

DISSERTATION ABSTRACT

Monika Sundqvist (2007) **Development of gastrointestinal motility and the enteric nervous system in the amphibian *Xenopus laevis***. Department of Zoology/Zoophysiology, Göteborg University, Box 463, 405 30 Göteborg, Sweden.

Development of the gastrointestinal (GI) tract in the amphibian *Xenopus laevis* occurs in two phases. The gut is formed during embryogenesis of the herbivorous tadpole and later, at metamorphosis, it is remodelled to suit the carnivorous feeding behaviour of the frog. The aim of this thesis was to study the development of gut motility and its control by the enteric nervous system (ENS), in larval and metamorphosing *Xenopus*.

GI motility in the early larval stages was recorded using a video microscopy technique, while the activity of the GI smooth muscle around metamorphosis was recorded from circular muscle ring preparations suspended in organ baths. Presence of neurotransmitters and neurotrophin (NT) receptors were detected using immunohistochemistry, while semi-quantitative PCR was used to detect the neurotrophin ligands.

The amount of nerve fibres immunoreactive for Trk-like neurotrophin receptors is high early in *Xenopus* development, diminishes during stage 54 and increases again at metamorphosis. The mRNA expression of the neurotrophin NT-3 follows a similar pattern, suggesting that Trk-like receptors and NT-3 could be important for development of the ENS both in the early larvae and during metamorphosis. The p75^{NTR} receptor and the neurotrophins NT-4, BDNF and NGF were present at all stages investigated.

Motility in the *Xenopus* gut starts as irregular, segmental contractions first seen at stage 41 and develops into regular contraction waves at stage 43, showing that motility is well established before the onset of exogenous feeding at stage 45. Functional receptors for acetylcholine, neurokinin A, VIP, adenosine and a functional response to nitric oxide are present from stage 43, while an endogenous cholinergic tone appears at stage 45.

The neural control of motility established early in development undergoes dramatic changes during metamorphosis. In the stomach there is a development of a nitrergic tone, the appearance of a 5-HT receptor involved in muscle contraction and complex changes in the response to UTP involving a switch in the receptors located on smooth muscle from relaxing to contracting, as well as the possible development of UTP receptors on inhibitory nitrergic neurons. In the intestine, purinergic receptors, possibly P2Y₁₁-like, mediating relaxation develop.

To conclude, these studies show that motility is well developed before the onset of exogenous feeding in *Xenopus* and that from the first coordinated contractions, the motility can be regulated by a number of different neurotransmitters. The results also suggest that there is a development of the ENS during metamorphosis possibly partly regulated by NT-3 interacting with Trk-like receptors. Moreover, metamorphosis results in several changes in the control of gastric and intestinal motor activity suggesting that adaptations from a herbivorous suspension diet to a carnivorous diet of solid consistency include rearrangements in receptor expression and function both on smooth muscle and in the ENS.

Keywords: African clawed frog, ontogeny, development, motility, acetylcholine, NKA, VIP, nitric oxide, UTP, ATP, adenosine, purinergic, ENS