

Artistic YET SCIENTIFIC

FACULTY-DEVELOPED CURRICULUM ENCOURAGES STUDENTS TO EXPLORE LINKS BETWEEN ART AND SCIENCE

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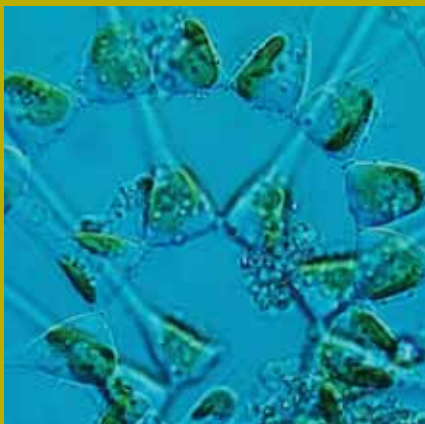
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HAT BEGAN AS A SIMPLE INVITATION TO A COCKTAIL PARTY TRIGGERED AN IDEA THAT MAY WIND UP INCREASING ELEMENTARY AND SECONDARY SCHOOL STUDENTS' AWARENESS OF HOW ART AND SCIENCE ARE INTERTWINED. ★ THAT HAS BECOME THE GOAL OF A TEAM OF OLD DOMINION UNIVERSITY FACULTY MEMBERS WHO ARE BETTING THAT THE PHOTOGENIC ATTRIBUTES OF PLANKTON, MICROALGAE, SEAGRASS AND SEA SLUGS WILL MAKE THEIR WAY INTO AN "ART IN SCIENCE" CURRICULUM STARTING IN VIRGINIA AND EVENTUALLY MAKING ITS WAY ACROSS THE NATION.

Old Dominion's "art in science" project began in 2000 when Martina Doblin received an invitation to a cocktail party hosted by Lisa Drake, her colleague in the Ocean, Earth and Atmospheric Sciences Department. Doblin was immediately struck by the jewel-like image of a phytoplankton from Norfolk's Lafayette River that adorned the invitation. Along with her R.S.V.P., Doblin suggested pooling their resources of marine organisms to form an artistic venture.

"When I got the invitation, I realized we could do something with this imagery," the Australian native recalls, adding that her graduate school adviser had often presented scanning electron micrograph images of plankton. Doblin, whose research focuses on the microbial ecology of ships' ballast water, the ecology of harmful algal blooms and the food web effects of agricultural pollution, has photographed plankton from the Elizabeth River and the Chesapeake Bay, as well as salt crystals, and contributed those images to the project.

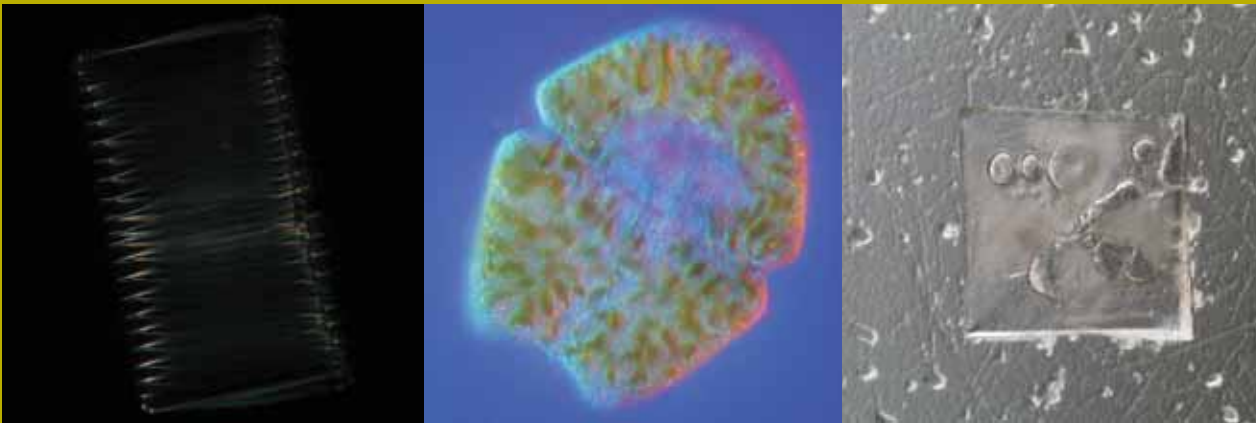
The two research assistant professors began delving into Drake's collection of vivid images of marine plankton, gathered in her investigations of invasions biology of marine microorganisms, microbial ecology and interactions among seagrasses and the organisms that grow upon them. Drake photographed the plankton, found in Hampton Roads waterways, the Bahamas, and California's Monterey Bay, with a digital camera attached to a microscope. The images, known as photomicrographs, are frequently set against colored backgrounds. The color is attained using a set of prisms and filters on the microscope that are arranged to achieve Nomarski Differential Interference Contrast, an optical technique that uses light instead of biological stain to distinguish different components of specimens. As a result, images can be seen in striking color, as well as in exaggerated three dimensions. The plankton ranges from simple rodlike shapes to complex, winding chains of star-shaped cells, adding to the artfulness of the images.



To further weave art and science together, Drake and Doblin joined forces with Robert Wojtowicz, chair of the art department, and B. Stephen Carpenter II, a former Old Dominion professor of art. Initially, they discussed compiling a coffee-table book of the images, but it soon became clear that the project had a broader impact. The venture took off when the framed, colorful images of the marine organisms were placed on display on the Old Dominion campus, followed by exhibits at Nauticus Maritime Center in Norfolk, the Virginia Marine Science Museum in Virginia Beach and Virginia Beach's Contemporary Art Center. Along the way, Lisa Murray, director of corporate and foundation relations in the university's Office of Development, secured a grant from the ODU Research Foundation to print note cards, each featuring a different image of the microscopic organisms.

Art and Science Enter the Classroom

The science and art faculty members, however, realized that their project could have ramifications far greater than an exhibit. Carpenter teamed up with Wendy Frazier, assistant professor of science education, and with input from the group, developed an "art in science" curriculum using the photomicrographs to teach the concepts of visual art and life science in a way that would spark students' imagination. The Old Dominion team presented the curriculum during a 2003 workshop with staff at Norfolk's Larchmont and St. Helena elementary schools, resulting in constructive comments from both art and science teachers.



“We think these are good tools for education,” Drake says. “The feedback from teachers has been positive and helpful to us in refining our ideas.” Frazier and Carpenter based the curriculum on the 5E model of education (Trowbridge et al., 2000): engagement to excite students in what they are learning; exploration to delve into the images; explanation to make sense of what they have seen; elaboration to apply the concepts and their experiences during the previous phases; and evaluation to assess the students’ understanding. To be widely used in Virginia schools, the “art in science” curriculum must be shown to address the state’s Standards of Learning in science and art objectives.

As part of an effort to promote “art in science” outside Virginia, Carpenter recently presented the curriculum at an international symposium in Qatar, as well as to students at a private school there. Frazier and the team plan to present the curriculum at an upcoming conference of the National Science Teachers Association. She believes teachers throughout the nation will gravitate to the project as they seek new ways to trigger student interest in science.

“National Science Teacher Association standards call for curricula that are more inclusive of the children’s backgrounds and interests,” Frazier says. “This curriculum is based on the work of female scientists and helps unite art education and science education. Both disciplines are based on observation and experimentation. The main message of both artists and scientists is that we use evidence in multiple ways.”

One of the curriculum’s activities calls for students to organize pictures according to different and similar characteristics, such as whether the organism captured in the microphotograph is living and whether it is simple or complex. Students also learn about the objects pictured and see

how scientists can magnify objects to make them appear hundreds of times larger than their actual size.

“It’s a hands-on inquiry approach to capture students’ interests and draw more students into science,” Frazier says.

The Old Dominion faculty members are also trying to determine which content area in science to target for implementing the curriculum. It was initially designed to be placed in biology and earth science courses but can be expanded to include other scientific disciplines.

With younger students, the art side appears to hold more appeal. Lisa Murray says “art in science” has many applications for art classes, where students can explore the aesthetics of the marine organisms, compare the images with paintings and determine if their own drawings are art. “The long-term vision includes having a summer art camp at Old Dominion to immerse students in art and science,” Murray says, adding that students would also board the university’s research vessel, the R/V Fay Slover, to collect specimens in the Chesapeake Bay for their own photomicrographs.

A New Way to Display Marine Organisms

The plankton, algae and other marine creatures set against vivid colors have intrigued students in Norfolk Public Schools, where “art in science” has been presented as a pilot project. Many youngsters have been surprised to learn that the artful pictures are of objects found in local waters. Doblin and Drake are quick to point out that they do not manipulate the organisms or the colors on the slide to obtain the perfect image. They simply choose a color within the micro-

scope prism's color spectrum based on what will best accentuate the organism they are viewing.

"These colors are what we see under the microscope, using the particular optics the microscope has," Doblin explains. "We're not gluing specimens on microscope slides and making things happen. Scientists are in the business of unambiguous documentation. However, we're presenting these organisms in a new way."

She adds that some specimens are asymmetrical or appear to be floating when they are placed under the microscope. "The choices I make are what amuse me and what we think are aesthetically appealing."

Drake notes that creating these images is not necessarily an easy task. In addition to collecting the samples, she must ensure the organism she photographs meets both scientific and aesthetic qualifications. "I may collect one pleasing image after a couple hours of work. My first criterion is that the technical aspects must be correct, then the art. If an image is cluttered by bacteria cells, that will mar the composition."

Interestingly, Drake and Doblin are carrying on a centuries-old tradition of the intermingling of art and science. "There are some prominent examples in science where scientists created books of art using marine organisms," Doblin says. For example, Doblin's graduate adviser, Gustaaf

Hallegraeff, is the author of a book of photomicrographs called "Plankton: A Microscopic World," published in 1988. In an historical context, botanical drawings have been used as art for centuries. Organizations, such as Art and Science Collaborators Inc. (www.asci.org), specialize in raising public awareness about artists and scientists who use science and technology to explore new forms of creative expression.

"This has been going on for as long as science has existed," Doblin adds. "But this is our version."



FOURTEEN OF THE ART IN SCIENCE

IMAGES ARE CURRENTLY ON DISPLAY

AT NAUTICUS: THE NATIONAL

MARITIME CENTER, IN NORFOLK, VA.

NOTECARDS FEATURING THE IMAGES

ARE AVAILABLE AT THE OLD DOMINION

UNIVERSITY BOOKSTORE.

"THESE COLORS ARE WHAT WE SEE UNDER THE MICROSCOPE, USING THE PARTICULAR OPTICS THE MICROSCOPE HAS. WE'RE NOT GLUING SPECIMENS ON MICROSCOPE SLIDES AND MAKING THINGS HAPPEN."

— MARTINA DOBLIN

"WE THINK THESE ARE GOOD TOOLS FOR EDUCATION. THE FEEDBACK FROM TEACHERS HAS BEEN POSITIVE AND HELPFUL TO US IN REFINING OUR IDEAS."

— LISA DRAKE

