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Identifying new targets to improve skeletal formation in human adults

Anja Nohe
University of Delaware, USA

Humans rely on their skeleton during their lifespan for several crucial functions as diverse as body support, walking, and energy balance. Unfortunately, during aging the human skeleton loses bone mass and its function are impaired. This leads to diseases such as Osteoporosis. A woman's risk of breaking a hip due to osteoporosis is equal to her risk of breast, ovarian and uterine cancer combined. And a man age 50 or older is more likely to break a bone due to osteoporosis than he is to get prostate cancer. For most bone diseases, new innovative treatments and therapeutics are needed. However, in order to develop these, the formation of the skeleton and the skeletal changes in adults must be determined. Bone is a dynamic living tissue that hosts a variety of different cell types embedded into mineralized matrix. Bone morphogenetic protein 2 (BMP2) is a growth factor that drives stem cell differentiation and bone growth in vivo. However, it has several side effects, when being used in the clinic. Therefore therapeutics and treatments based on the signaling pathway of BMP2 may show great potential to induce skeletal growth. Using a systems biology approach we modeled the BMP2 signaling pathway and defined key targets in the BMP2 signaling pathway. We confirmed their role using atomic force microscopy combined with fluorescent microscopy. Moreover, we developed a peptide that activates specific signaling pathway in vitro and in vivo. We showed that systemic injection of this peptide in mice causes increase in bone mineral density and mineral apposition rate as well as trabecular thickness. These results suggest that the peptide is a powerful mediator of skeletal growth and may be used to improve skeletal formation in adults.

Biography

Anja Nohe is an Associate Professor in the Department of Biological Sciences at the University of Delaware. She received her PhD in Chemistry in 2000. After a Postdoctoral fellow at the University of Western Ontario in Canada, she accepted a first Faculty position at the University of Maine in Chemical and Biological Engineering. In 2008 she relocated to the University of Delaware. She is a member of several editorial boards and her research is currently funded by the National Institute of Health. She uses novel imaging approaches such as AFM and the family of Image Correlation Spectroscopy to define cellular processes during stem cell differentiation and skeletal formation. Moreover, utilizing novel techniques and tools such as real time imaging and nanoparticles, she focuses on protein dynamics in cells as well as on protein distribution in mice.

anjanohe@udel.edu

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