



STEM CELL RESEARCH AT THE UNIVERSITY OF CALIFORNIA – PROPOSITION 71 FUNDING

The University of California is leading the way in developing key scientific advances in the area of stem cell research. Scientists at UC are studying stem cells to gain a better understanding of the biological processes involved in human health and disease, with the goal of translating discoveries from this research into treatments for a variety of ailments such as Parkinson's disease, multiple sclerosis, Alzheimer's and cancer. UC scientists on every campus are engaged in stem cell research that can significantly contribute to our understanding and treatment of human disease. UC is also engaged in significant education efforts to train the next generation of stem cell researchers, providing course work and hands-on training in stem cell biology, its clinical applications, and social, ethical and policy issues related to use of stem cells.

For years, UC scientists have conducted research in the area of stem cells, first studying adult stem cells in animals and humans, and, more recently, also studying embryonic stem cells. In fact, the term "embryonic stem cell" was coined by a researcher at UC San Francisco, and UCSF is one of only two academic institutions to have produced human embryonic stem cell lines that qualified for inclusion on the National Institutes of Health registry, allowing them to be used in federally funded research.

Proposition 71

Proposition 71 funding is helping to greatly expand stem cell research at the University of California. Passed by voters in 2004, Proposition 71 authorizes a \$3 billion bond program over the next 10 years to fund stem cell research in California. Proposition 71 gives priority to funding research that cannot be done with federal funds (such as human embryonic stem cell research on lines produced after the 2001 Presidential funding restriction).

Awards to UC Campuses from the California Institute for Regenerative Medicine

Researchers at UC campuses have fared very well in the competitive peer review process for CIRM awards, receiving a significant number of the training, Scientific Excellence through Exploration and Development, comprehensive and facilities grants recently awarded. All 10 UC campuses have received at least one CIRM award, and most have received more than one. In total, UC campuses will receive 72 of the 136 awards made by CIRM.

Training Grants

UC campuses received half of the 16 training grants awarded by CIRM in 2005 (which were funded beginning in April 2006), totaling approximately \$20.8 million over three years. These grants will prepare the next generation of researchers to work in this evolving field.

SEED and Comprehensive Research Grants

UC researchers captured half of the first round of research awards issued by CIRM, receiving 38 Scientific Excellence through Exploration and Development (SEED) grants totaling approximately \$21 million over two years. SEED grants are intended to provide funding for preliminary research projects that are expected to generate data and results that can be extended to future, full-scale investigations.

UC researchers were awarded 17 — more than half — of the 29 comprehensive research grants announced by CIRM in March. This represents \$42 million of the \$74.6 million CIRM will distribute for these grants over the next four years. These awards were given to scientists with a record of accomplishment in the stem cell field, to support work in the area of human embryonic stem cell research. UCSF researchers received more comprehensive research grants than any other institution, with seven projects funded by CIRM. Three scientists at UC Irvine, three at UC San Diego, two at UC Davis and two at UCLA were also awarded comprehensive research grants. The work that will be conducted with these grants includes projects with applicability to a wide range of diseases and disorders, including Parkinson's disease, heart disease, stroke, Alzheimer's disease and blood disorders.

Facilities Grants

On June 5, 2007, CIRM approved 17 facilities grants to fund construction of shared research laboratories at academic and nonprofit institutions in California. Of these, nine awards, totaling more than \$21 million, went to UC recipients. These awards will provide funding over three years for the design and renovation of core laboratory space, equipment for new facilities, and operating expenses. The shared laboratories to be funded by CIRM will provide dedicated space for the culture of human embryonic stem cells (hESCs) and in some instances are to be complemented by additional funding for training courses. Applicant institutions are required to provide at least a 20 percent match of the total cost for renovation and equipment.

New Faculty Awards

On Dec. 12, 2007, CIRM approved grants totaling more than \$54 million for New Faculty Awards — UC campuses received half of the 22 grants awarded, totaling \$24.7 million. The awards are designed to encourage and foster the next generation of clinical and scientific leaders in stem cell research. The award provides salary and research support for up to five years to new faculty members at stem cell research programs across the California. In addition, the funding helps scientists at the time between the end of their formal training and the beginning of their independently supported research activities, when funding is typically hard to secure.

UC Stem Cell Projects Funded by Proposition 71:

- **UC Berkeley** In 2005, UC Berkeley was awarded a three-year \$2.5 million CIRM training grant to establish training in the scientific and social issues surrounding the study and use of stem cells. The grant to UC Berkeley and Children's Hospital Oakland Research Institute was the only CIRM training grant to include fellowships to educate lawyers and humanists in the unique biological, sociological and legal issues raised by stem cell research. In February, 2007, two Berkeley researchers received SEED research grants from CIRM, totaling \$1 million over two years, for work that includes the study of whether T-cells (that can attack pathogens but not react to one's own organs) can be developed from human embryonic stem cells. In June 2007, UC Berkeley received a \$2 million CIRM grant to fund facilities that will provide a central repository and resource for culture and maintenance of stem cell lines, and imaging and cytometry analysis. Berkeley was awarded \$2.2 million in New Faculty Awards in December 2007.
- **UC Davis** UC Davis was awarded a three-year \$2.6 million CIRM training grant in 2005, and in February 2007, two UC Davis researchers were awarded CIRM SEED research grants, totaling \$836,000 over two years. The CIRM-funded research includes a study of whether human embryonic stem cells could be used to develop

cells useful in repairing damage associated with hearing loss, and a study of using human embryonic stem cells to regenerate cartilage that could lead to a therapy for osteoarthritis.

The SEED grants were followed in March 2007 by CIRM comprehensive grants awarded to two UCD professors whose work will focus on the use of cells obtained from human embryonic stem cells to repair and treat damaged kidneys prior to birth, and the development of technologies for safer liver transplantation through the development of a human liver cell line that can be employed in liver cell transplantation and cell-based therapeutics.

In June, 2007 UC Davis was awarded \$2.8 million over three years for the 2,500 square-foot Translational Human Embryonic Stem Cell Shared Research Facility. The facility will provide stem cell laboratories for investigators performing regenerative medicine research in nonhuman primate models and will include scientific partners from around the state. Researchers at UC Davis received a \$2.4 million New Faculty Award in December.

- **UC Irvine** UC Irvine was awarded a three-year CIRM training grant of more than \$2 million in 2005; more recently, in February 2007, six UC Irvine scientists were awarded a total of \$3.5 million over two years in CIRM SEED awards to support research in areas such as how embryonic stem cells may help repair nervous system damage in patients with multiple sclerosis, and how immunosuppressive drugs (which may be needed if patients are to undergo stem cell therapy) interact with embryonic stem cells.

In March 2007, three researchers at UC Irvine were awarded CIRM comprehensive grants totaling more than \$7 million. Their innovative projects will focus on:

- Applying methods for genetically manipulating hES cells to studying the growth of hES cells in order to allow expansion of hES cells in the large quantities required either for transplantation or for drug screening;
- Creating a renewable human source of cells destroyed in cervical spinal cord injuries to restore upper limb function in both acute and chronic spinal cord injuries;
- Documenting what happens to the mitochondrial DNA (mtDNA) during the creation and growth of hES and hES cells, determining if the mitochondria and mtDNAs of hES cells can influence the differentiated state of tissue cells, investigating the nature and extent of mtDNA mutations that accumulate in ES cells, and determining if mixing different mtDNAs in cells is deleterious. The accumulation of mtDNA mutations has been associated with aging and the development of cancer.

UC Irvine is also the recipient of a \$3.9 million CIRM facilities grant to upgrade its core embryonic stem cell research laboratory and expand a program to train young scientists on research techniques involving human embryonic stem cells. The grant will provide more research space and purchase new equipment designed to genetically modify and analyze stem cells, as well as equipment to isolate specialized cells for disease treatment. UCI was one of only six institutions in the state chosen by CIRM to train new researchers in the use of human embryonic stem cells as part of its facilities grant. CIRM awarded \$2.1 million in a New Faculty Award in December.

- **UC Los Angeles** UCLA was awarded a \$3.75 million three-year CIRM training grant in 2005, and in February 2007, seven UCLA researchers were awarded CIRM SEED research grants that total almost \$4.2 million over two years. These projects include a study of whether human embryonic stem cells can be used to develop a novel approach to treating invasive melanoma.

More recently, two UCLA researchers were the recipients in March of CIRM comprehensive grants for projects related to the future use of hESC-derived nerve cells in the clinical treatment of nerve injury and neurodegenerative diseases such as stroke and Parkinson's disease; and the manipulation of Human embryonic Stem Cells (hESCs) to modify cells in the immune system to develop future therapeutic approaches to combat HIV disease.

In June 2007, UCLA's Institute for Stem Cell Biology and Medicine was awarded a \$2.86 million CIRM facilities grant. The award will fund construction of an approximately 4,700-square-foot, multiuser laboratory space with four tissue culture areas that can be reserved by UCLA and non-UCLA stem cell researchers on a time-share basis. The state-of-art facility will allow human embryonic stem cell research that is either not allowed under current federal funding restrictions or not technically feasible in individual research laboratories. In December, UCLA researchers received \$7.6 million in New Faculty Awards.

- **UC Merced** UC Merced was recently awarded a \$364,000 CIRM SEED research grant to develop a system to grow and controllably differentiate human embryonic stem cells into cells that could potentially be used to restore function to patients with congestive heart failure. In addition, UC Merced is a partner on the UC Davis CIRM training grant, which has facilitated UC Merced graduate student participation in the funded stem cell training programs. UC Merced received a New Faculty Award in December for \$1.6 million

- **UC Riverside** In February, two UC Riverside researchers were awarded a total of \$1 million over two years in CIRM SEED research grants to explore using a chemical genetics approach to identify small organic drug-like molecules that promote stem cell survival and differentiation, and to develop molecular tools that can control stem cell differentiation. In June 2007, CIRM awarded a stem cell research facility grant of almost \$2.8 million to UCR. The grant will fund dedicated laboratory space for the culture of hESCs, particularly those that fall outside federal guidelines. UC Riverside received a \$2.1 million New Faculty Award in December.

- **UC San Diego** UC San Diego was awarded a three-year \$3.6 million CIRM training grant in 2005 to provide stem cell training to graduate students, postdoctoral fellows and clinicians. In February 2007, seven UC San Diego scientists were awarded CIRM SEED grants, totaling about \$3.7 million over two years. UC San Diego recipients of CIRM SEED awards will conduct research in a variety of areas, including whether forebrain neurons can be generated from human embryonic stem cells, which could have applications in addressing several neurological disorders including Alzheimer's disease.

In March, 2007, three UCSD researchers received CIRM comprehensive grants totaling \$7.5 million. Their projects will focus on: the use of human embryonic stem cells to generate human neuronal models of hereditary Alzheimer's Disease to better understand its cellular basis; the use of hESCs to develop data sets to be used in the future development of therapies relating to paraplegia associated with aortic aneurisms and traumatic spinal injury; and the promotion of efficient self-renewal of hESCs, a prerequisite for the development of hESCs into human therapeutics.

The UCSD Human Stem Cell Core Facility, which supports multiple research projects using stem cells to advance the understanding and ultimately the treatment of disease and injury, was awarded a \$2.8 million facilities grant by CIRM in June. The funding will be used to upgrade the current core facility, and to support the establishment of a new satellite facility to expand the resources available to investigators. The existing core facility provides a specially equipped, centralized location for the maintenance of a number of established human embryonic stem cell lines, the training of scientists in basic techniques to work with these cells, and for dedicated laboratory space, technology and support for research utilizing stem cells. The planned 2,775-square-foot satellite core facility will be located in UC San Diego's Jacobs School of Engineering and will build on the research and expertise of faculty from Bioengineering and other departments in the Jacobs School, and from the Division of Physical Sciences. UC San Diego researchers received \$2.2 million in New Faculty Awards funding in December.

- **UC San Francisco** UCSF has one of the largest stem cell research programs in the United States, encompassing some 60 laboratories. The UCSF Institute for Regenerative Medicine combines the talents of molecular biologists, developmental and cell biologists, neurobiologists, immunologists and cancer researchers, whose combined efforts are aimed at gaining a better understanding of how defined types of tissues develop in order to develop cell-based approaches to treating disease.

UCSF was awarded a three-year \$3.6 million CIRM training grant in 2005 to implement a stem cell training program at the graduate, postdoctoral and clinical levels. Nine UCSF researchers were awarded CIRM SEED grants, totaling \$4.8 million over 2 years, to conduct stem cell research in a variety of areas, such as studying the genetic code that regulates the differences between cancer cells and stem cells and in March, UCSF received seven comprehensive grants.

In March, seven UCSF faculty members studying the use of human embryonic stem cells relating to disorders ranging from heart disease, stroke, Parkinson's disease, multiple sclerosis, epilepsy to blood disorders were awarded CIRM comprehensive grants totaling more than \$17 million. UCSF received more comprehensive grants than any other institution. The grants will support research that builds on promising preliminary studies with animal and adult stem cells, including many that will involve testing the use of human embryonic stem cells in animal models of particular diseases, such as heart disease.

Finally, in June 2007, UCSF received a \$3.8 million CIRM facilities grant to expand its non-federally funded human embryonic stem cell research laboratory and establish a stem cell techniques course for scientists throughout Northern California. The expansion will nearly double the size of a recently remodeled, 1,147-square-foot space designated for non-federally funded research that was constructed with UCSF funds and will be used for deriving, growing and characterizing non-federal human embryonic stem cell lines that will be provided to approximately 32 UCSF investigators. The new space will be complemented by a planned stem cell techniques course that will provide important training for UCSF scientists and scientists from 10 other research institutions.

- **UC Santa Barbara** In 2005, UC Santa Barbara was awarded a three-year CIRM training grant in the amount of \$1.3 million, which is being used to train two graduate students and four postdoctoral fellows, who will conduct some of their work in a new Laboratory for Stem Cell Biology. The long-term goal of UC Santa Barbara's stem cell research program is to understand how human embryonic stem cells can be differentiated into ocular cells that might be used to treat eye disease, especially macular degeneration. In June, UCSB received a CIRM facilities grant of \$2.26 million to fund the design and development of a shared laboratory to expand existing stem cell studies and to stimulate new investigations of the biology and engineering of stems cells at UCSB and other nearby research institutions.

- **UC Santa Cruz** The UC Santa Cruz Training Program in Systems Biology of Stem Cells, supported by a \$1.2 million three-year CIRM training award, provides pre-doctoral and postdoctoral students with a solid understanding of the biology of stem cells, as well as the skills to use stem cells in their own research. In February, two UC Santa Cruz researchers were awarded a total of \$1 million over two years from CIRM to explore whether cell replacement could become an effective treatment for amyotrophic lateral sclerosis (ALS), and to study certain aspects of human embryonic stem cell growth and differentiation. In June 2007, UCSC received a \$2.7 million CIRM grant to fund a stem cell research facility. The facility will be shared by UCSC researchers investigating conditions ranging from Parkinson's disease to birth defects. The grant provides funding for the renovation of 2,000 square feet of laboratory space, as well as equipment and staffing for the new laboratory. CIRM awarded \$4.5 million in a New Faculty Award to UC Santa Cruz in December.

For more information:

UC Berkeley	http://stemcellcenter.berkeley.edu
UC Davis	http://www.ucdmc.ucdavis.edu/stemcellresearch
UC Irvine	http://stemcell.uci.edu
UC Merced	http://research.ucmerced.edu
UC Riverside	http://www.stemcell.ucr.edu

UCLA	http://www.iscbm.ucla.edu
UC Santa Barbara	http://research.ucsb.edu
UC Santa Cruz	http://research.ucsc.edu
UC San Diego	http://stemcells.ucsd.edu
UC San Francisco	http://stemcellfacts.ucsf.edu