available at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/brainres

BRAIN RESEARCH

Research Report

Neurogenic development of the auditory areas of the midbrain and diencephalon in the *Xenopus laevis* and evolutionary implications

Shao Ju Zeng[a,*], *CuiPing Tian*[b], *XinWen Zhang*[c], *Ming Xue Zuo*[a,*]

[a]*Key Laboratory for Cell Proliferation And Regulation Biology, Ministry of Education, Beijing Normal University, China*
[b]*School of Life Science, Beijing Normal University, 100875, Beijing, China*
[c]*Department of Biology, Hainan Normal College, Haikou, China*

ARTICLE INFO

Article history:
Accepted 28 January 2008
Available online 20 February 2008

Keywords:
[3H]-thymidine autoradiography
Immunohistochemistry
Auditory nuclei
Core-shell organization
Amphibians
Evolution

ABSTRACT

To study whether the core-versus-shell pattern of neurogenesis occurred in the mesencephalic and diencephalic auditory areas of amniotes also appears in the amphibian, [3H]-thymidine was injected into tadpoles at serial developmental stages of *Xenopus laevis*. Towards the end of metamorphism, [3H]-thymidine labeling was examined and led to two main observations: 1) neuron generation in the principal nucleus (Tp) started at stage 50, and peaked at stage 53, whereas it began at stage 48.5, and peaked around stage 49 in the other two mesencephalic auditory areas, the laminar nucleus (Tl) and the magnocellular nucleus (Tmc). 2) Neuron generation appeared at stage 40, and peaked around stage 52 in the posterior thalamic nucleus (P) and the central thalamic nucleus (C). Our study revealed that, like the cores of mesencephalic auditory nuclei in amniotes, Tp showed differences from Tl and Tmc in the onset and the peak of neurogenesis. However, such differences did not occur in the P and C. Our neurogenetic data were consistent with anatomical and physiological reports indicating a clear distinction between the mesencephalic, but not the diencephalic auditory areas of the amphibian. Our data are helpful to get insights into the organization of auditory nuclei and its evolution in vertebrates.

1. Introduction

The organization of mesencephalic and diencephalic auditory nuclei is similar in amniotes. Each auditory nuclei is composed of an internal 'core' and an external 'belt' or diffuse surround (reptiles: Balaban and Ulinski, 1981; Browner et al., 1981; Belekhova et al., 2002; birds: Karten, 1967, 1968; Durand et al., 1992; Wild et al., 1993; Zeng et al., 2004; mammals: Aitkin and Webster, 1972; Morest and Oliver, 1984; Faye-Lund and Osen, 1985; Huffman and Henson, 1990; Jones, 1998). Auditory

* *Corresponding authors*. Fax: +86 10 58807721.
E-mail addresses: sjzeng@bnu.edu.cn (S.J. Zeng), mxzuo@bnu.edu.cn (M.X. Zuo).

Abbreviations: C, central nucleus of the dorsal thalamus; Lpd, posterodorsal division of the lateral thalamic nucleus; Lpv, posteroventral division of lateral thalamic nucleus; La, anterior division of the lateral thalamic nucleus; OT, optic tectum; P, posterior nucleus of the dorsal thalamus; PV, parvalbumin; SP, substance P; Teg, Tegmentum; Tl, laminar nucleus of the torus semicircularis; Tmc, magnocellular nucleus of the torus semicircularis; Tp, principal nucleus of the torus semicircularis; TS, torus semicircularis; TSc, central part of the torus semicircularis; V, ventricle; VLd, ventrolateral thalamic nucleus, pars dorsalis; VLv, ventrolateral thalamic nucleus, pars ventralis; VM, ventromedial thalamic nucleus; VZ ventricle zone

0006-8993/$ – see front matter © 2008 Published by Elsevier B.V.
doi:10.1016/j.brainres.2008.01.101

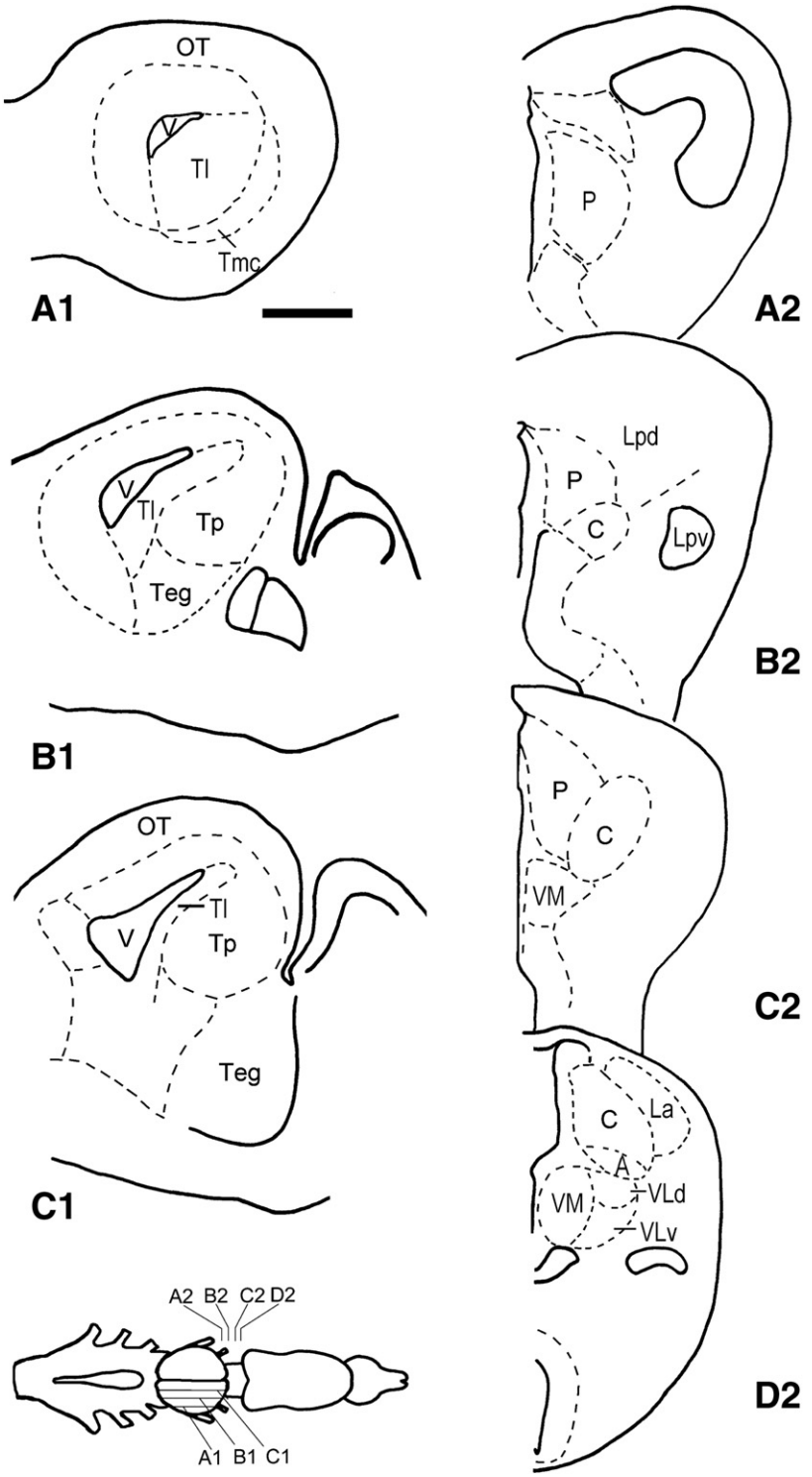

Fig. 1 – Schematic diagrams of mesencephalic and diencephalic auditory areas in *X. laevis* around the end of metamorphosis. Mesencephalic auditory nucleus, comprising the principal nucleus (Tp), the laminar nucleus (Tl) and the magnocellular nucleus (Tmc), is equally divided into four portions with about 200 μm interval by three saggital planes (A1, B1 and C1). Diencephalic auditory nucleus, comprising the posterior thalamic nucleus (P) and the central thalamic nucleus (C), is equally divided into five parts with about 200 μm interval by four coronal brain planes (A2, B2, C2 and D2). The locations of saggital (A1–C1) and coronal (A2–D2) planes in the brain are shown in the insert (rostral is to the right). These planes will be adopted in the following figures. Dorsal is up for A1–D2, and medial is left for A2-D2. Scale bar = 0.5 mm for A1-D2. For other abbreviations, see list.