SEROTONIN AND DOPAMINE ARE BOTH ACTIVE DURING THE PRE-NERVOUS EMBRYONIC DEVELOPMENT OF VERTEBRATES

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Monoaminergic transmitters are present in eggs and early embryos of a wide variety of animal groups and regulate early embryonic development long before the appearance of the nervous system. Using molecular genetic techniques, we investigated the composition of the serotonergic and dopaminergic systems of early embryos of Xenopus and mouse.

Several serotonin receptors are expressed simultaneously at early developmental stages of Xenopus and mouse. These receptors are coupled to the same second messenger system (adenylate cyclase) but in the opposite ways. At the same time, two dopamine receptor, that are expressed at early stages of Xenopus development, both inhibit cAMP-signaling. This may be associated with complex concentration-dependent mechanisms and spatio-temporal organization of transmitters system regulations. Membrane, as well as vesicular transporters of dopamine and serotonin are expressed at early stages of Xenopus and mouse embryonic development. Thus, both transmitter systems have all the components necessary for their activity as signaling molecules during the earliest stages of embryogenesis.

Presence and functional activity of serotonin and dopamine system components at the ealy stages of development 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. Our results demonstrate that the multiplicity of possible mechanisms of action is one of the characteristics of pre-nervous embryonic serotonergic and dopaminergic systems.

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