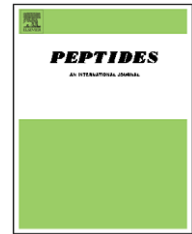


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Spatiotemporal sequence of appearance of NPFF-immunoreactive structures in the developing central nervous system of *Xenopus laevis*

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Abbreviations:

Ad, anterodorsal mesencephalic nucleus

Av, anteroventral mesencephalic nucleus

AOB, accessory olfactory bulb

ac, anterior commissure

Acc, nucleus accumbens

Am, amygdala

C, central thalamic nucleus

Cb, cerebellum

cc, central canal

DB, diagonal band

dh, dorsal horn of spinal cord

DP, dorsal pallidum

Dp, dorsal pallium

Dth, dorsal thalamus

gl, glomerular layer

ABSTRACT

Neuropeptide FF-like immunoreactive (NPFFir) cells and fibers were analyzed through development of *Xenopus laevis*. The first NPFFir cells appeared in the embryonic hypothalamus, which projected to the intermediate lobe of the hypophysis, the brainstem and spinal cord. Slightly later, scattered NPFFir cells were present in the olfactory bulbs and ventral telencephalon. In the caudal medulla, NPFFir cells were observed in the nucleus of the solitary tract only at embryonic and early larval stages. Abundant NPFFir cells and fibers were demonstrated in the spinal cord. The sequence of appearance observed in *Xenopus* shares many developmental features with mammals although notable differences were observed in the telencephalon and hypothalamus. In general, NPFF immunoreactivity developed earlier in amphibians than in mammals.

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Hb, habenula
Hyp, hypophysis
Hypo, hypothalamus
il, intermediate lobe
igl, internal granular layer
Ip, interpeduncular nucleus
LA, lateral amygdala
LC, locus coeruleus
LF, lateral funiculus
lfb, lateral forebrain bundle
Lp, lateral pallium
Ls, lateral septum
MeA, medial amygdala
MOB, main olfactory bulb
Mp, medial pallium
Ms, medial septum
nII, optic nerve
nV, trigeminal nerve
Nsol, nucleus of the solitary tract
OB, olfactory bulb
oc, optic chiasm
on, olfactory nerve
PB, parabrachial nucleus
pc, posterior commissure
POa, anterior preoptic area
POp, posterior preoptic area
Pv, posteroventral mesencephalic nucleus
RC, retrochiasmatic nucleus
Ri, inferior reticular nucleus
Rm, medial reticular nucleus
Rs, superior reticular nucleus
SC, suprachiasmatic nucleus
St, stage
sol, solitary tract
Str, striatum
Tect, mesencephalic tectum
Tegm, mesencephalic tegmentum
Tor, torus semicircularis
TP, posterior tubercle
v, ventricle
VF, ventral funiculus
VH, ventral hypothalamic nucleus
vh, ventral horn of spinal cord
VL, ventrolateral thalamic nucleus
VM, ventromedial thalamic nucleus
VP, ventral pallium
Vth, ventral thalamus

1. Introduction

The neuropeptide FF (NPFF) is an FMRF-NH₂-like octapeptide first isolated from bovine brain [74] and distinct from the molluscan tetrapeptide FMRF-NH₂ [58]. Several studies have demonstrated that NPFF is present in numerous places of the mammalian brain [31,40,43]. In particular, NPFF immunoreactive (NPFFir) structures were found in the posterior

pituitary, hypothalamus, pons, medulla, and dorsal spinal cord [31,41,44,54]. Characteristically, NPFFir cell bodies were found in a few locations within the rat brain and spinal cord, whereas a dense network of immunoreactive fibers extended throughout almost the entire central nervous system [53].

The functional significance of NPFF in the brain has been tested in mammals. Thus, behavioral observations have shown that NPFF is capable of modulating opioid functions,

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