In this study conformational behavior and unique response of OMM-64 to environment conditions are presented. Increasing the content of ordered secondary structure in the presence of TFE detected by far UV CD spectra indicated that OMM-64 has tendency to gain ordered structures. Decrease of Stokes radius in the presence of counter ions: Na^+, K^+, Mg^{2+}, Ca^{2+} was observed implying existence of squeezed partially collapsed conformation. The strongest effect was observed in the presence of calcium ions, which are ligand for the protein. The effect of temperature, pH and chemical denaturant was also investigated. 'Turned out' response to heat and changes in pH was demonstrated. Cooperativity of denaturant induced unfolding was not observed. In low concentration of guanidium chloride (GdmCl) OMM-64 was more compact than without or in high concentration of denaturant.

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Keywords: biomineralization, IDP, OMM-64.

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Conservativeness and features of pre-nervous serotonergic signaling system in early embryonic development

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Neurotransmitters, such as serotonin, catecholamines and acetylcholine have numerous non-neuronal functions in addition to classic one. These signaling molecules exist in eggs and early embryos of a wide variety of animal groups and are functionally active during early embryonic development, long before the appearance of the nervous system. It is suggested that the primary function of these substances was humoral regulation of the functional state of the cell, and neurotransmitter function arose secondarily in nerve cells.

Non-neuronal functions of serotonin were most intensively studied since the beginning of the researchers in this field. This biogenic amine is commonly occurring in embryos at early stages of development. Pharmacological experiments on embryos of sea urchins have shown that serotonin is functionally active during the period of cleavage and is required for cell cycle regulation and blastomere interactions. Using molecular genetic techniques, we investigated the composition of the serotonergic system of early embryos three model objects belonging to different phylogenetic groups - sea urchin *Paracentrotus lividus*, clawed frog *Xenopus* and mouse.

Enzymes of serotonin synthesis are expressed at early stages of development, and it is the neural form of tryptophan hydroxylase that is presented in early embryos. Early embryos of all three species have a membrane transporter SERT performing the uptake of serotonin from the extracellular environment to the cytoplasm. Vesicular monoamine transporter VMAT is also expressed during early development of mice and frogs that is required for the accumulation of serotonin in the excretory vesicles and further intercellular signaling. It is interesting that in the early stages of development *Vmat2* gene is expressed, which is typical for the nervous system.

Receptors are the key components of the serotonergic signaling system. In all species investigated several serotonin receptors were expressed simultaneously at early developmental stages. This may be associated with multifunctionality of serotonin at this stage of development. In the case of mice and frogs, receptors that are expressed on the early stages of development influence the same second messenger system (adenylate cyclase) in the opposite way. This fact may indicate a sensitive concentration-dependent serotonergic regulation of early development or its complex spatio-temporal organization.

Our results suggest that the mechanisms of serotonergic signaling in early embryogenesis are generally similar to those in the nerve cells. However, the multiplicity of possible mechanisms of action is one of the characteristics of pre-nervous embryonic serotonergic system.

Keywords: development, neurotransmitter, serotonin.

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Defining cell type-specific transcriptomes in the early plant embryo

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Multicellular land plants (Embryophytes) develop as a result of the continuous formation of tissue layers and organs made possible by the establishment of diverse cell types and their specification, in space and time, during embryogenesis. A fundamental difference between plants and animals is the cellular and physiological constraints that prevent migration of plant cells. Plants and animals each developed independently from unicellular ancestors and, consequently, plants depend on their own cellular and molecular mechanisms to form their multicellular body. In seed plants, embryogenesis establishes the basic body organization of an apical-basal and radial pattern while the remainder of the plant body develops through the activity of the meristems – stem cell niches in which pluripotent stem cells continuously divide to produce differentiated cells for organ formation. These stem cells are prevented from differentiation by the so-called organizer cells and, while active throughout plant life, they are first specified during embryogenesis. A key unanswered question in plant biology is how these cell types are specified in the early embryo. The embryo of the plant *Arabidopsis thaliana* is a perfect model to study these processes, as most cell divisions are highly invariable and well characterized and therefore highly predictable. During embryogenesis a distinct developmental stage can be discerned (early-globular stage) in which precursor cell types of the future root apical meristem, including the first stem cells and the organizer cell, are being specified. Recently, important insights concerning cell fates have been gained through cell-specific transcriptomics during post-embryonic development in plants. In the present study our aim has been to determine the transcriptome of the first stem cells, the organizer cell and precursors of the root apical meristem to characterize the underlying genetic network responsible for their specification during embryogenesis. To accomplish this we have adapted a genome-wide approach that allows single cell transcriptomic studies in the embryo.

Keywords: Plants, Stem cells, Transcriptomics.