Find out from Dennis why UC Santa Barbara is a leader in stem cell research

In the search for cures for debilitating diseases like Alzheimer's, Parkinson's, macular degeneration, and diabetes, and for better ways of treating devastating injuries, stem cells have been among the most promising avenues of research. What makes stem cells so useful is their ability to turn into almost any kind of cell found in the human body to potentially provide replacement parts for tissues compromised by disease or injury. If stem cells could be coaxed into becoming brain cells, for example, they could possibly replace those wiped out in Parkinson's disease. Eye cells could be grown to save patients' sight, and skin cells cultured to help people with severe burns.

Stem cell research in the United States has been limited by federal restrictions on the work, enacted by President Bush in 2001 in response to concerns over the use of...
human embryos as a source of stem cells. In 2004, voters in California passed Proposition 71, the California Stem Cell Research and Cures Initiative, which provides $3 billion in funding through 2014 for stem cell research at universities and research institutions in the state. That prompted scientists at UC Santa Barbara to set up a stem cell research and teaching program—the Center for Stem Cell Biology and Engineering.

About two-thirds of the current funding for the center comes from the state, via the California Institute for Regenerative Medicine; roughly a quarter is from private donors, and there’s a small contribution from the federal government. A $6-million state-of-the-art stem cell research facility is now under construction in the Biological Sciences 2 building, and is scheduled to open in June 2010.

Convergence talked with Dennis Clegg, chair of UCSB’s Department of Molecular, Cellular, and Developmental Biology and co-director of the Center for Stem Cell Biology and Engineering, about the university’s stem cell research program.

What’s so exciting about stem cells?

Embryonic stem cells are amazingly powerful cells. They can be sustained indefinitely and can turn into almost any of the different cell types in the body, giving them the potential to treat an extremely wide range of diseases and injuries. That’s what’s generated so much excitement in this area and stimulated people to work in the field of regenerative medicine. Embryonic stem cells are golden cells—we have to harness their power.

What does UCSB bring to stem cell research?

I think we are uniquely positioned in the stem cell field because of our interdisciplinary culture here and our strengths in fundamental molecular mechanisms and in bioengineering and biotechnology. I hear over and over again from people that come from other institutions that it’s just so much easier to get interdisciplinary research going here—we don’t have the typical boundaries between departments, so it’s very easy to collaborate. I think it also has to do with the spirit here... We have the mindset of the new kid on the block in that we’re willing to try approaches that are very novel and are perhaps more risky, but could potentially have large payoffs.

We’ve created a new Center and have about 15 different lab groups with active stem cell research projects, and the number is continuing to grow. We are also recruiting new faculty in the stem cell field.

Dennis Clegg meets with research associate Amy Friedrich and graduate student Teisha
Stem cell pioneer James “Jamie” Thomson of the University of Wisconsin accepted an adjunct professor position at UCSB last year. He was the first person to grow human embryonic stem cells in the lab, in 1998. That was quite a coup getting him, wasn’t it?

It’s been fantastic for our program to have him aboard. He’s been very generous with his time and his expertise. Even though he’s only here part time, he’s available all the time by e-mail, and his postdoctoral fellows (postdocs) talk to our postdocs all the time.

Jamie’s been coming out about once a month and working in his lab here, bringing people with him from Wisconsin on occasion, and we’ve had postdocs, grad students, and professors from Santa Barbara go to Wisconsin to learn, so there’s been an exchange of people and ideas between “Thomson west” and “Thomson east.”

We’re already seeing a payoff, in terms of science being done and in publications.

Has the United States lost ground to the rest of the world in stem cell research, because of the restrictions on federal funding for research on human embryonic stem cells?

Yes, we’re lagging the rest of the world, and that’s a big concern. The country has wasted time because of the underfunding of this very promising field. Other countries are funding stem cell research far better than our federal government, in fact, some people have moved from this country to other places because of that.

Now that Proposition 71 is funding human embryonic stem cell research in California, are we reversing that outflow of talent?

I think California is stepping in to fill the void that developed in the United States, and the state is poised to become a world leader in stem cell research because of Proposition 71. It was very insightful of the people of California to do something new and unusual, stepping in to do what the federal government should have been doing. We’re reversing the brain drain away from the United States by attracting stem cell researchers to the state.

It’s just amazing and exciting how quickly people are moving to this field and how fast the field is moving.

UCSB doesn’t have a medical school, so researchers here can’t work on potential clinical applications for stem cells. Is that a problem?

We can contribute to the understanding of the fundamental molecular mechanisms that are involved in stem cell proliferation and differentiation. The other area we think we can contribute in is bioengineering and biotechnology. UCSB, of course, is known for its
bioengineering and there are important unsolved questions in stem cell culture, sorting, and differentiation that are engineering problems.

Our lack of a medical school doesn’t stop us from translating our work to the clinic. We’re partnering with other universities and private companies to apply our basic research discoveries to develop cellular therapies.

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What are some of the first advances we are likely to see come out of UCSB’s stem cell work?

We’re very interested in developing cellular therapies for eye diseases, especially macular degeneration and retinitis pigmentosa (an inherited eye disease that leads to progressive vision loss). We’ve generated ocular cells from human embryonic stem cells that may be useful in treating these and other diseases. But there’s also bioengineering and biotechnology work going on here that could be used in stem cell research as well as clinical applications. An improved method of growing stem cells could be applied very quickly, and could lead to clinical applications.

We’re hearing a lot in the media about the promise of stem cells to treat or cure disease and injury. Is there too much hype?

I’m a little worried that the public may have expectations that are too high. Proposition 71 and the stem cell field in general have generated a lot of hype about rapid cures. In fact it’s going to be a long and difficult process to develop cellular therapies for diseases. However, clinical trials using adult stem cells are underway, and embryonic stem cells are soon to follow.

What about the ethical debate over the use of human embryonic stem cells? Some people disapprove because these cells, taken from embryos a few days old, have the potential to develop into human beings. What are your thoughts?

It’s an important ethical question. I think it’s a personal decision everyone has to make for themselves. My own personal belief is that if we have the opportunity to cure a disease, we should be trying to do that. I think it would almost be immoral not to do this research because of the great potential for treating miserable human diseases.

Human embryonic stem cell research uses excess embryos that people have donated to science. Many do not understand that there are 400,000 frozen embryos in the United States at in vitro fertilization clinics that will eventually be discarded. It just seems to me, why would you throw out any of this material if you could use it to treat human diseases?

Has there been opposition from the local community or from people within the
university to research at UCSB on human embryonic stem cells?

California, being perhaps more liberal than the rest of the country, is by and large very supportive of stem cell research. I’ve been amazed to see how it cuts across traditional political boundaries. People with a child with diabetes or a mother with Alzheimer’s can see the utility of stem cell research beyond their own personal politics. But yes, there are some people on campus who are opposed to stem cell research based on religious beliefs.

What kind of oversight is there of the UCSB stem cell research program?

We have an oversight committee (chaired by Lois Jovanovic, who heads the Sansum Diabetes Research Institute in Santa Barbara and is a member of the Center for Stem Cell Biology and Engineering at UCSB)), which includes scientists, bioethicists, and people from the community. The committee weighs in on the ethical issues associated with any proposed project. Most of the work at UC Santa Barbara uses established embryonic cell lines and does not deal with ethically controversial procedures.

Scientists have been trying to develop sources of stem cells other than human embryos, including adult stem cells. Does that work look promising?

The problem is that we don’t know which stem cell type will be better. It’s worthwhile to pursue both adult and embryonic cells, because at this point it’s too early to know which cell will be the best.

One of the most exciting developments in the field recently has been work by Jamie Thomson and Shinya Yamanaka showing that a skin cell, a fibroblast, can be reprogrammed to behave like an embryonic stem cell by adding four genes. These are
called induced Pluripotent Stem (iPS) cells. The reason it’s generated so much attention is that the possibility now exists for patient-specific stem cells that wouldn’t be rejected by the immune system. If you use ‘foreign’ stem cells, from sources other than your own body, you have to use immuno-suppressant drugs. If you could convert one of your own skin cells into a stem cell, that would be wonderful. That may be the ultimate solution. We are working hard on these cells in the Center for Stem Cell Biology and Engineering.

Relevant links:

California Institute for Regenerative Medicine:
www.cirm.ca.gov [2]

Dennis Clegg’s homepage:
www.lifesci.ucsb.edu/mcdb/faculty/clegg [3]

Dennis Clegg gives an introduction to stem cells (video):

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