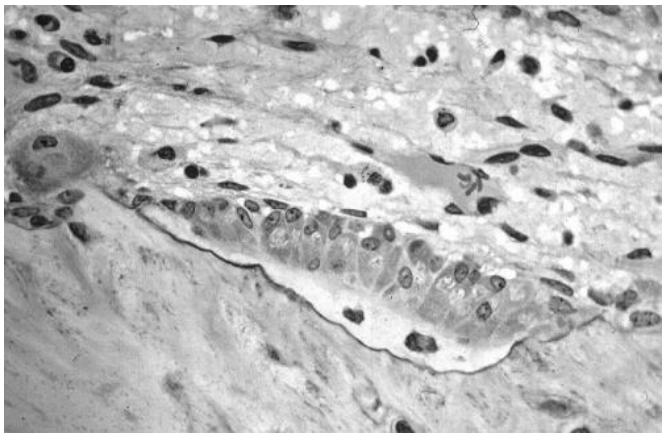
Networking is key for cells during bone formation

18 July 2017



Osteoblasts actively synthesizing osteoid. Credit: Robert M. Hunt; Wikipedia.

A new study into the way bone cells organise during bone formation could open the door to a better understanding of diseases such as osteoporosis.

The research, led by the Max Planck Institute of Colloids and Interfaces in Potsdam, Germany, used an interdisciplinary approach combining biology, medicine and physics to analyse the osteocyte lacuno-canalicular network (OLCN) in different bone types from mice and sheep.

Reporting their results today in the *New Journal of Physics*, the team show there is a universal mechanism behind the way individual cells organised themselves into a large, interconnected network during bone formation and mineralisation.

Dr Philip Kollmannsberger, who led the research, said: "Osteocytes and their cell processes 'live' in a large, interconnected network of voids permeating the mineralized bone matrix of most vertebrates. This osteocyte lacuno-canalicular network (OLCN) is believed to play important roles in sensing and maintaining the bone's constant internal environment, and for the mechanical properties of bone.

"Although the extracellular matrix structure of bone has been extensively studied on ultrastructural and macroscopic scales, there is a lack of quantitative knowledge on how the cellular network is organized."

The results allowed the team to define a number of robust, quantitative measures derived from the physics of complex networks. These measures enabled them to gain insights into how efficiently the network is organized in terms of intercellular transport and communication.

The measures showed that the cell network in regularly organized, slow-growing bone tissue from sheep is less connected, but more efficiently organized compared to irregular and fast-growing bone tissue from mice.

On the level of statistical topological properties, however, both network types are indistinguishable, suggesting a universal mechanism underlying the self-organization of individual cells into a large, interconnected network during bone formation and mineralization.

Dr Kollmannsberger said: "The quantification we developed could be useful in assessing bone quality during physiological development or pathological conditions of age, disease and pharmaceutical intervention, complementary to existing measures such as bone mineral density.

"Although we did not apply our analysis to compare healthy to diseased bone, our choice of different bone types, reflecting different degrees of organisation, demonstrates the potential of our method to quantify differences in efficiency."

More information: "The Small World of

Osteocytes: Connectomics of the Lacuno-Canalicular Network in Bone" Philip Kollmannsberger et al 2017 *New J. Phys*. 19 073019 iopscience.iop.org/article/10. … 088/1367-2630/aa764b

Provided by Institute of Physics

APA citation: Networking is key for cells during bone formation (2017, July 18) retrieved 14 April 2021 from https://phys.org/news/2017-07-networking-key-cells-bone-formation.html