

that the anterior segments of the skull tend to undergo fission in the direction of the axis of the chain of segments, and that the cleft separating the maxillary lobe of the embryo from the middle and lateral frontal lobes is morphologically horizontal—lying between the hæmal and neural elements of more than one segment ; and in proof of this view a variety of evidence is adduced.

II. "On the Structure and Growth of the Tooth of *Echinus*."

By S. JAMES A. SALTER, M.B. Lond., F.L.S., F.G.S.
Communicated by THOMAS BELL, Esq. Received March 5,
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(Abstract.)

The author commences his paper by stating that the researches upon which it is based were made more than four years since, and then without the knowledge that the structure had been previously investigated by others.

An abstract of the *literature* of the subject (contained in very narrow limits) is then given.

In 1841 Valentin, in Agassiz's Monograph on the Echinoderms (*Anatomie des Echinodermes*), published a description and many good figures of the minute anatomy and growth of the Echinus-tooth.

Professor Quekett, in his 'Lectures on Histology' (1854), referring to the minute *mature* anatomy of the organ, states its ultimate structure to resemble bone and dentine of vertebrata.

Dr. Carpenter, in his work 'On the Microscope,' speaks of the tissue of the tooth as essentially of the same nature as the shell of the Echinidæ generally (1856).

Lastly, Professor W.C. Williamson describes the subject more fully than his predecessors, entering into the question of the development of the tooth both generally and histologically (though apparently in ignorance of Valentin's Essay), in a paper on the "Histology of the Dermal Tissues," &c., in the British Journal of Dental Science, 1857.

The coarse anatomy and relations of the Echinus-tooth are then described, and the question is discussed as to how far the organ resembles and how far it does not resemble the incisor tooth of a Rodent mammal, to which it has constantly been likened.

Some remarks then follow on the method of investigation, which the peculiar physical characters of the structure render very difficult.

Before describing the histology of the mature tooth, the author premises some succinct remarks upon the several elementary parts that are formed at its growing extremity, and by which its complex structure is built up—showing how the shape and plan of these elements determine the microscopical appearances of the several regions of the tooth as seen in different sections.

These elementary parts are—(1st) the *Primary plates*, which consist of a double series of triangular sheets of calcareous matter, and which constitute the physiological axis of the tooth, about which and connected with which the four secondary elements are developed. These latter are (2nd) the *Secondary plates*, lappets of similar calcareous sheets attached to the outer edge of the primary plates ; (3rd) the *Flabelliform processes*, elaborate reticulations of calcareous fibres ending in fan-shaped extremities ; (4th) the *Keel fibres*, certain long cylindrical rods with club-shaped ends of the same chemical nature, which pass towards the enteric region of the tooth in their growth ; and (5th) the *Enamel Rods*, which are minute very short developments of the same character, and which are formed in the opposite direction. Thus far a primary and secondary stage of formation are represented : a third stage, that of consolidation, now occurs in the development of (6th) the *Soldering particles*, multitudes of minute discs of carbonate of lime which appear over the whole surface of the previously-formed elementary parts, and by which they are soldered together, the intervals between these (in a certain sense) constituting the tubular character of the mature tissue.

The primary plates, secondary plates, and the proximal portion of the flabelliform processes are stated to constitute the body of the tooth—the distal extremities of the flabelliform processes the *skirtings* of the enteric region of the body of the tooth ; the keel fibres wholly form the keel ; while the short enamel rods compose the thin white layer on the dorsal surface of the tooth—the enamel.

The histology of the tooth is remarkable as exhibiting apparent inconsistencies in different lines of section. A vertical section of the tooth presents the appearance of vertebrate bone, lacunæ, canaliculi, and lamellæ ; while a transverse section displays some regions resembling dentine (the body of the tooth), and others having the closest

similitude to an oblique section of the shell of some Mollusca, such as *Pinna*.

The author then proceeds to describe in detail and with particularity the form and progressive growth of the several elements of the tooth as they are met with in examining the growing extremity and proceeding from it towards the mature structure, as long as the elements are susceptible of isolation and individual examination. The anatomy of the soldering particles, and their relation to the production of the cavitary structure of the tooth, is specially dwelt upon. The soldering particles are supposed to be isolated at first, but as they enlarge they become connected by a thin film from their upper and under faces. This occurs before the final consolidation of the tissue, and before the soldering particles are indissolubly connected with, and themselves indissolubly connect, the contiguous elements of the tooth. At this stage these particles are still susceptible of isolation, and they may be separated *en masse*, being held in relative position by the films that connect them. The soldering particles and the connecting films thus constitute a tubular system, which has an independent existence before the final consolidation of the tissue, and this tubular system is introduced between, and interpolated among the previously existing elementary parts of the tooth.

The author concludes by expressing a coincidence of opinion with Dr. Carpenter, that the minute structure of the tooth is essentially of the same nature as that of the shell of the Echinidæ generally.

April 11, 1861.

Major-General SABINE, R.A., Treasurer and Vice-President,
in the Chair.

The following communications were read:—

- I. "On the Motion of a Plate of Metal on an Inclined Plane, when dilated and contracted; and on the Descent of Glaciers." By the Rev. HENRY MOSELEY, M.A., Canon of Bristol, F.R.S., Inst. Sc. Paris Corresp. Received March 14, 1861.

(Abstract.)

The case in which the upper edge of such a plate (supposed rec-