DOI: 10.1017/S1431927605503131
Microsc Microanal 11(Suppl 2), 2005

Larval to Adult Microvascular Anatomy of the Small Intestine of the South African Clawed Toad, *Xenopus laevis* Daudin: A Scanning Electron Microscope Study of Vascular Corrosion Casts

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While the development and remodeling of tissue components of the small intestine of amphibians from larval to adult life have been studied by several authors, little attention has been paid to the intestinal microvasculature and its behaviour during this period [1, 2]. The present study demonstrates by means of resin-made vascular corrosion casts and scanning electron microscopy (SEM) the changes the microvascular bed of the small intestine of tadpoles of *Xenopus laevis* Daudin undergoes during metamorphosis when the herbivorous tadpole becomes a carnivorous juvenile.

The cirulatory system of three tadpoles per developmental stage 55 – 64 (for staging see [3]) was cast via the conus arteriosus with Mercox-Cl-2B (Ladd Res. Inc., Burlington, VT), diluted 4+1 (v+v) with monomeric methylmethacrylic acid (Fluka Chemicals, Basle, CH) at a flow rate of 7ml/h [4]. In adult animals (2 females, 1 male) resin injection was done manually via a flexible tubing inserted via the ventricle into the conus arteriosus. For more technical details on vascular casting see [4, 5].

In at least one tadpole per stage the vasculature of the small intestinum was sufficiently well cast and specimens could be studied in the SEM.
In stage 55 tadpoles the wall of the small intestine consists of a simple, locally ciliated columnar epithelium. In the rostral portion the intestine owns a prominent invagination termed typhlosole (Fig. 1). The microvascular bed is made up of a single layer of flattened vessels with the larger vessels – mostly venules – arranged circularly (Fig. 2). Interposed between venules and rare arterioles are capillaries which form networks with meshes of varying sizes. Frequently signs of intussuceptive microvascular growth ((IMG) are present hinting to an ongoing differentiation of the still immature microvascular bed. Supplying arterioles are few and integrate within a short distance into the capillary bed.
In stage 64 tadpoles the small intestine already reveals longitudinal mucosal folds (Fig. 3). Mucosal folds have a distinct three-dimensional network of blood vessels with the feeding arterioles ascending towards the crest of the fold (Fig. 4). Arterioles capillarize to supply the trough areas between folds and the proper fold capillary bed. At the fold crest a slightly thicker marginal (crest) fold venule is present. Fold capillaries form venules which locally pierce the wall of the intestine, join other venules to finally drain into the intestinal vein.
In the adult the small intestine anatomy is basically similar to that of stage 64 tadpoles, but with more, larger and more complex mucosal folds and a thicker muscularis in the adult (Fig. 5). The same is true for the microvascular anatomy (Fig. 6). In contrast to the tadpole where one layer of capillaries only is present in the muscularis the adult intestine has several layers which show a rectangular arrangement outlining the longitudinal and circular smooth muscle cell layers.

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[6] This work was funded by the Stiftungs- und Förderungsgesellschaft der Paris Lodron Universität Salzburg. The assistance of S. Tholo, A. Zankl and Dr. W.D. Krautgartner is gratefully acknowledged.

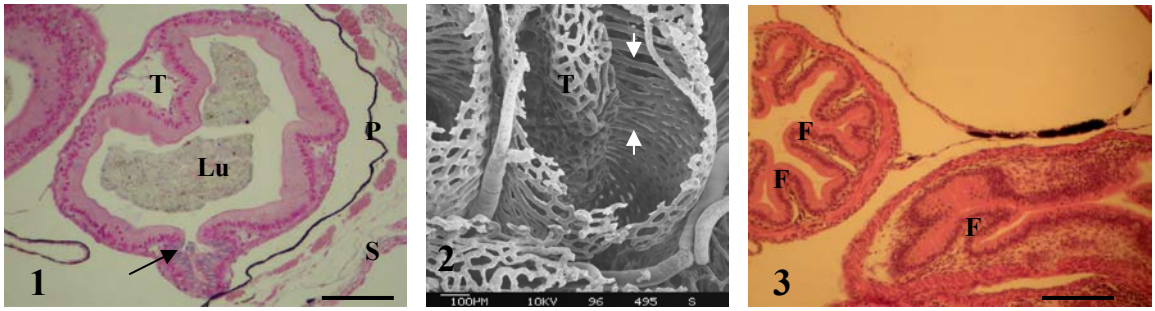

Fig. 1. Small intestine of a tadpole of *Xenopus laevis* at stage 55. Transverse section (10 µm). H.E. Lu lumen, P peritoneum, S skin, T typhlosole. Note the entrance of the common bile duct (arrow). Bar = 125µm. Fig. 2. Microvascular anatomy of the proximal small intestine of a tadpole at stage 55. VCC. Part of the vascular bed is removed to show typhlosole (T). The vascular bed is one-layered. Note circular vessels (arrwos). Fig. 3. Small intestine of a tadpole at stage 63. Transverse section (10 µm). H.E. Note the longitudinal mucosal folds (F). Bar = 125µm.

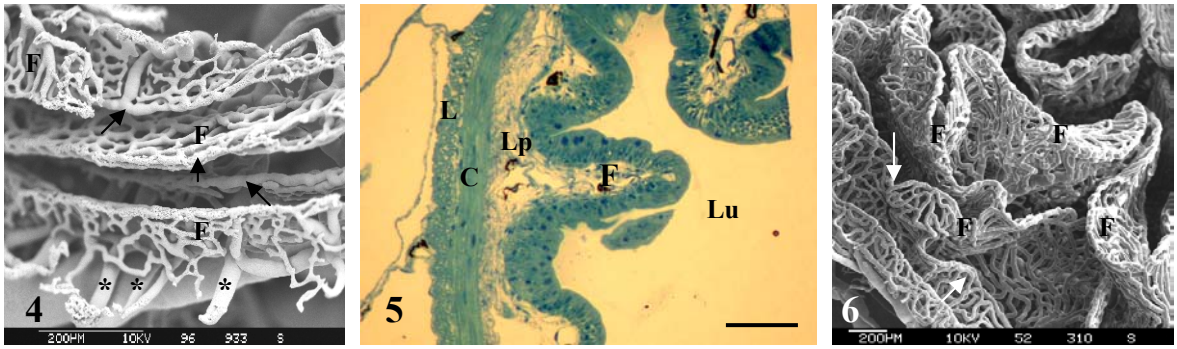

Fig. 4. Microvascular anatomy of the proximal small intestine of a tadpole at stage 64.VCC. Part of the vascular bed is removed to show longitudinal mucosal fold (F). Note marginal venule at the crest of mucosal folds (arrows) and circularly running vessels (asterisks). Fig. 5. Small intestine of an adult *Xenopus*.. Transverse section (1 µm). Methylenblue. C circular layer of muscularis, F mucosal fold, L longitudinal layer of muscularis, Lp lamina propria, Lu lumen. Bar = 110µm.
Fig. 6. Microvascular anatomy of the proximal small intestine in adult *Xenopus*. VCC. Luminal view. Note undulating longitudinally running mucosal folds (F) and marginal venules at the fold crest (arrows).

https://doi.org/10.1017/S1431927605503131 Published online by Cambridge University Press