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.