The Evolution of the Mouth

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The teeth show an adaptive modification of structures to change in bodily functions and have been modified during the various stages in development from the lowest organisms to the highest forms. Osmosis is the process of alimentation of the ameba. There is no special collection of cells at the orifice of the alimentary canal of the *coelenterata*, or the annuloida for the preparation of food. In the arthropoda and crustaceans, there are cells at the beginning of the canal which partially prepare the food. In the suctorial mouth of the *Petromyzon marinus* there are corneal modifications of the epidermis which serve as teeth. Their attachment to the maxillae and mandible are acrodont, pleurodont and thecodont. In the rays there is a sexual difference in the shape of the teeth. The authority for the above statement is Hopwell-Smith, and as this paper is being prepared, the writer is planning to verify this statement with research in this particular field. Some amphibians have no teeth, as the *Bufo americanus,* while others, as the *Rana castesbiana,* have teeth not unlike the pisces, at least always on the maxillae but the mandible of the *Rana castesbiana* is edentulous. Most reptilia have teeth and the mandible is jointed at the symphysis and articulates with the skull through the quadrate bone. The poison fangs of the crotalus, etc., are in the maxilla and in the *Heloderma suspectum* the venum conducting fangs are in the mandible. The chelonidae have a horn-like covering for the border of the jaw. The aves have no teeth, the beak being a horny sheathing of the ends of jaw bones and some with serrations. The first type of tooth of interest other than a fang is the molar of the ungulates which are herbivorous and granivorous. The molar teeth of the *Equus caballus* are good examples of teeth in a jaw with a marked lateral excursion of the mandible. This is practically the only motion of the mandible and makes the serrations of the molars run antero-posteriorly; which is exactly the reverse of the form of molars of the rodentia, in which a postero-anterior movement of the mandible is responsible for the grinding necessitating a different arrangement of the occlusal surface of the teeth. In the rodentia, we find the persistent pulp and the tooth grows out as it is worn off. The carnivorous animals differ from the class just described in the character of their teeth and also in the manner of the movement of the mandible. The skulls of a *Procyon lotor* and *Odocoileus hemionus* show a vast difference in the grinding teeth as shown in their mandibles. The carnivorous molars comminute while the herbivorous molars triturate. There is a marked difference in the tempormandibular articulation of

these two animals. The herbivorous have a flat glenoid fossae to render possible the lateral excursion of the mandible. The carnivorous animals have no lateral excursion. The condyles fit into the fossae so tightly as to make a hinge joint, and in some instances the distal part of the eminentia articularis so far over hangs its glenoid fossa that it cannot be seen. In some cases it is necessary to fracture the skull to remove the condyles.

In the apes, dentures are found which are approximately like the human. In the new world monkey almost exactly the same type of denture is found as that of man, except that there are three bicuspids instead of two. There are two incisors, a cuspid, three bicuspids and three molars on each side. The old world monkey is the first animal representing exactly the dental formula of man. There is, however, a space between the upper lateral incisor and cuspid which is to admit the lower cuspid. These animals are largely frugivorous.

The human oral cavity has in front a transverse aperture, the rima oris; behind, it communicates with the pharynx through the isthmus faucium. An outer, the vestibulum oris, bounded externally by the lips and cheeks, and internally by the teeth and gums which cover the outer aspect of the alveolar process of the jaws. The maxillary arch is elliptical, the mandible is parabolic in outline. The teeth of man do not, normally occlude by means of their cusps, but by a perfect system of interdigitation. This is enharmosis.

In primitive man the upper incisors came into opposition edge to edge with the lower incisors, and were frequently worn flat in consequence. While in modern man there is a tendency for them to over bite. The third molars are the last to erupt and among the first to be lost and some never erupt. In prehistoric man they erupted and functioned in mastication. A fourth molar may be observed occasionally in the gorilla and much more frequently in the orang in which a fifth tooth has been noted in rare instances. Accessory molars are very infrequent in the gibbon and in the old world monkeys. This anomaly is found occasionally in American monkeys ateleus. In modern man we find supernummerary incisors and molars, and the jaws are generally short and not as prognathous, and the teeth are inclined to be irregular and crowded.

Owing to the effects of civilization, the teeth of the high classes of both the American and European people are often carious, which is not so much the effect of a weakness of structure of the teeth as it is the result of unnatural foods and habits.

Wiedersheim reports upon evidence of caries of the teeth, after an examination of a large number of skulls from various museums as follows: Esquimaux 2.5 per cent; Indians 3.10 per cent; Malays 3.20 per cent; Chinese .40 per cent; Europeans 80-100 per cent.

For several generations man has been endeavoring to trace a resemblance between human beings and apes. The earliest trace of fossil man

yet discovered in Europe is that of the jaw of *Homo heidelbergensis.* The main features were the massive character of the long frame work, which at first sight seemed more anthropoid than human, that the masticatory muscles must have been more highly developed here than in any known human race. The jaw is believed to have been 1,000,000 years old. The Neanderthal skull (*Homo mousteroemsos*) was unearthed near Dusseldorf in 1856, a few years before the publication of Darwin's "Origin of Species". This skull had an extremely flattened cranium with largely developed superciliary ridges. In 1910, on the south coast of Jersey after the removal of 25 feet of material nine teeth were discovered, which without doubt belonged to an individual of the Neanderthal race, but in certain features are more primitive than the teeth of the Heidelberg mandible. In 1886, two skulls were found at Spy in which the third molars were larger than the second and these than the first, all having three roots. It is probable that the Heidelberg and Neanderthal are survivals of a very ancient type and in no way indicative of the stage reached by *Homo sapiens.* In 1891, a skull was brought to Europe from Java *(Pithecanthropus)* which appeared to be intermediary between man and ape. The skull of a Pre-Boulder clay man was discovered which is thought to be 100,000 years old or more. The jaws were lost, but the isolated teeth were preserved and found to be small in size, very much worn down, not materially different from the modern type of tooth, and totally dissimilar to those of Neanderthal man. The next oldest, as far as yet ascertained, is the skull found in excavating for the Tilbury Docks in 1883, which is probably 30,000 years old. The Indians of America are generally macrodonts, the teeth being large, strong and well set in a round arch. There is a considerable variety among the divers races of North and South America, large, medium and small teeth are found. Deformities are not infrequent and fourth molars and third incisors sometimes occur. The mound-builders had fine teeth in a round arch, and were yellow. The ancient Aztecs had small arches and small fine teeth. The Indians of the United States of later times had large fine teeth, but with the degeneracy and disease incident to the vices acquired from the white man, they became degenerate and defective.

In conclusion, as animal life progressed from the higher forms of invertebrates to the lower forms of vertebrates, a specialization of the digestive tract evolved bringing with it the inauguration of special organs for mastication. As higher forms of vertebrates evolved, so the dentition became more efficient to take care of the needs of the digestive tract and food habits of the animal. So we see that dentition may differ considerably from species to species and different genera within a single family show how completely dissimilar one dentition may be from another.

DEWEY-THOMPSON, "Comparative Dental Anatomy."
TODD, "Mammalian Dentition."
HOPEWELL-SMITH, "Dental Anatomy and Physiology."