This study is focused on external respiratory structures of vertebrate larvae. Developmental morphogenesis of the external gills of Senegal bichir (Polypterus senegalus) and Mexican axolotl (Ambystoma mexicanum) was examined together with development of external gill filaments of weather loach (Misgurnus fossilis). Scanning electron microscopy was used to describe external aspects of developmental formation of outer gill structures and classic histology and cryosections with imunohistochemical staining helped to understand internal morphology and developing tissue context. My data revealed that external respiratory structures are in each species formed by dissimilar developmental modes which can clearly be characterized by tissue-specific formation. Whereas external gill filaments of weather loach were found to develop as simple filamentous prolongations of outer ectoderm, in the Mexican axolotl instead, major components of external gill formation seem to be mesenchyme of neural crest and mesoderm origin, which differentiate into extensive connective tissue and muscles, respectively. In the Senegal bichir, interestingly, the lateral expansion of the pharyngeal endoderm was found to be responsible for the early formation of the external gills and this mode of formation is probably derived from the specific mode of bichir gastrulation. These differences are discussed with respect to specific embryonic development, specific tissue context and different timing and need of functionality of particular structures of each species. Finally several concepts of homology that are widely discussed today are introduced, to manifest what kind of data is necessary for final assessment of homology of external respiratory structures across lower vertebrates.

Key words

external gills, external gill filaments, pharyngogenesis, larval respiration, evolution, homology, Senegal bichir, Mexican axolotl, weather loach