Aim: The aim of the project is to create a substrate for cellular colonisation through the use of a bioactive scaffold based on porous materials produced by ice templating.

Valvular heart defects are a common and difficult problem in cardiology, and the only effective treatment for advanced lesions is cardiac valve replacement. This form of treatment, although necessary, is burdensome for the patient and requires a significant financial outlay. Therefore, it is extremely important to develop durable valve prostheses that reduce the risk of complications and the need for rapid reoperation. A defective heart valve can be replaced by using different types of biological or mechanical transplant. Both of these solutions have a number of disadvantages. The first is the biodegradation of the graft, calcification, inflammatory and immunological reactions and susceptibility to infection, which limits durability. The second is the need for anticoagulant treatment.

New ways of preparing tissues for transplantation involve the development of autologous tissue material, e.g. biological valves obtained by tissue engineering and material engineering, in which the framework is a cell-free biodegradable matrix of xenogeneic origin (tissue or organ from an individual of another species) with the patient's own cells (isolated from bone marrow). Such an implant will be free of the complications observed with current prostheses.

A new concept is currently being sought to obtain a biological heart valve, which would not cause complications such as those currently experienced with commercially available heart valves. Advances in materials engineering and its link to tissue engineering may offer promising tools for creating a new type of valve prosthesis.

The project involves the scientific development of a process to prepare a porous material for the creation of an ultimately fully functional tissue. An appropriately designed and optimised temperature transfer profile to the material should influence the formation of a pore in the material. Experimental verification will consist of determining the degree of differentiation and the ability of the tissue to maintain its own function. Optimisation will be carried out in a 'Lab on Chip' microenvironment.