/stucon/regs.html

Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations. Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

♦ Cheating-use or attempted use of unauthorized materials, information or study aids
♦ Fabrication-falsification or invention of any information
♦ Assisting-helping another commit an act of academic dishonesty
♦ Tampering-altering or interfering with evaluation instruments and documents
♦ Plagiarism-representing the words or ideas of another person as one’s own

Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.

Use of cellular phone call, texting, messaging and twitter functions is not permitted in the classroom during lectures. Feel free, however, to use phones to look up information during class.

“The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student’s freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office.”

Prerequisites and Co-requisites

DESIRED PREREQUISITES: BB451; BB492/592; MCB554 (can be waived with instructor consent)
Schedule Winter 2017:

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Type</th>
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<tbody>
<tr>
<td>Jan 9</td>
<td>Introduction to chromatin and epigenetics</td>
<td>Lecture 1</td>
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<td>Jan 11</td>
<td>DNA and histone modifications</td>
<td>Lecture 2</td>
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<td>Jan 13</td>
<td>UHRF1 links histone and DNA methylation</td>
<td>Discussion 1</td>
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<td>Jan 16</td>
<td>Martin Luther King Day</td>
<td>No class</td>
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<td>Jan 18</td>
<td>Chromatin remodeling</td>
<td>Lecture 3</td>
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<tr>
<td>Jan 20</td>
<td>Histone Demethylation and Chromatin Remodeling</td>
<td>Discussion 2</td>
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<td>Jan 23</td>
<td>Assays for chromatin: ChIP and Hi-C</td>
<td>Lecture 4</td>
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<td>Jan 25</td>
<td>HiC in Neurospora</td>
<td>Lecture 5</td>
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<tr>
<td>Jan 27</td>
<td>Post-transcriptional gene silencing, RNA interference</td>
<td>Discussion 3</td>
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<tr>
<td>Jan 30</td>
<td>RNA-induced DNA methylation in plants</td>
<td>Lecture 6</td>
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<tr>
<td>Feb 1</td>
<td>Position-effect variegation in flies and yeast</td>
<td>Lecture 7</td>
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<td>Feb 3</td>
<td>Fission yeast heterochromatin</td>
<td>Discussion 4</td>
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<td>Feb 6</td>
<td>Centromere chromatin structure</td>
<td>Lecture 8</td>
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<td>Feb 8</td>
<td>CENP-A and histone acetylation</td>
<td>Discussion 5</td>
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<td>Feb 10</td>
<td>Assembly of heterochromatin</td>
<td>Lecture 9</td>
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<tr>
<td>Feb 13</td>
<td>Two complexes – neither called ACDC</td>
<td>Discussion 6</td>
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<td>Feb 15</td>
<td>Fighting invaders with heterochromatin: genome defense</td>
<td>Lecture 10</td>
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<tr>
<td>Feb 17</td>
<td>DNA transposons adapted to form heterochromatin</td>
<td>Discussion 7</td>
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<td>Feb 20</td>
<td>Maintenance of heterochromatin</td>
<td>Lecture 11</td>
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<td>Feb 22</td>
<td>Inheritance of histone marks</td>
<td>Discussion 8</td>
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<td>Feb 24</td>
<td>Polycomb and Trithorax complexes: H3K27me and H3K4me</td>
<td>Lecture 12</td>
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<td>Feb 27</td>
<td>H3K27 methylation and non-coding RNA</td>
<td>Discussion 9</td>
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<tr>
<td>Mar 1</td>
<td>Dosage compensation: One problem, three solutions</td>
<td>Lecture 13</td>
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<td>Mar 3</td>
<td>X-chromosome inactivation</td>
<td>Lecture 14</td>
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<td>Mar 6</td>
<td>X-chromosome inactivation: battling RNAs</td>
<td>Discussion 10</td>
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<td>Mar 8</td>
<td>Genomic Imprinting</td>
<td>Discussion 11</td>
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<td>Mar 10</td>
<td>Imprinting of dormancy in plants</td>
<td>Lecture 15</td>
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<td>Mar 13</td>
<td>Epigenetics and Neo-Lamarckism – wrap up</td>
<td>No class</td>
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<tr>
<td>Mar 15</td>
<td>and Mar 17 – Freitag at Fungal Genetics Conf</td>
<td>No class</td>
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TERM PAPER DUE (11:59 pm – no excuses)
**Reading for BB484 – Winter 2017**

1. All background reading is posted on Canvas in the folder for each lecture. This includes chapters from “Epigenetics, 2nd edition” or reviews that complement the lecture discussions.

2. Papers for discussions (absolutely required reading for all students):

   **Group 1**  

   **Group 2**  

   **Group 3**  

   **Group 4**  

   **Group 1**  

   **Group 2**  

   **Group 3**  

   **Group 4**  

   **Group 1**  

   **Group 2**  

   **Group 3**  

   **Group 4**  