

The relation of the alveolar form of cleft palate to the incisor teeth and the intermaxillary bones / by W. Turner.

Contributors

Turner, Wm. Sir, 1832-1916.
Royal College of Surgeons of England

Publication/Creation

[London] : [publisher not identified], [1884?]

Persistent URL

<https://wellcomecollection.org/works/ywntzjgg>

Provider

Royal College of Surgeons

License and attribution

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

13

*from the
author.*

FROM THE
JOURNAL OF ANATOMY & PHYSIOLOGY

Vol XIX

THE UNIVERSITY OF CHICAGO

THE HISTORY OF THE REFORMATION OF THE
CHURCH OF ENGLAND
IN THE SIXTEENTH CENTURY
BY
JOHN CALVIN

THE HISTORY OF THE REFORMATION OF THE CHURCH OF ENGLAND IN THE SIXTEENTH CENTURY BY JOHN CALVIN. This work is a history of the Reformation of the Church of England in the sixteenth century. It is written by John Calvin, a French theologian and reformer. The work is divided into two parts. The first part is a history of the Reformation of the Church of England in the sixteenth century. The second part is a history of the Reformation of the Church of France in the sixteenth century. The work is written in Latin and is one of the most important works of the Reformation. It is a history of the Reformation of the Church of England in the sixteenth century. It is written by John Calvin, a French theologian and reformer. The work is divided into two parts. The first part is a history of the Reformation of the Church of England in the sixteenth century. The second part is a history of the Reformation of the Church of France in the sixteenth century. The work is written in Latin and is one of the most important works of the Reformation.

THE HISTORY OF THE REFORMATION OF THE CHURCH OF ENGLAND IN THE SIXTEENTH CENTURY BY JOHN CALVIN. This work is a history of the Reformation of the Church of England in the sixteenth century. It is written by John Calvin, a French theologian and reformer. The work is divided into two parts. The first part is a history of the Reformation of the Church of England in the sixteenth century. The second part is a history of the Reformation of the Church of France in the sixteenth century. The work is written in Latin and is one of the most important works of the Reformation. It is a history of the Reformation of the Church of England in the sixteenth century. It is written by John Calvin, a French theologian and reformer. The work is divided into two parts. The first part is a history of the Reformation of the Church of England in the sixteenth century. The second part is a history of the Reformation of the Church of France in the sixteenth century. The work is written in Latin and is one of the most important works of the Reformation.

THE RELATION OF THE ALVEOLAR FORM OF CLEFT
PALATE TO THE INCISOR TEETH AND THE
INTERMAXILLARY BONES. By Professor W.
TURNER, M.B., F.R.S.

(Communicated to the Royal Society of Elinburgh, December 15, 1884.)

IN an essay on the intermaxillary bone published in 1786, the illustrious Goethe, by the recognition of a suture on the palatal aspect of the upper jaw, extending from the incisive foramen to the interval between the canine and lateral incisor tooth, and of a prolongation of the same suture into the naso-palatine canal, determined the presence of this bone on each side of the human upper jaw. In a subsequent essay, published in 1819, he cited other facts in support of this position, and stated that in hare-lip the incisive or intermaxillary bone is separated from the superior maxilla, and the suture between the two bones remains open. Since that time it has been the current doctrine that the lateral cleft in the alveolar border of the jaw, which so frequently accompanies a hare-lip, marks the separation between the intermaxillary and superior maxillary elements of the human upper jaw.

In an essay published in 1879,¹ Dr Paul Albrecht traversed this conclusion of Goethe's. From the examination of the skull of a young horse, with a double hare-lip and alveolar cleft, of the skulls of two calves with lateral alveolar clefts, and of similar malformations in the human upper jaw, he came to the conclusion that the cleft was not between the intermaxilla and superior maxilla, but was intra-incisive in position, and co-existed with the usual suture of articulation between the superior maxilla (exognathion) and the intermaxilla. He considered that the explanation of this condition was to be looked for in the presence during earlier stages of development of two intermaxillary bones on each side, a mesial (endognathion) and a

¹ Die morphologische Bedeutung der seitlichen Kieferspalt und die wahrscheinliche Existenz von vier Zwischenkiefern bei der Säugethieren, *Zoologischer Anzeiger*, 1879, p. 207.

lateral (mesognathion), and that the alveolar cleft was an open state of the suture (endo-mesognathic suture) which ought to have connected them together. In support of this position he refers to observations by Albinus, Autenrieth, J. F. Meckel, Leuckart and himself on the existence of the remains of a suture in many hard palates, situated in the area between the mesial palatal suture and the maxillo-intermaxillary (meso-exognathic) suture.

Since the publication of this essay Dr Albrecht has written a number of papers on the same subject, and has accumulated many additional observations in support of his views.¹ As he has done me the favour of presenting me with copies of these papers, I have been able to make myself acquainted with his opinions on this interesting topic, and have tested his statements by an examination of such material as I have been able to obtain access to.

I propose in this communication to give an account of some observations which I have made on this interesting branch of teratological anatomy. My observations fall under the following heads:—

A. The examination of an extensive series of casts of the roof of the mouth in cases of cleft palate, where the cleft had extended forwards through the alveolar border of the jaw, either on one or on both sides. For the opportunity of examining these casts, and for information regarding the cases, I have to express my obligations to my colleagues, Professors Annandale and Chiene; to Dr John Smith, President of the Royal College of Surgeons, Edinburgh; Dr Joseph Bell, Senior Surgeon, Edinburgh Royal Infirmary; W. Bowman Macleod, Esq., L.D.S., Dean of the Dental School; and Andrew Wilson, Esq., L.D.S., Lecturer on Dental Anatomy, Edinburgh.

B. The examination of a large number of human hard palates

¹ Sur les 4 os intermaxillaires, &c.; Communication faite à la *Soc. d'Anthropologie de Bruxelles*, Brussels, 1883; sur la Fente maxillaire et les 4 os intermaxillaires de l'Ornithorynque, Communication faite à la *Soc. d'Anatomie Pathologique de Bruxelles*, 1883; Erwiderung auf Prof. H. v. Meyer, *Deutsche Zeitsch. für Chirurgie*, 1884; Die morphologische Bedeutung der Kiefer-, Lippen- und Gesichtspalten, *Langenbeck's Archiv*, Bd. xxi. Heft. 2; under the same title in *Centralblatt für Chirurgie*, 1844, No. 23; Ueber die Zahl der Zähne bei den Hasenscharten Kieferspalten in *Centralblatt für Chirurgie*, 1884, No. 32.

in the Anatomical Museum of the University, where there was no cleft, with the view of ascertaining if any sign was visible to indicate the division of the intermaxillary region of the upper jaw into a mesial and a lateral portion.

A. *Casts of the Roof of the Mouth in Alveolar Cleft Palate.*—In the absence of preparations of cleft palate, either in the dry bones or in spirit-preserved specimens, carefully prepared casts of the roof of the mouth are of service, as they show not only the position and direction of the cleft, but the number, arrangement, and forms of the teeth, and the relation which the alveolar cleft has to the teeth in the incisor and canine series. They do not, of course, enable one to state with absolute precision the particular part of the jaw in which the alveolar fissure is situated, and still less do they permit one to determine if a maxillo-intermaxillary suture coexists with the alveolar cleft. But, as in the living mouth itself, the relations of the teeth to the cleft can be accurately determined; also in so far as the development of the incisor teeth is to be associated with the position of the intermaxillary elements of the human upper jaw, an estimate can be formed from them of the position and extent of the intermaxillary bones, and of their relations to the superior maxilla.

In the course of the description of the casts I shall have to refer to the presence or absence of a tooth in the dentary series in the interval between the canine tooth and the alveolar cleft. To avoid mixing theoretical considerations with the description, I shall call this tooth *precanine*, from its position,—a convenient term which has also been employed by Dr Albrecht.

1. *Left Alveolar and Mesial Palatial Cleft.*—Cast from the museum of Professor Annandale. The patient was æt. 15, and was operated on in 1864.¹ On each side of the 1st and 2nd permanent molars, both the bicuspids and the permanent canines were erupted. Between the right canine and the cleft the right lateral incisor and the two central incisors were in position. Between the left canine and the cleft was situated the crown of a well grown *precanine* tooth, which bounded the cleft on its outer side.

2. *Left Alveolar and Mesial Palatial Cleft.*—Cast from the

¹ Operation described by Mr Annandale in *Edin. Med. Jour.*, Jan. 1865.

museum of Professor Annandale. Adult. On each side all the true molars, the bicuspid, and the permanent canine were erupted. Between the right canine and the cleft were two incisor teeth, which were apparently the central incisors. On the left, *i.e.*, outer side, of the cleft, but on the palatal side of the permanent canine, was the crown of a well grown tooth, which obviously represented the left *precanine*, although it was displaced out of its regular order in the dentary arcade, and consequently was not so close to the cleft as in the preceding specimen.

3. *Left Alveolar and Mesial Palatal Cleft*.—Cast from the collection of Dr John Smith. Adult. On each side all the true molars were erupted, on the right side both bicuspid, on the left one bicuspid, also the permanent canine on each side. Between the right canine and the cleft were four incisors, a left and right central, and two right laterals. It is possible that the lateral incisor immediately in front of the right canine was a retained milk incisor. A small *precanine* was situated immediately in front of the left canine and close to the cleft.

4. *Left Alveolar and Mesial Palatal Cleft*.—Cast from the museum of Mr Bowman Macleod, L.D.S. Adult. On each side all the true molars, bicuspid, and the permanent canine were erupted. Three incisor teeth had been situated between the right canine and the cleft, but the right lateral incisor had been extracted. The crown of a small *precanine*, which projected beyond the gum like a little tubercle, was situated immediately in front of the left canine and close to the cleft.

5. *Left Alveolar and Mesial Palatal Cleft*.—Cast in the museum of the Dental Hospital and School, London.¹ On each side the 1st and 2nd true molars, both bicuspid and the permanent canine were in place. Between the right canine and the cleft were the right lateral and both central incisors, and the left central incisor projected almost horizontally forwards. The small crown of a left *precanine* occupied the interval between the left canine and the cleft, and it projected almost horizontally forwards and inwards about half way across the cleft.

6. *Left Alveolar and Mesial Palatal Cleft*.—Cast from the

¹ For the opportunity of examining the copy of the cast of this and the other casts in the Museum of the London Dental School, described in this communication, I am indebted to W. Bowman Macleod, Esq., L.D.S.

museum of Professor Annandale. Adult. All the true molars, the bicuspid, and both the canines were erupted. Between the right canine and the cleft were two incisor teeth, and as there was a diastema between the cleft and the incisor on its mesial side, it is possible that another incisor may have been extracted. On the palatal side of the left canine was the crown of a well-developed tooth, which projected vertically and parallel to the canine, and which, from its size, was obviously not a milk tooth. It was close to the alveolar cleft, but the crown of the canine, from being a little bigger, overlapped obliquely this tooth, so as to approach closer to the cleft. I regard this tooth as a *precanine*, displaced from its proper order in the dentary arcade.

7. *Left Alveolar and Mesial Palatal Cleft*.—Cast in the museum of the Dental Hospital, London. Transitional dentition; first permanent molar, all the milk molars and canines were erupted. Two permanent incisors were cutting the gum between the right canine and the cleft. A milk *precanine* was situated between the left milk canine and the cleft, and close to the cleft.

8. *Left Alveolar and Mesial Palatal Cleft*.—Cast from the museum of Professor Annandale. Permanent dentition. There were apparently four incisors between the right canine and the cleft; but the cast wanted definition in that region. The left canine came up to the cleft, and no *precanine* was interposed.

9. *Right Alveolar and Mesial Palatal Cleft*.—Cast in the museum of Professor Chiene. Child. First permanent molar and 1st bicuspid erupted on each side; 2nd milk molar in place, also the milk canines. The two milk central incisors had been shed, and the permanent incisors were appearing in their place, but the left lateral milk incisor was in front of the corresponding canine. Between the right milk canine and the cleft was the small crown of a milk *precanine*, which projected close up to the cleft.

10. *Right Alveolar and Mesial Palatal Cleft*.—Cast in the museum of Mr Bowman Macleod, L.D.S. Youth, æt. 16. On each side the 1st and 2nd permanent molars, both bicuspid and the permanent canines were erupted. Three permanent incisors had been present in the interval between the left canine and the cleft, but the right central incisor had been extracted

before the cast was taken. Immediately to the right side of, *i.e.*, external to the cleft, was a tooth which obviously represented a right *precanine*, though it was displaced from its proper order in the dentary arcade, and had erupted on the palatal side of the right canine.

11. *Right Alveolar and Mesial Palatal Cleft*.—Cast in the museum of Mr Andrew Wilson, L.D.S. Permanent dentition. The molars, bicuspid, and canines on each side were erupted. Between the left canine and the cleft were the two central incisors and the left lateral incisor. Between the right canine and the cleft was a *precanine*, the crown of which was small, and overlapped the cleft. It was somewhat displaced from its proper order in the dentary arcade, and was in part situated on the palatal side of the right canine.

12. *Right Alveolar and Mesial Palatal Cleft*.—Cast in the museum of Professor Annandale. Transitional dentition. No *precanine* was situated in the interval between the right canine and the cleft.

13. *Double Alveolar and Mesial Palatal Cleft*.—This very interesting case occurred in the practice of Dr Joseph Bell, who removed the projecting intermaxillaries with their incisor teeth. Before this operation, a cast of the roof of the mouth was taken by Mr A. Wilson, L.D.S., who has kindly lent me both the cast and intermaxillary bones for examination. The patient was about 17 years of age, and presented on each side a deep alveolar cleft which joined posteriorly a mesial palatal cleft. The projecting, isolated, and mesially-placed intermaxillaries were fused together into a single bone, and contained four incisor teeth, the two central of which were directed vertically and with their crowns honeycombed; whilst the two lateral projected almost horizontally outwards, each at its own side. Behind the cleft on each side were, from behind forwards, the 1st and 2nd permanent molars, though the crown of the 1st was decayed, two bicuspid and the permanent canine, but on the left side the temporary canine was still present in the dentary arcade between the permanent canine and 1st bicuspid. On each side, also, a small *precanine* tooth projected about 4 mm. beyond the gum in the interval between the permanent canine and the alveolar cleft, and close to the outer side of the cleft.

14. *Double Alveolar and Mesial Palatal Cleft*.—Cast from the museum of Mr Bowman Macleod, L.D.S. The intermaxillary bones had been removed during early infancy. The cast was taken when the permanent molars, bicuspid, and canines had erupted. No *precanine* tooth was present on either side, and, as the intermaxillaries had been removed, there were no representatives of incisor teeth.

15. *Double Alveolar and Mesial Palatal Cleft*.—Cast in the museum of the Dental Hospital, London. The conjoined and isolated intermaxillaries showed no evidence of incisor teeth. The first permanent molar on each side, both the milk molars and milk canine, were erupted. On each side a distinct *precanine* tooth was situated between the milk canine and the cleft.

The casts above described are fifteen in number, and of these eight are left-sided, four right-sided, and three double clefts. The greater frequency of the alveolar cleft on the left than on the right side is in accordance with previous observations on the same subject, for Th. Kölliker states¹ that of 165 cases of one-sided cleft recorded in teratological literature, 113 were on the left side, and only 52 on the right side. It would seem, therefore, as if in this region of the face the development of both the bones and soft parts is more likely to be incomplete on the left than on the right side of the mesial plane.

In the eight specimens of left alveolar cleft with one exception, in the four right alveolar clefts with one exception, and in the three double clefts also with one exception, a *precanine* tooth existed in the interval between the canine and the cleft, although it was in three cases displaced to the palatal side of the canine, so that in only three of the fifteen specimens did the canine tooth form the immediate boundary of the cleft on its outer side. In the specimens of single cleft in which a *precanine* was present on the side on which the cleft existed, two, three, and in one case four incisors were situated in the intermaxillary region between the cleft and the canine on the opposite side. In one of the cases of double cleft,

¹ "Ueber das Os intermaxillare des Menschen und die Anatomie der Hasenscharte und des Wolfsrachsens," *Nova acta der Leop. Carol. Akad. der Naturforschen*, Bd. xliii., Halle, 1882.

four large incisors projected from the conjoined intermaxillaries, and, in addition, a precanine tooth was present on each side.

In his elaborate and important memoir on the development and anatomy of the intermaxillary bones, Dr Th. Kölliker has given an account of the relations of the teeth to the alveolar fissure or fissures in forty-nine wet or dry preparations which he has examined in several of the museums in Germany. Twenty-eight of these specimens had a cleft on both sides, sixteen had the cleft on the left side only, and five on the right.

In the sixteen left-sided clefts there was no tooth in two specimens between the canine and the cleft. In fourteen specimens such a precanine tooth was present; in nine of these cases this precanine coexisted with three incisors situated on the opposite side of the cleft, so that, including the precanine, the incisors had the normal number, four; whilst in the remaining five cases this precanine was an additional tooth on the side on which the cleft occurred, and the number of incisors was raised to five.

In the five right-sided clefts there was no tooth in two specimens between the canine and the cleft; in one a precanine coexisted with three incisors on the opposite side of the cleft; in one the precanine was an additional tooth on the side on which the cleft occurred, and the number of incisors was raised to five; in one very remarkable specimen no less than three precanine teeth were interposed between the right canine and the cleft, and four incisors were situated between the cleft and the left canine tooth, so that the teeth lying between the opposite canines were seven in number.

In the twenty-eight specimens of double cleft, there was no tooth in six specimens between the canines and the clefts; in three specimens a precanine was present on one side only; in nineteen specimens the precanine was present on both sides. In some of these nineteen specimens the precanine brought the incisors up to the normal number, four; but in other specimens it formed an additional tooth in the incisor series, and in five specimens there were six teeth interposed between the opposite canines, viz., four in the isolated and projecting intermaxillary

bones, and one on each side between the canine tooth and the cleft.¹

Dr Kölliker's forty-nine preparations and my fifteen casts make in all sixty-four specimens in which the relations of the alveolar cleft to the teeth have been definitely observed. These specimens resolve themselves into two groups—*a*, one in which no precanine tooth intervened between the canine and the cleft, and in this group were thirteen specimens; *b*, one in which a precanine was situated between the canine and the cleft, and this consisted of fifty-one specimens. Obviously, therefore, much the larger number of persons with the alveolar form of cleft palate possess a tooth in front of the canine, which is cut off from the incisor series of teeth by the gap in the border of the jaw. The question therefore arises as to the nature of this precanine tooth.

A well-known principle has long been accepted by anatomists, that all the teeth situated in front of the canines are incisor teeth, and that all those teeth which occupy this position in the upper jaw are implanted in the intermaxillary bones. Hence, the expressions incisor and intermaxillary are synonymous terms for these teeth in the upper jaw. If this principle be applied to the determination of the nature of the precanine tooth in alveolar cleft palate it would have to be called an incisor tooth. But the precanine is cut off from the other incisor teeth by the cleft in the border of the jaw, and it would therefore follow that the intermaxillary bone would also be divided into an inner and an outer portion by the cleft, that the precanine tooth would be situated in the outer division of that bone, and that the cleft would lie, therefore, between the two divisions of the intermaxilla and not between the inter- and superior maxilla. This is the position assumed by Dr Albrecht, and granting the accuracy of the principle that all precanine teeth are necessarily intermaxillary in their implantation, the specimens belonging to group *b* might all be cited in support of his position. The specimens of double cleft palate in which four incisor teeth

¹ Professor Humphry, in his well-known treatise on the Human Skeleton, has figured (plate xiii. fig. 1) a specimen of double cleft palate in the human skull. On each side a precanine tooth had erupted, which he describes as a supernumerary canine.

projected from the intermaxillary bones (case 13), and a pre-canine tooth also existed on each side, are in no way opposed to this position, although the presence of the normal number of incisors in that region, which is undoubtedly intermaxillary, might at a first glance seem to be so. For not only is six a very common number of upper incisors in various mammals,¹ but, as is well known to dental surgeons, three incisor teeth are sometimes developed on each side of the human upper jaw when there is no alveolar cleft. I have now before me the casts of two otherwise normal palates taken from different persons by Mr Andrew Wilson, L.D.S.—one with the milk, the other with the permanent dentition, in each of which six upper incisor teeth had been developed. The question therefore naturally arises, Which of these teeth is suppressed in the normal incisor dentition in man? Some light is thrown on this question by these cases of alveolar cleft. In the cases of double cleft, with two incisors in each half of the projecting intermaxillaries, these teeth would be in dental notation In^1 , In^2 , whilst the precanine would be In^3 . But in many cases of alveolar cleft, more especially when it is one-sided, only one incisor tooth exists between the mesial suture and the cleft, whilst a precanine is present in its outer side. The precanine, as in the preceding example, would be In^3 , whilst the incisor situated mesially to the cleft would in the majority, if not all, of cases without doubt be In^1 ; the suppressed incisor therefore would be In^2 , and it is not unlikely that in normal human dentition the incisor which does not develop is also In^2 .

This view of the homology of the precanine tooth and of the normal lateral incisor—viz., that it is In^3 —is also advocated by Dr Albrecht.² Dr Th. Kölliker, however, has not apparently formed any exact conception of its homology; for although he sometimes refers to it as In^3 , at others he speaks as if it repre-

¹ From the investigations of Mr Spence Bate, published in *Trans. Odontological Soc. London*, vol. v., it would appear that in the mole, *Talpa europæa*, four teeth are developed in each intermaxillary bone, an example, therefore, in a placental mammal of eight upper incisors, though Mr Spence Bate himself speaks of the outermost incisor as a canine tooth. The case related by Dr Th. Kölliker, in which seven teeth were situated in the human upper jaw between the opposite canines, is therefore an approximation to the arrangement in the mole.

² *Sur les 4 os intermaxillaires, &c.*, Bruxelles, 1883.

sented the ordinary lateral incisor, which incisor he obviously regards as a different tooth from *In* ³.

Moreover, Kölliker disputes the position that the relation of the teeth to the cleft in alveolar cleft palate can enable us to determine whether the cleft is a gap in the intermaxillary bone or a cleft between the intermaxilla and the superior maxilla. For the teeth and the jaw are, he says, quite independent of each other in the early stages of their development, and only become related to each other secondarily, as the processes of tooth formation and bone formation respectively advance. The independence of these two processes in their early stages will, I should say, be generally admitted. No one probably would, from the study merely of such a series of casts as I have described, without at the same time having had the opportunity of examining the jaws, have come to the conclusion that the cleft was not, as Goethe taught, in the maxillo-intermaxillary interval, but, as Albrecht now teaches, within the intermaxillary itself. Though the fact that, in so large a proportion of the casts, an incisor tooth was situated on the canine side of the cleft could scarcely be without some significance, and from the frequency of its occurrence, should not be regarded as a mere accidental displacement of a tooth germ.

Albrecht has, however, had the advantage of examining several skulls in which the alveolar cleft was seen to separate the intermaxilla into an inner and an outer part, each carrying its appropriate incisor or incisors. In addition to the skulls of the horse and the calves referred to in his first essay on this subject, he has since described and figured an adult human skull in the University of Kiel, in which a right cleft existed in the corresponding intermaxilla, and the right maxillo-intermaxillary suture co-existed with and was quite distinct from the cleft; a new-born infant with double cleft, in which the same suture was present; the jaw of a child about one year old, in the museum at Ghent, in which, with a left cleft in the corresponding intermaxilla, a left maxillo-premaxillary suture was present. In all these cases the part of the intermaxilla which was situated to the outside of the cleft contained the socket for the precanine incisor. One must therefore accept the conclusion, that the anatomical evidence justifies the statement that, in a proportion of cases of

alveolar cleft palate, the cleft lies within the intermaxilla, the cleft coexists with the maxillo-intermaxillary suture, and an incisor tooth is situated in the interval between the cleft and the canine of the same side.

But I have stated in an earlier part of this paper that there is a group of cases (*a*) of alveolar cleft (*ante*, p. 206) in which no precanine tooth intervened between the canine and the cleft. In some of these only two or three incisors were present, but in others four incisors were situated in the region between the cleft and the opposite canine. It is not improbable that these cases may be examples of a cleft occurring in the plane of the maxillo-intermaxillary suture, and not within the intermaxilla itself. Wherever a suture exists, there, of course, a possibility of an imperfect union of the two bones may arise. Should the bones remain separate, and should the want of union be accompanied by a non-closure of the superjacent soft parts, then the imperfect development would lead to the production of a cleft in the alveolar region, and the theory of Goethe would therefore be applicable to such cases.

For many years the existence of the intermaxillary part of the human upper jaw as an element distinct from the superior maxilla rested rather on general anatomical considerations than on embryological data. Even so recently as December 1858, M. Em. Rousseau, in a paper in the *Comptes Rendus*, was of opinion that, in the normal ossification of the upper jaw, there was no evidence that the intermaxilla had a centre of ossification distinct from the superior maxilla, and a similar view was expressed by Dr Cleland.¹ Dr Joseph Leidy had, however, published some years previously² a short account of a dissection which he had made of a human embryo 1 inch 11 lines in length from vertex to heel, and which he believed to be nine or ten weeks old. He found the intermaxilla in apposition with the superior maxilla for $1\frac{2}{3}$ ds of a line; but they were easily separable at this period along the plane of a suture which passed through the alveolar ridge between the incisor and canine alveoli, and which divided the nasal process into two nearly equal por-

¹ "On the Relations of the Vomer, Ethmoid and Intermaxillary Bones," *Phil. Trans.*, 1861.

² *Proc. Acad. Nat. Sc.*, Philadelphia, 1848-49, p. 145.

tions. Dr Leidy's observations did not, probably owing to the periodical in which they appeared not having much circulation in Europe, for many years attract attention. Mr G. W. Callender furnished some important observations¹ on this subject several years afterwards. He described in a foetus, 2·3 inches long, a smooth plate of bone as passing forwards from the base of the nasal process of the superior maxilla, and he called this plate the "incisor process." The intermaxilla, he stated, "consists of deposits of bone about the posterior edge of the incisor process, which subsequently grow down to form the plate of bone on the inner side of the middle incisor socket, and the posterior wall of the incisor sockets below and internal to the course of the incisor branches of the dental nerve." In a foetus 4·4 inches long, "the intermaxilla is completely formed, and may be traced as a distinct bone." It forms the front of the palate, and fills up the notch between the incisor and palatal processes of the superior maxilla; it also possesses "a narrower portion, which ascends and fits by a convex surface into the groove of the nasal process, ending above at the ridge for the turbinate bone, part of which ridge it forms." Callender accounts for the absence of all trace of the human intermaxilla on the facial aspect of the upper jaw by the bone being shut off from the face by the nasal and incisor processes of the superior maxilla. "It is joined to the superior maxilla during the latter part of the fifth or beginning of the sixth month." But the independence of the intermaxilla in its earliest stage has also been demonstrated by Dr Th. Kölliker in his essay already so frequently referred to. By adopting a process very similar to that recommended a number of years ago by Dr Lionel Beale,² for the purpose of studying the stages of ossification in the early embryo, of rendering the soft tissues transparent by digesting the foetus in a solution of caustic alkali, Kölliker has seen the centres of ossification in the upper jaw without any disturbance of their natural relations. He has described and figured the head of

¹ "The Formation and Early Growth of the Bones of the Human Face," *Phil. Trans.*, 1868.

² Beale's *Archives of Medicine*, vol. i. p. 150, 1859. Dr Beale's formula is eight or ten drops of solution of caustic soda in each ounce of alcohol. A foetus soaked for a few days in this fluid, and then preserved in spirit, forms, he says, a very beautiful preparation.

an embryo at about the eighth week, in which the centre for the intermaxilla was quite separate from that which gave origin to the superior maxilla.

B. *The Hard Palate where there was no Cleft.*—The object of examining the hard palate where there was no cleft was to ascertain if any suture, or the remains of a suture, could be seen in its anterior part, immediately behind the incisor teeth, to indicate that, as Dr Albrecht contends, the incisive or intermaxillary element of the human upper jaw had originally consisted of two bones on each side, a mesial or internal, and a lateral or external.

As is well known, it is not uncommon to find in young human skulls, and less frequently in adult palates, the remains of the incisive suture which Goethe recognised as connecting the intermaxillary element of the upper jaw to the superior maxillary element. Th. Kölliker, who has especially looked into this matter statistically, states that he has seen the maxillo-intermaxillary suture, or the remains of it, ninety-six times in 325 adult crania which he has examined.

The authors cited by Albrecht in his first communication on this subject, Albrecht himself, and subsequently Professor Hermann v. Meyer, have referred to crania in which the remains of an intra-incisive (endo-mesognathic) suture were also seen; and Albrecht has figured¹ the hard palate of a child about five years old, in which the mesial palatal suture, a pair of lateral maxillo-intermaxillary sutures, and a pair of intra-incisive sutures were visible. The observations which I shall now refer to enable me also to state that a narrow fissure in each intermaxilla, which together apparently represent the remains of a pair of intra-incisive sutures, may occasionally be seen in the hard palates of both young and adult human crania, in conjunction with a pair of maxillo-intermaxillary sutures.

a. Superior maxillæ; milk dentition. A maxillo-intermaxillary suture visible on palate, floor of nose, and nasal aspect of ascending process of superior maxilla. A short intra-incisive fissure on the palatal aspect, branched off from the maxillo-premaxillary suture 2 mm. from the mesial palatal suture, and external to the naso-palatine (incisive) canal; it extended for 2 mm. in the direction of the interval between the central and lateral incisor,

¹ *Deutsche Zeitsch. für Chirurgie*, 1844.

but did not reach the alveolar border. It did not extend through to the nasal surface of the bone.

b. Superior maxillæ; milk dentition. Arrangement similar to that described in *a*.

c. A similar preparation, but the fissure in the right bone extended for between 4 and 5 mm. on the palatal aspect, and reached the interval between the orifices for the gubernacula of the permanent central and lateral incisor teeth.

d. A similar preparation, where there was only an indication of an intra-incisive fissure scarcely 1 mm. long on the palatal aspect of the upper jaw.

e. Superior maxillæ, in which all the permanent teeth were erupted except the wisdoms. Maxillo-premaxillary suture visible both on the hard palate and on the nasal surface of the bone. An intra-incisive fissure branched off from it, and extended for 2 mm. in the direction of the interval between the central and lateral incisor.

f. Right superior maxilla. All the permanent teeth erupted. The maxillo-premaxillary suture was visible on both the palatal and nasal surfaces, and on the former reached the alveolar border. An intra-incisive fissure arose from it 4 mm. from the mesial palatal suture, and extended for 6 mm., so as to reach the alveolar border a little to the inner side of the septum between the central and lateral incisor. This fissure, as in the other specimens, was not visible on the nasal surface.

The place of origin of the intra-incisive fissure in the majority of the specimens was from the maxillo-premaxillary suture external to the incisive canal, which canal, therefore, on the theory that the intermaxilla consists of an inner and an outer division, would lie in relation to the inner division close to the articulation between it and the superior maxilla. In one instance the intra-incisive fissure penetrated into the naso-palatine canal. Obviously, therefore, some condition arising during the development of the bone determined the origin and direction of the fissure in question.¹

Th. Kölliker, who, as already stated, is opposed to Albrecht's theory of the double constitution of the intermaxilla, has recog-

¹ A detailed description of the naso-palatine canal in man is given by Prof. H. Leboucq in *Archives de Biologie*, vol. ii., 1881.

nised similar fissures on the hard palate as many as five times, he says, in the skulls of thirty children. But he regards these fissures not as sutures, but as vascular furrows connected with the distribution of the anterior palatine vessels. As a rule, however, the intra-incisive fissure in my specimens did not arise from the anterior palatine fossa,¹ but from a definite point in the maxillo-intermaxillary suture on the surface of the hard palate. The intra-incisive fissure corresponded closely in its character with the maxillo-intermaxillary suture, with which it was continuous; so that, as far as one can judge from similarity in appearance, if the latter is a suture, which every one admits, then the former may be fairly regarded as one also.

What is yet wanted, however, in order to give completeness to the evidence of the division of the intermaxillary bone into an inner and an outer part, is the discovery that the intermaxillary bone normally rises from two distinct centres of ossification, one for the inner, the other for the outer part. Of this we have at present no evidence. But, in connection with this matter, we ought not to forget that it is quite recently that the embryological evidence of the origin of the intermaxillary part of the human upper jaw from a centre distinct from that of the superior maxilla has been completed. And yet for nearly a century, on such minor evidence as was advanced by Goethe, viz., the suture on the hard palate extending through to the nasal surface, anatomists have believed and taught that the human upper jaw represented both the superior and intermaxillary bones in any other mammal. Where a question in human embryology hinges upon an examination of parts in a very early stage of development, we often have to wait for many years before an appropriate specimen falls into the hands of a competent observer.

¹ I prefer to call the large foramen in the hard palate behind the incisor teeth the anterior palatine fossa, whilst the lateral foramen opening into it on each side is the incisive or naso-palatine canal, or canal of Stenson, and the two foramina in the mesial suture are the foramina of Scarpa.

THE DUMB-BELL-SHAPED BONE IN THE PALATE
OF *ORNITHORHYNCHUS* COMPARED WITH THE
PRENASAL BONE OF THE PIG.¹ By Professor
W. TURNER, M.B., F.R.S.

As an additional argument in support of his view that the intermaxillary bone consists of an inner, or mesial, and an outer, or lateral part, Dr Albrecht refers to the arrangement of the bones of the beak of *Ornithorhynchus paradoxus*. All anatomists have recognised as intermaxillary bones the pair of bones articulating with the nasals and superior maxillæ, which form the anterior end of the beak of this animal, and which curve inwards in front, but do not meet mesially. Rudolphi described² them as the outer intermaxillaries, and gave the name of inner intermaxillary to an ossicle situated on the palate, and separated from the outer intermaxillary by a considerable interval. J. F. Meckel described this ossicle as an unsymmetrical 8-shaped bone³ attached by membrane to the anterior end of the palatal portion of the superior maxilla, and he also considered it as a division of the intermaxilla. Sir Richard Owen regarded⁴ this detached intermediate bone as a separate centre of ossification of the palatine process of the intermaxillaries. Albrecht has also examined this ossicle, and has pointed out that the incisive or naso-palatine canal opens on each side of it. He considers that its position between these two canals incontestably demonstrates it to be the two internal intermaxillary bones united together, and he calls it *l'os paradoxo*. As this bone is separated on each side from the outer intermaxilla, Albrecht regards the *Ornithorhynchus* as having normally a submucous double maxillary cleft and four intermaxillary bones.

Since reading Albrecht's paper, I have examined both a carefully prepared skull and a recent dissection of the head of

¹ *Sur la Fente maxillaire et les 4 os intermaxillaries de l'Ornithorynque*, Bruxelles, 1883.

² Quoted by Meckel and Albrecht.

³ *System der vergleichenden Anat.*, Bd. 2, Ab. 2, 1825; and *Descr. Anat. Ornithorhynchi paradoxo*, Lepsia, 1826.

⁴ "Monotremata" in Todd's *Cyclopædia*, vol. iii.