系統発生学的観点によるショウワギス消化器系臓器の形態と機能に関する研究

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Comparative morpho-functional study in the digestive organs of the Antarctic rock cod, *Trematomus bernacchii* , in relation to phylogeny

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The digestive tract is a tube, seldom straight and often tortuously coiled, commencing at the mouth and terminating at the vent or anus. It functions in ingestion, digestion, and absorption of foodstuffs and in elimination of undigested wastes. Major subdivisions of the tract are the oral cavity, pharynx, esophagus, stomach, and small and large intestines. Associated with the tract are accessory organs, such as the pancreas, liver, and gallbladder. Blind pouch-like evaginations (ceca) of the tract are common. The digestive tract and accessory organs constitute the digestive system.

The teleost stomach is usually well developed, although in some forms it is reduced or absent. Where present, the stomach of teleost varies greatly in shape. Fish stomachs may be classified into five general configurations. These include (a) a straight-shaped, (b) a U-shaped, (c) a J-shaped, (d) a Y-shaped, and (e) the absence of a stomach. The stomachless fishes are stated to have no gastric glands and no pyloric sphincter. A straight tubelike stomach is found in Gobidae, Gasterosteiformes, and Symbranchi. In most fish stomach may be shaped like one of the letters U, J, Y(Akioshi et al., 2005).

The hepatocyte-sinusoidal structures of the livers were classified into three different types: (a) cord-like form, b) tubular form c) solid form. Biliary tract structures were classified into four types: (a) isolated type, (b) biliary-arteriolar tract (BAT) type, (c) biliary–venous tract (BVT) type, and (d) portal tract type. As phylogenic advancement is graded from ancient to recent, the parenchymal arrangement progressed from solid or tubular form to cord-like form, but the biliary tract structures were not involved (Akiyoshi and Inoue 2004) .

Teleostei is classified into three infradivisions: Elopomorpha, Otocephala, and Euteleostei. Euteleostei is the most recent branch of the teleostei phylogeny; preceded by Otocephala, the second branch; and the Elopomorpha is the most ancient branch. Notothenioids, especially the 49 species of the family Nototheniidae, display considerable ecological diversity, occupying niches filled by phyletically unrelated fished in temperate and tropical oceans. Dominated by perciform teleosts of the suborder Notothenioidei, the ichthyofauna of the Southern Ocean surrounding Antarctica is unlike that of any other large marine ecosystem in its limited taxonomic diversity. To demonstrate the correlation between the digestive system and ecological status, we observed the digestive organs in Antarctic rock cod, *Trematomus bernacchii*, by histology and biochemistry technique, and subject the data to phylogenic analyses.

Histology: The stomach typically has a lining of columnar epithelial epithelium, without a striated border. Light micrograph of a cross-section of the body region in the stomach, the gastric mucosa consists of the mucus-secreting surface epithelium forming gastric pits. The lamina propria of the body is filled with branched, tubular fundic glands. The fundic gland consists of 3 regions from the end of the gastric pits to the base of the gland: the neck, body, and base. The submucosa is composed of connective tissue containing blood vessels, Meissner's nerve plexus, and mast cells. The muscularis is composed of smooth muscle fibers oriented in 2 layers. The external layer is longitudinal muscle layer, and the internal layer is circular muscle layer. The Auerbach's nerve plexus is located in between the outer longitudinal and inner circular layers of the muscularis.

The intestinal caeca closely resemble the intestine in structure, with a well-developed muscularis consisting mainly circular muscle fibers. The inner epithelium contained goblet cells, but light and electric microscopic studies indicate that they lack cells that secrete digestive enzyme. In the liver, the hepatocyte lining is multi-layered; Solid form. The hepatic sinusoids are narrow and short tortuous capillaries. The hepatocytes are polyhedral, and the fat droplets are observed in the cytoplasm of the hepatocytes. The portal triad is seen the portal spaces in hepatic lobule, and contains branches of the portal vein and hepatic artery. Bile duct is accompanied with a hepatic artery; Biliary-arteriolar tracts type.

Function:The function of the caeca is not clear. Since they originate from that region of the intestine where bile and pancreatic juices are released, the caeca many form digestive compartments active in resorption of certain nutrients.

Although Antarctic nototheniid fishes are ecologically diverse, this survey of aspects of the anatomy and histology of the digestive system of Antarctic rock cod, showed interspecific variation in the structure of this system. We demonstrate that this study is teleost digestive organs phylogenically, and their architectural differences are shown in the route of digestive ontogenesis. In digestive ontogenesis, the formation of the digestive organs is acquired phylogenically, but the biliary pathway may be adapted in the ecological and behavioral patterns.

References

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