"It puts an exclamation point on the sentence," says Michael Leon, Irvine's associate dean of undergraduate biology education.

O'Dowd found that students can misunderstand key concepts when they're presented two-dimensionally. For example, many students perceive DNA plasmids as a flat circle, which is how they're typically drawn. But they are actually loops, with empty space in the middle. Her 3-D "plasmid," manufactured from an old garden hose, shows students the proper shape.

Students often become moving parts in her demos—for example, they make great motor proteins. A volunteer in O'Dowd's lecture might portray a kinesin, carrying the vesicle-wig across the giant cell's microtubule tracks, or one in a lineup of myosins, pulling and pushing to simulate muscle contraction. Dozing off in class is dangerous—the sleepy undergrad could wind up starring as the "resting neuron" in a one-act play on nerve cell stimulation.

O'Dowd tries to break through the invisible barrier between the lecturer droning at the podium and the students slouched in their chairs. "They have to feel like they're people in your class, not just one in a sea of faces," she says.

Even those who remain seated are engaged, shouting out instructions to their friends onstage. "They stop looking at their computers and start looking at the lecture," says graduate student Melissa Strong, who was a teaching assistant in the course. In one demonstration, O'Dowd uses tennis balls to represent hydrogen ions in the blood, and invites six students to come to the front of the room and act as carbonic acid and bicarbonate ions buffering the blood's pH. Three tennis balls "in solution"—that is, on the floor—represent the ideal pH. The job of the student buffers is to pick up or drop tennis balls to maintain that perfect state. Once, O'Dowd set out five "hydrogens," two too many. When three students reached for balls, she recalls, "The whole class yelled, 'Nooo!'" The third bicarbonate quickly dropped his ball, keeping the blood pH at equilibrium.

In an anonymous survey, 90 percent of students rated the demos "helpful," O'Dowd reported earlier this year in the journal *CBE—Life Sciences Education*. Vivian Nguyen, a junior who works in O'Dowd's lab, recalls that the textbook was crammed with details, but the demos "went straight to the point." Sophomore Marina Nemetalla says she thought back to demonstrations during exams and continues to do so now in her research. During a recent lab meeting, Nemetalla even launched into a demonstration of her own, using colored beads to represent DNA bases.

The students are not the only ones to benefit. O'Dowd says she gets more satisfaction from teaching than in years past. Inspiring young people provides rewards that her research on learning and memory in fruit flies cannot. No fellow neurobiologist has ever written her with the comment she occasionally hears from her students: "You changed my life." ■ –AMBER DANCE

FOR MORE INFORMATION: To see some of Diane O'Dowd's classroom demos, visit www.researchandteaching.bio.uci.edu/lecture_demo.html.

2009 HOLIDAY LECTURES ON SCIENCE

EXPLORING BIODIVERSITY

Sometimes it pays to look in unlikely places to uncover the secrets of biology. Researchers Bonnie Bassler and Baldomero Olivera know from experience that nature holds clues to medical science, and this winter they'll be sharing their insights in HHMI's 2009 Holiday Lectures on Science. Available live by Webcast on December 3 and 4, the four-part lecture series "Exploring Biodiversity: The Search for New Medicines" will introduce viewers to the intriguing research of these two biologists. ¶ Bassler, an HHMI investigator at Princeton University, studies glow-in-the-dark marine bacteria to learn how they communicate with each other. Understanding how they coordinate their actions could help improve treatment of bacterial infections in humans. ¶ Olivera, an HHMI professor, focuses his University of Utah research lab on the venomous cone snail, which can produce up to 100 different toxins. He is sorting through the molecules that make up these toxins in search of compounds to treat human disease. ¶ Both researchers' work illustrates the value in studying the diversity of organisms found off the beaten path. For more information on the 2009 Holiday Lectures, visit www.hhmi.org/biointeractive/hl.