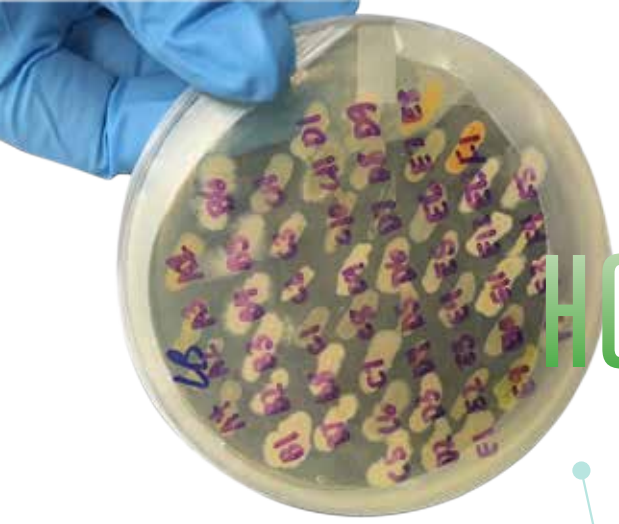
Shannon Anderson (Class of 2017) tests a soil sample.



HOCKADAY STUDENTS JOIN THE QUEST FOR NOVEL ANTIBIOTICS

PROLOGUE, ERIKA KURT '98

During the 2015–2016 academic year, Dr. Barbara Fishel, Hockaday's Dean of Studies and Director of Research, was selected to pilot an innovative undergraduate science program in one of her high school courses. The program – the Small World Initiative (SWI) – was developed at Yale University in 2012 by Dr. Jo Handelsman, the founder of the Yale Center for Scientific Teaching and the outgoing Associate Director for Science in the White House Office of Science and Technology Policy. SWI aims to inspire and retain students in the sciences while addressing one of the most pressing global health challenges – the antibiotics crisis. The program centers around a biology course in which students conduct hands-on field and laboratory research on soil samples in the hunt for new antibiotics. This is particularly relevant as most antibiotics come from soil bacteria.

***Erika Kurt '98** leads the initiative and has grown the program to 180 schools across 35 US states, Puerto Rico, and 12 countries. Thanks to generous funding from **Lyda Hill '60**, Kurt was able to introduce the program at the high school level and knew that Hockaday would be the perfect high school pilot partner with Dr. Fishel leading the course. Before becoming a teacher and transforming Hockaday's science programs, Dr. Fishel earned her doctorate in cellular biology and worked at the bench. Fishel found that SWI had such a strong impact on her students in last year's biology course that she now teaches two versions of the program, and includes it in summer research projects.*

Sara Held, Tori Gudmundsson, and Lily Johnson (all Class of 2017) work with soil samples.

An example of soil before collection for extraction

SWI AT HOCKADAY, DR. BARBARA FISHEL

We were thrilled to find that the research-based curriculum of the SWI introductory college lab course mirrored our own philosophy and goals for how best to teach science. Grounded in a significant, real-life problem, the SWI curriculum encouraged student-generated research questions and design of experiments to develop a capacity for scientific reasoning, and required application of the basic biological concepts taught in any first-year biology course.

Research has shown that girls who see relevance to social and relational issues are more likely to remain engaged, and this was certainly true in the biology course into which we incorporated the SWI approach. From the outset, students commented:

- *It truly shows the relevance of learning biology.*
- *Allows me to get involved in an issue that will affect my future.*
- *We are learning about relevant and pressing issues as well, which helps stress the importance of what we are learning and gives us a clear idea of how our knowledge could be used in the real world.*
- *This class is very different from my other science classes I have taken because we aren't just studying for tests all the time. We are doing real research, and that keeps me engaged much more than a regular biology class would.*
- *We do real experiments and real research … To me that means the class doesn't feel like busywork.*

Importantly, the girls found connections between the concepts they studied in the classroom and the results of their experiments, and commented:

- *This is a new type of learning experience.*
- *We combine lab work with a standard biology course to help us gain further knowledge of biology as well as lab procedures.*
- *Biology class echoes with some of what we find/observe during the experiments.*

I was often humbled when listening to the students discuss how they might improve their next attempt to find antibiotic producing bacteria, and by the depth of their understanding of the procedure and the growth of bacteria – this does not happen in most traditional student lab courses. Discussions among themselves on how to proceed developed over the course of the year from "what did I do wrong" to "what is going on with this system that we are investigating and how can we design an experiment that better explores it". By early spring, whenever the students were preparing a report on results for class or for one of the national conferences that several attended, I would routinely hear exchanges such as:

- *We need to discuss the extensive amount of experiments we have done in the class in order to fully learn these procedures and how to examine our results properly.*
- *It is important to consider our failures in certain procedures, and then what we did to fix those (i.e. our first experiment compared to our final, and what we changed and why).*

Current Hockaday seniors Shannon Anderson and Lily Johnson, two of the nine girls enrolled in the pilot course, have contributed their perspective to this article by reflecting on their experience, and the impact it had on them, via the pictures and accompanying text that follows.

Bacterial colonies tested for antibiotic production; clear areas indicate a producer.

Shannon Anderson and Lily Johnson (both Class of 2017) attend GAINS (Girls Advancing in STEM) Conference.

WHAT WE DID:

We opted to take regular biology instead of AP Biology or one of the many semester biology courses the school offers, and were introduced to the SWI program in the class. Upon research into the problem, we were immediately hooked. It is not often that high school students have the potential opportunity to make a life-changing discovery in a biology class, so the goals of the Small World Initiative were very exciting.

By partnering with SWI, we got the chance to do real research that is being used by scientists to solve a global problem. Antibiotic resistance is a major issue in our world, and yet it is an unknown problem to many.

The SWI's approach of crowdsourcing the search for new types of antibiotic producing bacteria through the use of students as the focus of an introductory college lab course taught us how to find bacteria that can be isolated from the dirt that surrounds us, and potentially identify new antibiotics.

WHAT WE LEARNED:

Incorporating SWI into our biology course taught us about biology in the context of learning how antibiotic resistance occurs, and which parts and processes of the cell that antibiotics affect, but it also taught us a lot about trial and error. We were able to apply the knowledge and skills learned in the classroom to actual experiments and research, and discovered that research is a long, active process – but that we can get results. We were excited when we found a number of bacteria that had antibiotic activity, even though we were not able to determine if they produced known or unknown antibiotics. We ventured into a world of science that we would have never had the privilege to see, realized the importance of process in understanding how life works, and the effect that we can have as human beings on the world around us.

WHAT WE WANT OTHER HOCKADAY STUDENTS TO KNOW:

Even if you think that you are not interested in biology, SWI is an amazing opportunity to get into the lab and make a difference in the world in which you live. We learned so much in this course and are certain that anyone else who takes it will feel the same. We made the best memories in that class (like when one of our group got a soil sample at a Friday football game) and we were part of something bigger than simple classroom learning. The topics we studied contributed to the research we were doing, and the research we did helped move everyone closer towards a solution to a global health issue. Working with SWI was an amazing experience, and we would not trade it for any other biology class.

Biology Bake Sale ad to raise money to help combat antibiotic resistance during World Antibiotic Resistance Awareness Week