One step close to growing a new set of dentures.

A team headed up by Dr. Jinhua Yu of the Institute of Stomatology at Nanjing University, China, has continued to lay the foundation for a whole new line of dental treatment – the ability to grow new teeth. The team, consisting of Jinhua Yu, Huixia He, Chunbo Tang, Guangdong Zhang, Yuanfei Li, Ruoning Wan, Junnan Shi, and Yan Jin, conducted their research into understanding how teeth and surrounding tissues develop from stem cells within the laboratory as well as living organisms after short and long periods of growth time, and how their replication rate is affected with time.

Stem cells are precursor cells, able to differentiate into the many different types of cells within the human body. As they replicate, each stem cell divides into two daughter cells (Figure 1), one of which remains a stem cell while the other differentiates into a cell of a specific type (like bone, organ, skin, nerve, etc type cells). The importance of stem cells comes from their ability to differentiate (Figure 2) and how quickly they replicate, but since numerous stem cells for research are taken from human embryos, many moral dilemmas have hampered their use in scientific research. Using dental pulp stem cells (DPSCs), normally dormant in dental pulp but active for repair in response to tooth trauma, Dr. Yu's team deftly avoided these ethically controversial issues. His team was able to identify dental pulp stem cells which had STRO-1 (STRO-1 DPSCs), a specific protein easily recognizable as a marker. In essence, DPSCs with STRO-1 are cells expressing a flag that specially marks them and makes them easily identifiable. These cells were then allowed to grow inside special petri dishes, plates filled with a special environment designed to facilitate proliferation. As each plate filled with cells, some of the cells were taken and transferred onto another plate which allow for it to continue to grow, a process called serial passaging. Dr. Yu and his team took cells from the first serial passage plate and cells from the ninth serial passage plate and compared their proliferation rate and ability to differentiate into types of teeth structures both in the laboratory and also in rats.

Dr. Yu and his team found that there are at least three different subtypes of DPSCs. Taking STRO-1 DPSCs from both the first and ninth serial passages, the researchers immersed them into different environments designed to encourage differentiation of the cells into lineage specific cells which resulted in the development of osteoblasts (bone precursor cells), odontoblasts (tooth dentin precursor cells), and chondrocytes (cartilage precursor cells). Interestingly, STRO-1 DPSCs from the ninth serial passage seemed to become specialized tissue cells far more readily than STRO-1 DPSCs from the first serial passage. Conversely, STRO-1 DPSCs from the first serial passage proliferated more quickly than those from the ninth passage. This matched the qualitative observation that STRO-1 DPSCs from the first passage were small, while those from the ninth passage were larger and had physical characteristics indicative of more mature cells.

Dr. Yu's team also placed STRO-1 DPSCs from the first and ninth serial passages into rat kidneys for two weeks, and then extracted them. STRO-1 DPSCs from the first passage had differentiated into osteoblasts, odontoblasts, and chondrocytes (bone, teeth, and cartilage precursors), while STRO-1 DPSCs from the ninth passage differentiated just into the osteoblasts cells. Dr. Yu and his team explained this to mean that, over time, the dental pulp stem cells limited their ability to proliferate, but could differentiate much more efficiently. Although dental pulp stem cells still have all three subtypes within them to differentiate eventually into odontoblasts, osteoblasts, and chondrocytes, the mature body only seems to have an environment conducive for differentiation into osteoblasts and does not seem to have the environment to support DPSC differentiation into odontoblasts and chondrocytes.

While modern dentistry includes fillings for cavities, dentures, and even implants, Dr. Yu's research has helped to continue laying the foundation for growing teeth in the lab, the hope of implanting precursors for growing new or additional teeth inside the mouth. Their research may also have importance in how to treat oral bone conditions, and possibly correcting tooth development conditions. While initial costs may be prohibitive, the ability to grow replacement teeth would provide another option to dental treatment for patients, one with nearly limitless possibilities. Even with the currently limited clinical application, this research continues to show the importance of modern stem cell research to health and the development of new dental treatments, especially in light of the growing population requiring dental treatment in their lifetime.

Word Count = 758

Works Cited

Yu *et al.*, "Differentiation potential of STRO-1+ dental pulp stem cells changes during cell passaging"

BMC Cell Biology 2010, 11:32.

Watterson, B. 25 Great Calvin and Hobbes Strips. Retrieved from

<*http://[progressiveboink/com/archive/calvinhobbes.htm*>

Figures

Figure 1: Comical illustration of stem cell proliferation speed. Calvin is a stem cell talking to Hobbes, a mature dental pulp stem cell. The duplication machine is representative of how rapid proliferation is for stem cells. Comic courtesy of Bill Watterson's Calvin and Hobbes.

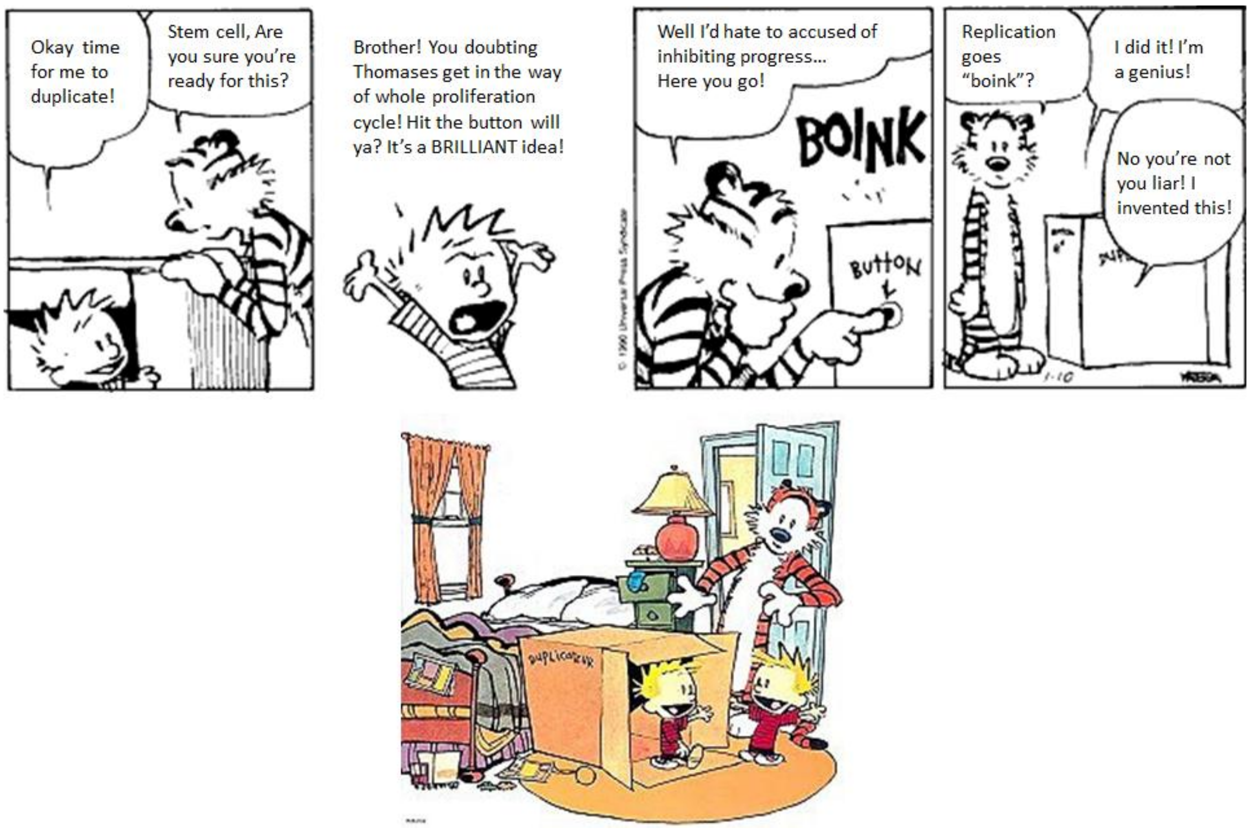

Figure 2: Comical illustration of stem cell proliferation speed. Calvin is a stem cell talking to Hobbes, a mature dental pulp stem cell. The transmogrifier machine is representative of a stem cell going through a serial passage. The size difference between the two tigers in the last panel is representative of the size difference between mature and immature dental pulp stem cells, with immature dental pulp stem cells significantly smaller than mature ones in size. Comic courtesy of Bill Watterson's Calvin and Hobbes.