Odontogenic Tumors of Salmon

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Teeth are present in nearly all vertebrate animals except turtles and birds, but tumors of these structures are seldom reported (7). Recently, we had the opportunity to examine the head of a large adult chinook salmon, *Oncorhynchus tshawytscha*, and a photograph and histological sections of a second one. Both fish were taken from the Columbia River, Oregon, in May, 1955, and displayed innumerable tumors on all tooth-bearing surfaces.

GROSS APPEARANCE

The lips of the fish are greatly deformed by lobular confluent masses that extend onto the dental surfaces of the jaws; teeth can no longer be identified (Figs. 1 and 2). A roentgenogram of the head of the fish available for study shows no evidence of bone destruction. In the Salmonidae (trout and salmon) teeth are present not only on the maxilla and mandible, but also on many bones bounding the mouth; viz., vomer, glossohyal, basibranchials, and branchial arches. Isolated tumors, usually spherical in shape, are present on these accessory dental surfaces (Fig. 3). On close inspection, small tumors may also be seen arising from single gillrakers on the branchial arches (Fig. 4). In some instances a portion of the normal gillraker can still be recognized (Fig. 5). All the tumors are firm and rubbery in consistency, yellow-white in color. On section the cut surface has a whorled fibrous pattern.

MICROSCOPIC APPEARANCE

The teeth of most teleosts are continuously replaced during the life of the fish. The development of the enamel organ and its ameloblasts from the dental epithelium and that of the dentin-producing odontoblasts from the mesenchyme of the dental papilla (Fig. 6) are essentially the same in these fishes as in mammals (5, 6, 11). The gillrakers of some sharks (1) and sturgeons (2) are dentin-containing homologs of teeth. Among most teleosts, such as salmon, however, the supporting tissue of the gillraker is bone, and in the absence of an enamel organ the homology with teeth is doubtful (12).

The histological appearance of the tumors is characterized by the presence of irregular masses of epithelial cells often widely separated by interlacing bundles of connective tissue. In the neoplasms arising on the gillrakers, the periphery of the epithelial nests is usually bordered by a single layer of cuboidal cells; the remaining cells are closely approximated, resembling stratified epithelium (Fig. 7).

In tumors of the tooth-bearing regions the epithelium appears as a stellate reticulum surrounded by a layer of columnar cells. Transition stages between the latter and the stellate cells are in evidence (Fig. 8). The columnar cells probably represent enamel epithelium (ameloblasts). The stellate cells are homologous with the modified epithelium which appears between the internal and external layers of ameloblasts as the enamel pulp during odontogenesis in mammals (10). Although the epithelial element of these tumors is identical with that of the human ameloblastoma, the abundant connective tissue suggests that the mesenchymal portion of the tooth germ, the dental papilla, also participates in the formation of the neoplasms. They may, therefore, be classified as soft mixed odontomas (fibroameloblastomas) in which the enamel epithelium and the mesenchymal elements have failed to produce enamel or dentin, respectively (8). These odontogenic neoplasms can also be placed in the general category of hamartomas along with the tumors of the gillrakers in which the epithelium is not a derivative of the enamel organ.

DISCUSSION

Only four dental tumors have been reported in fishes. Of these one was an ameloblastoma in a haddock, *Melanogrammus aeglifinus* (9), and one an odontoma in a croaker, *Micropogon opercularis* (4). Most interesting, however, are the two cases of multiple odontomas described by Plehn (3) in the European brook trout, *Salmo fario*. In these fish the lesions were grossly similar to those we

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found in the salmon. Histologically, the tumors were better differentiated, being composed of atypically formed teeth.

The odontogenic tumors of the salmon and trout differ from those described in other animals and in man by their multiplicity. In all four fish virtually the whole of the tooth-bearing surfaces of the jaws and many of the pharyngeal teeth were replaced by tumors. The absence of bone destruction can be ascribed to the fact that the teeth of teleosts, unlike those of mammals, are superficial to the supporting bone. At no time during development are they wholly or in part enclosed by bone: they have no roots; attachment is by ankylosis.

Because these tumors may, in part at least, be dependent on a developmental fault and because they have been found in fishes belonging to the same family (Salmonidae), the possibility of a genetic factor must be considered. Additional cases should be reported, particularly any that are found in young salmon before they have entered the sea, or in young trout reared at fish hatcheries.

SUMMARY

Multiple odontogenic tumors (fibroameloblastomas) have been described as occurring on the jaws and other tooth-bearing surfaces of two salmon.

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Mr. H. Rietze, Oregon Fish Commission, found the specimen which is the basis of this report, and Dr. R. R. Rucker, U.S. Fish and Wildlife Service, allowed us to publish his photograph of a second specimen and to examine the tissue microscopically.

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Fig. 1.—Head of chinook salmon showing sausage-shaped tumor extending from the angle of the mouth onto the dental surfaces of both upper and lower jaws. (Photograph, courtesy Dr. R. R. Rucker.)

Fig. 2.—Head of second chinook salmon with lips markedly deformed by partially confluent tumors. Figs. 3–5, 7–8 are also of this specimen.

Fig. 3.—Floor of mouth showing numerous tumors on dental surfaces of lower jaw and branchial arches.

Fig. 4.—Spherical tumor replacing single gillraker on branchial arch. Millimeter scale at top of figure.

Fig. 5.—Small tumor occupying one side of gillraker, the base and tip of which are normal. Millimeter scale at top of figure.

Fig. 6.—Developing normal tooth of 8-month-old rainbow trout, *Salmo gairdneri*. The bell-shaped epithelium represents the inner and outer layers of ameloblasts. Bounding the inner layer of ameloblasts is a clear space representing the site occupied by enamel dissolved during preparation. Protruding into the "bell" is the dental papilla composed of mesenchymal cells which at the periphery are lining up as odontoblasts. The gray material between the odontoblasts and the enamel area is dentin. H. & E. stain. Mag. ×200.

Fig. 7.—Section of tumor from gillraker, showing interlacing bundles of connective tissue and nests of epithelial cells. A small area of metaplastic bone formation is also present. H. & E. stain. Mag. ×160.

Fig. 8.—Epithelial component of the odontogenic tumor; the columnar cells are identified as ameloblasts, and their stellate derivatives may be compared to the enamel pulp of a developing tooth. The histological pattern seen in this figure is similar to that of the human ameloblastoma. H. & E. stain. Mag. ×270.

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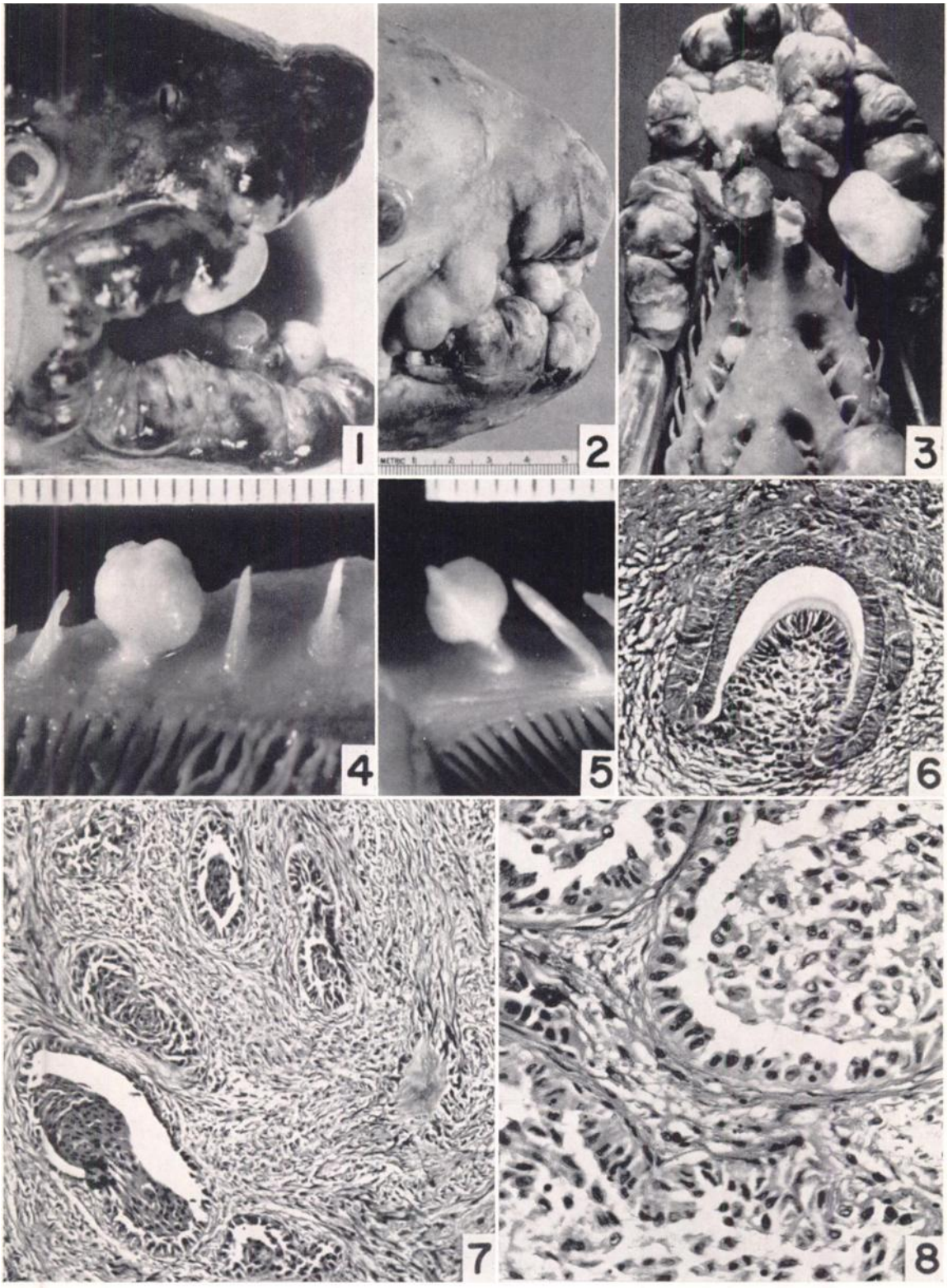

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