

## DISSERTATION ABSTRACT

JOHANSSON, ÅGOT **Tachykinin and serotonin gastrointestinal smooth muscle activation in rainbow trout, *Oncorhynchus mykiss* and African clawed frog, *Xenopus laevis*.** Department of Zoophysiology, Göteborg University, Box 463, SE-405 30 Göteborg, Sweden

The tachykinins constitute a family of neuropeptides that has been known to exist in the enteric nervous system and have contractile effects on gut smooth muscle in mammals since the first tachykinin (substance P, SP) was found in 1931. Since then several tachykinins (most of them non-mammalian) have been identified and their effect on the control of the mammalian gut has been intensively studied. The monoamine serotonin is also abundant in enteric neurons. Serotonin is considered to play an important role in the control of gut motility and has been found in all animal groups investigated. However the knowledge about the activation mechanisms for these signal substances in other animal groups than mammals is scarce.

The aim of this study has been to investigate tachykinin and serotonin mechanisms in the control of gut motility in two non-mammalian vertebrate species, one teleost species, the rainbow trout (*Oncorhynchus mykiss*), and one amphibian species, the African clawed frog (*Xenopus laevis*).

By use of immunohistochemistry it was demonstrated that the gut wall of *X. laevis* is richly innervated with tachykinin containing nerves. Two different tachykinin peptides were isolated from gastrointestinal tissue from *X. laevis*. The amino acid sequence of the two peptides was determined, one of the peptides, *Xenopus* SP, was identical to a previously identified peptide (bufokinin) from the cane toad. The other peptide, *Xenopus* NKA, had no obvious sequence similarities to other tachykinins except for the last five C-terminal residues, which are the same as for mammalian NKA and NKB. Taken together with what is known for other species it can be concluded that tachykinins as a group are very well preserved between species, but notable variations in the N-terminal region may occur.

Functional studies on isolated strip preparations of gastrointestinal smooth muscle from *X. laevis* and rainbow trout showed that tachykinins had exclusively excitatory effects. Serotonin was excitatory in rainbow trout but a dual action was seen in the African clawed frog stomach circular smooth muscle, one relaxing and one contracting. From the diverse responses to serotonin in *X. laevis* stomach it was concluded that there are at least two different serotonin receptors present on this tissue.

Receptor binding and functional studies revealed that there are at least two different types of tachykinin receptors present in *X. laevis* gut and that tachykinin receptors present in amphibians are as complex as those found in mammals.

The access to extracellular  $Ca^{2+}$  was shown to be important for the tachykinin-induced contractions in *Xenopus* intestine longitudinal smooth muscle as well as for the serotonin response in stomach circular smooth muscle in both *Xenopus laevis* and rainbow trout. In contrast the longitudinal smooth muscle from rainbow trout is able to contract in response to serotonin even in  $Ca^{2+}$ -depleted medium.

In conclusion, the tachykinin and serotonin mechanisms in rainbow trout and *X. laevis* show both similarities and differences compared to mammals.

KEY WORDS: teleost, amphibian, tachykinin, serotonin, gastrointestinal, smooth muscle, receptor, calcium