Stem Cell Research
Conducted by the Dental Research Community

Stem cell research offers tremendous potential for addressing human diseases that, to date, have been difficult or impossible to treat effectively. Among the conditions cited are Alzheimer's disease, cancer, lack of saliva for chewing and speaking, diabetes, and many others. Despite this promise, stem cell research is caught up in controversy in the US over whether adequate embryonic stem cell (ESC) lines are available for researchers to pursue medical solutions. The Federal Government has restricted the number of available cell lines that may be explored using Federal grant money to those that existed on August 9, 2001. This precludes using the 128 new ESC lines developed world-wide since President Bush's policy went into effect three years ago.[1]

Adult stem cells (ASCs) do not face the same Federal grant restrictions, although it is generally agreed that ASCs do not have the same potential as ESCs to develop into a broad spectrum of cell types and tissues. Dental researchers have been working with stem cells to help address both oral and systemic health problems. Through this research, postnatal stem cells have been isolated from primary ("baby") teeth that can develop into a wider range of cell types than can cells of other postnatal tissues. Furthermore, these cells are easily obtained, since every person has his or her own "stockpile".

Here are a few of the exciting discoveries in the world of dental and craniofacial research that may expand research using stem cells while avoiding current political, moral, and other objections some have to the use of ESCs.

Bone Marrow Stromal Cells

Stem cells can be isolated from bone marrow, and these have the ability to form bone and a hematopoietic microenvironment *in vivo* after transplantation into mice.

(more)

Post-natal Stem Cells from Human Periodontal Ligament

Periodontal diseases can gradually destroy the periodontal ligament (PDL), bone, and cementum that together hold teeth in the jawbone. Destruction of this tissue is a major cause of tooth loss world-wide. Recent research has discovered stem cells within the PDL of third molars (wisdom teeth) that have the potential to generate cementum and new PDL. [2]

Transplantation of these newly discovered stem cells holds great promise for restoring tissues destroyed by periodontal diseases. Large-animal studies, followed by clinical research, are needed to confirm this hypothesis. Successful clinical studies could lead to an era in which stem cells could be preserved when third molars (wisdom teeth) are extracted and "banked" against a potential need for biology-based regenerative treatment later in life.[3] Such an approach would overcome potential problems associated with rejection, since the person's own cells would be used.

Post-natal Stem Cells from Dental Pulp

Stem cells have been identified in the pulp of human primary (baby) teeth. These cells have been designated as SHED (stem cells from human exfoliated deciduous teeth). SHED have been found that divide continuously and can differentiate into a variety of other cell types, including nerve, fat, and tooth-generating cells. SHED have been transplanted into mice, where they can differentiate into bone and dentin. Deciduous teeth may provide an ideal source of stem cells to repair damaged tooth structure, to regenerate bone, and perhaps even to treat nerve damage. Stem cells from deciduous teeth differ from those found in permanent teeth, because they divide more quickly and can generate bone, whereas cells from adult human dental pulp only form a tooth-like complex of dentin and pulp. Although additional research is needed, it appears that SHED are more immature, and therefore less committed to forming a specific cell type than older post-natal stem cell populations.[4]

The goal of the National Institute of Dental & Craniofacial Research (NIDCR) research effort in this area is to isolate and describe craniofacially derived PNSCs, determine the mechanism of PNSC in developmental and pathological processes, and pursue potential clinical applications.[5]

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[1] Daley G (2004). Missed opportunities in embryonic stem-cell research. *N Engl J Med* 351:627.

[2] Seo B, *et al.* (2004). www.thelancet.com. Vol 364, July 10.

[3] www.nih.gov/news/pr/jul2004/nidcr-08.htm.

[4] Miura M, *et al.* (2003). www.pnas.org/cgi/doi/10.1073/pnas.0937635100 May 13.

[5] http://csdb.nidcr.nih.gov/csdb/dbu.htm.