## BIOL 16-17 #14

**Packet Contents**

1.1 *Summary*

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**New Course**

1.2 BIOL 3337/5337 Science Communication (3 credits)

1.11 BIOL 3338 Science Communication Lab (1 credit)

1.19 BIOL 3339/5339 Bioethics (3 credits)

**LibEd Goal Area 9**

1.27 BIOL 4447/5447 Genomics (3 credits)

1.35 BIOL 4448 Genomics Lab (2 credits)

1.39 BIOL 4449 Gene Expression (4 credits)

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1.47 *Signatures*
BSU Curriculum Forms

Form 1

Curriculum Modification Summary

College: CAS
Department: Biology
Proposer: Andrew Arsham
Proposer’s position: Assistant Professor

Describe the modification(s) you propose, and how it (/they) will work to students' advantage. (This description and explanation will be included in Curriculum Report packets forwarded to the Faculty Senate.):

The accompanying course proposals add courses to the Biology department that:

1. Serve the distance learners at North Hennepin Community College who are enrolled in BSU’s Biology Baccalaureate Partnership. These courses include online, face-to-face, and laboratory components that form the bulk of the upper-division curriculum for this group of students. Three of the courses cover advanced genetics and genomics topics.
2. Serve students on the Bemidji campus and beyond with asynchronous online delivery of genomics, science communication, and bioethics courses.
3. Serve graduate students with 5000-level sections of the genomics, science communication, and bioethics courses.

Of the six courses proposed here, five have been successfully taught twice in experimental form and one has been taught once.

Modifications proposed (specify number of each):

____ Course Modification(s) (form 2)
___6___ New Course(s) (form 3)
____ Course Drop(s) (form 4)
____ Program Modification(s) (form 5)
____ New Program(s) (form 6)
____ Program Drop(s) (form 7)

The modifications affect (check):
__x__ Liberal Education
__x__ Undergraduate Curriculum
__x__ Graduate Curriculum
____ Teacher Licensure Program(s)
BSU Curriculum Forms

Form 3:
Updated: 9.19.15

New Course Form

Course Number:
  Undergraduate: BIOL3337
  Graduate: BIOL5337

Course Title: Science Communication

Course Description: This online course includes training in the skills, tools, and habits of mind of the practicing scientist. These skills include navigating and understanding the scientific literature, framing evidence-based and model-driven scientific questions, proposing and testing hypotheses, conducting research responsibly and ethically, analyzing and visualizing data, and communicating scientific rationale and results in lab meetings, presentations, research funding applications, and job searches.

Credits: 3

Prerequisite(s):
  Undergraduate: none
  Graduate: none

1. Reason(s) for creating this course:
Most college graduates have received little or no training in the scientific method, the epistemology of science, the responsible conduct of research, the many modes of scientific communication, and data visualization. This course is designed to meet those needs for Biology majors.

2. How often will this course be offered?
Once per year.

3. What are the student learning outcomes for the course (please precede each outcome with "Students will...")?
  • Students will find, organize, analyze, annotate, and cite a variety of scientific and mass media sources clearly, concisely, and logically
  • Students will create compelling written and oral communications with clearly defined goals and appropriately scaled information content and complexity
  • Students will critique and improve their own and others’ work effectively and generously
  • Students will use features of Microsoft Office and other software to increase productivity and efficiency, and improve document style, consistency, readability, and navigation
  • Students will summarize and practice the norms and requirements for the responsible conduct of research
  • Students will assess the ways in which the practice of science is both dependent and independent of the society in which it functions, and recognize instances where the scientific enterprise can recapitulate institutional and cultural biases despite the appearance of objectivity
• Students will create clear, parsimonious, and rigorous data visualizations, and critically analyze published data visualizations from a variety of sources
• Students will understand different models of scientific thinking and their strengths and limitations, and apply them to propose testable scientific hypotheses to extend existing knowledge

4. What are the major content areas for the course?
Unit 1: Who Are We, What is Science, and Why and How is it Communicated?
Unit 2: The Responsible Conduct of Research
Unit 3: Statistics and Data Visualization
Unit 4: Written and Oral Communications

5. Is this course repeatable for credit, and if so, what is the maximum number of credits that can be earned? No

6. If this course is intended primarily for off-campus delivery (not offered on campus), what delivery mechanism will be used? Asynchronous delivery via D2L and supplementary synchronous meeting via video or chat

7. What is the projected maximum class size (cap)? 20

8. What qualified faculty will be available to teach this course? Assistant Professor Andrew Arsham

NOTE WELL: Department and dean, in approving this proposal, attest both to the adequacy of the qualifications of faculty here named, and to their availability to teach the course at the frequency specified above, without excessive overload or disruption to other curriculum.

9. What additional library and other resources need or should be provided for this course, that are not already available? None

10. What special personal property or service fee(s) would be charged to students taking this course? These charges would be for 1) items that are retained by the student and have an educational or personal value beyond the classroom, or 2) services that are on the student’s behalf (see MnSCU Board Policy 5.11).
   Amount per student: $
   For: None

11. Attach a sample syllabus for the course. Note: if this course is double-numbered (u-grad/grad), the syllabus must include an additional component for graduate students.
BIOL 3337/5337 Science Communication

The Basics

BIOL3337 - 5337

Online via D2L - 3 credits

https://bemidjistate.ims.mnscu.edu/d2l/home/3289260

BSU IT HelpDesk

Andrew M Arsham, Ph.D.
Assistant Professor of Biology, Bemidji State University
aarsham@bemidjistate.edu
763-488-0426
North Hennepin Community College BHCC 240

Office Hours (appointments are highly recommended):

M W 9-11a
M Tu W Th 330-5p

Unless otherwise noted, all face-to-face BSU courses on NHCC’s campus will follow the NHCC schedule for holidays, breaks, and class cancellations

Course Description, Values, and Policies

When asked what skills their students most need (and lack) for post-college school and work, faculty members at graduate and medical schools frequently mention communications skills and scientific thinking. They want students to be better able to navigate the biomedical literature, to frame scientific questions, and to communicate the rationale and results of their work in lab meetings, presentations, and funding applications. This course is designed to prepare students with practical analytical and communications skills for post-graduate research and professional environments, whether that’s med/grad/pharm school, a research lab, a biotech company, a hospital, a parks system, the DNR or anything in between. The goal is to help students develop skills that will facilitate achievement of their professional and intellectual goals.

Graduate Section

Graduate students will cover the same material as undergraduates with the addition of:

1. A brief wrap-up writing assignment for each unit summarizing and synthesizing the unit’s material as it relates to the student’s pursuit of graduate training and career aspirations

2. Graduate student projects will support the student’s graduate research or teaching goals and culminate in a grant or fellowship submission or in the creation of a new teaching unit. Early in the semester graduate students will seek out funding sources or will define a research or teaching goal to be accomplished, in consultation with their graduate advisor if applicable. The grad student final project will thus serve a course-specific pedagogical purpose similar to the undergraduate project, but will also achieve a concrete professional goal specific to the student’s graduate training or career.
Learning Objectives
By the end of the semester, students should be able to:

1. find, organize, analyze, annotate, and cite a variety of scientific and mass media sources clearly, concisely, and logically
2. create compelling written and oral communications with clearly defined goals and appropriately scaled information content and complexity
3. critique and improve their own and others' work effectively and generously
4. use features of Microsoft Office and other software to increase productivity and efficiency, and improve document style, consistency, readability, and navigation
5. summarize and practice the norms and requirements for the responsible conduct of research
6. assess the ways in which the practice of science is both dependent and independent of the society in which it functions, and recognize instances where the scientific enterprise can recapitulate institutional and cultural biases despite an emphasis on objectivity
7. create clear, parsimonious, and rigorous data visualizations, and critically analyze published data visualizations from a variety of sources
8. understand different models of scientific thinking and their strengths and limitations, and apply them to propose testable scientific hypotheses to extend existing knowledge

Course Structure
The course will be broken down into 4 major content units. Each unit will last from 3-4 weeks and will use a wide variety of methods (discussion, writing, thinking, individual work, group work, problem sets, tests, quizzes, and presentations) to give all students as many opportunities as possible to learn in different styles. There will be a fair amount of writing, in and out of class, which will give you the chance to think through your ideas and will give me a chance to see how you are grappling with the material. This structure requires your focused engagement with the material and with your classmates.

Most of the coursework will be structured around a genetics research topic of your choice. In the first few weeks of the semester, each of you will select a scientific question that interests you—it is important that you're excited about the question since it will provide the material for many of our short graded and ungraded communications exercises and all of our major assignments. During the first weeks we will spend time in class discussing, sharing, and workshopping these questions so that everyone has a good one. The topic must fulfill the following criteria:

- There must be a substantial scientific literature about the topic
- There must be substantial non-scientific material about the topic (online, newspaper, magazines, etc.)
- The topic should be something that will sustain your interest for the semester and that you will be excited to learn about and communicate to a variety of scientific and non-scientific audiences
- The topic must be related to genetics or gene expression, broadly defined

At the end of the semester we will take time to work on individual final projects that integrate newly acquired skills and content into a research poster, a written grant proposal, and oral presentations.

Learning Community
Science is a communal endeavor that requires openness, communication, and lots and lots of wrong answers—fear of confusion and fear of being wrong are fundamental impediments to our growth as scientists. Everybody has the tools to practice science and scientific thinking, and this course will model the scientific values of openness and communication. You aren’t expected to know all the answers in class; you are expected to actively engage with your community in a search for answers. Wrong answers give us all
the opportunity to improve our understanding; share your ideas, share your confusion, and we might all get smarter together.

**Course Communications**

We will rely heavily on internet access for course communications—if you do not have consistent access to a computer and a quality internet connection outside of class, please contact me as soon as possible. Laptops or tablets are frequently useful in class—if you do not have a mobile computing device larger than a phone, please let me know as soon as possible.

As a BSU student, you may install Microsoft Office 365 on your personal computer, and I suggest you do so. Instructions are [here](#).

Email will be our primary communications channel outside the classroom. You **must check** your BSU email address at least once a day. I will check my email at least twice a day Monday through Friday, and will do my absolute best to respond to weekday emails within 24-48 hours—students should plan to do the same. Here are email configuration instructions for **iOS**, **Android**, and **Outlook**. I expect you to read email from me within a day of my sending it, and I expect a response if one is asked for.

The other major communications component for the course will be the Brightspace (aka D2L) online learning environment. All readings, assignments, grades, and feedback will be distributed and completed through Brightspace. If access to Brightspace is a problem, alert me right away. Within Brightspace, various technical support and policy information are in the “HelpLinks” box on the right side of the course home screen.

Other technical support can be found in the BSU IT [Knowledge Base](#) and the [Help Desk](218 755-4207 or studenthelp@bemidjistate.edu)

**Inclusiveness and Accommodation**

My goal is to create an accessible environment where everyone has the opportunity to learn and to succeed, and I try to design my courses accordingly—please let me know if there are things I can do to make this course more accessible or more compatible with assistive technologies. In addition, institutional resources are available:

- BSU has a [Disability-Related Accommodations and Access Policy Manual](#) and [Disability Services Office](218-755-3883, disabilityservices@bemidjistate.edu) which provide academic accommodations for students with documented disabling conditions enrolled online or on-campus courses.
- For classes on NHCC’s campus, students needing additional accommodation can contact Tom Lynch ([tlynch@nhcc.edu](#), 763-493-0556), the Director of [Access Services](#) at NHCC to discuss accommodations. Be sure to mention at the outset that you are in the BSU Biology program so he knows to coordinate with BSU.

**Attendance and Lateness**

Classroom participation, group work, and in-class writing require attendance. As soon as you know you will be absent or late for a class, email me. If you check with me ahead of time or have an emergency that you tell me about immediately, I will gladly accept assignments within 24 hours of the missed class with no penalty. For longer absences and illnesses, we will come up with a catch-up plan and due dates.

If you miss an in-class or online assignment without notice or explanation, it will be graded as a zero.
Academic Integrity

Academic and research integrity are non-negotiable. Academic dishonesty will not be tolerated, and students are expected to follow BSU’s Academic Integrity Policies. The most basic rules of thumb are:

- never take credit for work or ideas that are not yours
- always cite your sources, even if it’s an idea you got from one of your classmates over lunch

Plagiarism in written assignments, including online discussion, is a very serious offense and can lead to a failing grade in the course and to notification of department chair and/or dean. Students are encouraged to email me with any questions regarding plagiarism or academic dishonesty.

Online Journal and Database Access

Many of our readings will be part of subscription databases that require logging in to the BSU library using your 14-digit ID located under the barcode of your BSU ID—the default password is your last name, all lowercase. Details are covered in a PDF tutorial. You should have been mailed a BSU student ID card—if you do not have one, email the Extended Learning office immediately. If you cannot log in to BSU’s library, let me know.

Grading

There will be many graded assignments in different categories, all of them via D2L. All grades except quizzes will be on a scale from 0-5, and larger assignments may be weighted more heavily; there will be a one-point penalty for each day of unexcused lateness, and a zero for assignments not completed within 5 days of the due date. Even late assignments can earn a passing grade if it’s been arranged with me ahead of time—I’d much rather you do the work late than not at all. See below for grade categories, general grading rubric, and final grade calculation.

<table>
<thead>
<tr>
<th>Assignment Categories' Percent of Final Grade</th>
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<tbody>
<tr>
<td>25 Short Exercises x 5 points each = 125 pts</td>
</tr>
<tr>
<td>Written Poster 25 pts</td>
</tr>
<tr>
<td>Written Grant Proposal 25 pts</td>
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<tr>
<td>Zotero Library 25 pts</td>
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<tr>
<td>Video Grant Presentation 25 pts</td>
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<tr>
<td>Video Poster Presentation 25 pts</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Assignment Grading Rubric</th>
<th>Final Letter Grade Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5: Excellent work demonstrating completion of the reading/thinking assignment, strong independent thought, and integration of issues, ideas, or trends from the world outside our classroom.</td>
<td>4SA&lt;5</td>
</tr>
<tr>
<td>4: Very Good. Assignment demonstrates reading and comprehension of the relevant material, awareness of how the material relates to overall learning objectives and to other class material, and has a coherent structure and viewpoint.</td>
<td>3sB&lt;4</td>
</tr>
<tr>
<td>3: Good. Assignment demonstrates that the student has done the assigned reading and/or thinking and has put a modicum of effort into writing a coherent and readable piece.</td>
<td>2SC&lt;3</td>
</tr>
<tr>
<td>2: Needs Improvement. Assignment provided modest evidence that the student has done the assigned reading but not much else.</td>
<td>1SD&lt;2</td>
</tr>
<tr>
<td>1: Unsatisfactory. Assignment was turned in but showed no evidence of content comprehension or intellectual effort.</td>
<td>&lt;1: Unacceptable</td>
</tr>
<tr>
<td>0: Assignment was not turned in</td>
<td></td>
</tr>
</tbody>
</table>
Bemidji State University Policies

As BSU students, you have access to a variety of student services and advising resources.

The BSU Student Handbook includes policies governing course withdrawal and tuition, and a student code of conduct, which states that:

- Students will work as honest and respectful partners with the University in fulfilling its academic and administrative mission and responsibilities, fulfilling their academic endeavors in an honest and forthright manner.
- Students will speak and listen to others with care, seeking personal understanding and maintaining respect and civility.
- Students will respect and protect the personal privacy, rights, and safety of others with regard to physical and sexual boundaries, living space, possessions, electronic accounts and academic endeavors.
Course Calendar (scheduled class cancellations in red)

Unit 1: Who Are We, What is Science, and Why and How is it Communicated?

Unit Objectives
At the end of this unit, students should be able to:

1. Navigate (and know the difference between) the formal scientific literature and science journalism and social media
2. Identify and explain the parts of a scientific paper and their purposes
3. Build a personal annotated digital library using Zotero
4. Assign styles in Microsoft Word and use them to easily and quickly change the look and feel of a document
5. Identify an important current question in genetics and, using the scientific method, outline the current state of knowledge and potential future directions

Unit Content
1.1 (Week 1): Getting to know each other, and thinking about how we know what we know (and what we don't)
1.2 (Week 2): Introduction to science communication; science research, news, blogs, and tweets
1.3 (Week 3): To see the world in a grain of sand, hit the scientific literature - but first you have to find the right grain
1.4 (Week 4): Sorting sand - Buddha at the beach

Unit 2: The Responsible Conduct of Research

Unit Objectives
At the end of this unit, students should be able to:

1. Use role play and discussion to recognize examples of scientific misconduct, distinguish between misconduct and fraud, and model ethical and constructive responses
2. Create a personal values statement about diversity and equity in science and propose concrete steps, if any are necessary, to pursue those values

Unit Content
2.1 (Week 5): Science is always hard, and often wrong, and sometimes fraudulent - what are the reasons (and how can we tell them apart)?
2.2 (Week 6): Interactive movie: “The Lab!”
2.3 (Week 7): Science, society, and diversity: who does science and does it matter?

Unit 3: Statistics and Data Visualization

Unit Objectives
At the end of this unit, students should be able to:

1. Understand the meaning, importance, limitations, and abuses of statistical significance, and make quality judgements regarding statistical tests in the scientific literature
2. Correctly use the appropriate statistical test in common data analysis scenarios
3. Create high quality data visualizations based on an understanding of underlying principles of graphic design and data transparency
4. Use standard and advanced data analysis features of Microsoft Excel including table formatting, conditional formatting, sparklines, and graphs.

Unit Content
3.1 (Week 8): Principles of data visualization, featuring Edward Tufte
3.2 (Week 9): Microsoft Excel: nobody loves it, everybody uses it, and almost nobody uses it well
3.3 (Week 10): What is the meaning of significance?
3.4 (Week 11): Do it again! Science’s “reproducibility crisis”

Unit 4: Written and Oral Communications

Unit Objectives
At the end of this unit, students should be able to:
   1. Write about complex scientific topics with vibrant and clear prose
   2. Communicate data and ideas with audience- and format-appropriate detail and information density
   3. Write a compelling and fundable research proposal based on existing data and models
   4. Use Microsoft PowerPoint to create rigorous, informative, high quality slide decks and posters for formal and informal presentations
   5. Critique and improve their own and each other’s work with rigor, compassion, and generosity

Unit Content
4.1 (Week 12 Nov): The return of Tufte - did PowerPoint blow up the space shuttle?
4.2 (Week 13 Nov): Creating and presenting posters
4.3 (Week 14 Nov): Authorial voice and known and unknown unknowns
4.4 (Week 15 Nov): My mind on my money and my money on my mind - writing grants

Final Presentations and Debrief (Week 16)
BSU Curriculum Forms

Form 3:
Updated: 9.19.15

New Course Form

Course Number:
   Undergraduate: BIOL3338
   Graduate:

Course Title: Science Communication Lab

Course Description:

All students in the Biology Baccalaureate Partnership at North Hennepin Community College are expected to co-enroll in this 1 credit face-to-face section on the NHCC campus when taking BIOL 3337 online. The on-campus discussion section will cover supplementary topics and material and is intended to build scientific community and communications skills among the BBP cohort. The lab section will not impact the main course grades.

Credits: 1

Prerequisite(s):
   Undergraduate: co-enrollment in 3337
   Graduate: none

1. Reason(s) for creating this course:
This lab section will supplement the online content delivery with face-to-face contact among the BBP cohort, which is necessary to build scientific and intellectual community and communications on the NHCC campus.

2. How often will this course be offered?
Once per year.

3. What are the student learning outcomes for the course (please precede each outcome with "Students will…")?
   • Students will find, organize, analyze, annotate, and cite a variety of scientific and mass media sources clearly, concisely, and logically
   • Students will create compelling written and oral communications with clearly defined goals and appropriately scaled information content and complexity
   • Students will critique and improve their own and others’ work effectively and generously
   • Students will use features of Microsoft Office and other software to increase productivity and efficiency, and improve document style, consistency, readability, and navigation
   • Students will summarize and practice the norms and requirements for the responsible conduct of research
• Students will assess the ways in which the practice of science is both dependent and independent of the society in which it functions, and recognize instances where the scientific enterprise can recapitulate institutional and cultural biases despite the appearance of objectivity
• Students will create clear, parsimonious, and rigorous data visualizations, and critically analyze published data visualizations from a variety of sources
• Students will understand different models of scientific thinking and their strengths and limitations, and apply them to propose testable scientific hypotheses to extend existing knowledge

4. What are the major content areas for the course?
Unit 1: Who Are We, What is Science, and Why and How is it Communicated?
Unit 2: The Responsible Conduct of Research
Unit 3: Statistics and Data Visualization
Unit 4: Written and Oral Communications

5. Is this course repeatable for credit, and if so, what is the maximum number of credits that can be earned? No

6. If this course is intended primarily for off-campus delivery (not offered on campus), what delivery mechanism will be used? Face-to-face delivery at distance learning site NHCC

7. What is the projected maximum class size (cap)? 20

8. What qualified faculty will be available to teach this course?
Assistant Professor Andrew Arsham

NOTE WELL: Department and dean, in approving this proposal, attest both to the adequacy of the qualifications of faculty here named, and to their availability to teach the course at the frequency specified above, without excessive overload or disruption to other curriculum.

9. What additional library and other resources need or should be provided for this course, that are not already available? None

10. What special personal property or service fee(s) would be charged to students taking this course? These charges would be for 1) items that are retained by the student and have an educational or personal value beyond the classroom, or 2) services that are on the student's behalf (see MnSCU Board Policy 5.11).
    Amount per student: $
    For: None

11. Attach a sample syllabus for the course. Note: if this course is double-numbered (u-grad/grad), the syllabus must include an additional component for graduate students.
BIOL 3338 Science Communication Lab

The Basics

BIOL3338

Face to Face Lab for BBP students at NHCC - 1 credit

https://bemidjistate.ims.mnscu.edu/d2l/home/3289260

BSU IT HelpDesk

Andrew M Arsham, Ph.D.
Assistant Professor of Biology, Bemidji State University
aarsham@bemidjistate.edu
763-488-0426
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Office Hours (appointments are highly recommended):

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Unless otherwise noted, all face-to-face BSU courses on NHCC’s campus will follow the NHCC schedule for holidays, breaks, and class cancellations

Course Description, Values, and Policies

All students in the Biology Baccalaureate Partnership at North Hennepin Community College are expected to co-enroll in this 1 credit face-to-face section on the NHCC campus when taking BIOL 3337 online. The on-campus discussion section will cover supplementary topics and material and is intended to build scientific community and communications skills among the BBP cohort. The lab section will not impact the main course grades.

Learning Objectives

By the end of the semester, students should be able to:

1. present face-to-face oral communications with clearly defined goals and appropriately scaled information content and complexity
2. discuss and critique their own and others’ work effectively and generously
3. analyze and discuss sensitive topics and issues related to the responsible conduct of research, and equity in science

Grading

Grading will be on the basis of attendance and participation in discussions (1/3), in-class writing assignments (1/3), and on presentations (1/3).

There will be many graded assignments of varying scope and weight, such that both you and I will have a continuously up to date understanding of your graded performance over the course of the semester, and such that no single event or assessment will have a disproportionate effect on your final grade. All graded assignments, grades, and other feedback will be take place on Brightspace.
Course Structure

The course will be broken down into 4 major content units. Each unit will last from 3-4 weeks and will use a wide variety of methods (discussion, writing, thinking, individual work, group work, problem sets, tests, quizzes, and presentations) to give all students as many opportunities as possible to learn in different styles. There will be a fair amount of writing, in and out of class, which will give you the chance to think through your ideas and will give me a chance to see how you are grappling with the material. This structure requires your focused engagement with the material and with your classmates.

Most of the coursework will be structured around a genetics research topic of your choice. In the first few weeks of the semester, each of you will select a scientific question that interests you—it is important that you’re excited about the question since it will provide the material for many of our short graded and ungraded communications exercises and all of our major assignments. During the first weeks we will spend time in class discussing, sharing, and workshopping these questions so that everyone has a good one. The topic must fulfill the following criteria:

- There must be a substantial scientific literature about the topic
- There must be substantial non-scientific material about the topic (online, newspaper, magazines, etc.)
- The topic should be something that will sustain your interest for the semester and that you will be excited to learn about and communicate to a variety of scientific and non-scientific audiences
- The topic must be related to genetics or gene expression, broadly defined.

At the end of the semester we will take time to work on individual final projects that integrate newly acquired skills and content into a research poster, a written grant proposal, and oral presentations.

Learning Community

Science is a communal endeavor that requires openness, communication, and lots and lots of wrong answers—fear of confusion and fear of being wrong are fundamental impediments to our growth as scientists. Everybody has the tools to practice science and scientific thinking, and this course will model the scientific values of openness and communication. You aren’t expected to know all the answers in class; you are expected to actively engage with your community in a search for answers. Wrong answers give us all the opportunity to improve our understanding; share your ideas, share your confusion, and we might all get smarter together.

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### Inclusiveness and Accommodation

My goal is to create an accessible environment where everyone has the opportunity to learn and to succeed, and I try to design my courses accordingly—please let me know if there are things I can do to make this course more accessible or more compatible with assistive technologies. In addition, institutional resources are available:

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- For classes on NHCC’s campus, students needing additional accommodation can contact Tom Lynch (tlynch@nhcc.edu, 763-493-0556), the Director of Access Services at NHCC to discuss accommodations. Be sure to mention at the outset that you are in the BSU Biology program so he knows to coordinate with BSU.

### Attendance and Lateness

Classroom participation, group work, and in-class writing require attendance. As soon as you know you will be absent or late for a class, email me. If you check with me ahead of time or have an emergency that you tell me about immediately, I will gladly accept assignments within 24 hours of the missed class with no penalty. For longer absences and illnesses, we will come up with a catch-up plan and due dates.

If you miss an in-class or online assignment without notice or explanation, it will be graded as a zero.

### Academic Integrity

Academic and research integrity are non-negotiable. Academic dishonesty will not be tolerated, and students are expected to follow BSU’s [Academic Integrity Policies](#). The most basic rules of thumb are:

- never take credit for work or ideas that are not yours
- always cite your sources, even if it’s an idea you got from one of your classmates over lunch

Plagiarism in written assignments, including online discussion, is a very serious offense and can lead to a failing grade in the course and to notification of department chair and/or dean. Students are encouraged to email me with any questions regarding plagiarism or academic dishonesty.
Online Journal and Database Access
Many of our readings will be part of subscription databases that require logging in to the BSU library using your 14-digit ID located under the barcode of your BSU ID—the default password is your last name, all lowercase. Details are covered in a PDF tutorial. You should have been mailed a BSU student ID card—if you do not have one, email the Extended Learning office immediately. If you cannot log in to BSU’s library, let me know.

Bemidji State University Policies
As BSU students, you have access to a variety of student services and advising resources. The BSU Student Handbook includes policies governing course withdrawal and tuition, and a student code of conduct, which states that:

- Students will work as honest and respectful partners with the University in fulfilling its academic and administrative mission and responsibilities, fulfilling their academic endeavors in an honest and forthright manner.
- Students will speak and listen to others with care, seeking personal understanding and maintaining respect and civility.
- Students will respect and protect the personal privacy, rights, and safety of others with regard to physical and sexual boundaries, living space, possessions, electronic accounts and academic endeavors.
Course Calendar (scheduled class cancellations in red)

Unit 1: Who Are We, What is Science, and Why and How is it Communicated?

Unit Objectives

At the end of this unit, students should be able to:

1. Navigate (and know the difference between) the formal scientific literature and science journalism and social media
2. Identify and explain the parts of a scientific paper and their purposes
3. Build a personal annotated digital library using Zotero
4. Assign styles in Microsoft Word and use them to easily and quickly change the look and feel of a document
5. Identify an important current question in genetics and, using the scientific method, outline the current state of knowledge and potential future directions

Unit Content

1.1 (Week 1): Getting to know each other, and thinking about how we know what we know (and what we don't)
1.2 (Week 2): Introduction to science communication; science research, news, blogs, and tweets
1.3 (Week 3): To see the world in a grain of sand, hit the scientific literature - but first you have to find the right grain
1.4 (Week 4): Sorting sand - Buddha at the beach

Unit 2: The Responsible Conduct of Research

Unit Objectives

At the end of this unit, students should be able to:

1. Use role play and discussion to recognize examples of scientific misconduct, distinguish between misconduct and fraud, and model ethical and constructive responses
2. Create a personal values statement about diversity and equity in science and propose concrete steps, if any are necessary, to pursue those values

Unit Content

2.1 (Week 5): Science is always hard, and often wrong, and sometimes fraudulent - what are the reasons (and how can we tell them apart)?
2.2 (Week 6): Interactive movie: “The Lab!”
2.3 (Week 7): Science, society, and diversity: who does science and does it matter?

Unit 3: Statistics and Data Visualization

Unit Objectives

At the end of this unit, students should be able to:

1. Understand the meaning, importance, limitations, and abuses of statistical significance, and make quality judgements regarding statistical tests in the scientific literature
2. Correctly use the appropriate statistical test in common data analysis scenarios
3. Create high quality data visualizations based on an understanding of underlying principles of graphic design and data transparency
4. Use standard and advanced data analysis features of Microsoft Excel including table formatting, conditional formatting, sparklines, and graphs.

Unit Content
3.1 (Week 8): Principles of data visualization, featuring Edward Tufte
3.2 (Week 9): Microsoft Excel: nobody loves it, everybody uses it, and almost nobody uses it well
3.3 (Week 10): What is the meaning of significance?
3.4 (Week 11): Do it again! Science’s “reproducibility crisis”

Unit 4: Written and Oral Communications

Unit Objectives
At the end of this unit, students should be able to:

1. Write about complex scientific topics with vibrant and clear prose
2. Communicate data and ideas with audience- and format-appropriate detail and information density
3. Write a compelling and fundable research proposal based on existing data and models
4. Use Microsoft PowerPoint to create rigorous, informative, high quality slide decks and posters for formal and informal presentations
5. Critique and improve their own and each other’s work with rigor, compassion, and generosity

Unit Content
4.1 (Week 12): The return of Tufte - did PowerPoint blow up the space shuttle?
4.2 (Week 13): Creating and presenting posters
4.3 (Week 14): Authorial voice and known and unknown unknowns
4.4 (Week 15): My mind on my money and my money on my mind - writing grants

Final Presentations and Debrief (Week 16):
BSU Curriculum Forms

Form 3

Updated: 9.19.15

New Course Form

Course Number:
  Undergraduate: BIOL3339
  Graduate: BIOL5339

Course Title: Bioethics

Course Description: In this online Bioethics course we will grapple with the many philosophical, ethical, and practical questions created by advances in medicine and biology using a combination of readings, case studies, scientific literature, and popular culture. The course has undergraduate and graduate sections and is intended for students in their Junior year of college or later. Topics include prenatal testing, abortion, assisted suicide, human augmentation/transhumanism, cloning, disability rights, animal rights, genetically modified organisms, and environmental ethics.

Credits: 3

Prerequisite(s):
  Undergraduate: none
  Graduate: none

1. Reason(s) for creating this course:
To give students an opportunity to consider and discuss the moral, ethical, and public policy impact of medicine, biotechnology, agriculture, and animal rights. The course takes a practical approach to bioethics that includes formal ethical frameworks but focuses on how ethics can and must inform individual and societal decisions about healthcare and the environment.

2. How often will this course be offered?
Once per year

3. What are the student learning outcomes for the course (please precede each outcome with "Students will…")?

   • Students will identify ethical, moral, and philosophical questions raised by advances in medical care and biotechnology
   • Students will analyze the impact that these issues can have on individual humans and animals, and the societal impact on the law, social equality, civil liberties, and the common good
   • Students will recognize and apply distinct formal ethical approaches to different biomedical dilemmas
   • Students will apply the concept of personhood as it relates to individual rights in healthcare decision making and resource allocation

4. What are the major content areas for the course?
Unit 1: Introduction and Ethical Frameworks
Unit 3. At Death’s Door: Healthcare Decisions at the End of Life
Unit 4. Reproductive Citizens: Parents' Rights, Infants' Rights, and Technology
Unit 5. Ethics of Dominion: Every Creeping Thing That Creepeth Upon the Earth

5. Is this course repeatable for credit, and if so, what is the maximum number of credits that can be earned? No

6. If this course is intended primarily for off-campus delivery (not offered on campus), what delivery mechanism will be used?
Asynchronous online delivery via D2L

7. What is the projected maximum class size (cap)?
40

8. What qualified faculty will be available to teach this course?
Assistant Professor Andrew Arsham

NOTE WELL: Department and dean, in approving this proposal, attest both to the adequacy of the qualifications of faculty here named, and to their availability to teach the course at the frequency specified above, without excessive overload or disruption to other curriculum.

9. What additional library and other resources need or should be provided for this course, that are not already available?
None

10. What special personal property or service fee(s) would be charged to students taking this course? These charges would be for 1) items that are retained by the student and have an educational or personal value beyond the classroom, or 2) services that are on the student’s behalf (see MnSCU Board Policy 5.11).
Amount per student: $ None

11. Attach a sample syllabus for the course. Note: if this course is double-numbered (u-grad/grad), the syllabus must include an additional component for graduate students.
BIOL 3339/5339 Bioethics

The Basics

BIOL 3339/5339, 3 credits
Online only
Textbook: None
https://bemidjistate.ims.mnsu.edu/d2l/home/3273920
Andrew M Arsham, Ph.D.
Assistant Professor of Biology, Bemidji State University
aarsham@bemidjistate.edu
763-488-0426
North Hennepin Community College BHCC 240

Office Hours (appointments are highly recommended; I’m happy to chat by phone or skype as well):
M W 9-11a
M Tu W Th 330-5p

- Because this course is online and enrolls students from many locations, assignments will be due regardless of the holiday or class-cancellation schedule of any particular campus.
- The one exception will be Thanksgiving, when there will be an amended holiday assignment schedule

Course Description, Values, and Policies

In this online course in Biomedical Ethics we will grapple with the many philosophical, ethical, and practical questions created by advances in medicine and biology using a combination of readings, case studies, scientific literature, and popular culture. The course has undergraduate and graduate sections and is intended for students in their Junior year of college or later. Biomedical ethics as a field attempts to synthesize a systematic ethical framework for decision-making in medical care and biological research. Many of the topics, and even the definitions of terms, can touch on deeply held personal beliefs and can excite passionate disagreement. Topics include prenatal testing, abortion, assisted suicide, human augmentation/transhumanism, cloning, disability rights, animal rights, and genetically modified organisms. Because this is a Biology course, our approach will be more concrete than might be found in a Philosophy department. Nonetheless we will use some of the formal theoretical tools of ethicists and philosophers to help us build analytical frameworks to contextualize and connect our discussions. Student performance is assessed through regular writing assignments and online discussions. The course has no synchronous components or proctored exam requirement, but is highly structured with multiple scheduled assignments each week and requires consistent student engagement throughout the semester.

Graduate Section
Graduate students will participate in all course modules alongside the undergrads, covering the same shared material will also be required to:
1. find and include an additional scholarly publication in their weekly discussion post
2. include additional specified components in unit wrap-up assignments
3. generate at least one personal learning objective related to their graduate training and career aspirations
4. submit a longer and more difficult final project
Learning Objectives
Upon completion of this course, students should be able to:

- identify ethical, moral, and philosophical questions raised by advances in medical care and biotechnology
- analyze the impact that these issues can have on individual humans and animals, and the societal impact on the law, social equality, civil liberties, and the common good
- recognize and apply distinct formal ethical approaches to different biomedical dilemmas
- apply the concept of personhood as it relates to individual rights in healthcare decision making and resource allocation

Course Structure
The course is broken down into 5 major content units of three weeks each. There is no textbook—all readings will be assigned online and will be freely available either through D2L, the BSU Library website, or open access online repositories.

The course is offered as a 3000-level undergraduate course and as a 5000-level graduate course. The graduate students will participate in all course modules alongside the undergrads but will have some additional reading and writing assignments, and may be asked to take on some leadership roles as the course proceeds.

Each unit will consist of two weeks of readings, writing, and online discussion, and a one-week wrap-up assignment that will tie together the ideas of the prior two weeks. This structure requires your focused engagement on a day-to-day basis with the material and with your classmates. For these assignments I'm much less interested in word counts than I am in the quality and creativity of your thinking and the rigor of your analysis.

At the end of the semester we will take time to work on individual final projects that will try to synthesize some larger ethical and practical frameworks tying the different units together for 25% of your final grade. This will be due before the start of finals week—there is no final exam.

Our weekly structure will reflect the 3-day-a-week schedule that is typical of a 3 credit course. When budgeting your time, consider the readings to be homework and the writings to be analogous to classroom discussion.

**Monday:** by midnight, each week’s readings are due, along with a brief 300 to 500-word (equivalent to a half to a full page single-spaced) analysis of the key issues and ethical frameworks. These will be graded out of a total of 5 points each.

**Wednesday:** all students will be assigned to groups of 4 or 5. by midnight Wednesday you will be required to find some cultural artifact (video, movie, novel, visual art, essay, newspaper or magazine article, song, whatever) that in some way addresses the weeks’ issues, and write a brief 100 to 250-word blog post for the members of your group analyzing the key ethical and/or practical questions and how they relate to the unit topic. **Graduate students will bring in both a cultural artifact and a journal article from the scientific literature for their analysis.** The blog posts should be written with your group in mind as the audience.

**Thursday:** by midnight all members of the group must read the group thread and either respond briefly but substantively to each the other students’ posts or write a summary post about the whole set. **This discussion will earn a group grade out of a maximum of 5 points** – all students in the group will receive the same grade based on the overall strength and quality of the cultural artifact posts and group discussion. I encourage you to treat these as study groups and to create as vibrant and participatory a space as possible.

Unit wrap-up assignments will be posted in D2L and will be graded out of a total of 10 points each.
Learning Community
This may not always feel like a science class, but it is. Science is a communal endeavor that requires openness, communication, and lots and lots of wrong answers—fear of confusion and fear of being wrong are fundamental impediments to our growth as scientists, and to our ability to openly engage with thorny and difficult ethical questions. You are expected to do your best to create an environment that is both rigorous and generous, and to allow your classmates and yourself the space to work through complex ideas.

Course Communications
As an online-only course, the D2L/Brightspace learning environment is our classroom. All readings, assignments, grades, and feedback will be distributed and completed through Brightspace. If access to Brightspace is a problem, alert me right away. Within Brightspace, various technical support and policy information are in the “HelpLinks” box on the right side of the course home screen.

Email will be our secondary communications channel. You must check your BSU email address at least once a day. I will check my email at least twice a day Monday through Friday, and will do my absolute best to respond to all emails within 24-48 hours—students should plan to do the same. Here are email configuration instructions for iOS, Android, and Outlook. I expect you to read email from me within a day of my sending it, and I expect a response if one is asked for.

Other technical support can be found in the BSU IT Knowledge Base and the Help Desk (218 755-4207 or studenthelp@bemidjistate.edu).

Inclusiveness and Accommodation
My goal is to create an accessible environment where everyone has the opportunity to succeed, and I try to design my courses accordingly—please let me know if there are things I can do to make this course more accessible. In addition, institutional resources are available:

- BSU has a Disability-Related Accommodations and Access Policy Manual (word doc) and Disability Services Office, (218-755-3883, disabilityservices@bemidjistate.edu) which provide academic accommodations for students with documented disabling conditions enrolled online or on-campus courses.
- For classes on NHCC’s campus, students needing additional accommodation can contact Tom Lynch (tlynch@nhcc.edu, 763-493-0556), the Director of Access Services at NHCC to discuss accommodations. Be sure to mention at the outset that you are in the BSU Biology program so he knows to coordinate with BSU.

Lateness
If you check with me ahead of time or have an emergency that you tell me about immediately, I will gladly accept assignments within 24 hours of the due date with no penalty. For longer absences and illnesses, we will come up with a catch-up plan and due dates.

If you miss an assignment without notice or explanation, it will be graded as a zero.

Academic Integrity
Academic and research integrity are non-negotiable. Academic dishonesty will not be tolerated, and students are expected to follow BSU’s Academic Integrity Policies. The most basic rules of thumb are:

- never take credit for work or ideas that are not yours
- always cite your sources, even if it’s an idea you got from one of your classmates over lunch
Plagiarism in written assignments, including online discussion, is a very serious offense and can lead to a failing grade in the course and to notification of department chair and/or dean. Students are encouraged to email me with any questions regarding plagiarism or academic dishonesty.

**Online Journal and Database Access**
Many of our readings will be part of subscription databases that require logging in to the [BSU library](#) using your 14-digit ID located under the barcode of your BSU ID—the default password is your last name, all lowercase. Details are covered in a [PDF tutorial](#). You should have been mailed a BSU student ID card—if you do not have one, email the [Extended Learning](#) office immediately. If you cannot log in to BSU’s library, let me know.

**Grading**
There will be many graded assignments in different categories, all of them via D2L. All grades will be on a scale from 0-5, and larger assignments may be weighted more heavily; there will be a one-point penalty for each day of unexcused lateness. Zeroes really hurt averages—consider the benefit of turning in even sub-par work vs getting a zero on a late or missed assignment. Late assignments can earn a passing grade if it’s been arranged with me ahead of time—I’d much rather you do the work late than not at all. See below for grade categories, general grading rubric, and final grade calculation.
Bemidji State University Policies

As BSU students, you have access to a variety of student services and advising resources.

The BSU Student Handbook includes policies governing course withdrawal and tuition, and a student code of conduct, which states that:

- Students will work as honest and respectful partners with the University in fulfilling its academic and administrative mission and responsibilities, fulfilling their academic endeavors in an honest and forthright manner.
- Students will speak and listen to others with care, seeking personal understanding and maintaining respect and civility.
- Students will respect and protect the personal privacy, rights, and safety of others with regard to physical and sexual boundaries, living space, possessions, electronic accounts and academic endeavors.
Course Calendar (subtopics subject to change)

Unit 1: Introduction and Frameworks: Who are the persons in this class? And what is a Person anyway?
1.1 (Week 1 Aug 22): Introductions and ethical frameworks
1.2 (Week 2 Aug 29): What is the theoretical basis of ethical obligations to others?
1.3 (Week 3 Sept 5): Unit Wrap-up

2.1 (Week 4 Sept 12): Disability, citizenship, and personhood
2.2 (Week 5 Sept 19): Is healthcare a right? Are we obligated to distribute it ethically?
2.3 (Week 6 Sept 26): Wrap-up

Unit 3. At Death's Door: Healthcare Decisions at the End of Life
3.1 (Week 7 Oct 3): Autonomy, decision-making, and quality of life for the elderly
3.2 (Week 8 Oct 10): I’m not dead yet…but I will be – creating a healthcare directive
3.3 (Week 9 Oct 17): Wrap-up

Unit 4. Reproductive Citizens: Parents' Rights, Infants' Rights, and Technology
4.1 (Week 10 Oct 24): When does a rights-bearing person come into existence?
4.2 (Week 11 Oct 31): Who has a voice, and who decides for those without one?
4.3 (Week 12 Nov 7): Wrap-up

Unit 5. Ethics of Dominion: Every Creeping Thing That Creepeth Upon the Earth
5.1 (Week 13 Nov 14): Is there an ethical obligation to sentient non-people?
5.2 (Week 14 Nov 21/Thanksgiving): Is there an ethical obligation to the environment?
5.3 (Week 15 Nov 28): Wrap-up

Final Projects Due (Week 16 Dec 5): Due on Sunday December 11
BSU Curriculum Forms

Form 3

Updated: 9.19.15

New Course Form

Course Number:
  Undergraduate: BIOL4447
  Graduate: BIOL5447

Course Title: Genomics

Course Description:
Genomics is the study of the content, structure, organization, evolution, and conservation of whole genomes. Because of its reliance on precision instrumentation and scale, and the unprecedented volume of data produced, genomics is unusual among biological disciplines in its integration of engineering, statistics, and information science. Genomics also requires the biologist to engage in systems thinking by taking a wide view of the dynamic physical and informational network that comprises a single genome. One must further consider the human genome as itself a component of an even larger network of genomes that make up the holobiont—that’s us plus our always-changing resident community of microbial pals. After covering these and other topics, and carrying out a substantial genome annotation project for the lab component of the course, we explore personal genomics, or how all this information and understanding affects our lives as 21st century human beings.

Credits: 3

Prerequisite(s):
  Undergraduate: BIOL2360
  Graduate: none

1. Reason(s) for creating this course:
The content of this course is not covered elsewhere in BSU’s catalog. The sequencing of the human genome and many others is profoundly impacting our understanding of evolution, human health and disease, and the health and environmental impact of microbial communities (collectively known as the microbiome). This course covers the ideas, technologies, and impacts of the broad and multidisciplinary field of genomics.

2. How often will this course be offered?
Once per year

3. What are the student learning outcomes for the course (please precede each outcome with "Students will...")?
- Students will describe the origins and techniques of genome sequencing technology and the mechanisms and impact of so-called “next-generation” sequencing and emerging single-molecule approaches.
- Students will understand the scale of biological data being generated by whole genome sequencing and the reliance of biologists on computer scientists, mathematicians, statisticians, and engineers for the tools and algorithms necessary to generate, process, and analyze sequence data.
- Students will use systems thinking to understand how genomes are complex, dynamic, and evolving
networks and how multiple species’ genomes can exist in larger competitive or cooperative networks.

- Students will identify areas of the human body that are routinely colonized by microbes and explain the importance of those commensal biological relationships and the impact of their disruption on health and disease.
- Students will compare informational and spatial organization of genomes between eukaryotes and prokaryotes, and analyze the role of different levels of organization in gene expression and disease.
- Students will differentiate between realistic goals for precision or personal medicine and business- or policy-driven hype

4. What are the major content areas for the course?
Unit 1: The Informational and Three Dimensional Genome
Unit 2: Genome Technology
Unit 3: The Hologenome
Unit 4: The Personal Genome

5. Is this course repeatable for credit, and if so, what is the maximum number of credits that can be earned?
No

6. If this course is intended primarily for off-campus delivery (not offered on campus), what delivery mechanism will be used?
Asynchronous delivery via D2L with potential synchronous meetings via video or chat software

7. What is the projected maximum class size (cap)?
40

8. What qualified faculty will be available to teach this course?
Assistant Professor Andrew Arsham

NOTE WELL: Department and dean, in approving this proposal, attest both to the adequacy of the qualifications of faculty here named, and to their availability to teach the course at the frequency specified above, without excessive overload or disruption to other curriculum.

9. What additional library and other resources need or should be provided for this course, that are not already available?
None

10. What special personal property or service fee(s) would be charged to students taking this course? These charges would be for 1) items that are retained by the student and have an educational or personal value beyond the classroom, or 2) services that are on the student’s behalf (see MnSCU Board Policy 5.11).
Amount per student: $
For: None

11. Attach a sample syllabus for the course. Note: if this course is double-numbered (u-grad/grad), the syllabus must include an additional component for graduate students.
BIOL 4447/5447 Genomics

The Basics

Genomics

4447-5447 Online 3 Credits

https://bemidjistate.ims.mnscu.edu/d2l/

Andrew M Arsham, Ph.D.
Assistant Professor of Biology
Bemidji State University
aarsham@bemidjistate.edu
763-488-0426
North Hennepin Community College BHCC 240

Office Hours:
Drop-in Friday 9am-noon
By appointment (don’t be shy!) Monday, Tuesday, Thursday 9am-11am and 3:30-5

Course Description, Values, and Policies

Genomics is the study of the content, structure, organization, evolution, and conservation of whole genomes. Because of its reliance on precision instrumentation and scale, and the unprecedented volume of data produced, genomics is unusual among biological disciplines in its integration of engineering, statistics, and information science. Genomics also requires the biologist to engage in systems thinking by taking a wide view of the dynamic physical and informational network that comprises a single genome. One must further consider the human genome as itself a component of an even larger network of genomes that make up the holobiont—that’s us plus our always-changing resident community of microbial pals. After covering these and other topics, and carrying out a substantial genome annotation project for the lab component of the course, we explore personal genomics, or how all this information and understanding affects our lives as 21st century human beings.

Learning Objectives

Upon course completion, students should be able to:

Describe the origins and techniques of genome sequencing technology and the mechanisms and impact of so-called “next-generation” sequencing and emerging single-molecule approaches.

Understand the scale of biological data being generated by whole genome sequencing and the reliance of biologists on computer scientists, mathematicians, statisticians, and engineers for the tools and algorithms necessary to generate, process, and analyze sequence data.

Navigate bioinformatics resources and use genome browser software to analyze and annotate raw sequence data for inclusion in genome databases.

Use systems thinking to understand how genomes are complex, dynamic, and evolving networks and how multiple species’ genomes can exist in larger competitive or cooperative networks.

Identify areas of the human body that are routinely colonized by microbes and explain the importance of those commensal biological relationships and the impact of their disruption on health and disease.
Compare informational and spatial organization of genomes between eukaryotes and prokaryotes, and analyze the role of different levels of organization in gene expression and disease.

Differentiate between realistic goals for precision or personal medicine and business- or policy-driven hype

Course Structure

The course will be broken down into 4 major content units. Each unit will last from 2-4 weeks and will have a number of repeating elements such as group work, reading a scientific paper, or quizzes. We will use a wide variety of methods (listening, talking, writing, thinking, individual work, group work, problem sets, tests, quizzes, lecture, and lab) to give all students as many opportunities as possible to learn in different styles. This structure (and, I would argue, any meaningful learning in any class) requires your engagement with the material and with the group. There will be a fair amount of writing, in and out of class, which will give you the chance to think through your ideas and will give me a chance to see how you are grappling with the material.

At the end of the semester we will take time to work on individual final projects that integrate the major unit content and culminate in student presentations—for these projects, you will teach yourself something new, and then you will teach it to your classmates for 25% of your final grade.

Graduate Students

This course includes graduate students. The general course structure and grading scheme is similar, but students registered for 5930 will also have the following additional assignments:

- In alternating weeks, each graduate student will be asked to choose a paper from the biomedical literature to assign to the other graduate students. Each grad student will read the paper and participate in an online Journal club led by the student who chose the paper—students will be responsible for finding a time to meet via video for this purpose
- Grad students will be assigned an extra ‘wrap-up’ assignment at the end of each unit that summarizes and synthesizes the unit’s material—these assignments will be used for review and subsequently assessed by the undergraduates
- Every other week (non-journal club weeks) grad students will be asked to write a discussion prompt for the undergraduates to respond to and will then lead an online discussion with the undergraduates. The grad-leader will initiate and facilitate the threaded discussion, and will assess undergraduate student performance
- Grad student final presentations will be similar in format to undergraduates but will be longer and require a higher degree of technical sophistication.

Learning Community

Science is a communal endeavor that requires openness, communication, and lots of wrong answers—fear of confusion and fear of being wrong are fundamental impediments to science. I don't expect you to have all the answers in class; I do expect you to actively engage with your colleagues and with me to search for them. Everybody has the tools to practice science and scientific thinking. This course will model the scientific values of openness and communication and will embrace the idea that wrong answers are important and informative because they give us the opportunity to improve our understanding. Share your ideas, share your confusion and we all get smarter together.

Course Communications

We will rely heavily on internet access for course communications—if you do not have consistent access to a computer and a quality internet connection outside of class, please contact me as soon as possible.

Email will be our primary communications channel outside the classroom. You must check your BSU email address at least once a day. Help with email setup can be found here and here. I will check my email at least twice a day Monday
through Friday, and will do my absolute best to respond to all emails within 24 hours—**students should plan to do the same.**

**Brightspace (D2L) Learning Environment**
The other major communications component for the course will be the Brightspace (aka D2L) online learning environment. All readings, assignments, grades, and feedback will be distributed and completed through Brightspace. If access to Brightspace is a problem, alert me right away.

**Inclusiveness and Accommodation**
My goal is to create an environment where everyone has the opportunity to succeed, and I try to design my courses to be accessible to all students. Students needing additional accommodation should contact Tom Lynch, the Director of Access Services at NHCC to discuss accommodations. Be sure to mention at the outset that you are in the BSU Biology program so he knows to coordinate with BSU.

Upon request students with a documented disability may receive appropriate and reasonable accommodations in this course including information in an alternate format. Please contact the Disability Services Office at 218-755-3883 or email disabilityservices@bemidjistate.edu.

**Attendance and Lateness**
Because participation, group work, and in-class writing are all used in this course, attendance is critical. As soon as you know you will be absent or late for a class, email me. If you check with me ahead of time or have an emergency that you tell me about immediately, I will accept assignments within 24 hours of the missed class with no penalty. For longer absences and illnesses, we will come up with a catch-up plan and due dates.

**If you are absent without notice, any in-class assignments from the missed day will be graded as a zero.**
Academic Integrity
Academic and research integrity are non-negotiable. Academic dishonesty will not be tolerated, and students are expected to follow BSU’s Academic Integrity Policies. The most basic rules of thumb are:

- never take credit for any work that is not yours
- always cite your sources, even if it’s an idea you got from one of your classmates over lunch.

Plagiarism in written assignments, including online discussion, is a very serious offense and can lead to a failing grade in the course and to notification of department chair and/or dean. Students are encouraged to email me with any questions regarding plagiarism or academic dishonesty.

Online Journal and Database Access
Many of our readings will be part of subscription databases that require logging in to the BSU library using your 14-digit ID located under the barcode of your BSU ID—the default password is your last name, all lowercase. Details are covered in a PDF tutorial. You should have been mailed a BSU student ID card—if you do not have one, email the Extended Learning office immediately. If you cannot log in to BSU’s library, let me know.

Grading
There will be many graded assignments of varying scope and weight, all of them via Brightspace. All grades except quizzes will be on a scale from 0-5; with a one point penalty for each day of lateness. At the end of the course, grades will be tallied and a final score of 1-5 will be calculated that reflects the scores and weights of the individual assignments.

Overall grading scheme
4 < A
3 < B ≤ 4
2 < C ≤ 3
1 < D ≤ 2
0 < F ≤ 1

Grade Scale
0: Fail. Assignment was not turned in
1: Poor. Assignment was turned in but showed no evidence of content comprehension
2: Not Good. Assignment provided modest evidence that the student has done the assigned work but not much else
3: Good. Assignment demonstrates that the student has done the assigned readings and/or thinking and has put a modicum of effort into writing a coherent and readable piece
4: Very Good. Assignment demonstrates reading and comprehension of the relevant material, awareness of how the material relates to overall learning objectives and to other class material, and has a coherent structure and viewpoint
5: Excellent. Demonstrates comprehension, contextual awareness, independent thought, and integration of issues, ideas, or trends from the world outside our classroom
Lab
The 2-credit lab component of the course will consist of hands-on annotation of genomic sequence as part of the Genomics Education Project, as well as practice using other bioinformatics tools and databases. Your lab grade will be determined by your attendance and by the quality of your sequence annotation and documentation which will be detailed in class.

Bemidji State University Policies
As BSU students, you have access to a variety of student services and advising resources.

The BSU Student Handbook includes policies governing course withdrawal and tuition, and a student code of conduct, which states that:

- Students will work as honest and respectful partners with the University in fulfilling its academic and administrative mission and responsibilities, fulfilling their academic endeavors in an honest and forthright manner.
- Students will speak and listen to others with care, seeking personal understanding and maintaining respect and civility.
- Students will respect and protect the personal privacy, rights, and safety of others with regard to physical and sexual boundaries, living space, possessions, electronic accounts and academic endeavors.
Course Calendar

Unit 1: The Informational Genome
Week 1 (1/11/2016): introduction to genomics, the GEP, and What is a Gene?
Week 2 (1/18—Monday MLK holiday): genome organization—genes, junk, introns, and complexity
Week 3 (1/25): the genome in 3D
Week 4 (2/1): the evolving genome

Unit 2: Genome Technology
Week 5 (2/8): sequencing from Sanger to single-molecule
Week 6 (2/15—Monday 2/15 Presidents’ Day holiday): genome databases
Week 7 (2/22—classes canceled Friday 2/26 for staff development day): genome analysis algorithms—homology searches, gene finders, etc.
Week 8 (2/29 classes canceled Tuesday 3/1): genome technology teach-o-rama

3/7 Spring Break!

Unit 3: The Hologenome
Week 9 (3/14): the microbiome—where are they, who are they, what are they doing?
Week 10 (3/21): the microbiome in human health and disease
Week 11 (3/28): the microbiome and evolution

Unit 4: The Personal Genome
Week 12 (4/4): personalized medicine hype vs. reality
Week 13 (4/11): 23&me analysis
Week 14 (4/18): 23&me analysis

Final Projects
Week 15: 4/25 [no classes Friday 5/29 study day]
BSU Curriculum Forms

Form 3

Updated: 9.19.15

New Course Form

Course Number:
  - Undergraduate: BIOL4448
  - Graduate:

Course Title: Genomics Lab

Course Description:
All students in the Biology Baccalaureate Partnership at North Hennepin Community College are expected to co-enroll in this 2 credit face-to-face section on the NHCC campus when taking BIOL4447 online. This lab section consists of a hands-on genome annotation project in collaboration with the national Genomics Education Partnership, as well as practice using other bioinformatics tools and databases.

Credits: 2

Prerequisite(s):
  - Undergraduate: BIOL2360, co-enrollment with BIOL4447
  - Graduate:

1. Reason(s) for creating this course:
This lab section provides an authentic research experience in genomics for undergraduates as part of a nationwide collaboration.

2. How often will this course be offered?
Once per year

3. What are the student learning outcomes for the course (please precede each outcome with "Students will...")?
   - Students will understand the mathematical and computational principles underlying common bioinformatics tools like BLAST, CLUSTAL, etc
   - Students will use software to infer evolutionary relationships between and within species and understand the biological and mathematical basis for these inferences
   - Students will use genome browser software to analyze and annotate raw genome sequence, including searching for and identifying most likely homologs, identifying transcriptional and translational start sites and intron/exon boundaries, and depositing processed sequence annotations in genome databases
   - Students will complete a package of sequence annotations of sufficient quality to be included in the Genome Education Project’s next group publication—any students completing this objective will qualify as authors on any publication that uses their annotations

4. What are the major content areas for the course?
   - Introduction to annotation and genome browsers
• Introduction to Drosophila and the 4th chromosome
• Group Annotation
• Solo Annotation
• Evolution and phylogenetic trees

5. Is this course repeatable for credit, and if so, what is the maximum number of credits that can be earned?
   No.

6. If this course is intended primarily for off-campus delivery (not offered on campus), what delivery mechanism will be used?
   Face-to-face delivery at North Hennepin Community College

7. What is the projected maximum class size (cap)?
   40

8. What qualified faculty will be available to teach this course?
   Assistant Professor Andrew Arsham

NOTE WELL: Department and dean, in approving this proposal, attest both to the adequacy of the qualifications of faculty here named, and to their availability to teach the course at the frequency specified above, without excessive overload or disruption to other curriculum.

9. What additional library and other resources need or should be provided for this course, that are not already available?
   None

10. What special personal property or service fee(s) would be charged to students taking this course? These charges would be for 1) items that are retained by the student and have an educational or personal value beyond the classroom, or 2) services that are on the student’s behalf (see MnSCU Board Policy 5.11).
    Amount per student: $
    For:
    None

11. Attach a sample syllabus for the course. Note: if this course is double-numbered (u-grad/grad), the syllabus must include an additional component for graduate students.
BIOL4448 Genomics Lab

The Basics
Lab 2 credits : 3 hours per week

Andrew M Arsham, Ph.D.
Assistant Professor of Biology, Bemidji State University
aarsham@bemidjistate.edu
763-488-0426
North Hennepin Community College BHCC 240

Office Hours:

Course Description
All students in the Biology Baccalaureate Partnership at North Hennepin Community College are expected to co-enroll in this 2 credit face-to-face section on the NHCC campus when taking BIOL4447 online. This lab section consists of a hands-on genome annotation project in collaboration with the national Genomics Education Partnership, as well as practice using other bioinformatics tools and databases.

Learning Objectives
Upon course completion, students will be able to:

- Understand the mathematical and computational principles underlying common bioinformatics tools like BLAST, CLUSTAL, etc
- Use software to infer evolutionary relationships between and within species and understand the biological and mathematical basis for these inferences
- Use genome browser software to analyze and annotate raw genome sequence, including searching for and identifying most likely homologs, identifying transcriptional and translational start sites and intron/exon boundaries, and depositing processed sequence annotations in genome databases
- Complete a package of sequence annotations of sufficient quality to be included in the Genome Education Project’s next group publication—any students completing this objective will qualify as authors on any publication that uses their annotations

Grading
There will be many graded assignments of varying scope and weight, such that both you and I will have a continuously up-to-date understanding of your graded performance over the course of the semester, and such that no single event or assessment will have a disproportionate effect on your final grade. All graded assignments, grades, and other feedback will be take place on Brightspace.
Overall grading scheme

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>≥ 90% of all available points</td>
</tr>
<tr>
<td>B</td>
<td>≥ 80%</td>
</tr>
<tr>
<td>C</td>
<td>≥ 70%</td>
</tr>
<tr>
<td>D</td>
<td>≥ 60%</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

Bemidji State University Policies

The BSU Student Handbook includes policies including **course withdrawal and tuition**, and **student code of conduct**, which states that:

- Students will work as honest and respectful partners with the University in fulfilling its academic and administrative mission and responsibilities, fulfilling their academic endeavors in an honest and forthright manner.
- Students will speak and listen to others with care, seeking personal understanding and maintaining respect and civility.
- Students will respect and protect the personal privacy, rights, and safety of others with regard to physical and sexual boundaries, living space, possessions, electronic accounts and academic endeavors.

You also have access to a variety of student services and advising **resources**.

Upon request students with a documented disability may receive appropriate and reasonable accommodations in this course including information in an alternate format. Please contact the Disability Services Office at 218-755-3883 or email **disabilityservices@bemidjistate.edu**.

Course Calendar

**Weeks:**

1. Introduction to the Genome Education Partnership, Sequencing Technology, and review of Leung et al 2015
2. Hands on with the UCSC Genome Browser and the basics of BLAST searching
3. Introduction to Drosophila and the 4th chromosome
4. Group Annotation I
5. Group Annotation II
6. Group presentations and discussion of gene annotation
7. Solo Annotation I
8. Solo Annotation II
9. Solo Annotation III
10. Project Presentations
11. Project Presentations
12. Understanding phylogenetic trees, how they’re made, and what they mean
13. Evolution I: Constructing phylogenetic trees
14. Evolution II: Constructing phylogenetic trees
15. Evolution presentations
BSU Curriculum Forms

Form 3

Updated: 9.19.15

New Course Form

Course Number:
  Undergraduate: BIOL4449
  Graduate:

Course Title: Gene Expression

Course Description:

While mutations in genomic DNA play a major role in human health and disease, the control of gene expression plays the pivotal role in establishing developmental patterning, cellular differentiation, responsiveness to environmental stimuli, and defense against pathogens and invasive genetic elements. Changes in genomic DNA over time are a key driver of evolution, but the control of gene expression is also a major generator of species diversity and a driver of genome structure and function. Chromosomes in eukaryotic nuclei are made up of a combination of DNA and proteins packaged and compacted into a composite called chromatin—in turn, chromatin structure and modification determines whether a gene is “open” for transcription or closed.

One of the most efficient and well-characterized systems for studying the relationship between chromatin and gene expression is the so-called position effect variegation (PEV) in the compound eye of Drosophila melanogaster, in which the variable expression of a reporter transgene allows reproducible measurement of gene expression in response to genetic and environmental factors. We will use a combination of classroom and laboratory approaches to understand and complete original research projects using this system.

Successful completion of this course satisfies BSU Biology’s capstone requirement.

Credits: 4

Prerequisite(s):
  Undergraduate: BIOL2360
  Graduate:

1. Reason(s) for creating this course:
This course is an exploration of advanced topics in gene expression using both lecture and lab components. It covers topics unique to the BSU catalog and provides an opportunity for novel student-centered research in a structured classroom environment. It will be taught as part of the distance-learning transfer partnership at North Hennepin Community College and will satisfy the Biology departmental capstone requirement for those students.

2. How often will this course be offered?
Once per year.

3. What are the student learning outcomes for the course (please precede each outcome with "Students will…”)?
• Students will understand the unique historical importance and continued relevance of the fruit fly in genetic research.

• Students will describe the biochemical and functional difference between heterochromatin and euchromatin and the molecular methods by which these differences are investigated.

• Students will describe the genetic mechanisms by which *Drosophila* and other organisms defend against mobile and repetitive DNA elements, and the impact of genetic attack-and-defense on genome structure and evolution and on the idea of “junk” DNA.

• Students will propose and test hypotheses about the regulation of chromatin state using *Drosophila* to generate specific genotypes required for testing genetic hypotheses.

• Students will use a variety of morphometric, biochemical, and molecular methods to reproducibly measure gene expression in *Drosophila*.

• Students will work in scientific teams to compare and analyze data, troubleshoot experimental approaches, and contribute to shared scientific goals.

• Students will prepare high quality summary reports, posters, and presentations explaining the work and summarizing the results.

4. What are the major content areas for the course?
Unit 1: Fly husbandry, P-elements, transgenes, and position effect
Unit 2: Molecular biology of gene silencing
Unit 3: Measurement of gene expression
Unit 4: Data Analysis

5. Is this course repeatable for credit, and if so, what is the maximum number of credits that can be earned?
No.

6. If this course is intended primarily for off-campus delivery (not offered on campus), what delivery mechanism will be used?
Face-to-face at North Hennepin Community College

7. What is the projected maximum class size (cap)?
24

8. What qualified faculty will be available to teach this course?
Assistant Professor Andrew Arsham

NOTE WELL: Department and dean, in approving this proposal, attest both to the adequacy of the qualifications of faculty here named, and to their availability to teach the course at the frequency specified above, without excessive overload or disruption to other curriculum.

9. What additional library and other resources need or should be provided for this course, that are not already available?
None

10. What special personal property or service fee(s) would be charged to students taking this course? These charges would be for 1) items that are retained by the student and have an educational or personal value beyond the classroom, or 2) services that are on the student’s behalf (see MnSCU Board Policy 5.11).
Amount per student: $
For:

11. Attach a sample syllabus for the course. Note: if this course is double-numbered (u-grad/grad), the syllabus must include an additional component for graduate students.
BIOL4449 Gene Expression

The Basics

BIOL4449  4 Credits
T H 11:00am - 12:50pm + Open Lab Time TBD
BHCC 213
https://bemidjistate.ims.mnscu.edu/d2l/home/3289263
BSU IT HelpDesk
Andrew M Arsham, Ph.D.
Assistant Professor of Biology, Bemidji State University
aarsham@bemidjistate.edu
763-488-0426
North Hennepin Community College BHCC 240

Office Hours (appointments are highly recommended):
M W 9-11a
M Tu W Th 3:30-5p

Unless otherwise noted, all face-to-face BSU courses on NHCC’s campus will follow the NHCC schedule for holidays, breaks, and class cancellations

Course Description, Values, and Policies

While mutations in genomic DNA play a major role in human health and disease, the control of gene expression plays the pivotal role in establishing developmental patterning, cellular differentiation, responsiveness to environmental stimuli, and defense against pathogens and invasive genetic elements. Changes in genomic DNA over time are a key driver of evolution, but the control of gene expression is also a major generator of species diversity and a driver of genome structure and function. Chromosomes in eukaryotic nuclei are made up of a combination of DNA and proteins packaged and compacted into a composite called chromatin—in turn, chromatin structure and modification determines whether a gene is “open” for transcription or closed.

One of the most efficient and well-characterized systems for studying the relationship between chromatin and gene expression is the so-called position effect variegation (PEV) in the compound eye of Drosophila melanogaster, in which the variable expression of a reporter transgene allows reproducible measurement of gene expression in response to genetic and environmental factors. We will use a combination of classroom and laboratory approaches to understand and complete original research projects using this system.

Successful completion of this course satisfies BSU Biology’s capstone requirement.

Learning Objectives

Upon course completion, students should be able to:

Understand the unique historical importance and continued relevance of the fruit fly in genetic research
Describe the biochemical and functional difference between heterochromatin and euchromatin and the molecular methods by which these differences are investigated
Describe the genetic mechanisms by which Drosophila and other organisms defend against mobile and repetitive DNA elements, and the impact of genetic attack-and-defense on genome structure and evolution and on the idea of
“junk” DNA
Propose and test hypotheses about the regulation of chromatin state using Drosophila to generate specific genotypes required for testing genetic hypotheses
Use a variety of morphometric, biochemical, and molecular methods to reproducibly measure gene expression in Drosophila
Work as a scientific team to compare and analyze data, troubleshoot experimental approaches, and contribute to shared scientific goals
Prepare high quality summary reports, posters, and presentations explaining the work and summarizing the results

Course Structure
The structure of this course is based around acquiring the knowledge we need to understand and set up our experimental approaches in lab. Initial classes will focus on understanding the history, origins, and mechanisms of the core elements of our Drosophila melanogaster experimental system. Later weeks will cover the techniques and molecular mechanisms by which we will be measuring gene expression in the fly, as well as statistical methods to assess the magnitude and significance of phenotypic changes. Final weeks will encompass summary reporting of each students’ findings in publishable units. Assessments will be based on documentation of experimental setup and results and by summary and discussion of scientific papers.

There will be 2 hours per week of required open lab time outside of class hours—we will discuss this in class and figure out when to make the lab available.

Learning Community
We will work in pairs and/or small teams, and also as a large group to frame and ask novel scientific questions to which nobody knows the answer. This is real science! Accordingly, even when it comes to reading existing scientific literature, you can’t know all the answers ahead of time; you are expected to actively engage with your community to advance our shared knowledge. We will all be confused together, and with any luck we will also get smarter together.

Course Communications
We will rely heavily on internet access for course communications—if you do not have consistent access to a computer and a quality internet connection outside of class, please contact me as soon as possible. Laptops or tablets are frequently useful in class—if you do not have a mobile computing device larger than a phone, please let me know as soon as possible.

As a BSU student, you may install Microsoft Office 365 on your personal computer, and I suggest you do so. Instructions are here.

Email will be our primary communications channel outside the classroom. You must check your BSU email address at least once a day. I will check my email at least twice a day Monday through Friday, and will do my absolute best to respond to all emails within 24 hours—students should plan to do the same. Here are email configuration instructions for iOS, Android, and Outlook. I expect you to read email from me within a day of my sending it, and I expect a response if one is asked for.

The other major communications component for the course will be the Brightspace (aka D2L) online learning environment. All readings, assignments, grades, and feedback will be distributed and completed through Brightspace. If access to Brightspace is a problem, alert me right away. Within Brightspace, various technical support and policy information are in the “HelpLinks” box on the right side of the course home screen.
Other technical support can be found in the BSU IT Knowledge Base and the Help Desk (218 755-4207 or studenthelp@bemidjistate.edu)

Inclusiveness and Accommodation
My goal is to create an accessible environment where everyone has the opportunity to learn and to succeed, and I try to design my courses accordingly—please let me know if there are things I can do to make this course more accessible or more compatible with assistive technologies. In addition, institutional resources are available:

- BSU has a Disability-Related Accommodations and Access Policy Manual (word doc) and Disability Services Office, (218-755-3883, disabilityservices@bemidjistate.edu) which provide academic accommodations for students with documented disabling conditions enrolled online or on-campus courses.
- For classes on NHCC's campus, students needing additional accommodation can contact Tom Lynch (tlynch@nhcc.edu, 763-493-0556), the Director of Access Services at NHCC to discuss accommodations. Be sure to mention at the outset that you are in the BSU Biology program so he knows to coordinate with BSU.

Attendance and Lateness
This is a discussion and laboratory class—as such, regular attendance is essential and your teammates will depend on you. As soon as you know you will be absent or late for a class, email me. If you check with me ahead of time or have an emergency that you tell me about immediately, I will gladly accept assignments within 24 hours of the missed class with no penalty. For longer absences and illnesses, we will come up with a catch-up plan and due dates.

If you miss an in-class or online assignment without notice or explanation, it will be graded as a zero.

Academic Integrity
Academic and research integrity are non-negotiable. Academic dishonesty will not be tolerated, and students are expected to follow BSU's Academic Integrity Policies. The most basic rules of thumb are:

- never take credit for work or ideas that are not yours
- always cite your sources, even if it’s an idea you got from one of your classmates over lunch

Plagiarism in written assignments, including online discussion, is a very serious offense and can lead to a failing grade in the course and to notification of department chair and/or dean. Students are encouraged to email me with any questions regarding plagiarism or academic dishonesty.

Online Journal and Database Access
Many of our readings will be part of subscription databases that require logging in to the BSU library using your 14-digit ID located under the barcode of your BSU ID—the default password is your last name, all lowercase. Details are covered in a PDF tutorial. You should have been mailed a BSU student ID card—if you do not have one, email the Extended Learning office immediately. If you cannot log in to BSU's library, let me know.

Grading
There will be many graded assignments in different categories, all of them via D2L. All grades except quizzes will be on a scale from 0-5, and larger assignments may be weighted more heavily; there will be a one-point (i.e., 20%) penalty for each day of unexcused lateness. Zeros really hurt students’ average score—consider the benefit of turning in even sub-par work vs getting a zero on a late or missed assignment. Even very late assignments can earn a passing grade if it’s been arranged with me ahead of time—I’d much rather you do the work late than not at all. See below for grade categories, general grading rubric, and final grade calculation
Bemidji State University Policies

As BSU students, you have access to a variety of student services and advising resources. The BSU Student Handbook includes policies governing course withdrawal and tuition, and a student code of conduct, which states that:

- Students will work as honest and respectful partners with the University in fulfilling its academic and administrative mission and responsibilities, fulfilling their academic endeavors in an honest and forthright manner.
- Students will speak and listen to others with care, seeking personal understanding and maintaining respect and civility.
- Students will respect and protect the personal privacy, rights, and safety of others with regard to physical and sexual boundaries, living space, possessions, electronic accounts and academic endeavors.
Course Calendar (scheduled class cancellations in red)

Like any fun experiment, the below schedule is highly speculative and subject to change without notice!!

Unit 1: Fly husbandry, P-elements, transgenes, and position effect
1.1 (Week 1 Aug 23/25): Review of basic Drosophila melanogaster maintenance, phenotypes, and crosses
   • Also the basics of our own experimental system
1.2 (Week 2 Aug 30/Sept 1): Chromatin and to position-effect variegation: P-elements can report on chromatin state
   • Also we will start collecting flies and think through experimental design
1.3 (Week 3 Sept 6/8): P-elements and recombinases in Dmel: origins in nature and use as a molecular tool
1.4 (Week 4 Sept 13/15): Polyten chromosomes: so classic they never go out of style

Unit 2: Molecular biology of gene silencing
2.1 (Week 5 Sept 20/22): CRISPR and Argonaute: who says prokaryotes don’t have adaptive immunity. Also, CRISPR was discovered by yoghurt scientists.
2.2 (Week 6 Sept 27*29): The piRNA gene silencing system
2.3 (Week 7 Oct 4/6): Probably more piRNA or maybe dicer/RNAi

Unit 3: Measurement of gene expression
3.1 (Week 8 Oct 11/13): Use of morphology to bring reproducibility and rigor to phenotype analysis
3.2 (Week 9 Oct 18/20*): Use of colorimetric assays in measurement and statistics
3.3 (Week 10 Oct 25/27): Introduction to RT-PCR
3.4 (Week 11 Nov 1/3): Use of RT-PCR to measure gene expression at the molecular level

Unit 4: Data analysis and presentation
4.1 (Week 12 Nov 8/10): Data analysis: reproducibility and graphical representation
4.2 (Week 13 Nov 15/17): Data analysis: finding genotype-phenotype and phenotype-phenotype correlations
4.3 (Week 14 Nov 22/24*): Reporting: Goals, structure, and outline
4.4 (Week 15 Nov 29/Dec 1): Reporting: Writing and editing

Final Presentations and Debrief (Week 16 Dec 6/8):
BSU Curriculum Forms

Form 8
Updated: 09.18.15

Signatures

Andrew Arsham, Assistant Professor, 11/28/2016

Elizabeth Rave / Professor and Biology Department Chair / 11.30.16
Elizabeth Rave, Professor and Chair of Biology [date]

Note: "All departmental recommendations [on curriculum] must be reviewed and approved by the department's faculty."--IFO/MnSCU Master Agreement 2009-2011, 20.A.3 (p. 80).

At this point, packet goes to Records Office/Curriculum Coordinator to be logged in to the Curriculum Proposal Progress Grid.

Colleen Greer / Dean of the College of Arts & Sciences / 12.16.16
Colleen Greer, Dean of the College of Arts & Sciences [date]

Note: If proposal is sent back to the Proposer, please notify the Curriculum Coordinator. If approved, packet goes to Academic Affairs Office.