



On the knowledge of the age of the horse by his teeth : with remarks

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ON
THE KNOWLEDGE OF THE AGE OF THE
HORSE
BY HIS TEETH.

WITH REMARKS.

BY

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On knowing the Age of the Horse by his Teeth.

IT was in the commencement of the Veterinary College, in the year 1792, that I composed this Table, apprehending strongly that it would create a smile among my friends, if, as being a young student, I should be mistaken in giving the age of a horse, I therefore, for a few months, gave my attention entirely to this object, procuring an enormous quantity of jaws and teeth from the neighbouring slaughter-houses for this purpose.

This Table is a collection of all the material circumstances which attend the teeth from birth to the latest period of life; for the fact turns out to be, that it is the history of the teeth which forms the basis of this knowledge, taking into the account some discrepancies and anomalies which disturb its uniformity, and to which are to be added certain changes which age produces in other parts of the body.

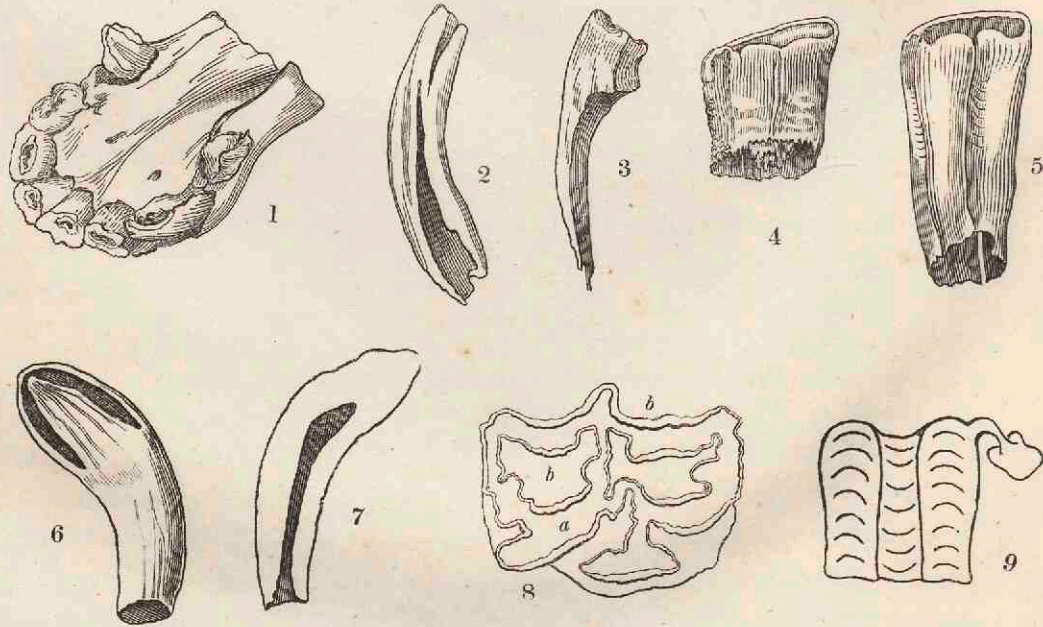
The changes which take place in the teeth at any age are seen in the Table: if we look down the column perpendicularly for any age, we see the state of every tooth at that age; or if we look for any particular tooth, by carrying the eye along the line horizontally, we see the state of that tooth at half-yearly periods through all its progress to old age; so that, with this Table before him, the tyro may soon acquaint himself with every particular, and much better than by the vague, unconnected, and often untrue accounts hitherto given.

We may perhaps advantageously preface our remarks with a short view of the formation of these Incisor teeth, according to the best information we have been able to obtain, and from our own reflections; not only on account of some novelties we introduce into it, but as being one of the most singular and interesting processes of the animal economy. Their formation appears to be nearly as follows:—A cavity, by absorption, is first formed in the bone of the jaw, which, when sufficiently enlarged, receives a deposit of a mass resembling jelly or gluten, but is more tough, and covered over by a thin fine vascular membrane; a sac also, or membranous capsule of some thick-

TABLE OF THE APPEARANCE OF ALL THE TEETH

	<i>At Birth</i>	<i>12 Days.</i>	<i>5 Weeks.</i>	<i>2 Months</i>	<i>3 Months</i>	<i>6 Months</i>	<i>1 Year.</i>	<i>1½ Year.</i>	<i>2 Years.</i>	<i>2½ Years.</i>	<i>3 Years.</i>	<i>3½ Years.</i>
<i>INCIS.</i> 1st pair..	Not ap.	Appears	Advncg.	Level	Wearing	Worn	Worn	Mk. ob.	Smooth	<i>SHED</i>	H. Tooth sharp edged	Level
.... 2nd pair..	Not ap.	Not ap.	Appear	Advncg.	Wearing	Worn	Worn	Worn	Worn	Mk. ob.	Mk. ob.	<i>SHED</i>
.... Corner...	Not ap.	Not ap.	Not ap.	Not ap.	Appear	Level	Wearing	Worn	Worn	Worn	Worn	Worn
<i>ANT.</i> 1st pair..	Not ap.	Appear	Advncg.	Level	Wearing	Worn	Worn	Mk. ob.	Smooth	<i>SHED</i>	H. Tooth	Level
.... 2nd pair..	Not ap.	Not ap.	Appear	Advncg.	Wearing	Worn	Worn	Worn	Worn	Mk. ob.	Mk. ob.	<i>SHED</i>
.... Corner...	Not ap.	Not ap.	Not ap.	Not ap.	Appear	Worn	Wearing	Worn	Worn	Worn	Worn	Worn
1 Molar	Appear	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	<i>SHED</i>	Level	Advncg.	Advncg.
2 Molar	Appear	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	<i>SHED</i>
3 Molar	Appear	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.	Advncg.
4 Molar	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	<i>RISES</i>	Level	Advncg.	Advncg.	Advncg.	Advncg.
5 Molar	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.		<i>RISES</i>	Advncg.	Advncg.	Advncg.
6 Molar	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	Not ap.	<i>RISES</i>	

TUSHES, Lanivarii or Canini



POSTERIOR TUSH.

Sharp and prominent, just rising.

ANTERIOR TUSH.

Rises.

ness and strength, and double, is also found to envelope this jelly or pulp; the fine membrane covering the pulp, is supposed to be an extension of the periosteum, the usual, and perhaps universal, genetrix of bone. This pulp, growing and enlarging within the capsule, becomes at length of the figure and mould of the crown of the future tooth, and assuming next the office of a gland, begins to secrete upon its surface a thin shell of bone of its own figure; this shell is not, however, formed in one entire surface at once, but by a separate deposit on the most projecting and prominent points first, which uniting, form the shell, and it then becomes general over the whole pulp, and if examined at this period, it is found but very loosely adhering to it. A thin shell of bone is no sooner formed by the pulpy gland, than the capsule, assuming a glandular property also, commences depositing upon its surface the enamel, first in parallel longitudinal lines and processes, and then by a reticulated coat, and finally a glossy covering of smoother enamel; so that by the gland within thickening the shell inwardly, and by the enamel being deposited without, the crown of the tooth is completed. And while the thickening process is going on above, an extension of the shell proceeds below, formed by the same jelly or gland, which, as it elongates, diminishes in diameter as it proceeds, and the enamelling process follows it, till at length is formed the crown, the body, and shank or tube of the tooth. The Horse Incisor in this stage is a mere hollow shell or tube of bone and enamel, enlarging upwards, and bent to the exterior figure of the jaw. The head or crown of the tooth being sufficiently consolidated, and provided with a tube or shank of certain length, is in a state for external protrusion and use.*

The external capsule, or investing double membrane of the tooth, having completed its office, grows thinner by degrees, and is at last totally wasted and absorbed. The gums also waste, and the tooth is then in a state for external appearance.

This curved figure of the new formed tooth, we may remark, brings the

* It has been formerly supposed that the investing capsule was the secreting agent of the bony shell of the tooth; but as this would only be so for a moment, or till the thinnest lamen of bone was formed, since this would effectually cut off all future communication between the capsule and the gland, so the after-thickening of this bony case inwards must entirely depend on the gland within it: and we find on examination, that the primitive shell so formed differs in nothing from the substance afterwards added, and, therefore, it is but reasonable to conclude the whole is formed by the same agent.

AT ANY AGE OF THE HORSE.

4 Years.	4½ Years.	5 Years.	6 Years.	7 Years.	8 Years.	9 Years.	10 Years.	11 Years.	12 Years.	18 Years.	24 Years.	50 Years.
Wearing	Wearing	Worn.	Mk. ob.					Round.	Oval.	Oblong.	Triang.	Longit. Oblong. Fall?
Level.	Wearing	Wearing	Wearing	Mk. ob.					Rounded	Oval	Triang.	
Mk. ob.	<i>SHED</i>	Level.	Wearing	Worn.	Mk. ob.					Oval	Triang.	
Wearing	Wearing	Wearing	Wearing	Worn.	Worn.	Mk. ob.	Mk. ob.	Smooth.	Rounded	Oval	Triang.	
Level.	Wearing	Wearing	Wearing	Worn.	Worn.	Worn.	Mk. ob.	Mk. ob.	Rounded	Oval	Triang.	
Mk. ob.	<i>SHED</i>	Level.	Wearing	Wearing	Worn.	Worn.	Worn.	Mk. ob.	Rounded	Oval	Triang.	
Advncg.	Adv.	Adv.	Adv.	Adv.	Adv.	We believe a well-recorded case of a Horse attaining 60 years, has occurred in this country.						
Level.	Adv.	Adv.	Adv.	Adv.	Adv.	The teeth of the famous Eclipse horse are now before me, and the incisors are getting triangular; his age, when he died, is well known to have been 26.						
Adv.	Adv.	<i>SHED</i>	Level.	Adv.	Adv.							
Adv.	Adv.	Adv.	Adv.	Adv.	Adv.							
Adv.	Adv.	Adv.	Adv.	Adv.	Adv.							
Level.	Adv.	Adv.	Adv.	Adv.	Adv.							Fall?
Risen.	Half inch long, grooved, concave within.	Large, convex without, concave within.	Fully formed.	Rather worn at the point.	More worn, and fuller on the inside.	Considerably worn and rounded.	Wearing shorter and rounder.					Rounded, and conical close to the gums.
Risen.				Much worn.			Very much worn.					It is probable, that life becomes extinct in these animals before the final destruction of their teeth, that is, if left to a pure state of nature.

crown of it in a position almost perpendicular at its first emerging from the jaw, and occasions it to meet the teeth of the opposite or upper jaw nearly perpendicularly; but as the tooth wears away, and, in very advanced age, after passing through a succession of inclining angles, is at last reduced to the shank, which being placed nearly in the direction of the jaw itself, will occasion these teeth to meet the opposing teeth of the upper jaw in nearly an horizontal line, so that their internal lateral surfaces get worn, instead of their points, into an oblong irregular figure, and the reduced lean jaw bones approach each other in the same direction, the redundant skinny lips are seen protruding beyond the teeth; whereas in the youthful jaw these parts are rounded, plump, and deep in front. Accessions to the fang or posterior parts of these front teeth are made to almost the latest period of life, which accessions are flattened in the opposite direction to the compressed flatness of the crown of the fresh tooth, and thus diminish the lateral extent of the jaws. And these prolongations are, after a certain age, of solid bone, without enamel, of a yellowish colour, and very hard.

In the centre of the crown of the tooth, and externally visible, is an inverted hollow or funnel of enamel, which we have called the *infundibulum*; it has been called *the mark* by dealers, and is supposed by them to fill and grow up, but is in reality worn away by the use of the teeth, and obliterated about the sixth year.

The primitive germs and formation of both sets of teeth, must be sought in the foetus some months before birth; but the circumstances attending the growth and progress of the teeth generally, are most beautifully to be observed by the dissection of the jaw of a horse two years old previous to their shedding a tooth. On carefully taking the jaw to pieces, we may observe underneath the two front milk Incisors, and lying within them, the front pair of the second set, now about one inch and three quarters long, consisting of hardly anything more than a shell of enamel, with the small enamel inverted cone coming down the inside of it from the crown, and tapering to a point; this hollow tube is now of the full size of the tooth, and requires only to be strengthened with bony matter for being brought into use. The second pair of Incisors are only one inch long, consisting of a shorter case of enamel, covered with a brown furred matter of an ochre colour, and the inverted enamel cone within is not closed at the point, so that you see through it. The enamel in both the cone and the

tooth terminate below in a fine thin edge, which shows that the formation of this matter commences at the crown of the tooth, and is carried downwards, thickening as it proceeds, and not all formed at the same time. The extreme upper edges of this second pair are just become white, hard, and glossy with enamel.

Of the third pair of Incisors, we have not yet any appearance, but we may observe the bone is very cellular, and here and there considerable spaces in it, so that we see a cavity is forming by the absorbents for the reception of the crown of the tooth. What consciousness leads these vessels to remove an old formation for the reception of a new one entirely different? What sense should urge these absorbents to provide a space so long before the want is really experienced? and what power is it that should direct a mere arterial vessel to become the reflecting architect of so extraordinary a structure and figure as is one of these horse's teeth! Dr. Darwin, I observe, calls this power, animal appetency, which is almost or quite synonymous to the stimulus of necessity of Hunter: want certainly may lead to an effort, but what sense directs its issue? Modern researches, have, however, much removed this appearance of mystery, by showing us that a portion or off-set from the capsule of the milk tooth is thrown off to form the second set, passing out by a channel or foramen of the alveolus for this purpose, and it is likely, though too minute for vision, that the germs of both sets of teeth are given with the foetus, and only wait their evolution: and it is the stimulus of the presence of these germs that produces these operations.

In noticing the two first Grinders in this two-year old head, which are deciduous or milk teeth, their lower parts are so absorbed as to resemble somewhat the fangs of a human grinder. They stand astride the Grinder beneath, and are ready to fall out on the least application of lateral violence.

We may observe, that at this age the jaws are full of young and growing teeth, and must be in a particular degree tender and susceptible of injury, therefore great care should be taken that they receive no blows or violence of any kind at this period on these parts.

The Horse Teeth, on the shedding of the Milk Teeth, appear to rise in their sockets, for they are so very soon level with the remaining Milk Teeth, that it appears almost impossible the Milk Teeth can be soon worn down to them and the jaw absorbed so rapidly; whether it be so, might be seen by marking the other teeth with a file opposite the crown of the

Horse Tooth. On trying this experiment, it did appear that they really rose in their sockets to the level; this perhaps may be performed by the growth of the fang, which, lengthening backwards, forces it up. This, I since find, has been generally admitted by writers on the teeth.

An Incisor tooth, on first emerging from the socket, presents only two sharp edges of enamel, the posterior edge much lower than the front edge, and serrated; from the wear the outside and inside edge are soon reduced to a level, and proceeding further, four sharp lines of enamel present themselves from the enamel of the cavity becoming distinct; or we may describe them as two concentric circles of enamel somewhat elevated: these prominent edges must make the grasp or hold of the tooth very firm. After the enamel cavity is obliterated, for it is a more correct expression to say obliterated than filled up, (which is the common phrase of the dealers); there is then left only one circle of enamel, which environs the outside of the tooth.

The use of this hollow cavity in the Incisors of the horse appears to be to give sharpness to the upper surface of the tooth; but the very different lengths of this inverted enamel cone or *infundibulum* in the teeth of horses, and which is called the mark, occasions its obliteration to be very irregular, and, therefore, an uncertain criterion in judging of the age. This mark in the front teeth I have sometimes seen after eight or nine, and in others, as is generally the case, obliterated at six. The compressed flatness of the tooth at its early rising should be particularly observed, and also the length or degree of its exposure.

The *Incisor* tooth of the horse, when fully formed, is of an oblong conical figure, very much curved, the curvature obeying the sloping figure of the front of the jaw; and when young is very hollow in the inside. The filling up of this hollow gradually takes place from the sides towards the centre, and a section of the tooth exhibits a very elongated cone, and narrow towards the apex, and the actual filling up with solid bone does not much precede the demand for its use by the wear; in this way, with sufficient strength, the jaw is kept lighter in weight. The bone successively filling this hollow appears like a brown mark in the centre of the tooth, and enlarging as the tooth grows older, presents us with another means of judging of the age of the horse; and Vegetius appears to have made obscure mention of this. This brown or black mark, examined with a lens, appears

in a remarkable manner sometimes to have a small circle of enamel, forming a white eye in the centre of it.

If we make a section of the Incisor with a saw in several places down its body and shank, they will exhibit very much the appearances they present in the course of wear.

St. Bel used to place much reliance on the upper corner Incisor tooth being worn to an angle, always declaring the horse nine under these circumstances; we have seen, though rarely, this angle worn at seven, much depending on the distance of the lower Tush, and his manner of using the Incisors of the lower jaw, by being too much in advance, or not taking sweep enough, to grind them all to an even surface.

The *Cuspidati*, *Laniarii*, or Tushes, in the horse, are separated at some distance from the Incisores, and still greater from the Molares; they are only given to the males, though rudiments of them are often seen with the females; they are formed of harder bone than the teeth, and the part that rises above the jaw is nearly straight, the part beneath it is generally curved like the Incisors, but describing the segment of a smaller circle.

The Tush is every where covered with enamel at its first rising, and is very like a carnivorous tooth, having a sharp lacerating edge on each side, which forms a sort of arch inside by meeting at the top, the centre longitudinally projecting and convex, the outside more gibbous, but reaches no farther than the gums, where it becomes rounded and curved. Horses, in fighting, would probably make great use of them, or in tearing their own bodies, as they sometimes do in extreme anguish. For a description of their rise, change, and decay, we refer to the Table.

In judging of the age of the horse, the thickness and roundness of the Tush at its base is of consequence to be observed as affording a good criterion in forming an opinion, for though old, it shall often be sharp at its point and concave on its inside, depending on the accidental contact or its absence with the other teeth; for we find the wear of this tooth is very uncertain; in some cases it is liable to receive no friction at all, in others it is quickly worn, but the base of it, whether its point is worn or not, is almost uniformly rounded and exposed by advancing age. In ascertaining the age, it is also well to examine both the Tushes and both corner teeth, for they sometimes differ very much on the different sides of the mouth, depending on the manner of using their jaws.

Of the Grinders.—These teeth are almost entirely removed from our view, and therefore are of small value as indicators of age, but of no secondary importance in the business of the mouth and mastication, and as such deserving our earnest attention.

The *Molares*, or Grinders of the horse may be said to be larger in proportion to the size of the head, than the Grinders of most other animals, and are remarkably square and solid. These teeth are formed in linear ridges and angular elevated points of enamel. By these irregularities they grind their corn and crush the hay with much greater ease and effect, and for this reason the enamel is introduced into the centre of these grinding teeth, which are gradually filled up with bone as it becomes wanted, by exposure and wear, and the matter of the bone being softer than the enamel, is more easily worn away, and so ever leaves these asperities of enamel in prominent points and lines, to retain and divide the food.

The body of one of these upper Grinders is nearly a square column throughout, a little diminishing downwards, and slightly curved to the inside or lingual aspect, with the grinding surface nearly at right angles to the direction of the curvature, which causes it to slope inwards and towards the mouth, and to throw the food upon the tongue. The outside or *malar* aspect of this upper Grinder has prominent longitudinal ribs, and two flat surfaces, one of them more depressed, which, on the inside, is answered by a flat projecting rib of rather greater width, and the sides resting against the neighbouring teeth are nearly flat.

A Grinder Tooth of the lower jaw is smaller, thinner, and flatter in figure than the upper one, and nearly straight, its upper grinding surface obliquely shelving outwards, or in the contrary direction to the upper grinder; its inside or lingual aspect is ribbed in four or five longitudinal lines or projections, and one deep depression; the outside or aspect to the cheek has two flattened columns, with a depressed narrow line between them, which receives a process of bone from the jaw to secure it, and of the dental sides, one is flat and the other obliquely slanting. For this description, we have taken one of the middle Grinders, the extreme or end ones being sharpened to their terminating edge. These teeth are left hollow for a considerable time, and do not appear to fill up solid with bone till late, or it is wanted by exposure and wear.

The Grinders are all pretty much the same; the capsule of the third

foetal grinder is however remarkable in sending off two dental germs or offsets, one to form the horse tooth immediately beneath, the other to form the fourth permanent grinder. The fourth again sends off one to form the fifth grinder, and the fifth one to form the sixth. The tush, it is probable, is a single primitive formation.

And it appears upon examination, that the fourth Grinder in its structure, differs from the rest in this, that the columns of enamel are not continued more than half way down the body of the tooth, and there converge to a blunt point; indeed this tooth is not so long as any of the rest, and is in part closed over at the bottom by a process of bone, like a cover, attached by processes to the sides. We have noticed in the table, that this tooth is finally shed earlier than the third, and perhaps in some instances, than the second, and this furnishes us with the reason.

The three farthestmost Molar teeth are placed in the jaw, not upright, as the others, but leaning forwards, and occupying a wider part of the jaw, are of an extraordinary length.

The Grinders of the horse, with process of age, have at last three fangs, which to the young teeth are almost wanting, and the sixth with one fang more than the others. The third Molar is however the largest.

Observation shows that the enamel is deposited in longitudinal striæ, on an extremely thin shell of bone; over these striæ a harder matter is laid, having a reticulated appearance in dense irregular lines and threads; over this again is applied, or, as it were, floated, in transverse lines, a coating of the whitest, most compact, and shining enamel, which extends from the crown and prominent points downwards, covering by degrees the former structure, so that in fact three different coats unite to form the complete body of enamel. Small black points, or pores, are discoverable with a lens in the terminating edges of the last coating. The first coating of enamel will, on drying, split into regular lines longitudinally, with intervening spaces, and is much softer than the thin bony shell on which it is deposited.

We may observe, in respect to the molar motion of the Grinders, that it is not rotatory, or like one millstone upon another, in an horizontal plane, but is chiefly or wholly lateral, or from side to side, at an oblique angle, inclining upwards, so that the stroke is from either side successively. For if we observe the wear of the upper and under Grinders, they are

different; the outer edges of the upper, highest or most projecting, and the outer edges of the lower or posterior jaw obliquely deficient and worn away, which with the arched appearance of the upper teeth, makes it pretty clear that the molar motion is nearly a lateral one, or from side to centre only, and if we make this motion with the dead jaw, we bring the worn surfaces of these teeth into contact in the direction in which they are worn.

A Molar tooth of the horse, in its upper grinding surface, presents us with an almost appalling complexity of construction, where we see labyrinths and tortuous circles of enamel, winding and meandering about in the solid bone, and which the most perfect knowledge of the formation of an Incisor tooth, does not furnish us with any clue to the solution of.

By the researches of Dr. Blake, we have been taught, however, the explanation of these appearances, and we shall attempt in the following brief description, to convey a notion of the singular manner of the formation of these complex teeth.

A horse's grinder though, strictly speaking, it consists but of one piece, is arranged in so tortuous a manner, that it has the appearance of a collection of variously figured teeth, covered every where outside with enamel, as the Incisors, and held together and consolidated into one mass by an intermediary deposit, secreted into all those spaces which their irregular forms do not allow of their coming into contact or apposition of surfaces.

To trace the lines and contortions of enamel in one of these grinders, would be difficult, or to reduce them to any system; we shall, however, form some idea of their actual distribution, if we compare them to the lines and double curve of the open letter **B**^o the semi-circles which are placed next the tongue, twice repeated; the second smaller, and adhering to the outside of the arches of the former; the back of the letter also is straight, but in the tooth tortuous, forming a double zig-zag, or two angular lines, making together a triple series of shells, the last is however single. On being worn, two transverse elevations of the bone appear with as many transverse depressions between them; such is the case with the upper jaw. In the lower jaw, whose teeth are narrower, only two transverse courses of shells are found; and in the fresh recent tooth, these lines are single, forming one edge of enamel, but by the wear, a double line is soon presented, as we see in the letter.

In following the process of their actual formation, we may imagine five

or six of these irregular figured tubes or cases placed together, being formed by as many pulps, first by points, and then united into one shell; these shells are quickly covered with enamel, laid on in three coats, as we have stated: first the striated, next the reticulated, and finally the glossy coat. The first, however, I consider rather as a foliated coat, being formed of parallel leaves, somewhat like the inside of the horse's hoof, to hold on the enamel more securely, and to afford, perhaps, a slight degree of elasticity and yielding: as an homogeneous, hard, chrystaline body like this, would be liable to be more easily fractured, without this softer bed to act against. Each of these may be seen distinctly by looking down the course of the tooth, from its crown to the shank, being formed in succession, and we apprehend have not been distinctly noticed before.

These shells being strengthened by enamel without, and hard bone within, are in a state to receive a most extraordinary process for their union and consolidation into one mass, which is done, according to present knowledge and apprehension, by the membranes of the capsule, which had just covered them with enamel, changing the nature of their secretion, and pouring forth solid bone between these cases, and filling up and obliterating all the intervening spaces, till the tooth becomes one solid body, and the membranes are excluded by their own secretions.

For the accomplishment of this purpose, processes are sent off from the investing capsule, which wind among all the convolutions of the shells, and deposit this bony matter. Now, it has been said, that these membranes pass down perpendicularly from the capsule, going down between the shells, and pouring out their secretions, till the spaces are filled; this view of it, however, would lead us into embarrassment, and give us an erroneous idea of the real process: for this matter is not poured out as lead might be supposed to be poured out, among some pipes or tubes stuck in a bed of sand, where the process of consolidation would commence at the bottom and proceed upwards: since, if we examine the horse's tooth, we see evidently enough, that the consolidating process begins at top, near the crown of the tooth, in order that this part should be early brought into use. Now, if these membranes dipped down perpendicularly from above, they would, by the filling up of the tooth at top, be cut off from their sources, and be destroyed, that it would appear necessary, in order to conceive this process aright, that we should consider these membranes, though standing perpendicularly, in respect to the position of the tubes or shells, to have rather a

lateral communication with the capsule, and, like the wind-screen before the fire, which, though standing perpendicularly, receives its motion, when moved, laterally; or, more familiarly, perhaps, we may compare these membranes to the *septa* of an orange, which pass into it laterally from the rind, and are appearing above and also below, perpendicularly between every quarter of the fruit; so these membranes are entering all the convolutions of the teeth, and depositing upon the shell, enamel first, and then bone, or supplementary bone; beginning and finishing this process at the crown of the tooth first, and afterwards passing downwards, fill up the tooth by successive vertical layers, meeting in the centre, and obliterating the vacuities, and rendering it nearly solid; and the tooth so filled up and made solid, then presents us, as we have already observed, to an enigma of no easy solution.* The outside of the tooth is also covered over with bone of the same kind by the investing double capsule, supporting the enamel outside.

This peculiar kind of succedaneous bone is rather softer than the real bone of the tooth within the enamel, and is more easily marked with the graver, and is often yellower, and in its analysis differs nothing from bone. It has been called by Dr. Blake the *crusta petrosa*, but not being a shell, which *crusta* implies, nor yet *petrosa*, or rocky, or stony, as *petros*, would signify, we have ventured to propose with diffidence, in speaking of this supplementary material, to call it, till a better name shall be found, *Stereodontum*, or *Stereodont*, from *στερεωω* to strengthen, and *οδους-οντος* a tooth; and in speaking adjectively of its qualities, we may use *stereodontic* or *stereodontous*, while the two former words would require a tedious circumlocution, especially when used adjectively.

The term *cortex striatus* for the enamel, we have hardly thought less unfortunate, and could not with any pleasure follow, not only on account of its complexity, but also because it is not the property of bark to be harder than the wood which it covers, or be at times inside it. That I have preferred the use of the simple term enamel, though in some respects objectionable.

The term *striatus* seems also not well chosen, as the striæ are not visible externally, but by a transverse section of the tooth, when they appear as short radiating lines, having a direction towards the centre of the tooth,

* The enamel, by chemical analysis, is not found to differ very much from bone, being phosphat of lime, with a small portion of carbonate of lime, and without any cellular fibre.

and being in reality the processes of the foliated first coat we have described of the enamel.

I have seen in the possession of my worthy friend Thomas Bell, Fellow of the Linnean Society, and Lecturer on the Teeth at Thomas's and Guy's Hospitals, whose kindness in assisting me with information, and use of his elegant museum, deserves my public acknowledgements, a preparation of a foetal molar tooth of the horse, covered with its membranes, both equally injected, which shows that both the membranes of the capsule are nearly equally vascular; John Hunter having asserted, that the inner, and Dr. Blake, that the outer, was chiefly possessed of vascularity. This preparation, my friend informs me, was made by that excellent man and philanthropist Joseph Fox,* and exhibits an arched stylus or petiolus, proceeding from near the top of it, and conveying away the embryo of its future successor. This petiolus seems somewhat thin in the middle by its extension, and is about half an inch long, of the thickness of a crow quill, and holding at its extremity the germ of the tooth, being a portion of the capsule, with, probably, the modelling gland within it. This mass is about the size of a small horse-bean, and outwardly somewhat angular: it seems to have escaped like the cicatrice of an egg, conveying a portion of the membrane with it.

In the foetus we have only three Grinders, which appear as fully to occupy the whole of this part of the jaw as the six do afterwards, the jaw therefore lengthens behind principally, and not in the same degree anteriorly, as the three horse Molar teeth are formed directly under these foetal teeth. The three posterior Grinders at this age, are to be sought in the wide part of the jaw, which posterior part is covered by the masseter muscle. It may be remarked also, that the space without teeth, called *the bars*, extending from the first Molar to the Incisors, is nearly wanting in the foal, or at least bears no proportion to the rest of the jaw when compared with the same space of the jaw when the mouth is complete.

We may remark, that the symphysis of the upper jaw, or where the two

* This benevolent character, in the early difficulties and attempts of Lancaster to form Schools of mutual instruction, seeing a danger of their failing for want of funds, gave to Lancaster, in a private donation, more than two thousand pounds, and kept the expiring cause upon its legs. He has also left behind him a most valuable Treatise on the Teeth, and especially of their Diseases.

halves unite, is singular in possessing projecting lamellæ of great length, and terminating in toothed points to render the connexion more firm.

The broad triple series of enamel shells in the upper jaw to grind against, makes quick dispatch; nor need we be so much surprised when we see the apparatus, that a horse on his journey should so soon remove his half peck of corn. The points of the lower grinders appear to be more irregular than the upper, and fall into their depressions, and these undulations in the teeth increase their quantity of surface, and their effect also. The transverse channels across the Molar teeth, we may observe, are perfectly straight, which would seem to show that the grinding motion must be nearly or quite so.

Having considered the teeth themselves, we shall make some remarks of a general nature in respect to judging of the age, which it may be necessary to notice in order to form an accurate judgment; for instance,—if we examine a horse in May, and find his mouth denote neither 5 nor 6, we do not say that he is between 5 and 6, though the marks denote it, but exactly 5 or 6, as most colts are foaled in this month; and this we are led to do, as the appearances predominate in the mouth for 5 or for 6, though it is true there are some Autumn colts, but such are of rare occurrence, and after May we should say that he had just passed 5 or 6, though the appearances of the mouth may hardly indicate that he had attained it; for it is necessary that we should be guided by these considerations, as the teeth themselves are subject to almost endless variations in every different subject, and this is the only correcting rule that can be applied, for irreconcilable difficulties occur but too frequently; sometimes a young Tush with old Incisors, and sometimes young Incisors with a worn Tush, and very convex and full in the inside; in these cases we must, after considering all the circumstances, take the more predominating, and make our decision, recollecting the season of the year. The age of the mare is more uncertain and dubious for the want of the Tush; in judging by the Incisors, it is particularly necessary to be recollected, that in the fresh tooth rising from the jaw, it is very wide and flat, with two nearly parallel cutting edges of enamel; by wear, these are soon reduced to a level, and the lateral width diminishing and increasing in the opposite direction, the tooth produces a sort of ellipse or oval, and next a rounded figure, and finally a triangle, all of which may be seen by making a series of transverse sections of an incisor tooth down the

shank. Dealers are often led to feel the Tush only, and if they find it pointed and hollow, they are sure of a young horse; but when this part is made very full on the inside, as it sometimes is, and convex, or has been rapidly worn away by the bitts or otherwise, they will be very likely, if guided by this circumstance alone, to be led into error in believing the horse to be older than he really is. The upper Tush is latest in appearing, but is by much the soonest worn away, beginning to wear about 9, or generally earlier. I am uncertain whether this wear is done by the mouth-piece or bitt, which is usually placed posteriorly to the lower Tush, and nearly opposite the upper Tush, or whether it is the lower Grinders that do this, though they appear too remote for this effect. The wear of these upper tushes, if we examine them attentively, is in a sort of waving line, almost confined to the inside of the tooth, and is extremely smooth and highly polished, as though it had been worn by some soft body, and would lead one to conjecture whether it was not done by the tongue, or by occasional contact with grit or rough particles received with their food.

It would dilate this account too much, to enter upon all the varieties and singularities which occur in different mouths, yet some of the most remarkable may here be noted; thus I have seen the four-year old milk tooth remaining in and unshed till after six, the corner Incisor horse tooth being up and in parallel line with it and the rest of the teeth, so as to make seven Incisors in the upper jaw; this one should suppose, must have arisen from an unusually long shank or fang to the milk tooth. Sometimes we have seen the front Incisor horse tooth with its cavity obliterated, before the four-year old corner milk tooth was shed, so that the one was indicating six and the other four years old. This early detrition, or obliteration, of the cavity, must have arisen from an unusually short enamel cavity, or *infundibulum* and long fang, as we have stated, to the milk tooth.

I once remember to have seen an error of the mouth which deceived an able judge; the near side corner tooth of the lower jaw was perfectly fresh and sharp as at its first appearance, consequently indicating four years and a half; the corresponding tooth on the opposite side indicated by its wear seven or eight. On examining the upper jaw on the near side, the corner tooth, by some accident, was found to have been knocked out, so that the opposing tooth in the lower jaw receiving no friction, had consequently retained its perfect freshness.

When the front surface of the Incisors is worn, it is generally done by rubbing against the manger, and may indicate a suspicion of crib biting, though not always so, for irritation of the stomach, from foul or too high feeding, often induce them to lick, gnaw, or rub the manger.

Of the other indications of advancing age in horses, we may remark that the upper Incisor teeth become arched in front like a parrot's beak, projecting over the inferior ones, and meeting these almost in front, for the upper teeth are ever larger and stronger than the lower ones, and receive their action chiefly laterally, which occasions the formation of this arch, and so much do the upper teeth sometimes project over the lower ones, as to wear them in front to a considerable angle; whereas, at setting out, or at four or five years old, this surface is highest in front, and the back of the tooth is lowest.

The teeth of horses are found sometimes subject to decay, of which I possess various specimens; it is known by the difficulty of chewing the food, and the inflammation and swelling of the adjacent parts; in this case they have been drawn out, but are more easily punched out; this is however an extremely severe operation, and we may perhaps find a better substitute in the application of the actual cautery or acids to the nerve, or by dividing the nerve itself going to the tooth; though anti-phlogistic remedies are generally sufficient, and in the course of a long practice with horses, I never found it necessary to extract a tooth.

The sunken eye and prominent orbit, the hollow eye-pits, the grey eyebrow, the rugged temple, the lean thin muzzle, the over-hanging thin lips, the rising points of bone every where, the dry hard skin and disfigured hoofs, indicate sufficiently the advancing age, without any appeal to the mouth. The grey horse becomes flea-bitten, the chesnut dark, and the bay horse more dull.

I purchased a young chesnut mare in Suffolk for experiments on the feet, and also to observe the changes and shedding of the teeth. She shed her front Incisor tooth October 12, 1808, within a month after I bought her, which proved her to be two years and a half old; for, as we have remarked, they are foaled in the Spring, but shed their teeth in Autumn, successively at two and a half, three and a half, and four and a half, years old. The gap or space where the tooth came away was soon covered with red gum, very irregular, broken in the middle, and rising higher on the sides, but there was a view of the horse Incisor that was to emerge. She did not shed

her second pair till Christmas day of the next year; the Horse tooth was much below the rest of the teeth, and a long period elapsed before they were even. On February 9th, 1810, one tooth of the second Incisors still remained, and this was in the upper jaw, which seems to show that they shed them rather later than the posterior jaw; perhaps the fangs in these are also longer.

My bay blood stallion (Heathfield) did not shed his first pair Milk Teeth till the end of November, and the upper pair on this occasion were shed before the lower; the shank of the tooth was for some days projecting out before it fell, and the body of the tooth appeared to be held by the new tooth and the gums within, and the shedding of the teeth I thought was attended with a slight fever, which caused him to look hagged, and to be rather feebler than at other times. The four front teeth, from the first to the last shed, took about three weeks, that is, from December the 1st to about the 21st; when shed, the difference of elevation between the surfaces of the old and the sharp edges of the new was about a quarter of an inch; ten days after there was no sensible elevation, or the unevenness perceptibly restored. January 15th, the level was not near restored. This length of time would make one almost suppose that they did not sometimes rise in their sockets, but depended more upon the wear of the other teeth for restoring the level among them. The second pair of Incisors were shed not a year, as might have been expected, but in little more than half a year, so that there is considerable irregularity in the periods of this process.

It is a singular fact that the lower jaw of horses, where the masseter muscle is inserted, is sometimes in old horses worn through into a hole. Is this simply from the extreme tenuity of the bone with age, or the muscles being inserted on both sides the bone. The perforation is mostly as large as a crown piece.

FIG. 1. Lower jaw, with incisors and tush.

2. Section of an incisor, shewing the cavity and infundibulum, which sometimes at the point is found to contain stereodont.
3. A shed incisor, having the shank absorbed half away, to make room for the advancing horse-tooth.
4. Crown of an incisor horse-tooth in the shell, the infundibulum not closed.

FIG. 5. Incisor horse-tooth ready for protrusion.

6. The tush seen internally.
7. Section of the tush.
8. View of the windings of the enamel in the third upper grinder—*a*, the bone, *b b*, the stereodont.
9. The capsule covering a fetal grinder, and sending off the germ for the horse-tooth.—See p. 12.