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Korea develops thermoresponsive nanotopography cell culture platform

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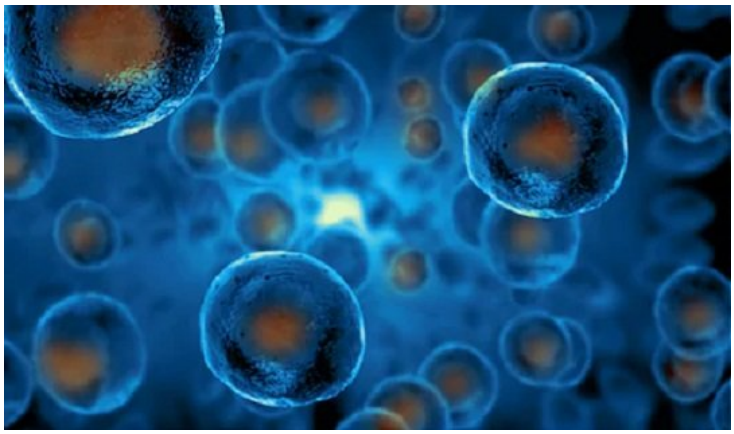
Stem cell sheets harvested in just two days



A research team led by Pohang University of Science and Technology (POSTECH), Korea has recently succeeded in drastically reducing the harvest period of stem cell sheets.

A joint research team comprised of Professor Dong Sung Kim and researcher Andrew Choi of POSTECH's Department of Mechanical Engineering and Dr InHyeok Rhyou and Dr Ji-Ho Lee of the Department of Orthopedic Surgery at Pohang Semyung Christianity Hospital has significantly reduced the total harvest period of a stem cell sheet to two days.

Professor Kim's research team focused on poly(N-isopropylacrylamide) (PNIPAAm), a polymer that either combines with water or averts it depending on the temperature. In previous studies, PNIPAAm has been introduced as a coating material for cell culture platform to harvest cell sheets, but the range of utilization had been hampered due to the limited types of cells that can be made into sheets.

The study conducted focused on making stem cells, that are effective in tissue regeneration- into sheets in a short time in order to increase their direct utility. The team achieved this by applying an isotropic pattern of nanopores measuring 400 nanometers on the surface of a 3D bulk PNIPAAm. As a result, not only did the formation and maturity of human bone marrow-derived mesenchymal stem cells on the nanotopography of bulk PNIPAAm accelerate but the surface roughness of bulk PNIPAAm at room temperature below the lower critical solution temperature (LCST) was also rapidly increased, effectively inducing the detachment of cell sheets. This in turn enabled the rapid harvesting of human bone marrow-derived mesenchymal stem cell sheets.

The research was conducted with the support from the Basic Research Program (Mid-career Researcher Program) and the Biomedical Technology Development Program of the National Research Foundation and the Ministry of Science and ICT of Korea.