

A treatise on the teeth of the horse : shewing its age by the changes the teeth undergo, from a foal up to twenty-three years old ; especially after the eighth year / translated from the French of M. Girard ... by T. Irwin Ganly.

Contributors

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A TREATISE
ON THE
TEETH OF THE HORSE.

A TREATISE

ON THE

TREATMENT OF THE HORSE.

Chapman and Co. St. Mary Axe.

A
TREATISE
ON THE
TEETH OF THE HORSE,
SHEWING ITS AGE

BY THE CHANGES THE TEETH UNDERGO,
FROM A FOAL UP TO TWENTY-THREE
YEARS OLD;
ESPECIALLY AFTER THE EIGHTH YEAR.

WITH COLOURED PLATES, AND A TABLE.

TRANSLATED FROM THE FRENCH OF
M. GIRARD,
DIRECTOR OF THE ROYAL VETERINARY SCHOOL AT ALFORT,

BY
T. IRWIN GANLY,
FORMERLY A PUPIL AT THAT SCHOOL, AND VETERINARY SURGEON TO
THE 11TH LIGHT DRAGOONS.

LONDON:
PUBLISHED BY SHERWOOD, GILBERT, AND PIPER,
PATERNOSTER ROW.

1829.

TREATISE

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SHewing ITS AGE

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WITH COLOURED PLATES AND A TABLE.

TRANSLATED FROM THE FRENCH BY

M. GIRARD,

MEMBER OF THE ROYAL ACADEMY OF SCIENCES AT PARIS,

BY

T. IRWIN, SENY,

PRINTED AND SOLD BY T. IRWIN, SENY, AND W. BENTLEY, SENY, AT THE SIGN OF THE

LONDON:

PRINTED BY RICHARD CLAY AND COMPANY, BUNGAY, SUFFOLK.

TRANSLATOR'S PREFACE.



IN undertaking the present Translation, which I am induced to do, as a token of gratitude to the Editor, I trust it will be found acceptable as well as highly useful to the Profession, and the admirers of the Horse in general. I have to state, that having been some years in habits of the closest intimacy, not only with the late lamented author, in whom the Profession has lost one of its brightest ornaments, but also with the father, who has edited the present edition, and to whose kind attention and instruction conjointly, I owe whatever knowledge I possess in the Veterinary Art; and having moreover, during my studies at the Royal Veterinary College at Alfort, promised both father and son that I would translate into the English language (and get published, if possible) the former's very valuable work on the Anatomy of the Horse, &c. being, as I consider, by far the best system on that subject, and the only one as deserving that name, which has hitherto appeared; and I am now most happy to say, that having very nearly completed the translation, I shall shortly be able to perform that promise, and which would have been accomplished ere this, but for my time having been much employed in preparing to join my regiment now in India.

I do not consider that there is any necessity for apologising for attempting this translation, further than by simply stating the fact, that there is not in the English language, as far as I have been able to learn, any work that appears to convey correct ideas, or useful information on this subject, at least beyond the eighth year of the horse's age. Mr. Percivall has certainly given a short sketch in his book, as from *Pessina*, and also from a little French periodical; and he has, if my recollection serve me right, added some remarks of his own, which so far as his opinion goes, would throw very complete discredit on them: this, I apprehend, must have arisen, either from his not having paid sufficient attention to the subject, and consequently not clearly understanding it, or from prejudice; the latter of which I should be sorry to suspect him.

On my own part, I have for several years past, in a very extensive practice, paid great attention to the subject, and I can fully confirm the correctness of the principles laid down in the following work.

The great necessity for an useful treatise on this subject, I believe few persons will deny, when they consider that by the present mode in general use in England of judging the horse's age, after the teeth are completely changed, extend to only three years of the most useful period of his life;—viz. from five to eight years old;

and in addition to the many recorded instances of a longer life in the horse than is commonly met with, I can adduce the following in one of my own, and the best I ever possessed, whether in the field or on the road, and which I bought when he was *twenty-two* years old: this I clearly ascertained afterwards from the person who bred him; and after this he was hunted hard three seasons, as well as rode as a hackney during the summers.

The numerous mistakes I have seen made as to the age of horses, by those persons who *ought* to have known better, and some of whom would be considered as high authorities even in the Profession, have long since convinced me of the necessity for having some better data than those in general use: I have, it is true, heard of a gentleman in extensive practice, who asserts, that he can tell the age of any horse to within a fortnight; but if my information be correct, I am quite certain that he must be one of two things which shall be nameless; and to my own knowledge, he has been more than two years mistaken in a horse's age.

When I observed a work on the age of the horse, by Mr. Bracy Clark, announced, and, judging from his other learned and truly scientific essays, connected with the horse, as well as from his having been the first person to demonstrate the elastic nature of the horse's foot,

and (as I have since learnt) to whom we are indebted for the only true principle of shoeing, if the various plans now in use deserve the name of principle, I was consequently led to suppose, it would supersede the necessity of another work on this subject, and that a translation of M. Girard's Essay would not be wanted; but on perusing it, I found little or nothing new, and, with the exception of that part which relates to the composition of the teeth, he has only presented us that with which nearly every person acquainted with horses was already familiar.

I cannot conclude without expressing my gratitude to the memory of my lamented friend, the author of the following pages, whose urbanity and politeness were only equalled by his high professional attainments, and the readiness with which he gave explanations, and communicated information; and it ever appeared to afford him the highest gratification to advance the studies, and smooth the path for those around him. As to the father, his high professional merits, so laboriously and perseveringly acquired, have placed him above any eulogium of mine, however deeply I am indebted to him for whatever small share of professional knowledge I may possess.

T. IRWIN GANLY, V. S.

May, 1829.

11th Light Dragoons.

EDITOR'S PREFACE.

THE Treatise on the Age of the Horse, published in the *Recueil de Médecine Vétérinaire*, for January, February, and March, 1824. The copies which were taken separately at the time of the first impression, had a rapid sale, and had been all sold at the period of the fatal event (October 1825) that deprived me of an only son, on whom I had rested my fondest hopes, and who had already greatly distinguished himself as an Anatomical Professor and Teacher. I have been strongly solicited to reprint that production, at the same time to make such additions and alterations to it as might appear necessary to me. All solicitations had been vain, if the idea of honoring the memory of him who ought not to have preceded me to the tomb had not determined me on undertaking this labor.

It is not my province to point out whatever merits the little work may have, which was one of the first attempts of the author, and which has been spoken of with commendation by one of the distinguished Professors of the Royal Veterinary School of Alfort.* I shall only say

* See the account of the labors of the Royal Veterinary School of Alfort, during the scholastic year from 1825 to 1826.

of this little work, that it has been favourably received; that it includes all the new observations since the days of La Fosse; and that it represents the present state of our knowledge on the subject of the age of the horse. The remarks that I have had occasion to make in the course of my anatomical labors, on the changes the teeth undergo after eight years of age, in consequence of wear, and a succession of years, are pretty nearly all included in the text of this tract. Since 1824, I have not given my attention to any new researches, nor have I collected any particular ideas relative to the distinctive signs of the age. This edition has however undergone corrections, particularly the descriptive part, in which there had been a good deal of negligence. I have also made some additions which have appeared to me as useful and necessary to increase the interest of this Essay. The two Plates placed at the end of the text, to facilitate the understanding of the rules laid down, and which were not in the first edition, were executed under my own eye, from the pencil of M. Rigot, head of the anatomical labors at the Royal Veterinary School of Alfort.

Having been intrusted in 1806, by the late M. Tenon of the Institute, to make researches of the wear of the teeth in the larger domestic herbivorous animals, I conceived the idea of a work on the different alterations that these parts un-

dergo. M. Tenon approved highly of this project, and marked out to me the course I should pursue to attain my object with more certainty; and at the same time communicated to me numerous remarks that he had made on the diseases of the teeth, and on their false wear. From this period I occupied myself in collecting all the anatomical specimens that presented any peculiarities relative to the subject that I purposed to treat of. In some years my collection became numerous and important: it embraced all the domestic quadrupeds; the most interesting preparations of these were those relating to the study of dentition. Nearly eight hundred pairs of ends of jaws, mounted on small pieces of board, (according to a new method*) belonged to the horse tribe. Amongst the rare and curious specimens, I shall mention first three or four horses' heads, in which different molar teeth were transformed into hard black bodies, without any determinate organization;—second, the head of a mare, in which the upper molar teeth on the right side did not wear, except on the inner side, and their external surfaces were of a prodigious length.—Third, another head of a mare, whose upper incisor teeth came further forward than those of the lower jaw, which

* I have presented two specimens to Professor Coleman of this extremely ingenious mode of mounting the jaws, which very much facilitates the study of the age, and occupies very little room. TRANSL.

had perforated the palatine surface of the small super-maxillary bones.—Fourth, a considerable number of jaws of horses and dogs, having supernumerary teeth, &c. &c.

The occupation of the School of Alfort by foreign troops in April 1814, caused the dispersion of this collection that had cost me so much labor and care: this circumstance did not a little contribute to make me abandon my original project, which I could not otherwise pursue than by re-establishing the specimens that were destroyed or altered: embarrassments of different kinds did not allow me to undertake such re-establishment; but it became the task of the son not to allow the fruit of the labors of the father to be lost.

Motives, which it is useless to relate here, placed me in 1811 under the necessity of finding a date for some new observations on the organization, growth and wear of the incisor teeth of the horse. For this purpose I addressed a letter to M. Tessier of the Institute, which he caused to be inserted in the forty-sixth volume of the Annals of French Agriculture. I chiefly endeavoured to make known the different shades that the teeth present after the obliteration of the mark, to prove, in opposition to the generally-received opinion, that the horse carries indications of his age as long as he lives, as well as that it is implanted in the maxillary socket.

In the early periods of its formation, the incisor of the horse resembles a cellular body, the thin sides of which are soft and membranous, and promptly become hard and thickened, becoming reflected at the side of the table. This first dental production gives rise to two cavities that have no communication with each other, and differ most essentially; the largest being situated next the root, (*See plate 1st, fig. 16,*) contains the pulpy substance, whilst the outer cavity is open at the side next the table, forming a reflected funnel.

This same dental production becomes transformed into enamel, which is quickly surrounded by the bony substance on both its surfaces; the latter incrusts itself in greater quantity on the side next the root, and never completely fills the funnel, the cavity of which does not become obliterated but by the effect of wear. The funnel is formed, as has been just stated, by the reflection of the elementary membrane of the tooth, and forms a genuine septum or partition, acquires a certain length, and terminates in a rounded blind pouch.*

In consequence of wear, the enamel of the incisors is divided into two portions, the one exterior or casing enamel, the other interior and

* The incisor teeth of the other domestic quadrupeds, beside the monodactyls, or single or solid footed, have not any dental funnel, but only present rudiments of it, like the tushes of the horse, and the incisors of the ox.

central, which surrounds the funnel. Being harder, and presenting more resistance than the bony substance that surrounds it on all sides, the central enamel forms a slight prominence, and takes on different forms, in proportion as the funnel becomes destroyed and narrowed. These different anatomical considerations, which I merely mention, and which are capable of the most useful application to a knowledge of distinguishing the number of years that the animal has lived, will be found more amply explained in the text of this treatise.

The age is, of all knowledge of the horse's exterior, the part to which amateurs of the horse more particularly apply themselves, whether the animal be for pleasure, for labour, or as an article of commerce; it is also one of those points upon which opinions do not always agree, and which give rise to several disputes, when they usually have recourse to a veterinarian. In fact, a pupil, when he quits the school, is not only called upon to treat and cure diseases, but is also consulted on the choice and purchase of these animals. Medical and surgical knowledge is not then sufficient for him, it is also necessary that he should be able to distinguish all the exterior signs that characterise beauty and goodness, or that prejudice the solidity and duration of his services: he should be acquainted with all the shades capable of marking the annual periods of the life of the individual: he should

especially know how to appreciate the different anomalies that occur, and to form the necessary approximations; and finally be able to draw correct conclusions as to the number of years that the animal has lived. The want of positive and correct ideas on these important points, may expose him to disagreeable contradictions, to injure his reputation, and even to lose it altogether in the public opinion. By dint of experience, habit, and practice about horses, many men acquire, without any preliminary study, a particular tact, that enables them to judge promptly and correctly to the very bottom of the subject. Some even arrive at a power of correctly distinguishing the age up to eight years old. This knowledge is in truth but practical and empirical, but it is sufficient to expose the ignorance of the veterinarian who has formed an erroneous opinion, either from a want of a sufficient quantum of instruction, or who, from his experience being limited, is unable to apply the principles that he has been taught.

The successive changes that the incisor teeth undergo throughout the whole course of life, form, without doubt, the most certain chronometer to mark the number of years of the different large quadrupeds; the other external signs are neither so striking, nor so little liable to variation, and they can merely indicate the extreme periods of life. Thus, in youth, or rather at the age of a foal, it presents a physiognomy

that is peculiar to it; its motions are in general quick and lightsome, the body is supple and fat, the skin tight and soft; the shapes appear clumsy for want of the proper developement of the bones. During the first years of the foal's life, the head has an agreeable shape, the forehead broad and flattened, and the occipital protuberance pronounced; after the falling of his sucking incisors, the head becomes deformed and heavy, the maxillary bones become insensibly enlarged, the sub-maxillary spine becomes depressed, &c. The prominence of the orbitary arcades, as well as the zygomatic spine, the deepening of the depressions and sides of the muzzle, the wrinkles of the skin in different parts of the body, the existence of thick hairs about the eyelids, the nostrils, and the mouth, most certainly betoken the weight of years. But these different signs of youth and age are so uncertain, and undergo so many variations, that they cannot be of any utility in appreciating the number of years that an animal has lived.

The knowledge of the age of the horse by an examination of his teeth, goes back to a very remote period, since the ancient writers speak of it as of a thing known long before them. Both the Greeks and the Romans knew perfectly well that the horse's teeth were forty in number, and the mares thirty-six perfect, that the incisors were temporary, and replaced by others from thirty months to five years old, that the tushes

or angular teeth appear from four to five years old, that at eight years old the mark is obliterated in all the incisors, that is to say, the horse has lost his marks.

The ancients had also remarked some of the changes that the teeth undergo after eight years old. In the extracts from the Greek authors by M. J. Jourdin, we read the following passage:

“ At the end of the eighth year we begin not
“ to distinguish any thing more of the precise
“ age of the horse, but perfectly to distinguish
“ old age; we remark in the canine teeth or tush-
“ es, which during youth were long and sharp,
“ are in old age worn and stumpy, particularly
“ those of the lower jaw, and are by this time
“ marked by a slight blackness in the middle,
“ which lasts, according to the observations of
“ some persons, until the twelfth year, when the
“ teeth begin to slant outwards, and to become
“ thickened on the inner side.”* Later writers,
such as Solleysel, Garsault, La Fosse, Bour-
gelat, Sind, Brizelius, Brugnone, Walstein,
Pessina, Fechner, &c. have done little more, if
we may say so, than comment, more or less ex-
tensively and differently, and apply the remarks
of the ancients; but none of them have taken
notice of this little blackness, which, according
to Jourdin, shows itself, after the obliteration

* “ The true Knowledge of the Horse, his Diseases, and their Remedies,” by J. J. D. E. M. 1647, page 10.

of the mark, in the middle of the table, and subsists up to twelve years old or thereabouts. This blackish mark was evidently produced by the dental funnel, which puts on particular shapes, and disappears at about twelve years old.

The first period of the age of the horse, that of the *gnomonion* of the Greeks, and which extends to eight years old exclusively, and marked by the first appearance and replacement of the incisor teeth, and by the obliteration of their external cavity, the period which follows and continues for the rest of life, also present two distinct epochas, the wear of the dental funnel, and the wear of the portion of the tooth next the root. During the first of these two last periods (the wear of the funnel) the table of the incisor teeth bears in its middle the central enamel, and the funnel, at first transverse from side to side, becomes successively triangular, oval, and round. After the disappearance of the central enamel, the table presents a colored point, that appears before the wear of the funnel is completed, and takes different shades and different shapes : it is not even uncommon that in very old teeth this root gives place to a small black cavity.*

In studying well all that these marks present remarkable, produced by the funnel and its

* See the letter inserted in the *Annals of Agriculture*, Vol. 46.

root, in noticing exactly the appearance and duration of each of these changes that it undergoes, we may distinguish old subjects by principles nearly as certain as those founded on their first appearance, and the obliteration of the mark in them. Besides, the direction of the teeth, and the shape of their table, furnishes important approximations to rectify variations; and these approximations become particularly useful after the destruction of the dental funnel, for its root is not always very pronounced, or perfectly distinct. Professor Pessina, of Vienna, explains the gradations of years beyond eight years old uniformly by the shapes that the incisors put on, according as they wear: he has distinguished four successive periods, the oval, the round, the triangular, and the biangular. His considerations are very extended, and perhaps too minute; are capable of acquiring much greater importance, and exhibiting more accuracy, if he had paid attention to the marks that remain after the obliteration of the marks; and if he had established all the points of comparison that could lead him with more certainty to the truth. In this present treatise, we have made all the approximations, and the deductions have been founded as much on the shape and direction of the teeth, as on the different shades of the central enamel and its root. The author has entered into all the details proper to enable

us to well appreciate the principles by which we are to be guided for distinguishing the age. If it has not attained the degree of perfection which such a work is susceptible of, it will at least have the merit of having placed it in a fair way for new researches.

HIPPELIKIOLOGIA :*

OR THE KNOWLEDGE

OF THE

AGE OF THE HORSE.

IT is only within these few years that we have possessed any tolerably exact knowledge of the age of the HORSE after his eighth year; previous to which, habit, or a more or less erroneous routine, was the only guide; of course embracing numerous errors. Thus this branch of veterinary knowledge was found exactly in the state in which it was left by Aristotle, Varro, Columella, Absyrtes, Vegetius, and all the other ancient authors. L. Rusius, Tacquet, Ruini, Garzoni, and Solleysel, hardly added any thing to what was already known as to the manner of organization, the formation, the appearance, or the wear of the teeth; we are even only indebted to modern authors, such as Guérinière, Garsault, Buffon, and Bourgelat, for having exposed the folly of certain opinions; they no longer believed that the folds of the skin, or the number of processes of the bones of the tail, were indications of the age; but very properly confined themselves to an examination of the teeth; they however stated nothing new; in fact they possessed only empirical notions as handed down from the first Hippiatrists.†

* From three Greek words—*Hippos*, a horse; *elichia*, the age; and *logos*, a discourse.

† From two Greek words—*Hippos*, a horse; and *iatros*, a physician. TRANS.

The observations of Tenon* placed those of Ruini, on the three first molars being temporary, beyond all doubt, and in demonstrating the true cause of the wear of the teeth, induced Lafosse to think that the form of the incisors ought to be at all periods of life one of the most certain indications of the age that we could consult; but he did not profit by this happy idea, and even alluded to it so slightly, that few veterinarians know of his having mentioned it.† Professor Pessina has fallen into the opposite extreme: he attached a great deal too much importance to the different shapes that the incisors take, and put forward as facts, remarks, of which experience does not always prove the strict correctness. However, the work of Pessina is, without doubt, notwithstanding its prolixity, and the minuteness of its researches, the best that we possess on the age of the horse. It is necessary always, to distinguish amongst his numerous observations, those that are correct, from a greater number that are merely the fruit of the imagination—this we have for some years past endeavoured to do. The study of the funnels of enamel of the incisors, pointed out by the elder M. Girard, in his letter to M. Tessier,‡ has also formed a part of the subject of our observations, which, if they are not sufficient in all cases and under all circumstances to avoid error, we hope, present more correctness than any of the treatises that have been published on this subject up to the present time.

* Mémoires de l'Institut, tome 1^{er} 1797.

† Manuel d'Hippiatrique.

‡ Annales d'Agriculture, tome xlvi.—Traité d'Anatomie Vétérinaire, tome 1^{er}, 2^e édition.

ARTICLE I.

GENERAL DESCRIPTION OF THE TEETH.

The Teeth are very hard, bone-like instruments of mastication, inserted more or less deeply into and exactly filling the alveoli or sockets of the maxillary bones, from whence they project in such way, that the superior and inferior come in contact. In the manner of their formation they present some analogy to horny productions, and they resemble bones in their physical and chemical properties.

Ranged one after the other, on the alveolar edge of the maxillary bones, the teeth form in each jaw a curved, parabolical line, called *dental arcade*, the superior of which is broader, stronger and longer than the inferior. Each arcade is composed of two rows of teeth, interrupted towards the anterior fourth, and united inferiorly into a semi-circle.

In the horse species, we reckon from thirty-six to forty-four teeth, distinguished into *incisores*, intended to incise or cut the food; *angulares*, *tushes*, or *laniaria*,* because carnivorous animals use them to tear; and *molares*, that grind the food as between two mill-stones.

All the teeth are first formed in the interior of the maxillary bones, from whence they push out after having acquired a certain size, and having destroyed or caused the absorption of the exterior table of their sockets. Some appearing shortly after birth, are called *sucking teeth*; they are also called *fœtal*

* *Laniarium*, a butchery or slaughter-house, from the verb *lanio*, meaning both to butcher and to tear. TRANSL.

teeth; but more properly *temporary*; these are the incisors and the three first molares. The formation and appearance of the others are later; they are called *permanent*. Finally, those that succeed the temporary, and take their place, are called *replacers* or *horse teeth*.

1st. INCISORES, OR INCISIVE TEETH.

These teeth are six in number: they form the anterior or inferior extremity of each dental arcade, and in young horses, they represent a tolerably regular semicircle, from which they depart as the subject advances in age.

The two anterior or middle are called *nippers*, (*medii*) which name they undoubtedly take from their situation so well adapted for nipping. Those placed at each side are called *dividers* (*proximi*;) finally the two last that form the extremities of the semicircle are called *corners* (*angulares*.)

Each permanent or horse incisor, when it has completed its growth, or in other words has pushed out to its full extent, and before it has undergone any wear, presents two portions for our consideration; viz. the *free part*, or that which is out of the gum, and the *root*, or that part which is embedded in it, and the jaw:—the first, which protrudes from six to eight lines beyond the edge of the gum,* is flatted

* Six to eight French lines are about equal to from seven to nine English, or from rather better than half to three quarters of an inch. TRANSL.

from front to rear, and represents a cone the base of which is the table of the tooth, and whose apex is towards the edge of the socket. By this arrangement the incisors, at first, only touch at the corners of the table, whilst, towards the socket they leave a space between them that is filled up by the gums and the partitions between the sockets.

The anterior or outer surface is slightly convex, and has two deep longitudinal channels, generally more remarkable in the incisors of the upper than in those of the lower jaw, and which increases gradually up to a certain age. The posterior or inner surface, (*See plate 1st, figure 11.*) is a little concave and depressed at the external side, and presents a much less surface than the anterior. When the tooth appears completely shot out, the inner surface hardly rises above the gum, whilst in old horses it is sometimes nearly as long as the outer surface. In most teeth, particularly the corner teeth, it is divided into two equal portions by a very remarkable groove, that extends from the socket to the inner edge of the tooth.

The extremity of the free portion of the tooth (*See plate 1, fig. 2, 3, 4 & 5.*) or that part by which the corresponding teeth of each jaw come more or less in contact, and by which they rub one against the other, presents a broad surface flatted from front to rear, that is denominated the *table of the tooth*. In teeth that have not been worn this table presents, first a deep cavity stretching from one side to the other, and which soon becomes filled with a yellow and black substance; this has been usually termed

the *mark*; second two elevated edges that bound the cavity, having an unequal height, and joining, form an acute angle at each side. The outer or anterior edge is longer and higher than the inner or posterior edge, the latter presents a tolerably deep nick in the centre formed by the continuation of the groove of the posterior surface: consequently the surface of wearing ought not to be called the *table*, until after a certain degree of wear, when the two edges are upon a level. Then the cavity only forms part of the surface of wear, in the centre of which it is seen formed by a sort of funnel, which, according as the animal advances in age, becomes narrower, gets closer to the posterior edge, and finally disappears entirely. The body of the tooth, as well as this dental funnel or *infundibulum*, undergoes similar changes, in truth much more slowly, but which is notwithstanding very perceptible, when the *infundibulum* presents only a round, and is arrived at the full term of its wear. It has like the *infundibulum* a conical shape, and the narrowness that it presents next the gum, is so remarkable in the incisors of the ox, as well as in the old temporary incisors of the horse, that these teeth appear as if coming to a shank next the edge of the socket.

As to the lateral edges of the free or exposed portion of the incisors, the inner or that which is next the *median line** is rounded, and much thicker

* *Median line*, is a term frequently occurring in French anatomical works, by it is meant an imaginary line dividing perpendicularly the body, head and neck into two equal parts. TRANSL.

than the outer edge, which is generally thin, and even sharp in the corner teeth. In the young subject these edges lap over, the outer projects forward and is seen placed over the inner. This sort of lapping over would seem to proceed from the manner of the growth of the incisors, that always appear by opposite pairs, which only get into line by degrees and at the end of a certain time, this lapping over is perceptible until towards eight years of age.

The portion *buried in the gum*, generally called *the root* of the tooth, is firmly implanted in the maxillary socket; it is curved backwards, forms a well marked convexity anteriorly, and ends in a blunt point. The nippers are parallel to the axis of the jaw, or in other words perpendicular to it; the dividers are oblique, and the corner teeth still moreso, with their roots turning inwards. The arcade formed by the roots of these teeth, is much narrower, and takes up less space than that of the free portion.

The length, the shape, and the size of the root varies according to the different degrees of age, and presents some differences that it is necessary to point out. During the period of the protrusion of the tooth, the root is generally short, round, and quite hollow; its internal cavity, the sides of which are very thin, is only of temporary duration, and does not present, like the external cavity, a sort of funnel or infundibulum, which is peculiar to the latter. It buries itself deeply, is prolonged externally, surrounds the outer funnel, and contains a pulpy substance, that seems to be the central germ of vitality and nourishment of the tooth. According as the

subject advances in age, this cavity at the root diminishes progressively, and its obliteration proceeds from the bottom of it, beginning towards the inner edge of the tooth, it is collected from the side next the root. The latter lengthens, continues constantly to grow, and the fresh portions, instead of being rounded, are successively triangular, then flatted from side to side; and finally, at a period that varies according to the teeth, the cavity disappears altogether; the root is then pointed at the end, and entirely ceases to grow.

The entire length of the temporary incisors, is from about fifteen to twenty lines, and of the horse incisors, from two inches and a half to three and a quarter. Their form as we have seen is not the same throughout. Thus, next to the surface of wear, flatted from front to rear, they narrow towards the edge of the socket, and become in succession, first oval, then rounded; towards the base of the root they are triangular, and their extremity flatted from side to side. This difference is much more remarkable in the nippers and dividers than in the corner teeth, this is very easy to demonstrate, by making several transverse sections at two lines apart of an incisor tooth. (*See plate 2, fig. 10.*)

The arrangement of the two cavities is such, that they cross each other in the interior of the tooth; the exterior proceeds towards the posterior, and the interior more particularly towards the anterior edge: they are separated by two divisions or partitions that differ in their nature and density, to which M. Girard, sen. has given the name of *dental*

septa, and which remain jointly on the table of the tooth up to a certain period of life. (See plate 2, fig. 3.)

The incisors vary amongst themselves in length, shape, and the depth of their cavities. The corner teeth are in general shorter than the dividers or nippers, and have not so regular a form: they are narrower towards the external lateral edge, so that they never become as perfectly oval, rounded, or triangular as the others; the infundibulum is also less deeply inserted into the interior of the tooth.

In general, we find the infundibulum, when the incisors have completed their growth, from nearly six to seven lines long in those of the lower jaw, and nearly double that in those of the upper jaw.*

The incisors of the upper jaw are likewise stronger, broader, and more developed than those of the lower. Hence it happens that the outer edge of the lower corner teeth rest against the centre of the upper corners, and wears them in such a way as to produce, in some jaws a triangular nick, which is to a certain extent a guide in determining the age. This nick, which never appears until seven years of age, disappears in time, but more quickly in proportion as the jaw takes a more horizontal direction.

The temporary incisors are in general broader than

* In the horse of six years old, the infundibulum of the lower nippers is from six to seven lines, that of the dividers from seven to eight, and the corners from five to six. In the upper jaw the length of the infundibulum of the nippers is from eleven to twelve, the dividers from twelve to thirteen, and the corners from eight to nine lines.

those of the adult (in proportion to their length) and are in the beginning of a greyish white; their exterior surface is covered with a number of small shallow striæ, and the channel of the posterior surface is but slightly marked. In a more advanced age, and as they approach the period of their fall, the exterior surface becomes bright and polished like those of the horse teeth and the striæ give place to small channels; but then the teeth are separated from each other, and present at their base a narrowing into a regular neck, that we never meet with in the horse teeth, be the animal ever so old. (*See plate 1, fig. 11, 12.*)

2nd. MOLAR OR GRINDING TEETH.

(*Columelares Dentes.*)

The molar teeth, twenty-four in number, of which twelve are in each jaw, six to the right and six to the left, are placed firmly by the side of each other in their sockets in the maxillary bone, and form the lateral portions of the dental arcade. From the first molar on each side to the tush, the distance is about four inches, but the space is a little less in the lower than the upper jaw.

The anterior molars, three in number on each side, have long been (and upon the authority of Aristotle) considered as permanent. Buffon, Bourgelat, Daubenton, &c. continued to look on them as such, although Ruini had published, in 1598, that two of these teeth were temporary; and that error was persisted in, until Tenon* had established positively, that the three anterior molars were liable to fall and to be replaced.

Each molar considered in the adult, presents a free or exposed portion and a concealed or implanted portion; the free portion protrudes beyond the gum about five or six lines; its external surface which is nearly upright, presents in the teeth of the upper jaw, two longitudinal grooves, nearly always however in the first horse molar there are three of them; in the sixth lower molar these grooves are replaced by two channels. In all the other lower molars there is only one very deep channel, that extends down to

* *Loco citato.*

where the root divides. The interior surface is not so high as the external in the molars of the upper jaw, but on the contrary is the highest in those of the lower jaw. As to the lateral surfaces, they are straight, and applied throughout their extent to the corresponding surfaces of the neighbouring teeth.

The surface of wear in the unworn tooth is composed of small bands, arranged in zig-zag, leaving indentations between them, that are broader and deeper in proportion to the youth of the tooth. The bands that circumscribe these indentations are also sharper when the tooth has not been worn, and this provision undoubtedly assists the exit of these teeth from their sockets. When the molars have been worn, they present a different appearance; the edge of the circumvolutions are blunt; the indentations appear filled up and levelled; finally the surface of wear becomes changed into an uneven table of a regular quadrilateral shape, taking a slightly oblique direction, from within outwards in the lower jaw, and from without inwards in the upper jaw. The surface of this table is then formed of transverse eminences and depressions, disposed regularly in the direction that the teeth rub on each other.

The embedded portion, or the root of the molars, extends into the bottom of the socket, and present a proportion and a length that varies in the different teeth. The third and the fifth are generally longer than the others, and according to Tenon, they continue the longest during life. They are stronger in the upper than in the lower jaw, and they exhibit through their whole extent, the continuation of the

channels and grooves that we have remarked in the free or exposed portion.

The root of the first molar is directed forward ; those of the second and third are straight, the three last point backwards ; their extremities are pierced with many deep cavities that cross those of the exterior, do not communicate with them, but like those in the roots of the incisors, are deep in proportion as the animal is young. Finally, at a certain period (generally from four to five years old) the extremity of the root throws off fangs to the number of three in the first and sixth upper molar, and four in the other molars of the same jaw.* In the lower jaw the first and last are tricuspid, and the others are bicuspid. Sometimes, however, the first only presents two fangs.

Besides these molars there are sometimes others, that have been called *supplementary*. These latter have some resemblance to the first molar of the dog, are placed one on each side of each jaw, anterior to the first temporary molar ; and as the first replacing molar is larger than the temporary, it almost always happens, that in pushing out the latter it also pushes out the supplementary tooth, so that it is very rare to find one after two years and a half old ; besides which they are not always present.

It is generally with the molars as with the incisors, that those of the upper jaw are bigger, stronger, and their dental arcade broader, than those of the

* We sometimes, though very rarely, find a supplementary hinder molar situate close to the sixth.

lower. Their arrangement with respect to the incisors is such, that when the molars are in contact the incisors are separated, and *vice versa*; this was necessary, on account of the incisors acting from front to rear, and the molars from side to side.

OF THE TUSHES.

(*Dentes Canini.*)

The Tushes or Tusks, so called more on account of their form in the hog and wild boar than that which they present in the horse, are situate in the interval that separates the incisors from the molars and much nearer the corner teeth in the lower than in the upper jaw, where they are nearly an inch and a half distant from them. It follows from this arrangement, which is similar to that which exists in carnivorous animals, that tushes do not rub against each other, but cross when the jaws close.

The free portion of these teeth represent a cone with its base next the socket; its external surface is convex and striated, its internal surface presents in its middle a conical eminence, circumscribed by two very deep grooves, that unite at the point and are separated at the base.

The embedded portion, which takes a direction backwards like the corner incisors, presents at its extremity the orifice of a cavity that in young teeth is prolonged up to the extremity of the free portion; according as the animal advances in age, this cavity becomes obliterated, commencing at its bottom; the

root diminishes in thickness and increases in length, like a tube of glass drawn out over a lamp; finally the cavity disappears altogether.

The tushes differ but little from each other; those of the lower jaw however are a little longer and stronger. They seem to belong exclusively to horses; mares are not provided with them, or at most they have only the rudiments of them, resembling supplementary molars; it happens very rarely that they attain any considerable size, but still it is possible to be mistaken on this point; when they do, they are small teeth having no eminence or grooves on the inner surface.* Castration does not produce any effect on the size or strength of the tushes, or on the period of their appearance, which is extremely variable, and without any cause that we are acquainted with.

* The ancients supposed that mares having tushes were barren, and called them *brehaignes*. (I have never heard a word in English to express this epithet. TRANSL.)

ARTICLE II.

ORGANIZATION OF THE TEETH.

The teeth are composed of two substances, differing in their color, their density, and their uses: the one which is exterior is called *enamel*; the other, interior, is called vulgarly the bony substance; but which is with much more propriety called by Hunter and M. Cuvier the *ivory*. This substance is not in fact bone: it is not produced, it is not supported, and it is not re-produced, after the manner of the bones: it has no analogy with them except in its chemical composition; but even in this, according to M. Morichini and M. Berzelius, there is some difference, for they have shown the presence of a small quantity of fluuate of lime in it.*

The ivory exists throughout the whole substance of the tooth; towards the free portion it is covered by enamel, and only forms the root to it. It is of a yellowish white, very compact, and formed of striæ ranged transversely to the axis of the tooth, which gives it a silky appearance.

The finest injections have not demonstrated any vessels in it; but we must admit, however, that soaking causes liquids to penetrate into its deepest layers, in the same manner as they penetrate into horn, which is always softer at its internal surface, as is well known. The red color that the internal layers of the ivory of the teeth assume in those

* The general opinion of chemists is, that we do not find fluuate of lime except in fossil bones and teeth.

animals that are fed with madder, at least while the teeth are growing, is alone sufficient to prove that this absorption takes place. The recent observations of MM. Magendie and Fodera tend to demonstrate, that the mechanism of absorption is itself under all circumstances nothing but an imbibition.

The ivory of the young incisors is prolonged down to the extremity of the root; on the contrary it becomes more distant from it in proportion as the root increases in length, and the tooth is pushed out of the socket. The enamel forms a sort of crust over the *eburnous** substance of the free portion; it is of a milky white, and is more polished in the adult teeth than in those of the young or of old subjects: its hardness is such, that it gives fire with flint: it is completely impervious to injections. Its chemical composition is a little different from that of the eburnous substance; it is almost entirely formed of the phosphate of lime, and contains a small quantity of animal matter, which amounts, according to Berzelius, to but two per cent. whilst there exists in the bony substance of the tooth from twenty-eight to thirty per cent.

The interior of the teeth is provided with a cavity that communicates with the bottom of the socket, by means of an opening in the extremity of the root, the diameter of which is greater in proportion as the tooth is young. This cavity diminishes with age: it is filled with a gelatinous, greyish substance, which is simply a papilla filled with mucus of the

* From *ebur*, ivory. TRANSL.

mouth, surrounded by a membrane abounding in vessels and nerves, which do not penetrate into the eburnous substance.

The arrangement of the ivory and the enamel varies in each kind of teeth; it is not the same in the molars as in the tushes, nor in those as in the incisors: we shall only examine it in the latter, as they are the principal object for our consideration.

The enamel, after having covered the entire of the external surface, doubles itself towards the surface of wear, and dips down into the interior of the tooth, forming a conical cavity, which becomes narrow, and approaches towards the posterior edge of the tooth, the more according as it is nearer the root. This prolongation of the enamel presents then two portions for our consideration:—first, the cavity that it forms to the exterior:—secondly, the horn or infundibulum which envelopes this cavity. This funnel, which is very easy to perceive in making different sections of the tooth, is surrounded in young teeth by the cavity of the pulp, which is continued to the extremity of the free portion, but which is found more especially on the side corresponding to the anterior edge of the tooth. As the animal advances in age this outer cavity becomes obliterated, and the infundibulum is then only surrounded by a mass of ivory, much thicker anteriorly than posteriorly. (*See plate 1, fig. 7, 8, 9 & 10.*)

Veterinary anatomists admit yet a third substance, which they call the *cortical substance*, or the *cement*, and which, according to them, covers the exterior surface of teeth that have not undergone

any wear. That which they consider as a peculiar substance, is evidently a portion of greyish or yellowish enamel, which has not as yet acquired the hardness and color that it afterwards possesses.* They range in the same class the matter that fills the bottom of the inner cavity or infundibulum and forms *the mark*. In the very young tooth this cavity extends to the end of the funnel, and terminates in a *cul-de-sac*, or blind pouch. Subsequently, when the tooth is a little worn, it wants from three to four and even five lines of being so deep, which is filled up by a yellowish substance, that is nothing more than tartar, to which it has the most perfect analogy both as to its physical and chemical characters.

As has been already remarked, the teeth are formed in the interior of the maxillary bones; but their developement occurs sooner or later in different animals. In the fœtus of a mare three months gone, there are not as yet any traces of teeth. We can merely perceive cavities in the interior of the jaws, that are subsequently to be converted into sockets: they contain vesicles that are the future nuclei of the teeth. Towards the fourth or fifth month these vesicles exhibit at their summit, next the side of the socket, one or more plates of ossific substance, which are not long before they unite, and form those circumvolutions that are subsequently

* This substance has lately been submitted to analysis. It is composed, according to M. Tassaigne, of 53.9 of phosphate of lime, 3.9 of carbonate of lime, and 42.2 of a parenchymatous animal matter, analogous to that which exists between the teeth and the bones.

perceived on the table of the tooth. These plates increase quickly in thickness by the addition of new layers to the internal surface.* It at the same time becomes more developed on the sides, always, however, towards the extremity that is intended to protrude outside beyond the gum, so that the root may be the last formed, and that the plates of ivory may always be thicker towards the summit of this dental nucleus. It follows from this that the pulp decreases in proportion as the tooth becomes larger; and that this process, or this ossification, (if we may be allowed the expression,) continuing throughout the duration of life, a period should arrive, and which, in fact, is the case, wherein the pulp has entirely disappeared, and wherein there does not any longer remain a trace of the cavity in which it was contained.

The enamel is not formed in this manner by the addition of successive layers from within outwards; it is secreted by the membrane that lines the sides of the socket, and spreads itself over the ivory which it encloses down to the extremity of the root. Its thickness remains always the same. The enamel once formed, it does not undergo any further change. In the young molars, we very distinctly perceive this substance applied against the ivory in the form of plates running parallel between them, and also to the axis of the tooth: these plates have a certain analogy in their appearance to the leaves

* This opinion is not exactly in unison with that of M. de Blainville. Vide *Dict. d'Hist. Natur.* art. DENT.

of the reticular tissue of the anterior surface of the foot of the horse ; they do not acquire all their density until a later period, and but a short time before their protrusion, but always proceeding from the edge of the tooth next the socket. The enamel does not receive any more vessels than the eburnous substance, though in all other respects it differs essentially from it. It does not increase in thickness with age ; it does not become red under the use of madder ; when it is broken, the fragments do not again unite as those of the ivory do, by the addition of new layers ; it does not contain fluete of lime ; finally it dissolves more or less completely in a dilute acid, whilst the ivory preserves its form, and merely becomes transparent and flexible.

The formation of the dental vesicles and their ossification does not take place precisely at the same period in all animals.

In the foetus of a mare four or five months gone we find twelve opaque dental vesicles that are beginning to ossify, that is, six for the molars and six for the incisors (the corner teeth are not hardly perceptible.) According as the foetus approaches towards the full period of its sojourn in the womb, the ossification increases, so that towards the ninth month the teeth have already become very solid, even the corner teeth themselves are ossified, and we can perceive sufficiently distinct the vesicles of all the teeth that in course of time will protrude.

As the tooth continues constantly to grow, and that too in every direction, it gradually separates the sides of the cavity that contains it, and which in

a short time ceases to be sufficiently large to contain it; it must then endeavour to perforate the socket on that side that presents the least resistance, and consequently it protrudes on the side next the mouth towards the alveolar edge of the maxillary bone, penetrating the bone and the gum covering it.

When the teeth have once accomplished their protrusion, they continue to grow in length in their roots, or in other words to shoot their roots deeper, during a much longer time in the horse, and other monodactyls,* than in the other large herbivorous domestic animals. This continual growth being accompanied with an equal tendency to push outward, it follows of necessity that the portions worn away are constantly replaced by others, and that such portion of the tooth that at six years old formed part of the root, at a more advanced period of life forms the table. It is according to this continual growth of the incisors, that Tenon, Lafosse, Pessina, and M. Girard, sen. have established principles, by which it is possible to point out the age of horses that have passed seven or eight years, with more certainty, than by means of characteristics given by Buffon, Daubenton, Bourgelat, &c.

In fact, we have seen that an incisor that has completed its protrusion, but which has not as yet undergone wear, is flatted from front to rear towards the extremity of the free portion or table; that at some lines lower down it is oval, then rounded, then triangular, and finally flatted from side to side. As

* From *monos*, single, and *dactulos*, Gr. a finger. TRANSL.

the tooth pushes out in the same proportion as it wears, each of these oval, rounded, triangular portions, &c. become in succession the table of the tooth, and form the surface of wear: it is sufficient then to specify at what periods these changes take place in the table of the teeth to form sufficiently correct ideas on the age of old horses. It is the same with the cavity or infundibulum: it contracts, becomes oval, triangular; and when it has disappeared gives place to the *cul-de-sac*, or blind pouch, of the root. The period of the disappearance of the infundibulum has also been observed by M. Girard, sen.; he has also noted the appearance of the end of the cavity or funnel that contained the pulp, and to which he has given the name of the internal dental septum. (*See plate 2, fig. 3, 5 & 6.*)

It is not alone in consequence of their disproportion to the alveoli or sockets, that the teeth are pushed outwards. At the period when the cavity is obliterated, and when the roots have ceased to increase in length, the maxillary bone itself becomes increased, pushes them outwards, and ends in part by filling up and obliterating the alveolar cavity.

This action of the jaws on the teeth is not matter of doubt. The shape that the head and the teeth assume in old age proves it. We have stated that the incisors, which are very broad towards their wearing surface, were much narrower towards the socket. This last portion, at a more advanced age, forms the surface of wear, and the tooth is then nearly the same breadth throughout. The incisors should then be, as in the ruminating animals, sepa-

rated from each other; on the contrary they are in contact, and this phenomenon can be perhaps only the result of the action of the maxillary bones.

It would be difficult to determine in what proportion an incisor tooth protrudes in the year. However, Pessina has attempted it: he affirms, that in high-bred horses they are worn a line a year, and a line and a half in common horses. As their length is always nearly the same, at least in the greater number of horses, it will follow from that, that these teeth are pushed outwards in the same number of lines each year.

When a molar tooth is wanting, the tooth corresponding to it in the other jaw acquires a considerable length: it is not then the wear that causes the continual protrusion of the tooth; the growth continues nevertheless. Examples of this sort are frequent.*

All that we have just said applies particularly to the adult teeth, to those that have taken the place of the fœtal teeth, and that remain during the rest of life.

Otherwise these teeth follow in their evolution the same order as the sucking teeth: every thing

* Tenon has calculated that the molar teeth of the horse are capable of acquiring a length of about six inches, in case they lost nothing by wear. In the head of a mare killed for dissection in October 1805, marking from six to seven years of age, one of the upper right molar teeth that had not been worn but at its inner surface, presented from the extremity of the root to the extremity of the free or exposed portion, a length of about five inches, and this diminution is pretty much the same in the five other molars.

leads us to believe that they exist at the same time with them, and that they only require a longer time to arrive at perfection. They form a range of vesicles within or behind, and above or below the temporary teeth, and present precisely the same considerations. In the beginning they exist at the bottom of the socket, approach by little and little towards the alveolar edge, become ossified, destroy the partition that separates their cell from that of the temporary tooth that corresponds with them, destroy the root of the latter, compress the vessels and nerves that go to it; finally they determine their fall, and are not long themselves in making their appearance.

There is not only wear, but also absorption of the root of the temporary teeth. This is particularly remarkable in the molars, and which form only a small plate when they fall.

The replacing molars pushing immediately down on, or up against the temporary teeth, it is easy to account for the fall of the latter. In the incisors it is not the same; the replacing teeth form a broader range than the temporary teeth, and situated behind them in such a way, as that their extremities do not exactly correspond. Whence it follows, that the replacement of the incisors takes place generally much less regularly than that of the molars, and that they present supernumerary teeth frequently.

The manner of the growth and protrusion of the replacing incisors, also explains why the roots of the temporary teeth become depressed at their anterior surface, and at a certain period only form a long,

thin process, liable to break more or less near the neck of the tooth, and to remain fixed in the socket against the replacing tooth. These portions of teeth are observed more particularly when the sucking teeth have been drawn too early, and the root broken. The destruction of this root by the replacers, causes the table of the latter never to exhibit the radical covering, and the reason of this is so evident as not to need explanation. We shall also point out that, when the temporary incisor ceases to receive nourishment, it becomes whiter, more smooth, and polished.

ARTICLE III.

SIGNS BY MEANS OF WHICH WE CAN DISTINGUISH
THE AGE.

The teeth are incontestably the parts of the body capable of furnishing the most certain indications of the number of years that the animal has lived, and the incisors in particular are suitable for this purpose; they are indeed the only teeth that give correct ideas on the age of the horse, throughout almost the entire duration of his life. The difficulty of examining the molars, and the irregularity of their table, prevent our being able to obtain any result from the inspection of these teeth. As to the tushes, besides mares not being provided with them, the period of their protrusion varies very much: as they do not rub against each other but sideways and across, they can only be considered accessory means of judging.

The study of the age of the monodactyls, by an examination of the incisor teeth, presents three distinct periods, the changes peculiar to the temporary teeth, the protrusion, and obliteration of the mark in the replacers, and, finally, the different shades that these latter present, beginning at the obliteration of the mark, and going down to the most advanced old age.

1st. THE PROTRUSION AND OBLITERATION OF THE
MARK IN THE TEMPORARY TEETH.

Foals that have arrived regularly at the full term, are generally foaled in the spring of the year, and it is also from this season that horses' ages are reckoned from in each year. It is very rare that at this period any of the incisor teeth have made their appearance; the first and second molars are the only ones that have shot out; when they are not at the time of birth, they never delay more than three or four days; the third is always shot out before a month.

The nippers appear from six to eight days,
The dividers from thirty to forty days,
The corners from six to ten months.

We perceive, at the time that each incisor makes its protrusion, a sharp edge convex anteriorly and concave posteriorly, this is the anterior edge, the posterior does not appear for some days after, and it is then we distinguish the cavity.

The protrusion of these teeth takes place earlier in proportion as the mother is in good health, the foal well fed and in good health itself. As to the rest, a precise knowledge of the moment of the appearance of the temporary incisors is of little importance at this period, when the foal has not as yet quitted the mother, or at least not far separated from her, so that positive information of his age can be obtained. (*See plate 1st, fig. 1.*)

The incisors of the upper jaw generally appear a little earlier. This however is not so far general that the contrary does not occasionally happen.

The two molars that appear at birth, still mark the age of two to two and a half years by their fall, and the protrusion of the replacers; but from this period the molars can assist in a knowledge of the age, and we should only consult the incisors.*

From the moment that incisor teeth have appeared, they undergo some change in consequence of their wear against those corresponding and opposed to them. The wear commences on their anterior edge, it being much more elevated and sharper. In a short time it is on a level with the posterior; then they both wear together; the cavity which was at one time longways, becomes narrower, and afterwards triangular; finally, at a certain period it disappears, and is replaced by the small end of the funnel next the root; it is this wear taking place regularly that is called *losing the mark*, (*See plate 1st, fig. 4.*) This wear takes place from the moment that the upper and lower teeth come in contact, whence it follows that obliteration of the mark is often completed in the nippers when the corner teeth are beginning to appear: as to the rest, it is very variable in the sucking teeth, and can only give indications not much to be depended on, either because there is great irregularity in the period of the appearance of the corner teeth, or on account of variations

* The supplementary molars, when they are present, generally appear from five to six months old.

As to the hinder molars, it is too difficult to examine them for them to be of any service to a knowledge of the age.—The first appears about ten or eleven months, the second about twenty months, and the third from four to six years.

in the period of weaning the foal; and also if they have made use of fibrous food; or else because the food varies much in hardness in different situations.

When an incisor tooth has commenced wearing, and that its two edges are on a level, the table presents two bands of enamel, the one exterior, that surrounds the tooth, which is the *casing enamel*; the other internal, that only surrounds the cavity, which is the *central enamel*,* (*See plate 1st, fig. 3, 4.*) In every case, the incisor teeth of the lower jaw wear more quickly than those of the upper, and their wear is also always much more regular. The reason of this has been sought for without being able to find one altogether correct: according to some the rubbing body always wears more than the body rubbed, and the lower jaw being the most moveable, its teeth ought to be worn soonest; others have thought that it was on account of the strength and compactness of the upper incisor teeth, as in them the exterior layer of enamel and the infundibulum are thicker. The only cause of this difference lies in the disproportion that exists between the infundibulum of the superior incisor teeth and the infundibulum of the inferior. In all the teeth that I have examined and compared together, the cavities were deeper and the infundibulum longer by about a third in the upper teeth; and that very well explains why the upper teeth seem to wear more slowly, notwithstanding that they wear quite as much as the lower. Whatever may be the cause of this difference, it is

* Tenon, already quoted.

very remarkable. We also observe that the wear is much more regular in the lower jaw; that undoubtedly arises also from the manner in which it rubs against the upper.

It follows, in all cases, from this observation, which is particularly applicable to the horse teeth, that it is difficult to determine the period of the obliteration of the mark in those of the upper jaw, and that all authors who have considered it as being able to assist in the knowledge of the age, have fallen into error.

The marks in the lower nippers are always obliterated at ten months,

The dividers at one year,

And the corners from fifteen to twenty-four months.

The upper nippers have their marks already nearly altogether obliterated, so that at two years old the cavities have disappeared in all the teeth, as well of the lower as of the upper jaw.

At this period the crowns of the nippers become insensibly smaller, and they have become necked at their base, they become dried up and put on a yellowish brown colour; shortly after they loosen, have hardly a hold in the gums, and fall to make way for the other teeth. It is then that the second period of the age of the horse commences.

2nd. APPEARANCE AND OBLITERATION OF THE MARK IN THE REPLACING OR HORSE TEETH.

As we have seen, the replacing or horse incisor teeth are ranged behind the sucking teeth, and

appear successively like the latter, first presenting the anterior, the appearance is followed in one or two months after, by that of the posterior edge. The teeth of the upper jaw also appear in general from eight days to a fortnight sooner.

The nippers appear at from two years and two years and a half to three years,

The dividers, from three years and a half to four years,

The corners, from four years and a half to five years ;

So that a horse of three years old ought to have four horse incisor teeth, a horse of four years old has eight of them, and at five years old all the incisor teeth have appeared.

Such is the course pointed out in all works, but without any explanation; and this brevity has given rise to more than one error. It is certain that if Nature was left to herself, it would be almost always thus; I say *almost always*, because there are cases where the state of the jaw is different.

We have already stated that we consider all horses foaled in spring, but the birth may take place (taking one with another) three or four months sooner or later. In the case where it is late I should suppose the individual to be of a breed that is slowly developed, of weak temperament, and that it has been badly kept; the other, on the contrary, is placed under circumstances the very reverse. If we examine them in the month of August; in one the corner teeth have appeared, in the other there is no appearance of them, the dividers alone being out.

However both the one and the other are in truth but four years old. Let us look at them nine months later, in the month of May: the first has twelve teeth well shot out; the corners in the second are only beginning to appear, notwithstanding they are both five years old.

It is always sufficiently rare for this to occur when Nature is left to herself. But the dealers who are interested in giving young horses the greatest age they can, draw sucking corner teeth and sometimes the dividers, and by this means hasten the appearance of the horse teeth, giving the horse the appearance of being older than he really is. It follows from this, that every horse (particularly if the other parts are well pronounced) that in the month of May, and more certainly if in the month of June, has not the corner teeth appearing, and even well shot out, ought to be considered being but four years old. In a word, a horse must have lived sixty months to be five years old.* When the horse is not quite five years, but wants only two, three or four months of it, it is said *he is rising* five years old. If he is on the contrary nearer to four than five it is said he is four years old *off*. The difference then between *rising* and *off* relates to the period of

* This is not meant as an attempt at wit. All veterinarians well know that, according to dealers, the corner teeth are the teeth of five years old; but, say they, a horse that has his five-year-old teeth must be five years old. The orders relating to the remounts (in the French service) direct that horses to be eligible should be five years, or *sixty months off*.

the year in which the examination takes place, since they are all supposed to be foaled in spring.*

The first horse molar ordinarily appears from the thirtieth to the thirty-second month; the two others remain sometimes up to three years. The supplementary molars, when they exist, are generally pushed out by the first horse molar, at the same time as the first sucking molar. Sometimes the latter pushes out by the side of it, then the supplementary molar remains a longer time; this happens more frequently in the lower jaw, where the supplementary molar is not so near the first front molar.

It is at this period that the tushes appear. Their time of appearance is by no means regular; sometimes they appear at three years old, at other times they do not until six; but the more general period

* The appearance of the teeth, whether sucking or horse teeth, does not take place at the same period in all countries. Thus, in the horses of the South of France, that are reared in the district where they have been foaled, the horse incisors make their appearance sometimes in the first days of September, more frequently in the beginning of October; but they are always shot out in the first fortnight of December. This protrusion is much later in the colder climates; in Normandy, for example, it does not take place, when Nature is left to herself, but in the months of January, February, March, and even April. In Limousin is rarely finished before the month of January. These variations depend so much on climate, that when foals are transplanted from a cold into a warm country, the appearance of the teeth takes place earlier; it is more slow in the opposite case, and that in proportion as the difference of the temperature is greater between the two places.

is four years old.* We cannot draw any but very uncertain principles from the state of these teeth.

The exertion that the teeth make for their protrusion is in every direction, and not alone on the side where they make their appearance : it is easy to be satisfied of this on the heads of horses or foals that die during dentition. The plates of the maxillary bones are worn, and often even perforated ; also these periods, particularly that of the second dentition, are those, in all animals, in which inflammatory diseases make their appearance, differing in the different species, and more or less severe in proportion to the difficulty with which the protrusion is performed. The separation of the sides of the maxillary bones, and the swelling that is the consequence of it, gives to the head a roundness and an air of youth that disappears with what gave rise to it.†

* I had in my own possession some years back, a good-shaped, powerful chesnut gelding, able to carry fourteen stone hunting, and of an excellent constitution, whose age I knew without reference to his teeth to be seven off, that had not the slightest appearance of tush ; his other teeth exhibited the usual appearances at that age. **TRANSL.**

† From this circumstance, I some years since pointed out to Mr. William Sewel, who then said it was quite new to him, that we could make a pretty close guess at the age of a horse in the dark, by taking the edge of the lower jaw between the fingers, opposite the roots of the grinding teeth, and laying the other hand along the side of the face opposite the roots of the grinding teeth of the upper jaw, and if the horse was young, the lower jaw would feel thick and plump, and the side of the face round and full ; but if old, the lower jaw would feel quite thin, the roots of the grinding

The obliteration of the mark in the horse incisor teeth takes place tolerably regular; but not so much so as to enable us to distinguish precisely the age of a horse, as one would be tempted to believe, in reading all the veterinary works that have treated on this subject.

They all say that the marks in the lower nippers are obliterated at from five to six years old, and the corners from seven to eight, &c. But from the age of three years, the period when the nippers appear, up to five, they have had time to wear, and they are already almost quite smooth, when we perceive the corner teeth; it then follows, that it is to those teeth that have undergone the least wear that we should refer. Consequently, at this period we should consult the state of the corner teeth; and it will be difficult to mistake in the exact age of the animal, let us have had ever so little experience.

At five years old, when the circumstances that we have pointed out do not exist, the corners coming

teeth having quitted it, the two plates of the jaw-bone come in contact, and the side of the face will feel hollow, it having fallen in from the same cause. Mr. S. has since, however, I believe, attached much importance to this fact, and I dare say has altogether forgotten where he got it. The truth however is, it can only be of use in case a person wished to steal a horse in the dark, which is an expedient I trust none of my readers will have recourse to. I was also the first who pointed out to him the existence of the subscapulo-hyoideus muscle in the horse, of the existence of which, although a highly important muscle, he was not before aware. I also pointed out to him the utility of combining aromatics with mineral tonics—*cum multis aliis*. TRANSL.

to shoot out are not on a level with the dividers;* the anterior edge is much more elevated than the posterior, and the anterior edge of the dividers is slightly worn; in the nippers it is on a level with the posterior edge, the cavity or mark has altogether disappeared, or nearly so. The entire of the incisor teeth wholly taken, as well superior as inferior, represents a pretty regular semi-circle; the tushes are most generally completely shot out, but do not as yet show any wear.

At six years old, the corners become a little more elevated, and are found to be nearly on a level with the dividers; the outer edge is a little more worn, the dividers are in the state in which the nippers were at five years old; the mark in the nippers is always and completely effaced.†

At seven years old, the mark in the dividers is obliterated; the outer edge of the corner teeth is on a level with the inner; we sometimes perceive a notch in the upper corner teeth.

Finally, at eight years old, all the lower jaw has the marks obliterated in it:‡ the teeth are on a

* We speak constantly of the lower teeth when we do not distinguish them, as they alone have the mark obliterated with regularity.

† At this period the last molar tooth has shot out, and the horse has forty teeth, of which twelve are incisor teeth, twenty-four molar teeth, and four tushes, without counting the supplementary molar teeth when they exist.

‡ These, however, are not always so. The cavity or mark in the corner teeth often remains at nine years old, and even beyond it. This arises from these teeth not wearing regularly.

level, their form is changed, they have become oval, and the cavity has been replaced by a longish transverse eminence of enamel, which is the termination of the central enamel or the funnel next the root.— (*See plate 1, fig. 10.*)

3rd. THE SUCCESSIVE SHAPES THAT THE TEETH ASSUME, AND THE DIMINUTION AND DISAPPEARANCE OF THE CENTRAL ENAMEL.

After eight years, the obliteration of the mark in the superior incisors is, according to the greater number of authors, the only means of ascertaining the age of the horse. For a great length of time we have perceived the insufficiency of this method, since people are in the habit of declaring all horses *aged* that have passed eight years old. This expression has been a kind of anathema to all those that it has been applied to. But there is nevertheless a great difference in value and capability of performing service between a horse of nine years old and one of eighteen; and it certainly is not a matter of indifference to be able to distinguish the ages of those that have passed this terrible epoch.

We have already seen that the incisors, as well as the other teeth of the horse, are continually growing during life, and that every part of them in succession forms the table, and that when the wear had been regular, when in a word they had been fairly worn, this table becomes by age oval, rounded, triangular, and finally flattened from one side to the other. (*See plate 2, fig. 9.*) We shall extract from the

observations of Pessina, which by the way are in every respect too minute and too circumstantial, those of the correctness of which experience has convinced us, and which we consider ought to be admitted.

The incisors that at the period of their appearance, and at three, four, and five years old, were flattened from front to rear, and very long from side to side, diminish progressively in extent in this latter dimension, so that at eight years old the nippers of the lower jaw have taken on an oval shape, and we remark that the dividers and the corner teeth do the same in succession, and become narrow by little and little; the tables of these same teeth become round up to thirteen years of age, they then put on a new appearance, and become triangular in the same order in which they had become oval and rounded. (*See plate 2, fig. 7.*)

This triangular form is not very much pronounced in the beginning, the edges are slightly rounded, and the three sides are pretty much of an equal length, afterwards the lateral portions grow longer, whilst the anterior or outer side appears to diminish; the extremities become angular, and this lengthening in a short time becomes so great, that at from nineteen to twenty years of age, the incisors become in reality flattened from one side to the other.* (*fig. 9.*) This flattening proceeds in succession from the nippers to the dividers, and from them to the corner

* This flattening from side to side (the *biangularity* of Pessina) is not well pronounced in some horses, it is in general a very long, or in other words, a very acute triangle.

teeth, in such a way as to enable us to distinguish the age of the horse up to twenty-two or twenty-three years.

Such is the substance of Pessina's remarks, and taken thus in the general way, they are sufficiently correct. We cannot, however, say the same of the details that he gives, nor of the divisions and sub-divisions that he establishes between those different periods. But further he reasons as if the rounded, triangular, and biangular shapes, were as regular as geometrical figures; but undoubtedly this is very far from being the case, at least in the greater number of instances. One would believe, according to what he says, that the teeth of the upper jaw wear with as much regularity as those of the lower, and that the characters they present, and the principles we can deduce from them, are equally regular and equally invariable. To demonstrate the error into which he has fallen, we can only repeat what we have already said on the obliteration of the mark or disappearance of the exterior cavity in the teeth of either jaw. In fact, if we believe what he says on the subject, he has arrived at the highest degree of correctitude in the knowledge of the age of the horse, and that the appearance of these different shapes is so regular, so exact, and so well marked, that it is not possible to be deceived even to a few months. We leave the correctness of these assertions to the judgment of Veterinarians.

When in consequence of the obliteration of the mark the external cavity has disappeared, we no longer perceive on the wearing surface any thing

but a grain of enamelly substance, longish from one side to the other, and having a slight depression in its centre,* and it is placed a little nearer to the posterior than to the anterior edge of the tooth. This grain, which is merely the termination of the funnel next the root or central enamel, still remains up to a certain period, becomes narrower, rounded, approaches closer to the posterior edge of the tooth, and finishes by disappearing entirely. (*See plate 2, fig. 5.*) These successive changes, and this disappearance, will cease to astonish us when we recollect the situation of the funnel next the root, such as we have already described it. We at the same time said, that this pulpy cavity was prolonged into that portion of the tooth which is outside the gum between the two internal surfaces of the central enamel. This cavity becoming obliterated by the addition of new layers of ivory, exhibits in the course of time, like the exterior, an infundibulum of ivory substance, which in consequence of the continual growth and wear of the tooth, appears at a certain period on the wearing surface.

“ Before the complete destruction of the first of
“ these marks (the central enamel) when it is nearly
“ oval, we perceive the termination of the pulpy
“ cavity appear in front of the first, and against the

* The prominence of the central enamel is caused by its being surrounded with ivory, which being much softer, wears more quickly. This inequality is particularly remarkable in the table of the molar teeth, where we can extremely well distinguish the bands of enamel, which gives them some appearance of a worn mill-stone.

“ anterior edge of the table, in the form of a zone,
“ afterwards transverse and yellowish, then round
“ and greyish, and after that white and longish from
“ front to rear. It differs essentially from the first
“ mark in its never becoming prominent, and its
“ being always on a level with the remainder of the
“ surface of the table: we also observe that it con-
“ tinues until the fall of the tooth; and that if it
“ sometimes disappears, it is invariably replaced by
“ a small round black cavity.”*

We should recollect, before going further, that the funnel of enamel which envelopes the external cavity is not of the same length in all the incisor teeth; it is generally longer in the dividers than in the nippers, and in the latter than in the corner teeth, and this difference is sometimes so great that it has disappeared in the latter teeth when it still remains in the others. We already know that its length is comparatively greater by nearly one half in the upper incisor teeth; the central enamel ought then to remain much longer in them. However, the total length of the upper incisor teeth is the same as that of the lower; they ought all then to undergo their change of form in the same time, since they are of the same length, as they wear, and grow out of the gum continually, and the same number of lines; and the observations of Pessina on this point are altogether incorrect.

We are reasoning in the supposition that the wear in the teeth of the upper jaw takes place regularly;

* Letter from M. Girard to M. Teissier, already quoted.

but we have seen that most generally such is not the case.

In applying the principles that we have been just explaining, we may distinguish the age at different periods, according to the following characters.

At eight years old (*See plate 2, fig. 1.*) complete obliteration of the mark (most generally) in the lower jaw, the nippers, the dividers, and the corner teeth, the central enamel is triangular and nearer the posterior than the anterior edge of the tooth, the termination of the cavity next the root appears near the anterior edge in the form of a yellowish band, longish from one side to the other.*

At nine years old (*fig. 2.*) the nippers become rounded, the dividers oval, and the corner teeth have become narrow, the central enamel diminishes and approaches the posterior edge.

At ten years old (*fig. 3.*) the dividers are becoming rounded, the central enamel is very near the posterior edge and rounded.

At eleven years old (*fig. 4.*) the dividers have become rounded, the central enamel is hardly any longer apparent in the teeth of the lower jaw.

At twelve years old (*fig. 5.*) the corner teeth are rounded, the central enamel has completely disappeared,† the yellowish band is of more extent, and

* It is of a lighter color than the remainder of the ivory that forms the wearing surface, undoubtedly because it has existed a shorter time. We remark in fact that the eburnous substance becomes of a deeper yellow in proportion as it becomes old; it is of a milky white in very young teeth.

† It disappears almost at the same time in all the teeth; we should recollect the reason for this.

occupies the centre of the wearing surface; the central enamel remains in the teeth of the upper jaw.

At thirteen years old (*fig. 6.*) all the lower incisor teeth are rounded, the sides of the nippers are becoming longish, the central enamel remains in the teeth of the upper jaw, but it is round and approaching to the posterior edge.

At fourteen years old (*fig. 7.*) the lower nippers have an appearance of being triangular, the dividers are becoming long at the sides, the central enamel of the upper teeth diminishes but still remains.

At fifteen years old (*fig. 8.*) the nippers are triangular, the dividers beginning to become so, the central enamel of the teeth of the upper jaw has not disappeared as yet.

At sixteen years of age the dividers are triangular, the corner teeth beginning to become so, the central enamel of the teeth of the upper jaw will in many instances be found to have disappeared.

At seventeen years of age (*fig. 9.*) all the teeth of the lower jaw have become completely triangular; but as we have before seen the sides of the triangles are all of a length.

At eighteen years of age, the lateral portions of the triangle lengthen in succession, first the nippers, then the dividers, and afterwards the corner teeth, so that at nineteen years of age the lower nippers are flatted from one side to the other.

At twenty years of age, the dividers are of the same shape.

Finally, at twenty-one years of age this shape appears in the corner teeth.

After this period the incisors do not present any distinguishing characters capable of directing us even to an approximation; these teeth become flattened more and more, and seem to converge towards each other, touching merely by their lateral and anterior edge; they become dried up, the gums become whitened, the jaw bones become narrow, the tables of the teeth become greyish, the incisors are yellowish in the entire remainder of their extent, frequently enveloped at their base by a thick layer of tartar, whilst every thing announces in the individual old age and fragility.

The continual growing up of the teeth of the horse from the side next the root are such, that the socket not being sufficiently long, the pressure of the new portion of root pushes the tooth outwards. To this consideration we should add, that these new portions of teeth being always narrower, it becomes necessary that the sockets should contract in order to hold the tooth firmly from this narrowing, and the horizontal direction of the jaws at an advanced age; an alteration well worthy of remark, which Tenon and others have attributed to the manner in which the jaws rub against each other; whereas this action of the jaws can only be considered as very secondary in the production of these phenomena. Whatever may be the explanation of it, it is invariable that the sides of the superior maxillaries become flattened, that the head seems to become lengthened and pointed, which gives to the animal an oldness of look, in which it is not easy to be mistaken. The horizontal direction, owing to the same cause, is also always

indicative of an advanced age; but this direction is very much pronounced in some horses, and not at all in others; the cause of this remains a question.

To sum up, the incisor teeth of the horse remain as guides long after the term assigned by the Greeks; they mark throughout the whole of life, and they indicate the different degrees of age up to twenty-one years; first by the order in which they appear, second by the obliteration of their outer cavity, third by the changes and disappearance of their funnel, and fourthly and lastly by the successive shapes that their table takes on after nine years of age, and which are the oval, the rounded, the triangular, and the biangular. The appearance of the teeth, and the obliteration of the mark, are without doubt the periods that furnish the most certain indications for distinguishing the age. During the four or five years that follow the obliteration of the mark, the knowledge of the age is still tolerably certain, because there are many modes of correcting it; such as the state of the termination of the blind pouch, of the funnel next the root, the general appearance of the tooth, and the shape that the table of the tooth puts on. The periods of triangularity and biangularity present the greatest difficulties; the data for these latter periods are most commonly only approximations; nay, it is impossible to pronounce a positive opinion on the age of a horse from sixteen years of age to twenty. In conclusion, the different points for consideration in the age of a horse, and to render them more concise and more easily comprehended, we have considered it right to construct the

following table, which may be consulted in every case. This table, the model of which is to be found in Pessina, will have the double advantage of saving the labour of seeking for observations scattered through the body of this essay, and also of putting the principles which it establishes within the comprehension of every person.*

* The different forms that the teeth take on are much less regular in the corner teeth than in the nippers and dividers. It is also necessary to observe, that in the following Table we only speak of the incisors of the lower jaw : also that the teeth do not pass suddenly from one form to another these changes take place more or less slowly, are sometimes earlier, and sometimes later, according to the density of the substance of the tooth, and its power of resisting wear, according to the nature of the food that the animal makes use of, and sometimes also according to the temperament of the animal. To properly understand this difference, we have marked in *Italic letters* the oval, the triangular, and biangular, when commencing, and in *Roman letters* when these forms are completed.

TABLE of the AGE OF THE HORSE, commencing at Five Years old.

Age	NIPPERS.	DIVIDERS.	CORNER TEETH.	OBSERVATIONS.
5	Mark lost more or less	On a level with nippers, and its inner on a level with its outer edge	Lower than the divider, nick in the inner edge, which is not on a level with the outer	At this period are fresh, although well shot up, the dental arcade of the incisor teeth forms a very regular semi-circle
6	Mark lost, end of outer blind pouch slightly concave in the middle	Mark lost	On a level with dividers, outer edge a little worn	Nick in upper corner tooth in some mouths
7	Central enamel triangular	Mark lost, central enamel concave in the middle	Inner edge on a level with the outer, beginning to lose mark.	Appearance of the end of blind pouch of inner cavity, in the form of a small yellowish or greyish band, longish transversely, and placed between the centre enamel and the inner edge of the tooth.
8	Oval central enamel narrowed, and very near inner edge	Oval, central enamel triangular ..	Mark lost, central enamel concave in the middle	
9	Rounded, central enamel round, and very near inner edge	Oval, central enamel rounded, and approaching inner edge	Oval, central enamel triangular ..	
10	Rounded, central enamel round, and still nearer inner edge	Rounded, central enamel as in the nippers	Oval, central enamel as in the nippers and dividers	
11	Rounded, central enamel gone, or only forming a small round speck close to the inner edge ..	Rounded, central enamel as in the nippers	Rounded, central enamel as in the nippers and dividers	
12	Rounded, central enamel gone ..	Rounded, central enamel gone ..	Rounded, central enamel gone ..	
13	Rounded	Rounded	Rounded	
14	<i>Triangular</i>	Rounded	Rounded	
15	<i>Triangular</i>	<i>Triangular</i>	Rounded	
16	<i>Triangular</i>	<i>Triangular</i>	<i>Triangular</i>	
17	<i>Triangular</i>	<i>Triangular</i>	<i>Triangular</i>	
18	<i>Triangular</i>	<i>Triangular</i>	<i>Triangular</i>	
19	<i>Flatted from side to side</i>	<i>Triangular</i>	<i>Triangular</i>	
20	<i>Flatted from side to side</i>	<i>Flatted from side to side</i>	<i>Triangular</i>	
21	<i>Flatted from side to side</i>	<i>Flatted from side to side</i>	<i>Flatted from side to side</i>	
22	<i>Flatted from side to side</i>	<i>Flatted from side to side</i>	<i>Flatted from side to side</i>	

APPENDIX.

This appendix will form the completion of the work on the age; it will include two principal articles, in which is pointed out the most important variations which the principles established on the changes and successive shapes are capable of undergoing, and that the incisor teeth present.

OF HORSES BADLY MARKED.

The incisor teeth do not push out and wear with such regularity as the rules we have laid down in all cases, and to all horses. Sometimes the appearance of the incisors does not take place in the natural order; at other times these teeth take a wrong direction; some of the sucking teeth may also remain and form supernumerary teeth, &c. These aberrations of the teeth constitute horses *badly marked* or *badly mouthed*,* and may arise from many causes.

First,—In the case where the teeth are faulty, by being either too long or too short.

Second,—When the obliteration of the mark has been irregular, and that the wear has not taken place evenly on the table of the tooth.

* This expression is certainly trivial, and we have for a long time hesitated to make use of it; but we could not find another that conveys the same idea in a single word. In all cases we say *badly marked*, or *badly mouthed*, but which should not be confounded with *bad mouthed*, which is used to express horses that have not been properly bitted.

Third,—Finally, whenever the appearance of the teeth above the gum has sustained interruptions in its progress.

Whether it is that some horses have the enamel of their teeth harder than others, or that the increase of the root exceeds the wear of the table, or, finally, that the jaws have such a form and direction* that the wear only takes place on the very table of the incisor teeth; it is not rare for the incisors to preserve a more or less considerably disproportioned length, in such case it is certain that our principles are not applicable, because they were founded on the constant and proportional growth and wear of the teeth. Pessina has sought to fulfil this object, and if he has not entirely succeeded in it, he has at least permitted himself to be corrected up to a certain point. We may convince ourselves every day of the utility of his data, although they only approximate.

* I have seen several horses in which one jaw was longer than the other, in which case the incisor teeth acquire a very great length, some of them wear the anterior edge, and others the posterior. It is generally the upper jaw that exceeds, and in this case the superior incisor teeth become curved at their anterior surface. There is then a continual growth of them like the incisor teeth of rabbits (see *Journal de Physiologie*, tom. 3, page 1.) and the development that these teeth acquire in this latter animal, is owing perhaps also entirely to the disproportion in the length of the jaws. There is at present in the museum of Alfort a jaw thus formed: it has but five upper incisor teeth. Sometimes there is only a single tooth that becomes lengthened in this way. We have spoken of this case, that we have already said is more frequent in the molar teeth.

The length of the nippers being commonly about eight lines, or rather better than three quarters of an inch, that of the dividers about seven lines, and the corners about six, let us take the medium for all the teeth, we shall then have about seven lines out of the gum from its edge to the wearing surface of the tooth. According to Pessina, each tooth ought to wear a line in well bred horses, and a line and a half in common horses, each year; at least such is the case with those in whom the wear takes place with the greatest regularity. If the portion of the tooth that is seen out of the gum (always considered generally for the facility of demonstration) is more than seven lines in length, they have worn less than they ought to have done, and the horse is consequently older than the examination of his teeth would lead us to suppose, but how much older is he?

Each year the teeth ought to wear one line (I suppose this case as being the most simple) they are three lines too long, the animal would then appear three years younger than he is in reality, and a transverse section would prove such to be the case.

From hence it follows, that to determine the age of a horse whose incisor teeth are too long, we should add to the age that the table of his teeth indicate as many years as they have lines or lines and half of too great length.

On the other hand, and for the same reason, the horse whose incisor teeth are too short will appear older than he is; and to determine his age we should deduct as many years as the teeth are lines or lines and a half too short. This is tolerably common in

very old horses, whose teeth no longer retain any enamel; often also this shortness of the teeth is the consequence of a sort of crib-biting, for which the horse is returnable, simply because it does not leave any particular trace of it.*

Undoubtedly if we wish to seek for scrupulous exactitude in these observations, we shall not find it; but where in all the principles in the knowledge of the age of the horse does it exist to this degree? Would it not be unjust to proscribe without mercy all the observations of Pessina, to go back to Lafosse and copy him literally? Besides, we are not the only persons who have reduced those principles to practice with advantage, and all Veterinarians will ere long acknowledge how useful their application may be.

These premises once acknowledged and admitted, we shall not be embarrassed to pronounce upon the age of horses naturally bishoped.† This unnatural permanence of the cavity, or of the extremity of the blind pouch of the central enamel, that form the two anomalies, cannot lead any person into error

* I should doubt if this is the case in England, where, added to the glorious uncertainty of the law, we might perhaps have the *assistance* of twelve tailors to determine a horse cause. TRANSL.

† I say naturally bishoped, because I never heard a word in English that corresponds to the French *bégus*, which is said of horses that have the mark or cavity so extremely deep, that it remains for years after the usual period. I have seen many such cases. The French make two sorts of it. TRANSL.

who does not express his opinion without an attentive examination, having compared the shape of the table of the teeth, their length, and, in fact, the different characteristics of which we have spoken.*

It is then quite possible to correct ourselves when the teeth wear either too much or too little, provided the wear is regular; that is to say, when it takes place on the wearing surface, and in the manner we have pointed out. If, on the contrary, the wear has taken place in such way as to destroy the natural form of the tooth, we have no longer any indication, except the freshness of the incisors, tushes, &c. which happens when horses bite desperately against the bottom of the manger, or upon their collar shank. We can easily conceive that in such case the vices in question would give rise to the horse being returnable.†

When the range of the horse incisor teeth grows up too far back it does not destroy the root of the sucking teeth, nor compress their vessels and nerves; neither does it destroy the septum, or partition of

* In fact, sometimes horses are naturally bishoped, particularly that sort called false, without the teeth being too long. That arises, as we said before, in consequence of the infundibulum being more or less prolonged, even in teeth of an equal length.

† As we here only speak of crib-biters so far as it affects a knowledge of the age, we shall not go into any details on this defect, which is in a greater or less degree injurious to the horse's health, and which is communicated from one to another by imitation, and not as has been said by contagion.

bone between them; in a word, it does not cause them to fall. These new teeth now form a double row, which prevents the incisor teeth of the upper jaw from rubbing against the table of the lower, and gives to this surface such an irregular shape that it is sometimes impossible to distinguish it. This is, in every respect, the most difficult case, and we must be satisfied to remain in the most perfect ignorance of it. Fortunately it is of very rare occurrence, and frequently there are only one or two teeth that have not been forced out; they then have the appearance of a double tooth, which falls in the course of time, and they do not, in any great degree, impede our knowledge of the age.

**TRICKS EMPLOYED BY DEALERS FOR THE PURPOSE
OF DECEIVING THE BUYER AS TO THE AGE OF
THE HORSE.**

Dealers are interested that the horses should appear most near the age when they are of the greatest value, and when they can of course hope to get the highest price for them. If the horses are too young they endeavour to make them older in the eyes of the purchaser; and, on the contrary, they wish to make those that are older than they should be, appear young.

In the districts where they breed horses, particularly in Normandy (*quære*, in Yorkshire?) the breeders frequently draw the sucking dividers, par-

ticularly in colts that are *backward*,* and thus cause the appearance of the horse incisor teeth some months sooner. Those into whose hands the same horses afterwards fall do the same thing with the sucking corner teeth; so that, although the horse is no more than four and a-half years old, yet he is furnished with all his incisor teeth. We have pointed out, in speaking of the horse incisor teeth, the means of avoiding falling into this error, against which Veterinarians are not in general sufficiently on their guard.

Immediately after these teeth have been drawn, the place where the tooth that has been taken out stood is more or less inflamed, bruised, and excoriated. In the order of nature, when the sucking incisor teeth are fallen, the anterior edge of the horse teeth appears immediately; this is not the case until much later when the sucking teeth have been drawn. It is, then, always easier to ascertain to a certainty in the beginning; at a later period we can only be guided by the season of the year in which we may make our examination, and the more or less advanced state of the horse teeth.

They frequently only draw the teeth of the lower jaw; and that is the true cause that in a great number of horses their appearance out of the gum precedes that of the upper incisor teeth; this is too simple a case to be mistaken.

* An expression applied to distinguish horses the coming forward of whose teeth is late or slow. In the contrary case it is said that they are *forward*.

According to the opinion of Solleysel and all other Hippiatrists, the length of the teeth is an indication of old age; and this opinion, though generally adopted, is far from being always true. On the contrary, in very old horses, so far as we have seen, they become very short, at least when they have not taken a completely horizontal direction. However, in admitting this to be correct in all cases, and up to the most extreme old age, we must still believe that the animals would appear younger if we saw their teeth; and in this manner men may be imposed upon, who have only a superficial knowledge of the shape, the manner of growth, and the wear of the incisor teeth; but it happens, precisely on the contrary, that to a person acquainted with the subject, they either show the exact age of the horse, or else make him appear older than he really is, and they make clear to him what he would otherwise have been obliged to approximate to by calculation.

Let us state an example, to make ourselves better understood; suppose the mouth of a horse of which we wish to ascertain the age, to be in the following state: the lower nippers and dividers are rounded, the central enamel is round, and very near the inner edge of the tooth; the termination of the blind pouch of the cavity next the root is very apparent; the animal is eleven years old. But his teeth are ten lines long, instead of being only seven; he appears then very old; but suppose we were to saw them off, and take away three lines. The nippers are triangular; the dividers are beginning to become

so; the central enamel has totally disappeared; the animal then marks fourteen years, which is his true age, but which perhaps we should not have called so much before his teeth had been sawed, because then we had no means of correcting them but by conjecture.

If the horse's teeth are not, or at least are not at present, too long, it is necessary, for the purpose of cheating the purchaser, to work a cavity similar to that which had disappeared a shorter or longer time previously, for the purpose of making him appear as near six years old as possible, for it would be too difficult to make him go back to five.

It is not necessary to enter into a detail of the means employed to conceal this fraud, which some dealers perform very skilfully, but can only deceive those who have not studied the subject, or have had but little experience. We know in fact that the funnel that envelops the outer cavity, being the same as the casing enamel, and of a substance harder than the rest of the table, rises above its surface. When the termination of the blind pouch of this funnel remains, this cavity cannot be worked in the middle;* they then bore it very near the outer edge of the tooth: the position of this artificial cavity,

* We should not in fact consider as artificial a roundish hole that is sometimes found in the central enamel, and communicates with the interior of the root. We have already seen, in quoting a passage from the letter of M. Girard to M. Tessier, that the yellow spot which is only the termination of the blind pouch of the pulpy cavity, is replaced in some old teeth by a hole of this sort.

and the existence of the termination of the blind pouch of the central enamel on the table, suffices to point out the fraud. If the animal is older, and the central enamel has disappeared, the new cavity is not surrounded by an exuberant edge; besides, the general state of the jaw, and the form of the tooth, are more than sufficient to determine our opinion. Let us add to which, that the natural cavity is always similar in form to that of the table of the tooth, and which is not here the case.

EXPLANATION OF THE PLATES.

PLATE 1st.

The ten figures of the lower jaw, sketched in this plate, exhibit the ten principal periods in the age of the horse, from his birth up to eight years old.

The six teeth sketched separately, present the exterior of the incisor teeth, as also their internal organization.

Fig. 1. *Jaw of a foal newly born; the nippers have made their full appearance, but they are still a little on one side.*

Fig. 2. *In this jaw of from six to seven months old, the nippers have already undergone wear to a certain extent, and the inner edge of the dividers is on a level with the outer edge.*

Fig. 3. *This figure expresses a foal of a year complete; the corner teeth shot out about two or three months, are nearly on a level with the dividers, but they do not as yet present any appearance of wear.*

Fig. 4. *A foal of two years complete; the nippers have the mark completely obliterated, and the inner edge of the corner teeth is nearly on a level with the outer edge.*

Fig. 5. *End of the jaw of a foal of from thirty months to three years old ; the nippers are shot out within a short time, and their outer edge has begun to wear. The wear of the sucking dividers exhibits the bottom of the funnel.*

Fig. 6. *The state of this end of a jaw marks four years and a half old ; the horse dividers, newly shot out, are still quite fresh, and not as yet on a level with the nippers. The inner edge of the latter are still untouched, and lower than the external edge. The sucking corner teeth are much worn, and present only the extremity of the funnel.*

Fig. 7. *A horse just closing up to five years old ; the corner teeth have a short time shot out, they are fresh and untouched ; the nippers begin to lose the mark, the external edge of the dividers has undergone some wear, but the inner is nicked, as yet untouched, and lower than the outer.*

Fig. 8. *This figure represents the age of a horse of six years ; the nippers have lost the mark, the dividers have nearly so, but the inner edge of the corner teeth are still untouched, and also slightly nicked.*

Fig. 9. *A jaw in which the incisors mark seven years old complete, and the nippers and dividers have completely lost the mark, the inner edge of the corner teeth is on a level with the outer, in consequence of wear.*

Fig. 10. *In this jaw of eight years old all the*

teeth have lost the mark, and the nippers begin to assume the oval form, the remainder of the funnel is close to the inner edge of the table of the tooth.

Fig. 11. *The tooth of a foal viewed at its posterior or inner surface: a, the mouth of the cavity or funnel of the table;—b, the mouth of interior cavity, or funnel next the root.*

Fig. 12. *Another foal's tooth viewed at the anterior surface, and in which we distinguish—a, the body of the tooth; c, the neck; and b, the root.*

Fig. 13. *A very young foal's tooth, in which the casing or outer enamel is cut through its whole length, showing the central enamel.*

Fig. 14. *A horse incisor tooth divided into two parts throughout its length, and which shows the external cavity, a; and the internal cavity, b.*

Fig. 15. *A young horse incisor tooth, with an opening made at the middle of the anterior surface, leaving bare the lower portion of the funnel, a.*

Fig. 16. *A young horse incisor, sawed in the same way as that represented fig. 14:—a, the exterior cavity; b, the extremity of the funnel.*

PLATE 2nd.

The intention of the nine first figures of this plate is to show the number of years after eight years old; and the sections of the tooth sketched in Fig. 10 give an idea of the marks produced by the funnel and the septum of the root.

Fig. 1. *This jaw belonged to a horse that was eight years old off; all the incisors have lost the mark, and the septum of the root appears on the table of the nippers in the shape of a small transverse zone, situate in front of the funnel, and quite close to the outer edge of the tooth.*

Fig. 2. *The end of a jaw of nine years old: the nippers are rounded, and the dividers beginning to assume that form; the remainder of the funnel of these four teeth is round and quite close to the inner edge of the tooth. These same teeth exhibit the septum of the root, which is most pronounced in the nippers.*

Fig. 3. *A jaw of ten years old; there is merely the rudiment of the funnel in the nippers as well as in the dividers, and the remainder of the central enamel touches the inner edge of the table of the tooth. The nippers and the dividers are rounded, and the corner teeth present an oval form.*

Fig. 4. *From the state of the teeth of this jaw, it had attained its eleventh year; all the incisors are rounded, and only now carry a slight trace of the central enamel, which touches the inner edge of the table of the tooth; the septum of the root appears in all the teeth, and the remainder of the funnel is smaller in the nippers than in the dividers and corner teeth.*

Fig. 5. *In this jaw, which marks twelve years old, the nippers have lost the central enamel, and the septum of the root is rounded.*

Fig. 6. *This is aged thirteen years off; the nippers have become triangular, the dividers are also assuming that form, and the corners are still rounded. The septum of the root is rounded in the four latter, and is seen in the middle of the table. The tushes are very much worn.*

Fig. 7. *The horse to whom this jaw belonged might have been fourteen years of age; the nippers are triangular, and the dividers are becoming so. The tushes are still more worn than in the preceding figure.*

Fig. 8. *A jaw of fifteen years old off; the nippers and dividers have arrived at the period of being triangular, and the septum of the root forms a rounded point on all the tables of the teeth.*

Fig. 9. *These are teeth that indicate from fifteen to sixteen years of age; all the incisors are become triangular, and the nippers are beginning to be flatted at the sides. The tushes are more worn than in the preceding jaws.*

Fig. 10. *Exhibits six transverse sections of a young horse incisor tooth; the three first portions a, b, c, have got the funnel, and the two last sections, d, e, show the septum of the root of the tooth.*

THE END.



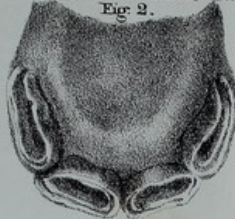
The first part of the paper is a list of names and titles, including the names of the authors and the titles of their works. The list is arranged in a columnar format, with the names of the authors on the left and the titles of their works on the right. The names are written in a cursive hand, and the titles are written in a more formal, printed style. The list includes the names of several prominent figures in the history of science and philosophy, such as Aristotle, Plato, and the Stoic philosophers. The titles of the works are also listed, and some of them are followed by the names of the translators or editors. The list is a comprehensive record of the works of these authors, and it is a valuable resource for scholars and students of the history of thought.

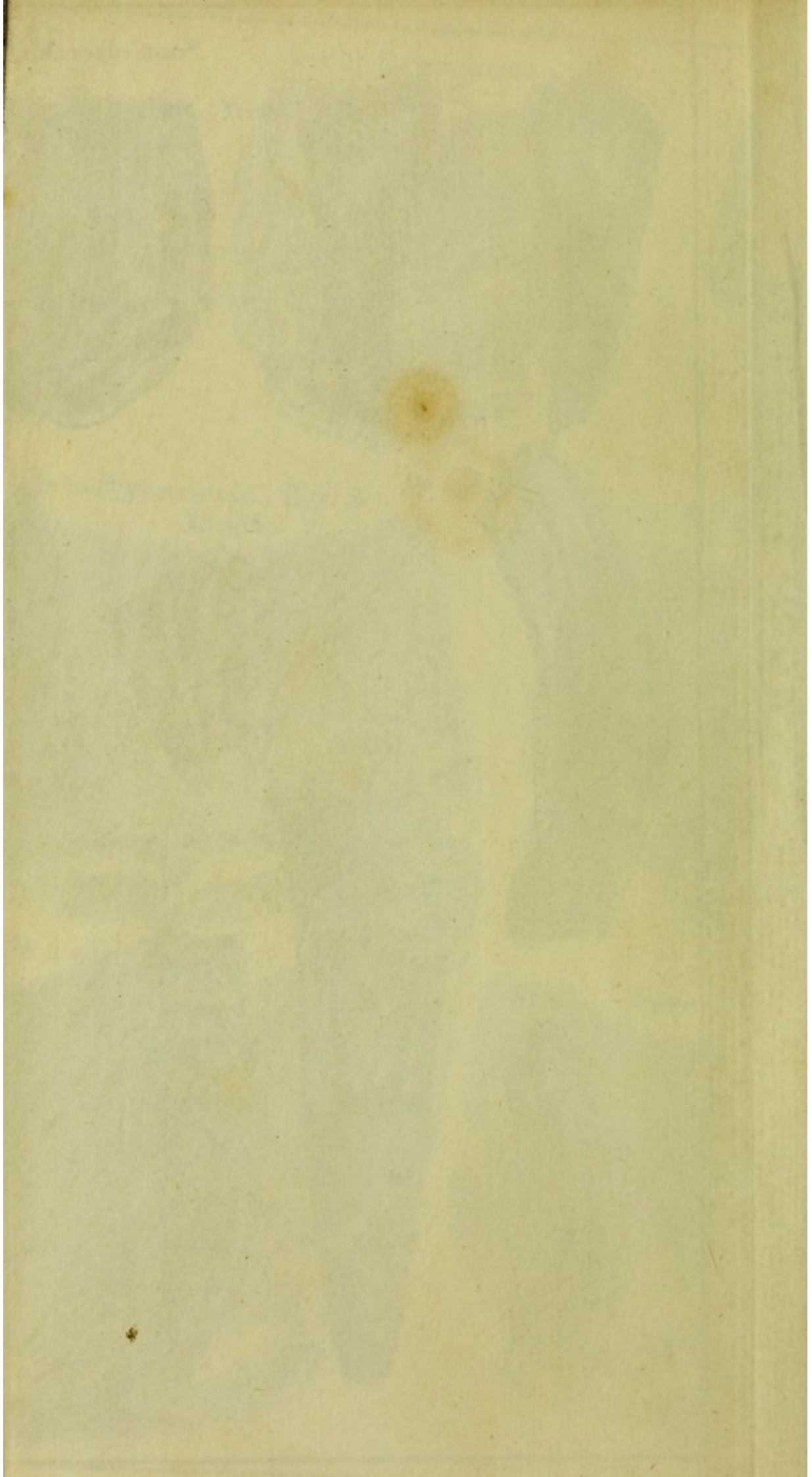
Soon after birth, Fig. 1.

Six or Seven months old, Fig. 2.

One year off, Fig. 3.

Two years off, Fig. 4.







Eight years old off.

Fig. 1.



Nine years old.

Fig. 2.



Ten years old.

Fig. 3.



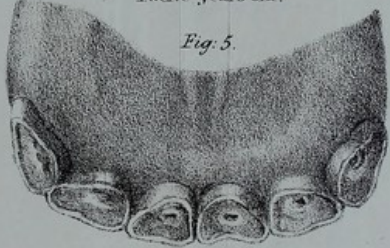
Eleven years old.

Fig. 4.



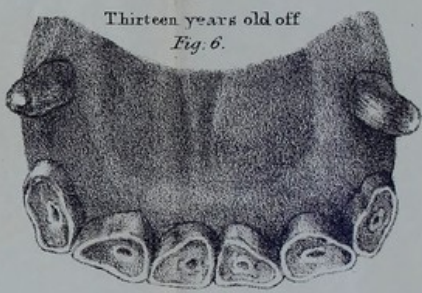
Twelve years old.

Fig. 5.



Thirteen years old off

Fig. 6.



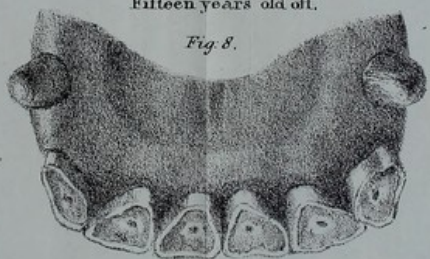
Fourteen years old.

Fig. 7.



Fifteen years old off.

Fig. 8.



Fifteen or Sixteen years old.

Fig. 9.



