Dear Dr. Spitsbergen:

I am writing this letter to apply for the Latva Teaching Award, after being nominated by Dr. Sharon Gill. I have taught a variety of upper-level courses since beginning at WMU in 2011. These include Ecology of the Human Microbiome, Professional Development which I co-taught with Dr. Sherine Obare, formerly from the Chemistry Department and a NEON Ecoinformatics Course, co-taught with Dr. Rachel Gallery from the University of Arizona and which resulted in a class-led publication (Docherty et al. 2015, *PLoS One*). However, the hallmark of my teaching has been my undergraduate Microbiology course (BIOS 3120-500), for which I have been the instructor of record nine times. This course serves 60-80 undergraduate Biomedical Sciences majors each semester, most of whom are juniors and seniors.

**Innovative Changes to Improve Student Understanding of a Scientific Process**

I have implemented a lot of changes in the Microbiology course over the years and I have more changes in mind for the years to come as I continue to learn more about what motivates the students and about my strengths as a professor and mentor. One of the biggest changes I made was to the lab. In 2014, Dr. Maarten Vonhof and I worked together with an ambitious graduate student named Diana Carter. As part of her much larger Master's project, Diana collected fecal samples from birds residing in urban and rural areas throughout southwest Michigan. She isolated bacteria from these samples and tested their resistances to a variety of antibiotics. Her results were rather astounding - many of the isolates were extremely resistant to at least one, and often multiple, of the antibiotics tested. **The results of Diana's original study were published in 2018 (Carter et al. 2018, *Science of the Total Environment*).**

**Learning Outcomes:** Using these isolated cultures, I worked with many students and teaching assistants over the years to develop and fine-tune a semester-long project that is now a major focus of the Microbiology laboratory. The main learning outcomes for the semester-long project are: learn how to develop a testable hypothesis, understand the prevalence of antibiotic-resistant bacteria in the environment, learn how to write and format a scientific paper, understand the value of replication in experimental design, gain relevant culture-dependent and culture-independent skills in the laboratory that are translatable to their future careers.
Class Project Description: The flow for this project throughout the semester is as follows: I introduce the project in the first week of the course, including discussing the variables (bird species, different antibiotics to be tested, land use where the bird was sampled). The content of my lecture materials builds toward a lecture around mid-semester where I discuss the discovery and modes of action of various antibiotics, and how the threat of antibiotic resistance is one of the biggest challenges they will face as future healthcare professionals. Meanwhile, in lab, the students are assigned two bacteria that they isolate and maintain throughout the semester. They conduct DNA extractions, PCR and analyze 16S rRNA sequence data to identify their bacteria, and then follow up their ID using these molecular approaches with further tests to confirm the ID using culture-based approaches. This is timed so that at the same time we are discussing antibiotic resistance in lecture, the students test their isolates for resistance to several antibiotics using the Kirby-Bauer test in lab. The TAs gather the class data together and I analyze it to produce whole-class results and statistical analyses, which I then present to the class.

Term Paper Preparation: Throughout the semester, the students write three versions of a term paper about this project, so for all intents and purposes it is a writing-intensive course. Since this is the first time most of these students write a paper in a scientific format, I wrote detailed rubrics for each of the versions so that the students know what structure each section should take, paragraph by paragraph. The first version includes Introduction and Methods sections and the students are assigned to peer-review groups of 4 people, which are led by the TAs. We strategically organize the groups behind the scenes so that one student who is doing very well in the class is in the same group as a student who is struggling in the class. In this way, everyone benefits by either getting practice in providing edits or receiving feedback on how to improve their paper. For the second version, the students include Introduction, Methods and Results sections, written using the whole-class results. Feedback for this second version has varied semester-to-semester; sometimes we do a second round of peer review and other times the TA gives written or verbal feedback to the students. The final version includes an Abstract and a Discussion section and any edits that were suggested from version 2.

Innovation and Improved Understanding

Since I implemented this project, I’ve noticed a big increase in the level of interest that the students have about the topic of antibiotic resistance, and I usually get at least 2 students who contact me about doing research related to antibiotic resistance in my lab. In addition, the TAs and I have noticed that the term papers have improved dramatically, in part because they have detailed rubrics to follow and in part because the students get so much feedback on their writing. Unfortunately, I have not done any formal assessment to gage improved writing skills or understanding of scientific concepts.

Recent Change in Teaching and Community Outreach

All of the preceding material has been the work of many years. However, this past year I made 2 major changes that also involve outreach to the community.

Interactions with Zoetis, Inc. - I have developed some excellent connections with scientists at Zoetis, and received a large donation of single-channel pipettes that are now being used for the Microbiology labs.
These single-channel pipettes replace previously-used glass serological pipettes which can be dangerous and have caused injuries in the past. They are also more relevant to the types of pipettes that are used in industry and research today, so the students receive training and practice on using pipettes that they could potentially use in their future jobs. This semester (Spring 2019) I also arranged for Zoetis to donate other equipment, including centrifuges and thermocyclers, which we can use to develop new exercises that will train our students to use these modern instruments.

In addition to acquiring new lab instrumentation, I also arranged for a "Biotechnology Industry Career Panel" this semester (Spring 2019) for the first time. I invited two scientists from Zoetis and one scientist from Bronson to discuss their career paths with my class. This was extremely successful and the students absolutely loved it and asked a lot of great questions. I was inspired to do this because, whenever I talk with students about their future career directions, they seem to think that going to medical school or PA school are their only options. They rarely realize that there are other career options that do not always require advanced degrees. I plan to continue this career panel and hope to develop better connections with Zoetis so that we can build a pipeline for students to receive the training that is appropriate for a career in industry and then be strong applicants for their internships and jobs after graduating.

**Outreach to High School Students** - Getting the word out about potentially deadly antibiotic-resistant pathogens is one of the biggest goals of my Microbiology course, but I recognize that I'm often preaching to the choir. To broaden the scope of this discussion, I challenged myself to develop a high school-level laboratory exercise based on my BIOS 3120 antibiotic resistance project. I presented this exercise in Fall 2018 to a group of high school teachers at the Kellogg Biological Station K-12 Outreach event. Since high school students may not be able to work with live bacteria, I took pictures of the antibiotic-resistant disk test plates from the lab in Fall 2018, and then made an exercise where students could measure the diameters of zones of inhibition from the photo instead. The high school teachers were enthusiastic about trying out the exercise in their classrooms, and gave me some excellent feedback to improve the experience. To address this feedback, I am currently advising an LHC student (Cody Benfant) who is redoing all the antibiotic resistance tests, taking high resolution photos of plates, and working to create content for a laboratory exercise that we will post online, freely available for high school teachers to use. Cody and I will also conduct a beta-test of this exercise in a high school classroom later this semester. I will also be able to use his data as a backup for future BIOS 3120 labs.

Thank you for considering my application for the Latva Teaching Award. Please let me know if you have any further questions.

Sincerely,

Kathryn M. Docherty