

# Stimulation of osteogenesis to fight osteoporosis

## Opinion

Osteoporosis is not just a phenomenon of bone demineralization and related problems, such as increased bone fragility or problems with bone knitting. Osteoporosis is also a problem of reduction of the internal surface of spongy bone. It was calculated that the total bone surface area - the surface of all trabeculae in all bones-can be anywhere between 380,000 and 420,000 m<sup>2</sup> in an adult.<sup>1-5</sup> On such surface area, bone marrow and other bone components come into contact with trabeculae, including microcrystals of carbonate hydroxyapatite - a mineral bone component. On this surface area, the chemo-physical balance is maintained between the marrow, blood vessels and others bone components, and phosphate and trabeculae collagen.<sup>6-10</sup> Obviously, that balance changes with the loss of trabeculae and minerals in the osteoporosis process. The changes are the greater the more developed osteoporosis. Another important problem is the transfer of elements from bones to soft tissues.<sup>11-18</sup> In the process of osteoporosis, not all elements released from bones are excreted outside the body. Some of them flow with blood and other body fluids and may settle in various places in tissues and organs.<sup>19,20</sup> This leads first to so-called hidden mineralization, and later, as a result of further crystallization, to overt mineralization (calcifications).<sup>21</sup> Hidden mineralization can be observed only in the results of chemical analyzes; it consists of substituting elements (mainly Ca and P) in biological structures in so-called crystallization centers.<sup>22-24</sup>

The harmfulness of such mineralization (of arteries, heart valves, joint cartilage, etc.), not to mention its potential carcinogenic effect, does not require detailed discussion. Therefore, stopping the progress of osteoporosis, its prevention, and, above all, elimination of osteoporosis entirely, is one of the most important medical problems, or even one of the biggest challenges for humanity. Different methods of fighting osteoporosis are widely known, including using high calcium medication and others substances. However, reconstruction of spongy bone trabeculae affected by osteoporosis cannot be done by administering calcium and phosphorus. These elements, delivered to a usually older organism (e.g. in the form of tablets), do not necessarily go to the bone. If they encounter crystallization centers in other places than bones - arteries, cartilage, etc.-they eagerly join biological structures there,<sup>24</sup> promoting the formation of mineralization (calcifications). Considering the fact that osteoporosis, and especially elements derived from bones in osteoporosis, can mineralize tissues,<sup>18</sup> additional doses of calcium and phosphorus introduced for the "treatment" of osteoporosis accelerate the formation of calcifications outside the bones, which can lead to many "accelerated" health problems. For the reconstruction of trabeculae we need collagen, with programmed crystallization centers where hydroxyapatite will crystallize again. It crystallizes in the bones from alkaline phosphatase produced by osteoblast mitochondria. This means that we should also "mobilize" osteoblasts to re-synthesize alkaline phosphatase.

When collagen is synthesized with crystallization centers (in the appropriate places of its structure) and alkaline phosphatase is present, the trabeculae will be reconstructed. The result will be strengthening of the spongy bone structure at sites affected by osteoporosis. How can we start this mechanism? In certain circumstances, it starts on

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its own. This happens in bone fractures, when the "osteosynthesis" process that occurs in the body from the moment of bone formation to their full mineralization is "repeated" in a natural way. So what is the factor that creates osteogenesis in bone knitting? Can this mechanism be used to strengthen bones affected by osteoporosis? Prowadzone badania i obserwacje procesu zrostu kostnego sugerują, że tak<sup>6</sup> - ten mechanizm można uruchomić. Dopracowanie metody i wejście w fazę jej aplikacji wymaga szeregu dalszych eksperymentów i dodatkowych czasochłonnych i kosztownych badań. Conducted research and observations of the bone knitting process suggest that yes; this mechanism can be started.<sup>6</sup> Fine-tuning the method and reaching the phase of its application requires a series of further experiments and additional time-consuming, costly tests.

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## Conflict of interest

The author declares there is no any conflict of interest.

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