On the structure, economy, and pathology of the human teeth, : with careful instructions for their preservation and culture, and concise descriptions of the best modes of surgical treatment, equally adapted to the uses of the medical practitioner, the student in medicine, and of the public. / By William Lintott.


G.C.W

ON THE

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OF THE

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THE MEDICAL PRACTITIONER, THE STUDENT IN MEDICINE,

AND OF THE PUBLIC.

BY

WILLIAM LINTOTT, SURGEON.

SURGICAL AND MECHANICAL DENTIST.

With upwards of Forty Illustrations.

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TO

ERASMUS WILSON, ESQ.

CONSULTING SURGEON TO THE ST. PANCRAS INFIRMARY ; LECTURER ON ANATOMY AND PHYSIOLOGY IN THE MIDDLESEX HOSPITAL SCHOOL OF MEDICINE ; HONORARY ASSOCIATE OF THE VETERINARY MEDICAL ASSOCIATION ; FELLOW OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY ; FELLOW OF THE MICROSCOPICAL SOCIETY ; AND HONORARY MEMBER OF SEVERAL MEDICAL SOCIETIES ;

IN ADMIRATION OF

HIS INDEFATIGABLE ZEAL AND PERSEVERING INDUSTRY

IN

THE PURSUIT OF MEDICAL SCIENCE;

AND

IN ACKNOWLEDGMENT OF MANY OBLIGATIONS,

IN THE

DOUBLE CAPACITY OF INSTRUCTOR AND FRIEND,

THIS LITTLE WORK

IS GRATEFULLY DEDICATED

BY

THE AUTHOR

PREFACE.

In pursuing the practical portion of my profession, I have been often struck with the anxiety displayed by my patients to become acquainted with the nature and composition of the teeth, and with the many remarkable and curious phenomena with which their history is associated. In another point of view, I have as frequently had occasion to regret the absence of information with regard to these structures in many who consulted me, and who, for want of proper information, either objected to modes of treatment best calculated for their relief, or demanded or sought for assistance which could but have an injurious tendency.

Impressed with a feeling arising out of these observations, I determined upon penning a small volume, which I could with confidence place in the hands of my friends, as illustrative of the principles which I deem most important in the care and cure

of the teeth. In carrying out this object, I was obliged to proceed more deeply into the minute structure of the teeth than I had at first intended; but I felt it my duty to leave no labour unattempted which might be conducive to my object, and was not without hope that my brief narrative might be found an useful guide to the student and practitioner of medicine, particularly to those who are engaged in practice in the country, and have the management of the teeth, as well as of the other organs, of their patients; and where the professional dentist is not to be found.

In describing the anatomical and microscopic structure of the teeth, I have discarded, in so far as I was able, all technical and professional terms; but I found, as I proceeded, that their utter exclusion would have been incompatible with my desire to make the composition of those organs thoroughly understood. Wherever, therefore, I have felt the necessity of using such terms, I have constantly accompanied them with an explanation of their etymology and popular signification, in the form of a foot-note.

For the purpose of explaining the text still more plainly and familiarly to the unprofessional reader, I have introduced a series of sketches illustrative of the textures, the most difficult to be understood;—

for the accuracy of these sketches I am myself responsible, insomuch as they were made by my own hand, and drawn immediately from the microscope. I need not say that the copies from the figures in Mr. Goodsir's paper, which I have acknowledged in the description of the plates, form an exception to this statement.

The examination of minute structure by means of the microscope has become a new science; and as an assurance that I was aided by the best means of pursuing my investigations, it is proper to state that I was permitted to employ for this purpose the superb microscope of Mr. Erasmus Wilson, made during the past year by Mr. Powell. The magnifying powers which I have used in my examinations have been principally 300 diameters, and in some instances 600 diameters, linear measure.

I cannot here pass over the numerous obligations that I feel to be due to my excellent friend Mr. Erasmus Wilson. To him I owe my first lessons in anatomy and physiology, under circumstances that I can never forget. I imbibed from him that enthusiasm to which the proper culture of this wonderful and beautiful branch of science so constantly gives birth. In him I found a willing Mentor, always ready to unravel the intricate mazes of professional study;

and he has still continued to realize the valuable personification of instructor and friend. That his success may be complete in the brilliant career upon which he has entered, is my most sincere and earnest wish.

I feel pride and gratification also in recording in these pages my sense of the kindness and liberality with which my esteemed relative Mr. Charles Bromley laid open to me the immense advantages of his long-established and extensive practice, whilst studying under him my immediate branch of the profession.

It gives me much pleasure to have been able to corroborate the observations of Retzius, and of Mr. Nasmyth, with regard to the structure of the dental organs.

The question of the tubular structure of the teeth has been much agitated, some physiologists affirming that the so-called tubuli were mere fibres. With regard to this matter of dispute, I feel perfectly confident of the existence of tubes with distinct parietes, and containing a substance of a nature quite distinct from the walls of the tubes, and from the intertubular structure.

My researches into the structure of the teeth have led me to the conclusion, that in this branch of

scientific medicine there is still much that is obscure, and much that demands the most close and persevering inquiry on the part of the physiologist. This is doubly the case with regard to the changes which precede and accompany the formation of disease in the teeth, and the subject opens a vast field of observation to the dental pathologist. I must not omit this opportunity of addressing myself to my unprofessional friends, and of requesting them to bestow more attention upon the important organs which form the subject of this essay, than has hitherto been their wont. It is not infrequent, as a reply to this advice, to hear it said, that man in the state of nature, that the savage, and that wild animals, know no toothache; that their teeth are sound without the assistance of the dentist; that in truth they need no medical attention to be directed to the culture of their dental organs. This popular and oft-repeated assertion is, however, both sophistical and untrue. As well might it be declared that man in the state of nature does not suffer from the effects of disease; that he does not suffer death. The savage pines but too frequently under the tortures of diseased teeth; animals suffer from the same cause, and most severely. The sceptic has only to pay an inquiring visit to the Zoological Gardens,

or any of our anatomical museums, to convince himself of the fact. It is true that the majority of instances which come under our notice are domestic animals; and it is undoubtedly this circumstance, the artificial state of our modes of life, the wear and tear resulting from our labours and duties, the luxuries of civilization, that chiefly conduce to the defective state of the teeth in society, particularly in large towns.

I must again repeat, that pain may be prevented, that the teeth may be preserved, that dyspepsia and its attendant evils, that other and more immediate disagreeable effects of morbid action in the dental organs, may all be averted by a proper and judicious attention to the rules of the dentist, and that the appearance of youth and beauty may be prolonged, and the semblance of old age and decrepitude deferred.

If my intervention shall be of use in effecting this most desirable end, for any who may chance to peruse these pages, my gratification will be complete, and my object in their composition will be fully accomplished.

69 Welbeck
~~34~~, ~~Mortimer~~ *Street, Cavendish Square.*
January, 1841.

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CHAPTER VIII.

DEVELOPEMENT of the TEETH.

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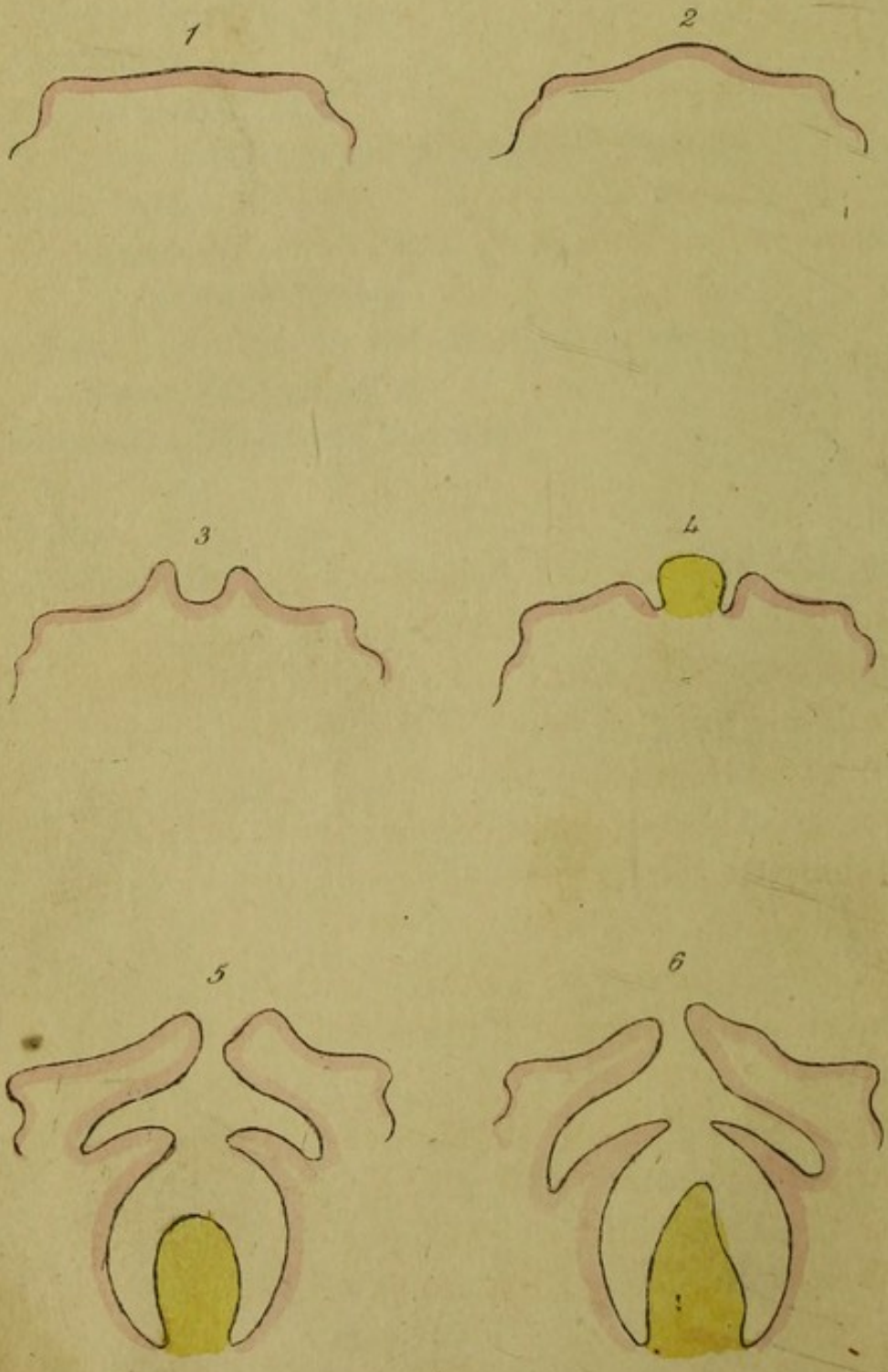


EXPLANATION OF THE DRAWINGS

ILLUSTRATIVE OF THE

FORMATION OF A TEMPORARY, AND ITS CORRESPONDING PERMANENT TOOTH, FROM THE MUCOUS MEMBRANE.

PLATE I.

Fig. 1.—Mucous Membrane.—A slight elevation in the middle, marks the situation of the future jaw. Each section is supposed to be made vertically through the rudiment of the lower jaw—the left hand side of the diagram indicating the front.

Fig. 2.—The mucous membrane, with a granular mass deposited in its texture, increasing the elevation at its middle.

Fig. 3.—A furrow or groove on the granular mass of the previous figure. This is the primitive dental groove.

Fig. 4.—A papilla or tooth-germ springing up from the floor of the primitive dental groove.

Fig. 5.—The primitive groove much deepened; the papilla surrounded by a follicle, is seen at the bottom of

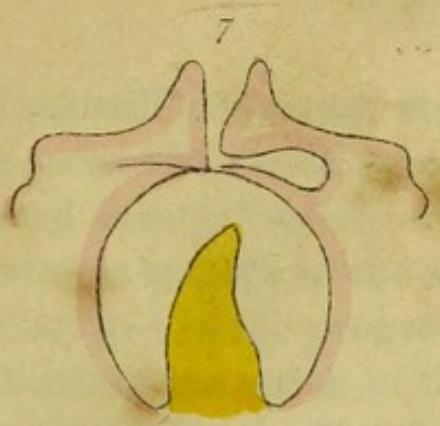
the groove; the pointed processes which overhang the mouth of the follicle, are the opercula in the course of formation; the space above the opercula is the future secondary dental groove, and the square-shaped processes nearest to the figure 5, and overhanging this space, are the approximating edges of the gum. The follicular stage of the formation of the tooth is now complete.

Fig. 6.—The papilla acquiring the configuration of the pulp of an incisor tooth. The opercula have become more pointed, and are approaching nearer to each other. The space above them, the future secondary groove, is larger, and the edges of the gum are yet separated. The mucous membrane lining the mouth and gums, is still continuous with the follicle of the tooth.

PLATE II.

Fig. 7.—The opercula have advanced so far as to have become united upon the middle line; by this union the follicle is converted into a "sac." The papilla has become a "pulp," and presents the exact form of the tooth which it precedes. The secondary dental groove is now complete. The front lobe of the gum has descended upon the anterior operculum, so as to close this half of the secondary dental grove. The posterior lobe of the gum is still raised over the portion of the secondary dental groove, which remains permanently. The latter presents the form of a follicle, being lined by the mucous membrane, which is still continuous with that of the mouth.

Fig. 8.—The lobes of the gum have now closed, the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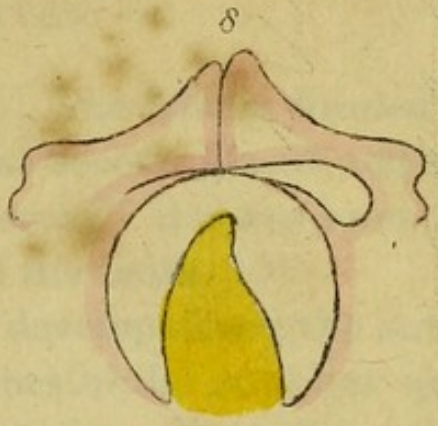
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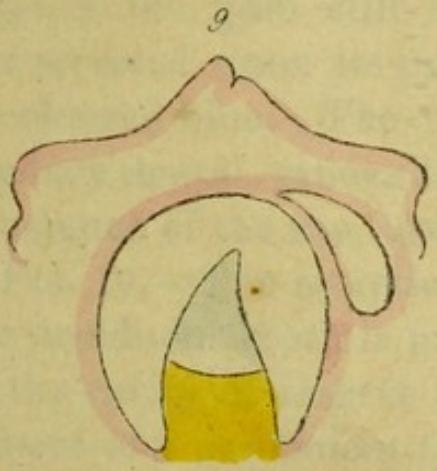
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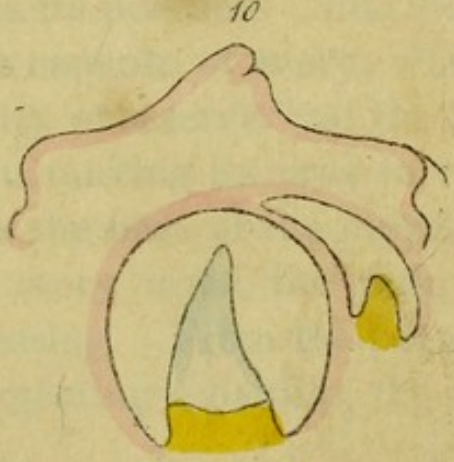
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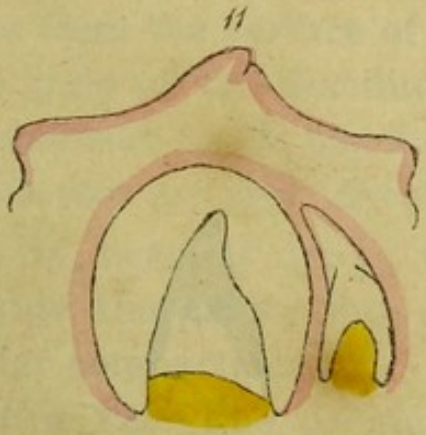
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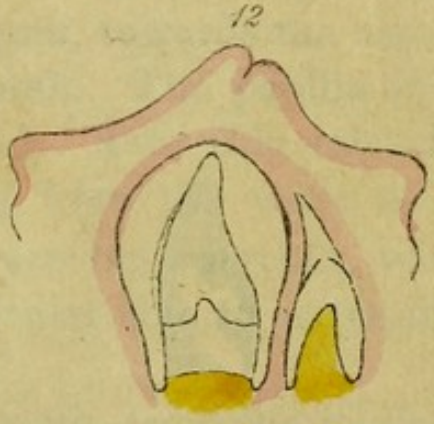
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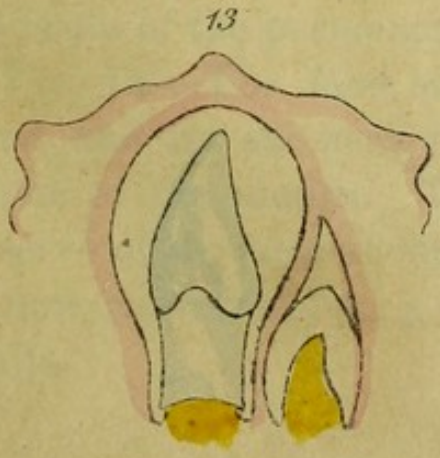
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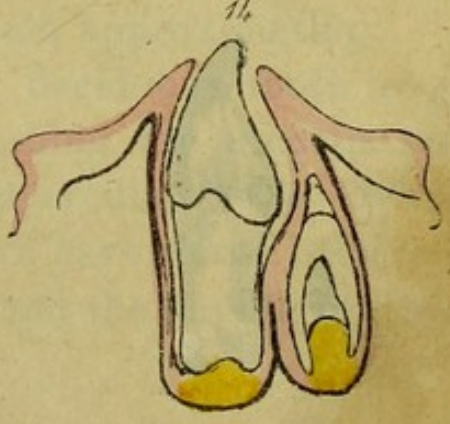
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suture still remaining visible. The follicle formed by the secondary dental groove has become closed, and converted into a "cavity of reserve;" it rests upon the posterior surface of the sac of the tooth.

Fig. 9.—In the progress of developement, the suture indicating the union of the lobes of the gum has quite disappeared. A slight indentation upon the callous ridge of the gum still marks its position. The pulp has secreted upon its point a capsule of ivory, which is coloured blue. The "cavity of reserve" of the secondary dental groove is seen making its way in the substance of the sac, towards the base of the pulp.

Fig. 10.—The secretion of ivory upon the pulp of the deciduous tooth is progressing. From the bottom of the cavity of reserve is projecting a papilla, the rudiment of a permanent tooth.

Fig. 11.—The cavity of reserve is receding still farther from the surface of the gum, towards the base of the pulp of the deciduous tooth. The papilla of the permanent tooth has increased. Two thin valve-like processes are now developing from the walls of the cavity, near its apex; these are the opercula, which divide the cavity into a follicular and an extra-follicular compartment.

Fig. 12.—The deciduous tooth acquiring its fang; the sac approaching the surface of the gum. The opercula of the permanent tooth approximating.

Fig. 13.—The fang of the deciduous tooth lengthened, and its sac nearly touching the mucous membrane of the mouth. The opercula of the cavity of reserve of the permanent tooth have closed; the cavity is now converted into a sac, and the papilla becomes a pulp.

Fig. 14.—The eruptive stage is now commencing; the apex of the deciduous tooth has pierced the gum, the two lobes of which are separated. The sac of the tooth has again returned to the state of an open follicle; its mucous surface being continuous with that of the mouth. In this figure the formation of the alveolus or socket of the jaw is denoted by a thick black line. In consequence of the rapid rise of the tooth, a space intervenes between its extremity and the bottom of the socket. In this space, growth takes place with more facility. The sac and papilla of the permanent tooth have enlarged; upon the latter the secretion of ivory has commenced.

PLATE III.

Fig. 15.—The formation of the deciduous tooth is now perfected, and its eruption nearly complete. The free portion of the sac has become the vascular border of the gum. The sac of the permanent tooth, with its pulp, is placed very deeply in the jaw; its upper part communicating with the surface by means of a rounded cord, the *gubernaculum dentis*, which is attached to the under surface of the gum immediately behind the crown of the deciduous tooth. The canal in the bone in which the gubernaculum is situated, is the *iter dentis*.

Fig. 16.—The permanent tooth by its growth has produced absorption of a great part of the fang of the deciduous tooth, and has raised it towards the surface of the gum. The permanent tooth is far advanced in

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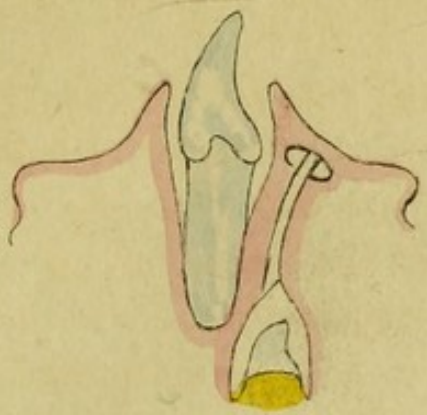

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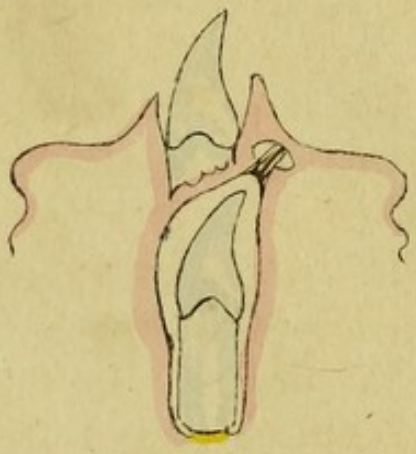

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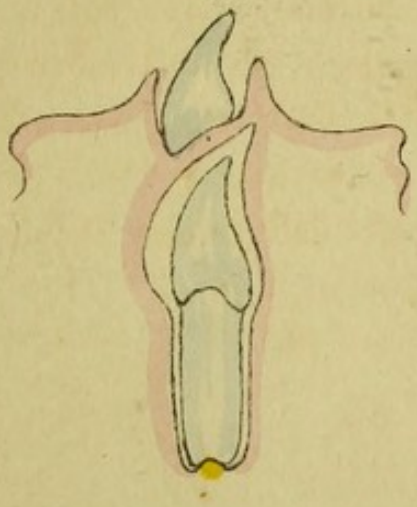

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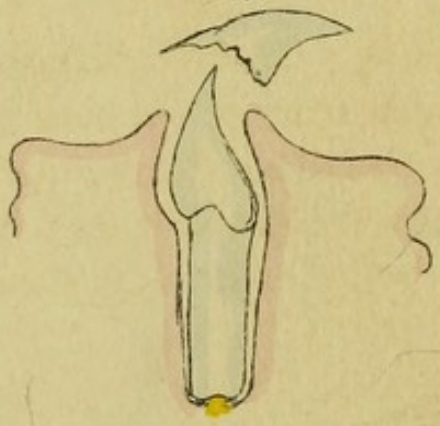

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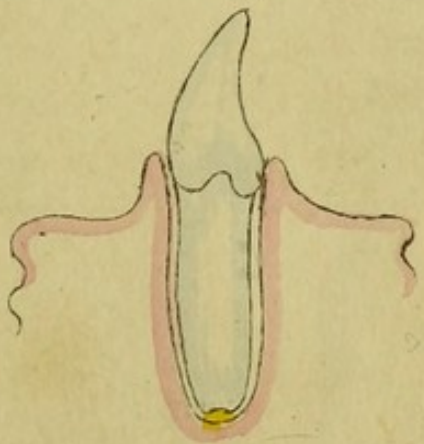

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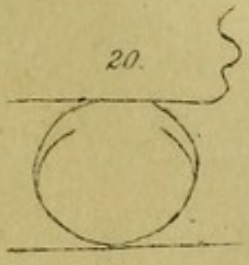

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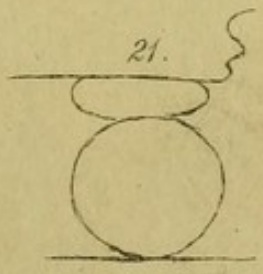

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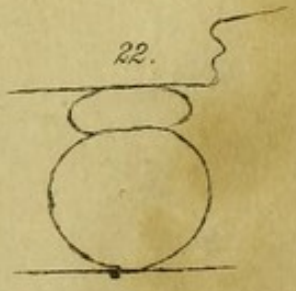

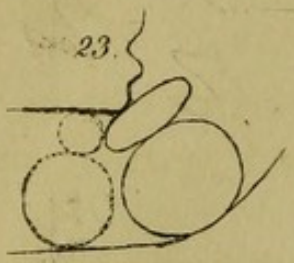
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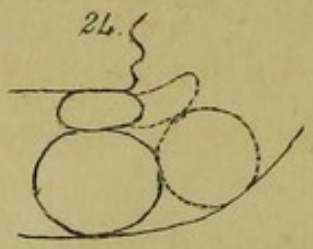
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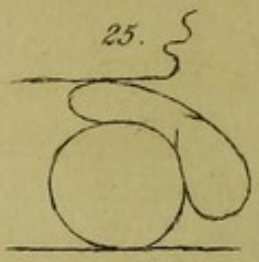
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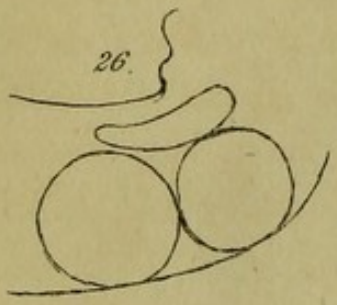
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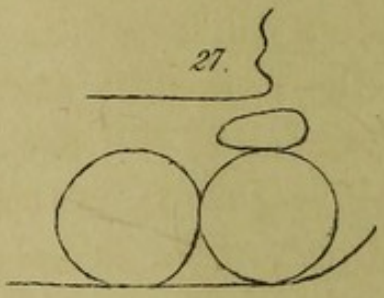
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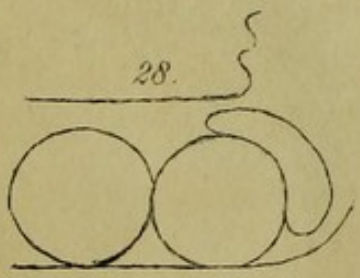
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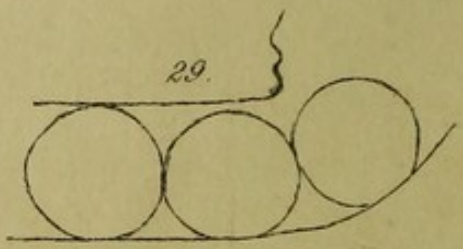
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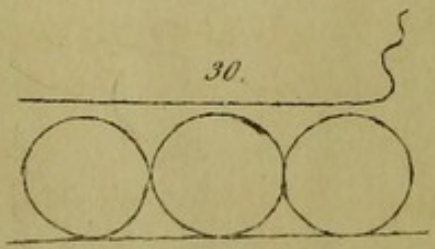
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growth, and is making its way by absorption along the iter dentis to the opening occupied by the gubernaculum.

Fig. 17.—The permanent tooth is still farther advanced, all bony obstacles are now removed, and it is seen pressing against the under surface of the deciduous tooth.

Fig. 18.—Eruption of the permanent tooth, attended by the shedding of the remains of the deciduous tooth. The sac of the permanent tooth is now continuous with the mucous lining of the mouth. A space exists between the extremity and the floor of the alveolus, in which growth is still proceeding.

Fig. 19.—The permanent tooth perfected and fully erupted.

DIAGRAMS

ILLUSTRATIVE OF THE

FORMATION OF THE THREE PERMANENT MOLAR TEETH.

Fig. 20.—The non-closed portion of the primitive dental groove, at the posterior part of the jaw. The upper line indicates the gum. The circle includes the cavity of reserve of the first permanent molar. The line on each side represents the opercula in course of developement. The space above these, the secondary dental groove.

Fig. 21.—The opercula have met and united, so as

to convert the cavity of the tooth into a sac. The portion of the secondary dental groove which still remains is a closed cavity of reserve.

Fig. 22.—The same as the preceding, a little farther advanced.

Fig. 23.—The sac of the first molar increased in size, and advanced along a curved path into the substance of the coronoid process, or maxillary tuberosity. The cavity of reserve lengthened out and advanced with the sac. The dotted line represents the situation it had quitted.

Fig. 24.—The sac of the first molar returned by the same path to its former position. The latter is indicated by the dotted line.

Fig. 25.—The cavity of reserve of the first molar sending backwards a process into the space previously occupied by the sac. In this process opercula are seen developing, which subsequently convert the cavity into the sac for the formation of the second molar tooth.

Fig. 26.—The sac of the second molar is advancing along a curved path into the coronoid process, or maxillary tuberosity, as did the sac of the first molar in Fig. 23. The cavity of reserve is lengthened for the second time.

Fig. 27.—The sac of the second molar returned to the level of the dental range. The cavity of reserve shortened for the second time.

Fig. 28.—The cavity of reserve sending back a process into the space previously occupied by the sac of the second molar. This process by its developement will subsequently become the sac of the third molar, or wisdom-tooth.

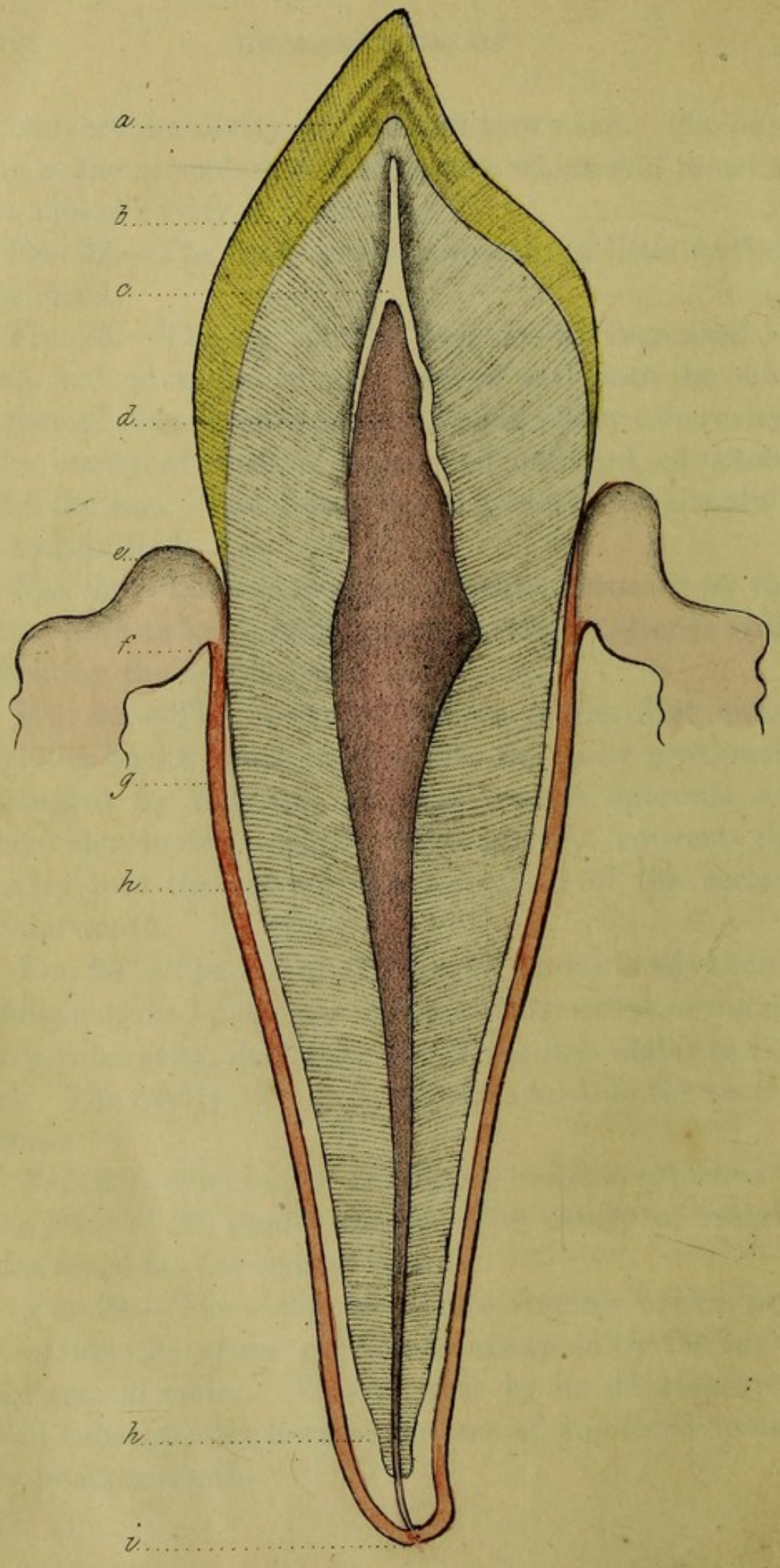

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Fig. 29.—The sac of the wisdom-tooth advanced along a curved line into the coronoid process, or maxillary tuberosity.

Fig. 30.—The sac of the wisdom-tooth returned to the extremity of the dental range. It occasionally happens, however, when the jaw does not lengthen conformably with the developement of the molar teeth, that the wisdom-tooth never regains its proper position, but remains permanently imbedded in the jaw ;—or, in rare cases, it may grow from the jaw in a horizontal position.

PLATE V.

This drawing is intended to point out the situation and relative proportions of the textures of a tooth: for this purpose, the section of a canine tooth of an adult, from the upper jaw, has been selected.

a. The enamel.
b. The ivory of the tooth.
c. The cementum deposited at the apex of the dental cavity.
d. The dental cavity, containing the pulp.
e. The surface of the gum.
f. The edge of the alveolar cavity.
g. The periosteum.
h h. The cementum of the fang.
i. The minute opening through which the vessels and nerves enter the dental cavity.

PLATE VI.

Fig. 1.—Enamel fibres; the dark borders of the fibres show that they are not square, but hexagonal. The transverse lines indicate the composition of the fibre of a series of minute blocks. The section is magnified 600 times linear.

Fig. 2.—The appearance produced by making a horizontal section of the enamel fibres. The fibres are seen to be irregular in their form, and not absolutely uniform in size. This section is magnified 600 times linear.

Fig. 3.—The tubuli of the ivory seen approaching the under surface of the enamel. The broken substance contained in the tubuli is represented, as well as the distance of the tubes apart. To the left the fibrous structure of the enamel is shown, and the irregular and pimply appearance of its under surface. This section is magnified 600 diameters.

Fig. 4.—A small portion of decayed tooth: the edge nearest the middle line is the decayed surface. The tubes of the ivory are seen to lose their calcareous contents as they approach this surface, and, before reaching it, the calcareous substance is broken into irregular masses, separated by considerable interspaces. Magnified 150 diameters.

Fig. 5.—The internal surface of the dental cavity, showing the openings of the tubuli; the latter are represented by the black dots. The wall of the tube is the cylinder between the central dot and the circular

Fig 1.

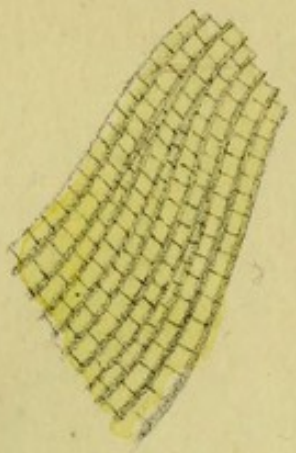

Fig 2.

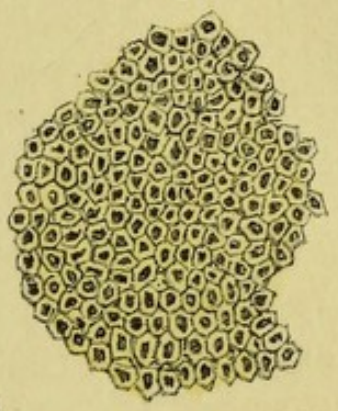

Fig 6.

Fig 3.

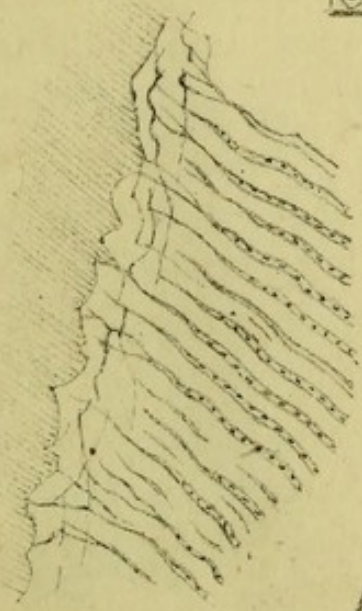

Fig 4.

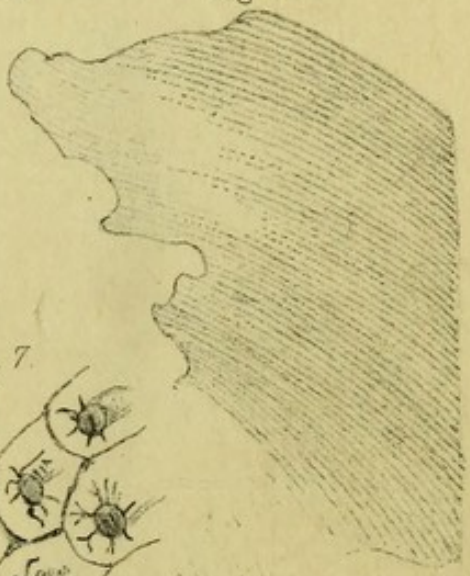

Fig 7.

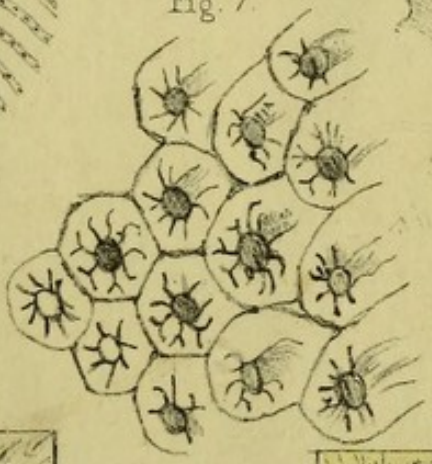

Fig 5.

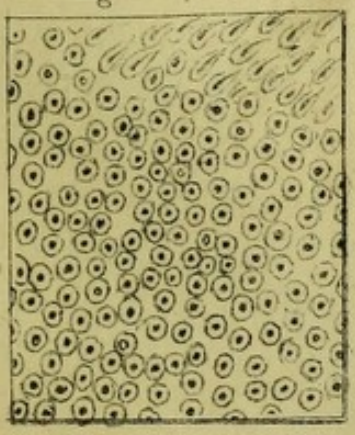

Fig 8.

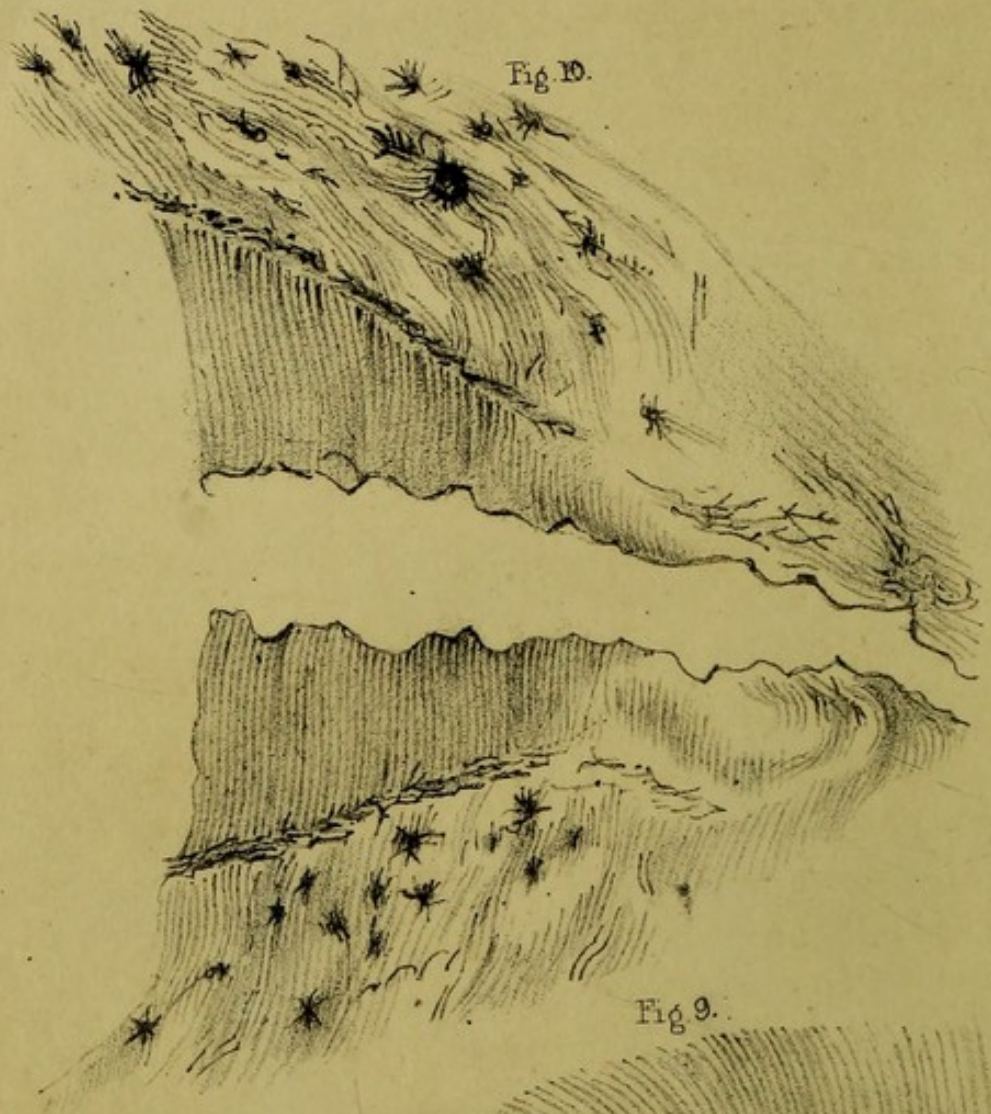

Fig. 10.

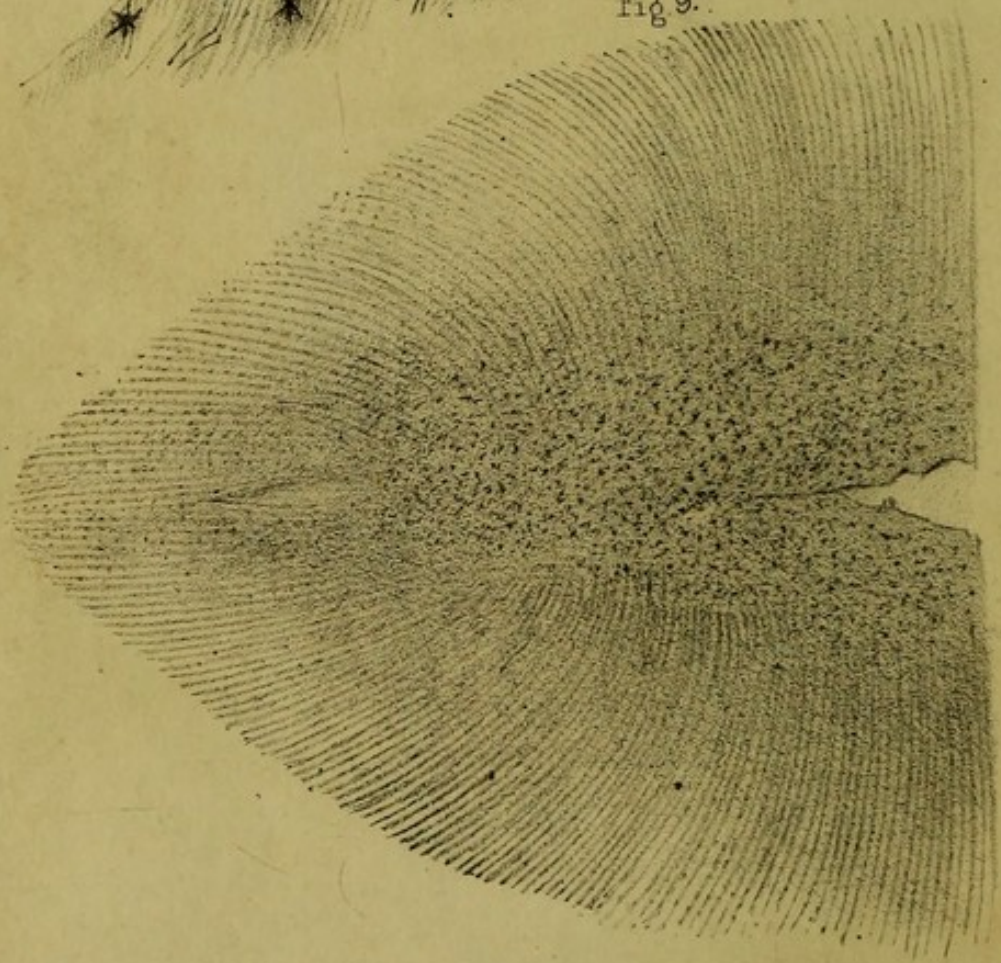

Fig. 9.

Ad. Nat: del[t] W Lambott.

line surrounding it. Near the edge of the section, some of the tubes are divided obliquely, exposing more of the canal of the tube. Magnified 300 diameters.

Fig. 6.—Another portion of the wall of the internal cavity of a tooth. In some parts the section is so thin, that the calcareous contents have fallen out, and the tube is seen as a hollow cylinder. The radiating lines are the first branches of the tubes. Some of the tubuli are divided obliquely. Magnified 300 diameters.

Fig. 7.—An enlarged diagram, copied faithfully from a part of the section delineated in the preceding figure. The cylinders of the tubuli are situated so closely in contact with each other, as to have assumed a polygonal form. The first ramifications of the tube are seen near its commencement, and a slight shade indicates the extension of the tube from the surface.

Fig. 8.—A portion of cementum from the apex of the dental cavity of the tooth of an adult. Magnified 600 times. With a lens of lower power, the cementum presents the granular appearance seen in Plate VII. Fig. 9.

PLATE VII.

Fig. 9.—A longitudinal section of the crown of a sound canine tooth, showing the arrangement of the tubuli of the ivory, and their termination in the cementum above the apex and on the parietes of the dental cavity, with the granulated appearance of the cementum. Magnified 300 diameters.

Fig. 10.—A longitudinal section through the ex-

treme end of the fang of a sound tooth, showing the cementum investing it, with the peculiar corpuscules and ramifying tubuli seen in that structure. Magnified 300 diameters.

OF THE

STRUCTURE, ECONOMY, AND PATHOLOGY

OF THE

HUMAN TEETH.

CHAPTER I.

ANATOMY AND STRUCTURE OF THE TEETH.

THE teeth are inferior in organisation, and distinct in their general structure, from the other hard parts of the human frame, and are considered by modern anatomists, with much reason, to be an appurtenance of the tegumentary rather than of the osseous system. They differ from bone in two essential particulars. Firstly, in being produced by secretion from a pre-existing structure; and secondly, in being unpreceded by cartilage, like osseous tissue. The teeth are composed of an *organic* and of an *inorganic* substance, are sparingly supplied with blood-vessels and nerves, from which they derive vitality and nutrition, and an exquisitely modified degree of sensibility.

There are three different textures entering into the composition of the structure of a tooth ; two of these are peculiar to this organ, viz. the *ivory* or proper tooth-substance, which forms the body and root,—and the *enamel,* which invests the crown of the tooth. The third texture, the cementum, is analogous to the crusta petrosa in the teeth of animals, and bears a very close resemblance to true bone in its structure.

The first discovery of the peculiar structure of the ivory or tooth-bone originated in that eminent philosopher of nature, Leeuwenhoeck,* towards the close of the seventeenth century. The investigation then slept for a time, but has since been prosecuted with great perseverance and industry, especially during the present decade, by several distinguished physiologists ; and their researches aided by the astonishing powers of the microscope, have been attended with the most gratifying and interesting results.

Among the authorities on this subject at the present day, the names of Purkinje,† Fraenkel, Rasch-

* A paper entitled "Microscopic Observations on the Structure of the Teeth and other Bones," by Leeuwenhoeck, will be found in the Philosophical Transactions for 1678. In this paper he also alludes to a "substantia corticalis," as existing in the calf, which would appear to indicate his acquaintance with the more recently described cementum.

† Purkinje's researches were published in 1835, in a thesis,

kow,* Retzius†, Müller; and of our countrymen, Nasmyth, Owen, and Tomes, stand pre-eminent.

It also gives me much pleasure to add, that I have been enabled to verify the results of the labours of these gentlemen by personal investigations, and therefore may be permitted to offer my humble testimony to the accuracy of their views. In these researches I enjoyed the opportunity of employing one of Powell's excellent microscopes, made during the past year.

In describing the form of a tooth, anatomists are in the habit of dividing it into a Body or Crown; a Neck; and a Fang or Root. The body is that part which appears above the gum, which fulfils the office of mastication, and gives depth and beauty to the mouth. This portion of the tooth is covered, strengthened, and protected by a semi-transparent crystalline substance, sub-organic, insensible, and of moderate thickness,—the enamel.

The neck is that part of the tooth which is embraced by the gum, and upon which the covering of enamel gradually ceases.

The remaining portion constitutes the root; it is received into the alveolar processes of the maxillary or jaw-bones, where it is firmly retained.

by Fraenkel, entitled "Observationes de penitiori dentium humanorum structurâ."

* Melemata circa dentium evolutionem.

† In Müller's Archiv. for 1837.

STRUCTURE OF THE IVORY.

The microscopic examination of the ivory of the tooth, both in man and animals, shows it to consist of a series of minute fibres, which give off branches from point to point, and terminate in an exceedingly delicate arborescent ramification. They are believed to be tubular. The larger ends of these tubular fibres open upon the surface of the cavity of the tooth, while the smaller and ramified extremities terminate at the surface of the ivory. They may, therefore, be regarded as radiating from a centre, which is represented by the cavity for the pulp, towards the surface of the tooth, and in this course they form a series of delicate undulations,* which are well seen beneath the microscope, and give the peculiar and beautiful satiny texture to the polished surface of the section of a tooth.

In certain animals the minute ramifications of these tubuli are interspersed with small cells or corpuscules, which serve as an important analogical link between ivory and true bone. The analogy between ivory and bone is found to increase in proportion as

* Professor Retzius of Stockholm describes a double series of undulations, the first consisting of very small curves; the second being much larger, and comprehending a number of the smaller curves. I have delineated this conformation from nature, in fig. 3. plate V.

we descend the animal scale, until, in the inferior classes, the structure is more nearly allied to the latter, both in structure and mode of connexion, than to the former texture. I have satisfied myself that in the ivory of the human tooth none of these corpuscules exist; but they are found in considerable number in the cementum.*

The tubuli of ivory, as well as the inter-tubular structure, are composed of a dense dental substance, and each tube contains within its cylinder a quantity of perfectly inorganic calcareous substance, apparently disposed in small irregular cylindrical masses. I think it probable that this broken appearance of the calcareous contents of the tubuli may depend upon the drying of the sections; in the decayed tooth it is very remarkable. In the teeth of animals, the calcareous matter forms the contained substance of the bone-like corpuscules.

When a thin section of the ivory of a tooth is magnified three hundred times, linear measure, it is seen that the tubuli are separated to a very considerable distance from each other; the inter-tubular spaces being occupied by a transparent and very dense ivory, in which the minute branches of the tubuli find room to ramify.† The tubuli of the ivory are about $\frac{1}{383}$ of a line in diameter; but my readers will best judge of the extreme tenuity of

* Plates VI. and VII. figs. 6 and 8.

† Plate VI. fig. 3.

these tubuli, from a remark made by Leeuwenhoeck in the paper before referred to. Thus he observes, "The whole tooth was made up of very small strait transparent pipes. Six or seven hundred of these pipes put together, I judge, exceed not the thickness of one hair of a man's beard."

The whiteness of the teeth depends upon the calcareous matter which they contain. This calcareous substance is lodged principally in the walls and in the cylinders of the tubuli. The intertubular structure also contains calcareous matter, but probably in a different state to that occupying the tubuli, for under the microscope it is perfectly transparent and incapable of conferring a white colour on the dental organs. In the course of my microscopic examinations, I have thought that I could distinguish a difference of opacity in the intertubular texture of the bluish and semi-transparent tooth, as contrasted with the yellowish and opake tooth, but in this observation I may have been mistaken.

When the calcareous matter is removed from a tooth by means of acid, the remaining animal substance is perfectly transparent, but the bulk of the ivory is very little diminished. The situation of the enamel, on the other hand, is occupied only by a thin film of loose cellular animal substance.

STRUCTURE OF THE ENAMEL.

A microscopic investigation of the enamel of the tooth, developes to our view an incalculable number of minute hexagonal fibres,* arranged with beautiful regularity; resting, by one extremity, on the surface of ivory, from which this interesting structure is separated by a thin layer of membrane, and by the other constituting the surface of the crown of the tooth. When a thin section of the enamel, made transversely to the direction of the fibres, is examined, it presents a very beautiful tesselated arrangement of irregular hexagonal plates,† formed by the cut extremities of the enamel fibres. Each of these enamel fibres is invested by a thin sheath of membrane, which is divided into a number of small oblong spaces, by little partitions, sent inwards from the internal surface of the membrane; so that when the enamel fibre is closely examined, it appears marked at pretty regular distances by transverse lines, the interspace between each of these lines being occupied by a minute crystalline hexagonal block, and the entire fibre being composed of a continuous series of such blocks. Besides serving after this manner to hold together the different minute blocks composing a single fibre, the enamel

* Plate VI. fig. 1. † Ib. fig. 2.

membrane retains all the crystalline fibres in close contact with each other; it is intimately connected by its central extremity with the membrane covering the ivory, and by its peripheral extremity with the external membrane of the enamel, the persistent capsule of Nasmyth, of both of which, indeed, it forms a part. This membranous apparatus of the enamel of the perfect tooth is the rudiment of the enamel organ of the embryo, in the structure of which the crystalline substance was originally deposited.

Although radiating from the internal surface of the enamel towards its peripheral surface, the enamel fibres are not straight throughout their entire extent, but near to their central extremity are variously twisted and curved, and present a peculiar arrangement, and one difficult to describe. I have observed that this disposition is more general in sections of the teeth of animals than in man, but it is always apparent in the human tooth, in those parts of the enamel which form the summit of the crown. Many of the enamel fibres terminate abruptly by pointed extremities before reaching the surface of the ivory;* and I think it probable that it is the disposition of these shorter fibres which gives the bent appearance above described to those which extend through the entire thickness of the enamel.

* Plate VI. fig. 1.

The external surface of the enamel forming the crown of the tooth is not perfectly smooth, as might from a cursory inspection be supposed, but is marked by a series of regular transverse ridges, which serve to indicate the successive growth of the enamel from the apex of the crown towards its base; the enamel being formed by a series of thin layers, corresponding with the form of the enamel organ. The internal surface of the enamel, that which lies in contact with the ivory of the tooth, is remarkable for its rugged appearance. When carefully examined I have observed that this roughness of surface depends upon the presence of a number of small cones with broad bases, arranged with a certain degree of regularity.*

STRUCTURE OF THE CEMENTUM.

The cementum is a later production than the two preceding textures: it is absent in the early periods of the formation of the tooth, and is developed only as the progress of age advances. Two opinions † are received with regard to its mode of formation: according to the first, it results from the ossification of the investing membrane of the root of the tooth; and, according to the second, it

* Plate VI. fig. 3.

† Wilson's Anatomist's Vade Mecum, page 57.

is due to a true secretion from this membrane. I am disposed to believe that the latter is the true explanation of its production.

The cementum forms a thin layer, which invests the entire root of the tooth, from its neck to the extremity of its fang. On the neck it is extremely thin, and commences at the line of cessation of the enamel. It grows thicker as it proceeds onwards towards the extremity of the root.* As age advances, a thin layer of cementum is also deposited upon the surface of the dental cavity. This deposit commences at the upper part of that cavity, and gradually increases with the years of the individual; in very old persons it so completely fills the dental cavity, as to leave behind no rudiment of its previous existence. In the latter situation it is produced by the reflected layer of the periosteal or investing membrane of the fang which lines the interior of the dental cavity, and constitutes the proper membrane of the pulp. When deposited in this situation, the cementum presses on the surface of the pulp, and gradually occasions atrophy of that structure. Or, according to some, (an opinion with which I cannot concur,) the entire pulp hardens by deposition into its texture, and becomes converted into this substance.

The fact, that the destructive effects of abrasion, or wearing down of the teeth, are in a mea-

* Plate V. letter *h*.

sure obviated by a new deposition of bony matter within the dental cavity, has been noticed by several writers,* by whom it has been observed, "that it is first deposited in that part of the cavity towards the worn surface, which becomes gradually more and more filled as the tooth becomes abraded." Also, that "it is undoubtedly from the vessels of the internal membrane that this new bony matter is formed."

In the course of my examinations of teeth at different ages and in different conditions, I had frequently remarked, in those neither worn down nor abraded, a layer of bone of a darker hue than the adjoining tooth-bone, resembling precisely the bone deposited in abraded teeth, commencing above the apex of the dental cavity, and extending downwards, gradually diminishing until it became lost on the walls of the cavity.†

I could find no appearance of this layer in milk-teeth, nor in young permanent teeth; but in both incisives and molares of the age of twenty to twenty-five, it is evident to the naked eye, and its extent increases in proportion to the age of the tooth.

On subjecting a section of a canine tooth of medium age, which presented this appearance, to microscopic examination, I found the deposit to con-

* Hunter, Bell, and others.

† Plate V. letter *c*.

sist of a structure analogous to the cementum of the fang, the characterising cells, or corpuscules, being more numerous and differing only from the appearances presented by the *external* cementum in the peculiarity that the ramifications of the tubes issuing from the cells were finer and more diversified, some of them putting on an arborescent character.*

From these appearances I am led to conclude, that this layer of *new bone* is secreted by a reflection of the periosteum of the fang over the inner walls of the dental cavity; and that its developement, though probably accelerated by the wearing away of the original tooth-bone, nevertheless constitutes a part of the natural structure of the tooth, and though delayed till a late period, takes place independently of external causes, such as abrasion, decay, &c.

The cementum approaches in structure very nearly to true bone.† Like bone, it contains the corpuscules of Purkinje, with their numerous ramifying tubuli; but it appears to me to differ from true bone in the more numerous and longer tubuli connected with the corpuscules, in the smaller size and less regular form and position of the corpuscules, in the presence of numerous curiously ramified tubuli, and also of numerous parallel curved tubes, which are dissimilar to anything which I

* Plate VI. fig. 6, † Plate VII. fig. 8.

have seen in the ivory of teeth, or in osseous tissue. Moreover, in the cementum of teeth, there are none of the laminated lines corresponding with the laminæ of the Haversian canals * of long bones, so characteristic of bone.

This substance, in old persons, not unfrequently becomes considerably increased in quantity on the fangs of teeth, so as to give them an exostosed appearance. When this morbid change takes place in the teeth of the adult from irritation of any kind, it is likely to present a serious obstacle to the removal of the tooth.

CHEMICAL COMPOSITION OF THE TEETH.

The chemical composition of the teeth, according to the analysis of Berzelius, is

	Ivory, including Cementum.	Enamel.
Animal matter and water	28·0	1·0
Phosphate and fluate of lime	64·0	88·5
Carbonate of lime	5·5	8·0
Phosphate of magnesia	1·0	1·5
Soda and muriate of soda	1·5	1·0
	100·0	100·0

The proportion of animal matter in the ivory of teeth, as compared with bone, is as 28 to 33 per cent.

* Wilson's Anatomist's Vade Mecum, page 2.

ANATOMY OF THE PULP.

If we take any one of the teeth, and divide it longitudinally by an incision with a fine saw, into two equal parts, the body will be found to be hollowed into a cavity of some size, which diminishes gradually as it extends through the length of the root or roots, until it terminates at the extremity of the fang, in the minute opening through which the vessels and nerves enter to supply the pulp. This is the "*Cavitas Pulpæ*," (the cavity of the pulp,) commonly called the dental cavity. It varies in shape and extent, in accordance with the outward form of the tooth. Its contents present to the eye a soft, pulpy, granular mass, which is made up of a cellular base, enclosing nerves and numerous blood-vessels. This substance, the pulp, was originally the secreting structure of the tooth, and is now the medium by which the changes required by nutrition and sensibility are still maintained in this organ.

The membrane which covers the outer surface of the root, is reflected over the inner surface also, investing the pulp, and forming a complete and exquisitely sensitive lining to the dental cavity. There can be no doubt in the mind of even a superficial observer, that blood vessels and nerves are plentifully distributed to the dental pulp, and

its investing membrane, but that vessels enter by minute branches into the dense structure of the tooth-bone has not hitherto been proved. My own observations incline me to the conclusion, that there is no circulation of fluids through the ivory, by means of vessels, but that the requisite nutrition is supplied by the imbibition of fluids from the pulp through the tubuli,* which commence by open mouths upon the walls of the dental cavity.†

The investigation of these tubes, and of their contents, is a point of extreme importance to the practical dentist. On the solution of the question, as to the manner in which the materials for its support reach the tooth-bone, rests the discovery of the proximate cause of decay, and the knowledge of this would doubtless facilitate and improve the remedial measures adopted to counteract the morbid influence.

The opening at the extremity of the root,‡ through which the vessels and nerves enter to perform their respective functions, is so minute in the perfect tooth, as to be barely perceptible to the naked eye. The extreme tenuity of the vessels themselves, then, may be conjectured, when it is known that through this opening pass the branch of the artery conveying the pure blood for the nutrition of the tooth, and the stimulation of the nervous substance; the vein which returns the im-

* Plate VI. fig. 3. † Ib. fig. 5. ‡ Plate V. letter *i*.

pure blood; and a branch of the fifth nerve, to supply sensation; and to these is added, by some, an absorbent vessel.

The arteries which supply the jaws, and from which small branches are given off to transmit the requisite proportion of blood to the pulp of each tooth, are derived from the internal maxillary branch of the external carotid, one of the large arteries of the neck; whilst the veins by which the blood is returned, terminate in the external and internal jugular veins.

The source and distribution of the nerves which supply the teeth, is a subject worthy of the closest attention of the dentist; for, without a good knowledge of the intimate connexion existing between all the organs of the body, inclusive of the teeth, by means of nervous communications, it would be impossible for him to comprehend or explain the innumerable sympathetic painful impressions and feelings, which occur in the dental organs from this association with other parts of the body.

In addressing the unprofessional reader, for whom this book is principally designed, I must content myself by observing generally, that the teeth are supplied by branches from a large nerve derived from the upper part of the spinal marrow, and called the fifth pair of nerves, (trigeminus, trifacial.) The fifth is the nerve of sensation for the entire face, in addition to the teeth; and it is to this cir-

cumstance that we attribute the frequent association of pains in the face with those of the teeth. In truth, in many instances the nerves supplying the teeth are the first affected, and communicate secondarily a painful affection to the face. And this the more readily results from the circumstance, that the nerves of the teeth, after quitting the jaws, actually terminate by being distributed upon the face. Again, all the important organs of the chest, as the heart and lungs, — and all those of the inferior cavity, as the stomach, intestines, liver, spleen, kidneys, &c., are supplied by two large and important nerves, which extend throughout the whole length of the trunk of the body, and communicate, with very few exceptions, with all the rest of the nerves of the system, viz. with those derived directly from the brain and spinal marrow. By means of these nerves, the sensations of the most distant organs are brought into relation with each other; disease of a part very far distant may give rise to toothache, of which we occasionally see instances in the dependence of this disagreeable pain upon pregnancy, or disordered digestive organs; hence, in common parlance, such pains and sensations have been called sympathies, and the nerves themselves the sympathetic nerves.

Such of my readers as may feel curious to explore more deeply the source, distribution, and con-

nexions of the nerves of the system, in relation with the face and teeth, I must refer to an exquisitely beautiful little work on anatomy by my friend Mr. Erasmus Wilson,—the "Anatomist's Vade Mecum."

Numerous are the instances detailed by authors, and many have come under my own observation, in which nervous affections the most remote, and the most serious, have been induced, and their violence kept up, by the irritation of decayed or unhealthy teeth: many discharges from the mucous membranes are perpetuated by this fruitful source of irritation: many hysterical affections, anomalous pains in the uterine organs, symptoms simulating intermittent fevers, convulsions, palpitations of the heart, &c., &c., may be traced to this origin.

Thus it may fairly be assumed, that by means of this complex communication of the nervous system, the affection of a dental nerve, *the common consequence of exposure of the dental cavity by decay, of pressure upon the pulp, of the presence of loose stumps in the gums, of an accumulation of tartar round the necks of the teeth, or indeed of any irritation,* may be accompanied by pain in any part of the head or face, in the ear, and in other more remote parts of the body. It will follow also, that in many cases of neuralgia or tic douloureux, where the symptoms are of a local character, relief may be sought and

obtained in the removal of decayed teeth or stumps, or of any other causes of irritation from the gums and contiguous parts.

ARTICULATION OF THE TEETH.

The alveolar process * of the jaw is so termed from presenting in its matured state a series of cavities or cells into which the roots of the teeth are implanted. These cavities correspond in number with the roots of the teeth, each root being provided with its respective alveolus.

The structure of the alveolar process is osseous, but differs considerably from the texture of the maxillary or jaw-bone, of which it forms a part; this difference consisting in its inferior density, and in its more spongy nature and appearance. It may be considered as being composed of two principal plates, one placed externally, the other internally to the roots of the teeth, with numerous transverse partitions of variable thickness passing between them. These latter circumscribe the alveoli, and at the same time separate the adjoining teeth to a proper distance from each other.

The interior of each alveolar cavity is lined, and so much of each tooth as constitutes the root is

* Alveolus, a socket or cell, from bearing some resemblance to the cells of a honeycomb.

invested by a delicate and sensitive membrane well supplied with blood-vessels. These membranes, although in close contact, are nevertheless perfectly distinct the one from the other, and intervening in this manner between the root of the tooth and the sides of the cavity in which it rests, they assist in preventing the shock of severe pressure from being communicated to the jaw. In this action they frequently receive extensive injury, the effects of which, though exceedingly painful, are unimportant as compared with injury to the jaws, and are easily allayed. They also tend to retain the teeth firmly in their position.

The osseous tissue of the alveolar processes is of an elastic and yielding nature, and is most admirably adapted to the purposes for which it is designed, namely, the prevention of vibration, enabling the teeth more readily to withstand the shock of forcible action, and allowing their removal when necessary, without the fracture and injury which must have resulted, had they been composed of a more compact and solid material.

ANATOMY OF THE GUMS.

The gum is a peculiar substance, possessing all the pliant and accommodating properties of a fleshy organised texture, with a firmness almost approaching to fibro-cartilage. In these particulars it is

admirably adapted for the office which it fulfils, clasping the necks of the teeth without any organic connexion with them, and resisting the pressure of hard substances introduced into the mouth. The gums are endowed with a low degree of sensibility, but are richly supplied with blood-vessels which terminate near to their surface in an intricate capillary plexus.

The surface of the gums is invested by mucous membrane, which is continuous with the rest of the mucous membrane of the mouth, and, through its means, with the common gastro-pulmonary mucous membrane which lines the interior of the lungs, and of the stomach and alimentary canal throughout their entire extent. It is upon this continuity of structure that depends the remarkable sympathy which I shall have occasion to advert to in the chapter on diseases of the gums, as subsisting between these organs and the stomach, and with the rest of the cavities lined by the same mucous membrane.

Like the rest of the mucous membrane of the mouth, that which covers the gums secretes from its surface a protective covering or epithelium, analogous to the thin horny layer which invests the exterior of the body, the cuticle.

This epithelium* "in the mouth is composed of laminæ of oval vesicles and thin angular scales,

* Wilson's Anatomist's Vade Mecum, p. ~~458~~ 570.

both possessing central nuclei. The vesicles form the deepest layer, and become gradually flattened and condensed as they approach the surface."

The teeth derive their support and solidity, firstly, from their insertion into, or articulation with, the alveolar processes of the maxillary bones: secondly, from the close embrace of the gum around a small space between the edge of the alveolus and the terminal line of the enamel; thirdly, from the membranous lining of the alveolar cavity and of the root; and, fourthly, from the mutual lateral pressure of each tooth against its neighbour. It may farther be inferred that some little support is afforded to the tooth by the vessels and nerves which enter it from the bottom of the alveolar cavity, by the minute opening at the extremity of the fang.

TARTAR GLANDS.—In that portion of the gum which surrounds the necks of the teeth are situated a considerable number of small sacs, or follicles, which open upon the surface of the gum, and pour out a peculiar secretion containing an abundance of calcareous matter. This calcareous substance is held in solution by the secreted fluid, but becomes deposited by degrees upon the teeth close to their junction with the gum, and constitutes the disagreeable incrustation which is called tartar. The tartar glands or follicles are best seen in the gums of the child at birth, where they seem to

serve the purpose of lubricating the gums by their secretion. When these glands sympathize with irritation or disordered action taking place in the stomach, the secretion contains an excess of calcareous matter, which increases around the teeth in such abundance as to separate the gum, produce absorption of the alveolar process, and thereby loosen the teeth, and cause them eventually to fall out. It is on this account that the removal of the tartar by scaling becomes one of the most important of the operations in dental surgery, for the *preservation of the teeth.*

The chemical composition of the tartar, according to Berzelius, is the following:—

Phosphate of lime and magnesia	79· 0
Salivary mucus	12· 5
Salivary matter	1· 0
Animal matter	7· 5
	100· 0

MUCOUS GLANDS.— Besides the tartar glands which are situated in the gums, there are numerous minute glands which occupy every part of the mouth, and are located immediately beneath the mucous membrane. These are variously named according to their position; some, from lying beneath the mucous membrane of the lips, are called labial glands, (labium, a lip;) those of the cheeks are named buccal glands, (bucca, a cheek;) but the

most numerous are imbedded in the hard and soft palate, and are called the palatal glands. The whole of these glands pour out a mucous fluid to lubricate and keep in a soft and moistened state the interior of the mouth: the teeth are, as I shall have occasion at a future page more particularly to show, materially affected in their healthy condition, and strikingly in their beauty of appearance, by the fluids with which they are surrounded. I have therefore deemed it a part of my duty to direct the attention of those who wish to protect their teeth, to the necessity of preserving a healthy condition of these fluids.

SALIVARY GLANDS.—By far the most important, however, as the most abundant in quantity of the fluids of the mouth, is the saliva. This secretion is derived from three pairs of large *salivary glands* situated in close proximity with the mouth;—the largest of the three is placed at each side of the face behind the jaw, and immediately in front of the ear: hence it is named Parotid, (παρα, near, οὖς, ὠτος, the ear.)

The second pair, in relation to size, are situated directly below and under cover of the sides of the jaw: hence they are named sub-maxillary, (*sub*, under, and *maxilla*, the jaw,) and popularly the kernels of the ear. The third pair is placed immediately beneath the tongue, and is therefore named sub-lingual (*sub*, under, and *lingua*, the tongue).

The secretion of these glands, the saliva, is poured into the mouth by means of several small openings; the opening of the tube or duct of the parotid gland is situated at about the middle of the cheek. That of the sub-maxillary glands opens on each side of the tie of the tongue; and the sub-lingual glands pour their secretion into the mouth by numerous small openings occupying the same situation.

The office which the saliva is intended to perform in the animal economy, is to assist in the conversion of the food into the state of a soft pulp, by mingling with it during mastication. But being, as I have above stated, one of the fluids brought into relation with the teeth, the latter organs are more or less affected by its healthy and natural condition.

The solid matter contained in saliva is one per cent. in quantity, when freshly secreted, and during a meal it is alkaline; during fasting, and when it has remained for some time in the mouth, and exposed to the action of the atmosphere, it becomes acid. According to the analysis of Tiedemann and Gmelin it contains—

Mucus.	Albumen.
Salivine.	Fatty Matter.
Osmazome.	Salts.

The salts, according to Mitscherlich, are,

Muriate of potass - - -	0·18	per cent.
Lactate of potass - - -	0·094	
Soda - - - - - - - - -	0·188	
Lactic acid - - - - - -		
Phosphate of lime - - -	0·017	
Silex - - - - - - - - -	0·015	

Salivine is the peculiar animal principle of saliva, and gives to that fluid its characteristic odour. It is one of those quaternary proximate animal principles that contains a large proportion of nitrogen, and is therefore highly decomposable.

CHAPTER II.

DEVELOPEMENT AND GROWTH OF THE TEETH.

Number of the Teeth.—In the human being, Nature furnishes two distinct sets of teeth,—the one adapted to the wants of infancy, and the size of the jaws at that period; the other to the uses and increased growth of adult age. The first or temporary set (the shedding or milk-teeth) begin to make their eruption from the gums at about the seventh or eighth month after birth. They are usually ten in number in each jaw; namely, four front teeth, the central and lateral incisors; two cuspidati, popularly named eye-teeth; and four molares, or grinding teeth.

There exists considerable variation both with regard to the period and the order in which the teeth first burst through the gums. Instances are on record in which children have been born with one or two or more teeth protruding;* and, on the other hand, cases

* I have now before me the jaws of a child, which died immediately after birth. In the upper jaw, the two central in-

are not unfrequent, in which their appearance has been delayed until the fourteenth or fifteenth month; and even to a much later period. The teeth of the lower jaw precede those of the upper, and the sixth or seventh month may be taken as the average date of their first appearance.

The following table gives the periods as well as the order in which the teeth of the first set may be looked for:

From 6 to 8 months	the 4 Central incisors.
„ 7 — 10 . . .	4 Lateral.
„ 12 — 16 . . .	4 Anterior molares.
„ 14 — 20 . . .	4 Canines.
„ 18 — 36 . . .	4 Posterior molares.

The first dentition of infants is frequently accompanied by severe and alarming symptoms, requiring prompt and cautious treatment. The consequences of neglect or mismanagement may indeed prove destructive to life. These cases are entirely out of the province of the dentist, and belong exclusively to the experienced medical practitioner.

FORMATION OF THE TEETH.

The state of science as regards the origin and developement of the teeth has been most materially aided in its advance by the diligent and most mi-

cisors are distinctly visible; whilst in the lower, one of the centrals has risen fully the eighth of an inch above the surface.

nute investigations of Mr. John Goodsir, jun., who has published the results of his labours in the "Edinburgh Medical and Surgical Journal of January 1839."

An abridged and careful abstract of this paper has been given by Mr. Erasmus Wilson in the "Anatomist's Vade Mecum," in which all the facts collected by Mr. Goodsir are retained, while their connexion is placed in a more simple and concise form. From Mr. Wilson's narrative, I have selected such passages as will be likely to convey to my readers' mind a knowledge of this truly interesting subject, and I have farther endeavoured to facilitate this object by giving an enlarged copy of Mr. Goodsir's illustrations. (See Plates I, II, III, and IV.)

At the *sixth week*, or a little later after conception, each jaw of the *embryo* presents the following appearances, viewed from without inwards:—Externally, and forming the boundary of the mouth, is a semicircular fold; this is the lip; next is a deep groove lined by the common mucous membrane of the mouth, which separates the lip from the future jaw; then comes the external alveolar ridge; then another groove in which the germs of the teeth are developed, the *primitive dental groove;* the next line is the rudiment of the internal alveolar ridge; and lastly, the rudiment of the future palate is seen bounding the whole internally. At the *seventh week*, the germ or papilla of the first or anterior temporary molar of

the upper jaw is apparent, projecting from the mucous membrane lining the floor of the primitive dental groove; at the *eighth week*, the germ of the canine tooth, and at the *ninth week* those of the four incisors, may be seen; and at the *tenth week* that of the second temporary molar makes its appearance, immediately behind the anterior molar; so that at this period the germs of the whole of the ten deciduous or shedding-teeth are quite distinct in the primitive dental groove of the upper jaw. Those of the lower jaw are a little more tardy. From about the eighth week the *deep portion* of the primitive dental groove becomes contracted; laminæ of the mucous membrane which lines it are thrown up, which increase in growth and envelope the papillæ or germs in follicles—little sacs—with open mouths. By the *thirteenth week* the whole are thus enveloped. From this period to the *fifteenth week*, small membranous processes are developed from the mouths of the follicles, which serve the purpose of opercula, (or covers,) and, closing over, convert the follicles into dental sacs. At the same period the papillæ have assumed the shape of the teeth they are intended to produce, and have become *pulps*.

The *deep portion* of the primitive dental groove, with the exception of a small space at the posterior part being thus closed in, that *portion nearer the surface of the gum* is still left open, and as it serves for the developement of all the permanent

teeth, with the exception of the anterior molares, it is called the *secondary dental groove.* During the fourteenth and fifteenth weeks, the rudiments of the follicles or *cavities of reserve* of the four permanent incisors, two canines, and four bicuspides, (the small grinders,) are developed immediately to the inner side of the closing opercula of the follicles of the shedding-teeth. As the secondary dental groove closes, these follicular inflections of the mucous membrane are converted into closed cavities of reserve, which recede from the surface of the gum, and lie in close contact with the dental sacs of the shedding-teeth. At about the fifth month, the anterior of these cavities dilate at their lower extremities, and a papilla projects into their fundus, constituting the rudiment of the germ of the permanent tooth. At the same time opercula are developed at their smaller or proximal extremities, by which they are converted into true dental sacs.

During the fifth month the posterior part of the *primitive* dental groove, behind the sac of the posterior temporary molar, has remained open. *In it has developed the germ and follicle of the first permanent molar.* Upon the closure of this follicle by its opercula, a large cavity of reserve is formed in the secondary dental groove immediately over it, lying in contract with the dental sac of the first permanent molar below, and with the gum above. In this state it remains until the seventh or eighth

month after birth, its position during the intervening period having been affected only by the pressure backwards of the first permanent molar by the temporary teeth, and the sacs of the anterior permanent teeth. At this time the jaws having sufficiently increased in length to permit the return of the first permanent molar to its proper position, a papilla is developed from the fundus of the cavity, and the dental sac of the second permanent molar is formed. A portion of the great cavity of reserve still remains in connexion with the superficial side of the sac. As the jaws still increase in length, backwards, the dental sac of the second permanent molar descends from above the sac of the first, and falls into the same curve. The remainder of the cavity of reserve again dilates for the last time,—developes a papilla and sac in the same manner, and forms the *third permanent molar*, or wisdom tooth."

GROWTH OF THE TEETH.

Immediately that the dental follicles have been closed by their opercula, the *pulps* become moulded into the form of the future teeth, and the bases of the molars divided into two or three portions representing the future fangs. The dental sac is composed of two membranous layers,—an internal or vascular layer, and a cellulo-fibrous layer. Upon

the closing of the follicle, this membranous structure becomes *a shut sac*, interposed as it were between the pulp, which it invests, and the structure of the jaw, to which it is adherent. Its inner surface is free, being separated from the pulp by an intervening cavity. As soon as the moulding of the pulp has commenced, this cavity increases, and becomes filled with a glutinous granular substance—*the enamel organ.* At the same period (the fourth or fifth month of intra-uterine existence) a thin lamina of ivory is secreted by the pulp, and deposited on its most prominent point. If the tooth be incisor or canine, the secreted layer has the form of a small hollow cone; if molar, there will be four or five small cones corresponding with the number of prominent points on the future crown. These cones are united by the secretion of additional layers, the pulp becomes gradually surrounded, and diminishes in size, depositing fresh layers as it retreats, until the bony substance of the body of the tooth, and great portion of the fang, is completed, and the pulp *proper* of the dental cavity alone remains."

Eruption.—The tooth being so far perfected that the fang has attained to the bottom of the socket, its point presses against the deep surface of the gum, and, assisted by the contraction of that portion of the primitive dental sac which still envelopes it, *bursts through the gum*, and is drawn upwards with a

rapidity more than commensurate with the still continued growth of the fang. A space is thus formed at the bottom of the socket, in which the completion of the apex of the fang is speedily effected.

During the progress of these changes, the developement of the sponge-like structure already described, the alveolar "process," has been perfected.

Amongst the interesting and extraordinary facts regarding the developement of the teeth which may be elicited from the foregoing account, the following are prominent:

That the human teeth originate from the mucous membrane covering that portion of the embryo which ultimately forms the jaws:

That the process commences at about the sixth week of intra-uterine existence, and extends over the whole period between that and the twenty-first year:

That the manner of developement of the deciduous teeth is common to the whole set; but that as regards the permanent teeth, there is a remarkable peculiarity in the formation of the *anterior permanent molares*, which, although they constitute, perhaps, the most efficient of the permanent set, are nevertheless developed from the *primitive* dental groove, so far partaking of the character of *milk-teeth;* whereas the ten anterior permanent teeth, as well as the two situated behind the anterior per-

manent molares, namely, the second and third molares, are developed from the *secondary dental groove:*

A striking proof of some peculiarity of formation of the anterior permanent molares is afforded by the frequency of a simultaneous decay of these four teeth at a very early period:

That at the earliest stage of developement of the ten anterior permanent teeth, they actually occupy a position *nearer the surface* than the germs of the temporary teeth; that as these last increase in growth, together with the surrounding structures, the rudimentary sacs of the permanent teeth appear to proceed deeper and deeper behind the advancing temporary teeth, until at the period of eruption of these, and up to the time of their change or shedding, the permanent teeth have attained a position nearly the reverse of that in which their primary developement took place:

That the mode and period of the developement of the second and third molares differ from that of the other permanent teeth, the germination of the third being dependent on that of the second, and on the sufficient lengthening backwards of the jaw-bones. The tardy appearance of the third molar or wisdom-tooth, and its occasional deficiency, are thus accounted for:

That although during their formation they lie in such close contact, yet the completion of developement and growth of the permanent teeth is inde-

pendent of the presence of the shedding-teeth, and may be perfected in due time, although the shedding-teeth may have been prematurely removed, provided that during the removal no extensive injury have been inflicted on the *secreting membranes* of the permanent teeth.

MEMBRANES.—The limits of this little work do not permit, neither does its object require, a complete enumeration and description of the membranes of the teeth,* a subject respecting which considerable difference of opinion still prevails amongst the highest authorities.

THE PERMANENT TEETH of the adult are thirty-two in number: namely,

4 Central incisors.
4 Lateral ditto.
4 Cuspidati or canines.
8 Bicuspides.
8 Molares (proper).
4 Dentes Sapientiæ.†

* I am now engaged in the investigation of these structures, and trust I shall be enabled, at no very distant period, to lay the results before my readers. (January 1841.)

† The last four are in fact also molares, but from their late appearance in the jaw, and uncertain growth, it is usual to class them separately. In many instances they will be found in the upper jaw only; in some they seem to be altogether wanting; whilst in others, either in consequence of their extreme sluggishness of growth, or imperfect formation, they rise through the gum in such a decayed state, as to prove wholly unserviceable. They are seldom visible before the age of eigh-

The following table indicates as nearly as possible the periods of eruption of the permanent teeth.

	yrs.	yrs.
The Anterior, or first permanent molares, from -	6 to	7
Central incisors - - - - - - -	7	8
Lateral do. - - - - - - -	8	9
Anterior bicuspides - - - - - -	9	10
Posterior do. - - - - - -	10	11
Cuspidati - - - - - - - -	11	12
Posterior, or second molares - - -	12	13
Third molares, or dentes sapientiæ - -	18	20

The teeth of the lower jaw commonly precede those of the upper by two or three months.*

teen or nineteen, and sometimes their presence is not discovered until a much later date, (even so late as fifty or sixty.) From the peculiarity of their late appearance, they have been named "dentes sapientiæ,"—wisdom teeth,—teeth of manhood.

* Derivation of names used to distinguish the teeth.

Incisor—Incisores. - { From the Latin. *In*, signifying into, and *scindo*, to cut.

Cuspidatus—Cuspidati - { From the Latin. *Cuspis*, a dart or spear—spear-shaped; called also, *Canines*, from *Canis*, a dog; in consequence of their resemblance to the tusks of the dog.

Bicuspis—Bicuspides - { From the Latin. *Bis*, twice; and *Cuspis*; double-pointed.

Molaris—Molares—From the Latin. *Molo*—to grind.

Dentes Sapientiæ—Latin—signifies, literally, teeth of wisdom.

POSITION, FORM, AND USES OF THE PERMANENT TEETH.

There is a regular gradation in the size, form, and uses of the teeth, from the incisors to the molares; the cuspidati holding a middle place between the incisors and the bicuspides, and the last being in every respect intermediate between the cuspidati and the molares.

Incisors.—The incisors, four upper and four lower, are situated centrally in front of the jaw. They are distinguished into "central" and "lateral" incisors. The central, when viewed from the front, are considerably broader, and somewhat longer than the lateral. When viewed from the side, their form resembles that of a wedge, the cutting edge being the thinnest part. From the edge, the incisor enlarges gradually as far as the neck, and thence as gradually decreases to the extremity of the root. It has but one simple root, which is nearly round in the upper, and somewhat flattened at the sides in the lower jaw. The root of the upper central incisor is larger and longer than that of the lateral. Their use, as their name implies, is to cut into, or divide, the food, their action being that of a pair of shears. They also assist materially in the articulation of sounds.

Cuspidati, (popularly, Eye-teeth.)—Next to the lateral incisors stand the cuspidati, two upper and two lower. The cuspidatus is the strongest tooth in the jaw. The body is not so much flattened as that of the incisor; is pointed in shape, more so in the upper than in the lower jaw, and is covered to a greater extent by the enamel. It is longer than the rest of the teeth, both from the edge or point to the neck, and from the neck to the extremity of the fang, which is single and rather flattened. On each side of the root a slight groove may generally be traced, indicating an approach to the change which takes place in the root of the next tooth, (the bicuspis,) viz. a division into two branches The cuspidati appear to be intended to lay hold of and tear the food.

Bicuspides.—The bicuspides, four upper and four lower, more commonly known as the "small grinders," stand next behind the cuspidati, two on each side of the jaws. These teeth belong only to the permanent set, the position they occupy in the jaws having been the seat of the anterior and posterior molares of the temporary set. A peculiarity, of importance as regards the regular arrangement of the teeth, attaches to the bicuspides; viz. they are less in size than the shedding-teeth which preceded them, whereas all the rest of the teeth making up the adult set, which replace similar teeth of the temporary set, are somewhat larger. This de-

crease in volume of the bicuspides, aided by the increased growth of the maxillary bones, counterbalances the difference in the space required by the enlarged anterior teeth of the permanent set, and permits their regular and uniform arrangement. The first or anterior bicuspis, from the edge to the neck, is somewhat smaller than the posterior, but the root is larger, approaching more nearly the length of that of the cuspidatus. On each side is a deep groove, running from a little above the neck to the extreme end of the root, where it forms a complete division into two branches. This is the first positive step in the change from the single to the double-fanged tooth, and is more marked in the upper than in the lower jaw. In the posterior bicuspis the change is often complete. The body of the bicuspis also approaches the shape and breadth of the molaris, terminating in two points, (whence its name,) the crown of the posterior being wider than that of the anterior. The bicuspides are used partly in tearing, partly in masticating the food.

Molares.—The molares (proper) are eight in number, four in the upper, and four in the lower jaw. They stand next behind the bicuspides, two on each side, and far exceed the rest of the teeth in size. The enamel on the grinding surface of these teeth, where they come in contact with their antagonists of the opposite jaw, is much thicker

than on the sides, and presents four or five prominent points, with corresponding depressions. These are so arranged that, in closing the jaws, the points of the upper teeth adapt themselves accurately to the depressions of the lower, and *vice versâ*. The molares of the upper jaw have always three roots, and sometimes, but very rarely, four or five, whilst those of the lower jaw are furnished with two only. Of the three roots of the upper molares, two are placed externally as regards the maxillary bone, and are directed straight upwards, nearly parallel with each other. The third root inclines inwards towards the palate or roof of the mouth. This arrangement of the roots secures to these teeth the firmness required in the discharge of their office of grinding and masticating the food, whilst, by their divergence, all interference with the "*antrum maxillare*," the bony cavity of the cheek, is avoided. The roots of the lower molares run in nearly a straight line downwards. They are flattened at the sides, and somewhat broader than those of the upper jaw.

Dentes Sapientiæ.—The four remaining teeth are the wisdom teeth.* As regards the body and crown, they are less in size and more rounded than the molares (proper). The points and depressions on the surfaces are not so strongly marked: the roots are shorter. In the upper jaw, three, four, or five

* See Note, page 37.

roots may sometimes be distinctly traced out, but they are generally so far united as to form in effect but one short cone-shaped root, and when this is the case the tooth is not so firm, and may be easily displaced. Sometimes, however, the roots are separate and much curved, and then it becomes a matter of difficulty, and requires care and skill to effect its removal with safety. This observation applies more particularly to the wisdom-teeth of the lower jaw, where the root generally divides into two or three branches, more or less united, and curving backwards into the more solid portion of the maxillary bone.

The use of the dentes sapientiæ is to assist in the process of mastication.

CHAPTER III.

ORDINARY DISEASES OF THE TEETH AND GUMS.

TOOTHACHE.—The immediate cause of this intolerable pain is *inflammation*. Whether it be induced by cold, by violence, by exposure, by denudation, by pressure on the nerve, or by other effects of decay of the teeth, still inflammation is the precursor and agent of toothache. What, then, is the course of treatment which naturally recommends itself to our attention? The adoption of all the means in our power; *firstly*, to prevent the occurrence of inflammation, by keeping the teeth and gums free from all external causes of irritation; and, *secondly*, when pain has supervened, to procure the immediate removal of all such causes.

There are two kinds of toothache, which I am in the habit of distinguishing into *true* and *false*, though both are equally the result of inflammation.

One cause of *false* toothache is the irritation of the nerves at some point of their course, when, although the actual seat of mischief may be more or less distant, yet, by means of the great sympathetic nerve and its branches, the sensations will be conveyed to the teeth.

Another and more common cause is the inflammation of the lining membranes of the root and socket of the teeth, induced either by violent contact with some hard substance, or, as is very frequently the case, by cold. When these membranes become the seat of inflammation, pain closely resembling true toothache is felt, but it is seldom confined to one tooth alone; the pain is general and undecided; the tooth or teeth affected seem suddenly to have increased in size, for in closing the mouth they appear to come in contact with those of the opposite jaw sooner than the others. This is in fact the truth; for the swelling of the two lining membranes attendant on their inflammation is sufficient, to raise the teeth in their sockets, and cause them to project farther than usual into the mouth.

Many persons, suffering thus from *false* toothache, and falling into the hands of ignorant or unprincipled practitioners, are deprived of a sound and most useful tooth; whilst, if a proper course of treatment had been adopted, such as—removal of all irritating causes, followed by some simple means of

depletion, namely, the application of a leech, or free scarification of the gums, or even the administration of a simple aperient, the symptoms complained of would have been speedily subdued.

When *true* toothache has been established, there are several *palliative* remedies which may be successfully employed before the last resource, extraction, is resorted to. It is with a most unwilling hand that I ever deprive a patient of a tooth, unless it be clearly apparent that the sacrifice of one partly decayed will materially assist in preserving another comparatively sound. The loss of a tooth from either jaw is a matter deserving of far more consideration than is usually bestowed upon it, and should never be incurred without serious reflection.

DECAY OF THE TEETH.

The common cause of *true* toothache is *decay of the body of the tooth.* There is considerable uncertainty and variety of opinion existing as to the manner in which the disease originates. It is an action "sui generis," the result of some unhealthy affection of the parts forming the bony substance of the teeth. It is certainly not "*gangrene*," as writers usually term it; at least if the definition given by the most eminent pathologists be a correct one, by whom "*gangrene*" is described as "*a state of the*

parts not absolutely incapable of recovery." It commences not, as generally supposed, *upon* the enamel, but immediately *underneath* that layer, upon the face of the bone. It will be remembered that the enamel is composed of crystalline fibres nearly indestructible, and consequently insusceptible of decay.

My own opinion with regard to the formation of decay is founded upon the endosmotic phenomena which I suppose to be taking place in the structure of the tooth. Thus, as no blood-vessels are traceable into the texture of the ivory, I conceive that the animal part of this structure derives its nutrition from the colourless liquor sanguinis imbibed by the tubuli from the vessels of the pulp. This mode of nutrition is seen in various of the tissues of the body, as for instance in cartilage, in the cornea, &c. That the tissue of the tooth is imbued with fluid, is evident from its solidity and colour; and also from its difference of weight in the fresh and dried state. This fact may be easily illustrated by immersing a dried tooth in water, when it is observed to absorb a considerable proportion of the water, and become materially changed in its density.

Now I think that I am warranted in inferring, that the nature of the fluid permeating the tooth from the vessels of the pulp is, in the normal state of the system, always similar.

On the other hand, the crown of the tooth may be regarded as being immersed in the salivary fluid by which it is constantly surrounded, and, as we know, this fluid undergoes a change from alkaline to acid by simple exposure to the influence of atmospheric air within the mouth. Again, from containing a large proportion of nitrogen, the saliva is constantly subject to a change in character from decomposition; and, lastly, the fluids of the mouth are obviously very much affected by the state of the stomach, and disease of various kinds.

Now in the above statement we have the precise conditions which are best calculated to induce an active endosmosis; an alkaline fluid contained within the tubular texture of the tooth, an acid fluid externally, the two being separated by an animal tissue. To question the existence of endosmosis under such circumstances would be to dispute the first principles of physiological science. But what, asks my reader, are the results which I deduce from my positions? They are important, and the following. In the first place, it is by this process that the colour of the teeth is altered in disease;—that they become yellow and discoloured during illness, by the transudation or endosmosis of discoloured and morbid fluids. And by the same process they are capable of regaining perfectly their original and wonted whiteness.

Secondly, I regard this endosmosis as the means

by which the calcareous matters are first dissolved, and secondly removed in a state of solution from the tubuli, leaving behind only the animal texture of the ivory, and thus establishing decay. I may be asked why, admitting my proposition, the decay should be localized to a single spot? Why should not all the tubes be affected similarly and simultaneously? My reply is, that the part most likely to be attacked, and that which under the above circumstances I believe to be affected, is one which is already placed in a morbid condition, either by imperfection of developement, or by injury to the tubular structure from pressure, &c.

The first indication of the existence of decay of the ivory of the tooth, is a slight discoloration, which is perceptible through the semi-transparent enamel.

Decay progresses much more rapidly in some individuals than in others. The bone becomes softened by the removal of the earthy or calcareous part, leaving the organic or animal part behind, and is destroyed in a direct line from the surface towards the centre of the tooth, in the course of the tubuli. The base on which the enamel rested is thus removed, some accidental pressure in masticating bears upon the spot, the enamel breaks down, and a cavity is suddenly found to exist in what had probably, hitherto, been deemed, by the unsuspecting owner, to be a sound tooth.

If the disease have proceeded far towards the centre, the dental cavity becomes partly or entirely exposed, inflammation of the lining membrane and pulp takes place, and *true* toothache is the immediate result.

Decay makes its appearance most frequently beneath the grinding surfaces of the molares, and on the sides of the teeth, where they come in contact with their neighbours, or where they are so formed as to offer a favourable lodgment for portions of the food. It also, occasionally, attacks the neck of the teeth, but is scarcely ever found on the roots.

Having once established itself, its destructive effects on the ivory of the tooth are extremely rapid: the enamel, losing its support, crumbles away piece by piece, until the roots alone remain: the vitality of the whole of the ivory being then extinct, the disease appears to have expended itself, for the roots, though dead and extraneous bodies *as regards the ivory*, will remain firm for years in the gums and alveolar cavities, affording a considerable degree of support to the adjoining teeth, and whilst in this state they should on no account be disturbed.

It must have attracted the attention of every practical dentist, as well as of myself, that one situation in the tooth is remarkably subject to decay; I allude to the deep groove which exists upon the surface of the crown of the molares,

and forms the line of separation between the tubercles. The first indications of decay are almost constantly perceived in this situation, and in the course of a groove which is frequently found on the outer side of the first molar of the lower jaw.

In reasoning upon the probable cause of the frequency of decay in these situations, I was at first led to infer that the diseased action must depend upon the collection of fluids, and upon the decomposition of alimentary matter in these grooves. But I must confess that this explanation, although undoubtedly partly applicable to the morbid process, was far from satisfactory, when I reflected that the decay occurred as frequently in the teeth of the upper as of the lower jaw ;—that it affected several teeth simultaneously ;—and was not unfrequently absent in the lower, while it was present in the upper teeth.

Finding, from repeated observation, that in teeth affected in the manner above described, the structure of the enamel was unnaturally brittle, and that the disease followed very accurately the line of the depressions on the crown, I was led to the opinion that the extreme susceptibility to diseased action must depend upon defective formation in this part of the tooth ; and farther investigation has served to convince me that this is really the case.

The mode of formation and growth of the tooth described by Mr. Goodsir throws considerable light

on this point, and affords an explanation of the phenomenon, which to my mind is perfectly satisfactory.

By referring to Mr. Goodsir's explanation of the production of the form of the upper surface of the crown of the tooth, it will be seen that this depends upon the developement of a number of opercular processes corresponding with the number of the tubercles of the tooth. These opercula meet at a line corresponding with the future groove upon the crown, and at this point become joined and continuous with each other, so as to constitute a single membrane, by the vessels of which the enamel fibres are secreted. Now, if we suppose these opercula, in consequence of interference in developement, to approximate only partially and imperfectly, or to unite and form a cicatrix, insufficiently supplied with blood-vessels, the natural consequence must be an improperly formed enamel, and one susceptible of falling an easy prey to the chemical influence of the decomposing fluids lying in contact with it, and imbibed into its texture.

Such, in my opinion, is the real cause of decay so constantly happening in the situation referred to,—a morbid process, which, it will be observed, differs from the ordinary course of disease by commencing in the enamel, and thence extending to the ivory, and not, as is usually the case, affecting first the ivory, and secondarily involving the enamel.

The cementum or cortex of the root, secreted by

the periosteum, (or investing membrane,) is endowed with a higher degree of vitality, and is more nearly analogous to true bone than the ivory. It is nourished, not by the vessels of the pulp, but by those of the investing membrane, and is consequently not so immediately affected by the death and decomposition of the less highly organised structure. Every practical dentist who uses his powers of observation, as well as those of extraction, will bear me out in the assertion, that on the removal of a fang which has remained for some time after the loss of the crown of the tooth, the cementum will be found comparatively sound, whilst nearly the whole of the ivory has been decomposed. This fact accounts for the length of time during which a fang may be usefully retained after destruction of the crown.

During the period that the fangs are allowed to remain, nature is employing means whereby she may rid herself of the presence of the remains of the decayed organ. Absorption of the gum, the alveolus, and of the root itself, is gradually taking place, whilst at the same time a deposition of bone is going on at the bottom of the alveolar cavity, which by degrees forces the remainder of the root from its socket, until it lies imbedded only in the gum, or on its surface, and by the adhesion of the latter is alone retained. As soon as this absorption has advanced so far as to render the roots loose, *they should be removed*, as

their longer retention is not only useless, but is attended by constant and extensive irritation of the gums and sockets, and not unfrequently by abscess and other very painful affections. The operation for their removal is simple, easy, and productive of little or no pain. It is only when stumps are firm, and *ought to be retained*, that the uncalled-for cruelty of "*punching them out*" is perpetrated.

The decay of the body of a tooth is not always accompanied by pain. I have had patients under my care who, although they had lost several teeth in this manner, yet assured me that they had never within their recollection suffered any pain in them: and I have also been enabled at once to fill up large cavities in such cases, when I could not have done so, had the teeth possessed their usual sensibility, without some previous preparation. In these cases I conceive that the decay was so gradual and progressive as to have been unattended with irritation to the pulp and membranes of the socket; and that the pulps were not endowed with the same degree of exquisite sensibility so remarkable in most persons, but particularly in those of a nervous and sanguine temperament.

EXCITING CAUSES OF DECAY.

There are, doubtless, certain peculiarities inherent in the constitution of individuals, which, ex-

erting a morbid influence on the primary developement of the teeth, render them less able to withstand the attack of decay, and perhaps lay the foundation for its origin. In what other manner can the defective state of these organs, which is so frequently common to all the members of a family, be accounted for?

The ordinary diseases of infancy, as well as some of the remedial means employed, especially *mercury*, exercise a very prejudicial effect on the future constitution of the teeth. The too free exhibition of mercury, at any period of life, is followed by most injurious results, both to the teeth and to the structures in their immediate neighbourhood.*

MECHANICAL INJURIES.

Mechanical injuries also tend toward the destruction of the teeth. By mechanical injuries, I mean

* I have in my possession a portion (fully two-thirds) of the lower jaw of a child aged three years, the removal of which became necessary, in consequence of extensive necrosis of the bone. I learnt from the mother of the child, that during an attack of measles, he had been brought into an extreme state of salivation. There is little or no doubt that in this case mercury caused those actions which here terminated in necrosis. I shall be happy to show the preparation to any one desirous of inspecting it. It is rendered the more interesting by the fact that the developement of some of the permanent teeth is distinctly exhibited.

the cracking or breaking off of a portion of enamel, by bringing the teeth into too violent contact either with each other, or with any hard substance. The practice of biting thread, or of using the teeth as a vice, for instance, is especially to be avoided. To this class of injuries may well be added the most absurd and unjustifiable practice of separating the teeth by the *free use* of the file, when they happen to appear rather crowded in the jaw. The use of *deleterious tooth-powders*, so plentifully and unhesitatingly offered as a means of "*whitening and preserving*" the teeth, is another very active excitant of decay. Most of these empirical compounds contain some powerful acid, which, whilst it "*whitens*" the teeth, destroys their protective coating of enamel, and leaves the bony substance an exposed and easy prey to its numerous enemies.

UNEQUAL LATERAL PRESSURE.

Many cases which have fallen under my observation have strongly influenced me in the *supposition* that the mutual pressure exercised by the angle of one tooth upon another, may, when carried to any extent, become an immediate excitant of decay. The infrequency of a decayed state of the incisors of the lower jaw, which are often pressed into very close contact, will perhaps be adduced as an argu-

ment against this idea ; but it must be remembered, that, in such cases, the pressure of the teeth is general and equal over the whole of the lateral surface, and consequently that the transudation of the fluids within the ivory is no more materially affected by it, than is that of a limb which has been carefully and equally bandaged from one extremity to the other. But, in the case of severe and continuous pressure of one point upon another, I conceive that the nutritive function of the tubes may be interfered with, and prevented, so that the action necessary to the vitality of the ivory being interrupted, death of so much of it as comes within the influence of the pressure ensues, and diseased action is set up in the remaining portion : thus decay is engendered, and the mischief proceeds, until the enamel, no longer strong enough to resist, gives way, and a cavity is found in either tooth, exactly beneath the spot where the chief point of contact existed. Or, it may be an endeavour on the part of Nature to avoid the pressure by establishing a new process, viz. absorption or removal of the calcareous matter of the part pressed upon—consequent softening—subsequent breaking down of enamel—and successive continuation of the malady.

Be this as it may, I have no doubt that *unequal lateral pressure* is amongst the principal of the exciting causes of decay, and is another reason for early and proper attention to the teeth. The in-

organic nature and consequent insusceptibility of the enamel are quite sufficient to upset the popular belief that decay is, or can be, communicated from one tooth to another. How, then, are we to account for the decay that is so constantly found to exist between two teeth, in such close contact, that a lodgment of food cannot have been the cause, unless we allow that an undue degree of pressure has produced it? If its origin be spontaneous, why should it not, as frequently, appear upon either face of the tooth?

There are other more remote exciting causes of decay, which, as arising from an unhealthy condition of the gums, will be noticed in connexion with that subject. The most popular supposition with regard to the origin of decay is, that it results from the lodgment and decomposition of particles of food between the teeth, and upon the inequalities of their surfaces.

EROSION OF THE ENAMEL.

Referring to the process of secretion and to the deposit of the enamel, which is the same in the formation of the permanent as in that of the temporary teeth, it may be well to notice a very remarkable affection, totally distinct in its character from the ordinary decay of the teeth, yet if possible more unsparing in its ravages, and more productive of injury

and unsightliness. It generally appears first on the front face of the central incisors, either in patches, or forming a continuous groove across these teeth, from whence it seems to extend gradually in a horizontal direction to the other teeth, utterly destroying the enamel in its course, and exposing the bony structure to the various chances of decay. The teeth thus attacked are generally tender, and extremely susceptible of pain when brought into contact with cold air, or hot or cold liquids.

There are no known means of arresting its progress. Where the disfigurement thus produced happens to lie near the point or edges of the teeth, some little may be effected towards its amendment by a moderate and judicious use of the file; but when it occupies a line nearly even with the edge of the gum, which it very frequently does, nothing can be done.

The cause of this extraordinary disease is evidently an imperfect formation of the enamel, resulting from disturbance of the system, either by ill health, or by the too free exhibition of mercury, during the process of secretion by the membranes of the dental sacs. I have seen several cases wherein two such lines of erosion existed, and have recently had under my care a young lady of delicate health, who had suffered from several severe attacks of illness during her infancy; her teeth exhibited a triple series of this morbid change, one line being situated on the cutting edge of the teeth, a second

midway down the crown, and a third partly above and partly below the terminal line of the enamel. In all these cases I have observed that the line of erosion, though horizontally continuous, deviated slightly according to the order of growth of the teeth affected.

The horizontality of the lines depends upon the successive formation of the enamel, and their direction is indicated in the healthy tooth by the transverse ridges already described * as existing upon the surface of the enamel.

* Page 9.

CHAPTER IV.

REMEDIES AGAINST DECAY—MODE OF TREATMENT CONDUCIVE TO PRESERVATION.

THOSE who possess a due knowledge of the importance of complete digestion to their general health, will be anxious to preserve, unimpaired, the uses of their teeth; and could the possessors of a good set of these most useful organs, by any possibility, experience, for a few minutes only, the annoyances and comparative insufficiency of the best mechanical apparatus which has hitherto been devised to supply their want, how eagerly would they resort in proper time to those measures by which alone they can hope to retain until old age, the powers of mastication which Nature has so liberally supplied!

In the first place, I would advise my readers that their dentist be well selected. Let not the cry of cheap prices induce them to trust their

chance of future comfort to the mercy of a practitioner whose only object is the fee that succeeds his labour, whose only consideration is to plan the means by which he can most quickly transfer that fee to his own purse. The results of true economy are never arrived at by the sacrifice of *quality* to *low prices,* which at best are merely nominal.

If the teeth be properly cared for, and skilfully treated in the first instance, the necessity for artificial assistance will probably never arise, and the expense of it will thus be saved. If the aid of the mechanical dentist be already required, be careful not only that he do his work skilfully and effectually, but that he use the best materials. My readers cannot suppose that any practitioner works for his amusement only; he must have his reward. What, then, can those expect to receive who purchase a set of teeth "*mounted on gold,*" at a price little above the first cost of the materials from which they *should* be manufactured?

I am no advocate for unreasonable and extortionate charges; but it grieves me to see quackery and deception carrying such appearances of prosperity as they do in this city, whilst, if the public would but judge for themselves, and no longer suffer specious and plausible professions to exert such an influence over their decisions, the case would be exactly reversed.

As an example of the trickery to which the

public is subjected by its patronage of this class of dentists, permit me to digress a little in recounting the history of a case, which I will preface with an extract from a daily publication.

"*Loose teeth securely fastened, whether arising from old age, neglect, the use of calomel, disease of the gums or, any other cause,*" *&c. &c. &c.*

A lady, advanced in years, consulted me; her lower front teeth had, by the progress of absorption of the gums and sockets, become very loose; she had yielded to the fascinations of some such advertisement as that above, and had had her teeth "*securely fastened!!*" and so indeed they were! From the appearance which they presented, I concluded that a mass of metallic amalgam, miscalled "*mineral cement,*" had been taken between the finger and thumb of the operator, and pressed into, and between, and upon, the loose teeth, tartar, decayed bone, diseased gums, &c., just as a plasterer would take a dab of mortar on his trowel, and stuff it pell-mell into the crevices of a clump of loose bricks. The amalgam soon hardened, and formed what I can only describe as *one irregular, rough, and mis-shapen mass*, made up of the four loose lower incisors, and the two canines, these two last named, as is often the case, being comparatively firm, and forming props of support to the cement. The result of this plastering dentistry had been extensive inflammation of the gums and neighbour-

ing parts, internally as well as externally, and the patient was undergoing excessive pain and inconvenience.

She was desirous that I should remove "*the fastening*," but as I could not do so without removing the teeth also, and as she was not prepared to submit to this, she left me, and I have since lost sight of the case.

I should be happy to learn some mode by which teeth, loosened in the manner here described, might be *fastened*, in a *proper*, *workmanlike*, *and sufficiently permanent manner*. I know of none, nor do I believe it can be effected. I have heard of loose teeth being perforated so as to admit of a piece of gold or silver wire being passed through them, and secured to some one or two adjoining firm teeth; but this is little, if at all, preferable to the *metallic plastering mode*.

To return to the proper course to be pursued in order to preserve the teeth. It is perhaps of little use to recommend abstinence from hot condiments, from acids, and from fluids taken into the mouth either very hot or very cold, but all of these are injurious to the teeth.

Brush the teeth well, both inside and out, every night and morning, with a moderately hard brush, constructed with three rows of bristles, standing so far apart that the elasticity of the hair may have its full play. Do not confine this operation to sim-

ply moving the brush across the faces of the teeth from side to side, but give it a rotatory, and, as far as possible, a vertical direction, so that the bristles may spring in between the teeth, and free them from the particles of food, and the incipient deposit from the secretion of the tartar glands.

Use, also, some dentrifice, not of too harsh a nature. Prepared chalk, with a little pulverized orris-root, myrrh, bark, and camphor, aided by a very small proportion of well-pounded cuttle-fish bone, is the best powder that can be used. The colouring matter usually employed does not add to its efficiency, and serves only to stain the lips and tooth-brush.

Have the mouth carefully examined at least once in every three months, in order that any deposit which may have formed may be removed before injury has arisen from its presence; that in case of fracture of the enamel, the rough edges may be smoothed before any lodgment has been effected on them; that if decay should have commenced upon any tooth, (which will easily be detected by the experienced practitioner, long before the cavity becomes apparent,) it may be at once extirpated, and the cavity, if it have so far advanced, be properly and effectually filled up. When this course is followed, a fair chance of permanently arresting the progress of the disease, in as far as the cavity under treatment is concerned, is afforded to the

operator; and the operation itself is unattended by pain or inconvenience.

OPERATION OF STOPPING, OR FILLING THE CAVITY.

It is not to be supposed that if one cavity in a tooth have been filled or stopped, as it is termed, and the progress of decay arrested in that spot, that the remainder of the tooth is no longer liable to its attacks. The same causes, whatever they may have been, which have already operated to the disadvantage of the tooth, may continue to exercise their influence, and thus a second cavity may be formed, either close to, or farther removed from the first. The operation of stopping, however, if not too long deferred, will be as successful in the second as in the first instance, and when recourse is had to it in due time, the chances are that the tooth so treated will become as serviceable, and almost as durable, as one perfectly sound.

It is in order to secure to the patient the detection of decay in its incipient state, that I urge a periodical visit to the dentist. The indications of its existence in the earlier stages, before it has penetrated so deeply as to affect the nerve, are so slight, that without close examination, it cannot be discovered. So unconscious, indeed, of his misfor-

tune is the individual whose teeth are thus affected, that even when, by the removal of a circumscribed portion of the enamel, ocular demonstration of the fact is afforded, it is with difficulty that the unwelcome truth is admitted.

It would be well for those who cannot persuade themselves of the necessity of this close attention to the teeth, if, upon experiencing the slightest painful sensation in any particular tooth, on drawing cold air or fluids into the mouth, they would allow their suspicions to be excited, and would at once seek advice. If the unpleasant visit be deferred until pain is experienced continuously, the chances of success are sadly diminished; not that teeth which have been neglected, even until the nerve is partially or wholly exposed, may not be stopped, and rendered serviceable for years, but the operation is then more tedious and painful, and the result more doubtful and unsatisfactory.

MATERIALS FOR STOPPING.

Lead and tin-foil are used for filling decayed teeth; but pure gold, from its power of resistance to the action of the saliva, its unchanging colour, and its great malleability, is the most fitting substance to be employed. The efficacy of the operation will depend, in a great measure, upon the pre-

vious preparation of the cavity, and on the mode of introducing the gold; two manipulations that demand a considerable degree of nicety and dexterity.

PREPARATION OF THE CAVITY.

If the decay be situated on the crown, or on any exposed surface of the tooth, it will be sufficient to perforate the enamel immediately over the spot, if it be not already broken down, and enlarge the opening until a good solid edge is obtained all around it. The decayed bone should then be removed with great gentleness, until *not the slightest particle that had been affected remains*, and the white and healthy ivory is fairly exposed. In effecting this preparation, care should be taken so to shape the cavity, that it shall be a little larger within than at the orifice. If the case have been attended to in proper time, this will be completed without giving pain to the patient. If, however, the decay have been allowed to approach too near the dental cavity, pain will be experienced, and the operator must desist, and have recourse to a different and less desirable mode of treatment. The cavity being properly prepared, it should be repeatedly wiped out with fine wool, until it be entirely free from moisture.

INTRODUCTION OF THE STOPPING.

A sufficient quantity of prepared leaf-gold, cut into strips adapted to the width of the cavity, and laid across and across the point of the stopping instrument, should then be gradually introduced with a firm but equal pressure, until it forms a solid mass, rising evenly with the edges of the opening. The surface of the gold should then be rendered slightly concave, so that the friction of the food, when masticating, may be warded off by the surrounding edges of the tooth; and, after smoothing and burnishing, the operation will be complete.

Experience proves, that the success of filling the cavity, and thereby stopping the progress of decay in its early stage, depends on the removal of every particle of the disorganized bone. There is, in my opinion, sufficient reason to infer, that when the orifices of the remaining healthy cylinders of the tubes of the ivory are laid open by the removal of the diseased structure, some portion of their calcareous contents may be poured out over the exposed surface, and by its presence contribute to render the stopping effective and permanent. And I think I am partly borne out in this opinion by the observation, that the contact of gold with the vital portion of the tooth is rarely productive of inflam-

mation, while the presence of any other foreign body —dead bone for instance—gives rise to a continuance of the disease.

When the decay is situated between the teeth, the bicuspides or molares especially, it will be necessary, preparatory to removing the decayed bone, to cut away the angle of the crown of each tooth (supposing both to be affected) so as to form a cone-shaped space between the two, the necks of the teeth constituting the apex of the cone. This precaution, in addition to facilitating the removal of the decayed bone, and the introduction of the stopping, adds materially to its security, by preventing any subsequent lodgment of food between the teeth. The same course should be followed in treating decay of the incisors, with this difference only, that the removal of such portion of the tooth as the completion of the operation demands, must be effected from the back or inner surface, guarding as much as possible against interference with the enamel of the front face, and thus avoiding the disfigurement that would otherwise follow.

DIVISION BY THE FILE.

Whilst decay of the incisors is in its incipient state, division with an exceedingly fine file, which cuts on one face only, may suffice to remove it.

One rule, however, in reference to all operations on the teeth, I especially desire to impress on my readers; namely, *that under no circumstances is the application of a file, or any other cutting instrument, to the enamel of a* SOUND TOOTH *justifiable.*

Meddling with the enamel of a *decayed* tooth even, is injurious; it is an evil, and so is decay; but of the two, decay is the greater, and its existence justifies recourse to any proper means of eradicating it.

CEMENTS.

When, in preparing the cavity for stopping, the operator discovers that the disease has been allowed to progress too far towards the pulp, and that too slight a plate of healthy ivory remains to shield that structure, no attempt should be made to introduce a stopping of gold. The degree of pressure necessary to consolidate the stopping would overcome the resistance of the healthy bone, and force it into undue contact with the membrane of the dental cavity. The results would be inflammation and acute pain, entailing most probably the loss of the tooth. In this case the use of a cement* formed of *a precipi-*

* The stopping so continually advertised under the title of "*mineral cement*," "*succedaneum, marmoratum*," &c. &c., is a similar preparation, alloyed with baser metals.

tate of pure silver may be successfully employed, as it is introduced, in a soft state, with but very little pressure, and quickly hardens into a solid mass. The objections to its general use are, that it is less durable than gold, that it oxydizes rapidly, and assumes so discoloured and unsightly an appearance, that its employment in the front of the mouth is wholly inadmissible. It serves, however, extremely well for filling extensive cavities in the molares.

In all these extreme cases, let it be clearly understood, that the success of stopping is doubtful. The tenderness of the tooth is sometimes so great, that although the cement be used, and introduced with great gentleness, without producing immediate pain, yet, after the lapse of a few hours, this unwelcome result may follow. If the suffering be not too acute, for the sake of saving a tooth, it should be borne with for a while, and the irritation alleviated by the application of the lancet, or of a leech, to the gum. Should the pain continue, the stopping must be removed, and attempts made to diminish the sensibility of the tooth, either by the careful introduction into the cavity of a piece of cotton or lint, saturated with a weak solution of nitrate of silver; or of a paste with which is combined a small quan-

From this circumstance, in addition to its injudicious employment without proper preparation, its use terminates generally in increase of suffering, and consequent disappointment to the patient.

tity of muriate of morphia, called "anodyne cement." This must be repeated from time to time until the tenderness have subsided. The stopping may then be renewed, and very frequently with success. If, however, inflammation should come on with excessive pain, extraction is the only alternative. I have found a camphorated solution of mastich,* introduced in the same manner, extremely useful in these cases; so much so, that I now seldom fill a tooth, so far decayed, without sponging the cavity previously with this spirit, as a matter of precaution.

There is a still more advanced stage of decay, in which the silver cement may be used with much advantage.

It has already been stated, that in some few neglected cases, decay attacks and destroys the whole ivory structure of the tooth without causing pain. In some cases also, individuals, either careless of results, or misinformed as to the possibility of obtaining relief, without undergoing extraction, endure toothache with wonderful fortitude, until the pulp, membranes, nerves, &c., are destroyed, and the vitality of the tooth becomes totally extinct:— it will be well for such patient sufferers to learn, that this desirable termination of their malady may be hastened by the repeated application of strong camphorated spirit, or of the solution of nitrate of

* Prepared by Messrs. Bell, chemists, &c., Oxford Street.

silver, as before directed. The latter, however, should be used with care.

Large portions of the enamel, the walls of the tooth as it were, still remain standing; if unsupported, they will break away piece by piece, until the roots alone remain; but if skilfully filled up and solidified with the cement, a mis-shapen, but nevertheless useful masticator will be formed, which will often endure the wear and tear of grinding the food for years. The only evil to be apprehended in this case, is the formation of an abscess at the extreme end of the roots of the dead tooth. Extraction must then be at once submitted to, but the very existence of abscess renders the operation easy and comparatively painless, and the cure follows immediately on the removal of the exciting cause.

Before filling a tooth in which decay has made such extensive inroads, the operator should ascertain whether abscess does not already exist. If an abscess have formed at the root of the decayed tooth, and the discharge find its way out through the gum, the fact will be at once apparent, and the patient should then be cautioned that the filling of the cavity will be but an experiment, as it is very questionable whether the operation may not be followed by such an aggravation of the symptoms as would render extraction of the tooth necessary. The filling of the cavity, in such cases, should of

course be followed up by curative treatment directed to the abscess. But supposing that no indications of the existence of abscess are afforded by the gum, and that the account of his sensations given by the patient are not conclusive on the point, the existence of abscess is still to be suspected, for very frequently the matter flows from it through the natural cavity of the tooth, finding vent through the decayed tooth itself. Should the operator venture to fill a tooth in this condition, the stopping would prevent the escape of the matter by its usual course; it would accumulate, causing excessive pain, until, burrowing through the alveolar structure, a new outlet would be established through the gum. If, therefore, having removed all the decayed portion of a tooth, the slightest traces of matter can be discovered on wiping the walls of the cavity, it is advisable to refrain from any immediate attempt to fill it. I have sometimes been enabled to fill such teeth effectively, after a short period, by the perseverance of the patient in keeping the cavity closed by cotton, steeped in camphorated spirit, which seems to excite the morbidly secreting surface to take on healthy action. It is very desirable to effect this if possible, as the presence of such a tooth in the mouth affects the breath very disagreeably.

CHAPTER V.

DISEASES OF THE GUMS AND ALVEOLAR PROCESSES.

THE close relation of these structures in a state of health, and their mutual association in disease, render their description under one head desirable. The diseases of these parts are of two classes; the one consisting of simple and ordinary affections, the result of local irritation; the other arising from constitutional causes.

Of the last it is not my purpose to treat, the subject involving questions of a far more extended nature than the intention of my work embraces.

The most common and frequent disease of the gums is that affection which is miscalled "SCURVY." This is neither more nor less than chronic inflammation, combined with its consequences, arising from irritation produced and kept up, either by dead teeth or stumps, which, in the process of ejectment by Nature, become loose, and are forced backwards and forwards during mastication; or by a deposit from the secretion of the tartar glands, which collects

around the necks of the teeth, and gradually usurps the place of attachment of the gum. This deposit increases hourly, pushes the gum before it, and produces considerable irritation and inflammation by the contact of its rough surface. The treatment ensuring its speedy cure is most simple and easy; and yet how many individuals go on day after day enduring constant pain, suffering considerable annoyance themselves from their inability to use the tooth-brush, and disgusting others by the disagreeable odour imparted to the breath by the presence of this disease, permitting their appearance to be disfigured, and entailing a host of future evils on their teeth and gums, which involve their ultimate loss, by the neglect or fear of the simple and painless operation of "scaling" or removing the tartar!

There exists a very popular, but most erroneous belief, that this operation is injurious to the enamel, and that it will be followed by loss of the teeth. If the operator be so unprincipled as to remove it by means of an acid, (the way in which many of the "*efficient tooth-powders*" act,) undoubtedly the belief will be well founded; but if it be cautiously and skilfully effected by the proper instruments, as often as it may become requisite, nothing will tend more to preserve the teeth, and ward off this first exciting cause of decay.

When tartar is allowed to accumulate, its effects are, a constant unpleasant taste in the mouth;

fœtor of the breath; inflammation, and its concomitants of pain, swelling, sponginess, bleeding, and suppuration of the gums; absorption, or wasting away of the alveolar processes and of the gums, inevitably followed by loosening and falling out of the teeth, through the withdrawal of their means of support; and by denudation, exposing those parts of the teeth, which have no protecting covering of enamel, to the action of decay.

The operation of removing the tartar is too frequently performed in a negligent and incomplete manner. It is not sufficient merely to take away that which adheres to the face of the teeth, and spoils their appearance: the most injurious portion is that which is lodged closely around and between the teeth, insinuating itself beneath the edge of the gum, where, if allowed to remain, it keeps up the irritation, and forms a nucleus for fresh deposits. If every particle be removed, and the whole exposed surface, both inside and out, be polished with a little finely-powdered cuttle-fish bone, applied on a piece of common rattan cane, all irritation will speedily subside, and the gum will re-attach itself to the necks of the teeth, and again give firmness to those which had become slightly loosened. It will be necessary to scarify the gums once or twice, if the irritation have been extensive, or long continued; and this, another most simple operation, is entirely ineffective, unless freely performed.

The mere scratching of the gums is productive of a little soreness and annoyance, but of no benefit whatever to the patient. The perfect restoration of the gums to a firm and healthy condition will be materially assisted, and the sensibility of the denuded parts of the teeth much lessened, by the use of an astringent lotion, and of a dentifrice composed of stimulating and astringent ingredients.

The excessive action of mercury is sure to prove sooner or later a fruitful source of absorption of the gums and alveolar processes, and will eventually occasion the loss of many of the teeth, either by gradual denudation, or by the formation of abscess in the alveolar cavities. In these cases, the falling out of the tooth is generally followed by the spontaneous disappearance of the abscess. So in cases of simple abscess of the gums, commonly known as gum-boil, arising from the irritation of a dead tooth or stump, its removal, if effected at once, will in most cases produce a cure. If the abscess be neglected, and the pus allowed to accumulate, it will be productive of serious injury, spreading and involving the alveolar process on either side, forming fistulous openings, internally and externally, sometimes terminating in caries and exfoliation of the jaw-bone; and if arising from a diseased molar of the upper jaw, very probably extending its pernicious influence to the membrane lining the cavity of the antrum, the hollow chamber of the upper jaw-bone,

and giving rise to some one or other of those malignant and intractable diseases, *tumours of the jaw*. These lamentable results may more especially be apprehended in persons of a scrofulous habit.

INDIGESTION.—A continued disarrangement of the digestive functions, as well as peculiarity of constitution, will be found to induce an increased deposit of tartar. Its effects are also quickly rendered apparent in individuals who are thus afflicted, by the rapid absorption of the gum and alveolar process, and consequent loss of teeth. The general health of the system must, therefore, receive its due share of attention in the endeavour to restore comfort and utility to the organs of mastication. The medical practitioner and the dentist should co-operate, for the health of the teeth is materially influenced by that of the stomach; and, on the other hand, the want of proper masticatory powers will weaken the digestive organs, and bring on *dyspepsia*, with its direful train of evils.

CHAPTER VI.

IRREGULARITY OF THE TEETH.

The contour of the features depends essentially on the form of the jaws. A lofty forehead, expressive eyes, and a well-shaped nose, are most effective adjuncts; yet the character of the countenance, as a whole, will be especially influenced by the position of the lower, and the due expansion of the upper jaw. When it is understood how far this desirable conformation depends on the arrangement of the teeth, a due importance will be at once attached to their progress, and the proper degree of watchfulness extended to them, particularly as regards the fairer portion of creation.

Deformity of the jaws may in almost every case be traced to an improper interruption of Nature in *prematurely extracting the shedding-teeth.* So long as man is content to follow Nature, all will go well; but no sooner does he attempt to take the rein,

than the mischievous effects of his interference become apparent.

SHAPE AND GROWTH OF THE MAXILLARY BONES.

At the early age of six or seven years there are *forty-eight* teeth in the two jaws. They must of necessity be crowded closely together. Up to this period, the shape of the jaw-bones has been that of a *half circle.* In the adult, they have become *elliptical.* It is therefore evident that the jaws must not only increase in size in order to accommodate the permanent teeth, but that a material change of shape must also occur.

The first permanent teeth that appear, be it remembered, are the anterior molares, which make their eruption from the gum, close behind the posterior temporary molares. In order to afford a base for these teeth to rest on, the jaw must have elongated backwards. At a later period, the posterior, or second permanent molares, present themselves; and later still, the third molares, or dentes sapientiæ. All these teeth being situated still farther back than the anterior molares, the jaws must have elongated in proportion to the additional space required.* Thus it is that the maxillary bone, from having been originally semicircular, becomes elliptical.

* See Plates III. and IV., figs. 20 to 30.

When the anterior permanent molar has made its appearance, the space constituting the front of the jaw, from that tooth on one side, to the corresponding tooth on the opposite side, is closely filled up by the four temporary molares, two cuspidati, and four incisors. The permanent teeth, destined to replace these, viz. the four bicuspides, two cuspidati, and four incisors, are now, far advanced in their developement, lying nicely packed together behind and beneath their predecessors; and they are, with the exception of the bicuspides, of much larger size, attaining to their full growth before they pierce the gums. In what manner, then, are the permanent teeth to find space for their uniform and regular arrangement? They must of necessity remain huddled irregularly together, until, by the *expansion and increased growth* of the maxillary bones, the requisite space is afforded them. In reference to this object, the temporary teeth perform the office of so many wedges, assisting by their presence in the maintenance of the shape and the expansion of the jaws. If they be removed before the permanent teeth are sufficiently advanced to occupy the space so produced, the consequence will be a *contraction* of the maxillary arch, and, of necessity, an irregular arrangement of the permanent teeth will follow.

This is one most serious evil clearly arising from the barbarous and injudicious practice of extracting

the temporary teeth, before Nature fairly indicates her need of such assistance; and it is to be feared that considerable injury is at the same time inflicted on the permanent teeth, as regards their perfect developement, by the probable rupture of the membranes * of the latter.

The process by which nature frees the jaws of the temporary teeth, when their presence is no longer required, is by the *absorption of the fangs*. By this action the crowns are deprived of all other support than that which the attachment of the gum

* There is *no connexion* existing between the neck of the temporary, and the sac of the permanent teeth, by means of a "connecting cord and peduncle," as asserted by Mr. Bell.

"The necks of the sacs of the permanent teeth, by which they originally communicated with the mucous lining of the secondary dental groove, exist in the form of minute obliterated cords, *separated from the shedding-teeth* by their alveolus, but communicating through a minute osseous canal with the fibrous tissue of the gum, behind the corresponding shedding-teeth." [1]

"These cords and foramina are not obliterated in the child, either because the cords are to become useful as '*gubernacula*,'[2] and the canals, as '*itinera dentium*;' (itinera dentium, from iter, a way or path, and dens, a tooth;) or, much more probably, in virtue of a law, which appears to be a general one in the developement of animal bodies, viz. that parts or organs which have once acted an important part, however atrophied they may afterwards become, yet never altogether disappear, so long as they do not interfere with other parts or functions."

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[1] Goodsir; in Wilson's Anatomist's Vade Mecum.

[2] Gubernacula, from gubernaculum, the rudder, or guiding apparatus of a ship.

affords, and consequently they will either come away themselves when pressed on by the food, or will be detached easily by the fingers. Sometimes, however, the progress of absorption of the fangs of the shedding-teeth is not commensurate with the growth of the permanent teeth, and the latter will thus be more or less diverted from their proper positions. For this reason it is requisite that the mouth should be frequently examined during the period of changing the teeth; and as soon as the point of the permanent tooth pierces the gum, or presses so hard against it as to be easily discoverable, *then*, and *not till then*, should the temporary tooth which is in the way be extracted.

If parents would content themselves with ascertaining that no obstacle of this description exists, that the six upper front teeth shut just clear over and beyond the six lower, and would leave the rest to the operations of Nature, at least until the age of fourteen or fifteen, the frequency of irregular conformations of the mouth, and consequent deformity of the features, would be greatly diminished.

There are, of course, some exceptions to this rule. Original malformation and contraction of the jaw-bones may exist, and the size of the permanent teeth may be utterly disproportionate to the expanse of the maxillary arch. Supernumerary teeth may be formed, and, pressing upon the others, may

force them out of their true position, and produce a considerable degree of irregularity ; and wherever it so happens that a front tooth of one jaw is, in closing the mouth, brought into irregular contact with another of the opposite jaw, one or both will be driven out of the proper position.

MODES OF TREATING IRREGULARITY.

When, at the age of fourteen or fifteen, the maxillary arch still remains too contracted to admit of the desired uniformity of arrangement of the upper front teeth, whether arising from original malformation, or, as it far more frequently does, from premature extraction of the temporary teeth ; it will be necessary, in order to obtain sufficient space, to extract either the first or second bicuspis on each side. The use of these teeth can be more easily dispensed with than of any of the others, and their position is so far back in the mouth, that their loss cannot well be discovered.

Space being acquired in this manner, supposing that the upper front teeth already shut over the lower, they will, without further interference, gradually fall into the desired position.

When the lower front teeth overlap each other

slightly, it will in most cases suffice to extract one of the incisors, as, from their similarity of form and greater concealment by the lip, the loss of one of them produces little or no apparent deformity. If, however, much space be required, the treatment must be the same as that for the upper jaw.

It very frequently happens that the anterior permanent molares, which, as before stated, are the first to make their appearance, are also, probably as a consequence of their peculiar developement, the first to decay. When this is the case, it will of course be more advisable to remove the decayed molares than the sound bicuspides; and the result, as regards space and arrangement, will be the same.

When, in the endeavour to arrange themselves uniformly, the front teeth of the upper jaw have assumed to themselves a much more extended arch than those of the lower, their consequent projection will thrust out the upper lip, and occasion considerable deformity of the features: moreover, these teeth cannot in such cases come into the requisite degree of contact, and their use as *incisors* will be lost. The remedy in this case will also be the removal of a bicuspis on each side of the upper jaw, which will allow the front teeth to fall back, and assume a more natural as well as a more useful position. Should the projection be very great, they will re-

quire mechanical assistance to compel them to fall back. The mode in which this may best be effected will be presently described.

When the upper front teeth of the *temporary* set take a direction inwards towards the palate, and by their contact force the antagonist teeth of the lower jaw outwards, the ultimate result as regards the child, if the irregularity be not corrected, will be that protrusion of the lower jaw which is indicated by the term "*under-hung*." Soon after the posterior temporary molares have attained their full height above the gum, or about the fourth or fifth year, an accurate model of both upper and lower jaw must be obtained, from which a casing or capping for the teeth of the lower jaw is to be stamped out of a thin plate of either gold or silver. The capping is to be continued from the first or second molar of one side, round to the corresponding tooth of the other:—it must fit closely over the grinding surface of the molares, where it must be rendered thick enough to prevent, by its interposition, the contact of the front teeth:—the plate must overlap and fit closely also to the outer side of the molares, and be carried entirely down the inner side, and partly on to the gum:—over the canines and incisors, it must extend rather more than two-thirds down, inside and out:—opposite the space between the necks of the molares, the plate is to be perforated, so as to permit the

passage of one or more ligatures, which, tied around the necks of the teeth, secure the capping firmly in its place :—on the ridge of the capping is soldered a thin plate of the metal, edge-wise, which must be smoothed gradually off. The whole apparatus being thus prepared, it only remains so to adjust the opposing edges of the capping and the upper teeth, that when properly fixed, the edge of the capping shall, on closing the teeth, just slide inside of that of each of the six upper front teeth. In this way the pressure exercised by the patient at each closing of the mouth, may be controlled and brought to bear upon such of the upper front teeth as need it, precisely in the required direction; and as the degree of resistance opposed by these, will be far less than that of the lower teeth assisted by the molares, it follows that they must gradually give way and submit to be forced outwards.

The presence of the capping will be productive of a slight irritation of the gums, which will facilitate the movement of the teeth. The patient probably will not be able to wear it continuously, but must endeavour to do so. As soon as the edges of the upper teeth have been brought a little beyond those of the lower, the capping may be dispensed with, for the natural action of the jaws will then be sufficient to perfect the desired change of position of the teeth. A proper expansion of the yielding structure of the upper jaw will follow; the perma-

nent teeth, as they form, will assume the same expanded arch, the jaw will solidify with advancing growth, and the threatened deformity will be entirely avoided.

When the anterior *permanent* teeth of the upper jaw have been allowed to assume this irregular position, they may be moved outwards in the same manner, the capping being fixed to the bicuspides, and, if necessary, to the first permanent molar also; but a more eligible mode of controlling their position is the employment of a light bar of gold or silver, passing round their front surface, by means of which they may be either drawn outwards, or driven inwards, as the nature of the irregularity may demand. The mode of preparing the bar, adjusting and securing it with sufficient firmness, is the same as for the capping already described, excepting that it requires to be fitted to the upper teeth only.

The capping over the bicuspides, by which the closing of the teeth is to be prevented, and the apparatus fastened, is to be carried well down their external surface, and to this part of the capping the bar is to be soldered, extending from the first bicuspis on one side, round to the same tooth on the other. The inner face of the bar is to be modelled so as to fit closely and evenly to as many of the six front teeth as already stand so far forward as to come up to or beyond the desired position. If none of the teeth are thus far advanced,

the bar must be made to describe exactly the line of the arch in which they ought to stand.

Precisely opposite to the centre of each tooth which is to be brought *out*, a strong piece of similar metal must be soldered into the upper edge of the bar: from these points, ligatures of a material known as "*Indian twist*," are to be passed round the necks of the irregular teeth, and drawn daily closer and closer, until the teeth, yielding to the constant pressure thus brought to bear on them, approach the bar, and assume their proper position.

When any one or more teeth project beyond the right line, and it is desired to move them *inwards*, a small hole must be drilled through the bar, over against the most prominent point of each; a screw-thread is then to be cut, and a short screw introduced, which, working through the bar, will, by a turn or two each day, keep up such a continued pressure against each tooth as will quickly force it back as desired.

The projection of the screw-heads must not be so great as to cause annoyance to the lip, and longer screws must be kept ready for use, in order to reach the teeth as they recede from the bar.

In this manner any required movement of the teeth, inwards or outwards, may be effected with great ease, and in very little time, causing no serious annoyance to the patient, the whole apparatus being removed and cleansed every two or three days. By

shifting the point of attachment of the ligature, or the direction of the screw, the force may be brought to bear in a lateral course, if requisite. Care must be taken that the application of the force thus acquired is so distributed, that the resisting power of those teeth to which the bar is fixed, shall be much greater than that of the teeth under treatment; and if necessary to secure this, one or two irregular teeth only should be acted on at the same time.

I have stated the age of fourteen or fifteen to be the period at which I would recommend the use of mechanical means to control the arrangement of the teeth, excepting in cases of evident malformation, or wherein injury is resulting to the teeth from improper contact, when assistance should be secured sooner. In all ordinary cases, the alteration may be almost as easily effected at the age of twenty as at fourteen. At this advanced period, the jaws will have attained their full growth, and it will be evident, if irregularity still continue, that Nature requires, in this instance at least, the assistance of art.

CHAPTER VII.

EXTRACTION.

THE removal of a decaying tooth should never be determined on, until every effort has been made to fill the cavity, and retain its use; unless, by its presence, it absolutely prevents the curative treatment of an adjoining tooth, or unless an abscess or tumour be evidently forming, and resist all other means of cure. The break in the arch of the teeth, consequent on the loss of one, weakens the whole set.

Those of the jaw whence the extraction has been made, lose the support afforded by *uniform lateral pressure*, as, in the endeavour made by Nature to fill up the gap, the remainder become separated from each other, and quickly assume a straggling and unsightly appearance.

The teeth of the opposite jaw, affected by the loss of their antagonists, will generally rise from their sockets, and become loose; mastication will be impeded, an undue degree of duty will be im-

posed on those which remain firm, and an untimely disarrangement of the entire apparatus will ensue.

It is an extraordinary circumstance, that an operation, which every one justly holds in so much dread, and which really is in itself a very important one, involving a forcible disarticulation of most firmly united bones, should be entrusted to individuals almost or entirely ignorant of the structures to which they are about to offer such serious violence. When it is considered, that the ordinarily constructed key, which is so universally employed by such operators, is, in their hands, a most dangerou instrument;—(for no one can apply it properly, unless he have previously acquired an intimate anatomical knowledge of the articulation of the teeth;)—that the force brought to bear upon the parts is infinitely greater than should suffice to overcome the resistance of the tooth, *if the attempted extraction be one that ought to be persevered in;* and that if the "*fulcrum*" be misplaced by a few lines only, this enormous force is exercised upon the bony structure of the jaw, as well as upon the tooth;—that the least unfortunate result to be expected is the crushing and breaking of the crown of the tooth, with the painful laceration and farther exposure of the already inflamed pulp;—and that probably extensive fracture of the alveolar structure may result, and may be attended by NECROSIS of the bone, involving the subsequent loss of many teeth;—when all these liabilities are

taken into account, it seems most strange that this wholesale mode of exterminating the teeth should continue to meet with encouragement.

Many improvements have been recently effected in the construction of the "*extracting key;*" yet, in my opinion, its use is still open to many well-grounded objections. That eminent surgeon, Professor Liston, in his "*observations on some tumours of the mouth and jaw,*" published in the Transactions of the Royal Medical and Chirurgical Society of London, says, in speaking of "*epulis,*" a dangerous kind of tumour,—"It seems to originate from disease of the teeth, from crowding or irregular distribution of these bodies, from injury, accidental, or inflicted in ill-directed operations for the removal of teeth,—*the bruising of the gum, for instance, by the bolster of the old key-instrument or pelican.*"

Well-constructed pairs of forceps, adapted to the peculiar conformation of each tooth of the series, together with two or three differently shaped elevators, will be found fully sufficient to meet all ordinary cases. These are the most effective as well as the safest instruments that can be employed, and I am fully persuaded that, in skilful hands, an extraction by forceps is attended by much less severe pain than follows the application of the key.

EXOSTOSED AND ANCHYLOSED TEETH.

There are cases of frequent occurrence, in which, by an unhealthy deposit of the cementum, probably superinduced by inflammatory action, the fangs of the teeth become considerably enlarged, presenting numerous bony prominences, closely resembling true "*exostosis.*" In such cases, should extraction be resorted to, in order to relieve the pain occasioned by the pressure of the enlarging fangs, very great difficulty will be encountered, and imminent risk of fracturing the alveolar process will be incurred, if the attempt be persisted in. Should the inflammation of the periosteal membrane have terminated in *anchylosis* of the tooth and socket, the attempt at extraction would necessarily occasion fracture of the jaw-bone. The use of the key, in such cases as these, would most likely be followed by some such lamentable result, especially in the hands of an uneducated practitioner, who, meeting with unexpected resistance, and ignorant of the true cause, would blindly apply the enormous degree of force of which the instrument is capable. The operator possessing a proper knowledge of anatomy, and practised in the use of the forceps, would, on the contrary, be enabled at once to detect the altered condition of the fangs, and would either re-

sort to a different process for effecting the removal of the tooth, if imperatively required, or would desist from the attempt.

It is the custom of some practitioners to dispense with the operation of *lancing the gum*, preparatory to the adjustment of the instrument for extraction. It certainly is not indispensably necessary to the completion of the operation. A tooth may be torn out of the jaw, and may bring a strip of the gum with it, an inch or more in length. I have seen it done. Should I unfortunately find myself under the disagreeable necessity of losing a tooth, I would insist on having the gum well freed from its attachment to the neck of the tooth, by the operator, knowing that it would facilitate the proper application of the instrument, and that the gum, so wounded, would heal far more expeditiously than if lacerated and bruised.

The only cases wherein the lancing of the gum is not requisite, are those in which, either through loss of vitality of the tooth, or by great absorption of the parts, and denudation of the neck, the connexion between the gum and the tooth has already ceased to exist.

CHAPTER VIII.

RESTORATION OF THE TEETH.

I HAVE endeavoured in the preceding pages to point out the condition of the teeth, and of the structures in intimate connexion with them, which ultimately leads to their destruction: the evils resulting from their loss, and the mode of treatment which, properly followed, may be the means of retaining them through life, and escaping the necessity of becoming dependent on art for a power, so important, so indispensably necessary to the maintenance of health, as proper mastication.

Should the permanence of this power become at any period endangered by the loss of one or more teeth, no fear of incurring ridicule, or of being subjected to the accusation of vanity, should be allowed to have weight, when placed in juxta-position with the personal comfort which is derivable from the skilful adaptation of artificial substitutes to the vacant spaces. An important question for consideration is the extent of loss which may be submitted to, before

recourse to the assistance of art becomes imperatively necessary, in order to secure the masticatory apparatus against farther inroads.

My own opinion, deduced from practical observation, is, that the only unimportant loss is that of the wise-teeth of either jaw, and that so soon as the loss of any other tooth occurs, the space thus caused should be at once filled up, so that *continuity of mutual lateral support* and *equality of antagonist pressure*, shall remain uninterrupted. The manner in which the whole set is affected by the loss of a single tooth, has been explained in the preceding chapter on extraction. There is, however, such a general feeling of repugnance to the idea of wearing false teeth, and so great a mistrust of their *efficacy*, arising from the unskilful, clumsy, and defective workmanship, and the employment of improper material in the construction of the trash now so extensively manufactured, and foisted upon the public by means of ostentatious advertisements, that it would be a vain and futile attempt, were I to endeavour to urge so close a degree of attention to the maintenance of integrity in the apparatus; although I am convinced that the result of such solicitude would well repay the patient.

Conscious that an unfavourable opinion regarding artificial remedies has thus been created, although, when properly applied, they give rise to such true comfort, and are wholly painless, and perfectly

efficient, I am compelled to limit the period when the rejection of such assistance can no longer be persisted in, to that, when the collision of the teeth by the loss of *antagonist molares* becomes transferred to the *anterior teeth.* The divergence of the roots of the grinding teeth enables them to withstand the continuous action of the jaws in masticating, but no sooner is this function imposed on the canines and incisors, depending for strength on one rounded fang each, and weakened by the loss of the lateral support which the proper grinding teeth did formerly afford, than they give way, become loose, and fall out.

In some cases, where the collision takes place unequally, or is but slightly participated in by the remains of molares, the substance of the anterior teeth will be worn down, and the dental cavity itself would in due course be exposed, were it not for the bountiful interference of nature, by whose agency a deposit of new material, which I have shown to be analogous to the cementum,* takes place from the investing membrance of the pulp, in proportion to the external abrasion of the ivory. This deposit keeps pace with the wearing down of the tooth, the pulp receding before it, and ultimately becoming completely atrophied; so that, notwithstanding this intervention of new substance, the loss of the teeth is no less certain, *unless the collision be*

* Page 9.

transferred back to artificial grinders, so adjusted as to prevent farther actual contact of the front teeth.

I have already alluded to the immense importance of a due mastication of the food, preparatory to its perfect digestion, which must be dependent on the efficiency of the grinding apparatus: and I think nothing farther need be urged in favour of a timely adoption of artificial teeth, by those who have had the misfortune to lose their own. It remains only to direct attention to the consideration of APPEARANCE as affected by the absence of teeth.—Of the front teeth I will say nothing more, than that their loss impedes very materially the articulation of sounds; the detrimental effect of a gap in the front of the mouth is too apparent to require comment; but the *change of physiognomy* consequent on the sinking in of the cheeks, and the approach of the chin towards the nose, permitted by the absence of the molar teeth, is seldom attributed to the right cause. The object of repairing the loss of teeth is, however, not to be confined to mere appearance; the legitimate aim is so to preserve the remaining teeth, that the power of mastication, and with it, health, comfort, and energy both of mind and body, may be secured or restored.

The first mechanical operation of this nature, which we may suppose to become requisite, will be the restoration of a single tooth. As regards the canines and incisors, the crown only being lost, and the root remaining firm, one or all of them may be replaced by "GRAFTING," or, as it is more commonly called, "*pivoting*." The root of the lost tooth is cut down smoothly, rather below the edge of the surrounding gum:—the constricted portion of the dental cavity occupying the centre of the root is perforated nearly to its base:—the crown of a natural or of an artificial tooth, matching the remaining teeth in form and colour, is accurately fitted on to the root, and retained in its position by a piece of *gold* wire, screwed firmly into the crown, and jointed closely into the perforated portion of the dental cavity. If absorption of the pulp have accompanied the destruction of the crown of the tooth, (which generally happens,) the operation will be painless, or, at the worst, followed only by a slight irritation and swelling of the neighbouring soft parts, which will speedily subside. If the pulp still remain endued with full vitality, (a rare occurrence unless the tooth have been forcibly broken off,) it must be removed, and some little pain will ensue.

The destruction of the pulp is easily effected by a turn of the perforator. It is the operation of less than a minute, not, as is generally supposed, a lengthened endurance of severe pain from the application of heated wires, &c. &c. Such may have been, and I believe has been, the practice, but all such barbarous proceedings have or should have disappeared with the advance of science. This operation of "GRAFTING" is certainly the pride of the art. The dreaded exposure of "*wearing a false tooth*" rests with the wearer, for even a close examination of the mouth, inside as well as outside, will not bring the fact to light, *if it have been effected properly.* The apposition of the two surfaces of the false and the true, as well as that of the wire to the perforation of the fang, should be so close, that all moisture is perfectly excluded. The operation being thus skilfully performed, and *collision with antagonist teeth carefully guarded against*, with fair use, and under favourable circumstances, the grafted tooth will endure for many years. I am in the habit of introducing the camphorated solution of mastich, already mentioned, into the perforation of the fang, preparatory to the permanent fixing of the tooth, and I conceive that the durability of the fang is much assisted by its presence.

The efficient restoration of a tooth in this manner is an operation that tests the skill of the dentist perhaps more surely than any other which he may

be called on to perform, and consequently it is seldom attempted but by those who feel themselves competent to its perfection. It is, however, the only proper mode of restoring a single-fanged tooth in the first instance. It occupies no more space, and depends nearly on the same means of support as did the natural tooth which preceded it.

Other modes there are of restoring a single tooth, which I am about to describe, in reference to the repair of more extensive losses ; but even when well executed, they are objectionable in restoring front teeth, particularly in the fact, that the bulk of the foreign substance thus introduced into the mouth, must of necessity exceed that of the lost tooth. The ordinary mode adopted by the inferior class of dentists, of *fastening a tooth by wires to the adjoining teeth*, is a most reprehensible practice. Neither utility nor improvement of appearance attend its introduction, and the only party benefited is the operator, for whom it quickly procures a second and a third opportunity for profitable employment, by wearing into and dragging out the teeth to which such an ill-planned piece must be successively attached.

When the grinding teeth, as well as some or all of the front teeth, have been lost, they may be restored either by ivory only, or by a combination of gold, ivory, and natural or artificial teeth.

In replacing lost molares, the dentist who under-

takes at the same time to restore the power of masticating, and to preserve the remaining teeth, must be careful so to regulate the height of the artificial masticators, that they shall by their contact prevent the positive collision of the front teeth. This must be effected, or the result will be neither beneficial to the patient, nor creditable to the operator. If no molar teeth remain, the case is simple. The ivory blocks, carved so as to represent these teeth, must be left of sufficient height in the first instance; and as they wear down with use, and allow the remaining front teeth again to come into undue contact, the grinding surface must be restored by riveting on a fresh face of ivory. If, however, one or more molares yet remain in the jaws, which from unfair use have been worn down beyond the proper level, whether they be loose or firm, whether the piece be constructed of ivory, or of gold, such teeth must be *capped*, and thus restored to the right height.

The most comfortable mode of restoring the teeth, especially if there be much absorption of the gums, is, unquestionably, the employment of a block of the ivory from the tusk of the hippopotamus: out of this is to be carved a piece, which being modelled to a cast of the mouth, shall fit to the gum so accurately, that the forces of *capillary attraction* and *atmospheric pressure* shall be brought into play, and shall suffice to secure the artificial masticators firmly in their right position. These principles are

equally applicable to a single tooth, or any number of teeth, as to a whole set. The teeth may either be carved out of the same piece of ivory which represents the gums ; or natural or artificial teeth may be bedded into the ivory gums, which may be stained so as to imitate the natural gum in colour. The congeniality of ivory to the structures with which it thus comes in contact, the superior facility with which it may be fitted to the remaining teeth, and be made to support them, to shield tender and decaying stumps, to cover over and increase the height of worn-down molares, are all so many reasons in favour of a preference of this mode to the use of a metallic plate. There are, however, serious obstacles in the way of the general use of ivory, the most important of which are, its want of durability, and the consequent increased expense attendant on the wear of artificial teeth so constructed. When ivory is constantly exposed to the chemical action of the saliva, it undergoes a change, and is decomposed very rapidly, so that the edges of the piece where it is sloped off to the surface of the gums and soft parts of the mouth, and the thin portions passing round and behind the remaining teeth, become so weakened in the course of a year or two, that the apparatus will probably in that time require renewal. The employment of ivory solely, is more expensive in the outset than a gold plate, in consequence of the higher degree of workmanship, and

greater consumption of time necessary to perfect a piece of this description; and this expense will be too frequently re-incurred to permit its adoption by any but the wealthy. Another objection to ivory, is the greater bulk of the piece necessary to secure a sufficient degree of strength; which in some cases, where little or no absorption of the gums has occurred, would impede utterance; and a third disadvantage is the disagreeable odour which the ivory will contract after a short period, if it be neglected. This latter objection is equally applicable to all artificial pieces, in the fabrication of which ivory is employed, but it may be entirely avoided by carefully cleansing the piece each night, and allowing it to remain immersed in camphorated spirits until the morning.

The mode of restoring the teeth most generally in use, is the adaptation to the gums of a plate of gold, of a high degree of purity, to which the teeth (and artificial gums if necessary) are fastened by means of gold pins soldered into the plate. A correct model of the gums, &c., having been obtained in wax, is transferred to plaster of Paris, and thence to metal. By means of this metallic model the plate is stamped up, and if the primary mould have been correctly taken, and the work well executed, the plate will fit accurately to all the inequalities of the surface of the gums; and the pressure will thus be evenly distributed over so large a space

that it will scarcely be felt, and the wearer will soon become almost unconscious of its presence. When there are two or three firm teeth remaining, they will afford sufficient support to retain the piece firmly in its place, without having recourse to the assistance of springs.

The clasps by which the piece is to be steadied, should be as broad as the teeth will admit of at the back, and narrowed to a point towards the front. The width of a well-fitted clasp will so much equalise the pressure of the piece against the firm teeth, that no injury will follow its constant wear; whereas, if a narrow band or wire be used, as is constantly the case, to save labour and material, it will inevitably wear away the enamel, and cut into and destroy the neck of the tooth around which it passes.

Should any teeth be present which, although loosened, admit of a probability of their being retained, the gold plate must be carried well up behind them, so as to form a kind of collar for their support.

In reference to the employment of this mode, it must be clearly understood that the artificial piece is not to be *hung on to the remaining teeth;* that it is not to derive its support from them, but is rather to afford them an additional degree of strength, by filling up the spaces between them, and by participating equally with them in the pressure of masti-

cation, taking it as much as possible off the loosened teeth.

In cases where it is requisite to increase the height of molar teeth, this will be easily effected by carrying the gold plate over the surface of the shortened tooth; and if this be insufficient, the plate may be doubled over the grinding surface, or may have a piece of ivory riveted on to it. If such teeth be firm, the capping may be made to fit so closely as to spring in towards the neck of each tooth, and this will afford a most advantageous security to the whole piece. If, on the contrary, the remaining molares be loose, the capping must be made to discharge the office of a shield towards them, and, thus relieved from pressure, they will probably regain a greater degree of firmness. If they be mere stumps, and still firm, they may be cut down to a plane with the surface of the gum; if loose, and the patient object to their removal, the plate may be carried over them in such a manner as to protect without pressing on them, and the height must be made up above the stump by riveting on an ivory masticator, as in ordinary circumstances.

When absorption of the gum, &c., has taken place to any extent, and the nature of the case, or the desire of the patient, demand the employment of a gold plate, the lost substance of the gum must be restored by means of ivory carved so as to fit on to

the gold plate as accurately as if the under surface of the ivory were intended to come in contact with the gum, without the intervention of the plate. The teeth are to be bedded into the ivory, which, as before said, may be so coloured as exactly to resemble the natural gums.

In restoring the front teeth only, where the fangs have been lost, without much consequent absorption, I incline strongly to recommend a gold plate, especially for the upper jaw, as it combines strength with neatness, and the occupation of so little space, that the articulation remains unimpeded. The plate should, if permitted, be carried round as far as the first or second bicuspis on each side.

The practice of assisting the fixing of a piece by means of *ligatures* passed around firm teeth, is highly objectionable. The patient to whom such a mode is proposed will be justified in concluding that he is not in the most skilful hands, for no well-planned and well-constructed piece will need such aid.

Much is said about the "*fixing of artificial teeth without extracting stumps, or giving any pain.*"

The removal of firm stumps I have already objected to generally, and so long as they remain firm, they are of the greatest assistance to the security of the artificial piece, keeping up the form and substance of the gum; but if loose, their removal should be unhesitatingly recommended, on the ground that by their presence they will keep

the gum in a constant state of irritation, and that as they become more loose, and are thrown up towards the surface, their longer retention will become impossible, and their loss will then be followed by absorption and change of shape of the gums, so that the piece, no longer fitting accurately, becomes imperfect.

When the patient assents to the removal of such useless annoyances from the gum, from ten days to a fortnight, or even five or six weeks, according to the nature of the case, should be allowed to elapse before the model of the gums be taken, in order that all change of shape likely to ensue may have taken place; and, in the mean time, the health of the system generally should be closely attended to, and the hardening of the gums assisted by astringent washes. The permanence and comfort of the artificial piece depends so materially on this preparatory treatment of the gums, that the very little suffering attendant on the extraction of loose stumps, which the patient may himself remove with his finger and thumb, should never be permitted to influence a decision against such treatment. The piece may certainly be adjusted without their removal, but it will never give satisfaction, and the wearer will assuredly become a very frequent visitor to his dentist.

From the many opportunities for observation of pieces of artificial teeth, of ordinary construction,

which have fallen in my way, I am disposed to attribute many of the failures which occur in the attempt to restore the power of mastication, as well as the appearance, and therewith the comfort and health of the patient, to the culpable oversight of neglecting to give sufficient height to the artificial grinders. The height of the remaining natural molares is too generally taken as a guide for the artificial substitutes, so that the improper contact of the front teeth remains undisturbed. The intended grinders are thus rendered useless, and the wearing down and loosening of the front teeth goes on until the whole are destroyed.

Great variety of opinion exists as to which is the most eligible mode of restoring lost teeth, as well as to whether *natural* or artificial teeth (known as mineral teeth) should be employed. In my opinion, no general rule can apply to the selection of the materials to be used, or the plan to be followed. A skilful dentist will allow no predilection in favour of, or prejudice against, one mode or another, to influence him in his decision. He will consider well the peculiarities of the case entrusted to his treatment, and will adopt such means as experience tells him are best calculated to ensure permanent ease and comfort to his patient, with perfect efficiency of the apparatus he supplies. The only obstacle to his success, over which he can have no control, is the unwillingness or inability of his pa-

tient to incur the expenditure requisite to enable him to construct the artificial substitutes of the best material, and yet secure to himself the well-earned reward for his ingenuity in devising, and his skill in executing his task; and in such cases he will do well to decline the undertaking altogether. Neither scantiness of material, nor baseness of quality, can be admitted in the construction of artificial teeth. The ivory of the hippopotamus, being, from peculiarity of structure, far more durable, when exposed to the chemical action of the fluids of the mouth, than that of the elephant or walrus, although much more expensive, must be employed. Gold undergoes no change, although continually exposed to air and moisture. The application of *pure acids* even will not cause it to oxidise. No metal is, therefore, so well adapted to this purpose as gold, and to secure fully the advantage it offers, it must be of a high degree of purity. The employment of gold very extensively alloyed, or even of baser metals slightly gilt over, is resorted to by the fabricators of *cheap teeth*, and it is therefore easily obvious, even supposing the planning and workmanship to be good, that the introduction of such articles into the mouth, will end in nothing but discomfort and disappointment to the patient, rendering that affliction which was already bad enough, much worse. I would recommend every one who may contemplate recourse to such a mode of procuring

a replacement of his losses, to gain a foretaste of his probable condition, by placing a copper coin in his mouth, and retaining it even for a few minutes. The experiment will possibly suffice to alter his intention.

The mode which, in my opinion, is best adapted to the generality of cases, and which seldom fails to give satisfaction in every respect, is the employment of a gold plate for the upper jaw, and of hippopotamus ivory for the lower.

As regards the description of teeth to be used: f the piece be of ivory, the teeth *may* be carved out of the same block; and for the formation of the grinders, this is the best mode, as the discoloration which ensues on exposure to the moisture of the mouth, &c., is of no moment. This unavoidable result is, however, a great objection to the use of ivory, divested of enamel, for the front teeth, and demands the employment of natural or of mineral teeth. Natural teeth, though not so durable, and subject to a slight alteration of colour, are yet preferable to mineral teeth, in this especially, that they are lighter and far more congenial to the structures of the mouth, producing a greater degree of comfort in use, and presenting altogether a much closer resemblance to nature. Some individuals, however, feel an insuperable objection to their use, although they should be regarded in the light of mere pieces of ivory, and to these the pro-

cess of fabricating artificial teeth has been a welcome discovery. Mineral teeth have long been in use on the Continent, but they are exceedingly brittle, and by no means well formed or coloured. Teeth of this description have recently been brought to great perfection in this country by Ash of Broad Street, and Lemale of Chandos Street, from whom those used by nearly all respectable practitioners are procured. The pretended new discoveries in this way, daily boasted of in the public prints, are merely importations of French mineral teeth, and, although cheaper, cannot bear comparison with those of our own manufacture, for the reasons above stated.

THE END.

LONDON:

IBOTSON AND PALMER, SAVOY STREET, STRAND.

REMARKS OF THE PRESS.

An invaluable little *brochure*, comprising a clear and lucid account of the structure, economy, and pathology of the human teeth, with simple and apparently judicious instructions for the preservation and culture of the teeth, and concise descriptions of the best modes of surgical treatment. For the purpose of explaining the text still more plainly and familiarly to the unprofessional reader, a series of engravings illustrative of the textures the most difficult to be understood have been introduced. We have already seen several works on the teeth, but this is by far the best and most comprehensive treatise of them all. It is divided into eight chapters, and discusses the anatomy and structure of the teeth; their developement and growth; the ordinary diseases of the teeth and gums; remedies against decay; irregularity and its remedy; extraction; and restoration. Mr. Lintott, who was a pupil of Mr. Erasmus Wilson, is evidently an enthusiast in his profession, and we believe that few persons have ever arrived at any great eminence in a pursuit who have not been so. Every head of a family should purchase this little volume, for it suggests, not only the best method of preserving the teeth, but the best and readiest mode of ministering to their diseases.—*United Service Gazette*, 10*th April*, 1841.

An excellent treatise, by one of the most rising dentists of the day, illustrated by some forty coloured engravings. Its merit consists in the simplicity and clearness of its arrangement (the *lucidus ordo* which HORACE says is the perfection of a poem, being also a fundamental condition of a work of science), and its satisfying completeness of information even for medical practitioners. Such works are usually either very superficial —the mere rinsing of the author's own meagre experience—or else too strictly professional to interest, or be intelligible to the public at large. Mr. LINTOTT has tolerably succeeded in hitting the medium here, and although his language generally partakes too much of the anatomical class-book idiom, yet he has not failed to explain his technical terms for the benefit of the uniniated. The chapters on "Diseases on the Teeth," "Remedies against Decay," "Extraction," and "Restoration of the Teeth," are especially deserving of universal attention. —*Atlas*, 10*th April*, 1841.

A very admirable treatise, containing an amplitude of information, rare in works of the kind. There are in it no less than forty illustrations, coloured, by which means it is rendered doubly intelligible.—*Court Journal*, 10*th April*, 1841.

We have been extremely interested in the perusal of this elegant little volume. It is at once the most philosophical, and at the same time the most practical, of the many treatises we have read on the subject. The proper mode of taking care of the teeth, and the best modes of curing their diseases, are

desiderata to all who value their health and comfort, to say nothing of other reasons which may apply to most persons without inflicting upon them the charge of vanity. Mr. Lintott's great talents have deservedly obtained him a high professional reputation in the metropolis; and the reader will find, on perusal of his work, that that reputation has not been gained without immense labor and research, and that the developement, structure, and pathology of the teeth have not till the appearance of Mr. Lintott's work, received a tenth part of the attention the importance of the subject deserves.—*Hampshire Advertiser*, 10*th April*, 1841.

Mr. Lintott takes up the subject of the masticatory organs as it should be taken, and treats it in a style which merits our fullest commendation. The little volume before us contains a great many diagrams which, aided by the letterpress, will enable any one clearly to understand the developement of the teeth. Without becoming tedious, or too scientific, Mr. Lintott gives the substance of all—Retzins, Hunter, Bell, Owen, and others have written on the subject; not that he has neglected to investigate the subject for himself, as most of our teeth book-making scribes are wont to do. Mr. Lintott appears to like his subject, and treats it *con amore.* The book will be a valuable *vade mecum* for dentists, and a readable and useful one for the general public.—*Conservative Journal, April* 17*th*, 1841.

This is an exceedingly valuable little work on a subject in which all are more or less interested. Mr. Lintott's object is to illustrate the principles which he deems most important in the care and cure of the teeth. He is not only intimately conversant with everything pertaining to the teeth, from his extensive practice as a dentist, but he has evidently bestowed the greatest pains on the preparation of his treatise on the subject. The little volume is one which ought to find its way into the hands of every student and practitioner of medicine, especially those who practise in rural districts where a dentist is not to be met with.—*British Queen and Statesman, May* 2*nd*, 1841.

(Second Notice.)—In the course of our perusal of this little treatise we have been much struck by the valuable discoveries made by means of the microscope; the structure of the tooth, nature of caries, tartar, &c. becomes, under the powerful means of the microscope, completely developed. We have only room for the following extract, but shall return to the subject:—"&c. &c."—*Hampshire Advertiser, May* 1*st*, 1841.

The treatment of the teeth is as important to the functions of life, in some senses, as the treatment of the stomach. Unpleasant breaths and unsightly mouths are not the only evils the neglect of these organs entail; indigestion, cancer in the stomach, caries in the jaw, or rather decay of the bone, to use plain language, are also its usual concomitants. Any effort, therefore, which is directed to remedy this neglect must be of advantage to humanity, and the individual who makes it is entitled to the gratitude of his kind. The book before us is an

effort of this nature, well meant and well directed; and though it may not remedy the evil, it will do much service to many. That the pathology of the teeth should be explained in such a small volume is not to be expected, and, therefore, fault may be found with that word in the title-page; but the structure and economy of these organs are so clearly and briefly exposed, and the several simple rules for their preservation so effectively laid down, that we do not feel disposed to quarrel with the author for this interpolation of a word. Those who read this little work with ordinary attention will find themselves much wiser than when they sat down to its perusal, and those who follow its precepts will find themselves much better. It is lucid, brief, and comprehensible in every part, and may be studied by a woman without any effort. As such, therefore, we recommend it to the public.—*Observer, 24th May*, 1841.

The author's object, which he has most ably expressed in his preface, is, by disseminating a knowledge of the teeth and of their proper treatment, to assist in delivering the Practice of Dental Surgery from the opprobrium cast on it by the absurd and mendacious professions of quack dentists. The history of the developement, growth, and microscopical structure of the teeth will be found new and interesting matter, more especially as the comprehension of these subjects by the unprofessional reader is rendered perfectly easy by a series of well-executed sketches and diagrams. The practical portions of the book, particularly the chapters on decay, and on replacing lost teeth, are written in a concise, impressive, and familiar style. We would recommend all who value their health and appearance, or who desire to escape the tooth-ache and retain their teeth until old age, to peruse this little work, and follow rigidly the simple rules therein so clearly given.—*Blackwood's Lady's Magazine, April*, 1841.

We have seen no work on this subject so well calculated to disabuse the public mind, and thus afford a wholesome check to the progress of quackery in dental surgery as the volume now before us. The book offers the fullest information on the structure of the teeth, their diseases, decay, and the proper remedies; extraction, regulation, and the best modes of replacing lost teeth, conveyed in simple and intelligible language, the comprehension of which is still further facilitated by the introduction of numerous coloured illustrations. With such ready means of enlightenment within reach, assuredly the public will not long continue to be deluded by the mendacious and palpably absurd professions of empirics.—*Morning Advertiser, May 6th*, 1841.

Had we detected in this little book ought savouring of charlatanism, or similar in character to those trashy and fraudulent publications that profess to impart to the reader knowledge which is only to be acquired by labour and practical study, it should have received unsparing castigation at our hands. As it is, we can recommend it to the inquirer as a very sensible

and soundly written work, loose in expression at times, yet in a manner that may be said rather to offend the fastidious among the learned, than to mislead those heretofore unacquainted with the subject. The chapters that treat of the ordinary diseases of the teeth, and the remedies against decay, are of unexceptionable merit; and those who pretend to what Burton calls "omnifarious learning" will find this an invaluable treatise. The diagrams are most clear.—*Tablet, May 8th*, 1841.

Mr. Lintott has rendered important service not only to his own profession, but to the public at large, by this excellent and well-written treatise on the human teeth. Decayed or defective teeth are the source of unspeakable misery wherever they exist, and when improperly treated, as they often are, by extraction, stopping up, or otherwise, the misnamed remedy becomes in many cases, a greater evil than the original disease itself.

Mr. Lintott has treated the subject comprehensively, as well as scientifically and skilfully. He has viewed it in all its bearings, and brought philosophy, observation, and an extended professional experience to bear on his positions. Among the points which he has amply illustrated, are the nature and composition of the teeth; their structure, anatomical and microscopic; and the best modes of treatment when diseased or injured. The little work is divided into chapters: those devoted to the consideration of the ordinary diseases of the teeth and gums, remedies against decay, and extraction, are particularly valuable, and ought to be read with attention by all into whose hands the treatise may come.

The chapter which Mr. Lintott has devoted to the extraction of teeth, is one which we could have wished, had our space permitted, to have given entire. Having suffered ourselves considerably, and known others suffer more, from the ignorance or recklessness of persons following the dental profession, we can appreciate the value of Mr. Lintott's advice, when he admonishes us not to resolve on the extraction of a decayed tooth, until every effort has been made to relieve the pain by filling the cavity. Not less alive are we to the importance of choosing a proper dentist, when the removal of the diseased tooth is found to be indispensable.

We wish our space had allowed us to go a little farther into Mr. Lintott's excellent treatise, which we ought to have before remarked, is illustrated with upwards of forty well-executed engravings. On a future occasion we may be able to give some further extracts from it. In the mean time, we feel we are doing a service to all—and their name is Legion—who are the victims of toothache, by calling their attention to a work which contains so much important information and valuable advice.—*London Saturday Journal, 22nd May*, 1841.