鳐鱼

颌与鳃弓：共同的发育蓝图

鳐类属于软骨鱼类， 其颌和咽弓骨骼保留了有颌脊椎动物咽弓骨骼的基本分区，是研究颌与咽弓发育和演化的重要现生比较材料。在有颌脊椎动物的胚胎发育过程中，第一咽弓(颌弓)形成颌部支撑结构；在软骨鱼类中，其主要背、腹侧软骨分别为腭方软骨和麦氏软骨。第二咽弓形成舌弓； 在鳐类中， 舌颌软骨参与颌的悬挂，颌通常不直接与脑颅形成关节连接。对鳐类胚胎的研究表明，颌弓、舌弓和鳃弓共享多种背腹轴发育调控机制，说明颌与鳃弓建立在相互关联的发育框架之上。可活动颌的形成扩大了脊椎动物获取和处理食物的方式，是有颌脊椎动物早期演化中的一项重要结构创新。

Batoidea

Jaws and Gill Arches: A Shared Developmental Plan

Batoids are cartilaginous fishes. Their jaw and pharyngeal-arch skeletons retain the basic regional organization of the gnathostome pharyngeal skeleton, making them valuable living comparative material for studying the development and evolution of jaws and pharyngeal arches. During embryonic development in jawed vertebrates, the first pharyngeal arch, or mandibular arch, gives rise to the supporting structures of the jaws; in chondrichthyans, its principal dorsal and ventral cartilages are the palatoquadrate and Meckel's cartilage, respectively. The second pharyngeal arch forms the hyoid arch; in batoids, the hyomandibular cartilage contributes to jaw suspension, and the jaws typically do not articulate directly with the neurocranium. Studies of batoid embryos show that the mandibular, hyoid, and gill arches share multiple dorsoventral patterning mechanisms, indicating that jaws and gill arches are built upon related developmental rameworks. The evolution of movable jaws expanded the ways in which vertebrates could capture and process food and was a major structural innovation in the early evolution of jawed vertebrates.

廖角山多鳃鱼

拥有众多鳃囊的无颌鱼类

廖角山多鳃鱼生活于约 4.19 亿年前的早泥盆世，是曲靖地区常见的盔甲鱼类之一。它的头部覆盖着坚硬的骨质头甲，口和鳃孔位于头甲腹面，内部具有十对以上密集排列的鳃囊，因此而得名。廖角山多鳃鱼化石为研究早期无颌脊椎动物的呼吸结构与头部演化提供了重要资料。

Polybranchiaspis liaojiaoshanensis

A Galeaspid with Numerous Gill Pouches

Polybranchiaspis liaojiaoshanensis was an Early Devonian galeaspid that lived about 419 million years ago and is one of the common galeaspids found in the Qujing area. Its head was covered by a rigid bony headshield, with the mouth and gill openings located on the ventral side. Internally, it possessed more than ten pairs of closely arranged branchial pouches, a distinctive feature reflected in its generic name. Fossils of *Polybranchiaspis liaojiaoshanensis* provide important evidence for understanding the respiratory structures and head evolution of early jawless vertebrates.

初始全颌鱼

最早的“人脸古鱼”

初始全颌鱼生活于约4.25亿年前的志留纪晚期，化石发现于云南曲靖关底组，估计全长超过20厘米。它的头部和躯干前部覆盖着坚硬的骨甲，整体形态具有典型盾皮鱼类特征；但其口缘却具有前上颌骨、上颌骨和齿骨等边缘颌骨，与硬骨鱼类及四足动物的颌部骨片排列相似。这一独特的特征组合表明，现代有颌脊椎动物面部骨骼的基本构型，在有颌类演化早期已经出现。初始全颌鱼的发现改变了人们对盾皮鱼类、软骨鱼类和硬骨鱼类早期演化关系的认识，为研究现代有颌脊椎动物颌与面部骨骼的起源提供了关键证据。

Entelognathus primordialis

The Earliest “Human-Faced Fish”

Entelognathus primordialis is a placoderm popularly known as the “human-faced fish.” Its fossils were discovered in Late Silurian rocks of Qujing, Yunnan, dating to about 425 million years ago. It is about 20 cm long, with a short, stout body and a large mouth capable of swallowing smaller animals. Like most placoderms, the front half of its body was covered with dermal bone. Its jaws, however, resemble those of more derived bony fishes, bearing osteichthyan-like dermal marginal jaw bones, including the premaxilla, maxilla, and dentary. *Entelognathus primordialis* documents a key transitional morphology between placoderms and bony fishes and fills an important gap in the early evolution of jawed vertebrates.

长吻麒麟鱼

揭示现代颌骨构型起源的鱼

长吻麒麟鱼生活于约 4.25 亿年前的志留纪晚期，是一种具有硬骨鱼式边缘颌骨的盾皮鱼类，估计完整体长超过 20 厘米。它具有向前突出的吻部，口和鼻孔位于头部腹面，头部与躯干前部覆盖着由多块骨片组成的甲胄。其颌部具有前上颌骨、上颌骨和齿骨等边缘颌骨，与硬骨鱼类及四足动物的颌骨排列相似。长吻麒麟鱼进一步表明，现代有颌脊椎动物颌与面部骨骼的基本构型，可以追溯至有颌类演化早期，为认识盾皮鱼类与现代有颌脊椎动物之间的演化关系提供了关键证据。

Qilinyu rostrata

A Placoderm That Illuminates Jaw Evolution

Qilinyu rostrata was a Late Silurian placoderm that lived about 425 million years ago. It had an estimated total body length of more than 20 cm. Its snout projected forward, while the mouth and nostrils were positioned on the ventral side of the head. The head and anterior part of the trunk were covered by bony armor. Its jaws bore marginal jaw bones, including the premaxilla, maxilla, and dentary, arranged in a pattern resembling that of bony fishes and tetrapods. *Qilinyu rostrata* shows that key elements of the modern gnathostome jaw and facial skeleton can be traced back to early jawed vertebrates, providing important evidence for the origin and early evolution of vertebrate jaws.