# HEART VALVE TISSUE ENGINEERING: A CURRENT UPDATE

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## Introduction

The prevalence and mortality of heart valve disease are very high and the current surgical treatment is valve replacement with either mechanical or biological prostheses. Due to the numerous drawbacks of both those methods, a new technique has emerged, that aims to the development of tissue engineered heart valves (TEHV).

## Methods

We conducted a literature review for the time period 2000-2012 in order to identify all the relative studies on "Heart Valve Tissue Engineering" in PubMed database.

## Results

The current research is focused on the in vitro tissue engineering technique, which consists of three steps analyzed below.

1) Cell sources

Possible cell sources are differentiated cells, such as smooth muscle cells and endothelial cells that have been put aside. More promising sources include standard vascular endothelial cells, endothelial progenitor cells and the most advantageous bone marrow stem cells that form valves with similar biomechanical properties to human ones. An alternative type is the umbilical cord stem cells -especially for pediatric patients- [Sodian, 2010] and adipose tissue derived cells, which have been recently identified as potential candidates. [Colazzo, 2011]

2) Scaffold

It refers to the starter matrix, which is seeded with cells and promotes tissue strength. There are decellularized allogenic or xenogenic scaffolds, biological polymeric scaffolds (collagen, fibrin and hyaluronic acid), synthetic scaffolds made of bioresorbable polymers and biomatrix-polymer hybrid ones. [Filova, 2009]

3) Bioreactors

In order to produce a viable heart valve, various types of bioreactors have been designed, to provide the tissue with stimuli, both biological (TGFβ, BMP, VEGF) [Chiu, 2010] and mechanical (dynamic loading, pressure difference), that simulate in vivo conditions. A recently developed Pulsatile Conditioning system accurately imitates pulmonary conditions. [Leslie, 2010]

## Discussion

The main concern is the unpredictable behavior of TEHV due to the genetic heterogeneity of each individual regarding the remodeling process. In addition, further optimization of the bioreactors and scaffolds is required in order to achieve the manufacturing of the ideal valve. [Simionescu, 2012] Only then can we proceed from laboratory and animal to human trials.

## References

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