In searching for a cure for diabetes, researchers from UCSF and their partners at ViaCyte, a San Diego biotechnology company, have already cleared some large hurdles.

ViaCyte has developed a line of human stem cells that have been specially cultured in the laboratory. When transplanted into rodents, these stem cells turn into insulin-producing beta cells, the cells of the pancreas that are destroyed in diabetics, according to Peter Stock, MD, PhD, principal investigator in the study for UCSF. Being able to generate such cells represents a major milestone on the road to a cure.

ViaCyte’s cells had one potential problem, which has been common to most embryonic stem cell-derived products: While the vast majority form beta cells, there remains an ongoing risk that, occasionally, one or more cells could grow out of control and form a teratoma, or embryonic growth.

ViaCyte believes it has solved this problem by encapsulating the pre-beta cells with a small, envelope-like device made of a semipermeable membrane that surgeons implant in the body, explains Eugene Brandon, PhD, ViaCyte’s director of strategic relations and project management. The envelope contains the embryonic cell-derived pre-beta cell clusters, which
form the new beta cells.

Sugar in the bloodstream can move through the membrane and be sensed by the beta cells, which then produce insulin in response. The insulin moves back through the membrane into the blood circulation. Having the process take place in the envelope, Brandon says, keeps any potential unwanted growth trapped and easily removed, as cells cannot get through the membrane.

The device may also help solve another key problem -- the threat of rejection. Without encapsulation of the cells, the patient would need a regimen of immunosuppressants to make the process work. The immune barrier created by the encapsulation may mitigate the immune response against the introduced tissue and potentially reduce, or even eliminate, the need for powerful immunosuppressive treatments.

Immunologists work alongside pancreas development experts, and all work closely with clinicians, forming what Matthias Hebrok, PhD, director of UCSF?s Diabetes Center, calls a comprehensive approach to diabetes that sets UCSF apart.

Jeffrey Bluestone, PhD, UCSF executive vice chancellor and provost, and Qizhi Tang, PhD, lead the immunology work. Clinicians Stock, Stephen Gitelman, MD, and Peter Sayre, MD, PhD, know how to get therapies out of the lab and into people.

Pancreas development experts Hebrok and Michael German, MD, who has a lab in the Eli and Edythe Broad Center of Regeneration Medicine and Stem Cell Research, are drilling deeper into the study of how and why ViaCyte?s cells grow into pancreatic progenitor cells with the capacity to generate new insulin-producing beta cells.

The California Institute for Regenerative Medicine awarded the UCSF-ViaCyte diabetes team $20 million to take the potential therapy, which has already shown promise in animals, to people in a clinical trial.

?We hope to go to clinical trial in three years,? Stock says.

ViaCyte?s Brandon is encouraged by the progress. ?Everyone has the same goal,? he says, ?which is to come up with something new to help diabetics, so they don?t have to inject themselves with insulin several times a day.?