**Annual Assessment Report for 2018-2019 AY**

Reports completed on assessment activities carried out during the 2018-2019 AY will be due September 30th 2019 and must be e-mailed to the Director of Assessment, Dr. Melissa Jordine (mjordine@mail.fresnostate.edu).

Provide detailed responses for each of the following questions within this word document. Please do NOT insert an index or add formatting. Furthermore, only report on two or three student learning outcomes even if your external accreditor requires you to evaluate four or more outcomes each year. Also be sure to explain or omit specialized or discipline-specific terms.

Department/Program: \_\_\_Plant Science\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Degree \_\_\_B.S.\_\_ Assessment Coordinator: \_\_\_\_\_\_Florence Cassel S., \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

UG Assessment Committee:\_\_\_\_Florence Cassel S., Dave Goorahoo, Margaret Ellis\_\_\_\_\_\_

**1. Please list the learning outcomes you assessed this year.**

The following learning outcome was assessed for the 2018-2019 AY:

SLO 1.4a- Students in the Plant Health option will describe, synthesize and apply methods to manage plant health considering environmental and economic constraints.

**2. What assignment or survey did you use to assess the outcomes and what method (criteria or rubric) did you use to evaluate the assignment? Please describe the assignment and the criteria or rubric used to evaluate the assignment in detail and, if possible, include copies of the assignment and criteria/rubric at the end of this report.**

Learning outcome SLO 1.4a

The PLTH 109 (Diagnostics and Control of Plant Diseases) Disease diagnostic report was selected to assess SLO 1.4a. On this outcome, we expected that all students score at least 80% on the disease diagnostic report, thereby achieving an overall “B (80%)” grade in the assignment.

The complete guidelines and rubric used for the assignment are shown in Attachments 1-6. In summary, the primary purpose of the assignment was to develop the student’s ability and skills to diagnosis fungal, bacterial, and viral plant pathogens and from those diagnoses to be able to

recommend a management plan to a grower. Upon successful completion of the assignment, the students would have:

• Developed skills in the laboratory and field that can be applied for the identification of important plant pathogens that affect major crops in California;

• Prescribed effective and environmentally responsible plant disease management strategies.

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• Effectively wrote a diagnostic lab report as done by university plant diagnostic clinics and conveyed the confidence in the diagnosis in writing so that growers can make informed decisions on management.

Students were required to compile a “Disease Diagnostic Report” from diagnostic activities that were completed in the class. These diagnostic activities included a series of exercises (Attachments 1-5) for diagnosing plant diseases and providing management recommendations that were compiled into a report. This assignment tested student’s abilities to use their prior knowledge gained from the prerequisite course PLTH 106 (Plant Pathology) to diagnose diseased plant samples and to learn how to effectively report those results and provide feedback and management plans to a potential client (grower) considering environmental and economic constraints. The rubric followed to evaluate the “Disease Diagnostic Report” is shown in Attachment 6. The assignment was reviewed by the three members of the Plant Science Undergraduate Assessment Committee- Drs. Florence Cassel S, Dave Goorahoo and Margaret Ellis, in an effort to assess the student’s ability to convey information regarding disease management options to a grower after conducting diagnostic tests.

**3. What did you learn from your analysis of the data? Please include sample size (how many students were evaluated) and indicate how many students (number or percentage instead of a median or mean) were designated as proficient.**

PLTH 109 is an upper division elective for students expected to be employed in the agricultural sector. Hence, the UG assessment coordinators strongly believe that it is critical that students perform above the “satisfactory C grade” in the disease diagnostic report. The primary goal of SLO 1.4a is that the students in the Plant Health option will be able to describe, synthesize and apply methods to manage plant health considering environmental and economic constraints.

The summary of ALL scores obtained for the twenty-four students enrolled in the course is provided in Attachment 7. The mean (± Std. Dev.) grade for the assignment was 85.9% (± 6.1%) with total scores ranging from 99% to 75%. Twenty of the 24 students scored at least 80% in the assignment, which meant that 83% of the students in the course met our expected outcome of attaining a “B” grade. According to the University grading system, a “B” grade is indicative that the student is “Very Good” and “has demonstrated a high level of competence, showing sustained superiority in meeting all stated course objectives and responsibilities and exhibiting a high degree of intellectual initiative” (Fresno State Academic Regulations, http://fresnostate.edu/catalog/academic-regulations/index.html#grading-policies). In addition, six students (25%) scored more than 90% in the assignment, thereby indicating that they “demonstrated the highest level of competence, showing sustained superiority in meeting all stated” assignment objectives and guidelines. Four students (17% of the class) scoring between 75 and 79% in the assignment, which is accepted as a “C” grade implying that the student has “demonstrated a satisfactory level of competence, showing an adequate level of understanding of course”.

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Overall, students were able to clearly explain the exercises they had completed in the class, however, in a few cases some of the recommendation made based on their results needed to be stronger. Also, some students could have done a better job using language to convey how confident they were in their disease diagnosis. This is important when talking with or making recommendations to a grower so that they can weigh the environmental aspects and economics of their management decisions. Overall the results from the students’ Disease Diagnostic Reports were strong.

**4. What changes, if any, do you recommend based on the assessment data?**

The PLTH 109 course was revised for 2020 to include a laboratory component. Many of the steps in the activities for the Disease Diagnostic Reports were shortened or not done due to time constraints in a lecture setting. By adding a lab, students will have more hands-on experience and be able to complete all or most components in their diagnostic activities. This will allow students to gain a deeper understanding of the subject matter and can benefit the final outcome of their Disease Diagnosis Reports.

**5. If you recommended any changes in your response to Question 4 in last year’s assessment report, what progress have you made in implementing these changes? If you did not recommend making any changes in last year’s report please write N/A as your answer to this question.**

N/A – A different learning outcome was assessed last year.

**6. What assessment activities will you be conducting during the next academic year?**

Since our undergraduate curriculum has just been revised (see section 7), the members of the Plant Science Undergraduate Assessment Committee will conduct an evaluation of our curriculum map and of the SLOs listed in our SOAP and thenceforth decide on the assessment activities for the next academic year.

**7. What progress have you made on items from your last program review action plan?**

Since our last assessment report, our undergraduate curriculum has been revised. This revision was a direct response to the recommendations made in the department's most recent program review, considerable faculty input, survey of similar Plant Science undergraduate degrees nationwide, and industry needs for a trained and modernized workforce in Plant Science. This revised curriculum provides a better "...balance between science theory and practical experience" and a more direct path to degree completion.

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Key changes to the curriculum include:

∙ Combining the Crop Production Management option and Plant Health Option into one Plant Science degree;

∙ Addition of a Crop Nutrition course in the major requirements;

∙ Reintroduction of Plant Propagation into the major requirements;

∙ Removal of the 2- prefix limit for electives;

∙ Unifying the course prefixes to either PLANT or MEAG;

∙ lntegrating the Chancellor's office mandates for General Education courses; ∙ Addition of MATH 11 for B4 GE and as a prerequisite for PLANT 99; ∙ Removal of BIOL 10 as a required prerequisite.

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**Attachment 1**

**Disease Diagnostic Report Instructions – Spring 2019**

The assignment will include completion of diagnostic tests to determine unknown pathogens and a report on your finding. Below are the guidelines.

Students will work in groups of two. You must report on the following exercises that we completed in class on fungi, bacteria, viruses, and molecular diagnostics.

For each exercise, please include the following sections in your reports.

1. An **introduction** about the pathogen you detected. Is this disease common in California? What are the signs and symptoms? What is the disease lifecycle? You could start by looking up the disease on the UC Davis IPM webpage.

http://www.ipm.ucdavis.edu/PMG/selectnewpest.tomatoes.html

2. The **material and methods** you used to detect the pathogen. Please be as detailed as possible.

3. What were your **results**? How confident are you in these results? What other tests might increase the confidence that these results are correct?

4. Based on your diagnosis what **recommendations** would you give to a grower about managing the pathogen.

The report will be a total of 200 points and is due on **March 25**. The report should be a minimum of 4 pages single-spaced (1 pages per pathogen). You can also include pictures in your reports to help explain results. Pictures do not count as part of the page limit requirement.

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**Attachment 2**

**Exercise 1: PLTH 109 – Spring 2019**

**Diagnosing Fungal Diseases in the Lab**

The first step in diagnosing any diseased plant material is to look at and record all observable symptoms and signs. Next take the plant specimen and observe the specimen for any evidence of pathogens/insects/mites under the dissecting microscope. Specifically, for fungal pathogens you may see signs of hyphae or spores on or near the infected material. To take a closer look at the infected material examine under the compound microscope. To do this you can make a free section mount slide by cutting small sections of the plant material near the edge of a lesion or infected plant material. Carefully place the sections on a glass slide with a drop of water and a cover slip. You may also make a tape mount slide (detail below) to capture any spores or hyphae observed under the dissecting scope. If no sporulation or obvious signs are observed, you can try and induce sporulation in a moisture incubator for 1-3 days. You might also try and isolate the pathogen onto synthetic medium from the infected tissue either before or after sporulation induced by the moisture chamber. To further ID your pathogen, you can use a dichotomous key to identify your specimen based on morphological features observed. Other diagnostic tests could include using molecular techniques such as PCR. To make sure the pathogen you isolated is responsible for the symptoms you observe you could carry out the inoculation and isolation steps to complete Koch’s postulates.

Preparing specimens for viewing under the compound microscope:

1. Please take a microscope slide a place a drop of water onto the slide.

2. Take a piece of clear tape and gently press the tape on to a growing culture. 3. Place the tape with the fungus on the microscope slide with the drop of water. 4. Observe your specimen under the compound scope.

5. Take another microscope slide and place a drop of water on the slide. 6. Take a very small piece of the fungal culture with a sterile dissecting needle (use same techniques as described above for fungal transfers).

7. Place the piece fungal side up on the microscope slide and gently press the cover slip over the specimen. A pencil tip eraser is a good tool to use to press down on the specimen, and so not to crack the cover slide.

8. Observe your specimen under the compound scope.

Today we will try to identify two unknown fungal pathogens using a dichotomous key. Please answer the following while trying to key out the fungi.

Does it produce septate or aseptate hyphae?

Are any asexual fruiting structures produced?

What is the color of the conidia?

Do the conidia have septations?

How are the conidia produced?

What does the conidiophore look like (branched, unbranched)?

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Next oranges have been brought in for you to diagnose. Please consider the following techniques discussed in lecture. Materials will be provided for the following tests that may be used to identify the putative plant pathogen from the oranges.

1. Moisture chamber

2. Isolations on to Potato Dextrose Agar + acid

3. Tape mount slides

Next week use the dichotomous key to key out the fungus you isolated from the oranges. What was it?

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**Attachment 3**

**Exercise 2: PLTH 109 – Spring 2019**

**Diagnosing Bacterial Diseases in the Lab**

**I. Observation and Isolation from Diseased Plant Material**

A bacterial streaming test is one of the first tests that you can do to identify a possible bacterial plant pathogen. To prepare a specimen for observation take a sterile scalpel and slice a thin section of plant material including both unhealthy and healthy tissue. Next, make a wet mount slide by placing the cut plant section and a drop of water on the slide and cover with a cover slip. Immediately examine the slide under a compound microscope. Start with 10X and look for evidence on all edges of the plant section for bacterial streaming. In the suspected area increase the magnification to 40X.

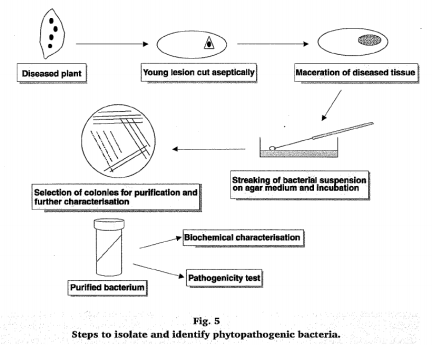


**http://www.oardc.ohio-state.edu/sallymiller/images/500px-bacterial\_streaming.jpg**

To isolate bacteria from an infected host surface, sterilize the sample with 70% EtOH and dry with a Kimiwipe. On a sterile surface using aseptic techniques cut and weight 0.2 g of diseased plant tissue and place into a flask containing 125 ml potassium phosphate buffer. Shake at 200 rpm for 30 minutes. Separate liquid from plant material and centrifuge samples at maximum speed for 15 minutes. Discard supernatant and suspend in 1 ml sterile water. Next make a 10-fold serial dilution in sterile water down to 10-6. Streak the dilutions 10-3, 10-4, 10-5, and 10-6 on nutrient agar or another media of choice. Incubate for a number of hours and select single colonies and transfer to new media.

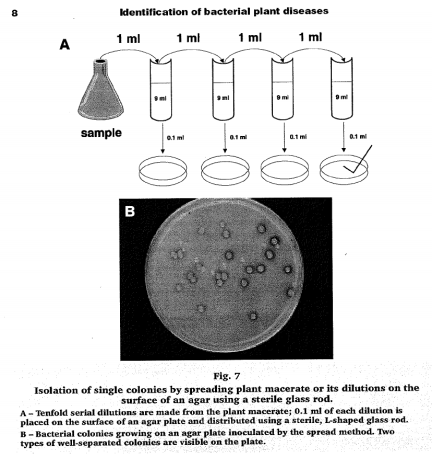
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**II. Identification of Plant Pathogenic Bacteria**

KOH Test

A 3% solution of potassium hydroxide disrupts the outer membrane of Gram-negative bacteria creating a viscous or gooey solution. Gram-positive bacteria do not have an outer membrane so the cells stay intact. To test a sample:

1. Place a drop of 3% KOH onto a glass slide.

2. Take a colony of bacteria using a sterile wire loop.

3. Mix the bacteria into the KOH.

4. Lift the loop from the slide.

Can you lift the bacteria from the slide with the loop?

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Hugh-Leifson Test – Utilization of Glucose

Used to identify Erwinia and related species that are fermentative anaerobic. To test bacteria: 1. Heat tubes in boiling water for 10 minutes to remove oxygen.

2. Cool to room temperature and using a sterile loop inoculate 2 tubes with the bacteria unknowns.

3. Cover one tube with sterile mineral oil to induce anaerobic conditions. 4. Incubate 72 hours and examine for color change

Carbohydrate Utilization Open Tube Closed Tube Fermentative Yellow Yellow

Oxidative Yellow near surface Green

Neither Blue/Green Green

Pectate Lyase Test

Soft rot bacteria such as *Pectobacterium carotovorum* subsp. *carotovorum* secrete pectic enzymes that results in tissue maceration and cell death. To test for these bacteria: 1. Take a slice of potato (5-7 mm) and surface sterilize by alcohol flaming. 2. Aseptically place the flamed potato in a plate containing a wetted sterile filter paper. 3. Make a small cut into the center of the potato, not all the way through. 4. Take a loop full of bacteria and place in a sterile 2 mL tube containing 100 ul sterile water. Vortex samples and pipette 50 ul into the depression on the potato. 5. Seal Petri dish and incubate at room temperature for 24 hours and observe results.

**References:**

Schaad, N.W., Jones, J.B., and Chun, W. 2001. Laboratory Guide for Identification of Plant Pathogenic Bacteria. 3rd ed. APS Press.

Plant Pathology 685 Diagnostic Field Plant Pathology Laboratory Manual. Sally A. Miller et al. 2009

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**Attachment 4**

**Exercise 3: PLTH 109 – Spring 2019**

**DAS ELISA**

**Objective:** To detect the Apple mosaic virus (ApMV) from rose leaves on campus.

**Material:**

Antibody-coated wells

PBST Buffer (Wash Buffer) (1X)

ECl Buffer (1X)

PNP Buffer (1X)

General Extract Buffer (GEB 1X)

Positive and Negative Controls

Airtight container for incubations

Distilled water

Paper towels

Micropipette and micropipette tips

Mortar and pestle

**Procedure:**

1. Follow the instructions provided by Agdia Inc.

2. Prior to the class the plate will be coated with the capture antibody

3. You will be provided with plant samples. Follow the instructions by Agdia starting with the section **grind and dilute samples**.

4. Take a prepared test strip from instructor that has already incubated for 2 hours and continue with the enzyme conjugation steps.

5. Take a second prepared test strip from the instructor that has incubated for 2 hours and complete the PNP substrate steps.

Questions to address in your final report.

1. What were your results?

2. How does a DAS ELISA work?

3. What is a positive result?

4. What would be a false positive? False negative?

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**Attachment 5**

**Exercise 4: PLTH 109 – Spring 2019**

**Molecular Systematics Lab**

**Objective:** To amplify a race specific amplicon of *Fusarium oxysporum* f. sp. *vasinfectum* race 4.

**Methods:**

1. DNA extraction

2. Polymerase chain reaction

3. Run PCR product on an agarose gel

**1. DNA Extraction – See PrepMan Ultra Directions**

**2. Polymerase Chain Reaction:**

a. Thaw the 5X Buffer, MgCl2, primers, and dNTPs on ice. Keep the Taq polymerase in the freezer (-20°C) until ready to add to the master mix.

b. Prepare the appropriate amount of master mix for 2 samples. Below is the recipe for one sample. Make sure to cross of each reagent as you add it to a 1.5 ml tube making sure you add everything to the master mix, otherwise your reaction will not work.

PCR: 25μL per reaction

Sterile deionized water 9.0μL x 2 = 18μL

5X Colorless GoTaq Reaction buffer 5.0μL x 2 = 10μL

MgCl2, 25 mM 2.5μL x 2 = 5μL

dNTP, containing 2.0 mM each 1.0μL x 2 = 2μL

Primers: 5 pmol

Forward primer (R4f) 2.5μL x 2 = 5μL

Reverse primer (R4r) 2.5μL x 2 = 5μL

GoTaq Taq polymerase (Promega) 0.5μL x 2 = 1μL

DNA (20-50 ng total) 2.0μL

Total 25.0μl

c. Add 23 μL of the master mix to 3 PCR tubes.

d. Add a 2 μL of a DNA sample to each PCR tube.

e. Add samples to the Thermocycler and run the following PCR program

PCR Thermocycler parameters

Denature: 94°C for 3 min

10 cycles: Denaturation 94°C for 30 sec

Annealing 59°C for 30 sec

Extension 72°C for 30 sec

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25 cycles: Denaturation 90°C for 30 sec

Annealing 59°C for 30 sec Extension 72°C for 15 sec

Final extension: 72°C for 1 min

Final Hold at 4°C

Yang, M.E., et al. 2006. Beltwide Cotton Conferences. pp 93-96.

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**Attachment 6**

**Rubric for the PLTH 109 Disease Diagnostic Report– Spring 2019**

The assignment is a total of 200 pts.

For each of the four exercises **(50 pts.)**, students will be graded on the content in the following sections. Students will lose points for excessive grammar mistakes.

1. **Introduction (10 pts.)** – the significance of the disease in California and the impact to California agriculture, common signs and symptoms of the disease, and the disease life cycle should be covered. Students will be graded on accuracy and content.

2. **Material and methods (10 pts.)** – the material and methods should be detailed enough that someone could repeat or have a clear understanding of the procedures used.

3. **Results (12 pts.)** – the results should be clearly explained. Using figures might help to convey results. Language should be used to convey the confidence in the results as provided in lecture 1.

4. **Recommendations (13 pts.)** – management strategies should be discussed that a grower might use given the results from the disease diagnosis. Students will be graded on the accuracy and content of the recommendation. Recommendations should include environmental and economic constraints.

5. **References (5 pts.)** – Students must reference all material used in their reports using a standard format such as MLA.

The report will be a total of 200 points and is due on **March 25**. The students will lose 10 pts. each day the report is late. The report should be a minimum of 4 pages single-spaced (1 pages per pathogen). You can also include pictures in your reports to help explain results. Pictures do not count as part of the page limit requirement.

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**Attachment 7**

**Summary of ALL grades for PLTH 109 –Disease Diagnostic Report - Spring 2019**

**Student**

**Diagnostic Report (pts)**

**Diagnostic Report (%)**

1 176 88.0 2 177 88.5 3 160 80.0 4 193 96.5 5 158 79.0 6 163 81.5 7 180 90.0 8 198 99.0 9 180 90.0 10 180 90.0 11 173 86.5 12 163 81.5 13 150 75.0 14 177 88.5 15 167 83.5 16 173 86.5 17 176 88.0 18 150 75.0 19 160 80.0 20 158 79.0 21 180 90.0 22 179 89.5 23 173 86.5 24 179 89.5 **Count 24 24**

**Mean 171.8 85.9 Std. Dev. 12.1 6.1 Std. Error 2.5 1.2 Maximum 198 99 Minimum 150 75**

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