

# Urban stress as a physiological phenomenon

## - Bone markers of acute stress reaction

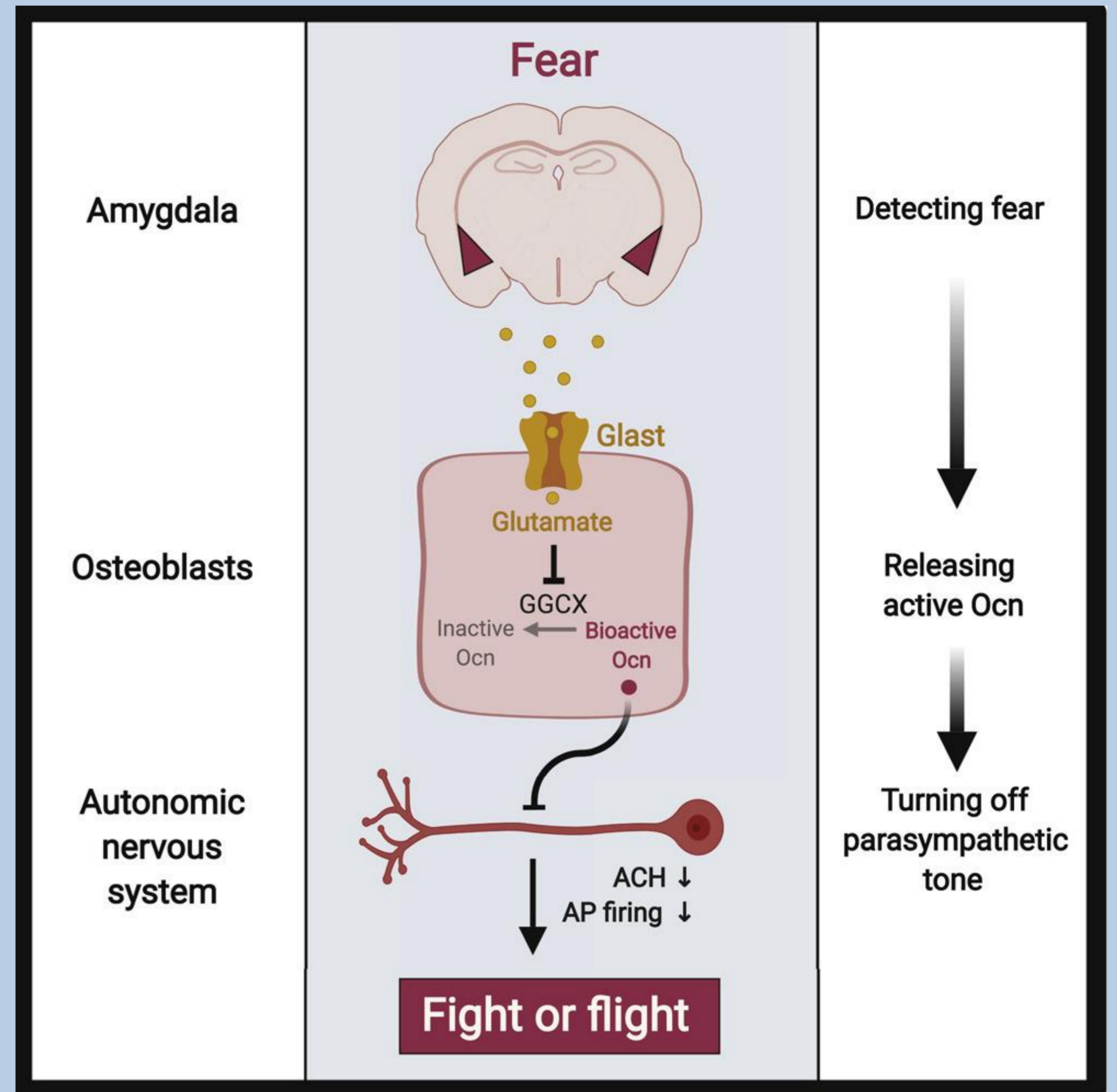
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### Background

- Stress is a condition in which consists of physical, emotional or mental stimulation of the body and the subsequent response to it. In broader sense, we could label by this term any biological activity taking place in the body. It is important to recognize also the effects of responding to a stressful stimulus. It may be a change in function, which during long-term stimulation with a stressful agents induces pathological conditions in the body.
- Several methods can be used to record these processes. One of the most interesting of these is proteomic analysis of the body's complex response to a stress stimulus. In our research, we would focus on a new angle of stress level detection through bone metabolic activity. The endocrine function of the bone plays an important role in the acute stress response of the body. Important signaling molecules in bone metabolism include, for example, osteocalcin, osteoprotegerin, osteopontin, but also many others. Thanks to the immediate response of the bone to the stress stimulus, these biomarkers provide an up-to-date view of the individual's condition and help us predict the stress response in him.

### Objectives of the dissertation

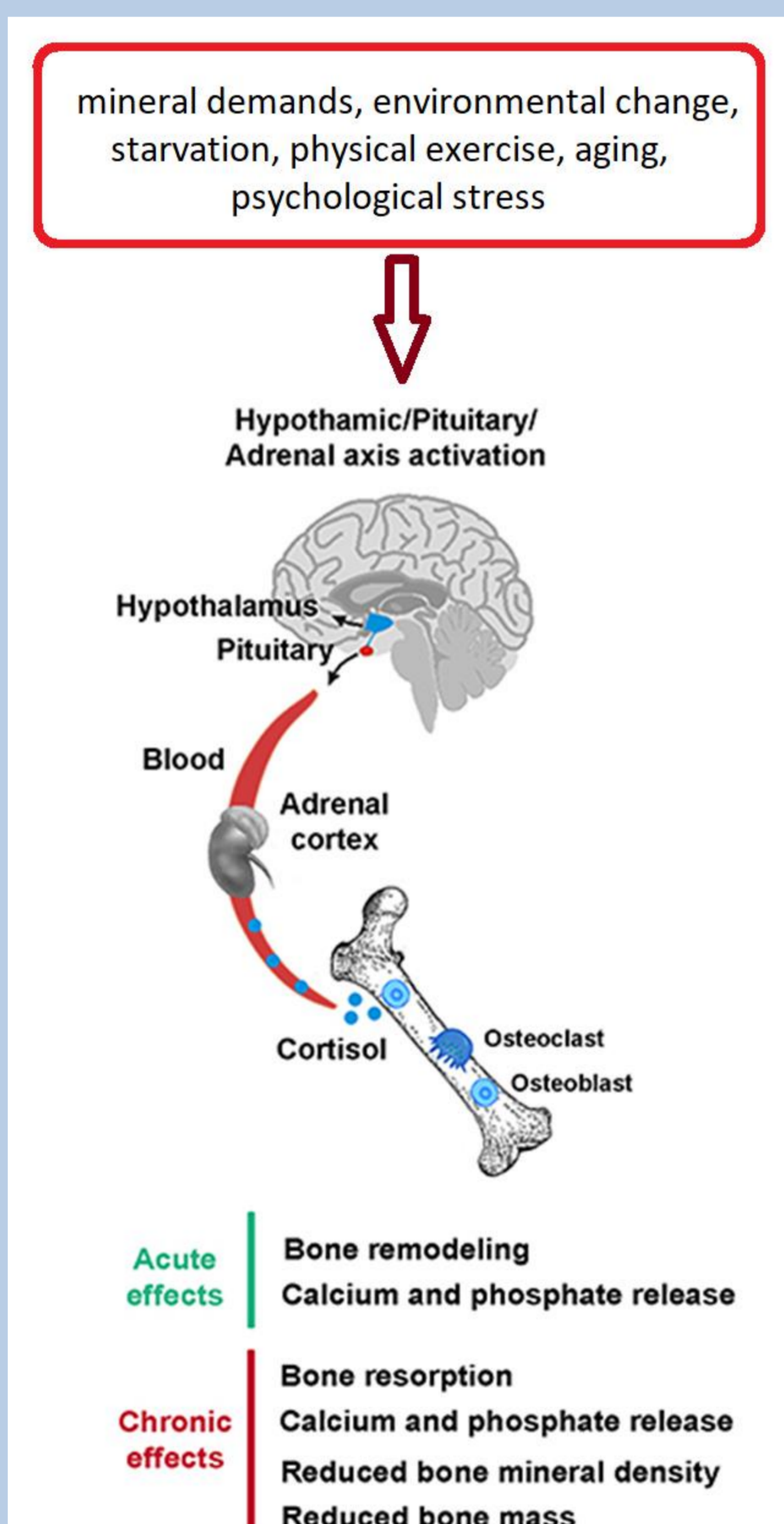
- Determination of the degree of sarcopenia from MRI images in patients undergoing spinal surgery and evaluation of the prognosis of patients after spinal surgery based on the degree of sarcopenia (in collaboration with Jan Dobrovolný, MD)
- Evaluation of the bone health parameters from MRI images in patients undergoing spinal surgery
- Biochemical analysis of the intervertebral disc and muscle ligament from its immediate vicinity from the patient after spinal cord injury and evaluation of the production of biomarkers of bone metabolism in the given tissues (in collaboration with Mgr. Jana Fialová Kučerová, Ph.D.)
- Evaluation of the possible risk of osteoporosis in patients (under the supervision of my supervisor Prof. Julie Dobrovolná, MD, Ph.D.)
- Issuing recommendations for the treatment of patients after spinal surgery



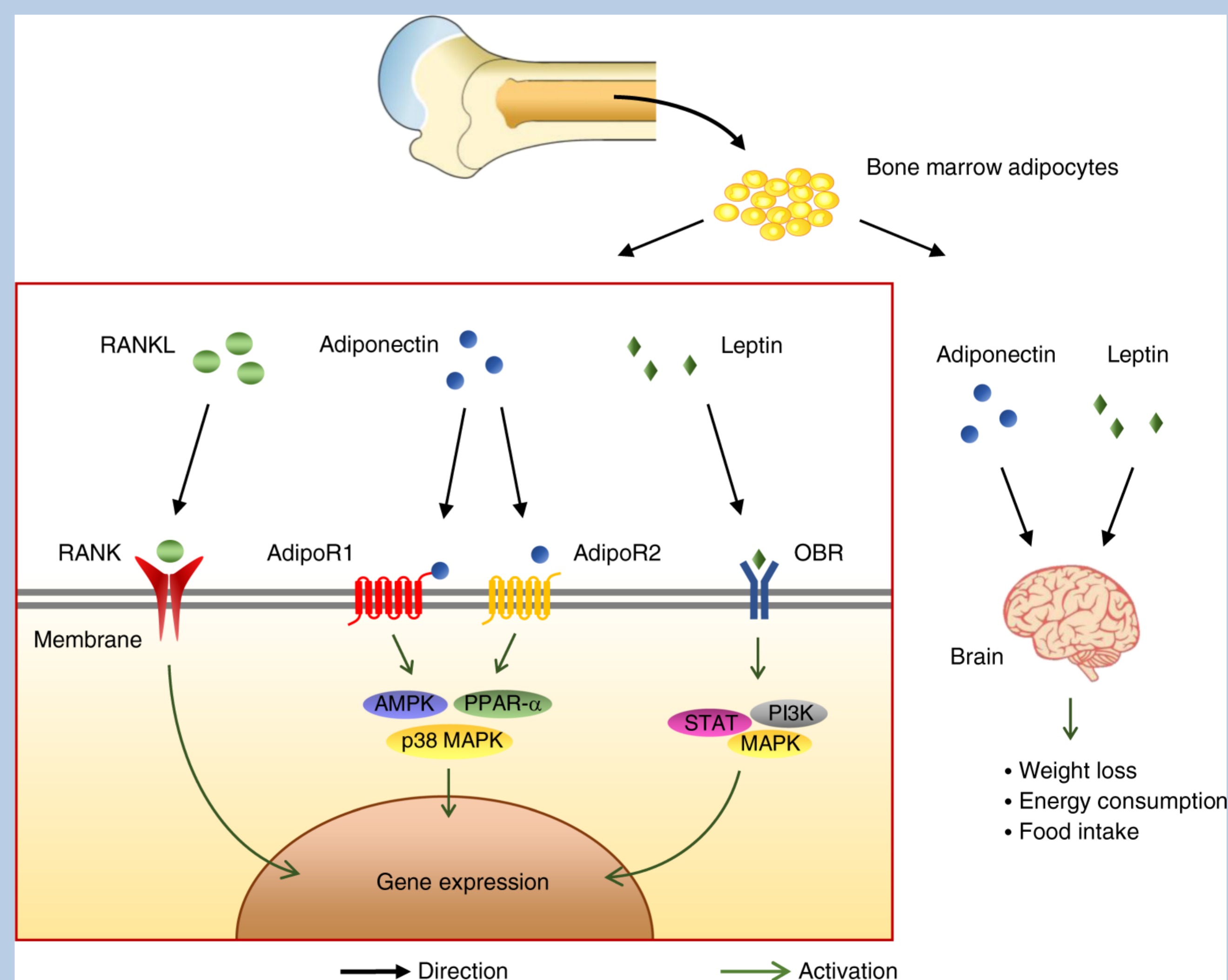
Pic. 2: Mediation of the acute stress response by the skeleton (Berger 2019).

### Use of bone markers for evaluation of acute stress reaction

- In recent years, many studies have focused on a more comprehensive understanding of bone function in the body with interesting findings. According to recent studies, bone tissue is able to influence other tissues and organs, as well as processes taking place in them, on the basis of endocrine activity. One example is the regulation of energy homeostasis of the entire body, another the regulation of the body's response to stress conditions (whether physical or mental stress) or involvement in the regulation of the nervous system or the immune response of organism after injury.
- This is also a reason to explore the possibility of biomarkers of bone remodeling. Early detection of changes in bone metabolism could help us in the future to predict metabolic diseases but also to estimate the overall mental and physical condition of the population.



Pic. 1: Stress-induced cortisol affecting bone mineral metabolism (Suarez-Bregua et al. 2018 – modified).



Pic. 3: Scheme of bone endocrine activity affecting cellular sugar metabolism and central nervous system (Zhou et al. 2021).

### References?

- Suarez-Bregua, P., Guerreiro, P. M., & Rotllant, J. (2018). Stress, Glucocorticoids and Bone: A Review From Mammals and Fish. *Frontiers in Endocrinology*, 9. doi:10.3389/fendo.2018.00526
- Berger, J. M., Singh, P., Khirman, L., Morgan, D. A., Chowdhury, S., Arteaga-Solis, E., ... Karsenty, G. (2019). Mediation of the Acute Stress Response by the Skeleton. *Cell Metabolism*. doi: 10.1016/j.cmet.2019.08.012
- Zhou, R., Guo, Q., Xiao, Y., Guo, Q., Huang, Y., Li, C., & Luo, X. (2021). Endocrine role of bone in the regulation of energy metabolism. *Bone Research*, 9(1). doi: 10.1038/s41413-021-00142-4

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