

## Unveiling The Code Of Life

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### HPA Biotechnology Class is First in State To Identify Genetic Code for Global Genomics Project

Students in Stephanie McDowell's Biotechnology class recently completed their portion of an international project to map the DNA of the planet's creatures large and small—research that was impossible to achieve at any level just a few years ago.



The task: Copy, amplify and identify a 650 base-pair genetic code of the barred sand bass' mitochondrial CO1 gene. But first, the 10 students in McDowell's elective class had to isolate the genomic DNA (gDNA) from samples of the fish's gill tissue. The students had 10 weeks to complete their research.

Sounds simple, right?

"It is a fairly complicated process," said junior Josh Patterson. "There are a lot of procedures [to follow]. But once we got them down, it wasn't hard."

"Well, yes, it wasn't that hard," agreed senior Leila Takahashi-Ruiz. "But we did have long periods to wait [while the PCR process completed its cycles of reproduction]."

Both worked with their classmates on the next set of experiments in McDowell's class, splicing genes.

Nearby, with electronic pipette in hand, and wearing a white lab coat contrasting starkly with her spray of dyed-purple hair, junior day student Kaliko Smith laughs as she prepares to splice a gene from a jellyfish into a bacterial sample nestled in a petri dish.

If successful, this experiment—which takes the lessons learned in the barred sand bass research to the next level—will result in a patch of bacteria that glows under ultraviolet light.



"When I explain to my dad what we're doing, he gets so lost!" she says with a laugh to McDowell.

Students at nearby lab tables also laugh—they've experienced similar reactions from their families.

"A decade ago, this type of research was not routine [in high schools]," said McDowell.

Taking the research from graduate school levels to high school hasn't been slowed because the students couldn't handle the procedures or the abstract concepts of biogenetics.

The lack of a curriculum and availability of specific lab instruments, however, did impede the progress into high school biology labs.



Spearheaded by McDowell's Master of Environmental Science research at Rutgers University and her search for a suitable research project for her biology students at HPA, a summer school program offered by Coastal Marine Biolabs of Ventura, California, seemed a





natural fit.

Last summer, McDowell attended the summer school program at Coastal Marine Biolabs with other high school teachers and university professors. Their mission: participate in a very large vision: identify through genetic codes as many of the planet's 30 million species as possible.

With funding from the National Science Foundation, Coastal Marine Biolabs participated in the development of a unique use for the bar codes found every day in grocery stores. But instead of identifying a product, the bar codes would be used to identify a specific species.



Thus the International Barcode of Life project was born. For the Barcoding Life's Matrix research program—the program McDowell's Biotechnology students just completed—Coastal Marine Biolabs developed a high school curriculum, with teacher's materials, and loaner lab equipment, to set up individual research projects in high schools in California and across the nation. HPA is the first, and to date, only Hawai'i high school to participate.

To truly understand what the HPA Biotechnology students accomplished in their bar coding of the species assigned to them—the barred sand bass—it is necessary to understand some of the biotechnology basics they learned: dideoxynucleotides, proteolytic enzymes, gel electrophoresis, heat-stable polymerase, chaotropism, electropherograms, centrifugal force, and more. Much more.



The project's genetic information will be published in a larger genetics bank.

"This is important work the students are doing," McDowell said. "Our planet's biodiversity is important. It's important we know what's here before it's gone."

Dreams of Nobels might dance someday in the imaginations of HPA's current students of biotechnology. But for now, their focus is set squarely on their lab research assignments, and the possible careers they might pursue after college.

Takahashi-Ruiz has plans to become a veterinarian, Patterson a computer-graphics designer.

"In 10 or 20 years, who knows where this research will take us?" McDowell said.