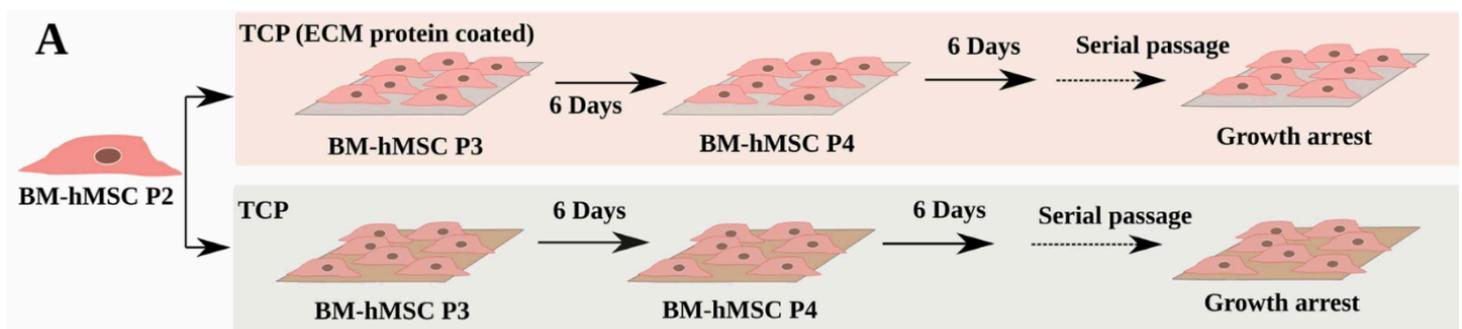


Development of a culture system to grow stem cells for tissue engineering and regenerative medicine

Project Lead: Prof. Abhijit Majumder

Specific problem being addressed: Through tissue engineering, one can restore, maintain, or improve damaged tissues or whole organs. Some examples are artificial skin and cartilage. Regenerative medicine covers much broader aspects such as self-healing. In this case, the body uses its systems, to generate cells or organs, sometimes with the help of foreign biological material. Further, adult stem cells have great therapeutic possibilities in various diseases including tissue damage due to accidents, loss of tissue due to ageing, cardiovascular diseases such as myocardial infarction (commonly known as a heart attack), diseases related to immune response, and cancer. However, stem cells in adult tissue are scarce. They also have limited growth potential in the lab. Together, as a result, stem cells are always in short supply for therapeutic use. This limited availability of stem cells is a major bottleneck to realising their full potential. Here we propose to design a system that will efficiently grow stem cells in the labs. If successful, this research may be a game changer in tissue engineering, stem cell therapy, and regenerative medicine, and will eventually help thousands of ailing patients.

Project Summary: Our lab has already found that stem cells grow better on soft materials. We have also shown that the skin stem cells, important for wound healing in burn patients, also grow faster on our optimized material. Here, we wish to understand the mechanism behind such control so that we can design an even better system. Additionally, we want to test the stem cells grown, on materials developed in our lab for their various properties and therapeutic potentials. In other words, we want to do a quality control check to confirm that our solution does not change the important characteristics of stem cells that are important for their clinical use. Once established at lab scale, we wish to check in animal models and then collaborate with clinicians for relevant clinical trials. The schematic shows the experimental design where bone marrow human mesenchymal stem cells (BM-hMSCs) were cultured on tissue culture plates, either coated with or without ECM-protein. The cells were routinely cultured on respective TCP flasks until they reached growth arrest.



Impact of this innovation: In regenerative medicine, stem cells are seen as the silver bullet. They have the potential to form and heal any damaged organ. In regenerative medicine and tissue engineering, the body uses its systems, to generate cells or organs, sometimes with the help of foreign biological material. Most of the approved technologies in this area are developed abroad and require to be imported. As a result, the treatment cost becomes unaffordable for a patient, especially in a developing economy like India. One of the most common examples where patients don't get adequate treatment is in the case of burn injuries. If successful, our work can deliver a technology that can result



in an indigenous product for tissue regeneration, wound healing, therapeutic possibilities for heart diseases, cancer etc., that is affordable to even an average person in developing economies.

Budget amount (INR): INR 1 Crore

Duration of project: 5 years
