P-025 Composition of pre-nervous serotonergic signaling system in early embryonic development of sea urchin, clawed frog and mouse

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Neurotransmitters, such as serotonin, catecholamines and acetylcholine have numerous non-neuronal functions in addition to their classic one, and 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. Serotonin 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 — the sea urchin *Paracentrotus lividus*, the clawed frog *Xenopus* and the 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 the Vmat2 gene is expressed, which is typical of 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.