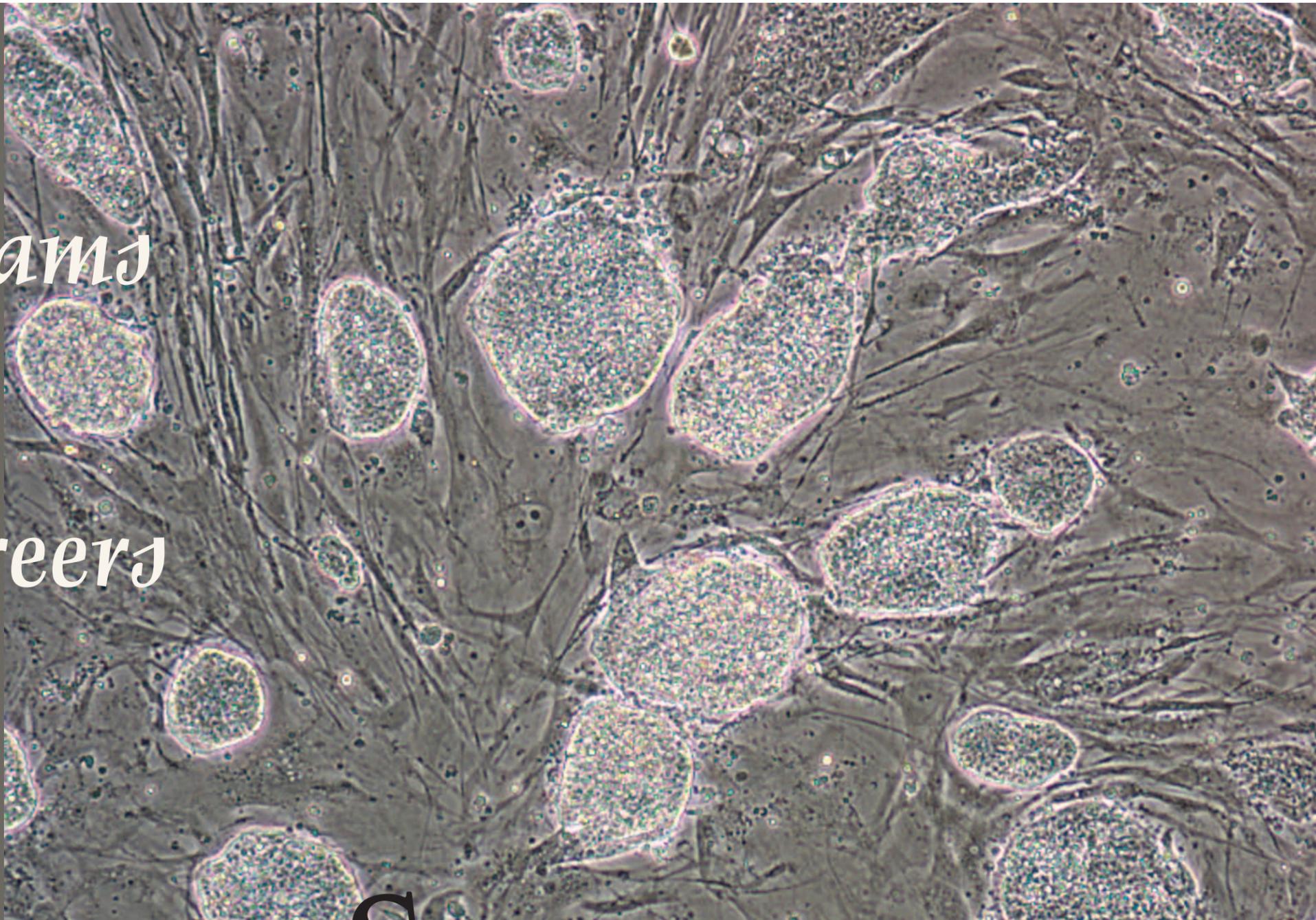


New SF State Programs Promote Stem Cell Careers

by Karin Busk

Photo courtesy of Dr. Chen



Embryonic stem cell colonies cultured on fibroblast feeder cells

California is poised to lead not only this country, but all countries on stem cell research. We cannot fall behind the nations who are making this life-saving science a priority.

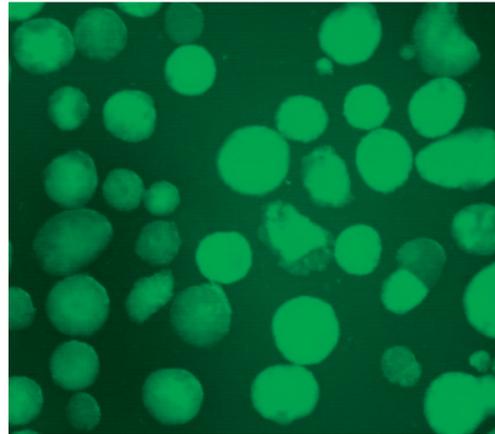
— Governor Schwarzenegger, July 2006

Stem cells give rise to new cells and cell types in the body. The most basic and generative type are the stem cells of embryos, which, depending on control signals, can give rise to over 200 different kinds of cells. Stem cell research is giving biologists a much greater understanding of how cells and tissues develop and differentiate. Stem cells also have important practical applications in the testing of new drugs and the creation of life-saving therapies. These applications include providing type I diabetes patients with insulin-producing cells; heart disease patients with healthy, new heart muscle cells; and burn victims with skin grafts cultured for transplantation.

Both PSM programs reflect a growing national trend toward better preparation for students who must meet the demands of a rapidly changing scientific work place.

Pluripotent embryoid bodies (expressing embryonic stem cell markers as green fluorescent proteins) have the potential to generate all tissues and cells of the body.

Photo courtesy of Dr. Chen



Dr. Chen (left) and PSM students: Navdeep Grewal (middle), Casey Haynes (right) conduct immunochemical stains on embryonic stem cell culture.



California has been, and remains, at the front line of stem cell research supported by federal and state funding, and California voters. Future medical treatments have apparently limitless potential. However, "significant technical hurdles remain," according to the National Institutes of Health website, and overcoming them will require intensive research as well as a new generation of professionals with specialized training in this field. With this challenge in mind, biology professor Dr. Lily Chen is leading the development of two new types of Master's programs. Both are designated Professional Science Master's (PSM); one with a concentration in Biotechnology and the other in Stem Cell Science. Both are rooted in

Chen's enthusiasm for teaching and research. And both reflect a growing national trend toward better preparation for students who must meet the demands of a rapidly changing scientific work place.

In 2004, Chen understood the need for a deeper knowledge of stem cells and their application to support an emerging and expanding workforce for the biotech industry. Together with Dr. Michael Goldman, biology department chairman at SF State, Chen became a faculty leader in the university's PSM Initiative.

The development of the stem cell and biotechnology programs are a part of a California State University (CSU) drive to develop new and innovative graduate degrees. Each program integrates rigorous scientific coursework with business training, research experience, and an internship in the biotech industry. The intent is to equip

PSM graduates with the skills they will need to advance rapidly in applied bioscience careers, including jobs in research, development, management, manufacturing, and marketing.

"I and others have had to go through many steps, and it has been a long process back and forward to get the new programs approved," says Chen. In July 2009, the CSU Chancellor's office gave final approval for SF State's Biotechnology and Stem Cell Science PSM programs.

CSU is the first state-wide education system to launch PSM degrees. A grant of nearly \$1.4 million from the Alfred P. Sloan Foundation, a non-profit organization that supports projects with clear benefits to society, underwrote much of the CSU effort. Currently, 14 of the CSU campuses are offering 18 different degrees including programs in bioinformatics, environmental science, forensic science, and genetic counseling. The PSM programs in Biotechnology and Stem Cell Science are the first to begin at SF State.

SF State received an additional \$1.7 million from the California Institute of Regenerative Medicine (CIRM) Bridges to Stem Cell Awards. This grant allowed SF State to offer specialized stem cell education, both within the PSM and traditional master's programs. CIRM is a state agency formed in 2004 after California voters approved Proposition 71. The proposition earmarked \$3 billion for stem cell research. Passage enabled California to maintain its leading position within the field during a time when the Bush administration restricted federal funds for embryonic stem cell research.

The National Science Foundation recently awarded \$700,000 to the SF State's PSM program and its two concentrations in biotechnology and stem cell science. NSF is funding over 20 such programs nationally. The grant will provide scholarships to 20 SF State students between now and 2013. The students will take rigorous scientific coursework in molecular biology, developmental biology, proteomics, and biosciences. They will also learn skills in management, organizational behavior, communication, and ethics. Their coursework will culminate in lengthy internships with Bay Area research institutions, biotech industries, public and non-profit agencies. The program's first seven students began studying in fall 2010.

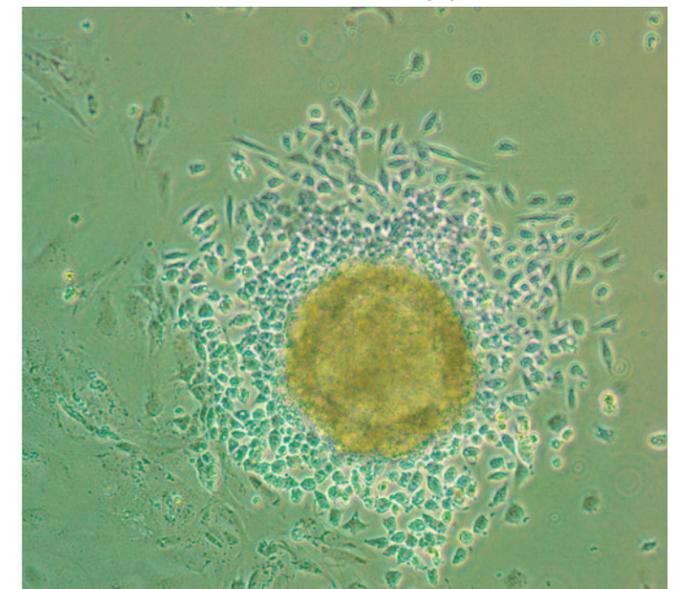
The PSM program differs from many conventional masters programs that primarily offer academic classes and research. Instead, training will be both interdisciplinary and applied. "I would like to teach students practical skills, not just something you can look up in a book," says Dr. Joe Conaghan who teaches a class for the program in Reproductive Technologies.



Lily Chen, Professor of Biology

Differentiated embryonic stem cells that will become beating cardiomyocytes (cardiac muscle cells.)

Photo courtesy of Dr. Chen



In addition to classes on campus, each student will complete an internship at a small start-up company, a mid-sized regional firm, an internationally known corporation, or an organization in



has enjoyed developing programs that encourage interdisciplinary collaboration to give students a solid, more adaptive base. Her intention with the PSM program is to widen students' options so they can pick between research at a laboratory, work in a biotech company, a job with a government agency, or further education toward a doctoral or medical degree.

PSM students will meet regularly with two mentors, one biology professor and either Program Director Lily Chen or Associate Director Dr. Linda Chen. Moving through the approved program as a united cohort will also allow the students to support each other. Mentors in their outside industry internships will also provide insights and experience. Lily Chen thinks it important that the new programs provide a good network of mentors such as she had during her own education.

Chen's face radiates with joy and playfulness as she discusses both the new programs and the background that led her to SF State. She was born in Taiwan and remembers spending most of her weekends visiting her father's mycology research laboratory. "My father gave me a playground," Chen recalls. She was allowed to conduct a lot of science experiments. "I have always felt that doing research and playing in the lab is a part of me. I can go to different worlds and try different things, but I always feel like the lab is my safe nest."

Chen knew she wanted to channel her never-ending curiosity toward scientific research. She entered the National Taiwan University College of Medicine in Taipei where she received a bachelor's degree in

the non-profit/public sector. "We are setting up potential internship sites," Chen explains, "but students have to choose and apply for themselves." Stanford, UC San Francisco, and the Buck Institute of Regenerative Medicine will all offer stem cell research opportunities. Students will also be able to work on applied research projects at a number of Bay Area biotechnological and pharmaceutical companies. This latter feature attracted Joy Chananukul, a prospective student in the PSM Stem Cell program. "I would like to have more industry experience," says Chananukul, "and stem cell research is an area I have always been interested in."

Explains Chen, "PSM is broadening the definition of a master's program. And, in the current economic situation it is more important than ever for students to be adaptive." She



Medical Technology. Before continuing her education in the U.S, Chen taught in a medical college as a laboratory instructor in immunology and microbiology and found a passion for teaching. After earning both her master's and doctoral degrees from State University of New York at Buffalo, Chen conducted postdoctoral research in virology and biochemistry at the Massachusetts Institute of Technology (MIT) and UCSF. Before joining SF State, Chen spent three years as an assistant professor at the University of Vermont. She has always appreciated how her broad-based science training has enabled her to feel comfortable with research and confident to enter new fields of science.

Chen's office reflects her wide-ranging interests. Stacks of paper cover tables bookshelves, and the floor creating a maze to navigate. At her desk in the center, she worked for three years to create the PSM programs and sheppard them through approval. With the new programs operating and with 12 years of teaching behind her, Chen decided to take a sabbatical to conduct research at Stanford and UCSF. Her goal is to generate a line of stem cells from the parasite that causes schistosomiasis, a devastating tropical parasitic disease second only to malaria. She will use the cell-line to study the parasite's development which may yield a key to its pathogenicity. UCSF has a strong parasitic lab and Stanford is known for its human embryonic stem cell research. Chen hopes that her collaboration with these lab groups will promote her knowledge of stem cell lab techniques that she can share with future students.

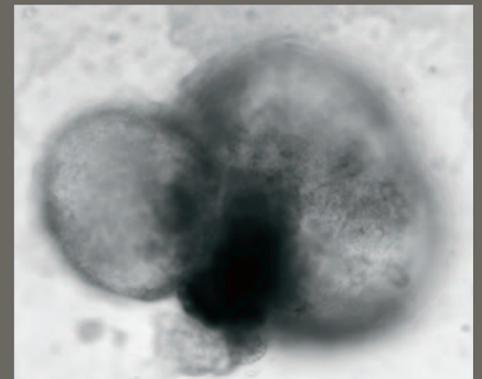
She is very excited about this future collaboration, as well as the overall potential of the new Professional Science Master's programs. "I hope they will provide additional opportunity for SF State students to expand their career options," she says, "and to bring new collaborations between academics and affiliated partners." ❖

Professional Science Master's Program Update

by Dr. Lily Chen:

The National Science Foundation recently awarded \$700,000 to the newly formed Professional Science Master's program (PSM) in Biomedical Science with two concentrations in Biotechnology and Stem Cell Science at SF State (Principle Investigator, Lily Chen).

The project provides prestigious NSF scholarships to twenty SFSU PSM students over the next three years (2010-2013). The new PSM program includes coursework in molecular biology, developmental biology, proteomics, biosciences, business management, communication, bioethics, teamwork skills and internships with Bay Area research institutions, biotech industries, public and non-profit agencies. The new master's program integrates rigorous scientific coursework with training in management, organizational behavior, communication and ethics, and culminates with a 3 to 12 months applied research internship, usually in industry settings. The program accepted its first cohort class in fall 2010. ❖



Beating embryonic stem cell-derived beating cardiomyocytes.
Photo courtesy of Dr. Chen

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Biology's stem cell techniques class provides extensive hand-on training to both PSM and CIRM students.

Bottom page 44
Dr. Chen (r) and students (clockwise): Connie Chow (PSM), Noel De Leon, Adam Harvey (PSM) view a live video capture of beating cardiomyocytes derived from embryonic stem cells.

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Joy Arakaki (CIRM bridge trainee) cultures stem cells in a tissue culture facility located in Hensill Hall.