Each cell found in an organism needs a mitochondria to provide energy and a nucleus to store information. In the same manner, Dr. Kimberly Tanner, director of the Science Education Partnership and Assessment Laboratory (SEPAL) at San Francisco State University, is the program's nucleus, mitochondria, and more. Through her, SEPAL has undertaken the enormous task of dissecting, testing, and improving biology education. SEPAL's staff, students, and faculty conduct research into new tools, techniques, and teaching methods that bring real-world scientific practices into classrooms—from kindergarten through graduate school. “We have fieldtrips of kids coming through here,” says Trisha de Vera, SEPAL administrator and resource center manager, “and we have lab coats waiting for them at each chair so they can actually feel like scientists when they come on to the campus.” Methods like this encourage children to ask questions and take an active role in their learning process. SEPAL aims to promote discovery, expand diversity within the sciences, and reduce the difficulty for both students and educators. With passion and dynamism, Kimberly Tanner guides it all.
These women often serve as memorable role models in the scientific world to whom the girls can relate.

As a girl Tanner found the inspiration to pursue a degree in science after working with her high school biology teachers, Charlotte McBee and Peggy Welch. Tanner was the first in her family to attend college, she says, and she completed her undergraduate studies at Rice University in Houston, Texas. She earned her doctorate in neurobiology at the University of California, San Francisco, where she remained to work in UCSF's science education program. In 2004 she was hired as a member of SF State's biology faculty as a professor specializing in science education.

After outlining her own academic pathway, Tanner continued to explain SEPAL's third focus: reducing the difficulty of learning and teaching science. Science tends to be complex, interconnected and fact-dense. “A lot of people find the sciences difficult or challenging,” Tanner said, swaying from side to side in her chair as if searching for something. “We also know that a large proportion of the population just doesn’t understand a lot of scientific ideas. Part of what we do in the [SEPAL] lab is to try and understand what’s difficult for people to learn in science, think about why it’s difficult to learn, and how to get that kind of information to really talented faculty so they can more directly address what’s difficult.”

Tanner’s lab has taken a new approach to addressing how and why science seems so difficult to so many. For people to understand individual fields of science such as climate change or genetic modification, she says, it’s crucial for them to be able to link ideas. “It is the connections between the ideas that are important.” The thought of connections prompts her to look down at her neck scarf: she relates that she is searching for the silhouetted tumors that were on the scarf she wore the day before. That simple, telling behavior exemplified the true scientist’s search for associations and connections in everything they do—even, sometimes, in what they wear! Tanner majors and biology experts think about life science. She gave the example of a test that uses various flash cards containing different biology problems. She and her co-investigators asked non-majors and biology experts to sort the cards based on fundamental biological ideas. Her study found a difference between how the two groups organize information. “What’s really interesting, if you ask a non-major to [sort the cards], they put all the plant problems together, they put the human problems together, and they put the microorganism problems together. So they represent biology based on organism type. If you ask faculty or expert scientists to do that same kind of sorting, they will say, ‘Oh, these are all about energy and matter, this is how we deal with energy and matter in living systems. Oh, these are all about information flow in genetics and how you copy cells. Oh, this is really all about evolution...’”

Thus, the sorting used by experts allows them to group large sets of similar information into more manageable groups. Educators call this method “chunking,” and it allows for easier access and use of learned information. Tanner and colleagues are now applying discoveries like this sorting dichotomy in classrooms to help address the difficulties in learning science.

As Tanner finished discussing the last of SEPAL’s three missions, her eyes seemed lit from within and her hand gestures became even more animated. At times, she reached out as if pointing to a ship on the horizon. Her obvious excitement made me wonder why it’s so difficult to so many. For people to understand individual fields of science such as climate change or genetic modification, she says, it’s crucial for them to be able to link ideas. “It is the connections between the ideas that are important.” The thought of connections prompts her to look down at her neck scarf: she relates that she is searching for the silhouetted tumors that were on the scarf she wore the day before. That simple, telling behavior exemplified the true scientist’s search for associations and connections in everything they do—even, sometimes, in what they wear! Tanner majors and biology experts think about life science. She gave the example of a test that uses various flash cards containing different biology problems. She and her co-investigators asked non-majors and biology experts to sort the cards based on fundamental biological ideas. Her study found a difference between how the two groups organize information. “What’s really interesting, if you ask a non-major to [sort the cards], they put all the plant problems together, they put the human problems together, and they put the microorganism problems together. So they represent biology based on organism type. If you ask faculty or expert scientists to do that same kind of sorting, they will say, ‘Oh, these are all about energy and matter, this is how we deal with energy and matter in living systems. Oh, these are all about information flow in genetics and how you copy cells. Oh, this is really all about evolution...’”

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Tanner’s professional passion is clearly intertwined with SEPAL’s successful history. In April 2014, SEPAL celebrated its 10-year anniversary. Tanner and her staff both created and developed the center’s numerous programs and research projects. Trisha de Vera, SEPAL’s administrator and resource center manager, has been with the educational laboratory since its inception.

I sat with de Vera, an enthusiastic administrator, to ask more about SEPAL’s sources of momentum and success. Without hesitation, de Vera answered, “Kimberly Tanner! It’s her drive, and I really mean that to the letter, D-R-I-V-E.” She spoke with eyes wide and index finger pointing as if she were selecting each letter from a suspended touch screen. “She has the drive to do everything and anything. It’s her drive and her passion for science education that has made this program very successful.”

Asked about her favorite among Tanner’s personal traits, de Vera again answered immediately. “She knows all of her students by name,” she said. “If there are students that need a little extra help, she is always willing to go the extra mile; her door is always open.” Tanner’s availability has made her a respected resource among staff, students, and faculty that extends far beyond SF State. When asked which of Tanner’s accomplishments since starting SEPAL has had the greatest impact, de Vera responded decisively: Receiving a huge Howard Hughes Medical Institute grant to support one of SEPAL’s innovative programs, Biology Faculty Explorations in Scientific Teaching. Tanner received this invitation-only grant in 2012 for the maximum stipend of $1.5 million. Tanner’s award represents the first time a faculty member at SF State has received this prestigious recognition and funding.

Curious to seek out her students’ perspective, this reporter returned to the SEPAL laboratory on a bright breezy spring morning, and found a pair of students willing to share their opinions on Tanner and the program. Second year grad student Stephanie Malmgren explained how her experiences with Tanner have impacted her education and aspirations. “Her skill set is really diverse. She is a really skilled biologist and scientific thinker, really bright and an astounding scientist.” As Young talked, her hands moved as if she was stitching a quilt. Occasionally her expression bore the upturned, awestruck look of a girl watching fireworks. She ended by saying that Tanner was “a connecter.” She has this really amazing ability to bring people together. I think,” she ended by saying that “she brings out the best in a lot of people… She has taught me so much about being a professional, demanding that I rise to being a colleague rather than treating me as a student. I feel like I’m in the process of rising and I think that’s because of her expectations.”

Tanner is clearly an instrumental and dynamic force in science education and her impact and accomplishments through SEPAL are evident. During our interview, Tanner shared these final thoughts. “What’s fabulous about SEPAL is that we really represent a large number of people who are going out and changing the world. We have more people that understand that we need to change the way that we are teaching and we need to think very carefully about who we’re teaching and how to engage them and make it relevant to their home communities … [in a way] that makes sense.” Tanner concludes: “If you had asked me 10 years ago if we would have so many people out changing the world, I would not have ever predicted what a powerful set of alums we [would] send out into the world every year.” Graduation time is “a very special time of year, because we are fledging all these fabulous advocates for social justice out in to the world that you know are going to make it a much better place for the next generation.”

Top photo: SEPAL Program Administrator, Trisha de Vera, partnered with Professor Kimberly Tanner to found and grow SEPAL since 2004.