The natural history of the human teeth, including a particular elucidation of the changes which take place during the second dentition, and describing the proper mode of treatment to prevent irregularities of the teeth. To which is added, an account of the diseases which affect children during the first dentition / by Joseph Fox.

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PROPER MODE OF TREATMENT TO PREVENT IRREGULARITIES OF THE TEETH.

TO WHICH IS ADDED,

AN ACCOUNT OF THE DISEASES WHICH AFFECT CHILDREN DURING THE FIRST DENTITION.

Illustrated with thirteen Copper-Plates.

BY JOSEPH FOX,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, LONDON;
AND OF THE SOCIETY OF MEDICINE, PARIS.

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TO HENRY CLINE, ESQ.

LECTURER ON ANATOMY, AND SURGEON OF ST. THOMAS'S HOSPITAL.

DEAR SIR,

THE numerous and continued marks of friendship and attention which I have received from you, demand my most grateful acknowledgments.

When at a very early age I was deprived of my father, you kindly stepped forward with your advice, and, by your countenance, and the sanction of your name, transferred to me the confidence of his friends, and secured the continuance of a respectable practice.

To the knowledge I obtained from you when your pupil, and the opportunities of information I have since derived from the easy access with which you have always favoured me, I attribute, in a very considerable degree the success which has attended my practice in that particular branch of the profession to which I have applied.

Your

Your having been pleased to speak favourably respecting the utility of the present Work, is a great encouragement to me in submitting it to the Public; and, in permitting me to inscribe it to you, I feel another flattering mark of attention conferred on,

Dear Sir,

Your faithful and obedient Servant,

No. 54, Lombard-street,
April 20, 1803.

JOSEPH FOX.

INTRO-

INTRODUCTION.

THE Natural History of the Teeth, although a subject curious in its nature, and important in its application to human comfort, has not sufficiently engaged the attention of the practitioners of medicine and surgery.

But the practice arising from the diseases and other circumstances of the teeth, has of late years become very extensive, and the great comfort experienced when they are preserved in a healthy state, will cause them to be attended to, more universally. The same consideration of their importance, with which the minds of the inhabitants of the metropolis have been impressed, is fast spreading through the country, so that surgeons who from their situation are obliged to undertake every branch of practice, will soon find a new object presenting itself, and calling for their particular attention.

Nature has provided for the purpose of mastication two sets of teeth, one adapted to the state of childhood, and another which is not brought to perfection until the time of completed adolescence, and which is designed to continue during the remainder of life. The preservation of the teeth during the

continuance of life, is very much affected by the care which has been bestowed upon them during the earlier periods.

The first set, or temporary teeth, are very liable to become diseased; and they seldom, in the human subject give way by a natural process in sufficient time to permit the second set, or permanent teeth, to arrange themselves in their proper order; hence the state of the permanent teeth is much influenced by that of the temporary during childhood, and attention to them at this period is of the greatest consequence, for they may then be preserved from falling into disease, and that irregularity of arrangement which occasions so much deformity may certainly and easily be prevented.

A knowledge of the changes which the teeth undergo, and the circumstances which attend the progress of the second dentition is highly necessary, as no safe or successful practice can be expected without a correct acquaintance with the anatomy and natural history of those parts.

Mr. Hunter's work is the best book upon this subject in our language; but although he speaks of the second dentition, and of the irregularity of the teeth, it is only in general terms, neither has he given an exact or precise description of the

proper

proper treatment, so as to lead any person to undertake with confidence the right management of the teeth during this period.

The extensive acquaintance I have had with medical men, has given me an opportunity of discovering how useful and important they would deem a clear and practical work upon the different stages of dentition. Being possessed of a series of preparations exhibiting the teeth under all their changes, and having been honoured with such a share of practice as to enable me to speak with confidence, I have ventured to present to the public those observations which I have been able to make, accompanied with engravings accurately illustrating the subject.

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Of the Formation of the temporary Set of Teeth.

WHEN the Fœtus has advanced so far, in the organization of its different parts, as to take some determinate form or figure, we may perceive a considerable progress, in the preparatory steps, for the formation of the teeth.

As soon as the ossific deposit commences, in the cartilaginous parts of the embryo, both jaws are filled with small membranous sacs, and, in the anterior parts, we may perceive the rudiments of alveolar processes.

In a Fœtus of about four months, the jaw bones are distinctly formed; but at this time they only consist of thin grooved bones, having a cavity extending through their whole length.* In the under jaw, anteriorly, this cavity is narrower

* The description of what takes place in one jaw, will completely exhibit what concerns the formation of the teeth in both, therefore, in order to avoid confusion, I shall refer to the under jaw only.

and deeper: but, posteriorly, it becomes wider and more shallow; at this time, if the membranous parts be removed, small processes of bone may be perceived shooting across from each side, which, as the Fœtus increases in growth, gradually acquire more distinctness, and at length form separate sockets for the teeth.*

During the fœtal state, and also for some months after birth, the blood vessels and nerves belonging to the teeth, run along at the bottom of this cavity, immediately below the pulps of the teeth; but afterwards a distinct canal is formed, through which the principal vessels and nerves pass; separate filaments being sent off to the several teeth.

When the gum which covers the alveolar groove of a Fœtus, of the age above-mentioned, is stript off from the bone, small processes or elongations from the inner surface of the gums may be distinctly perceived; these are the first appearances of the pulps from which the teeth are formed.†

The alveolar processes soon become perfectly distinct; for, the bony partitions which divide the longitudinal cavity in the

* Plate I. Fig. 1. † Plate I. Fig. 2

the jaw, rise to the upper margin ; and thus those membranous processes, now enlarged and become more evolved, begin to be contained in separate cells.*

In a Fœtus of about four months old, the rudiments of the teeth may be very distinctly seen ; upon examining those substances found in the jaws, they are seen to be soft, or pulpy bodies, bearing a resemblance to the figure of the body of the tooth to be formed, and each of them is contained in a membrane proper to itself.†

For some time during the formation of the teeth, the alveoli grow much faster than the teeth themselves, which are consequently but loosely contained within them. At the time of birth, the alveolar processes have increased so much, that they almost enclose or cover the teeth ; thus a firm support is given to the gums, and the infant is enabled to make considerable pressure in sucking, &c. without injury to the progress which is going on underneath.

The ossification of the teeth begins to take place very early. It is first visible upon the tips of the *incisores* ; In a Fœtus of

 about

* Plate I. Fig. 3. 5.

† Plate I. Fig. 4.

about five or six months, ossification has commenced upon the pulps of the incisores and cuspidati, and on the points of the molares; this gradually advances and extends itself, over the pulp, down to the neck of the tooth, from the cutting edges or highest points, where it had first commenced.

At the time of birth, the bodies of ten teeth are distinctly formed in each jaw; these are the teeth designed to serve during the years of childhood, and are commonly called the temporary, shedding, or milk teeth.*

These temporary teeth, which constitute the first set, are twenty in number, and are divided into three classes, *incisores*, *cuspidati*, and *molares*. In each jaw there are four *incisores*, two *cuspidati*, and four *molares*, and the teeth on one side of the mouth correspond in figure with those of the other, so that they are situated in pairs.

Beside these twenty teeth, there are in a very early stage of their formation, the rudiments of some other teeth, which are to form part of the permanent or adult set.†

After

* Plate II. Fig. 1. † Plate II. Fig. 1. A. B.

After birth, as the ossification goes on, the teeth become too long to be contained within the alveolar cavity, they therefore begin to make pressure upon those parts which cover them; this produces the process of absorption, which proceeds with the enlargement of the tooth, first removing the membranes which enveloped the teeth, and afterwards the thick gum which covered them, this gradually becoming thinner and thinner, till at length the teeth are suffered to pass through.

There is considerable variety as to the precise time when the teeth begin to make their appearance. This frequently seems to depend upon the health and vigour of the child; for sometimes the first tooth comes as early as four or five months, while on the contrary, in those of more delicate and weakly constitutions, no tooth makes its appearance until the child is ten or twelve months old; and it is not very uncommon for a child to be turned of fourteen months before any tooth appears.

It may be expected that the formation of the teeth will go on more rapidly in the healthy, and proceed more slowly in the weak and delicate: Yet there are exceptions to this, for often the teeth seem not to be influenced by any state of health. Those

of

of a weakly child will sometimes arise in rapid succession, while those of one more robust will often come forward but slowly.

In general children begin to have their teeth about the sixth, seventh, or eighth month after birth ;* those which correspond with each other generally appearing about the same time, first in the under jaw, and then in the upper.

The following is the order in which the teeth of a child generally appear.—The first teeth are the central *incisores* of the under jaw, one generally coming a few days before the other ; then, in the course of a month, the two central *incisores* of the upper jaw. These are succeeded in a few weeks by the lateral *incisores* of the under jaw, and then soon after by the lateral *incisores* of the upper jaw. The *cuspidati* are generally slower in completing their growth than the *molares* ; they are

* Sometimes a child is born having one or two teeth ; these are generally the central *incisores* of the underjaw : In such cases the socket for the forming tooth has not been sufficiently deep, and therefore the tooth has passed through the gum prematurely. These early productions are only the upper parts or crowns of teeth, no fangs having yet been formed. And as they have only a weak attachment to the gums, they soon get loose, producing a considerable inflammation in the mouth of the child, as well as occasioning inconvenience to the mother. It is therefore adviseable to extract them immediately, for they can never come to perfection.

are placed deeper in the jaw, and therefore are preceded by the first *molares*. The small *molares* of the under jaw usually come before those of the upper; they commonly appear about the fourteenth or sixteenth month, and are soon met by those of the upper jaw. After these, the *cuspidati* come through, first in the lower jaw, and then in the upper. At some time between two years and two years and a half, the second *molares* make their appearance, and thus complete the temporary set of teeth.*

The obtaining of the temporary teeth usually occupies a child from about the sixth or eighth month until between two or three years of age. The teeth most commonly follow the order abovementioned; but this is not always to be expected: There are often great irregularities; sometimes the upper teeth appear before the under; now and then the lateral *incisores* precede the central. I once saw an instance of the first *molaris* of the under jaw appearing before the lateral *incisores*; and sometimes more teeth come about the same time than ought naturally to be expected. These cases of irregular succession of the teeth are often attended with considerable derangement of health, and alarming symptoms of irritation.

CHAP.

* Plate II. Fig. 2, 3, 4.

CHAP. II.

Of the Formation of the permanent Set of Teeth.

IN the management of the teeth of children, it is highly necessary that the surgeon should have a perfect knowledge of the order, in which the teeth of the permanent set are formed, and of the time when each tooth is expected to pass through the gums.

The formation and perfection of this set of teeth, occupy a very important portion of our limited existence, no less than twenty years, and often more, being necessary for their complete evolution. Nature begins to attend to the production of these permanent instruments of mastication, even before birth, and in many instances, they are not wholly completed before the twenty-fifth, or thirtieth year.

The permanent set of teeth vary much from the temporary set, some of the teeth being much larger, and others differing much in figure; they are in number thirty-two, and therefore consist of twelve teeth more than the temporary set.

This

This set of teeth may be divided into two distinct classes; those which are to succeed the temporary, and those which are superadded; the formation of both these divisions begins nearly about the same time, and the progress furnishes one of the most curious changes the animal frame can exhibit.—The *incisores* and *cuspidati* of the child are succeeded by teeth similar in form, but larger in size, and they have the same appellation; but the teeth which take the places of the temporary *molares* are much smaller, and being divided at their grinding surfaces into two points, are called *bicuspides.* The *molares* of the adult are the teeth which are superadded, and these succeed one another as the jaws advance in growth.*

The teeth of the adult are divided into four classes: *Incisores, cuspidati, bicuspides,* and *molares.*

The teeth differ very much in the figure of their bodies, and in the number and shape of their fangs. The *cuspidati* are of a middle nature between the *incisores* and the *bicuspides*; as are the latter between the *cuspidati* and the *molares.*

The *incisores,* or cutting teeth, are situated in the anterior part of the jaw, and form the front of the mouth. In each

 jaw

* Plate VII.

jaw they are four in number, and are so placed that the two central stand somewhat more advanced than the lateral.

The bodies of the *incisores* are broad, and rather flat. The anterior surface is convex, the posterior concave ; they both go off from the neck of the tooth somewhat sloping : The two surfaces terminate in a cutting edge, which is placed in a direct line with the apex of the fang. When viewed in front, the cutting edge is seen to be the broadest part of the tooth, but gradually becomes smaller as we approach to the neck. When viewed laterally, the cutting edge is the thinnest, and the tooth to the neck of it increases in thickness. This gives to the body of the tooth the form of a wedge, which is its true office, it being used to cut or divide soft substances.

The enamel is continued farther, and is thicker on the anterior and posterior surfaces than on the sides; it is even thicker on the forepart than on the back part of the tooth. The fangs are conical, and are shorter than those of the *cuspidati.*

In the upper jaw the central *incisores* are much broader and larger than the lateral ; in the lower jaw they are all nearly of the same size, but much smaller than those of the upper jaw.

The

The *cuspidati* are four in number, one of them being placed on the outer side of each of the lateral *incisores*.

The shape of the crown of a *cuspidatus* is like that of an *incisor* with its corners rubbed off, so as to end in a point, instead of a broad edge. The fang is thicker and larger, and is more depressed at the sides, which causes it to appear considerably broader when viewed laterally, than when seen in front. The fang which is the largest of any of the teeth, may be felt with the finger running up a considerable length, and projecting beyond those of the other teeth.

The *cuspidati* of the lower jaw very much resemble those of the upper, both in figure and in length. The enamel covers more of the lateral parts of these teeth than of the *incisores*: When they are first formed they are pointed, but by the friction of each upon the other in mastication, they become rounded, and sometimes acquire a flat edge.

The use of the *cuspidati* is not like that of the *incisores*, to cut and divide substances, nor like the *molares* for mastication; but they are similar to the canine teeth of carnivorous animals, and seem to be designed for the laying hold of and tearing of substances.

The

The *bicuspides* are situated immediately behind the *cuspidati*. They were formerly called the first and second grinders, but as they do not possess the true figure of grinders, and only have an intermediate resemblance between those teeth and the *cuspidati*, Mr. Hunter considered them as a particular class.

These teeth are very much like each other, and when viewed as they are situated in the mouth, are not unlike the *cuspidati*. They are eight in number; those belonging to the upper jaw have the body divided into two points, one external, the other internal. Their fangs appear as if compressed at the sides, and resemble two fangs united with a depression running between them: Commonly the first *bicuspis* has two small fangs, the second has seldom more than one; but in this they are subject to variety.

The *bicuspides* of the under jaw are smaller than those of the upper; the points upon their surfaces are not so distinct, and they have only one fang. The enamel is distributed nearly equally around the crown, and they stand in the jaw almost perpendicularly, but have a slight inclination inwards.

The *molares*, or grinders, are placed behind the *bicuspides*; there are three on each side of the jaw, making twelve in the whole.

whole. The first and second *molares* are so much alike in every particular, that the description of one will convey a perfect idea of the other. The third grinder has several peculiarities, and therefore must be described separately. The *molares* are the largest teeth; they have a broad base furnished with several points, which fits them for their office in grinding of food, and they have several fangs.

The *molares* of the under jaw have an inclination inwards, while those of the upper jaw are placed nearly perpendicularly with respect to the jaw.

The upper grinders have commonly three fangs, two situated on the outer part of the tooth, and one on the inner; the inner fang is very oblique in its direction, and is larger and rounder than the others. Those of the under jaw have two fangs, one placed forwards, the other backwards; they are rather flat, and continue broad all down their length.

Sometimes *molares* of the upper jaw are met with having four distinct fangs.* I have one with five fangs, which is the only one I ever saw.† The *molares* of the under jaw now and then have three fangs.‡

The

* Plate VIII. Fig. 11. † Fig. 13. ‡ Fig. 6.

The third *molaris* is called *dens sapientiæ*; it is smaller than the others, its body is rather rounder, and the fangs are not so regular and distinct: They often appear as if squeesed together, and sometimes there is but one fang. The *dentes sapientiæ* of the lower jaw often have their fangs curved, and sometimes they are so much inclined inwards, as scarcely to rise above the ridge of the coronoid process.

The *incisores* of the upper jaw being much broader than the same teeth in the under jaw, cause the other teeth to be placed farther back in the circle than the corresponding teeth of the lower jaw; hence in a well formed mouth, when the teeth are shut close, the central *incisores* of the upper jaw come over the central and half of the lateral *incisores* of the lower jaw: The lateral *incisor* of the upper jaw covers the half of the lateral *incisor*, and more than half of the *cuspidatus* of the under jaw. The *cuspidatus* of the upper jaw falls between and projects a little over the *cuspidatus* and first *bicuspis* of the under jaw. The first *bicuspis* of the upper jaw falls partly upon the two *bicuspides* in the lower jaw: The second *bicuspis* shuts upon the second *bicuspis* and the first *molaris*: The first upper *molaris* covers two thirds of the first and part of the second *molaris* of the under jaw: The second upper *molaris* shuts upon the remainder of the second and part of the third;

and

and the third *molaris* of the upper jaw, being smaller than that in the under jaw, shuts even upon it. *

From this mechanism of the teeth their power in mastication is increased, and if one tooth be extracted, the antagonist tooth does not become useless, since it can in part act upon another.

The permanent *incisores* and *cuspidati* are formed behind the temporary *incisores* and *cuspidati* ; the *bicuspides* underneath the temporary *molares*, and they are contained in sockets of their own.

The *molares* are one after the other formed in particular parts of the jaws: In the upper jaw, that posterior part called the tubercle, is the place for the formation of the upper *molares* ; and the *molares* of the under jaw are formed in that part situated beneath the coronoid process, one succeeding the other, as the jaws in their growth carry the teeth forwards.

Those teeth of the permanent set which first begin to be formed, are the anterior *molares*, the pulps of which may be found in a Fœtus a short time previous to birth, when they are situated quite at the posterior parts of the jaws. At the

* Plate VII. Fig. 1.

the time of birth ossification has commenced upon their highest points; at this time also, on examining the membranes of the temporary *incisores*, small membranous sacs, containing a jelly-like substance, will be found attached to them at the posterior and upper part. These are the early rudiments of the permanent *molares*; ossification commences upon their tips soon after birth, but always first in the lower jaw.

When an infant has cut the central *incisores* of the upper jaw, and the four *incisores* of the under jaw, a considerable progress has been made in the ossification of the permanent *incisores* and first *molares*; in the under jaw it has begun on the points of the *cuspidati*, and in the upper jaw pulps for *cuspidati* have become distinct, the ossification of which usually commences when a child is aged about sixteen months.*

Between two and three years, when all the temporary teeth have appeared through the gums, the size of those permanent teeth already mentioned is much increased, and ossification has commenced upon the points of the *bicuspides* of the under jaw.†

After this time the teeth very much alter their position: At first the permanent teeth are contained in the same sockets as

* Plate II. Fig. 2, and 3. † Plate II. Fig. 4.

as the temporary; but as the formation of both sets advances, the permanent teeth, by the growth of the alveolar processes, become placed in a kind of niche; there is also a small bony process shooting across the bottom of the common socket, which gradually increases till at length nearly a complete separation is produced, and the permanent teeth are contained in sockets of their own. This may be very well observed in the head of a child of about four years of age; at this time the jaws have become deeper, in consequence of the complete formation of the temporary teeth and their alveolar processes, and the permanent set may be presented to view, upon removing the external plate of the jaws.*

About this age the ossification of the *incisores*, *cuspidati*, first *bicuspides*, and first *molares*, is much advanced, some progress has been made in the formation of the second *molares*, and soon after, the ossification of the second *bicuspides* commences.

At about six years of age those teeth designed to succeed the temporary ones, and the first and second *molares* are in considerable forwardness, and if none of the temporary teeth have yet been removed, there are at this time in the head, forty eight teeth, twenty *in situ*, and within the jaws beneath the gums, in the progress of formation, twenty eight.†

In

* Plate III.

† Plate IV.

In the eighth or ninth year the formation of the third *molares*, or *dentes sapientiæ* begins, by this time some of the front teeth have been shed, and all the others are much advanced in growth.*

The permanent *incisores* and *cuspidati*, during their formation, are all situated on the inner side of the temporary teeth, consequently they are contained within the segment of a circle, smaller than that which holds the temporary teeth; they are also much larger, and therefore very much crowded and forced into irregular order. The lateral *incisores* are placed sometimes crossways, and always behind, in the space between the central *incisores* and *cuspidati*. In the upper jaw the *cuspidati* are placed so high as only to be just underneath the suborbitar process, and in the lower jaw they are placed almost as deep as the under margin.

This description which has been given of the progressive steps taken by nature in the formation of the teeth, may not exactly agree with that given by some respectable writers. Into Mr. Hunter's treatise, for want of closer attention, many inaccuracies have been suffered to creep. Besides, descriptions of this kind are liable to disagree, because the forma-

 tion

* Plate V.

tion of teeth in children of the same age may be in a more or less advanced state. But from various preparations and observations I have made, the above is the order in which the formation generally takes place.

CHAP. III.

Of the Manner in which the Teeth are formed.

THE teeth are formed in a manner peculiar to themselves, differing from the mode observed in the formation of bones in general; instead of having for their basis cartilage or membranous substance, as the cylindrical and flat bones have, they are formed from a soft pulpy substance, which possesses the shape of the body of the tooth to be produced.

Each pulp is covered by a membrane strongly attached to the gum, and to the pulp at its base, so that the pulp at its edge is loosely contained within the membrane, which is only reflected over it; at the base the pulp is weakly connected with the alveolar cavity in the jaw.

When a jaw has been minutely injected, we find that the pulps are vascular, and also the membranes by which they are enveloped. These membranes may with care be separated into two *lamellæ*, the external of which is rather of a loose and spongy texture, and possessed of vascularity; the internal *lamella* is more smooth, and is also vascular: The membranes derive their vessels from the gums, and the pulps receive their's from the artery which passes through the jaw.

Some preparations, in the injection of which I have very happily succeeded, fully warrant the above statement in all its variations from those of Mr. Hunter, or Dr. Blake, the author of an inaugural dissertation, published in Edinburgh in 1798, containing many excellent physiological remarks on the formation of the teeth. Mr. Hunter observes, that the external membrane is soft and spongy, without vessels, the other much firmer and extremely vascular. Dr. Blake says, "they (the membranes) can easily be separated into two *lamellæ*, the external of which is spongy and full of vessels; the internal one is more tender and delicate, and seems to contain no vessels capable of conveying red blood." In several preparations which are minutely injected, taken from the human subject, and also from the fœtal calf, I have found both the *lamellæ* to be very vascular.*

The

* Plate IX. Fig. 1, 2, 3, 4.

The manner in which the permanent teeth derive their origin, was never properly understood until described by Dr. Blake, and is a discovery which shews very accurate observation.

When the rudiments of the temporary teeth are somewhat advanced, a new sac is given off at the upper and posterior part of their membranes. These sacs are at first contained in the same socket, and are so intimately connected with the membranes of the temporary teeth, that they cannot be separated without tearing one or both.* As the sacs of the permanent teeth advance, the sockets of the temporary ones become enlarged, and little niches are formed in the internal plate of the alveolar processes; these increase in proportion with the size of the permanent sacs, and gradually form a distinct socket round each of them.

There is however an opening left immediately under the gum, through which the membranes of both sets of teeth continue to be connected.† When the temporary teeth have risen in the socket, the membranes are much elongated, and remain attached to the gum at the neck of the tooth, small *foramina* being left in the jaw for them to pass through; thus they continue to derive their vessels from the gums.‡

The

* Plate IX. Fig. 5. † Fig. 10. ‡ Fig. 6.

The second and third permanent *molares* are in like manner formed from the first: A small process or sac is sent off posteriorly, which is at first contained in the same socket as the pulp of the first *molaris*; by degrees a new socket is formed, in which the pulp of the second *molaris* becomes perfect: This then sends off another process which forms the third *molaris*.*

A tooth is composed of two substances, one of which, called the enamel, is spread over that part which is not covered by the gums. The other substance is bone; it consists of the fang and all the body of the tooth situated within the enamel.

The bone of the tooth is formed from the pulp, and the enamel from the investing membrane. The bony part of the tooth is begun to be formed before the enamel. When the ossification of a tooth is commencing, bone is deposited from the vessels of the pulp upon its extreme points. In the *incisores* it begins upon their edges, and in the *molares*, upon the points of their grinding surfaces. The ossification usually begins in the *incisores* in three spots; these increase, soon unite and produce the cutting edge of the tooth: In the *molares* it begins in as many spots as there are grinding points, which in the lower jaw are commonly four, and in the upper, five: These soon unite and form one thin layer of bone over the upper surface

* Plate IX. Fig. 9.

surface of the pulp. The ossification soon extends to the sides of the pulp, and a thin shell of bone is spread over its whole surface.

If this shell be removed, the pulp, when uncovered, will be found very vascular. This is extremely well seen in the teeth of large animals, when in a state of formation. Some time ago I had the opportunity of examining the pulps of the teeth of a young elephant, which was dissected by Mr. Astley Cooper. Upon removing the ossification which had taken place upon the pulps, I found the vessels to be exceedingly full of blood: There was also a considerable degree of force required to separate the bone from the pulp, and this strength of union between the pulp and the ossified part, I have always found to be in proportion to the size of the tooth.

In the formation of the bone of a tooth the ossific matter is deposited in strata, one within side the other; thus a tooth is formed from the outer part to the inner, and this deposition of bone continues until the tooth becomes complete.—When the body of the tooth is formed the pulp elongates, and takes that form of the fang proper to each particular tooth, and bone is deposited upon it: It then becomes gradually smaller, until it terminates in a point. If a tooth have two

or more fangs, the pulp divides, and the ossification proceeds accordingly. The cavity within a tooth, as it is forming, is at first very considerable; it becomes less as the formation advances, until it arrives at a certain point, when a cavity is left in it extending nearly through the whole length, and retaining the shape of the tooth.*

In the crown of the tooth, the cavity is of the same figure, and it divides into as many canals as there are fangs to the teeth, a canal extends through each fang connected with the cavity in the body of the tooth: Into this cavity the nerves and blood vessels enter and ramify upon the membrane of the pulp, which remains to line the cavity after the formation of the teeth. In this manner the nerves give sensation to the teeth, and the internal parts of them are nourished.

The enamel is situated upon all that part of a tooth which in the healthy state of the gums is not covered by them. This portion of a tooth is called the body or crown. It is formed by the membrane which invests the pulp: When a shell of bone has been formed upon the pulp, this membrane secretes a fluid, from which a very white soft substance is deposited upon the bone; this at first is of a consistence not harder than chalk, for it may be scratched or scraped off by the nail; it

* Plate VIII. Fig. 4.

it however soon grows hard, and seems to undergo a process similar to that of crystallization, for it takes a regular and peculiar form.

The deposition of the enamel continues nearly as long as a tooth is contained within the membrane; it is always most in quantity upon those parts where its formation first began; it is thicker upon the edges and grinding surfaces of the teeth than upon the sides, and it gradually becomes thinner as it approaches the necks of the teeth. A tooth when sawn through, shews the arrangement of the enamel; and as it requires more heat to blacken and burn this hardest part of the animal frame than the bony part of the tooth, we can, by exposing it to the effects of fire, obtain a still more distinct exhibition of it.* By the time the enamel is completely formed, the tooth has risen so much in the socket, that by its pressure it occasions an absorption of the membrane, which completely prevents any further addition of enamel.

When perfect, the enamel of the teeth is so hard that a file in cutting it, is soon worn smooth; and when struck with it, sparks of fire will be elicited; an effect I have several times produced with human teeth, and which may be very readily

 seen

1

* Plate VIII. Fig. 1.

seen by striking the teeth of large animals with steel, particularly those of the Hippopotamus.

The enamel when broken appears to be composed of a great number of small fibres, all of which are so arranged as to pass, in a direction from the centre to the circumference of the tooth, or to form a sort of radii round the body of the tooth. This is the crystallized form it acquires sometime after its deposit; by this disposition of its fibres, the enamel acquires a great degree of strength, and thus it is not so readily worn down in mastication, nor so easily fractured by violent action of the teeth.*

While some eminent physiologists have contended, that the teeth, when they have attained their full growth, are to be considered as extraneous bodies, and that they no longer receive nutriment, like the other bones of the body; others have supposed that even the enamel is kept up in future life by continued deposit: but that this cannot be the case will be obvious, when it is considered that the membrane which invested the pulp and entirely produced the enamel is destroyed before the tooth can appear. When a tooth first appears, the enamel is thicker than at any other period of life, and

* Plate VIII. Fig. 2, 3.

and from that time it begins to decrease; this may be remarked in some of the permanent teeth. The *incisores*, when they first pass through the gum, have their edges notched; the *cuspidati* are sharp at their points, and the grinding surface of the *molares* is always irregular.—This sharpness of the points of the teeth is occasioned by a larger deposit upon those parts where ossification had first commenced. By the friction of the teeth, against each other, and against the food in mastication, the teeth are worn smooth, the notches upon the *incisores* disappear, the points of the *cuspidati* are rounded, or in many cases entirely removed, and the surfaces of the *molares* become much smoother.

The case is quite the reverse with the bony part, for when a tooth is first seen through the gum, scarcely more than two thirds of the fangs are formed, but the ossification continues for a considerable time afterwards.

The enamel upon some teeth has a very defective formation; instead of being a hard white substance, having a smooth polished surface, it is frequently met with of a yellow colour, and having a great number of indentations upon its surfaces. This occasions the teeth to resemble the exterior of sponge, and gives them what has been termed a honey-combed appearance.

 Sometimes

Sometimes this appearance of the enamel is only met with on the front teeth, near the cutting edge; at others it extends nearly over half of the tooth, the remaining parts being perfect. When the roughness is near the edge, it often wears out in a few years, or at the age of maturity it may be filed out. In some, one, two, or three indented lines pass across the front of the teeth.*

This defective formation of the enamel is usually confined to the *incisores*, *cuspidati*, and first permanent *molares*; it is rarely met with on the *bicuspides*, or second and third *molares*.—No certain reason can be assigned why the membrane secreting the enamel should so often deviate from its natural action, It can only be referred to some peculiarity of constitution, occasioning an irregular action in the membranes of the pulps during the first months; for this appearance is only met with on those teeth, the formation of which commences about the time of birth; and even upon them, in those parts only which are first formed. In a few months, after, the membranes acquire an healthy action, and the teeth which are formed later, rarely have defective enamel.

It is very remarkable that this circumstance often occurs in several children of the same family; indeed there is scarcely

* Plate VIII. Fig. 14.

scarcely any part in which they resemble each other more, than in the appearance and arrangement of the teeth. I have however constantly observed that these kind of teeth are not so liable to decay, as those which have the enamel very beautiful and transparent. We here find nature, as she does in many other particulars common to humanity, making up for defects in one part of her work, by bestowing greater perfection upon another.

Sometimes in the formation of the teeth two pulps unite, and, upon their surfaces, appear as two distinct teeth, but upon attempting to remove one, it is discovered to be united to the next. In plate VIII. are figures of several teeth of this kind, which must be regarded as *lusus naturæ*.*

Very often the fangs of the teeth become crooked from some obstruction to their growth; and teeth having two or three fangs are now and then met with, so much bent at their points as to occasion them to be very firmly placed in the jaw. When these circumstances occur, the extraction of the teeth is unavoidably an operation of the utmost difficulty.

The arteries which supply the teeth with blood, are called the dental; they are branches of the internal maxillary artery, which

* Plate VIII. Fig. 8, 9, 10.

which arises from the external carotid at that part where it is covered by the parotid gland, and lies behind the middle of the upright plate of the lower jaw, where it divides into the condyloid and coronoid processes. It passes first between the jaw and the external pterygoid muscle, and afterwards runs in a very winding direction towards the back part of the antrum maxillare; it here sends numerous branches to the parts belonging to both jaws, and to the teeth of the upper jaw. It then gives off one branch to the lower jaw, called by some, the inferior maxillary, and by others, the dental. This enters the jaw bone at the posterior maxillary foramen, passes through the maxillary canal, and gives off branches to the fangs of each tooth, and also supplies the substance of the bone: This vessel having sent a branch to the *incisores*, passes out at the anterior maxillary foramen; it is distributed to the gums, and communicates upon the chin with branches of the facial artery.

The nerves which are distributed to the teeth, arise from the fifth pair, the *trigemini*. This pair of nerves, divides into three branches; the opthalmic, the superior maxillary, and the inferior maxillary. The opthalmic branch passes through the foramen lacerum of the orbit, and is distributed to the parts in the neighbourhood of the eye. The superior maxil-

lary

lary nerve goes out at the foramen rotundum of the sphenoid bone, and divides into several branches, being continued to the posterior part of the nose, the palate, velum palati, and contiguous parts. At the posterior part, small filaments of nerves, accompanying branches of arteries, enter the superior maxillary bone by *foramina* which lead to the *molares*, and also to the membrane lining the *antrum maxillare* : The nerve then goes into the canal under the orbit, and forms the *infra orbitar* nerve. Whilst in the canal, it sends off branches to the *bicuspides*, *cuspidati*, and *incisores* ; it afterwards passes out at the *foramen infra orbitarium*, and is distributed upon the cheek, under eye lid, upper lip, and side of the nose.

The inferior maxillary nerve passes through the *foramen ovale* of the sphenoid bone, and is distributed to the muscles of the lower jaw : it sends off a large branch, the lingual, which goes to the tongue, which is the true gustatory nerve ; it then enters the maxillary canal of the lower jaw, passes through the bone under the *alveoli*, and gives off branches, which entering the fangs, ramify upon the membrane within the cavities of the teeth ; it passes out at the anterior maxillary foramen, and is spent about the chin and lip.*

There

* Plate VIII. Fig. 5.

There is another set of vessels, called absorbents, of the existence of which, in the structure of common bone, I believe there is no doubt; and on account of certain effects produced upon the teeth, we must conclude that they are not destitute of them.

During the progress of the second dentition, the fangs of the temporary teeth are absorbed; and even the permanent teeth when diseased, often lose a considerable portion of the fangs. It may be argued that in these cases the absorbent vessels are situated in the socket, and act upon the tooth as if it were an extraneous body. But in some cases we find the teeth undergo the ulcerative process, and a considerable quantity of the inner part is removed, a circumstance which could not happen unless there were absorbents entering into the cavities of the teeth, and properly belonging to them.

Beside these instances, the effects of absorption in the tusks of elephants are often seen; sometimes in sawing these bodies, iron balls, spear heads, &c. are met with, which have been forced into them in attempting to kill these animals. These extraneous substances are always found loose, having a space in which they can be moved. This could never happen, unless

there were some action going on, by which part of the bone could be removed, and there is no other mode in which it can be effected, but through the medium of the absorbent vessels.

The teeth are fixed in their sockets by that species of articulation called gomphosis. They are attached to the alveolar cavity by a strong periosteum, which is extended over the fangs, and which also lines the socket; it is connected to the gums at the neck of the tooth, and it is vascular, like the periosteum in other parts of the body.

It is very extraordinary that Mr. Hunter should have considered the teeth as devoid of internal circulation, and destitute of the living principle. The structure of the teeth is similar to that of any other bone, and differs only in having a covering, which is called enamel, for the exposed surface, and in the bony part being more dense. There are several parts of the body in which we cannot by injections demonstrate the existence of blood vessels, of the vascularity of which no one can entertain a doubt; and as bones in general are continually receiving nourishment from the vessels which enter into their substance, it may be justly inferred that the blood sent to the teeth affords a similar supply, especially as a

considerable portion of animal matter enters into their composition.

A large quantity of blood is distributed to the teeth; this may frequently be seen in performing some operations. In cutting off the crown of a tooth, in which the caries had not spread to the fang, for the purpose of engrafting a new tooth, I have several times seen a discharge of blood from the internal cavity.—This blood came from the vessels of the membrane in the cavity, which I have also several times seen injected. Blood carries with it the basis of nutrition, and is sent to those parts only where renovation is necessary. For what other reason then, but to impart some principle of nutrition, can so much blood flow into the teeth? If the teeth, after their first formation, received no supply from vessels, or did not require any nourishment, it would have been better if they had been destitute of an internal cavity, and of regular organization.

It is always observed, that as persons advance in life, their teeth lose that whiteness which they possessed in the time of youth. This change in the appearance of the teeth seems to depend upon one which takes place in their cavities by which the vessels entering them are gradually destroyed, and the supply

supply of blood is proportionally diminished. In the teeth of persons advanced in years, the cavity is very frequently obliterated, in consequence of a deposit of bony matter, which entirely destroys the internal organization. When this happens, the teeth always lose their colour and become very yellow, their texture also becomes more brittle, and they acquire a horny transparency.

When a tooth has been loosened by a blow, and has afterwards fastened in its socket, a great alteration in its colour is the consequence; it gradually loses its whiteness, and acquires a darker hue; this proceeds from the vessels which enter the teeth being destroyed, and the teeth consequently losing their supply of blood.

The teeth being constructed like common bones, are governed by the same laws, and are liable to be affected by similar diseases; like them, they are affected by the various causes of inflammation, and have the same diseased appearances produced upon them.

In bones, the power of resisting the effects of disease is in an inverse proportion to their density. The living principle is always less in the close textured cylindrical bones,

and greater in those which are flat and spongy.—The teeth being the most dense bones in the body, have the least power of resisting disease, and, in them, the general termination of inflammation is in mortification.

The teeth do not possess the power of exfoliation, it is not necessary they should, for the system suffers no injury by the loss of a tooth; and no person would have sufficient patience to bear the pain, attending upon, or wait the progress of so slow a process.—Like other bones, the teeth are subject to that species of inflammation called the ossific, by which the fangs become increased in size, acquire an additional quantity of bone, and exhibit all the appearances of exostosis.—They are also liable to inflammation of the membrane lining the cavity, and to its suppuration; during the progress of which the inner part of the tooth is removed by the absorbents, and an appearance is produced like that disease of bones called *spina ventosa.*

CHAP. IV.

Of the Shedding of the Teeth.

THE falling out of the temporary teeth, to make way for those which are to be permanent, is commonly called the shedding of the teeth. It is the consequence of one of the most curious actions of nature, and is of great importance to our comfort, since the beauty of the face, and the proper articulation of speech in a considerable degree depend upon the regularity with which this part of her work is accomplished.

The necessity of teeth for the mastication of food commences as soon as the time of support from the mother ceases, and therefore a set is provided at a very early period, which occupies but a few months in formation, and only continues a few years without falling into a state of decay. These teeth are only proportioned to the size of the mouth during childhood, and would consequently be too small and too few in number,

number, for the extended state of the jaws in the adult; hence the formation of new teeth becomes indispensible, and according to the manner already described, a set of teeth is formed, of a magnitude and number proportioned to the mature state of the body, and intended, from their compact structure, to continue through life.*

It is during the growth of the permanent teeth that the very curious process of absorption is going on in the temporary ones, which facilitates their removal from the socket, and affords a free passage to the permanent teeth.

It has been observed, that the pulps of the new teeth are placed behind the temporary ones, and in that situation they are very much crowded, and occupy but a small space. Now it is evident that as they advance in growth, they will require an

* The same circumstances take place in all animals: They, like the human subject, shed their teeth, and obtain a new set. But in some animals there is a variety in the mode, arising from the peculiar structure of their teeth and jaws. This is particularly and very curiously the case in the elephant, which animal, instead of having its new teeth formed under the temporary ones, they are formed in sockets beyond those to be shed, which in due time advance from the back to the front part of the jaw. This is very accurately described by Mr. Corse, in his paper in the Philosophical Transactions. A similar mode is observed to take place in one grinder of the *Sus Ethiopicus*, as described by Mr. Home, whose paper, with that of Mr. Corse, are in the Transactions for 1799.

an increase of room, to obtain which they must come forwards, so as to form a larger circle.

This effort first produces a considerable pressure against the bony partition, placed between the temporary and permanent teeth, and then upon the posterior part of the fangs of the shedding teeth. The pressure in this instance acts precisely in the same manner as it generally does in other cases where it is applied. It induces an absorption of the parts pressed against; and as the new teeth augment, the fore part of the socket which was formed around the pulp, and separated it from the temporary tooth, is removed by the process of absorption.*—The second teeth still continuing to protrude, press against the fangs of the temporary teeth, at which place their substance begins to be taken up: The absorption goes on until the greater part, or the whole, of the fangs are removed; at the same time the new teeth come forward, underneath the temporary ones, which soon drop out, when the edges of the new teeth may generally be distinctly felt.

The absorption gives to the fangs of the teeth an appearance of being broken, but this, when compared with a fracture,

* Plate II. Fig. 1, 2, 3, 4.

ture, will be found to differ from it very materially.—While the absorption of the fangs of the temporary teeth seems to depend so much on the pressure of the rising permanent ones, it is often found to go on without such pressure; for in some children the temporary teeth will loosen and drop out many months before new teeth appear, and in many cases the same effect takes place where a new tooth does not rise to replace the one which has been shed.

These circumstances seem to prove that the absorption of the fangs of the temporary teeth is an action of nature, sometimes independent of pressure: and it is a very singular circumstance, that at a time of life when so great a quantity of ossific matter is poured forth from all the arteries concerned in the formation of bone, in one particular part, there should thus be an absorption of this substance taking place.

In many instances, however, absorption of the fangs of the temporary teeth never takes place; and it is by no means uncommon to find one, two, or sometimes more of them, remain in their sockets for a great number of years. When this happens to be the case with several teeth, it is found that no permanent teeth had been formed: which shews that the absorption

sorption of temporary teeth, although a regular action in the animal œconomy, is very considerably influenced by the pressure of forming teeth. This defect always produces an unseemly appearance, from the small size of the old teeth, when compared with the new.

Cases of deficiency of the permanent teeth are by no means unfrequent. I have seen a young lady of about twenty years of age, who had never shed the two central *incisores* of the under jaw; and in the upper jaw, all the temporary *incisores* remained, except one of the lateral, which had been shed.

It frequently happens in the upper jaw, that the permanent central *incisores* only are formed, the lateral ones never appearing. Many persons are deficient in one or more of the *bicuspides*. I know a gentleman who resides at Bath, who has never had the *incisores* of the under jaw; and it is remarkable, that two other persons of his family are in the same situation. I have seen a lady who had only four teeth of the permanent set in each jaw. Mr. Taunton, Surgeon of the City Dispensary, has the preparation of a child's head, in the upper jaw of which only one *incisor* was forming.*—

* Plate X. Fig. 6.

These deviations often occur in the human subject; but so far as I have observed, they are very rare in animals, yet I once saw a horse rising between eight and nine years, which still retained one of the milk *incisores.*

The appearance of the fangs of the teeth, when absorbed, has given rise to a popular but erroneous opinion, that the first teeth have no fangs, and this was even taught by some of the old anatomists. It has also been erroneously conceived that the temporary teeth are pushed out by the permanent: Now that this cannot take place, will be seen by observing the state of the two sets of teeth. The temporary ones are firmly placed in sockets, whilst the new teeth, during their formation, are contained in cavities larger than themselves, and can only make such pressure as their gradual growth will permit. On this account, if the absorption of the old tooth be retarded, or the formation of the new tooth proceed too quickly, the latter will take an improper direction when they come through the gums, and form a second row of teeth, from the temporary teeth still remaining. Moreover, if the old teeth were pushed out by the new, we should always find those teeth about to be displaced, forced out of the line of the others, a circumstance which never occurs.

The

The period at which children begin to shed their teeth varies considerably. In some the teeth become loose as early as five or six years of age; in others this process does not begin until the eighth year: About six or seven years of age may be taken as the standard time.

The teeth of the permanent set, which usually appear first, are the anterior *molares*, which being somewhat more early in their formation, generally precede the *incisores;* and we must always expect, soon after the cutting of one or other of these teeth, that the shedding of the temporary teeth will begin.

Soon after the first permanent *molares* have appeared, the two central *incisores* of the under jaw become loose, and when they are but slightly attached to the gum, easily come away; the permanent central *incisores* soon after appear, one coming a little time before the other; in about two or three months the central permanent *incisores* of the upper jaw become loose, and having dropt out, the permanent central *incisores* succeed them.

In about three or four months more the under lateral *incisores*, having lost their fangs, come away, and the permanent lateral *incisores* succeed them. The lateral *incisores* of

 the

the upper jaw are the next which drop out, and the permanent ones appear shortly afterwards. In about six or twelve months more, the temporary *molares* begin to loosen; they generally come out before the *cuspidati*, the long fangs of which take a much longer time in being absorbed.

The first *bicuspides* take the places of the first *molares*, and about the time they appear, the second temporary *molares*, and the temporary *cuspidati*, become loose, and having been shed, are succeeded by the permanent *cuspidati*, and the second *bicuspides*.

The shedding of the teeth, commencing at six or seven years of age, is commonly completed in about five or six years, when all the temporary have come out, and those of the permanent set, as far as the second *molares*, have taken their stations. There yet remain, to complete the set, the third *molares*, or *dentes sapientiæ*, and these usually appear between eighteen and twenty-one years of age, but sometimes they do not come till much later; not before twenty-seven or thirty years; and I once was consulted by a gentleman, fifty years of age, who had great pain from cutting one of these teeth.

CHAP. V.

Of the Irregularity of the Teeth.

DURING the shedding of the teeth there are several circumstances which prevent the permanent teeth from acquiring a regular position, and often give rise to very great irregularity in their arrangement.

The most frequent cause is a want of simultaneous action between the increase of the permanent teeth, and the decrease of the temporary ones, by the absorption of their fangs. It rarely happens that so much of the fang of a temporary tooth is absorbed as to permit its removal by the efforts of the child, before the permanent tooth is ready to pass through: on which account the new tooth takes an improper direction, and generally comes through on the inside.

Cases are very frequent in which scarcely any absorption of the fangs of the temporary teeth had taken place previous to the appearance of several of the permanent teeth, and it often happens, that upon the removal of the shedding teeth to give room

room for the permanent ones, that no absorption of the fangs of the temporary teeth has taken place.

Irregularity of the permanent teeth is most commonly occasioned by the resistance made by the nearest temporary teeth; this is always the case if the temporary teeth are small and close set, for as the permanent *incisores* are much larger than the temporary, they require more room; but as the space left by the shedding of the temporary teeth is too small for the regular position of the permanent; they are exposed to the pressure of the next tooth, and hence are frequently turned out of their right direction.

Another cause of the irregularity of the teeth arises from the permanent teeth being too large for the space occupied by the temporary ones; those parts of the jaws not being sufficiently extended to permit a regular position of the new teeth—in this case the irregularity is considerable, and occasions great deformity in the appearance of the mouth. The *incisores* and *cuspidati* being much larger than those of the child, require more room, for want of which they are turned out of their proper positions. The central *incisores* overlap each other—the lateral *incisores* are either placed obliquely with their edges turned forwards, or they are pushed back, and stand between

between and behind the central *incisores* and the *cuspidati;* the *cuspidati* are projected, occasioning the lip to stand out with considerable prominence, and the *bicuspides* are placed very irregularly.

It will be proper, in this place, to observe the manner in which the jaw bones grow, (the under one being taken as the example) and to point out the difference between the temporary and permanent teeth.

After a child has obtained all the temporary teeth, the jaw in general grows very little, in the part which they occupy.—In those children who are an exception to this rule, the temporary teeth become a good deal separated from each other, and these are the cases in which the shedding of the teeth is effected without any assistance of art.

When the jaw of a child is compared with that of an adult, very striking difference is observed; that of a child forms nearly the half of a circle, while that of an adult is the half of a long ellipsis. This comparison clearly points out the part in which the jaw receives its greatest increase, to be between the second temporary *molaris* and the coronoid process; and this

lengthened

lengthened part of the jaw is destined to be the situation of the permanent *molares*.

By the elongation of the jaw a great change in the form of the face is produced; that of a child is round, the cheeks are plump and the chin flat; in an adult the face is more prominent, with a flatness of cheek and a considerable length of chin.

The temporary *incisores* and *cuspidati* are much smaller than the permanent, while the *molares* of the temporary set are larger than the *bicuspides*, which succeed them. Hence it is, that the *incisores* and *cuspidati* are so frequently irregular, and they never could be otherwise were it not that some space were gained from the *molares*, in consequence of the *bicuspides* being much smaller.

This circumstance is rendered intelligible, by examining jaws at various ages, and observing in what particulars they differ from each other.

Until about twelve months after birth, the jaw grows uniformly in all its parts, and at that time as far as the teeth extend it approaches nearly to a semicircle; at about three years

of

of age, when all the temporary teeth have appeared, it begins to lose its semicircular form, and become somewhat elongated; an extension takes place between the last temporary *molaris* and the coronoid process; and in that part, in an advanced state of formation, the first permanent *molaris* will be found.

At about seven or eight years of age, the jaw is more extended, the first permanent *molaris* has grown up, and the second is advancing in formation. At about eleven or twelve years of age it will be found still longer; the second *molaris* is ready to come through the gum, and the third *molaris* has begun to form.

The jaw acquires its full proportion at about eighteen or twenty years of age, when the third *molaris* makes its appearance, and the teeth are seen in the figure of their arrangement to form part of an ellipsis.

The growth of the jaw being nearly confined to the part situated behind the temporary teeth, where the permanent *molares* are placed, the anterior part of the jaw undergoes little more than an alteration in form; it adapts itself to the permanent teeth there situated, and scarcely receives any increase of size.

The same comparison of jaws exhibits the cause of irregularity in the permanent *incisores* and *cuspidati*. When a child is about to shed its teeth, the first permanent *molares* come through the gums behind the temporary *molares*, and therefore the teeth which are situated anteriorly to the permanent *molares*, can obtain no additional space.

The permanent *incisores* occupy the space of the temporary *incisores*, and half of that of the *cuspidati*. It commonly happens that the *bicuspides* are earlier in their appearance than the *cuspidati*; therefore, when the first temporary *molares* are shed, a little room is gained, as the teeth which succeed them are smaller. When the second *molares* are shed, still more room is gained; the two *bicuspides* go back against the first permanent *molares*, and thereby give sufficient room for the *cuspidati*. Thus, by the change of the *molares* of the child, which are large, for the *bicuspides* of the adult, which are small, room is obtained for the increased size of the permanent *incisores* and *cuspidati*.

This change of small teeth for larger, and of larger for smaller, points out the necessity of giving some assistance to nature in one of her processes, viz. that of throwing out the temporary teeth before the permanent teeth appear; if this

be

be done at a proper time, the teeth will always take a regular position, and every deformity arising from irregularity be prevented.

During the progress of the second dentition, an opportunity presents itself for effecting this desirable object; but every thing depends upon a correct knowledge of the time, when a tooth requires to be extracted, and also of the particular tooth; for often more injury is occasioned by the removal of a tooth too early, than if it be left a little too long; because a new tooth, which has too much room long before it is required, will sometimes take a direction more difficult to alter, than a slight irregularity occasioned by an obstruction of short duration. If an improper tooth be extracted irreparable mischief will ensue; as in the case where young permanent teeth have been removed, instead of the obstructing temporary ones, which I have several times known to have been done.

CHAP. VI.

Of the treatment to prevent irregularity of the Teeth.

THE advantage which attends the removing the teeth of children, depends upon its being done at the precise time when nature is tardy in effecting the absorption of the fangs of the temporary teeth. The performance of any improper operation will be prevented by a knowledge of the progress of the formation of the teeth, combined with observations upon the appearance of the gums, which become full when a tooth is about to pass through them.

To assist the permanent teeth in acquiring their proper arrangement, the mouth should be examined from time to time, that the operation be performed at the time required; for it is not sufficient to remove an obstructing tooth, when the new one is perceived to be coming irregularly, because it always requires a considerable time to bring the latter into its proper place, and often the irregularity remains unaltered.

The

The shedding of the teeth commonly begins at about seven years of age; sometimes it may be earlier, and at others rather later; however, it is about this time that a child's mouth begins to require frequent inspection.

There are two circumstances, the presence of either of which always denotes that the shedding of the teeth is about to commence. The first permanent *molares* of the under jaw make their appearance; or one or both of the central *incisores* in the under jaw begin to loosen.

Sometimes the absorption of the fangs of the temporary teeth goes on so slowly, that they do not get loose previous to the passing of the new tooth through the gums behind them. If then the permanent *molares* have been cut for some time, and there be a fulness of the gums behind the under permanent *incisores*, it will be expedient that the two central *incisores* be extracted immediately, although not yet loose. It most commonly happens that the under central *incisores*, by the early absorption of their fangs become loose, and are taken out by the child some time previous to the appearance of the new teeth; but it often occurs that although they have got somewhat loose, they are not sufficiently so, to come out of themselves before the new teeth are ready to pass through. When in this state,

the

the temporary central *incisores* should be removed, and this will permit the permanent central *incisores* to take their proper place. It will soon be seen, as the new teeth arise, whether they have sufficient room ; if not, it will be necessary to remove the temporary lateral *incisores.*

In two or three months afterwards, or sometimes later, attention must be paid to the central *incisores* of the upper jaw. If they have got loose they should be taken out, or if not, and there be the least fulness of the gums behind them, they must be extracted, or else one or both of the permanent *incisores* will come through, and produce one of the most unseemly cases of irregularity, as well as one of the most difficult to treat.

When the permanent central *incisores* are passing through the gum, there is seldom sufficient room for them, and it will be proper to extract the temporary lateral *incisores.*

The attention is next to be turned to the under jaw, for in three, or six months time, the lateral permanent *incisores* may be expected to appear, and if there be any fulness of the gum, where those teeth are to pass, the temporary *cuspidati* must be taken out. In two or three months more the same observations

tions should be made upon the upper jaw, and as soon as the permanent lateral *incisores* exhibit signs of approach, by a fulness of the gums, the temporary *cuspidati* should be extracted.

When the teeth are in this state, they may often remain without farther attention for near a twelvemonth, during which time the *incisores* will be acquiring their complete growth; and the *cuspidati* and the *bicuspides* be ready to come through. Care must now be taken that the permanent *cuspidati* do not take an improper direction; the gums should be examined, and if any prominence be felt, the first temporary *molares* must be extracted. It frequently happens that the first temporary *molares* get loose previous to any appearance of the *cuspidati*, and that when they are removed, the *bicuspides* soon appear.

After this, the treatment must be guided by circumstances. If either of the *cuspidati* exhibit signs of early approach, and there be scarcely room between the lateral *incisor* and the *bicuspis* already in its place, it will be proper to take out the second temporary *molaris*, the first *bicuspis* will then go somewhat back, and the *cuspidatus* will get more room.

When

When the second temporary *molares* have been removed, there remain no other obstacles in the way of the completion of the second dentition. The second *bicuspides* will come properly into their places, and the *molares* having no obstruction, will progressively occupy their proper stations.

Though the shedding of the teeth generally requires a period of four or five years, it sometimes occupies nearly six years. In some children the changes take place quickly, and in others slowly. I have seen a child of only seven years of age, more advanced in the process of dentition, than another of the same family when near eleven.

CHAP. VII.

The treatment to remedy irregularities of the Teeth.

THE mode of treatment described in the preceding chapter, is not always had recourse to, at a time when every irregularity might be easily obviated. Parents most commonly wait until, by an irregular growth of their children's teeth, a manifest deformity is produced, ere they perceive the necessity of advice.

In all cases of irregularity during the shedding of the teeth, the treatment to be observed is to remove the obstructing temporary teeth, and then to apply pressure in the most convenient manner upon the irregular tooth, in order to direct it into its proper situation.

I will now describe the different states of irregularity, and to avoid confusion, take each jaw separately.

In the underjaw, when the growth of the permanent central *incisores* has exceeded the absorption of the temporary ones, they grow up immediately behind them, in a direction towards the tongue. These two new teeth are generally so broad as nearly to cover the inner surface of the four temporary *incisores*. It will therefore be necessary, in order to obtain room for these teeth, that the four temporary *incisores* be extracted. The new teeth will then gradually come forward, in which they will naturally be assisted by the pressure of the tongue of the child, and may be occasionally helped by the finger of the parent or nurse.*

If the temporary central *incisores* have loosened, and come out previous to the appearance of the permanent teeth, the space is seldom sufficiently wide, and the new teeth will either grow up with their sides turned forward, or one will be placed before the other. In this case the two lateral *incisores* must be taken out. †

When the permanent central *incisores* have completely grown up, they occupy full two thirds of the space, which contained the four temporary *incisores*; therefore, when the permanent lateral *incisores* appear, they are placed partly behind the central

* Plate XI. Fig. 1. † Fig. 2.

incisores and the temporary *cuspidati*; or they grow up with one corner turned forwards, and the other pointing backwards. In either of these cases the temporary *cuspidati* must be removed to give room. *

The four permanent *incisores* take up nearly the whole of the space of the temporary *incisores* and *cuspidati*. The permanent *cuspidati* are large teeth, and when they have not sufficient room, they occasion very great irregularity. Sometimes they come through on the inside, but most commonly they cut the gum on the outside, and project very much out of the circular line from the temporary *incisores* to the temporary *molares*. In this case the necessity of the removal of the first temporary *molares* is obvious. †

It is not very common that the *bicuspides* of the lower jaw are irregular, because the temporary *molares* are generally removed before they appear; but when this is not the case, they always come through the gums on the inside, pointing towards the tongue, in which case the temporary *molares* must be removed, that the *bicuspides* may rise into their proper situations. ‡

* Plate XI. Fig. 3. 4. † Fig. 5. ‡ Fig. 6.

In the upper jaw the permanent central *incisores* sometimes pass through the gums behind the temporary ones; when this happens, the four temporary *incisores* must be extracted, and frequent pressure by the thumb should be applied to the new teeth, in order to bring them forward as soon as possible, and prevent one of the cases of irregularity most difficult to be remedied.

When the temporary central *incisores* have come out, the space is generally too narrow for the permanent ones, and hence they are pressed into some shape of distortion. Their edges do not assume the regular curve, but stand obliquely, or even sometimes one before the other. Cases of this kind require the removal of the temporary lateral *incisores*. *

The permanent central *incisores* are very broad; they occupy the greater part of the space of the four temporary ones, and leave scarcely any room for the permanent lateral *incisores*; on which account these latter teeth must grow very irregularly; they generally pass through behind, being forced considerably backwards by the resistance of the central *incisores* and the temporary *cuspidati*. Sometimes they pass through edgeways, and now and then they project forwards. In any of these cases the removal of the temporary *cuspidati* is absolutely

* Plate XI. Fig. 7.

lutely necessary, and unless the operation be timely performed, the irregularity is with difficulty remedied.*

The greatest deformity is generally occasioned by the want of room for the lateral *incisores* and the *cuspidati*, and when too long neglected usually becomes permanent.

When the permanent *cuspidati* make their appearance, they generally project very much forwards, and not only disfigure the mouth, but are very dangerous. I have known several instances, where, from the accident of a blow, the upper lip has been cut through. Whenever the *cuspidati* are growing thus, the first temporary *molares* ought to be extracted.†

When the *bicuspides* appear before the temporary *molares* have been extracted, they pierce the gums above the shedding teeth, and may be seen by raising the cheek and upper lip. The removal of the temporary *molares* immediately permits them to come down into their right situation.‡

In almost all the cases of irregularity which occur in the under jaw, nothing more is necessary after the removal of the obstructing tooth, than to apply the frequent pressure of the

* Plate XI. Fig. 8. 9. † Fig. 10. ‡ Fig 11.

the finger, in such a manner as to direct the irregular tooth into its proper place. It will assist the natural tendency of the teeth to form a regular circle, and to take up as large a space as possible. But in the upper jaw, when the irregularity has been suffered to remain for any length of time, it cannot be obviated without having recourse to other assistance.

Irregularity is often occasioned by the teeth being much too large for the space allotted them, and then it will be necessary to remove one or more of the permanent teeth.

When the *incisores* are perfectly regular, and the *bicuspides* have appeared before the *cuspidati*, there is so little space left, that the *cuspidati* are thrust too forward. *

It has been the common practice to admit the *cuspidati* to grow down to a certain length and then to extract them. This operation certainly removes the deformity of projecting teeth, but it destroys the symmetry of the mouth, and takes away two teeth of great importance. The *cuspidati* are exceedingly strong; they form the support of the front of the mouth, and in the advanced periods of life, to those persons

* Plate XI. Fig. 12.

persons who have the misfortune to lose the *incisores*, they furnish an excellent means of fixing artificial teeth.

On these accounts they should be preserved, and therefore it will be right to extract the first *bicuspis* on each side. The *cuspidati* will then fall into the circle, and if there should be any vacant space, it will be so far back that no defect will be perceived. This is often the case in the under jaw, as well as in the upper, and the same practice ought to be adopted.

The first permanent *molares* often become carious soon after they appear; when this is the case, and the other teeth have not proper room, considerable advantage always attends their extraction. Their removal permits the *biscuspides* to fall back, and gives way for the regular position of the *cuspidati*.

The removal of these Teeth when decayed ought always to be recommended, although they may not occasion pain, or there be no irregularity in the front teeth; diseased teeth always affect others, and therefore ought never to remain in the mouths of children.

If they be extracted before the second permanent *molares* appear, in a short time they will not be missed, because the *biscuspides* will go back, and the second and third *molares* will come forward, so that no space will be left.

The front teeth may even derive much benefit from this gain of room, as there will probably be left a small space between them, which will tend to their preservation; for it is observed, when teeth are situated so close as to press hard upon each other, they almost always fall into a state of decay.

Sometimes the upper jaw is too narrow from side to side, the teeth in the fore part are thrown forwards, and project very much over the teeth of the lower jaw, they also push out the upper lip. In this case the first *biscuspis* on each side should be extracted, which will permit the teeth to fall into a more regular curve.

When the permanent *incisores* of the upper jaw have cut the gum behind the temporary teeth, and have been suffered to remain until considerably advanced in growth, they always

ways stand so much inwards, that when the mouth is shut, the *incisores* of the under jaw stand before them, which is always an obstacle to their acquiring regularity, and occasions a great deformity.

There are four states of this kind of irregularity. The first, when one central *incisor* is turned in, and the under teeth come before it, whilst the other central *incisor* keeps its proper place, standing before the under teeth.*

The second is, when both the central *incisores* are turned in, and go behind the under teeth; but the lateral *incisores* stand out before the under teeth.†

The third variety is, when the central *incisores* are placed properly, but the lateral *incisores* stand very much in; and when the mouth is shut, the under teeth project before them and keep them backward.‡

The fourth is, when all the *incisores* of the upper jaw are turned in, and those of the under jaw shut before them. This is sometimes occasioned by too great a length of the under jaw, in consequence of which it projects con-

 siderably

* Plate XII. Fig. 1. † Fig. 2. ‡ Fig. 3.

siderably forwarder than the upper jaw.* But the majority of such cases originate entirely from neglect, and may be completely remedied by early assistance.

The time to affect any material alteration in the position of the teeth, is before thirteen or fourteen years of age, and as much earlier as possible; for after that time the sockets of the teeth acquire a great degree of strength, and the teeth are so fixed that they cannot be moved without much difficulty. If the irregularity be left to a much later period, it becomes a great deal more difficult to produce any alteration, and frequently all attempts are fruitless.

To remove the kind of irregularity abovementioned, two objects must be accomplished; one, to apply a force which shall act constantly upon the irregular tooth, and bring it forward; the other, to remove that obstruction which the under teeth, by coming before the upper, always occasion.

The first of these objects may be attained by the application of an instrument adapted to the arch of the mouth, which, being attached to some strong teeth on each side, will furnish a fixed point in front, to which a ligature previously fastened on

* Plate XII. Fig. 4.

on the irregular tooth may be applied, and thus, by occasionally renewing it, a constant pressure is preserved, and the tooth may be drawn forward.

The second object, that of removing the resistance of the under teeth, must be attained by placing some intervening substance between the teeth of the upper and under jaws, so as to prevent them from completely closing, and be an obstruction to the coming forwards of the irregular tooth.

This instrument may be made of gold or silver; it should be so strong as not easily to bend; if about the sixteenth of an inch in breadth, and of a proportionate thickness, it will be sufficiently firm.—This bar of gold must be bent to the form of the mouth, and should be long enough to reach to the temporary *molares*, which are the teeth to which it is to be tied. Holes are to be drilled in it at those places where ligatures are required, which will be on the parts opposed to the teeth designed to be the fixed points, and also at the parts opposite to the place where the irregular tooth or teeth are situated. Then to the bar a small square piece of ivory is to be connected, by means of a little piece of gold, which may be fastened to the ivory and the bar by two rivets. This piece of ivory passes under the grinding surfaces of the upper

teeth, is kept there fixed, and prevents the teeth from closing and consequently takes off all obstruction in front.*

The bar is to be attached by a strong silk ligature to the teeth at the sides, so that if possible, it may remain tight as long as it is required; a ligature is then to be tied around the irregular tooth, and the ends, being brought through the holes in the bar, are to be tied in a firm knot. In two or three days this ligature must be removed and a new one applied; the tooth will soon be perceived to move. A fresh ligature must be used every three or four days, in order to keep up a constant pressure, sufficiently powerful to bring the tooth into a line with the others.†

The same mode of treatment is to be observed whether there be one, two, or three teeth growing in a similar manner. The teeth are usually brought forwards in about a month or five weeks, and as soon as they are so much advanced as to allow the under teeth to pass on the inside, the piece of ivory may be removed, and the bar only be retained for a few days, until the teeth are perfectly firm, which will prevent the accident of the teeth again receding.

In

* Plate XII. Fig. 5. † Fig. 6, 7.

In cases where the irregularity has been suffered to continue too long, no success can be expected to follow attempts to remove it; we must content ourselves, in the treatment of these cases in adults, with taking away the most irregular teeth, and thus, as much as possible, lessen the deformity.

CHAP. VIII.

Of Supernumerary Teeth.

THE growth of more teeth than the natural number frequently occurs, and is always the cause of great irregularity of the teeth. It most commonly happens that supernumerary teeth are met with in the upper jaw, and they are chiefly placed in some part about the *incisores* and *cuspidati*. They are only rarely met with at the posterior part of the mouth, and then they resemble small *dentes sapientiæ*, being placed on one side or other of those teeth.

The form of supernumerary is very different from that of any of the other classes of teeth; they are generally small round teeth, resembling the point of a quill,* and sometimes they are not much unlike a broad *bicuspis* of the under jaw. †

When

* Plate XIII. Fig. 1. † Fig. 2.

When these teeth appear, they always create a considerable deformity; commonly there is only one of them, and and that is placed either between the central *incisores*, or projecting over them, or between the central and the lateral *incisores*, or behind, turning towards the roof of the mouth. *

When there are two supernumerary teeth, the fore part of the mouth is so filled as to occasion the *incisores* and *cuspidati* to be placed in a double row. I have seen three remarkable instances of this kind: In one, there were two supernumerary teeth, of the conical kind, which were placed together, and had come behind and between the central *incisores*, which they had thrust forwards. The lateral *incisores* grew in a line even with the supernumerary teeth, behind the central *incisores* and *cuspidati*, and so formed a second row. This was the most conspicuous deformity of the teeth I ever saw, for the mouth could not be opened to speak without completely presenting them to view.†

In the other two cases the supernumerary teeth resembled *bicuspides* of the lower jaw; they had large crowns, with depressions at their bases, and, by thrusting the other teeth into very improper situations, produced an appearance of a double row.‡

These

* Plate XIII. Fig. 4, 5. † Fig. 6. ‡ Fig. 7.

These supernumerary teeth should always be extracted as soon as they are perceived; and if they have occasioned the other teeth to turn out of their right direction, the application of a ligature will soon bring them again into their regular situation.

CHAP. IX.

Of the Decay of the Temporary Teeth.

THE temporary teeth are very liable to become carious, and generally cause a great deal of pain. Sometimes this disposition to decay shews itself very early, and in two or three cases I have seen every tooth in a diseased state at so early a period as three years. The little patients are generally dreadfully afflicted, and by their rest being disturbed, and their being unable to masticate food with comfort, the health is often much impaired. These circumstances render the extraction of these decayed teeth highly necessary.

Sometimes abscesses of considerable extent form about the sockets and gums of these carious teeth, and produce

considerable mischief. I have seen the gums acquire a sloughy appearance, discharging a quantity of fetid matter; and sometimes so much injury is done as to occasion the death and exfoliation of portions of the jaw bones; when this happens it usually extends so far as to include the sockets containing the forming permanent teeth, which I have seen come away with the diseased temporary ones.*

On these accounts it should always be recommended, when a child's teeth have become carious, and occasion pain, gum boils, or abscesses, to extract them, as they not only very materially injure the health, but also are liable to prevent the formation of the permanent teeth.

* Plate XIII. Fig. 12.

CHAP. X.

Of the Diseases which attend Dentition.

THE period of dentition in children is generally considered as one of the most critical in life. In infancy the animal frame is so delicate, that the least local irritation produces a sudden and universal sympathy throughout the whole body. Hence the excitement occasioned by the passage of the teeth through the gums often gives rise to the most alarming constitutional symptoms, which are always with difficulty alleviated, and not unfrequently terminate in death.

The mode in which the teeth pass through the gums is very much misunderstood; the prevailing opinion is, that as the teeth advance in growth, they find their way through the gums by their own mechanical pressure. This idea has given rise to the common expression of, cutting the teeth; and the pain during dentition has been considered as being produced by a laceration of the membrane and gum covering the tooth.

That this is an erroneous opinion will be perceived, when the state of the teeth and gums at that time is considered.—During its formation a tooth is loosely contained in the socket, and can exert no force sufficient to perforate so firm a substance as the gums. The gums also possess a certain degree of elasticity, and could, by the gradual pressure of the rising teeth, be stretched so as to become elongated with the progress of the teeth, and would continue to cover them.

A passage for the teeth is opened by the process of ulceration. By the pressure of any extraneous substance upon a sound part, or by a diseased enlargement of some part within the body, an absorption of the parts subjected to the pressure will take place. This, in a very remarkable degree, is seen in cases of aneurism, in which, by the pressure of a soft tumour, bones of the most compact structure are removed by the process of absorption, and that unattended with any secretion of pus.

When the teeth have advanced so much in their formation as to be too long to be contained in the socket, under the gum, they press upon the membranes which enclose them; these become absorbed, and then the pressure being applied against the gum, that also is removed, and the teeth make

their appearance. When the absorption of the membrane and gum takes place early, the child suffers no inconvenience during the progress of dentition. The teeth advance without any trouble, and their appearance is discovered by the mother or nurse with some degree of surprise: But when the growth of the teeth is too rapid for the absorption of the gums, dentition is often attended with much pain and derangement of the whole system. At this early period of life, as I have already observed, the constitution is so delicate, and the irritability so great, that the least cause of irritation produces an universal sympathy throughout the whole system. It is well known to many adults, that the pain attending the protruding of the *dentes sapientiæ* is very great, and it therefore cannot excite surprise that this cause of irritation should in children produce so many distressing symptoms, and even be the cause of destroying so many.

When the formation of the tooth goes on very rapidly, and the absorption of the parts which cover it does not proceed in proportion, it becomes confined; this produces a distention of the membrane, and occasions pressure upon the pulp, nerves, and vessels at the bottom of the socket. The tooth continues to grow, and the increased pressure, which is

 occasioned

occasioned by this augmentation, produces inflammation, and a variety of symptoms of general irritation.

Few children obtain all their teeth without undergoing some degree of suffering: In many, the symptoms are merely local, in others they often arise to a very alarming height, and not unfrequently terminate fatally.

When the symptoms are merely local, the gums become very tender, and look redder than ordinary, the child is restless and rather fretful: These symptoms with some children are of short duration, and always go off as soon as the tooth appears. Nature operates in a very salutary manner for their relief, by occasioning an increase in the secretion of the saliva, which generally is discharged in large quantities, and thus diminishes the action of vessels. In other cases a gentle diarrhœa takes place, which also reduces the state of irritability. They also find relief from rubbing or pressing the gums, which is best done by themselves. The coral, though used as a common appendage to a child's dress,is a very injurious and a very improper substance: Children ought to have nothing hard; they will put their fingers into the mouth and bite upon them.

them; or they may have a soft crust of bread; this slight pressure will expedite the absorption of the gum, and consequently the passage of the tooth; while that produced by a harder substance will increase the irritation and inflammation.

When the constitution becomes affected, all the symptoms of general irritation occur, and there is scarcely any affection we do not meet with in one case or other of difficult dentition.

Fever is a frequent attendant, and it often comes on very suddenly: At first there is a heaviness about the eyes, the child then becomes hot, having the skin dry and tongue white; it gets very restless, putting the hand into the mouth, and can neither eat nor sleep. Sometimes these symptoms are so much aggravated that delirium will take place, and convulsions supervene.

In other children the skin is more particularly affected; a little fever arises, which is soon followed by some kind of eruption. There are several appearances seen upon the skin during childhood, and which are the consequence of irritation during the time of dentition.

A very

A very common eruption is a rash, which resembles the measles, and which appears in spots about the face and neck, sometimes extending over other parts of the body. This rash is like an aggregate of small pimples, so that when the finger is pressed over the red part, from the skin which is healthy, a small rising may be felt. This has been called the red gum, and is very common to children during the early months. It may in general be esteemed beneficial; for the blood being carried to the skin, takes off any improper determination to important parts, and prevents more serious disease.

Sometimes pustules arise in different parts of the body; they are at first transparent, from being filled with a limpid fluid, which afterwards becomes purulent, a scab forms, and the changes afford an appearance not unlike a mild small pox.

There are other eruptions which form very unpleasant and extensive scabs; they break out upon the corners of the mouth, or on the cheek. Sometimes they begin upon the forehead, and spread over part of the scalp; they form large loose scabs, which drop off, but are soon succeeded by others. These scabs however, leave no scar, and therefore

therefore are to be considered only as troublesome, and not dangerous.

Other children are subject to an inflammation, and a discharge from behind the ears: This may always be regarded as salutary, since from its contiguity to the teeth, it tends to divert the inflammation.

A gentle diarrhœa, during teething, is a beneficial effort of nature; it takes off the excitement from the constitution, and diminishes the febrile symptoms. But sometimes it becomes so excessive as to produce the most alarming symptoms; the discharges are of a green colour, very frequent, and attended with excessive griping; the rest is so much disturbed that no strength is gained by it; the child is continually starting, and spasms of various parts are occasionally seen; at length the whole system becomes so reduced that convulsions of the whole body take place, which continue until nature becomes completely exhausted.

In some children, the irritability of the nervous system is so great, that convulsions supervene in a very short time after the appearance of any febrile symptom, and this is constantly the case with the cutting of every tooth. Besides these different-

ferent affections, there are so many other anomalous symptoms, that it may be truly said, that every symptom of general irritation which can be mentioned, may be met with during the time of dentition. In some children the lungs are much affected, and they are troubled with difficult breathing; in others, the continual derangement of health is often the cause of scrophula, rickets, or consumption. Mr. Hunter mentions a remarkable sympathetic affection in a child, which arose from the irritation excited by teething. Formerly children were often placed under most dangerous circumstances, when they happened to be attacked with the small pox at the same time as they suffered from dentition; but happily now, they may be defended from that dreadful malady, by the shield which has been raised by the admirable discovery of Dr. Jenner; and we have the certain prospect, that this most horrible of human maladies is about to withdraw its pestilential influence from the world for ever.

In the treatment of any affection incident to children during the progress of dentition, if the teeth are at all suspected to be concerned, the removal of the cause of irritation ought to be first attended to. This must be done by opening the gum, so as to take off the confinement from the tooth, and

enable

enable it to pass through. This operation ought always to be had recourse to in the first instance, and then other remedies should be applied according to the various symptoms which may appear.

When there is fever, the antiphlogistic regimen must be adopted. The bowels should be evacuated. The best medicine for children is calomel, which may be combined with rhubarb or scammony; or some of the neutral salts may be exhibited.

After these, saline draughts or gentle antimonials should be administered, in order to produce a determination to the skin. If the head should be much affected, a blister to the nape of the neck would be very useful. In all cases of rash, or eruptions, the child should be kept warm, and be particularly preserved from taking cold, as great danger often follows the sudden disappearance of any affection of the skin. If this should happen, the child should be put into the warm bath, and some medicines administered to produce diaphoresis; also attention is to be paid to the bowels, that no costiveness be suffered. In general slight eruptions are to be regarded as beneficial, and particularly those occuring behind the ears, attended with moderate discharge. In cases of difficult dentition, when no sore ear has arisen spontane-

ously, much benefit has followed the practice of rubbing a small quantity of blister ointment behind the ears, and thus inducing a slight discharge.

If scabs are extensive and become dry and hard, they may be washed with warm milk and water, and touched with a little oil. They also may occasionally be wetted with the *hydrargyrus muriatus, in aqua calcis*, in the proportion of 1 gr. to 1 oz : The scabs should never be picked off, but left to separate of themselves. When they extend over the head and are moist, much trouble and pain is occasioned by the sticking of the cap ; they should then be dusted with a little powder, or some fine fuller's earth, and a singed rag should be laid over them. In these cases much good has been seen to attend the use of an oiled silk cap, or a piece of oiled silk laid over the part, this prevents evaporation, and the scabs do not dry and become so troublesome.

All eruptions are to be regarded as salutary, for so great a sympathetic connection exists between the skin and the stomach, that it often happens, that the repelling of any eruption from the skin, immediately produces considerable derangement of that organ, which ought to be regarded as a sort of center of sympathetic action. This is very strikingly seen in

a variety of diseases in which the stomach sympathizes with the other parts of the body, and therefore during dentition it is of consequence not to check any mild eruption which may appear.

If a diarrhæa be only moderate, it should not be checked; it tends to diminish fever, and takes off the excitement from the constitution. As it is usually connected with acidity, a little magnesia, or some of the testaceous powders may be exhibited; but when the diarrhæa runs on for a great length of time, and seems to be causing weakness, which threatens fatal atrophy, serious endeavours must be made to subdue it.

The treatment of this complaint is attended with many difficulties, and medicines which succeed in some cases will totally fail in others. If the abdomen be much enlarged, two grains of calomel every night, purged off in the morning with ten grains of rhubarb and half the quantity of magnesia, will generally be found beneficial. This should not be persevered in more than three or four days successively, and should be succeeded by eight grains of the *pulvis cretæ comp. cum opio*, and four or five grains of columba root. The patient should be warmly clothed, especially on the abdomen and lower extremities. On some occasions the *pulv. trag. comp.* appears

 preferable

preferable to the *pulv. cretæ comp.*; and the *syrup.* or *decoct. althæ*, with 20 drops of paragoric elixir, have succeeded when the other usual means have failed. The warm bath may be considered as another perfect species of warm clothing, and is attended with good effects, by relaxing the pores of the skin and relieving the bowels. If the above-mentioned remedies cannot be taken by the patient, opiate frictions on the abdomen or back should be used, and the following formula will answer very conveniently. *R. Ung. hydr. fort.* ʒi.—*pulv. opii puri.* ℈i. *olei oliv.* ʒiij. *fiat linimentum bis terve in hebdomade infric*; but the quantity and repetition must be regulated by the judgment of the practitioner. If the patient is much distressed by tenesmus and stools streaked with blood, clysters of starch with 20 drops of *tr. opii*, and twice that number of *tr. catechu* or *kino.* should be given every evening.

When convulsions have taken place, we must endeavour to remove what appears to be the exciting cause. If the stomach have been overloaded with improper food, or there be signs of indigestion, a gentle emetic should be given. If there is costiveness, or the bowels are affected, they should be cleansed by a clyster: when the stools are offensive, or the breathing at all affected, a few grains of calomel and scammony may be given with advantage. If those medicines do not

not succeed, antispasmodics should be administered. It often happens that the deglutition is much affected, then it will be right to give an enema with assafœtida; or if not, in a draught, a drop or two of tinct. opii should be given. The back may be rubbed with oil of amber, or aqua ammoniæ. During the fit it is always proper to put the lower parts of the body into warm water, which, by exciting a greater flow of blood to the legs, takes off too great a determination to the head; a blister should be applied to the back of the neck, and leeches may be applied to the temples.

Other symptoms which arise, must be met according to their urgency; but we ought never to lose sight of what may appear to be the principal exciting cause, viz. the inability of some teeth to pass through the gums.

Under every circumstance of indisposition, arising from dentition, the lancing of the gums ought never to be omitted. The benefit which attends the operation is so sudden, and if performed sufficiently early, is so certain, that it ought never to be neglected. As soon as the gum is lanced and the membrane is divided, the tooth obtains an increase of room, the pressure is immediately taken off from the socket, and the cause of irritation is removed.

It is very surprising that, notwithstanding the manifest advantage which attends the lancing of the gums, in cases of painful dentition, there are persons who entertain strange prejudices against this safe and important source of relief. But the uniform experience of its good effects, and no instance of its doing harm ever having occurred, should produce an unanimous consent for adopting it. Some persons object to the operation on account of the pain which it will occasion to the child, not considering that the inflammation produced by the resistance of the gum to the tooth, is far more acute than dividing the gum with a sharp instrument. Others suppose that the formation of the teeth is injured, and that they are more liable to decay; but neither of these circumstances can occur; for at the time the tooth is about to pass through, the enamel is completely formed, and no injury can be done to the formation of the fang, which is always continued for some time after the appearance of the crown.

When it is necessary to lance the gums sometime before the teeth are quite ready to appear, they unite, and in this case the cicatrix has been said to impede the progress of the tooth, presenting a greater resistance than the gums in their natural state; but it is now certainly known that a newly formed part always gives way sooner to the process of absorption

absorption than the surrounding parts, and hence the passage of the tooth is facilitated.

The hœmorrage which is occasioned by the operation is never considerable, but is always beneficial; the vessels become unloaded, and the inflammation is always soon diminished.

The most convenient instrument for this purpose is a round edged gum lancet; this cuts much easier than a pointed one. It is necessary that the tooth be felt with the edge of the instrument, else the membrane may still be left upon the stretch, and no other benefit be derived than that which proceeds from the topical bleeding. In lancing the *incisores* it will be proper, in dividing the gum, to pass the lancet down on the anterior part of the tooth; for if it be carried deep on the posterior part of the tooth, there may be a danger of dividing the membrane which connects the pulps of the permanent teeth to those of the temporary, and the formation of the former may be injured.*

When the gums of the *molares* are to be lanced, a crucial incision may be made, or two semilunar incisions, the gums soon separate.

* Plate IX. Fig. 5.

separate, and the tooth shortly makes its appearance. The symptoms which usually precede any indisposition arising from teething ought to be universally known, because then the certain remedy may be applied in time, and a great deal of suffering be spared to the child. If the nurse be attentive, she will find the child does not take the nipple with the same degree of force as ordinary, or it holds it only for a short time, and soon lets it go; the gums feel hot, and are redder than usual; the cheeks appear flushed, the eyes look heavy, and the child is uneasy. When these symptoms appear, the mouth should be examined, and if there be any fulness of the gums, or they have appearance of inflammation, they should be lanced at that part. The order in which the teeth appear should always be kept in mind, and then there will be little probability of mistake, as to the spot where the cause of irritation is seated.

As a child increases in strength, the symptoms arising from dentition diminish, and often become merely local; but the diseases to which infants are liable, frequently keep them in weak health, and much disposed to be affected by any exciting cause of irritation.

To delicate children there is often danger attending the cutting of the *cuspidati* and the first *molares*. These teeth advance in growth nearly at the same time, so that there are eight teeth making pressure upon the membranes and the gums at the same period. If at this time a child should be at all indisposed, one or other of these teeth may be the cause of convulsions, or some other serious disease; therefore, when any of these teeth appear to be in a state of forwardness, the gum should be lanced. This is the only method of treatment to be relied on to bring a weakly child through this period.

During the second dentition, with one exception, scarcely any pain is felt; the constitution has acquired such a degree of strength that the sympathetic action is with more difficulty excited, and the only inconvenience ever experienced is, when the permanent teeth, which are placed at the base of the temporary ones, by the increase of their growth make pressure against them; this more particularly happens when the *bicuspides* are endeavouring to come forward, and being resisted, by the continuance of the temporary *molares*, a tenderness and pain are occasioned, which can only be relieved by extracting the temporary teeth, and thus giving way for the passage of the permanent

The exception to which I have alluded with respect to pain during the second dentition, is in the *dentes sapientiæ;* very often a great deal of pain attends the progress of these teeth. When there is scarcely sufficient space for them to grow, or the gum being very thick is firmly bound over them, considerable inflammation, and sometimes swelling of the face takes place. In many cases the pain is so severe as to excite a considerable degree of fever and indisposition. I have known persons confined from this cause only, during several weeks. If the *dentes sapientiæ* of the upper jaw pass through first, it very much increases the inflammation, because whenever the mouth is closed, the gums which cover the teeth in the under jaw are bitten upon by the upper, and being continually pinched, the patient suffers extremely.

Generally it is only necessary to lance the gums with a crucial incision; there is often a good deal of hemorrage, which is very useful in reducing the inflammation; the gum soon retracts, and the tooth gradually passes through. When the upper *dentes sapientiæ* appear first, it is sometimes necessary to cut off the piece of gum which covers the under tooth.

In

In many cases the gum is very thick, and will often close and unite again after the operation; this produces a necessity for repeating it; but which might always be prevented, by inserting a small piece of lint between the edges of the divided gum, which then cannot unite; they remain separated, and gradually receding, the tooth has no longer any obstruction.

Sometimes, in these cases the gum is exceedingly swelled over the tooth, and when divided by the lancet a considerable quantity of glary fluid escapes; in some instances I have met with considerable quantity of matter, and in one case the gum was ulcerated to a great extent.

CHAP. XI.

BEING desirous to render this work as complete as possible, I requested the favour of my friend, Mr. Pepys, to make a chemical analysis of the teeth, and from the accuracy with which all his experiments are conducted, I flatter myself that the following observations will not a little enhance the value of the publication.

THE ANALYSIS OF HUMAN TEETH.

BY W. H. PEPYS, JUN.

Mr. Charles Hatchet, in his valuable paper on shell and bone, [Phil. Transact. for 1799] enumerated the several substances which enter into the composition of the human teeth; it is to be regretted that the nature of his subject did not render it necessary for him to ascertain the proportions in which they are respectively found, as it could not have failed to have proved highly useful, and his known accuracy would have precluded the necessity of any other person undertaking such a labour.

a labour. Several good analyses of bone have been published, but I believe no accurate analysis of the teeth has yet been offered.

Bone, it has been observed, when exposed to the action of acid menstrua, becomes dissolved; that is to say, the solid or constituent substance of them is abstracted, and a gelatinous matter is left of the form of the original bone.

Nitric, muriatic, and acetic acids are capable of producing this change, which is accompanied with a liberation of an aeriform fluid, that precipitates lime in lime water, changes vegetable blues red, and by its gravity is known to be carbonic acid gas. These acid solutions yield a copious precipitate with pure ammonia, which is again soluble in either of the acids. After the precipitation by pure ammonia, the solution of the carbonate of ammonia will still produce a new precipitate.

The precipitate of the first solution, by pure ammonia, as noticed above, is soluble again in the acids before mentioned; these solutions yield, with a solution of acetite of lead, a copious precipitate, proving the presence of phosphoric acid.

The

The precipitate obtained by the carbonate of ammonia is also soluble in either of the above acids, but with effervescence; and these solutions are not precipitated by acetite of lead; they fall, however, with oxalate of ammonia, carbonate of ammonia, or any precipitant of lime.

The great solubility of the phosphate of lime, in even the weakest of the acids, is very extraordinary. Phosphate of lime mechanically suspended in water, is speedily and completely dissolved by passing a copious stream of carbonic acid gas through it.

With these facts before me, I have ventured to examine the several specimens of the human teeth; as the enamel, the bone, or roots, the teeth of adults, and the shedding teeth of children.

Previous to an account of the analysis, it may not be uninteresting to notice the action of some of the articles of the *materia chemica* on the teeth.

Sulphuric acid of the specific gravity 1. 83, appears at first to have no action; in the course of an hour small bubbles are perceived, the roots become blackened, and in twelve hours

hours the enamelled part bursts, cracks, and separates, accompanied with an evident formation of selenite, by the action of the acid on the lime, which enters into the composition of the teeth.

Nitric and muriatic acids of the specific gravity of 1. 12, act instantly on the tooth, accompanied with an evolution of a quantity of small air bubbles from the whole of the surface; about eight times their weight of these acids are sufficient for the solution of the solidifying principles of the teeth. The mass left undissolved has nearly the original form of the tooth, is flexible, semitransparent, and easily divided by the nail.

The dilute acetous acid (distilled vinegar) has a very trifling action, but when concentrated, acts both on the phosphate and carbonate of lime.

Boiling nitric acid acts strongly on a tooth, with the evolution of carbonic acid, and a considerable quantity of azotic gas. The gelatine and solid substance are dissolved as the surfaces present themselves; but the operation being stopped at any part of the process, the residuum is firm and hard,

but reduced in size proportioned to the time the tooth has been acted upon.

ANALYSIS OF THE ENAMEL.

One hundred grains of the enamel of human teeth, (carefully rasped) were placed in 600 grains of nitric acid of the specific gravity 1. 12. Slight effervescence ensued, and after twelve hours 200 grains more of the acid were added. Allowing for the loss by evaporation in a corresponding vessel, after thirty-six hours it was found to have lost four grains and an half.

It was then diluted with four ounces of distilled water, precipitated by pure ammonia, and then filtered.

The precipitate obtained being dried in a water bath, at 212°, weighed 102 grains. It was then ignited, after which it was found to weigh 78 grains.

The filtered solution was then precipitated by carbonate of ammonia in solution, and filtered:

The separated precipitate being dried in a heat of 212°, weighed six grains. Enamel then consists of

Phosphate of lime - -	78
Carbonate of lime - -	6
	84
Water of composition and loss -	16
	100

A loss of 16 grains here takes place, which is easily accounted for, from the impossibility of directly ascertaining the state of dryness in which the ingredients existed originally in the enamel; for we have seen, that by drying the phosphate of lime in a heat of 212°, (after which it had the appearance of being as dry as possible) it yet contained so much moisture, as to yield a gain of 8 grains in the analysis.

On the other hand, when ignited, its state is driven to the opposite extreme, and there is a loss of 16 grains. It is impossible, however, that the materials could exist in the teeth, in a state of dryness to be compared with that produced by exposing them to such a high temperature. And it appears but reasonable to conclude, that the real quantity of moisture lies nearer to that given by the heat of 212°, than to that given by ignition, and consequently that the 16 grains lost by exposure to such a high temperature, were chiefly water.

Bone, or roots of teeth, yielded by analysis in 100 grains,

Phosphate of lime - -	58
Carbonate of lime - -	4
Gelatine - -	28
	90
Water of composition and loss -	10
	100

The

The teeth of adults yielded on analysis in 100 grains,

Phosphate of lime - -	64
Carbonate of lime - -	6
Gelatine - -	20
	90
Water of composition and loss -	10
	100

Specific gravity of adults teeth - 2.2727.

The shedding, or primary teeth of children, yielded an analysis in 100 grains,

Phosphate of lime - -	62
Carbonate of lime - -	6
Gelatine - -	20
	88
Water of composition and loss -	12
	100

Specific gravity of childrens' teeth 2.0833.

In these analyses, as in the former, the phosphate of lime was also exposed to a red heat, and consequently was reduced to a greater degree of dryness than that in which it existed in the tooth,

In all of them the carbonate of lime was dried in a heat of 212° (above which it would have been liable to decomposition) and the gelatine of the three last in the same temperature.

FINIS.

EXPLANATION

OF THE

PLATES.

PLATE I.

THE rudiments of the alveolar processes, and the pulps of the teeth.

FIG. 1. The under jaw of a fœtus at three or four months. In the anterior part processes of bone are shooting across to form the alveoli for the incisores.

FIG. 2. The gums removed from the same jaw bone, exhibiting the first appearance of the pulps, those of the incisores being the most distinct.

FIG. 3. The under jaw of a fœtus at six months, in which the alveolar processes are seen more advanced.

FIG. 4. The pulps removed from the same jaw, distinctly formed, each contained within its proper membrane.

FIG. 5, 6. The upper jaws of fœtuses of the same age, as in Fig. 1, 2,; exhibiting the alveolar processes and pulps.

Plate 1.

Fig. 1

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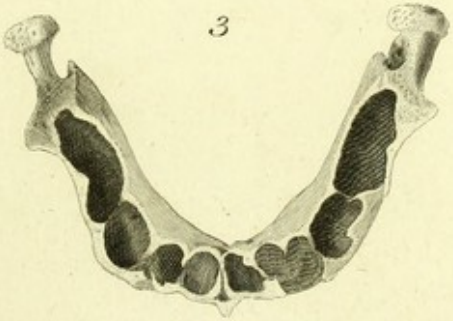

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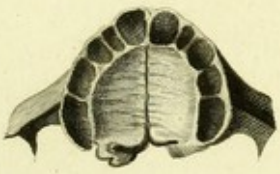

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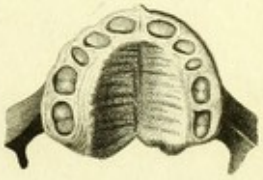

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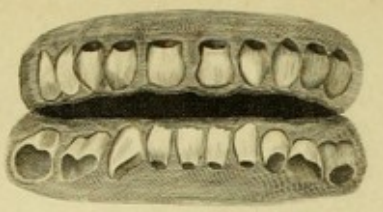
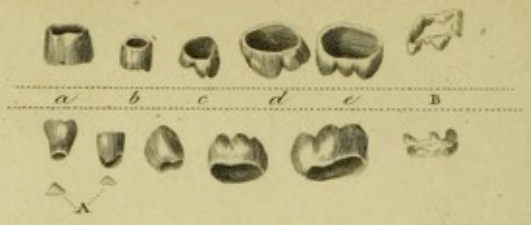
Fig. 1





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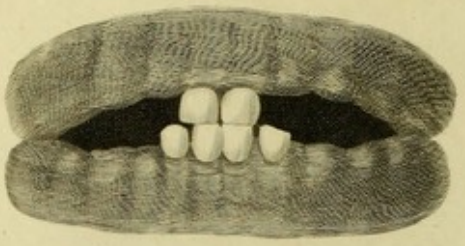


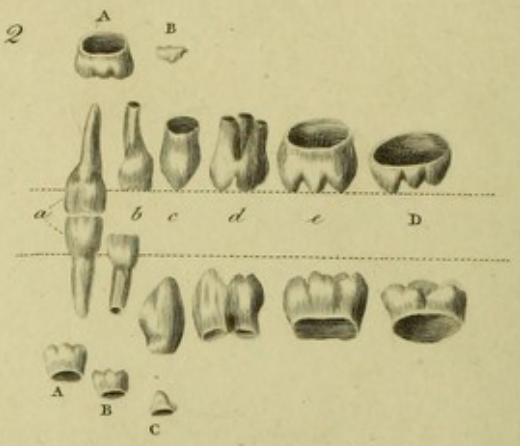
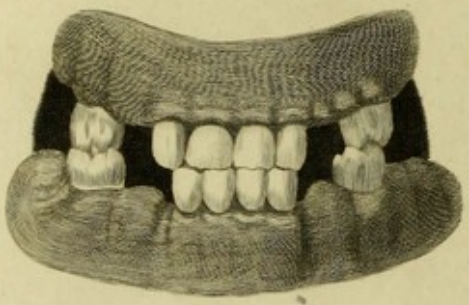


Fig. 3



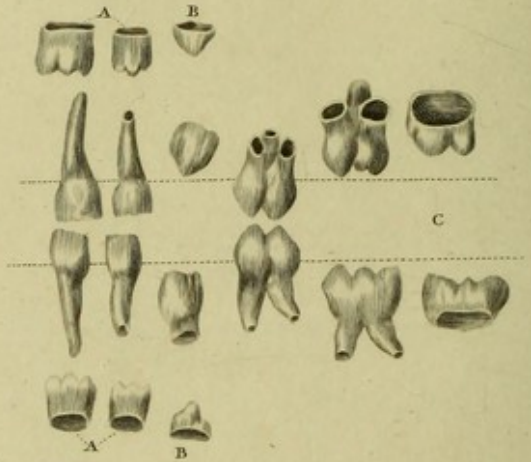
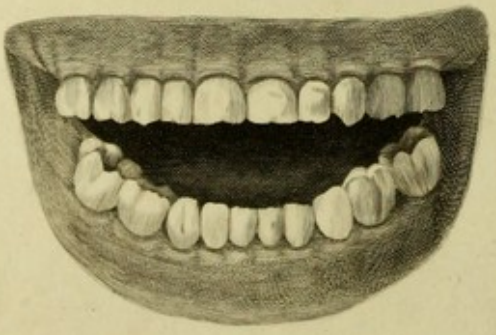


Fig. 4



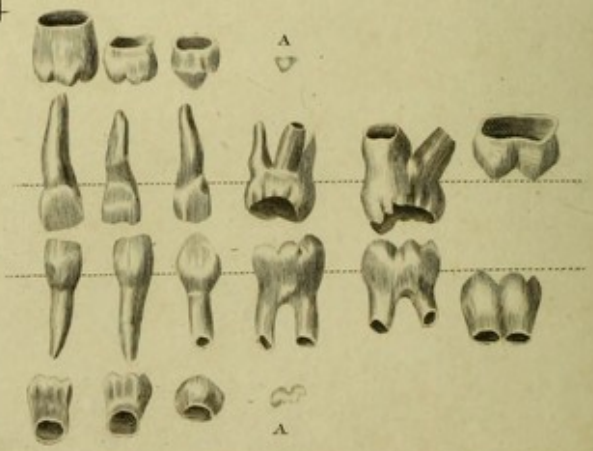


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PLATE II.

THE progress in the formation of the teeth from the time of birth, until between two and three years of age.

*** The figures on the left side of the plate represent the teeth as naturally situated; those on the right side as taken out from the sockets; the dotted lines represent the gums.

FIG. 1. The teeth at the time of birth, when they are only shells having the form of the crowns of teeth.

a. The central incisores.
b. The lateral incisores.
c. The cuspidati.
d. The first molares.
e. The second molares.

A. Points of ossification upon the tips of the pulps of the permanent incisores.
B. Points of ossification upon the points of the permanent molares.

FIG. 2. The teeth of a child about six or eight months after birth. At this time the central incisores of the upper jaw, and the central and lateral incisores of the lower jaw have made their appearance; the other teeth are considerably advanced in growth.

a. b. c. d. e. The temporary teeth.
A. The permanent central incisores.
B. The permanent lateral incisores.
C. The permanent cuspidatus of the lower jaw.
D. The first permanent molares.

FIG. 3. The teeth of a child at sixteen months. The incisores in each jaw, and the first molares have passed through the gums.

A. The permanent incisores much increased.
B. The cuspidati.
C. The first permanent molares.

FIG. 4. The temporary set of teeth have all passed through the gums, and in addition to the permanent teeth already described are,

A. A. The points of the first bicuspides.

PLATE III. *

THE teeth of a child between four and five years of age.

FIG. 1. A side view. FIG. 2. A front view.

a a a a. The central incisores.
b b b b. The lateral incisores.
c c c c. The cuspidati.
d d d d. The molares.

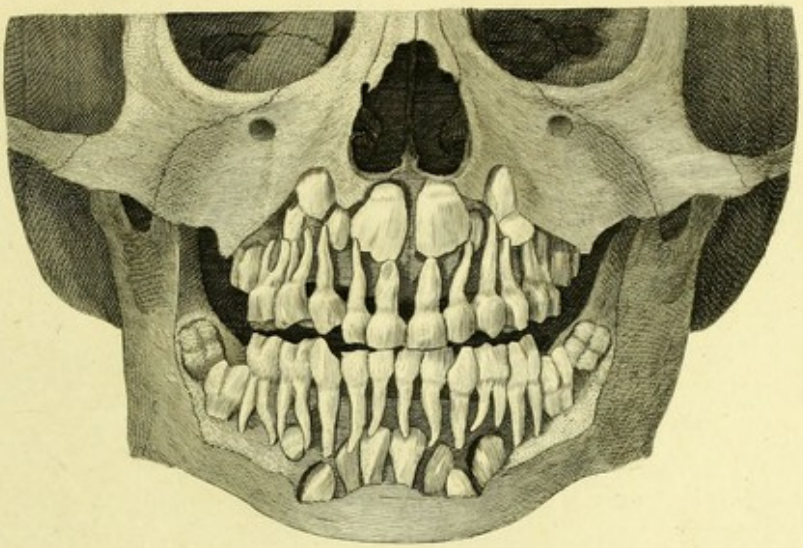
} Of the temporary set.

e e e e. The central incisores.
f f f f. The lateral incisores.
g g g g. The cuspidati.
h h h h. The first biuspides.
i i i i. The first molares.
k k. The second molares.

} Of the permanent set.

The formation of the second bicuspides has not yet commenced.

* For the references to this Plate, and Plates IV. and V. see the outline Plate VI.



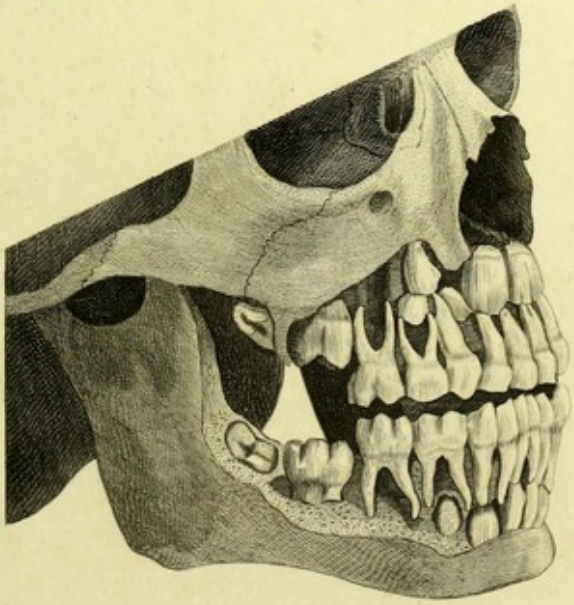


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PLATE IV.

THE two sets of teeth at six years of age.

FIG. 3. of Plate VI.

a a a a. The central incisores.
b b b b. The lateral incisores.
c c c c. The cuspidati.
d d d d. The molares.
} Of the temporary set.

e e e e. The central incisores.
f f. The lateral incisores.
g g g g. The cuspidati.
h h h h. The first and second bicuspides.
i i. The first molares.
k k. The second molares.
} Of the permanent set.

PLATE V.

The teeth at eight or nine years of age. The incisores have been changed, and the first permanent molares have appeared.

Fig. 4. of Plate VI.

a a. The cuspidati.
b b b b. The molares.

} Of the temporary set.

c c c c. The central incisores.
d d d d. The lateral incisores.
e e. The cuspidati.
f f f f. The bicuspides.
g g. The first molares.
h h. The second molares.
i i. The third molares, or dentes sapientiæ, beginning to form.

} Of the permanent set.

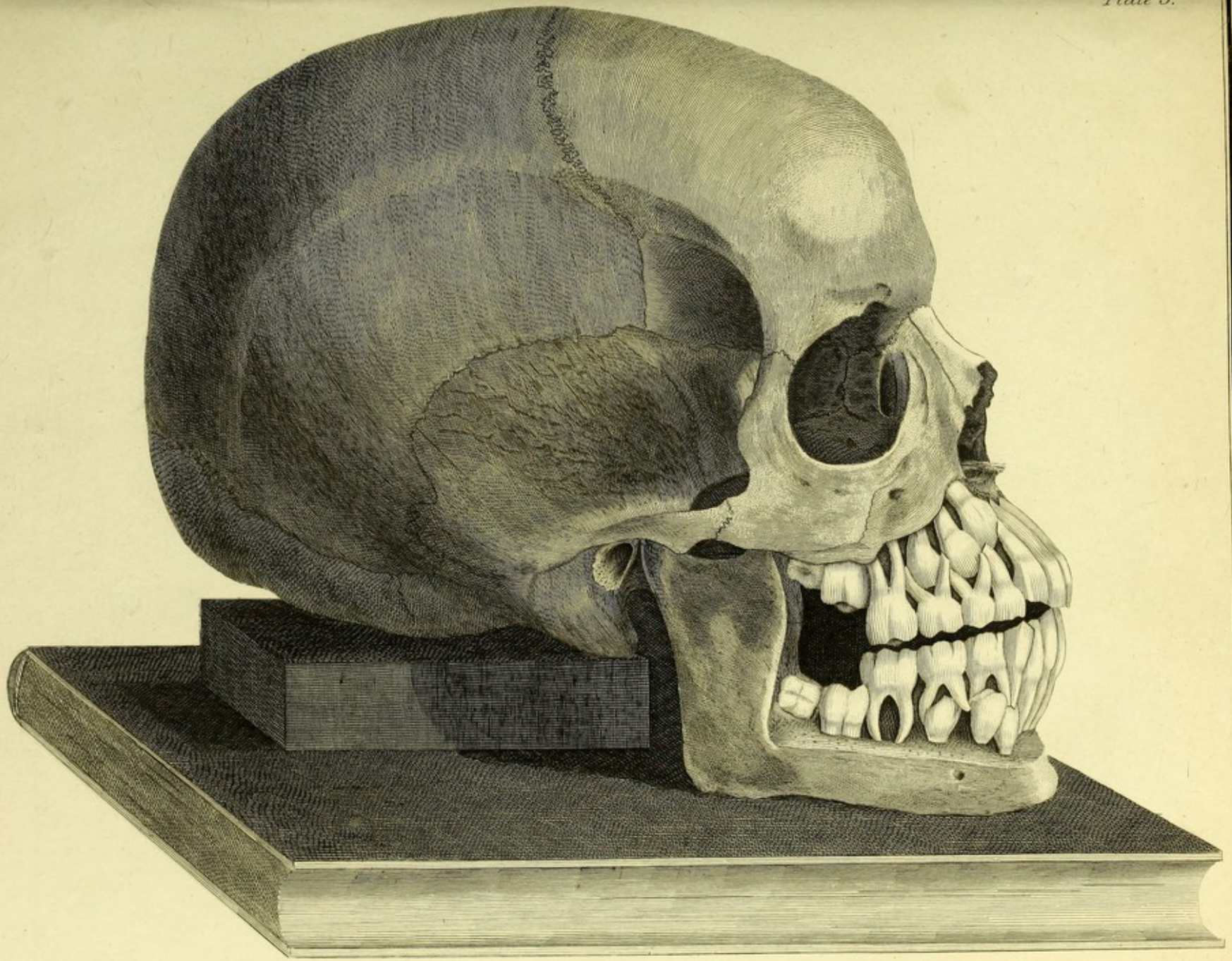

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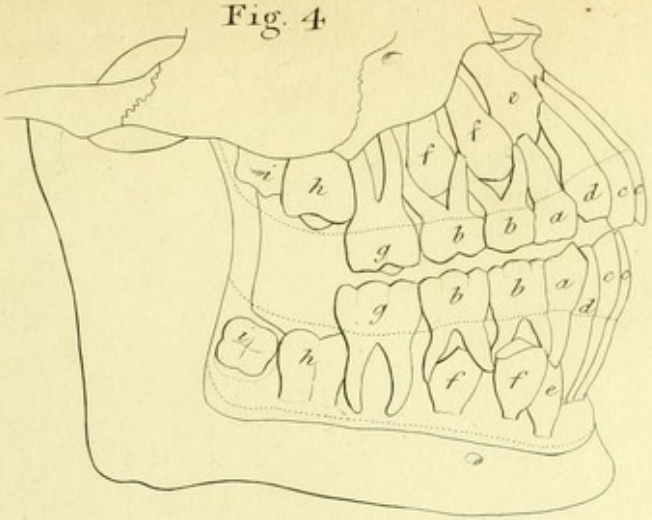
Fig. 4



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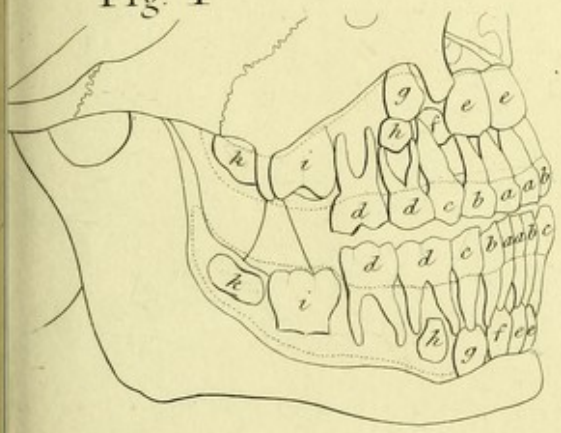


Fig. 2

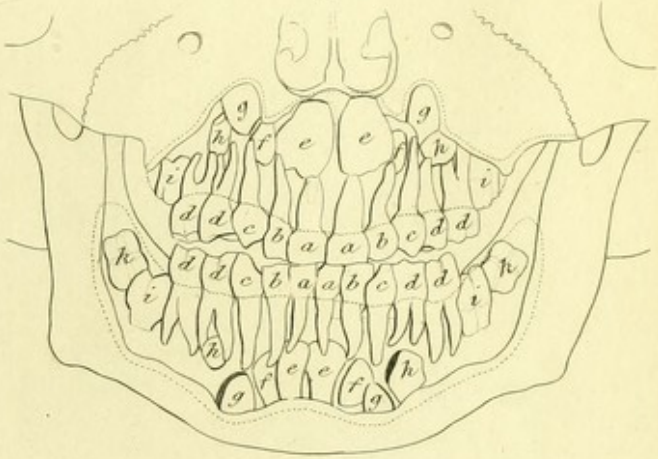
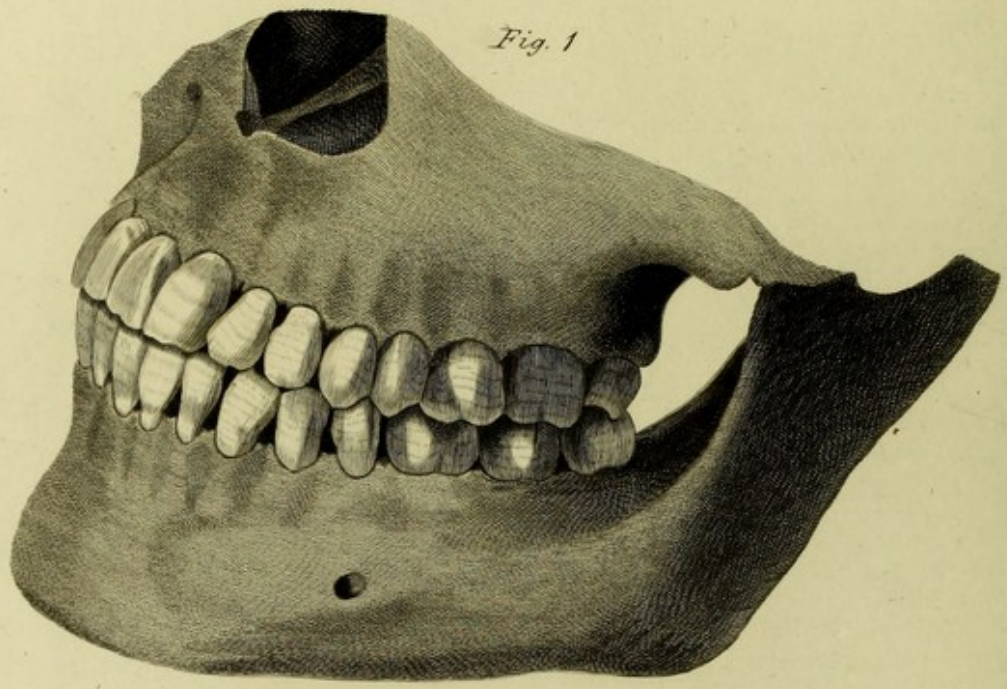


Fig. 3

Row 1

Row 2

Fig. 1



Row 3

Row 4

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PLATE VII.

Fig. 1. The permanent set of teeth complete.

Row 1. The temporary teeth of the upper jaw.

Row 2. The permanent teeth of the upper jaw.

Row 3. The permanent teeth of the lower jaw.

Row 4. The temporary teeth of the lower jaw.

PLATE VIII.

FIG. 1. Longitudinal sections of teeth, the bony part of which has been burnt, to render the distribution of the enamel more conspicuous.

FIG. 2 The transverse section of a molaris.

FIG. 3. A tooth magnified, to exhibit the striated appearance of the enamel.

FIG. 4. An under jaw, the fore part of which, and of the teeth, have been sawn away to shew the cavities in the teeth.

FIG. 5. A section of the under jaw; the nerve is seen, giving off branches which enter the cavities of the teeth.

FIG. 6. A molaris of the under jaw having three fangs.

FIG. 7. A molaris having on its side a deposit of enamel like a pearl.

FIG. 8. The central incisores of the under jaw united at the sides.

FIG. 9. Two views of the second and third molares of the upper jaw, which are united by the inner fangs.

FIG. 10. A molaris of the under jaw, having the crown of a bicuspis growing out of its side.

FIG. 11. A molaris of the under jaw having four fangs.

FIG. 12. The permanent central incisores of the under jaw, having an exceedingly deformed appearance.

FIG. 13. A molaris of the upper jaw having five fangs.

FIG. 14. Several teeth, shewing the appearance of the enamel when defective in quantity, the surface of the teeth being covered with small indentations,

Fig: 1.

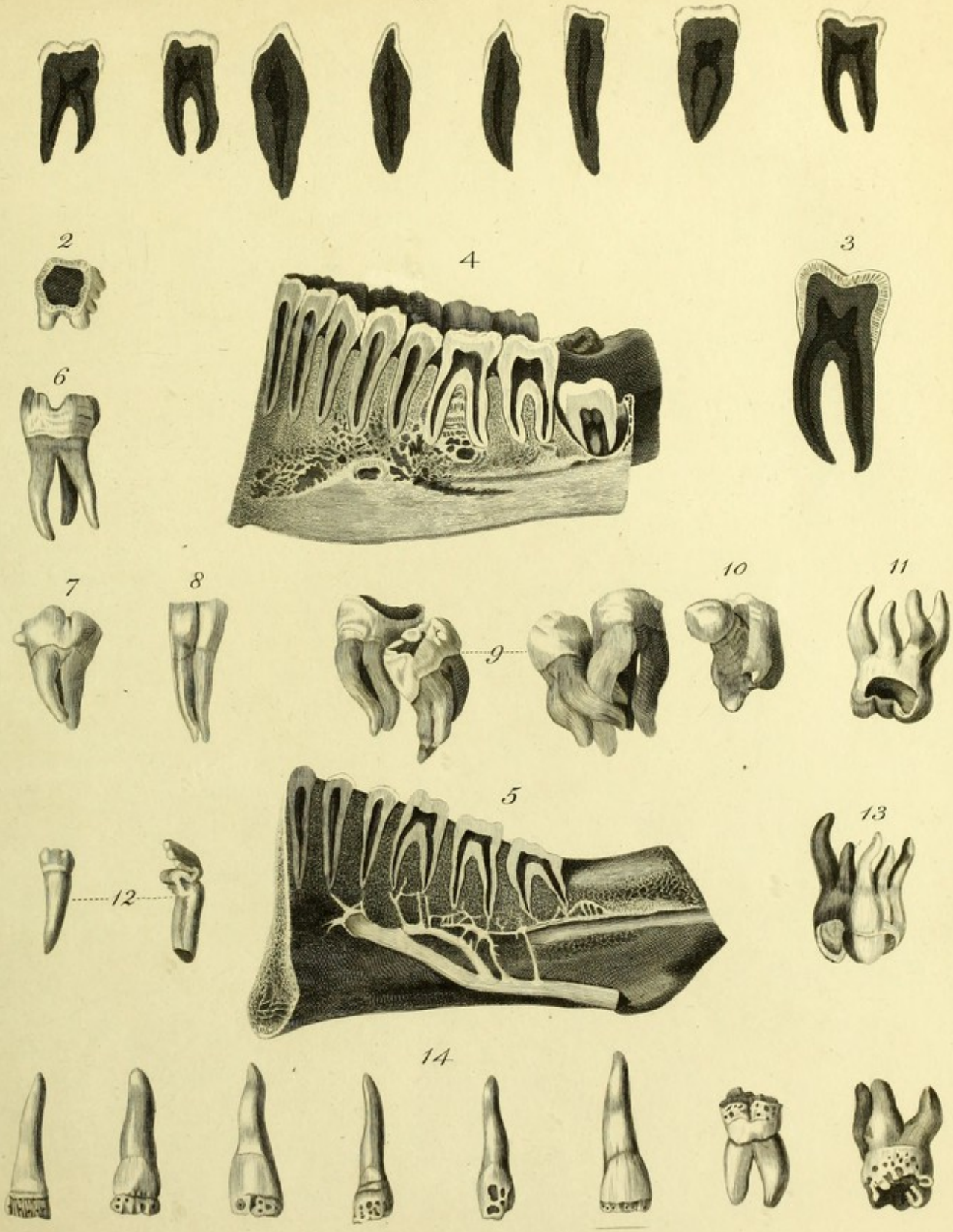

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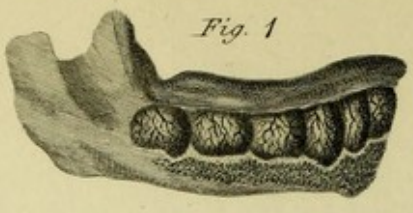
Fig. 1



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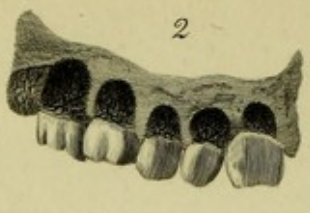

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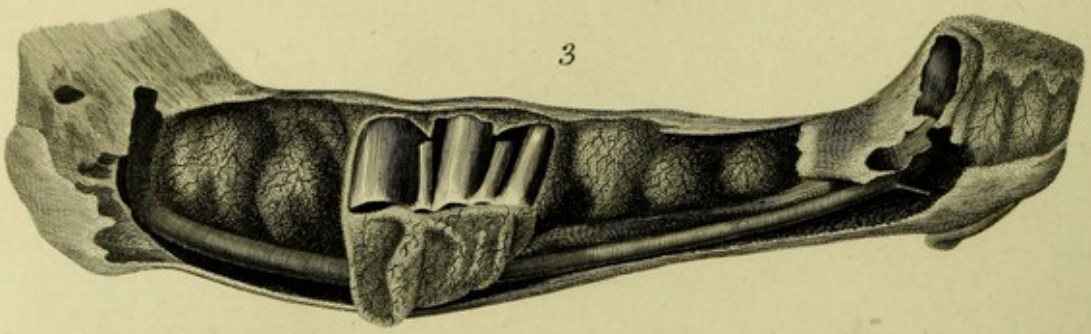

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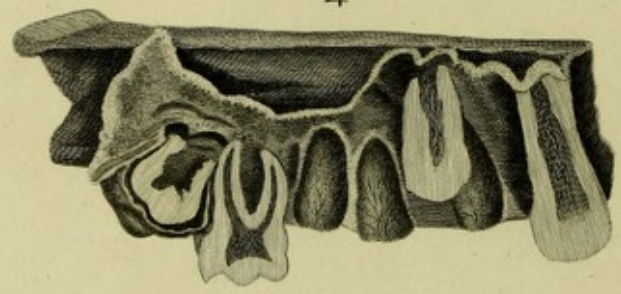

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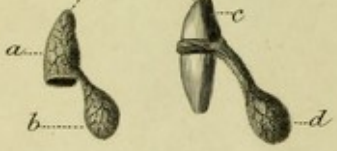

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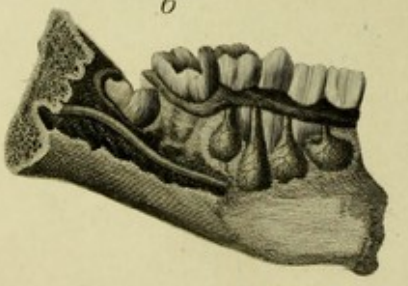

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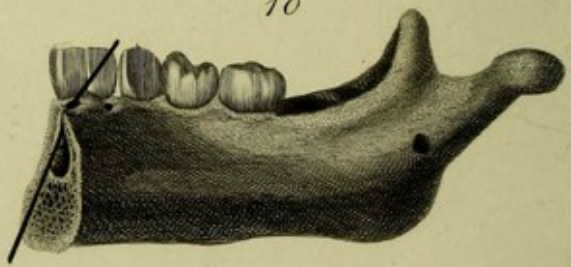

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PLATE IX.

All the figures of this plate are from injected preparations.

FIG. 1. The under jaw of a child at the time of birth; the fore part has been removed, and the membranes inclosing the teeth are seen to be vascular.

FIG. 2. The teeth have been turned out of the sockets, and the inner membranes are also seen to be vascular.

FIG. 3. The lower jaw of a fœtal calf, in which the vascularity of both membranes is seen. The membrane belonging to one tooth has been turned down to exhibit the vascularity on the inner side.

FIG. 4. Half of the upper jaw of a boy about eight years of age. Part of the central incisor, the cuspidatus, the first molaris and the second molaris, (not yet completely formed) has been cut away to show the vascularity of the membrane within the cavities of the teeth. The lateral incisor and the bicuspides are contained within the membranes.

Figures 5, 6, 7, 8, and 9, represent the manner in which permanent teeth are formed.

FIG. 5. Half the under jaw of a child soon after birth. The membranes of the teeth are seen, and over the bristle the membranes of the pulps of the incisores and the cuspidatus of the permanent set, which are firmly attached to the membranes of the temporary teeth.

FIG. 6. Part of the jaw of a child about three years of age. The permanent teeth are placed deep in the jaw, and their membranes remain attached to the gums.—The vessels of the membranes are derived from the gums. The artery which passes through the jaw sends off branches to the pulps of the teeth.

FIG. 7. Teeth which have been removed from the sockets to explain the attachment of the permanent to the temporary teeth.

a. The pulp of the temporary teeth inclosed within its membrane.

b. The pulp of the permanent teeth attached by its membrane to that of the temporary.

c. The temporary tooth completely grown.

d. The permanent tooth attached to the gum, the membrane being elongated into a sort of pedicle.

FIG. 8. A section of the lower jaw, shewing the temporary tooth, with the manner of the situation and attachment of the permanent tooth.

FIG. 9. Exhibits the manner in which the pulps of the permanent molares are produced.

a. The first permanent molaris inclosed in its membrane.

b. A small membranous substance given off from the membrane of the first, and which becomes the pulp of the second permanent molaris.

FIG. 10. Half of a young jaw, shewing the foramina through which the membranes of the permanent teeth pass, to be attached to the gums. A bristle is placed in one, and is seen going into the socket of the new tooth.

PLATE X.

FIG. 1. The progress of absorption in several of the temporary cuspidati.

FIG. 2. The same circumstance exemplified in several of the temporary molares.

FIG. 3, & 4. Sections of the lower jaw exhibiting the progress in the formation of the permanent teeth, and the absorption of the fangs of the temporary teeth.

FIG. 5. Exemplifies the changes which take place in the teeth at different periods.

A. Part of the under jaw of a child at six years, when the temporary teeth only are visible.

B. Part of the jaw of a child about eight or nine years of age. The temporary incisores and cuspidatus have been removed; the permanent incisores and the first permanent molaris have grown up.

C. In this jaw the first temporary molaris has been removed, and is succeeded by the first bicuspis; the cuspidatus and the second permanent molaris are appearing.

D. Part of a jaw in the adult state. The second temporary molaris has been succeeded by the second bicuspis. The third molaris, or deus sapientiæ, has made its appearance. In this series of jaws, the change of the temporary teeth for the permanent, and the addition of the permanent molares are clearly elucidated. The teeth which succeed the temporary incisores and cuspidati are larger, and those which succeed the temporary molares are smaller.

FIG. 6. The upper jaw of a fœtus, in which only one incisor had formed.

a. The incisor.

b b. The cuspidati.

c c. The first molares.

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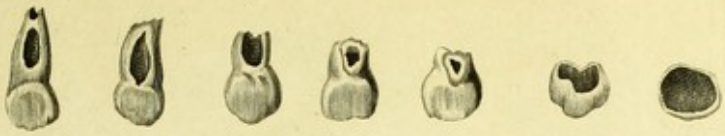

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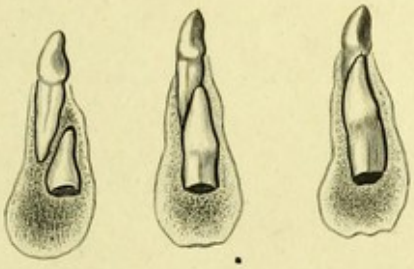

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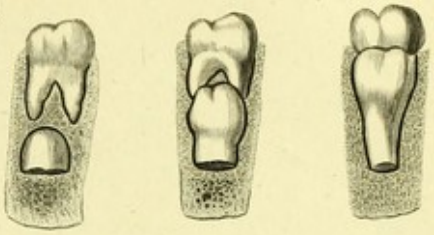

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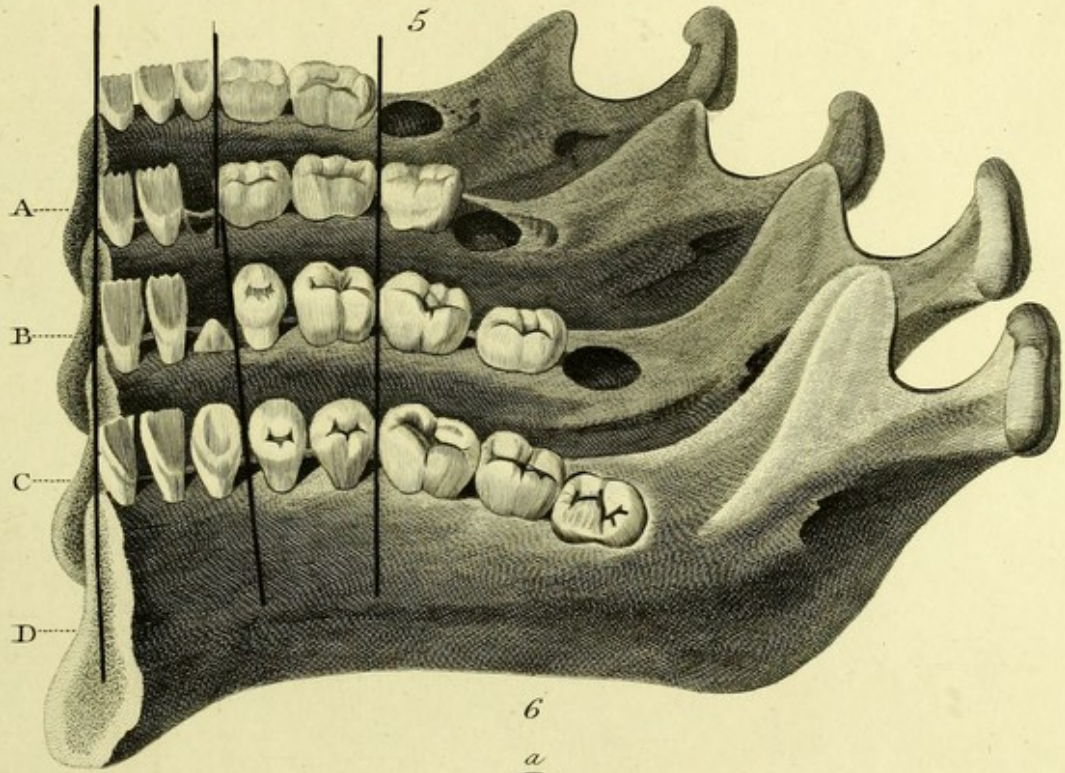

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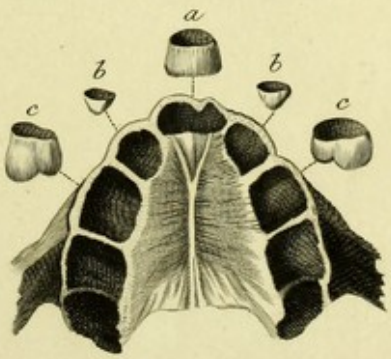

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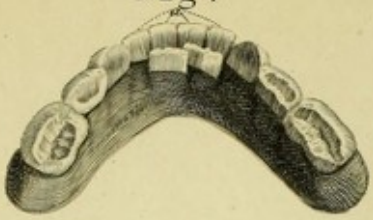
Fig. 1



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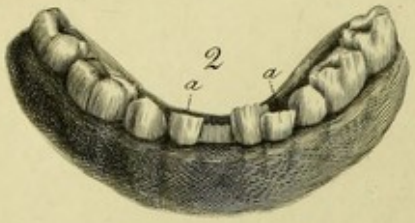

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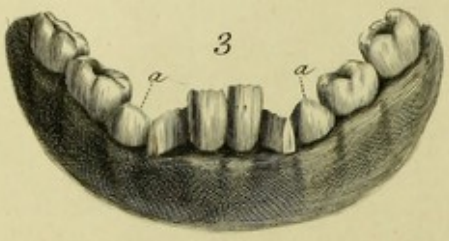

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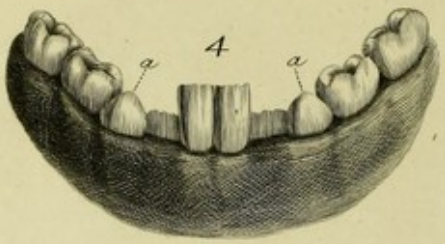

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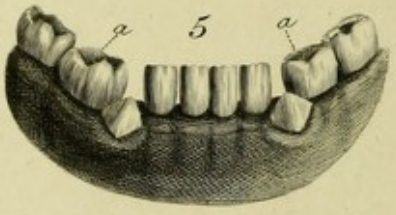

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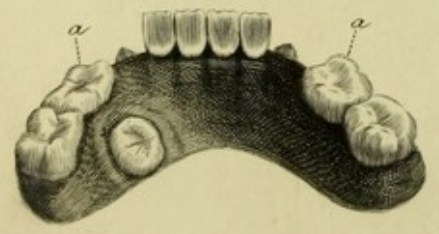
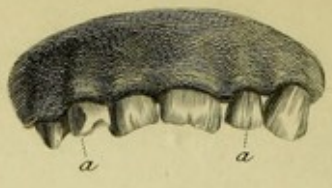


Fig. 7



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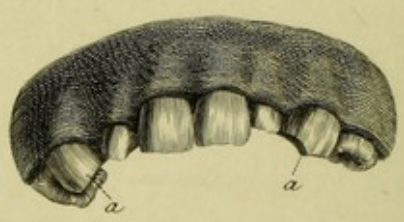

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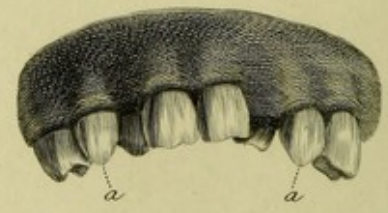

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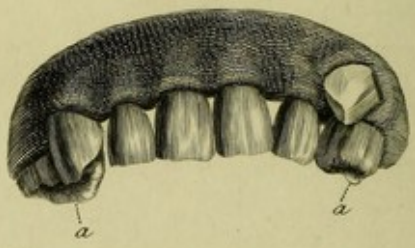

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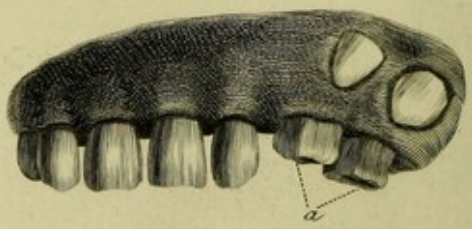

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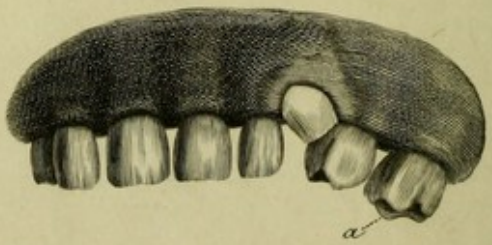

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PLATE XI.

Examples of irregularity sometimes occuring during the second dentition.

Those permanent teeth which are acquiring an irregular position are sufficiently obvious. Those marked a a, are the temporary teeth which ought to be extracted.

PLATE XII.

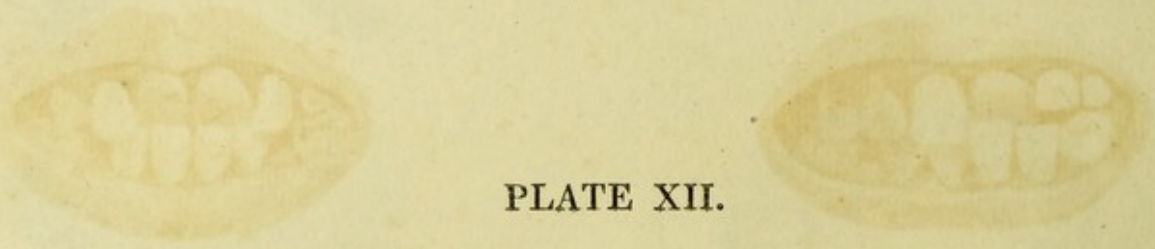

FIG. 1. One central incisor turned in, being placed, when the mouth is closed, behind the under teeth.

a a. The temporary lateral incisores.

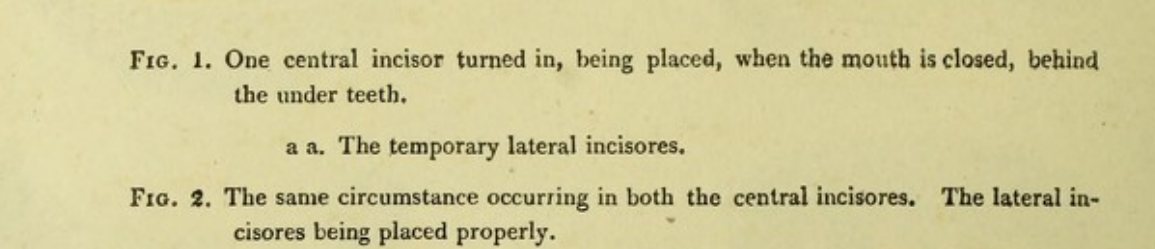

FIG. 2. The same circumstance occurring in both the central incisores. The lateral incisores being placed properly.

a a. The temporary cuspidati.

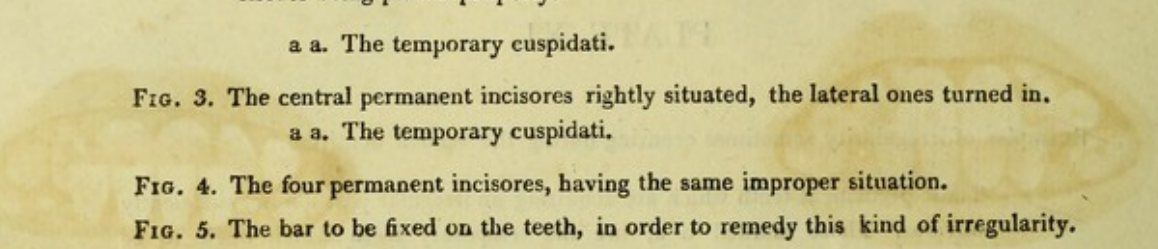

FIG. 3. The central permanent incisores rightly situated, the lateral ones turned in.

a a. The temporary cuspidati.

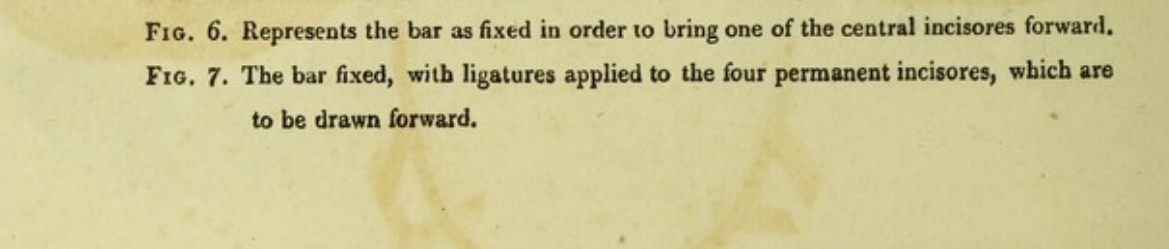

FIG. 4. The four permanent incisores, having the same improper situation.

FIG. 5. The bar to be fixed on the teeth, in order to remedy this kind of irregularity.

FIG. 6. Represents the bar as fixed in order to bring one of the central incisores forward.

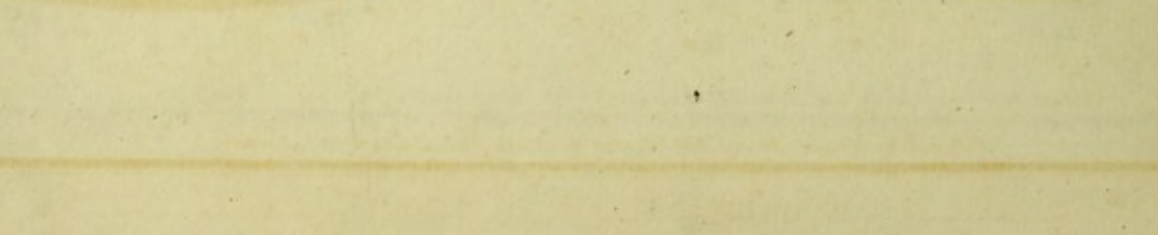

FIG. 7. The bar fixed, with ligatures applied to the four permanent incisores, which are to be drawn forward.

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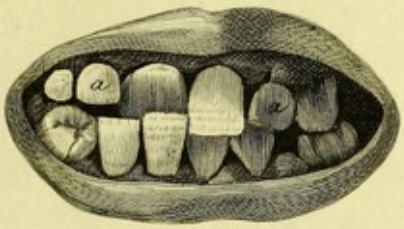

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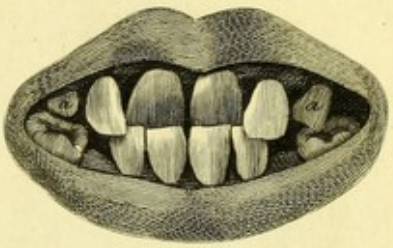

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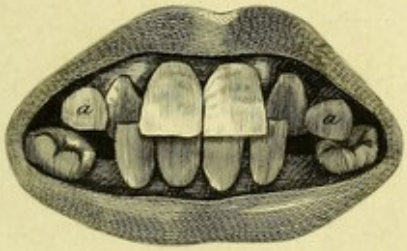

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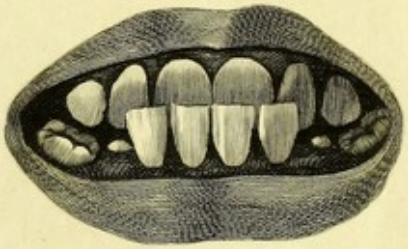

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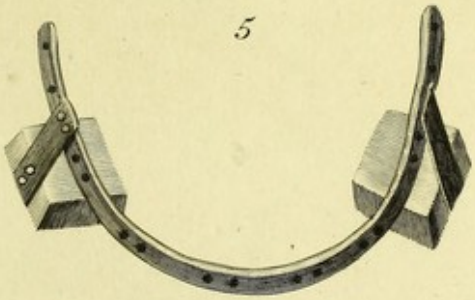

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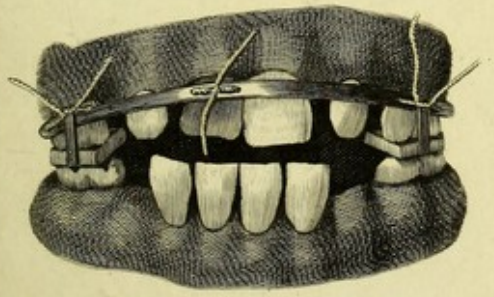

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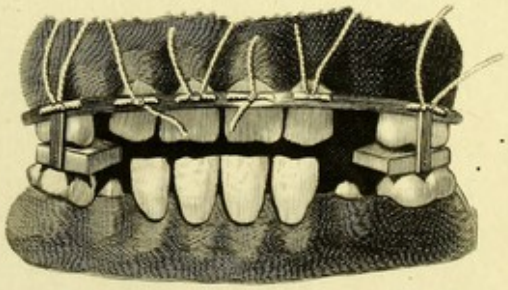

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Plate 13.

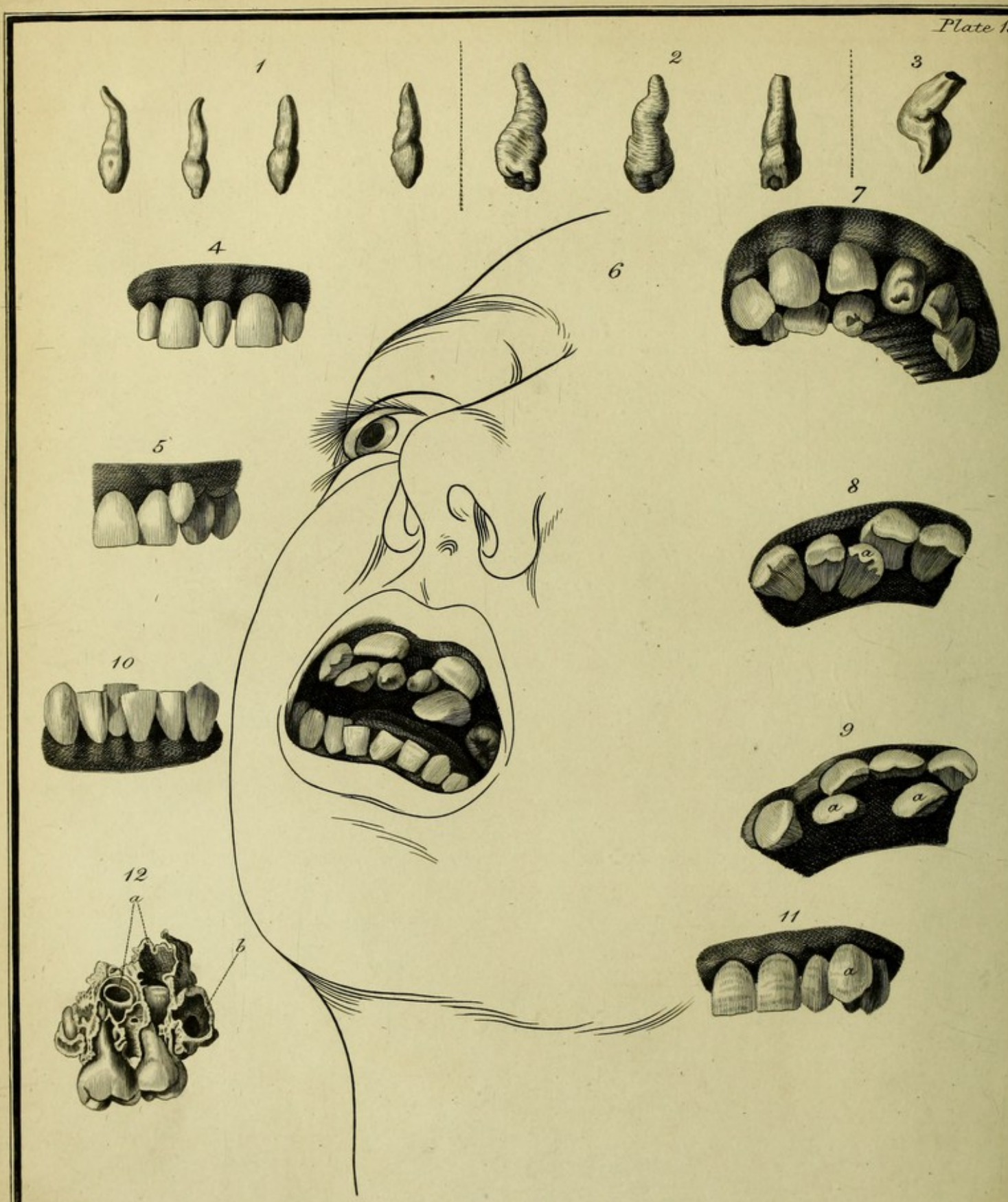

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PLATE XIII.

Cases of irregularity from supernumerary teeth, &c.

FIG. 1. Supernumerary teeth of the conical form.

FIG. 2. Supernumerary teeth resembling bicuspides.

FIG. 3. A tooth which acquired a distorted shape during its formation, from the resistance of the temporary tooth.

FIG. 4. A supernumery tooth placed between the central incisores.

FIG. 5. A supernumerary tooth growing above the central and the lateral incisor.

FIG. 6. A remarkable case of irregularity, occasioned by the growth of two supernumerary teeth.

FIG. 7. A similar case, the supernumerary teeth resembled bicuspides of the lower jaw.

FIG. 8. A case of two lateral incisores on the same side.

Irregularity at an advanced period.

FIG. 9. a a. The lateral permanent incisores to be extracted.

FIG. 10 The most irregular tooth must be removed when the others will approximate.

FIG. 11. A cuspidatus (a) left projecting until a late period; this being removed, the teeth will appear regular, as the lateral incisor and the first bicuspis are close to each other.

FIG. 12. An exfoliation from the upper jaw containing the temporary molares, and (a a.) the bicuspides advancing in formation. b. The socket for the permanent cuspidatus.