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Watching stem cells change provides clues to fighting osteoporosis in older women

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For years, scientists have studied how stem cells might be used to treat many diseases, including osteoporosis. One consistent challenge has been observing and monitoring the process through which stem cells transform. Now, using an established scientific method, University of Missouri researchers are able to watch how human fat cells transform into bone tissue cells; in the process the research team has uncovered information about osteoporosis in older women.

"Stem cell treatments and therapies hold tremendous promise in treating a range of diseases and injuries; however, there is still a lot to learn about how stem cells grow and convert to needed tissues," said Elizabeth Loboa, dean of the MU College of Engineering. "Sometimes the biggest hurdle is watching the process as it takes place. We need the ability to observe and monitor the process without impeding it; therefore, our team decided to analyze and study a new approach to monitoring stem cells as they transform into tissues we may need to treat disease."

To watch the cells transform, the team used electrical cell-substrate impedance spectroscopy (ECIS). ECIS currently is used to monitor how cells react to drugs and to assess how cell walls or cell barriers function. The team's target was stem cells derived from human fat, or human adipose (hASC) cells and the process these stem cells use to convert to bone cells when stimulated to do so.

Using human fat-derived stem cells from young (aged 24-36 years), middle-aged (aged 48-55 years) and elderly (aged 60-81) participants,

the team used ECIS to collect complex measurements during the growth and differentiation stages the hASC exhibited as they converted to bone cells. They found that elderly cells made the transition in less time, but younger cells converted more cells that secreted more calcium long-term.

"This is the first study to use ECIS to predict and monitor the potential of adipose cells transforming into bone cells," Loboa said. "Results demonstrate that ECIS can potentially be used to screen for osteogenic potential of hASC, track the stages of osteogenic differentiation for quality control purposes and better explain the underlying biological causes of variability among donors—and since the results typically are in 'real-time,' this technology could be incorporated into future manufacturing to track hASC throughout the process."

The study, "Electrical Cell-Substrate Impedance Spectroscopy Can Monitor Age-Grouped Human Adipose Stem Cell Variability During Osteogenic Differentiation," was published in *Stem Cells Translational Medicine*.

More information: R. C. Nordberg et al, Electrical Cell-Substrate Impedance Spectroscopy Can Monitor Age-Grouped Human Adipose Stem Cell Variability During Osteogenic Differentiation, *Stem Cells Translational Medicine* (2016). DOI: 10.5966/sctm.2015-0404

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