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Institut d'Investigació Biomèdica de Bellvitge

IDIBELL Technology Portfolio
Ref. 17ARC001

Regenerative medicine for drug screening

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HIGHLIGHTS

- ✓ **An effective tool for drug screening heart disease models**
- ✓ **A new technology for the generation of mature human cardiomyocytes**

TECH STATUS

- ✓ **TRL: Preclinical Studies**
- ✓ **IP: Patent Application EP18382391.3**

Problem to be solved

During last decades, much effort has been directed toward using stem cell therapy for cardiac regeneration. Although it has been demonstrated to be feasible and safe in animal models, the results have not been the same for patients. Heart transplant is the only therapy capable of restoring heart function after Acute Myocardial Infarction. However, transplantation is dependent on the number of donors and rejection reactions. Thus, there is an urgent need to find an alternative useful therapy.

Additionally, due to the complexity of the structural organization of cardiac tissue, the generation of *in vitro* heart models is also a challenge. Engineered cardiac macrotissues that resemble human native cardiac tissue are needed for drug screening and cardiotoxicity testing.

Background

The main problems using stem cell therapy in cardiac regeneration include: the big surface of the scar to be repaired, the low retention degree of administered cells and the limited survival of implanted cells. For this reason, therapeutic efforts are being refocused on Cardiac Tissue Engineering (CTE), which uses scaffolds (either biological or synthetic) and stem cells, directly injected into the infarct zone. Although researchers are obtaining good preclinical results, these are not being translated to clinical assays.

One of the critical points to generate a functional myocardium is the use of scaffolds with high similarity to the native myocardium. For this reason, the authors of the presented technology use decellularized scaffolds from heart biopsies.

Another common problem in transplants is the reaction of immune response. To avoid it, the authors have used multipotent mesenchymal stem cells (because of their regenerative and immunomodulatory activity) and iPS (reprogramming somatic cells towards pluripotency by defined factors).

Technology

Authors have developed a system that allows the generation of mature human cardiomyocytes. The technology is based on bioreactors that enable 3D culture of patient-derived-iPS.

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Applications

This technology can be applied for the *in vitro* use of a cardiac construct for the screening and evaluation of compounds for cardioprotective or cardiotoxic properties, as well as for disease modeling.

Another promising application in a future, is the replacing or regeneration of damaged heart tissue.

Technology status

Preclinical studies have been completed, demonstrating the efficacy in reproducing cardiomyocytes. The technology consists of 2 elements: decellularized scaffolds (biocompatible and highly similar to native myocardium) and cellular component (Wharton's Jelly-derived Mesenchymal Stem Cells or iPS).

IP status: Patent application in June 2018.

Market Opportunity

Heart failure is the first cause of dead worldwide. The pathology causes from 12 to 15 millions of visits each year and is responsible of 6,5 millions of hospitalizations per year. As the pathology is more prevalent in elderly population and population is ageing fast, the incidence of heart failure is increasing yearly.

It is the pathology that causes major Healthcare costs. According to a report by GlobalData, the heart failure market is expected to witness a compound annual growth rate of 15.7%, from $3.7bn in 2016 to $16.1bn by 2026.

Existing heart failure therapies have been effective in slowing the progression of the disease and reducing mortality and morbidity. The success of these therapies, however, is mostly limited to the reduction of ejection fraction (HF-REF). Novel therapies could have a significant impact in worldwide Healthcare systems economics. The major competitors are Novartis, Amgen, AstraZeneca, Sanofi and Merck.

Business Opportunity

IDIBELL is seeking a company partner to further develop the technology through a license agreement or an establishment of a Spin-off company.

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