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The anatomy of the endocrine pancreas among teleosts: phylogenetic implications

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Introduction

In vertebrates, the regulation of glycemia (glucose level in the blood) is mainly controlled by hormones from the endocrine part of the pancreas: insulin and glucagon. Anatomically, the endocrine cells of the pancreas form minute islets, called the islets of Langerhans, that are scattered in the other pancreas tissues. Generally, these tissues diffuse between the mesenteries and the coils of the intestine. However, according to the literature, some teleostean species display a more or less compact endocrine pancreas, with a giant or principal islet, named Brockmann Body (BB) (Figs 1 to 4).

The objective of this study is to examine the anatomical diversity of this organ in the Actinopterygii in a phylogenetic context.

Materials & Methods

A survey of the comparative anatomy of the endocrine pancreas on the basis of literature, dissections and MRI for the specimens across 300 actinopterygian species in 46 orders and 119 families was carried out. The recent hypothesis of actinopterygian phylogeny based on molecular data was used to illustrate this morphological evolution (Fig. 5).

Results & Discussion

The result revealed a wide range of variation. We observed that: (1) this variation was categorized first by the organization of the organ: diffused versus compact, with few BB (Figs 1 to 4); (2) the large endocrine pancreatic nodules have appeared several times during the evolution of the Teleostei: at least in some Ostariophysi, some Salmoniformes, Ateleopodiformes and the immense majority of the lineages within the Ctenosquamata (Myctophiformes plus Acanthomorpha) (Fig. 5).

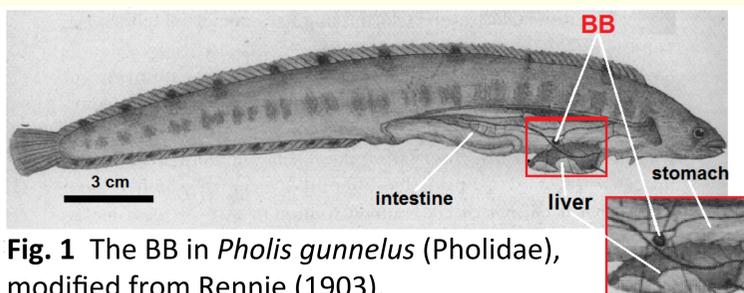


Fig. 1 The BB in *Pholis gunnelus* (Pholidae), modified from Rennie (1903).

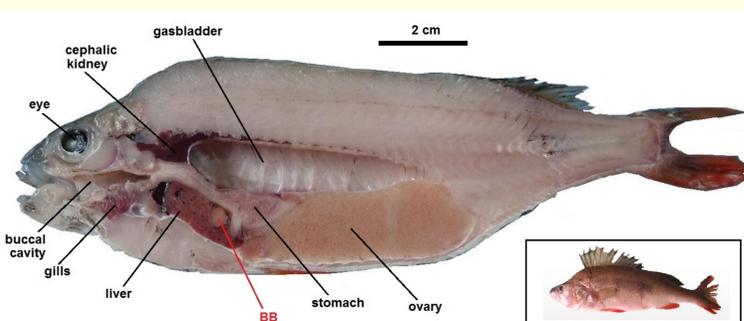


Fig. 2 Mechanical parasagittal section of *Perca fluviatilis* (Percidae), modified from Guintard *et al.* (2017).

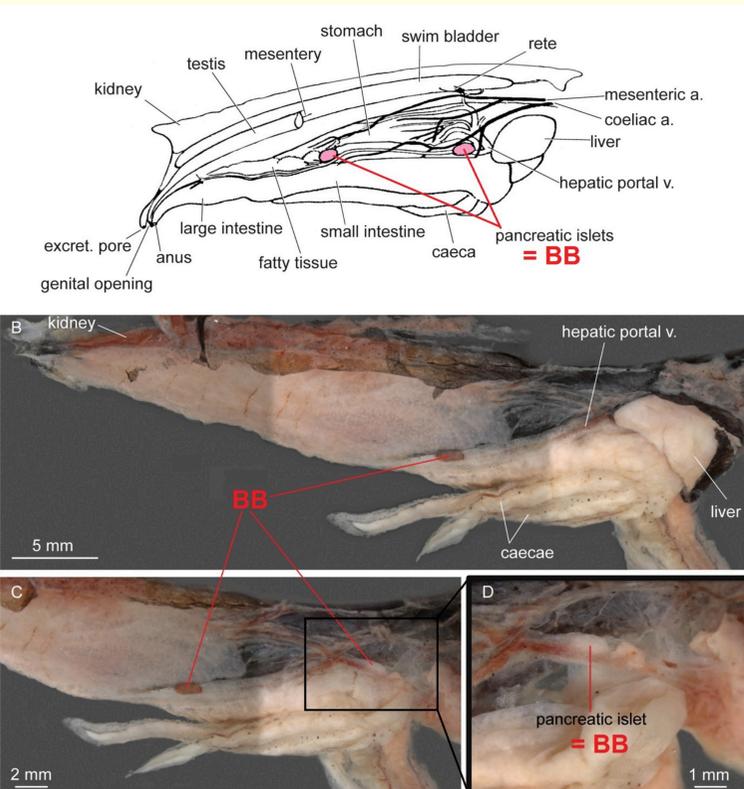


Fig. 3 The BB in *Gymnoscopelus braueri* (Myctophidae).



Fig. 4 The BB in *Ateleopus purpurus* (Ateleopodidae).

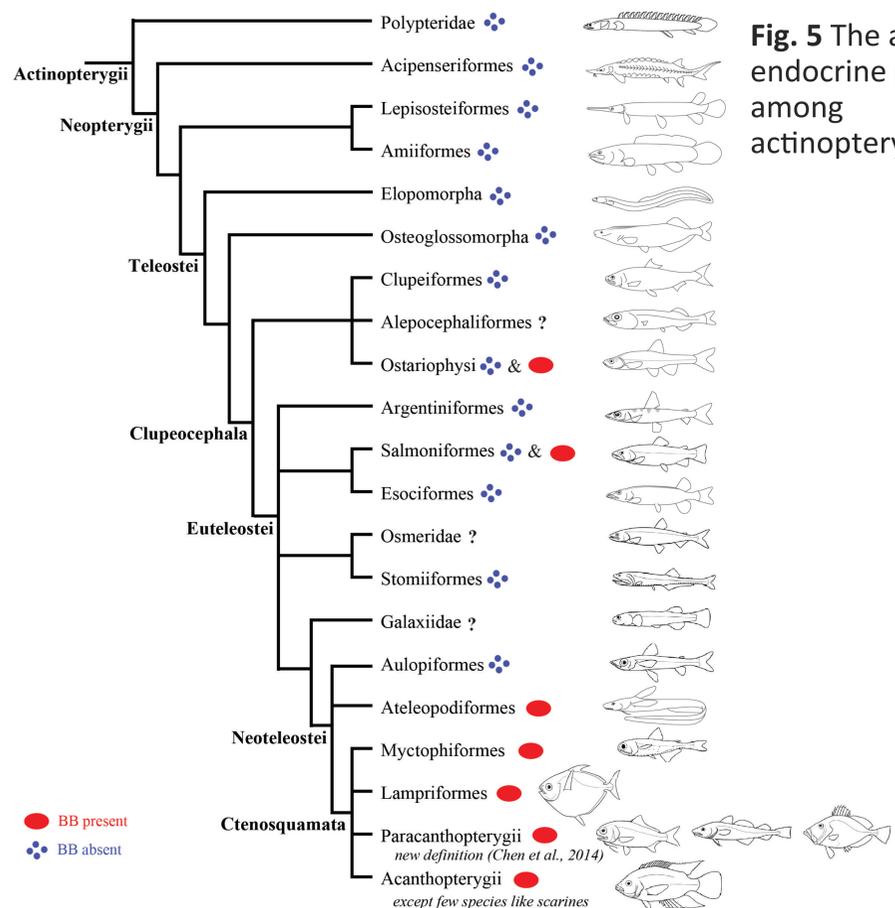


Fig. 5 The anatomy of endocrine pancreas among actinopterygian fishes

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According to the most recent molecular hypotheses (Chen *et al.* 2014; Betancur-R *et al.* 2013), Ateleopodiformes form a polytomy with Aulopiformes and Ctenosquamata. The presence of a BB in Ateleopodiformes and Ctenosquamata may be considered as a derived character shared by them, supporting thus their close relationship. Within the Acanthomorpha, the absence of BB is observed in parrotfishes and some of their labrid allies. More investigations are still needed to corroborate the existence or absence of BB as putative synapomorphies for these lineages.

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