

## BIO-ENGINEERED TOOTH-REPLACEMENT BY REGENERATION

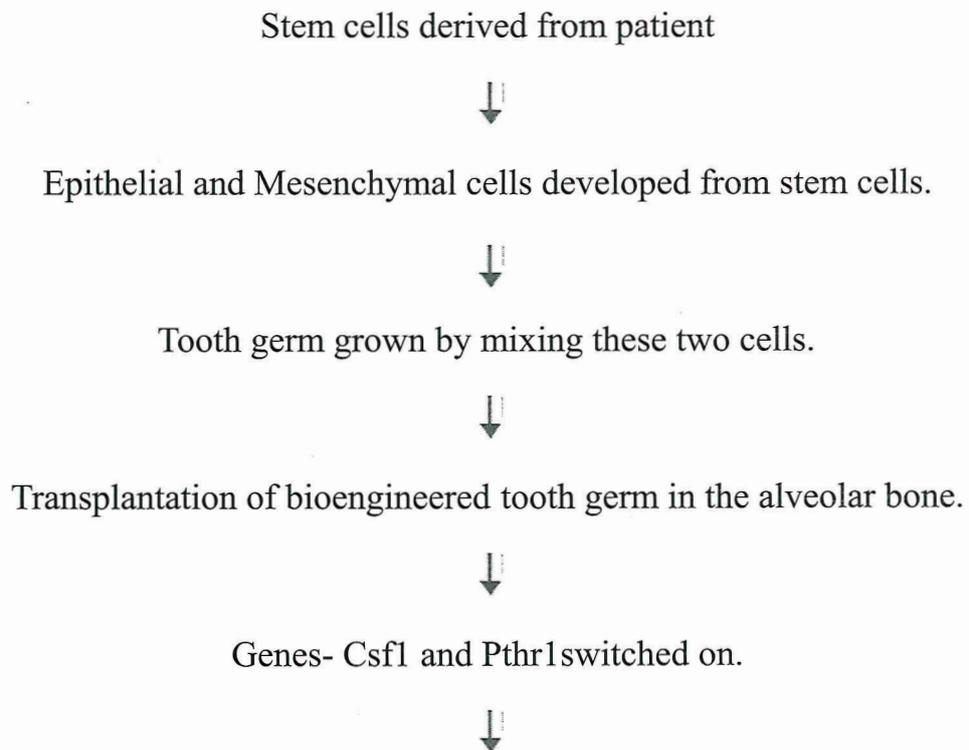
In the present scenario, the replacement of missing or extracted tooth are limited to prosthesis and implants. But, as every coin has two sides, these methods have inherent drawbacks and limitations. Implants bring risk of immune rejection and periodontitis with it, whereas the prosthetic treatment put pressure on adjacent teeth. So how about getting a treatment which is free of all these problems?

The best replacement for tooth would unquestionably be a tooth that is grown from the patient's own stem cells. The answer to this could be **ABIOENGINEERED TOOTH!!!**

**Bioengineering/Tissue Engineering is the application** of engineering to the fields of

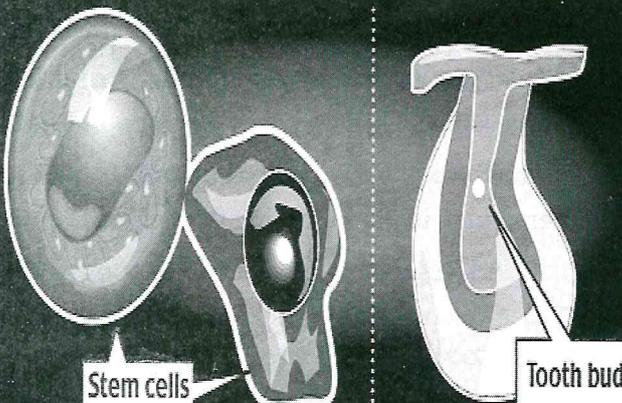
biology and medicine, and it aids in the development and replacement of defective or missing body organs. It is also called *biomedical engineering*.

Recently a bio-genetic tooth has been successfully grown in adult mice from embryonic stem cells by using tissue engineering. An experiment was carried out by a Japanese group, led by cell biologist Takashi Tsuji of Tokyo University of Science in Noda, Chiba Prefecture. The experiment is demonstrated in the following flow chart.



36.7 days after the transplant. These upper molars grew downward and made contact with the lower molars, an average of 49.2 days after the transplant. After the teeth met, the new tooth did not grow much.

## HOW THEY GREW THE NEW TOOTH



**Stem cells**

**1** Two types of mouse stem cell which between them contain genetic instructions for making teeth were mixed together and allowed to grow in the lab.

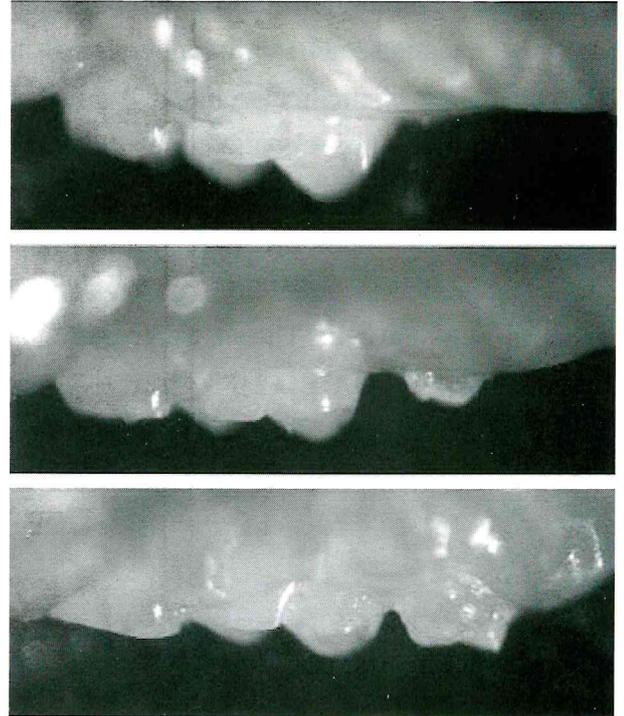
**2** After five days, they had created a tooth 'bud', half a millimetre long.

**Tooth bud**

**3** Bud was implanted into a hole drilled in a mouse's jawbone and quickly began to grow

**4** After five weeks, the tip of the tooth started to peep through the gum.

**5** Two weeks later (seven weeks after op), the tooth was fully-grown.



*A bioengineered tooth germ placed in the jaw of a mouse (top) buds through the gum at 36 days (center) and fully grows in after 49 days (bottom)*

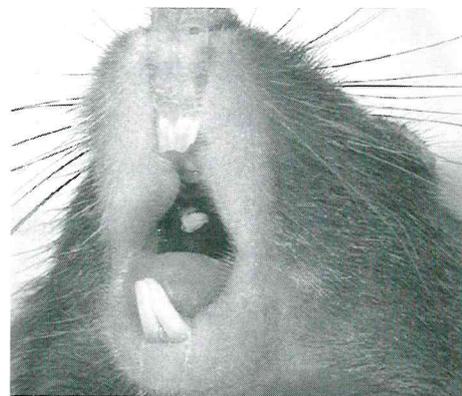




Fig.: Bioengineered tooth crowns developed. Scientists hope to use teeth like these in human mouths.

## **FUTURE ASPECTS**

This study demonstrates a technique that could lead to the development of bioengineered tooth replacements in humans. This research is expected to advance the development of “tooth regenerative therapy”, which may one day allow doctors to replace diseased or damaged teeth with bioengineered teeth grown from stem cells. This type of treatment could ultimately eliminate the need for dentures and false teeth.

## **Limitations in Tooth Regeneration Research**

1. Whether the principles of tissue engineering related to tooth regeneration can mimic correct tooth morphology? Because the crown width of the bioengineered tooth developed in mouse was smaller than that of other teeth, since at present we are not able to regulate the crown width and cusp position
2. Though adult bone marrow cells can replace dental mesenchymal cells, there is no suitable substitute for the embryonic oral epithelium which has a unique set of signals for odontogenesis.

At present there is no embryonic environment that enables bone marrow cells to differentiate into tooth germ.

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