Multi-Well Plate System to Assess Cellular Mechanobiology

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Technology description

OPPORTUNITY

In a sheet of endothelial cells, the cellular response to physical and chemical stimuli is often regulated uniquely by the mechanical microenvironment of the cell. However, the mechanical microenvironment which is composed of mechanical stretch, fluid pressure and shear stress, is not static. Monolayer stress microscopy (MSM) has enabled quantitative assessment of local forces that each cell, within a monolayer, exerts on its substrate as well as its neighboring cells. Unfortunately, MSM is complicated and often requires engineering experience. Technology that simplifies MSM would dramatically increase its usage. The global tissue culture market is expected to grow at a CAGR of over 10.7% during the forecast period, to reach $37.0 billion in 2022.

BREAKTHROUGH IN MECHANOBIOLOGY

Researchers at the University of South Alabama have designed the first multi-well plate system for long-term culturing of adherent cells in a quantitatively controlled microenvironment. This multi-well cell culture plate allows for the simultaneous monitoring of biochemical and mechanical signals. The controlled properties of the microenvironment include substrate stiffness, substrate stretch, and extracellular matrix components. This cell culture plate has many advantages compared to other commercially available plates. 1) It is made of steel so it can be easily temperature controlled (using potential proprietary heating coils). This also makes it possible to autoclave it for reuse. In addition, the steel construction prevents rust and prevents the assembly from bending when it is screwed together. The rigid necessity is essential because if it bends, the glass cover slips can break and the stretching using the PDMS membranes may not be uniform in each well. 2) They have a novel method and mold to make PDMS membranes to grow the cells on. 3) This system can be completely closed off so that pressure, oxygen, CO2 and humidity can be measured and monitored. 4) Fluid flow sheer stress is also a possibility using this multi-well cell culture plate. Therefore, stretch and sheer stress can be assessed simultaneously. In addition to the invention of this cell culture plate, they have also created MatLab scripts that can be used with the plate. Accessories including a heating coil that has a temperature sensor to turn on and off the coil to maintain a constant temperature has been also been designed, in addition to O2, CO2 and humidity sensors.

Advantages

• Enables the study of mechanobiology
• Allows for long-term experiments with a quantitatively controlled environmental conditions
• Allows for uniform temperature distribution
• Easy to use with minimal setup
• Reduces cost per experiment
• Suitable for reuse
• Non-reactive to cell solution
• Cleaned using an autoclave

Institution

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