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AGRI 115: Biotechnology – Food, Health and Environment, A Peer Review of Teaching Project Benchmark Portfolio

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Peer Review of Teaching Program (2017-2018) – Benchmark Portfolio

AGRI 115: Biotechnology – Food, Health and Environment

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Objectives of Peer Review Portfolio

The focus course of this Peer Review of Teaching Project (PRTP) benchmark portfolio is AGRI 115 – Biotechnology: Food, Health and Environment. My original intention for application and participation in this program was to engage more fully in review and analysis of my teaching and to provide the structure necessary to complete the review. I had three goals for creating this portfolio:

1. Reflect on current course structure and teaching methods.
2. Utilize a structured process for determining necessary revisions to the course.
3. Document my teaching methods to share with colleagues and for use in promotion package.

The final course portfolio will provide an overview of the entire course but focus analysis on selected items of student work in the course. The portfolio will focus in on the final project to assess if this assignment helps the students to apply what they are learning. A few selected student Reflection assignments will also be evaluated. Additionally, at the completion of this portfolio I hope to see where any potential gaps exist in the instruction or the teaching methods. As a teacher, I want to make sure that I'm creating an environment for the students which is conducive to learning. Working to align the course objectives with the activities and assessments will create a solid foundation for student learning.

Description of the Course

Biotechnology - Food, Health and the Environment (AGRI 115) is an Achievement-Centered Education (ACE) 4 course and thus addresses *using scientific knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.* The course provides an overview of three areas of biotechnology application: classical processes, genetic engineering and diagnostic techniques. Biotechnology can be defined as the use of naturally occurring biological processes for improving human life.

Biotechnology – AGRI 115 is taught as an online-only course and currently delivered using the Canvas LMS. The online delivery of this course allows students increased schedule flexibility supporting progress toward degree completion. Additionally, this course is an option for students pursuing online degree programs, such as the Bachelors of Applied Science.

The students in this course come from various majors and have varying levels of familiarity with scientific concepts. Most students are not pursuing a degree in a STEM field. Students are freshmen to seniors in college. There are also a few high school students in the course each time it is offered who are earning college credit. Enrollment ranges from 15 (summer offering) to around 40 students during the spring and fall offering. The majority of the students are resident students with only a small percentage who are true online, distance students (1-3 students per course offering).

By the end of the course I hope that students have a better understanding of the types of applications that biotechnology can accomplish and how this can impact their lives. I also hope that students end up less intimidated by science and increase their ability to work through scientific information they read about in daily life. This course has the potential to help students progress toward a more informed position on scientific topics and issues rather than only relying on emotional responses to science. The goal of presenting examples from the three different parts of biotechnology (classical processes, genetic engineering and diagnostic techniques) is to expose students to the examples of biotechnology which may, currently or in the future, impact their lives.

These goals are reflected in the course structure by providing real-world examples of research in each section of the course. See the course Syllabus for a complete outline of topics covered and coursework assigned.

Teaching Methods, Course Materials & Activities

AGRI 115 uses a combination of teaching methods including lecture/presentation, reflection, and question & answer to achieve course objectives. Use of a variety of teaching methods aims to provide different learning opportunities for the students. Course objectives (below) are not currently included in the course syllabus but were developed as part of the PRTP.

Course Objectives

1. Engage students (science and non-science majors) in the science of biotechnology.
2. Identify applications of classical processes, genetic engineering and diagnostic techniques in biotechnology.
3. Recognize how human motivation for healthy and sustainable food system drives biotechnology development.
4. Describe the contribution of basic and applied research in biotechnology.
5. Apply the concepts of classical processes, genetic engineering, and diagnostic techniques to a selected organism for improving it.

Each of these teaching methods addresses the five course objectives in some capacity. Providing students with lecture/presentation of content in the course directly addresses the objectives because without a foundational knowledge of the course content the students would struggle to apply the concepts. The reflection method provides an opportunity to digest the information and also contributes to students' ability to apply the content. Question and answer teaching method allows students to test their level of learning depending on the type of question being asked. This method occurs mainly through the quizzing and examination in the course. My hope is that if students engage with these teaching methods in an authentic way, learning will be facilitated. See Table 1 for a list of the course materials and Table 2 for course activities and assignments.

Course Materials	Goal	Comments
Lecture/presentation	Content presentation	Target length is 20 minutes or less per presentation
Readings	Application of biotechnology; content presentation	News articles, scientific papers, other relevant online resources
Videos	Application of biotechnology; visual explanation of concepts	

Table 1: Course materials in AGRI 115.

Course Activity/Assignment	Frequency in the course	Comments
Quiz	11 quizzes; one with each lesson	Multiple choice and short answer
Worksheet/Study guide	One with each lesson	
Reflection	8 total reflections	Two help progression on Final Project; others aim to help students apply biotechnology
Exam	3 exams; one after each section	Open-note, un-proctored; time limit of 1.5 hours; multiple choice, short essay, matching, true/false
Final Project	End of the semester submission	Voice-over PowerPoint presentation

Table 2: Course activities and assignments in AGRI 115.

Measurement of student learning using these methods occurs from weekly quizzing, eight reflection writing assignments throughout the semester, three unit examinations and a final project due at the end of the semester. Rubrics have been developed for each Reflection assignment which provide students with information about how the assignment will be graded. See the rubrics from two of the reflections. The rubrics also provide a grading structure and opportunity for feedback from the instructor to the students. The final project also has a rubric which is used for grading and communicating assignment expectations to the student.

Since the course is delivered completely online, all course activities are completed outside of a formal classroom setting. This requires students to manage their time, contact the instructor for clarification, complete all course assignments independently or with a small group of peers who are also in the course. Group work, however, is not a required part of this class.

All course materials are presented in a format compatible to online delivery. The lecture presentation material has a targeted length of 20 minutes or less for each item. These presentations provide students with the content for the weekly topic and lay a foundation to further learning. By targeting 20 minutes or less for these PowerPoint presentations, it allows students to consume the information in one sitting while hopefully maintaining their focus on

the content. Students can easily pause or rewind the presentation to take notes or review concepts.

Similarly, the readings from scientific papers, websites or news articles related to lesson content aim to supplement the lecture presentations. Occasionally, the readings will serve as the primary source of information. Existing videos developed and presented online related to biotechnology concepts are used to help students visualize certain procedures or molecular concepts. Weekly study guide worksheets serve as a way for the students to begin making connections between concepts and practice identifying the key concepts in the class. Reflections are used to encourage students to think about and review the concepts they are learning. Then the Reflections create a format which students can write and share their thoughts, opinions or findings. The reflections relate to the course content but may ask the students to find a biotechnology example of their own (e.g. a credible online source) and then connect how this example fits with the course content. Other reflections ask students to share their opinion or experience in connection with biotechnology (e.g. opinion of genetic engineering).

The Course and the Broader Curriculum

AGRI 115 is not a requirement for any major and is categorized as a "college course" in the College of Agricultural Sciences and Natural Resources. As mentioned previously, this class supports the overall ACE 4 outcome and therefore is focused on helping students use scientific knowledge to draw conclusions. It provides students with the opportunity to engage with science in an applied way which may allow them to better connect with the content.

Analysis of Student Learning

The course is composed of both formative and summative learning assessments. The main formative assessment in AGRI 115 is the Reflection assignments. The summative assessments include the exams and the final project. The focus of the analysis of student learning will be on these items to determine differences between a high-, mid- and low-level assignment submission.

The students are given instructions on each assignment and in the case of the Reflections and the Final Project are provided with a rubric for how grades will be assigned. They are regularly encouraged to ask me questions about any of the content or assignments in the course. The complete instructions for Reflections 2 and 5 are included below. Following each of the Reflections are examples of student submissions with brief explanations of how they were graded.

Reflection 2 – Classical processes of Biotechnology section

Recall your favorite food identified in Reflection 1. Then determine the organism that contributes to your favorite food. For example, if your favorite food is pizza you could choose the ingredient cheese and the focus organism would be cattle since this is where cheese comes from. Or wheat as the focus organism since wheat flour is used to make the crust. This organism will be the focus of your Final Exam Presentation, "Biotechnology of my Favorite Food." For this assignment, complete parts A, B, and C:

A. Identify a potential problem with your favorite food organism (i.e. disease, low yield, reduced nutrition, etc.). **Be sure you tell us what your organism is.** **State the problem** and answer the following questions:
1. What trait would improve the organism to help overcome your identified problem?
2. What is one trait that has changed in the organism over time through breeding? Remember, we are focusing on classical processes in biotechnology for this part of the course.
3. Where is the Center of Origin of your favorite organism?

B. Find and give the citation of a scientific research article that studies the trait you describe above. This can be in either your favorite food organism or in a model organism.

Citations need to include:

- title of article
- authors of article
- name of peer reviewed journal
- year published
- volume, page numbers, Internet link etc.

Make sure your article was published in a **peer reviewed journal**, and you provide the citation. Let me know if you have questions on finding this type of article.

C. With all the emphasis on 'fake news' lately, finding out if a resource is a credible reference is of high importance. Do you think this peer reviewed journal article is a credible source of information? Why or why not? Justify your reason. How do you know this reference is not 'fake news'?

HIGH-LEVEL SUBMISSION

Based on the student's complete responses to all parts of Reflection 2, they earned all 20 points. This student provided clear justification where requested and used proper grammar and spelling.

A. *One of my favorite foods is fruit pizza. On the fruit pizza is a variety of different fruits, usually depending on what is in season. However, the fruit I am choosing to focus on is the grapes. Throughout my time in South Africa, I had the chance to tour several table*

grape farms. One of the issues the farmers talked about was sacrificing flavor for size. The larger the grapes become, the less flavorful they are.

1. *A trait that would improve the grape, would be a flavor trait. For example, wine grapes are very flavorful, but also pretty small. The flavor trait in a wine grape would improve the table grape.*
2. *One trait that has changed in the grape overtime through breeding has been the size of the grape. Table grapes are almost three times the size of the original grape. Even wine grapes, though they are much smaller than table grapes, are larger than wild grapes.*
3. *The center of origin for the grape is the Central Asiatic Center.*

B. *Maia J., Ritschel P., Almeida U., et al. 2014 Oct. 'BRS Vitória' – a novel seedless table grape cultivar exhibiting special flavor and tolerance to downy mildew (Plamopara viticola). Crop Breed. Appl. Biotechnol. 14(3). http://www.scielo.br/scielo.php?pid=S1984-70332014000300011&script=sci_arttext*

C. *I believe the peer reviewed journal article cited above is a credible source of information. This is because the article is located in a journal both published online and in print. The online version of the journal has other articles posted as well, and it provides the volume and number of the article. It also provides a doi number, so there are ample ways of looking up the article in a different online database. In addition, the website provides copyright and licensing information along with contact information of the research institution that wrote this article. It also provides the authors of the article, which is another justification that it is a credible source of information.*

MID-LEVEL SUBMISSION

This is a good submission for Reflection 2. Overall the Reflection is well written and the student addressed all parts of the assignment but missed including a couple key points. The student did not provide a complete citation. The order of citation information is also not presented in an ideal format (e.g. author's name first) and the URL for the source is not provided. Lastly, the student did not accurately justify the reason they know this is a credible source. Their answer is not completely clear and is somewhat circular. The student scored 18/20.

My favourite food is my Grandma's plum pierogis. The most delicious part is the sweet taste of the plum that is surrounded by dough on the inside. Plum trees are prone to danger just like any other organism on this planet. A common disease that plum trees often take on is called the black knot disease.

A. *If scientists were able to find a trait that repels these fungus spores from landing on plum trees, this would most likely eliminate this problem.*
Overtime scientists have figured out ways to breed self-pollinated plum trees. This is crucial for farmers if they plan on expanding their farms. The more trees, the tougher it

is to take care of them all but with the trees pollinating themselves, this makes it much more efficient.
The center of origin for plum trees comes from Asia. Research believes that plums were one of the first fruits to be domesticated by humans.

B. *Your Plum Tree vs Black Knot. Voyle, Gretchen. Michigan State University Extension. 2013.*
This article is the closest thing to the trait I mentioned that I could find. The trait I described has yet to be done, however we have invented a spray that either treats the tree free from black knots or it can either prevent any further damage to the tree.

C. *I believe this source is a credible source of information. It comes from a very reliable source and is written by an expert on this topic. Fake news articles are often written by an unknown author with an unknown amount of education, however this article is written by an author which you can find out his education level and where he got his sources from.*

LOW-LEVEL SUBMISSION

This submission includes many of the requirements for Reflection 2. The student scored 16/20 points. They identified the incorrect center of origin for wheat and did not provide the correct journal title in their citation. The student had some good indicators for what makes a source credible but did not expand and fully justify their reasoning. Lastly, the assignment submission had some spelling and grammatical errors.

My favorite food that I chose in Reflection 1 was biscuits and gravy with an over easy egg on top. The organism that I determined to be the main contributor to this food would be wheat. Growing up I spent a TON of time at my grandparent's farm. And from I learned a few things about this very popular crop. The one large benefit of farming wheat is the sheer amount of product that can be made. With is high yield per plant, as well as how much you can plant in a square footage, you can make a whole lot of wheat. However, these benefits come as a very, very sharp double-edged sword. With the high yield per plant comes the difficulty with transporting and loading it. But being able to plant a large amount of plants/seeds within a square area comes with a much more relevant and catastrophic danger. Because each stalk of wheat is so close to each other, it makes the spreading of insect and diseases accelerate incredibly. Of course you can spray with insecticide and fungicide, but those only go so far, and are often not enough. One trait that would greatly improve this organism would be an increases resistance to fungus and insects, and ironically enough this is exactly what plant breeders have been focusing on for a long time. Also, the center of origin given to wheat is the New Americas.

"QTL mapping a marker-assisted selection for Fusarium head blight resistance in wheat". H. Buerstmayr, T. Ban, J.A. Anderson. Wiley Online Library. 2009.
http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0523.2008.01550.x/full

I do believe that this resource credible. While being backed by a huge amount of data and charts being shown nearly every page. The Article is also cited by over 250 other articles of similar topic.

Reflection 5 – Genetic Engineering of Biotechnology section

One of the main steps in the genetic engineering process is the transformation step. As you work on your final project for this class, it will be useful for you to have information about how your favorite food organism will be transformed during the genetic engineering process and who could assist you with the transformation. This Reflection will help you do some research on this topic.

Search the Internet for "Plant Transformation Service" or "Animal Transformation Service" based on your favorite food organism. Research several laboratories and then complete the following:

1. Find **two** laboratories or companies that would have the expertise to transform your favorite food organism. Provide the name of each and their website address.

2. Identify **two** criteria you think are important for a transformation facility to have if you were going to pay them to transform your plant or animal (i.e. cost, equipment, expertise, etc.).

a. Explain why you think these criteria are important.

b. **Compare and contrast** these two transformation facilities based on the two criteria you identified.

3. Estimate how long it will take the lab or company to provide you with a transgenic plant or animal that has your transgene. Justify why you believe it will take this amount of time. NOTE: even if the lab/company does not give an exact timeline you can make an educated estimate based upon what you have learned about the genetic engineering process and what you know about your organism.

HINT: Think about gestation time, life-cycle and other characteristics of your organism that may impact the transformation time.

4. How much will the transgenic plant or animal cost you? Do you need more than one transgenic organism? Please explain.

HIGH-LEVEL SUBMISSION

The student submitted a reflection that addressed all the aspects required of Reflection 5. There are a few grammar and spelling issues in this submission, but those criteria were not included on the rubric associated with the assignment. Based on the rubric used to grade this assignment the student received 20/20 points.

1. http://ucdptf.ucdavis.edu/services
http://www.biotech.iastate.edu/biotechnology-service-facilities/plant-transformation-facility/

2. I was reading in the links you had given us about the methods that this transformation is a difficult and meticulous task for the genetic engineer to accomplish. So If I were going to pay them a this amount of money for their services I would want the genetic engineer to have a good background (a lot of practice) in this area and credible knowledge in his job.

While I was searching for lettuce transformation facilities I came across plenty of articles that talked about the Agrobacterium-mediated Genetic Transformation in lettuce and this method seems to be a popular one with lettuce for kanamycin resistance. So with that being said, I would want a genetic engineer that specialized in this transformation method. This entails the genetic engineer to remove the genes from the Ti plasmid that causes disease and replace that gene with a desired gene. They alter this plasmid while plant is growing in tissue culture. So with that said I would also like the facility to have a well-recommended tissue culture lab as well.

b. The two I have chose are a little different and both are not services to my plant, lettuce, only the first one is. I had a little trouble finding two that specialized in lettuce. However, the reason I chose the second one was because they do the Agrobacterium-mediated transformation, even though it is on maize, it's a type of transformation that is preformed on lettuce. The second seemed to be more specialized in this type of method because it has a few different options and varieties. This tells me that they could be a little more knowledgeable and practiced with this type of transformation method. The second one is much more expensive and also allows less 'events' (2-3 plants per event) than the first link, which would be10 and the first being up to 8.

3. It seems that in order for the transformation in lettuce genes is to start with tissue culture method first. In tissue culture you must place the tubes in a well lit area (not direct sunlight) with moderate temperatures. New shoots typically develop within two weeks and advance in growth about 3 or 4 weeks later. Within this growth process is when the genetic engineer inncoluates the leaf disks with the Agrobacterium cell to help make the lettuce plant resist kanamycin. So I feel like the process would take about 3-5 weeks.

4. I would assume you would need more than one transgenic organism just to make sure that it worked because, as stated in one of the given links, the genetic engineer doesn't have control over all the steps so they play the 'number game' and says they repeat this process hundreds of times in order to produce the plant they desire. So with this in mind then you would maybe want to go with a lot of 'events'. In the first lab they are $1,460 per five events, which would be around 10-15 plants specimens. The second lab depends on which one you want but the two highest for five events are $3,125 and $7,800. That is a huge jump from one lab to another, now keep in mind that is performed on maize so the price difference could be due to the different specimens, but either way it informs you that you will be spending thousands of dollars to get this transformation completed.

Below are the links I used to help me with this reflection

http://www.academia.edu/9667139/An_Efficient_Agrobacterium-mediated_Genetic_Transformation_Method_of_Lettuce_Lactuca_sativa_L._With_an_Aphidicidal_Gene_Pta_Pinellia_ternata_Agglutinin

https://www.apsnet.org/edcenter/K-12/TeachersGuide/PlantBiotechnology/Documents/PlantTissueCulture.pdf

MID-LEVEL SUBMISSION

The majority of the information to fully address Reflection 5 was included in this submission. The student did not provide a full explanation for the comparison and contrast of the two facilities. There was no clear explanation for the length of time needed to design the transgene and develop the genetically engineered cow. Lastly, the student did not explain how this venture would pay for itself in 1-2 years. This submission received 17.5/20 points.

1. *USDA Agricultural Research Service: https://www.ars.usda.gov/news-events/news/research-news/2005/transgenic-cows-resist-mastitis-causing-bacteria/*
    a. *Animal Gene Transfer Facility: http://www.biotech.iastate.edu/biotechnology-service-facilities/animal-gene-transfer-facility/*
2. *I think a transformation facility needs two vital things for me to consider using their services: they need a validated and accredited staff, and they need proper equipment and the tools necessary for performing the task at hand.*
    a. *These criteria are important because they are essential to successful transformations and without these traits, they are no help.*
    b. *Facility #1 has more accreditation to their name being the USDA, but the Iowa State Facility may be able to preform the task faster due to priority. They also may have better equipment, but that's just an educated guess.*
3. *I think it will take Facility #1 roughly 15 months or less to develop a transgene of leaner cows. The USDA may have bigger priorities than my specific request. I think Facility #2 will take 12 months or less to develop my transgene because they will have more time and it may be a top priority for them. Both facilities will have to generate one cycle of offspring to see the effects.*
4. *I will ask for about 10-20 different cows, this is because disease could be an issue, or any number of factors that could result in defects or death. Each cow would probably cost anywhere from $4000-5000. The overall investment into leaner and healthier cows could pay itself off within one to two years.*

LOW-LEVEL SUBMISSION

This submission received 14/20 points. The student found two different facilities but did not provide the contact information for the specific laboratory. Rather than a direct link to the research laboratory the student provided the general URL for the institution. The student also failed to provide a cost estimate for this project. It is commendable that this student found an alternative way to make transgenic quail by using chicken facilities. This creative thinking by the student.

I was unable to find a lab that deals with quail so I went with a more common stock animal, the chicken. The university of Edinburgh and Cambridge have labs capable of working with poultry and genetically modifying them. The criteria I think that would be important for

selecting the lab would be one they have the capability. Cambridge has made chickens that are bioluminescent when they have a gene that resists the bird flu. Edinburgh has also worked on disease resistance in poultry in transgenetic ways making them another prime candidate. This also means they have expertise on how to do the work required to genetically modify an organism. It is important to have both the equipment and the expertise in this line of work. With out the equipment you can't do the work it's that simple. Expertise means that they have met these challenges before and know what to do. They also are likely able to do it a bit quicker. In economy this is huge, time is money after all. Granted the process is still very long but any time helps. Also if something out of the ordinary occurs for whatever reason they would more likely be able to handle it than a rookie lab. Cambridge likely has the better of both traits, not to count Edinburgh out. Edinburgh has done a lot with veterinary biological disease medicine but this is a more traditional method to handling disease. Cambridge has not only modified their chickens to have bird flu resistance but fluorescence to show they have it. While possibly off putting to eat it is an extra step to make sure the birds carry the gene. A way of possibly proving to the farmer down the line that they got what they paid for. Otherwise a regular chicken looks the same as a flu resistant chicken and there's no real way to prove resistance on the spot. It would likely take a few years to splice in some DNA into quail. Another few for testing before I could sell the GMO and have it deemed safe. All in all somewhere between 6-10 years would be a crude guess. It would probably be well into the millions to develop an organism. I imagine I could do with one organism for disease resistance or perhaps splice in chickens egg laying interval to keep quail laying year round. Size I am uncertain of on how many organisms required possibly one or more. With the cost, a small market to sell to and overall industry size wise it doesn't seem necessarily advantageous to make a GMO quail. Especially since they fit a health craze nowadays that shies away from GMOs, for whatever reason.

University of Cambridge https://www.cam.ac.uk/
University of Edinburgh http://www.uib.no/en

Final Project

The final project in the course is meant to provide an opportunity for students to apply the knowledge they have gained throughout the semester to an organism they select. The goal of the project is for students to identify their favorite food and from there narrow down to an organism which is a component of their favorite food. For example, if a student selects pizza as their favorite food then the focus organism for the project could be tomato, wheat, beef cattle, dairy cattle or any other ingredient of the student's favorite kind of pizza. Students begin work on their final project early in the semester by completing two separate Reflections which ask them to complete the first two parts of the project. I provide feedback on these sections which the student can use for putting together their final project. The project is made of three main sections corresponding to the three parts of the course: classical processes, genetic engineering and diagnostic techniques. Students must provide relevant information on their focus organism to describe how they would improve the organism through classical processes and genetic engineering and then describe how they would incorporate the use of diagnostic techniques. Students must put together a voice-over PowerPoint presentation and submit this

by the due date. A rubric and instructions are provided to the students so they are aware of the expectations for completing this assignment. I have selected three example projects demonstrating high-, mid- and low-level grade performance. Links to each of the presentations are provided to view the entire student project. To view these PowerPoint Show (.ppsx) presentations, please download the file found at each link.

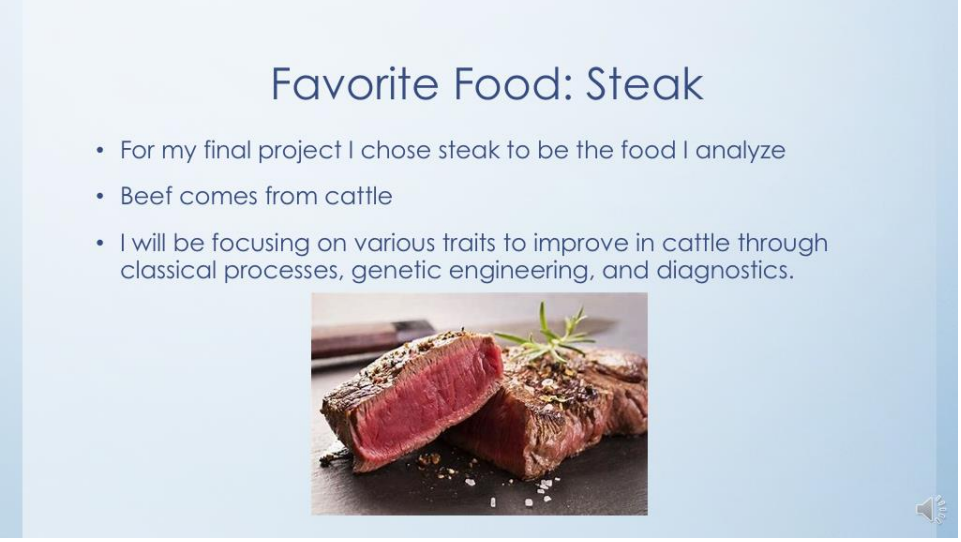
HIGH-LEVEL SUBMISSION

A final project on dairy cows is an example of a high-level submission with the student earning 100/100 points. This presentation addressed all required parts of the assignment including developing a presentation with relevant bullet points and images. The three sections of the project were included with appropriate discussion on how organism improvement could be accomplished.

Link to full presentation: https://unl.box.com/v/high-level-final

MID-LEVEL SUBMISSION

The student earned 86/100 points for this mid-level submission of the final project. The student addressed most aspects required in the project but missed points for the following: missing discussion on different disciplines working together, selected an incorrect method of genetic engineering for this organism improvement goal, and did not provide full citations of references. In addition, the reasoning for the reference credibility was lacking in clear justification. Considering the challenges some students face when they select beef cattle as their focus organism, this student put together a decent final project.



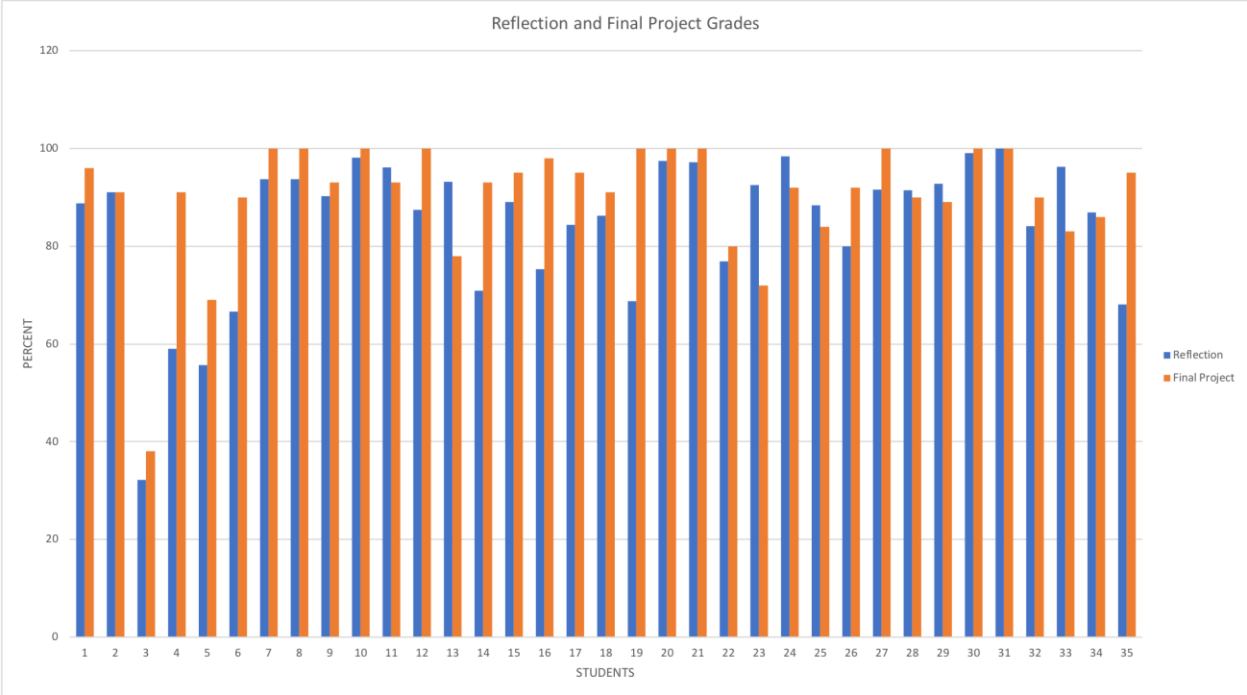
Link to full presentation: https://unl.box.com/v/mid-level-final

LOW-LEVEL SUBMISSION

The presentation was categorized as a low-level final project because the student was missing a number of items and therefore earned 78/100 points. The student did not include any discussion on how to improve the focus organism using classical processes of biotechnology. In the discussion on genetic engineering the student did not list or discuss the steps needed to genetically engineer the organism. The presentation failed to include information on the individuals needed from different disciplines to complete the project. The student did successfully create a PowerPoint using relevant images and bullet points highlighting main points. Additionally, the references selected were relevant to the topic and from credible sources.

Link to full presentation: https://unl.box.com/v/low-level-final

Graph 1 shows the distribution of grades for the total points earned on all reflections (blue) and the scores on the final project (orange). The majority of students scored 80% or higher on both the Reflections and the Final Project. Only one student had a failing grade in both and this was due to not turning in assignments and a lack of participation in the class.



Graph 1: Total Reflection and Final Project percentages by student.

Conclusions and Planned Course Changes

The process of creating this portfolio was very useful for me to really evaluate what I'm doing as a teacher in AGRI 115. Going through the graded work revealed a number of things to me about student performance and my instructor performance. The biggest surprise is that it appears I'm an easy grader. Identifying the high-, mid- and low-level examples for both the Reflections and the Final project showed a smaller gap than I anticipated. The low- to high-level examples on the Reflections were only separated by 6 points (14/20 was the low score). The Final Project separation was a bit wider with 22 points separating the low- and high-level examples. However, Graph 1 shows that most students scored 80% or higher on both these assignments. These scores could be due to diligent students or it could be due to a lack of more rigorous grading. Though, I use a rubric for grading each of these assignments, I think the rubrics need more refinement to help better differentiate student performance on these assignments.

The need to further refine the rubrics was also revealed in my review of the graded work. I discovered that I missed deducting a few points on one student's assignment when I had clearly deducted points for the same thing on another student's work. I believe this inconsistency could be remedied by having a more detailed rubric system. All rubrics for the Reflections and Final project need to have clear point deduction parameters rather than only having a point total for a particular section. In addition, the Final Project rubric and directions need focused revision.

The basic structure of the project is getting the students close to the target for what I would like to see in a final project submission. Most of the students include information on all three parts of the course and if they follow the current rubric will include the other required items. However, the required items included on the rubric need evaluation. Are these items still relevant? Is it clear to students why they need to include these items? How can I improve the clarity of the rubric and instructions? I believe I need to be more explicit in my expectations and consistent in how I deliver that message to the students.

Another observation I made is that I had a delayed response time in providing feedback to the students on their Reflections. Without additional grading assistance it was extremely difficult for me to get quality feedback to the students in a timely manner. This is not how I want to operate with the students since delayed feedback does not support their more immediate learning. The rubrics assisted in more efficient feedback but I still have an obvious need to either adjust my assignments or find additional grading assistance with these assignments.

Reviewing the course objectives identified for the course helped me see that while I hope to engage students in the science in this course, I do not have any way that I am currently assessing this. Perhaps implementing a pre- and post-survey in the course will help me better determine the student perception of science and biotechnology at the beginning and end of the semester.

Overall, I am pleased with the quality of work the students are producing in the Final Project. It is clear they are using the rubric and the feedback on the Reflections to develop the project at the end of the semester. I believe the Final Project is providing the students the chance to apply what they are learning and demonstrate that knowledge in a project at the end of the semester.

After reviewing AGRI 115 through this portfolio process, I plan to make the following changes to the course:

1. Update the Syllabus to reflect the overall course objectives rather than only content areas to be covered.

2. Evaluate and change grading rubrics for the reflections and final project to grade more objectively rather than subjectively or comparatively amongst the students in the class.

3. Hire an undergraduate TA to help with grading to provide more timely feedback to students on assignments.

4. Implement a pre- and post-survey to determine student interest in science & biotechnology.

Making these changes will create a better online learning environment for the students in AGRI 115. These changes will also allow increased enrollment in the class as online courses continue to grow in demand with college students.

Overall Assessment of Portfolio Process

The PRTP provided the structure I had hoped for to truly evaluate my course. I have gained skills for future review of what I am teaching and the program provided a process to better determine what the students need for learning. Networking with the other faculty in the program was invaluable. I gained insights from these colleagues about ways to make changes in my course, offer my feedback on their courses and make connections for future collaborations in teaching.

Appendix A: Course Syllabus

View the Welcome Message from Leah.

Biotechnology: Food, Health and Environment
AGRI 115 Sec 700

Instructors:

Leah Sandall
Assistant Professor of Practice

279L Plant Sciences Hall
(402) 472-9295
lsandall5@unl.edu

Technical Requirements

To take this online course, you'll need access to:

- a high-speed internet connection, preferably
- a Web browser (Mozilla Firefox, Google Chrome or Safari preferred)
- associated programs (ex: Microsoft Word, Adobe Acrobat, Microsoft Excel)

You may also need three, free plug-ins: Flash Player, Acrobat Reader, and QuickTime - in order to view all parts of this course.

Course Objectives

1. Define biotechnology.
2. Recognize how in our food system, the motivations of human health and human impact on environment drive the development of microbes, plants and animals with new traits or unique combinations of traits.
3. Diagram the relationship between genes, proteins and traits in living things.
4. List the possible functions of proteins in controlling traits.
5. Demonstrate how the process of selection is used in developing organisms with desired traits.
6. Determine where plant and animal breeding plays a vital role in developing organisms with desired traits.
7. Recognize the relative challenges a plant or animal species presents to the breeder whose goal is to improve a specific trait in that organism.
8. Recognize the relative challenges single gene and multi gene traits present to the breeder whose goal is to improve that specific trait in that organism.

9. Outline the steps for using genetic engineering to introduce new traits into microbes, plants and animals that are important in our food system.
10. Identify where gene cloning and gene discovery are critical in genetic engineering.
11. Employ gene design strategies that will result in the desired transgene expression.
12. Rank the relative difficulty for introducing genes into the genome of microbes, plants and animals.
13. Describe the importance of cell and tissue culture in biotechnology.
14. Apply the available techniques scientists have to detect differences between individuals at the protein and DNA levels.
15. Apply molecular diagnostics for either proteins or DNA sequences to determine potential environment or food safety problems, establish food quality or identity, or to aid plant or animal breeders in selection.
16. Demonstrate how knowledge of organism function at the cell and molecular level can be used to optimize the management and production of that organism for food, fuel, health or environmental reasons.
17. Describe the contribution of both basic and applied research in biotechnology

Course Participation

Participation in an online course can sometimes seem a bit elusive. Participation in this course will be assessed based on your timely completion of assignments and professional email communication with the instructor and peers.

Reflection Assignments - Your responses to the Refection Assignments is an important part of this course. Your individual assignments will be assessed primarily on the ***quality*** of your responses. Irrelevant, redundant or unresponsive comments are discouraged. More specifically, we will be examining the assignments based on the following criteria:

- The extent to which comments/questions relate to the current assignment.
- The extent to which the post addresses all aspects of the questions in the assignment.
- The extent to which the response is related to course content (e.g., assigned readings, activities, and assignments), or your own personal experience.
- The extent to which your reasoning is consistent and logical.
- The extent to which your response brings a fresh analytic perspective and/or increased insight to the questions.
- Correct grammar and spelling are important for clarity of your response to each assignment.

Course Outline

Grading:

- **Lesson Worksheet Assignments: (50 points)** Assignments are not graded. However, you will receive points for submitting your completed assignment each week. The online quizzes are significantly based upon the Assignment/Problem Set questions for each

lesson. After the online quiz is no long accessible, a key for the assignment questions will be available (in the Exam Review folder) so you can compare your answers to those in the key.

- **Quizzes Online: (135 points)** There will be an online quiz for each lesson. Each quiz is graded and counts toward your final grade in the course.
- **Reflection Assignments: (160 points)** There are eight, graded Reflection assignments. Your grade for each will be based upon completeness, relevance, and quality of your response. The bottom line, if you use the rubric and address all the requirements in each assignment, you will do well in this part of the course. Most topics go along with the lesson each week, but some will motivate you to explore the world of biotechnology beyond the science concepts in the lessons.
- **Exams: (300 points)** There are three exams, one at the end of each unit. Each exam is given online in Canvas and does not require you complete the exam in a testing center.
- **Final Exam Project: (100 points)** Due by the end of the course. Two of the Reflection assignments will help guide your completion of the final project.

Modules	**Lessons**
1	**Classical Processes** 1. What is biotechnology? How is it used to solve problems? 2. Plant Breeding 3. Using Models for Research - Animal Breeding 4. Microbe Mutations and Proteins 5. **Exam #1**
2	**Modern Processes: Genetic Engineering, Creating desired traits by introducing new genes into organisms.** 1. Genetic Engineering of Microbes 2. Genetic Engineering in Plants - Transformation Techniques 3. Animal Genetic Engineering - Gene Design 4. **Exam #2**
3	**Molecular Diagnostics, the CSI of Biotechnology** 1. DNA Detection in Microbes 2. Protein Detection in Plants 3. Animal Disease Diagnostics 4. Controversies in Biotechnology 5. **Exam #3** 6. **Final Project Work**
Finals Week	**Final Project Due**

Grading Scale

Letter grades: Grading is criterion based, not curved. We will total the points you earned in each category above and distribute final grades based on the following scale.

Range	Letter Grade	Grade Point
A +	100 - 98	4.0
A	97 - 93	4.0
A -	92 - 90	3.67
B +	89 - 86	3.33
B	85 - 82	3.00
B -	81 - 79	2.67
C +	78 - 74	2.33
C	73 - 70	2.00
C -	69 - 67	1.67
D +	66 - 64	1.33
D	63 - 60	1.00
D -	59 - 57	0.67
F	< 57	0.00

Student Conduct

Academic honesty:
Academic integrity is an essential indicator of the student's ethical standards. For this reason students are expected to adhere to guidelines concerning academic honesty outlined in Section 4.2 of University's Student Code of Conduct which can be found at: https://studentconduct.unl.edu/student-code-conduct. Students are encouraged to seek clarification of these guidelines whenever they have questions and/or potential concerns. Click here to see the complete Academic Integrity Statement for the Agronomy and Horticulture Department.

Diversity:
The University is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity. We assure reasonable accommodation under the Americans with Disabilities Act.

Ethics and Integrity:
The instructor is committed to offering a course that maintains an atmosphere of ethical behavior, individual integrity, and equitable treatment of each person. Expression of ideas from various perspectives acknowledges the dignity of all class members.

Technical Problems

For all technical problems related to this course, please use the Help feature in Canvas. Or contact Leah Sandall (lsandall5@unl.edu).

Appendix B: Example Reflection Rubrics from Canvas

Reflection 2 Rubric

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings	Pts
Part A is answered and all sub-bullets addressed; the focus problem with the organism is stated	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Part B is answered and a full citation is provided	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Part C is addressed and explanations are provided	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Proper spelling and grammar	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
		Total Points: 20.0

Reflection 5

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings	Pts
Identified two laboratories or companies with contact information	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Two criteria are identified; explanation provided regarding importance (2a) and two facilities are compared/contrasted using the criteria (2b)	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Time-frame identified for how long process will take; provide justification for this timeline	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Cost of transgenic plant or animal identified; explanation provided.	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
		Total Points: 20.0

Appendix C: Final Project Instructions & Rubric

Final Exam Project: 100 pts

DUE 04-30-18 by 11:59 p.m. Central.

Link to the file for Instructions for creating a voice-over PowerPoint
To complete the final exam, you must create a PowerPoint slide show that tells us how biotechnology is applied to a living thing or living things that are components of your favorite food. We have asked you to work on parts of this throughout the semester. Now you can pull all of this together for the final exam project. **See the Example Presentation at the bottom of the page.**

Your PowerPoint slide show will be shared with the class by posting it to Canvas.

Final Project grade:
Here is how you will earn your 100 points for the Final Exam Project:
1. Complete the two (2) Reflections throughout the course, outlined below with the following information:

- Post for Module 1 – Classical Processes
    - your favorite food organism
    - why these traits will make a difference
    - what trait you will target with classical biotechnology
    - what challenges and/or time frame will be expected with the classical biotechnology
- Post for Module 2 – Genetic Engineering
    - what trait you will target with genetic engineering
    - identify a potential gene (a real gene) that you could use
    - identify the steps necessary for Genetic Engineering in your organism.
    - transformation method and/or source of transformation expertise (a real scientist)
    - What controversy surrounds (or could potentially be raised) your genetically engineered organism? Is this controversy science, business, environmentally, ethically, or emotionally based?
- Module 3 – Diagnostics (**NOTE: did not complete this as a Reflection but must be included in your Final Project.**)
    - one type of molecular diagnostics that will be used in either the development of your improved organism or in determining the safety of your organism etc. How will this diagnostic technique be used in your organism? At what point during the process will it be used?
    - the biggest controversy you anticipate from the public that is associated with your improved organism.
    - discuss what different industries/disciplines need to work together to make your project a success

These Reflections, comments from the instructor and voiced-over presentations will then serve to help you organize your Final PowerPoint slide show.

2. Create the Final Exam Project PowerPoint - It will be graded as follows (**See Rubric under Assignments for more details):

- Submit on time as an Assignment. (10 pts)
- The presentation is original and uses visuals and organization that promotes learning. The presentation is narrated. Contact Leah Sandall if you have questions on making a narrated PowerPoint or using other visual + audio media. (30 pts)
- The presentation shows and describes how classical processes are used to improve an organism or organisms for your favorite food. (10 pts)
- The presentation shows how genetic engineering is or could be used to improve organisms for your favorite food. Includes the GE steps necessary and brief discussion about the process. (10 pts)
- The presentation shows how molecular diagnostics is or could be used to improve organisms for your favorite food with brief discussion. (10 pts)
- The presentation includes at least one potentially controversial aspect of biotechnology related to your favorite food (5 pts)
- The presentation includes a short discussion of how individuals from different disciplines will need to work together to complete the project (5 pts)
- The presentation references two sources of up to date scientific information that you used in developing your presentation. State why you believe the source is reliable. (20 pts)
- The presentation is completed and turned in by due date. Total = 100 points

Example Presentation

This is an example presentation from a previous semester. This student did a good job overall presenting the information for his selected organism. All areas of biotechnology are covered and the student addressed most of the required items. There are however a few areas I would have taken points off. See the list below and keep this in mind as you create your own final project presentation.

- Did not list out and identify the steps required in the genetic engineering process of rice.
- On some slides there is too much text. This should have been reduced to the main points in short phrases.
- There is not a list of sources with complete citations. The credibility of these sources is not discussed.

Final Project Presentation Rubric

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings	Pts
Project was submitted on time.	*This area will be used by the assessor to leave comments related to this criterion.*	10.0 pts
Presentation is original and uses visuals and organization that promotes learning. The presentation is narrated.	*This area will be used by the assessor to leave comments related to this criterion.*	30.0 pts
Presentation shows how classical processes are used to improve an organism or organisms for your favorite food. This should include discussion about how you would use classical processes like selective breeding, fermentation, etc. to improve your organism.	*This area will be used by the assessor to leave comments related to this criterion.*	10.0 pts
Presentation shows how genetic engineering is or could be used to improve organisms for your favorite food. The steps and/or process for how genetic engineering was done must be included.	*This area will be used by the assessor to leave comments related to this criterion.*	10.0 pts
Presentation shows how molecular diagnostics is or could be used to improve organisms for your favorite food. This section needs to include what tests/diagnostics you would use and why you selected these tests.	*This area will be used by the assessor to leave comments related to this criterion.*	10.0 pts
Presentation includes one potentially controversial aspect of biotechnology related to your favorite food. Explain why this would be a relevant controversy for your product.	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Presentation includes a short discussion of how individuals from different disciplines will need to work together to complete the project. Explain.	*This area will be used by the assessor to leave comments related to this criterion.*	5.0 pts
Presentation references two sources of up to date scientific information that you used in developing your presentation. State why you believe the source is reliable. The full/complete citation of the references must be included.	*This area will be used by the assessor to leave comments related to this criterion.*	20.0 pts
		Total Points: 100.0