QUIZ COMPEND

IRREGULARITIES

OF THE

TEETH

BY

EUGENE S. TALBOT, M. D., D. D. S.

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W. H. Freudenberg

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PREFACE

THE object of this work is not intended to take the place of the larger and more complete works, but to be used as a primer and reference for advanced students. The quiz compend principle has answered so excellently in medicine as to entail a similar system for dental students.

Etiology has been discussed at length since its knowledge must precede and determine the treatment. Questions and answers generally prove suggestive to the teacher as to new lines of study.

In the treatment of irregularities of the teeth, all forces may be applied individually to a given case. The author has intentionally avoided a discussion of special treatment since every teacher has of necessity his own methods of operation.

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on
Irregularities of the Teeth

CHAPTER I.

HISTORY.

Q. Is practice of dentistry ancient?

A. It was a very early specialty of medicine. According to Sayce and others, the Assyrians early practiced tooth filling with gold, and allied procedures.

Q. What was the folklore belief of dental decay?

A. That it was due to a worm in the tooth.

Q. Did the Assyrians reach a very high level in medicine?

A. They did not reach a higher level in medicine and surgery than that of the Chinese of to-day, who are presumably the inheritors of their science.

Q. What country had attained a relatively high status at this early period?

A. In Egypt nearly every branch of medicine had attained a high standard at the time of Herodotus.

Q. Do records show that dentistry was practiced earlier than this period?

A. As shown by the Eber's papyrus, dentistry was a differentiated specialty of medicine much earlier.

Q. When was gold used?

A. It was employed by the Egyptians for filling teeth as well as for correction of irregularities.

Q. What evidence is there for this?

A. Mummies are found containing teeth held in place and directed by gold or silver wires or plates.

Q. What other peoples practiced dentistry in early times?

A. In Hindoo civilization, dentistry early reached a high status as a specialty of medicine. Such civilization fell later into decay when the folklore notion of disease due to the worm in the tooth resumed its prominence.

Q. Was Hippocrates particular in regard to dental operations?

A. Caution was advanced by him in extraction of teeth and preserving them.

Q. What other important point was he critical about?

A. He attacked principally the fetichic origin of disease.

Q. What did this notion lead him to?

A. As this played a large part in compelling unnecessary extraction of teeth, he naturally was led to describe the character of teeth and the indication for their extraction.

Q. What important scientist followed him, and what great lesson did he teach?

A. One hundred and sixty years after him Erasistratus deposited in the temple of Apollo at Delphos an odontogogue or leaden tooth forceps, intimating that only teeth should be drawn which were loose enough to be extracted with this instrument.

Q. What was the lesson to teach?

A. This (an *ex-voto* offering for recovery from disease) was probably intended by Erasistratus as a popular lesson against too early extraction of teeth.

Q. Were the Romans influenced by this?

A. So far as dentistry is concerned, the Romans were as much influenced by Etruscan as by Greek culture, although the last had a very early influence.

Q. Were the Etruscans versed in dentistry?

A. They practiced dental procedures resembling, but more complete even than those of Greece.

Q. Did the Romans early practice dentistry?

A. In Rome artificial dentures, evidently modeled on Etruscan types, were made ere the period of the laws of the "Twelve Tables."

Q. When did Celsus practice?

A. He practiced A. D. 30. He was considered rather rough in his surgical operations.

Q. When did Galen practice, and what important name did he give to some of the teeth?

A. Galen practiced 150 A. D. He gave the canine teeth the present popular term, eye teeth, because he believed they were supplied by the optic nerve.

Q. What great medical school developed in the seventh century?

A. The Greek, Etruscan, Roman, and Arabian culture met at the famous school of Salernum, Southern Italy, which opened 700 A. D.

Q. Where and when did dentistry advance?

A. Under the influence of this school, dentistry was practiced more by surgeons and physicians, whereas it had been previously largely confined to charlatans.

Q. When was the antrum described?

A. About the middle of the thirteenth century, by Bruno of Langoburo, who mentioned various operations upon the teeth and antrum nearly four centuries before Highmore.

Q. When was the earliest European attempt to correct irregularities of the teeth made?

A. About the fifteenth century Giovanni d'Arcoli filled teeth with gold and made attempts to regulate them.

Q. Where did Shakespeare obtain his observations in regard to the teeth?

A. From the famous anatomy of Helkiah Crooke, published in 1618.

Q. When and by whom was the first French work published?

A. A work called "Le Chirurgien Dentiste" was published by Fauchard in 1728.

Q. Who wrote a similar work in French?

A. Aeubzi, of Lyons.

Q. Who made the earliest great impression upon the profession?

A. Crooke, who in discussing second dentition, remarks that "The shearing (i. e., incisors) teeth, when they do break forth, do thrust the first shearers out before them and issue betwixt the first two, the second and the dog tooth that is next unto them. But if the former teeth will not fall or be not pulled out, or if the latter issue before the first fall, then the latter make their way through new sockets and turn in the upper jaw outward, in the lower jaw inward, so that there seemed to arise a new row of teeth, and this hath deceived many historians and anatomists also."

Q. Who first mentioned supernumerary teeth?

A. Barth Ruspini, a century and a quarter after Crooke, claimed that all teeth which exceed thirty-two may be regarded as supernumerary. In his opinion irregularities of the canines and incisors were attributable to extreme narrowness of the jaws.

Q. Half a century later what did Robert Blake write?

A. He describes supernumerary and inverted teeth.

Q. Three decades after what did Joseph Harris and Joseph Winckworth remark?

A. That irregularities were due to supernumerary teeth.

Q. What causes attributable to irregularities, then advanced, are still defended?

A. Among these causes (still in considerable favor among dentists, laryngologists and general practitioners) may be mentioned, thumb-sucking, mouth breathing and enlarged tonsils.

Q. What theory was advanced by J. Imrie, six and one-half decades ago?

A. That irregularity is due to want of development of the jaw bones, intemperance of various kinds, combined with artificial modes of living induced by civilization, and sudden change from heat and cold to which the teeth are subject. Rabbit mouth is due to keeping the thumb in the mouth for hours after going to sleep. Underhung jaw is due to sucking the tongue which throws the under jaw from its articulation.

Q. What does he advise about the extraction of teeth?

A. A similar state of the teeth and jaws is induced when attempts are made by the inexperienced to regulate them by extraction of teeth in the upper jaw and neglecting to remove an equal number of the lower.

Q. What was J. Lefoulon's opinion?

A. That the most frequent cause of dental irregularities is the neglect of proper supervision of the second dentition.

Q. What did Thomas Ballard claim?

A. That serrated teeth and projecting jaws were the result of fruitless sucking.

Q. What was Stockton's opinion?

A. That the cause may be found in the form of the palate. Irregularity of position is almost exclusively confined to the five anterior teeth on each side of the median line brought about by the tongue upon the hard palate in sucking or mastication.

Q. What were Nasmyth's views?

A. That the projecting upper jaw was due to thumb and finger sucking. But when both were involved that it was due to arrest of development in the jaw where the expansion of the jaw was deficient.

Q. What changes occurred during the next twenty-five or thirty years?

A. The opinion as to the influence of thumb-sucking continued to grow.

Q. What opinions were prevalent in 1873?

A. A. A. de Lessert, Thomas Salter and J. W. White believed that thumb-sucking was the principal cause.

Q. How did Francis Fox view irregularities?

A. That the want of proportion in size of the teeth and jaw bones, or prolonged retention of the temporary teeth, supernumerary teeth, the habit of thumb-sucking, undue pressure from a hypertrophied tongue, and heredity were the causes.

Q. What effect did Helkiah Crooke's summary have?

A. His views influenced investigators about a century and a half afterwards. Thomas Berdmore claimed that the presence of supernumerary teeth or of a double row of teeth is due to the fact that the milk teeth are never shed, notwithstanding the fact that the permanent teeth appear.

Q. What did Joseph Fox claim as causes of irregularities of the teeth?

A. That the most frequent cause is a want of simultaneous action between the increase of the permanent teeth and the decrease of the temporary ones by the absorption of their fangs, most commonly occasioned by the resistance of the nearest temporary teeth.

Q. What did Joseph Murphy believe?

A. That irregularity is due chiefly to the first teeth not having been shed in time.

Q. What are Benjamin James and Parmly's views?

A. They agree with Murphy. Parmly further says that when the permanent teeth are large and growth of the jaw does not proceed in a corresponding proportion, they are found crowded, and overlap each other.

Q. What did G. White find?

A. That irregularities of the teeth are mostly occasioned by the pressure of the temporary upon the permanent, throwing them in the wrong direction.

Q. What are the views of S. S. Fitch?

A. Similar to those of Joseph Fox.

Q. What is the opinion of J. B. Garriot?

A. That the deciduous teeth, by their pressure, often prevent the permanent teeth from arranging themselves in their proper positions.

Q. What did John Hunter advance as a cause?

A. That the jaws grow at the posterior edges, and that an irregularity is often due to the ten anterior permanent teeth being larger than the ten anterior temporary teeth, while the corresponding part of the jaw is of the same size; therefore in such cases the second set is obliged to stand very irregular.

Q. From observation made upon young pigs, at what conclusions did G. M. Humphrey arrive?

A. That there is no interstitial growth. The five permanent teeth occupy exactly the same position throughout life and all conditional teeth are added to the hind end of the jaw. This hind end is enlarged by the absorption of the anterior coronoid edge and the deposition on the posterior edge where the molars are first formed they are under the coronoid process and are frequently exposed.

Q. What did L. Koecker claim in 1826?

A. That the deformity which consists in shutting the under incisor and cuspidati over the upper, has been produced by the injudicious extraction of some of the teeth of the upper without taking proper care to secure due proportion between the upper and under jaw.

Q. What did Thomas Bell think?

A. That the most usual cause of permanent irregularity is the actual want of sufficient room in the jaw for the ultimate regular arrangement of the teeth.

Q. What is Joseph Scott's opinion?

A. Irregularity arises from, first, a natural want of sufficient expansion in the jawbone at the time of their protrusion; second, from not extracting the temporary teeth at the proper time; third, from too early extraction of the temporary teeth; fourth, from supernumerary teeth.

Q. What did John Nicholls find?

A. That the deformity may be due to too long persistence of the temporary teeth, or arises from some malnutrition of the teeth or jaws, entirely beyond the previous control of the dentist.

Q. What are the views of M. Maclean?

A. That expansion of the jaw is prevented by premature extraction of the temporary teeth.

Q. What did E. E. Spooner find?

A. That the first and most frequent cause of irregularity is a want of simultaneous action between the protrusion of the permanent teeth and absorption of the fangs of the temporary. The second cause is a narrowness of the maxillary arch,or a wan't of proportion between the extent of it and the size of the teeth.

Q. What theories did William Thornton advance?

A. That irregularities of the teeth proceed from three causes: First, from natural want of sufficient expansion in the jawbone at the time of the protrusion of the teeth, second, non-extraction of temporary teeth at the proper time; third, too early an extraction of the temporary.

Q. What views did Mortimer have?

A. That irregularities of the teeth arise from natural and accidental causes. Natural causes arise from the bad conformation of the jaw, so that several teeth are over each other; from the teeth being much larger than they should be; from coming out of order and place; from teeth growing out of the plate or projecting out of the mouth. Accidental causes arise from neglect or ignorance in removing milk teeth too soon, when the second teeth take a direction inward or outward from some internal cause; underhung jaws arise from making faces.

Q. What theories did Charles de Loudes advance?

A. That irregularities are due to supernumerary teeth, to second teeth being large and maxillary arch too narrow, to early extraction, to too long persistence of the temporary teeth, to shape of the maxillary arch, and to heredity, where the child inherits the jaw of one parent and the teeth of another.

Q. What views did Samuel Ghimes suggest?

A. He spoke of the underhung jaw being due to the upper incisors extending inwards, and in closing the mouth, they come in contact with the lower. This makes the child incline to protrude the lower jaw, which finally becomes habitual and promotes the increase in the length of the jaw itself.

Q. To what does Nessel attribute irregularities?

A. To the premature extraction of the temporary teeth. The alveoli form a bone scar in such cases, which constitutes an obstacle to the advancement of the permanent teeth. In consequence, the permanent teeth come before the jaw is sufficiently expanded to receive them.

Q. Between what years was the theory of mouth breathing most prevalent?

A. Between 1860 and 1880, mouth breathing, especially during sleep, formed a prominently discussed etiologic factor.

Q. What was Tomes' opinion?

A. That deformity of the jaws is often caused by sleeping with the mouth open.

Q. What did Catlin, the ethnologist, claim?

A. He made popular propaganda in favor of nose breathing, and ascribed many diseases to keeping the mouth open. Malformation of the jaws and teeth were due to keeping the mouth open, since civilized man is the only animal who keeps his mouth open during sleep. This view still meets with much favor among dentists and laryngologists. It is, however, losing cast with pædiatricians.

Q. Sixteen years after Catlin, what views were advanced by W. Mathews?

A. Irregularities were attributable to enlarged tonsils, which necessitated breathing being carried on with the mouth open. They were also due to heredity. The maxilla was smaller in proportion than the teeth, owing to the lessened work of the jaws and teeth among civilized races. Cross breeding played an important part, as did thumb-sucking and lip-sucking; retarded shedding of the temporary teeth and too early extraction of the first permanent molars. The congenital V-shaped jaw is that formed where, previous to birth, the type of upper maxillæ is such that its cornua do not diverge posteriorly, but are parallel. As that portion of the jaw already formed never changes its form, the newly added parts will pass off in divergent lines, forming an angle with that previously existing in order to correspond with the increasing width of the base of the skull. The growing tendency exhibited from the time of Crooke to assign constitutional factors important places in the etiology of the teeth and jaw irregularities is noticeable in Mathews. He, while laying stress on local factors, was forced to recognize the importance of constitutional factors. Constitutional factors hence early began to assume considerable importance. John Fuller, while attributing, in 1810, irregularity to long persistence of temporary teeth, also remarked that the upper jaw is often too small for the permanent teeth, this condition frequently resulting in its irregularity.

Q. What was Sigmond's opinion?

A. That irregularities are due to natural and accidental causes. Causes are natural, (1) when they result from the jaw not expanding sufficiently to allow the teeth to form a regular circle; (2) when they are larger than the ordinary dimensions; (3) when they do not appear in their proper order and place. Causes are accidental when due to negligence or improper treatment at the time of growth.

Q. What views did Andrew Clarke advance?

A. That irregularity of the teeth is occasioned by want of room in the jaw and not from any effect that the first set of teeth may produce upon them, is evident from the fact that in all cases of irregularity, there is not room to admit of placing the teeth properly.

Q. What were those of J. P. Clarke?

A. That irregularity may arise from too premature extraction of temporary teeth. Disproportion between the teeth and jaws may be occasioned by a natural conformation of the parts, or may be the effect of unnoticed accident. For we seldom found any such disproportion and consequent irregularity in the teeth of men and animals in a wild state.

Q. What was William Robertson's hypothesis?

A. That deformity is due to inheritance of the contracted jaw of one parent and the large teeth of the other.

Q. What did David W. Jobson suggest?

A. That irregularity is due to smallness of the maxillary arch and the great size of the permanent teeth, and to their situation, part on the inner and of others on outer side of permanent teeth.

Q. What was John Mallan's theory?

A. That the adult teeth being larger as well as more numerous than the milk teeth, it is obvious that they require a great deal more room, and when the absorption of the latter does not progress equally with the growth of the former, the new teeth are crowded up and are apt to be forced out of their natural position by the resistance of the old. Again, if the permanent prove, as they sometimes do, disproportionately large in comparison with their predecessors, the jaw may not be sufficiently extended to admit of their being arranged in order, in which case some overlap the others and considerable deformity is occasioned.

Q. What was Maury's theory?

A. That the prominence of the upper jaw is due to narrowness of the arch; recession to the anterior teeth.

Q. What suggestion did C. H. Harris make?

A. That infringement of the laws of growth or disturbance of the organs of the face or head may determine improper development of the jaws and bad arrangement of the teeth. Irregularity of the teeth is due to narrowness of the maxillary arch and sometimes to the presence of the temporary teeth.

Q. What does W. K. Brideman suggest?

A. That the tongue, lips and cheek exert no influence in moving the teeth from their original direction. This is due to the shape of the jaw.

Q. What is Sam Harbert's theory?

A. That irregularities of the teeth are due to premature extraction of the deciduous teeth and protrusion of the permanent before the absorption of a deciduous fang. A projection of the lower jaw is attributable to neglect in second dentition. Generally it is supposed to be due to elongation of the jaw, which is almost always an error. When the dental arch becomes contracted at the medial line, giving to the mouth a pointed appearance, it is often the result of premature extraction of temporary teeth.

Q. What is Alfred Canton's opinion?

A. That irregularity of teeth as regards shape, position, direction, crowded condition, etc., is met with more frequently than is supposed to be the case. The causes are chiefly mechanical, depending either on the non-increase in size of the jaw in proportion to the growth of the teeth to be contained in the alveolar arch; on the position of the permanent teeth with reference to the fangs of their predecessor, and lastly, on the increase in size of one jaw in preference to the other.

Q. What is C. F. Delabarre's opinion?

A. That malformation of denture may be occasioned by defective conformation of the jaw; by simple arrest of development dependent upon the health of the individual; by excess of development of the teeth, though the jaws be in other respects well formed; by rapid development in the dentition of one set, and delay in that of the other; by the too great size of the teeth of one jaw, which do not harmonize with those that are opposite. Some forms of defective palatine arches are hereditary.

Q. What was J. R. Duval's opinion?

A. That in a projecting chin, the alveolar arch, in which the incisors and canines are placed, has taken a development upon a parabolic line—greater and more prominent than that presented by the bone. This differs very little from a similar one in the upper jaw, which projects over the lower. Upon attention to shedding of the temporary teeth depends the fine arrangement of the lower.

Q. What was Gunnell's opinion in regard to protrusion of the lower jaw?

A. That while in many cases hereditary, it is often brought about in the following manner: The incisors of the lower jaw are cut first, and when the upper ones appear, the lower have nearly arrived at full growth. In closing the mouth, they come in contact with the gum on the inside of the upper incisors, and for relief the lower jaw is thrust out, which condition soon becomes permanent.

Q. What was the opinion of Samuel Cartwright, Jr.?

A. That irregularities of the permanent are due, first, to non-absorption of the roots of the temporary teeth in proportion to the rise of those of replacement. Second, to the great difference which commonly exists in the size of the new teeth as compared with those of the first set. Third, to contraction of the arches of the jaws and other malformations of the maxillary and palate bones originating in hereditary, congenital, and other causes.

Q. What were the conclusions of Messrs. Mummery and Nichols, in 1860, after observations upon the teeth of primitive races?

A. They found that irregularities of the teeth, and contracted jaws, were rare.

Q. What did Messrs. Coleman and Cartwright's observations show?

A. That the primitive skulls in Kent, England, had well developed jaws and alveolar arches. The teeth still present were remarkably regular.

Q. What opinion did Samuel Cartwright express in 1864?

A. That irregularities result from selective breeding; that they both are congenital and hereditary; that there is very little increase in the anterior part of the jaw after eight or ten years; that if the temporary teeth were to remain, the jaws would not change from those of childhood; that in all cases irregularity of the maxillæ are more or less altered in proportion of development, whilst the teeth maintain in regard to size an average development.

Q. What did A. A. Blount suggest?

A. That the remote causes which produce irregularity will be found in the commingling of all nations with national and individual characteristics. The most frequent causes are the result of accident, indiscriminate action of the deciduous teeth, and too early extraction of the permanent teeth.

Q. What did H. Sewell suggest?

A. That protrusion of the incisors is apparently due to an abnormal development of the maxillary bone. Irregularities are due to retention of temporary teeth, causing permanent teeth to assume an unnatural position; also to malformation of the jaw, which is usually congenital and at the same time hereditary. They may be due, however, to injury and to accidental causes.

Q. What did J. L. Down find?

A. That excessive vaulting of palate is due to arrest of development of the sphenoid or defective growth of the vomer. The defects are development defects, and betoken a cause long anterior to the time when sucking the thumb is practiced, unless that habit be an intra-uterine one.

Q. To what does Kingsley attribute irregularities?

A. Irregularities are attributed chiefly to premature extraction of temporary teeth, marriage between persons of different nationalities, heredity, or disturbed innervation.

Q. What is S. H. Guilford's division?

A. Hereditary and acquired.

Q. What did the author conclude in 1880?

A. That the shape and size of the jaws may be inherited, but the manner of the eruption of the teeth is not transmitted, hence irregularities of the dental arch *per se* are not inherited.

Q. What other point did he settle?

A. That the muscles of the mouth and cheeks have nothing to do with the production of the V-shaped or saddle arch or their modifications.

Q. What was shown?

A. That the only tissues involved in the production of irregularities are the teeth on the one hand and the jaw bone and alveolar process on the other; that the incisors in the V-shaped arch always protrude, and never in the saddle; that the manner of the formation of irregularity is in the arrangement of the teeth (no matter what position the teeth take, the alveolar process builds itself about them to hold them in position); that there is a decided difference between the deformities produced by thumb-sucking in its various forms and the V and saddle arches. Owing to the jaws being transitory structures with an unstable nervous system, excessive and arrest of development takes place. One jaw may be excessive, the other arrested.

Q. What are some of the causes of an unstabl nervous system?

A. Debilitating, acute diseases of children are noticeably often followed by sudden overgrowth or undergrowth of bone. Cases of pneumonia and measles are followed by dental and maxillary deformities. Inherited or acquired neuropathic states are also evinced at the periods of stress marked by dental evolution or involution. Irregularities are due to constitutional origin, developing with the osseous system, and to local origin. Irregularities cannot occur until the teeth have erupted (as nothing can exist except it be present). This shows their relation to each other and to the jaw. Deformities always commence at the sixth year, and are completed by the twelfth. The forward movement of the posterior teeth produce the same results as arrest of development of the maxilla. The vault is not contracted by mouth breathing. Contracted arches are as common among low vaults as high, but appear high because of the contraction. Mouth breathing (due to hypertrophy of the nasal bones and mucous membranes, deformities of the nasal bones, adenoids, or any pathologic condition producing stenosis) does not cause contracted jaws, but like t' ›se is due to neuroses of development.

Q. What is Colyer's summary?

A. The opinion of previous writers into the statement that the causes which produce irregularities of the teeth are general and local.

Q. In 1901, to what did Arbuthnot Lane call attention?

A. To the association of deformities of the alveolar process and constitutional deficiencies (like those of the chest) referring the deformities to the action of local factors and ignoring the underlying constitutional element.

Q. Give a summary of the theories in the order in which they have been advanced to 1880.

A. Irregularities of the teeth were early recognized and attempts made toward correction. Irregularities were charged: To too long retention of the temporary teeth, too early removal of the temporary teeth, to supernumerary teeth, narrow jaws, inverted teeth, thumb-sucking, mouth-breathing, enlarged tonsils, want of development of the jaw bones, intemperance, heat and cold, sucking the tongue, extracting teeth on the upper jaw and neglect to extract the same number on the lower, the influence of the tongue, lips and cheeks, the form of the palate, tongue hypertrophy, heredity, too great permanent teeth for the space, pressure of the temporary against the permanent, want of interstitial growth, from removal of the temporary teeth (the bone scar prevents the permanent teeth from erupting regularly) sleeping with the mouth open, cross breeding, constitutional factors, congenital states, early decay and loss of the temporary teeth, non-absorption of the roots of the temporary teeth, selective breeding, arrest of development of the sphenoid or defective growth of the vomer, artificial life, disturbed innervation.

CHAPTER II.

HEREDITY.

Q. What are Luys' views as to heredity?

A. That the individual that comes into the world is but one link in a long chain which is unrolled by time, and the first links of which are lost in the dim past.

Q. What are the antecedents of the individual?

A. He has not merely two parents but the ancestors behind him.

Q. Do these ancestors represent the same, or different types?

A. These two parents may represent ancestors of very different types, whose qualities, seemingly absent in the parent, will appear in the descendant.

Q. Do the relative functions of the sexes become a factor?

A. They are a potent factor to be taken into consideration in estimating its influence.

Q. What part does the female play?

A. The original function of reproduction, that of cell division, is the part of the female.

Q. What part does the male play?

A. The male in the lower types of life (some plants and infusoriæ) simply supplies the female with nourishment.

Q. What happens with rise in evolution?

A. The protoplasm is differentiated.

Q. Which furnishes the type?

A. The female, which is the best capable of development, and which is properly nourished by a highly developed male.

Q. Which produces the greatest influence in the offspring?

A. As the product of fructification is longest under the nutritive influence of the female, her influence is most potent in redeeming defects or producing them.

Q. Are results identical from parent to child?

A. It is an incorrect conception of the law of heredity that looks for identical phenomena in each succeeding generation.

Q. What views have been expressed if the mental characteristics of the child be not similar to the parent?

A. Some have refused to admit that mental faculties were subject to heredity, because the mental characteristics of the descendants were not precisely those of the progenitors.

Q. On what grounds?

A. That each generation must copy the preceding. Father and son must present the spectacle of one being having two births and each time leading the same life under the same conditions.

Q. Where must the application of the law of heredity be sought?

A. It is not in the heredity of function or of organic or intellectual facts that the application of the law of heredity must be sought, but at the very fountain head of the organism in its inmost constitution.

Q. How is heredity divided?

A. Direct, indirect and telegony.

Q. What is direct heredity?

A. Direct heredity consists in the transmission of paternal and maternal qualities to the children?

Q. How is this divided?

A. This form has two aspects. The child takes after the father and mother, equally as regards both physical and moral characters, a case, strictly speaking, of very rare occurrence; (2) or a child, while taking after both parents, more especially resembles one of them.

Q. What distinction must again be made between two cases?

A. The first of these occurs when the heredity takes place in the same sex from father to son or from mother to daughter.

Q. What is the other form?

A. The other, which is more frequent, appears when heredity occurs between different sexes, from father to daughter, or from mother to son.

Q. What is reversed heredity, or atavism?

A. It consists in the reproduction, in the descendants, of the moral or physical qualities of their ancestors.

Q. How does this occur?

A. It frequently occurs between grandfather and grandson, as well as between grandmother and granddaughter.

Q. What is collateral or indirect heredity?

A. It is of rarer occurrence than the foregoing, and is simply a form of atavism, which subsists as indicated by name between individuals and their ancestors in the direct line—uncle or granduncle and nephew, aunt or niece.

Q. What is telegony, or the heredity of influence?

A. It consists in reproduction in the children by a second marriage of some peculiarity belonging to a former spouse.

Q. Do morbid parents always have morbid children?

A. The descendants of a victim of morbidity or abnormality do not always exhibit the morbidity or abnormality of the parent.

Q. Is morbid heredity ever wanting?

A. It is most often not present to the full extent.

Q. Is it not sometimes slight in the child?

A. Frequently slighter abnormalities than those in the parent may be detected.

Q. What two independent principles are here evident?

A. The transmutation of heredity and the atavism upon which it depends. Atavism at times tends to preserve the type and offsets the influence of degeneracy.

Q. What does it underlie?

A. Not merely the production of the sound action of degenerate stock, but also those in whom the degeneracy affects the earlier, and not the later, acquirements of the race.

Q. What direction does manifestation of morbid heredity take?

A. The line of least resistance.

Q. What is the extent and direction of the line of least resistance?

A. It depends upon the amount of healthy atavism which separate organs and structures of the body preserve.

Q. Is this also true of the cells forming its organs?

A. What is true of the organism as a whole is also true of the cells forming its organ.

Q. Is there a struggle for existence on the part of the cells?

A. While cell life is altruistic or subordinate to the life of the organ and through it to the life of the organism as a whole, still this altruism is not so complete as to prevent entirely a struggle for existence on the part of the cells or individual organs.

Q. Does this struggle increase, or decrease?

A. With advance in evolution this struggle decreases, to increase with the opposite procedure of degeneracy.

Q. What is the result?

A. From it results the phenomena of arrest and excessive development.

Q. By whom was this struggle for existence pointed out?

A. It was first pointed out by Aristotle, who showed that one organ was often sacrificed for the development of another.

Q. Was this more clearly pointed out later?

A. It was, and freed from obscurity by Goethe in 1807, and St. Hilaire in 1816.

Q. What is this law called?

A. The law under which the struggle operated is known as the law of economy of growth.

Q. How does it operate?

A. Its action sometimes aids, sometimes repels and prevents degeneracy.

Q What did VonBaer point out?

A. That the vertebrate embryo of the higher type has in it all the potentialities of the organs and structures found in lower types, therefore, in proportion as the ancestry is strengthened do these potentialities remain latent.

Q. What is the reverse?

A. In proportion as the ancestry becomes a subject of nervous exhaustion these potentialities gain nutrition at the expense of the later acquired organs, which are the ones likely to be affected by nervous exhaustion.

Q. Have all the organs of the body their own nervous system?

A. Practically they have, and it exercises a control over their nutrition through its influence on the blood supply and the means of excretion.

Q. How are these local actions regulated?

A. By the control of the nervous system for the benefit of the organism as a whole.

Q. What results when the central nervous system becomes involved?

A. When the central nervous system becomes weakened, the local nervous system given free play first draws greater nourishment and increased power and thereby becomes itself exhausted and a struggle for existence occurs between its parts.

Q. What results?

A. As in the case of tumors and cancers, cells take on the power of reproduction, which for a long time they had lost for the benefit of the organism as a whole.

Q. What effect has this struggle for existence?

A. It produces effects which are handed down by heredity or are fought by atavism.

Q. Are these factors a benefit, as well as a detriment?

A. It is obvious, therefore, that these two factors in heredity may play beneficial as well as injurious parts on the offspring.

Q. What effect does atavism have upon deformities?

A. As a rule atavism plays a beneficial part in correcting degenerate tendencies.

Q. To what extent may this be carried?

A. It may either be complete in the shape of a perfect return to a normal ancestor or may be so incomplete as to moderate in the offspring the extended nervous exhaustion which his ancestor has transmitted.

Q. What are the biologic effects of degenerative forces on heredity as shown by Moreau (de Tours)?

A. First, absence of conception; second, retardation of conception; third, imperfect conception; fourth, incomplete products (monstrosities); fifth, products whose mental, moral and physical constitution is imperfect; sixth, products specially exposed to nervous disorders in order of frequency, as follows: Epilepsy, imbecility, idiocy, deaf-mutism, insanity and other cerebral disorders; seventh, lymphatic products predisposed to tuberculosis and allied disorders; eighth, products which die in infancy in a greater proportion than sound infants under the same conditions; ninth, products which, although they escape the stress of infancy, are less adapted than others to resist disease and death.

Q. Are there more stillborn children?

A. There are more deadborn children in plural pregnancies and children born alive are more difficult to rear.

Q. What are Ansell's views as to this matter?

A. The proportion of infants stillborn or dying soon after birth is, in the case of males, nearly five times, and in the case of females, nearly four times, greater in multiple than in single births.

Q. What did J. M. Duncan find?

A. Pluriparity is especially associated with idiocy and imbecility and it especially affects the sterile ages or the ages of weakness of reproduction.

Q. What did Arthur Mitchell show?

A. That among imbeciles and idiots a much larger proportion is found to be twin-born than among the general community.

Q. What was observed among relatives of imbeciles and idiots?

A. That twinning is very frequent.

Q. When twinning is frequent, are deformities common?

A. Bodily defects likewise occur frequently.

Q. What effect does twinning have upon the economy?

A. It indicates imperfect development and feeble organization of the product.

Q. What did Herbert Spencer show?

A. That with increase in growth and specialization must occur decrease in the explosive manifestations of life.

Q. What effect has this on reproduction?

A. Among these explosive manifestations in early biologic history is the function of reproduction, which is common to all cells.

Q. What occurs with advance of evolution?

A. The functions of cells become specialized and the extent of reproductive power decreased.

Q. What did Spencer call this specialization?

A. He designates it individuation.

Q. What effect does degeneracy produce?

A. The organism returns to the lower type and consequently tends to reversion of individuation.

Q. What results?

A. First occurs absence of conception to which Moreau de Tours refers.

Q. What happens if the organism be less affected?

A. The plural and frequent repeated births of degeneration occur.

Q. Are abortions more frequent in plural births?

A. They are comparatively more frequent than in ordinary pregnancies.

Q. Are monstrosities common?

A. Monstrosities of all kinds are more common in plural than in ordinary pregnancies.

Q. How is it shown that twinning, triplets, etc., are a departure from the physiologic rule?

A. Everything known concerning triplets and quadruplets supports the opinion derived from twins.

Q. What observations support these views?

A. Valenta's, who observed two epileptics (mother and daughter) who illustrated this very decidedly. The mother had thirty-eight children, six times twins, four times triplets, and twice quadruplets. The daughter, at the age of forty, had thirty-two children, three times twins, six times triplets and twice quadruplets, and Kiernan, who found that ninety families of degenerates averaged eleven children each. Triplets, quadruplets and twins were more than ten times as frequent as among the population taken as a whole.

Q. What inference results from this?

A. That occurrence of large families should be regarded, not as an expression of advance, but of degeneracy.

Q. How is the status in evolution determined by progeny?

A. When multiple and frequent progeny occur in a family, the condition must be regarded as a transformation of malign heredity.

Q. What results from these conflicting factors?

A. That direct heredity is rare, and that acquired influences are apt to expend their force upon unstable structures, most subject to the struggle for existence occurring within the organism.

Q. Are the skull, jaws and teeth liable to this predisposition?

A. Their instability predisposes them to the struggle, and hence renders them peculiarly liable to the ply of hereditary influences or acquired defects of an ancestor.

Q. How does heredity act?

A. It merely furnishes, in case of the jaws and teeth, powder to be lighted up by factors locally applied during periods of stress after birth.

Q. Without these locally applied excitants, what would result?

A. The types usually ascribed to heredity by dentists will not occur.

Q. What furnishes the match?

A. Environment furnishes the match, but it makes a great difference whether, as Havelock Ellis says, the match be thrown into a powder magazine or the sea.

Q. What is Weismann's position?

A. He denies the inheritance of acquired defects.

Q. Has he modified his opinion since making the statement?

A. An attempt to transfer his position from the domain of biology to that of pathology led him to encounter facts he was obliged to explain in a manner inconsistent with his original position.

Q. What are his latest views?

A. He admits the origin of a variation equally independent of selection, and amphimixis is due to constant occurrence of slight inequalities of nutrition of the germ plasm.

Q. Do these variations accumulate?

A. These variations are at first infinitesimal, but may accumulate, and in fact they must do so when the modified conditions of nutrition which give rise to them have lasted for several generations.

Q. Upon what, according to Weismann, does individual variability depend?

A. Individual variability, according to Weismann, cannot be charged to direct action of external influence upon the germ cells and their contained germ plasm, since these are very difficult to change, yet he admits that this structure may possibly be altered by influences of the same kind continuing for a very long time.

Q. Why does Weismann claim that the causes of inheritable differences must be sought elsewhere than in these varying influences?

A. Influences which are mostly of variable nature, tending now in onə direction, now in another, as they do not act continuously, can hardly produce a change in the structure of the germ plasm.

Q. What does Weismann admit as to birth marks?

A. That there are a number of congenital deformities, birthmarks and other individual peculiarities, which are inherited.

Q. Are these, according to Weismann, acquired characters?

A. Yes.

Q. What was their origin?

A. They must have once appeared for the first time.

Q. What, according to Weismann, caused them?

A. At least a great proportion of them proceed from the germ itself, and must, therefore, be due to alteration of the germinal substance.

Q. How, according to Weismann, must the inheritance of acquired characters be proven?

A. If any of these hereditary deformities originate in the action of some external cause upon the already formed body (soma) of the individual and not upon the germ cell, then the inheritance of acquired characters is proven.

Q. How does Weismann show that such heredity of acquired characters occurs?

A. By admitting that tuberculosis may produce what he calls a "habit" "in the ancestor, which may be transmitted to the descendants. This habit consists in the formation of structural peculiarities, such as narrowness of the chest, etc." The admission of such a "habit" offsets any denial of the inheritance of acquired characters.

Q. Have recent investigations sustained the distinction between the germ and body plasm?

A. They have destroyed the embryologic distinction between the germ plasm and the body plasm and disproved the claim that the first division of the cell represented separation of body plasm and germ plasm.

Q. How often may these cells be divided before they can pursue a separate existence?

A. They may be divided twice, four times, and even sixteen times, if disassociated for growth, before separate cells can become well developed organisms of the parent type.

Q. What do experiments in production of double monstrosities show?

A. They long ago cast suspicion upon the embryologic position of Weismann.

Q. Of what value have been his researches?

A. They have done undeniable good in destroying loose notions as to direct heredity previously present.

CHAPTER III.

CONGENITAL FACTORS AND MATERNAL IMPRESSIONS.

Q. Can all abnormal conditions associated with the child at birth be considered inherited?

A. Hereditary influences must be separated from factors occurring during one pregnancy which affect the product of that pregnancy alone.

Q. What are these factors?

A. These are the factors causing "maternal impressions," or so-called mother's marks and other defects.

Q. What are maternal impressions?

A. Maternal impressions have been excellently illustrated by a case reported nearly two decades ago by T. C. Poole, of Mansfield, Texas. His sow gave birth (April, 1883,) to eight fully developed pigs. The ninth had the appearance of an elephant. It was destitute of hair, had dependent ears, a proboscis, two eyes behind upper two-thirds of proboscis, closely approximated, yet distinct, an abnormal superior maxillary, containing three large teeth with a long, thin upper lip of elephantine shape and color. The sow's gestation lasts three months and twenty days. On Christmas day, 1882, the boar was with her. December 29th, a menagerie had an elephant staked about three hundred yards from where the sow was, and in full view.

Q. What were the causes of this "maternal impression?"

A. The pig descending from the proboscidea, has, at one stage in intra-uterine development, a proboscis, whose musculature is still retained by the adult pig, in whom the nose plays, to some extent, the part of a hand for rooting purposes. The cause was, therefore, arrested development at the period of pig intra-uterine development when the proboscis existed. This arrested development could have arisen from nervous shock to the sow alleged, since these animals are easily upset during gestation.

Q. What are the usual views of maternal impression causes?

A. Maternal impressions have been considered from one standpoint only, and that is as to their supposed cause and its method of action. As the supposed cause is psychic and—in the conception of it usually adopted—immaterial in action, an absurd credulity respecting its powers, which existed at one time among obstetricians, has given way to an equally absurd skepticism.

Q. Do maternal impressions occur from mental photograph?

A. Specimens exist of newly-hatched chicks with a curved beak, like a parrot, and the toes set back, as in that bird. The hens in the yard, where these monstrosities were hatched, had been frightened by a female parrot, which, having escaped, fluttered among them before the eggs were laid, and greatly frightened the hens from whose eggs the malform chicks were hatched. This seems to confirm the photographic theory of maternal impressions; but these malformations are simply arrests of development, since birds are aberrant reptiles belonging to the sauropsidæ, and during their embryonic development pass through the reptilian phase.

Q. In a general way, how may alleged mental impressions be divided?

A. Into two classes. First, those in which an arrest of embryonic development has occurred, which may or may not be traceable to the alleged impression. Second, photographic impressions charged to a factor utterly incapable of producing them, because of the late period in embryonic life at which the impression is alleged to have acted.

Q. How do mental shocks act on the organization?

A. In a purely physical manner. Since all that is known of the mind is known of it as related to the purely physical conditions through which it acts, whether its action be initiated by conditions affecting physically the various sense organs or not.

Q. Does the fœtus react to mental influence on the mother?

A. It often exhibits very decided reaction to sensory impressions on the mother, whose dreams affect the fœtus. Even ordinary dreams of moderate excitation, not interrupting sleep, may produce fœtal movements. These dreams need not take the nightmare type, though such dreams would cause sudden contraction, under the influence of a terrifying idea, with the resultant cardiac disorder.

Q. What effect may these maternal mental changes have upon the fœtus?

A. Mental changes of the mother excite motor reaction in the fœtus, and, as with sensorial excitation, these reactions are stronger in the fœtus than in the mother.

Q. How do these motor reactions act?

A. The mechanism of these motor reactions is obviously the unconscious and involuntary movement of the uterine walls.

Q. Can the statistic method of proof be applied to maternal impressions?

A. Yes. Of 92 children born in Paris during the siege, 64 had slight mental or physical anomalies, the remaining 27 were all weakly, 21 were imbecile or idiotic, and 8 were normally insane.

Q. What were they called?

A. These figures led the working class of Paris to call children born in 1871 "doomed children."

Q. What effect had the financial crisis of 1875-1880, in Berlin?

A. It was followed by an increase in the number of idiots born.

Q. What effect has profound mental shock?

A. It can alter nutrition so that the mother shall furnish poisonous products in lieu of nutrition.

Q. How will these affect the fœtus?

A. Such poisonous products would tend to check fœtal development.

Q. While science rejects the photographic phases of maternal impressions, what does it admit?

A. It admits that a class of causes of arrested development exists, due to the effects of mental shock upon the mother.

Q. What structures are most liable to be affected by shock?

A. Structures variable in evolution.

Q. What may they be?

A. This influence most strongly affects nutrition of the dermal bone elements of the skull and jaws, and hence must affect the teeth.

Q. When will the results be manifested?

A. The results of this will not always be obvious until the periods of stress.

Q. What is one dental result of fœtal arrested development?

A. One expression of fœtal senescence is the child born with teeth.

Q. When does this occur?

A. This occurs under the law of economy of growth in connection with arrest of development at the senile period of fœtal development, four and one-half months.

Q. What grave deformity is frequently found with premature eruption of the teeth?

A. Cyclopia and grave brain degeneracy.

Q. Was the connection between degeneracy and teeth at birth very early observed?

A. It was since Shakespeare makes Richard III. remark:

> "The midwife wonder'd and the woman cried,
> O Jesu, bless us, he is born with teeth.
> And so I was; which plainly signified
> That I should snarl and bite and play the dog."

Q. Are ante-natal teeth rare?

A. They are not. The significance of natal eruption of teeth is not that of vigor; many of the subjects succumb early in life.

Q. Name authorities who cite instances where children have been born with teeth.

A. Pliny, Columbus, Van Swieten, Haller, Marcellus, Dinatus, Baudeloque, Cazeaux, Sœmmering, and Gardien.

Q. How many cases did Haller collect?

A. Nineteen cases.

Q. What prominent men were born with teeth?

A. Louis XIV. had two teeth at birth, Bigot, a medical philosopher of the sixteenth century, Boyd, the poet, Valerian, and some ancient Greeks and Romans.

Q. What other cases are on record?

A. Polyderus Virgilus describes an infant who was born with six teeth. There were two cases typical of fœtal dentition shown before the Academie de Médecine de Paris. One of the subjects had two central incisors of the lower jaw, and the other had one tooth well through. Levison saw a female born with two central incisors in the lower jaw.

CHAPTER IV.

POST-NATAL SKULL AND JAW DEVELOPMENT AND PERIODS OF STRESS.

Q. Is the child an immature adult?

A. No. The child, with its relatively enormous head, its large, protuberant abdomen, its small chest, short, feeble legs, comparatively vigorous arms, smooth, almost hairless skin, large liver, kidneys, thymus, and super-renal capsules, presents a distinct anatomic picture from the adult. The child's physiologic and psychic life are clear indications in the same direction.

Q. Do the anthropoid apes resemble man in this particular?

A. Yes. While the young anthropoid is comparatively human, the adult ape is comparatively bestial in character. The young ape has a smooth, globular head and relatively small face, like man. The profile is more human, with little prognathism. The base of the skull is more human than in the adult ape. The brain is relatively much larger than in the adult.

Q. What is the case with the gorilla?

A. The fœtus differs from the adult by having relatively a much larger head, a longer neck, more slender trunk, shorter thumb and great toe, while the head is more globular, the face less prognathous, and the hand more man-like. In nearly all these characters the fœtal gorilla approaches man.

Q. What becomes of the male ape as he grows older?

A. The adult male ape rapidly develops into a condition far removed from his early man-like state.

Q. What changes take place?

A. The brain becomes relatively very small, the receding skull becomes hideous, with huge bony crests, sharp angles, and on its enormously enlarged facial portions, prominent, outstanding, superciliary ridges, projecting jaws and receding chin, while the dark, hairy body becomes more bestial in character.

Q. How is the female affected?

A. She remains midway between the infantile and the adult male condition.

Q. When do man and the apes most resemble each other?

A. In the infantile stage.

Q. How do they differ as they mature?

A. While man, in the course of life, falls away more and more from the specifically human type of infancy, the ape, in the course of his short life, goes very much farther along the road of degradation and premature senility. The ape starts in life with a considerable human endowment, but in the course of life falls far away from it. Man starts in life with a still greater portion of human or ultra human endowment, and to a less extent falls from it, in adult life approaching more and more to the ape.

Q. From conception till after birth is there a greater change in zoologic evolution?

A. Up to birth, or shortly afterwards, in the higher animals, such as the apes and man, there is a rapid and vigorous movement along the line upward in zoologic evolution.

Q. Is there a time when this fœtal and infantile development ceases to be upward?

A. The time comes when the upward development is so directed as to answer to the life wants of the particular species.

Q. What develops later in life?

A. Throughout life there is chiefly a development of lower characters, a slow movement towards degeneration and senility, although one absolutely necessary to insure the preservation and stability of the individual and species.

Q. What occurs during fœtal life?

A. Fœtal evolution, which takes place sheltered from the world, is in an abstractly upward direction.

Q. What occurs after birth?

A. After birth further development is a concrete adaptation to the environment without regard to upward zoologic movement.

Q. What characteristics of humanity are found in the infant?

A. The human infant presents, in an exaggerated form, the chief distinctive characteristics of humanity, the large head and brain, the small face, the hairlessness, the delicate bony system.

Q. Which has the best chance in the world, from the standpoint of environment?

A. From the standpoint of adaptation to environment the coarse, hairy, large-boned and small brained gorilla is better fitted to make his way in the world than the delicate offspring; but from a zoologic point of view anything but progress occurs.

Q. Are the first years in man of rapid growth?

A. From about the third year onward, growth, though absolutely necessary, adaptation to the environment is to some extent growth in degeneration and senility. This is not carried to so low a degree as in the apes, although by it man is to some extent brought nearer to the apes.

Q. Does the progress toward senility differ in different races?

A. Among the higher human races the progress toward senility is less marked than among the lower human races.

Q. How does the negro child differ from the Caucasic child?

A. The negro child is scarcely, if at all, less intelligent than the Caucasic child.

Q. How do they differ as they grow older?

A. The negro, as he grows up, however, becomes more stupid and obtuse, and his whole social life falls into a state of hide-bound routine.

Q. How does the Caucasic race develop?

A. It retains much of the child-like vivacity.

Q. Which types most approximate the child?

A. The highest human type represented in typical man of genius, strikingly approximates to the child type.

Q. What great factors interfere with race development?

A. The great factors in environment which interrupt upward race progress are the periods of stress.

Q. How do the internal actions of the vertebrates affect its relations to environment?

A. Every vertebrate is an aggregate whose internal actions are adapted to counterbalance its external actions.

Q. On what does its existence depend?

A. Preservation of its movable equilibrium, and hence existence depends upon its development and proper number of these actions.

Q. How may movable equilibrium be ruined?

A. When one of these actions is too great or too small and through deficiency or need of some organic or inorganic cause in its surroundings.

Q. How can individuals adapt themselves to tnese changed influences?

A. In two ways, either directly or by producing new individuals who will take the place of those in whom the equilibrium has been destroyed.

Q. Why?

A. Since forces exist preservative and destructive to the race.

Q. If these two forces do not counterbalance, how is equilibrium established?

A. Since it is impossible that these two varieties of forces should counterbalance, it is necessary that the equilibrium should re-establish itself in an orderly way.

Q. What are these two preservative forces?

A. The impulse of every individual to self-preservation, and the impulse to the production of other individuals. These must vary in an inverse ratio, and the former must diminish when the second increases.

Q. What does degeneration constitute?

A. A process of disintegration.

Q. What term might be applied to all processes which complete and sustain life?

A. Individuation.

Q. What aids the formation and development of new individuals?

A. Generation.

Q. Are these terms necessarily antagonistic?

A. Yes.

Q. Do vertebrate embryos at the outset assume a common form?

A. Yes.

Q. What results from this?

A. Supernumerary organs and the repetition of teratologic types in vertebrates. The higher vertebrate embryo contains in essence the organs and potentialities of all the lower vertebrates. Under the influence of heredity or accidental defect an organ or structure or function constant in a species may be lacking in an individual without the necessity of explaining the immediate effects by distant atavism.

Q. What may varying environment stimulate?

A. These embryonic potentialities at the expense of the later acquired and more typic human organs.

Q. What is an application of this principle?

A. The Cohnheim theory of cancer.

Q. What is the law of economy of growth?

A. A fixed supply of nutriment, resulting in a struggle for existence on the part of the organs and structures. While determination by heredity exists there are always surrounding forces necessary, not simply the condition of activity by an essential element of the final product. There results an internal or physiologic struggle for existence between the organs, the cells and protoplasmic molecules of the organism.

Q. How does this unsimilarity of parts affect heredity?

A. It makes it impossible to establish laws which shall govern details of function as to the last cell or molecule, since in any army the commander-in-chief does not give a special order beforehand affecting every private in the ranks.

Q. Must there be potentiality of adaptation to surroundings?

A. Yes.

Q. What principle lies back of all development of tissues or organs?

A. Over-compensation of what is used, a quality which permits self-regulation and is rarely a necessary pre-condition of life.

Q. What does living matter present?

A. An external continuity in spite of change of condition.

Q. If the assimilation is not in excess, what happens?

A. If less than consumption, the organism comes to an end itself.

Q. If equal conditions result, what takes place?

A. Change and nourishment will fail, or injurious events will cause destruction.

Q. How can continuance be assured?

A. When more is assimilated than is consumed.

Q. Give an example.

A. Fire assimilates more than it uses, therefore it always has energy left over to kindle new material.

Q. Do organs assimilate more than they consume?

A. Yes. But they do not turn all they use to assimilation; energy remains over by which the process performs something.

Q. What does this work-product control?

A. Excessive assimilation, which otherwise would come to an end by not having sufficient material to assimilate.

Q. What are the more complex processes of life?

A. A radiation of assimilation, which although not identical with combustion is similar to it, the load which it carried favoring its continuity.

Q. How does this radiation load or over-product become directed?

A. By natural selection to keep up a supply of food, primarily by moving the assimilating mass.

Q. Is performance of function over and above assimilation a condition of continuous assimilation, and vice versa?

A. Yes.

Q. Is there an inverse relationship between growth and product?

A. Yes.

Q. Of what does the course of development consist?

A. In properly directing the work-products.

Q. What does this represent so far?

A. Merely a continuous productibility of function in connection with assimilation.

Q. A productibility which is stored up and discharged by an outer stimulus of environment will produce what?

A. It will be more economic, and give rise to what is known as reflex excitability.

Q. What happens when this reflex product dominates according to circumstances?

A. Function will sometimes be greater or less.

Q. What will happen under these conditions if assimilation continues?

A. There must sometimes be an overplus, sometimes a balance, and sometimes an excessive function, death, and their elimination.

Q. What must be done to avoid this last?

A. It is necessary that assimilation should depend upon use or upon stimulus which use calls forth.

Q. From the psychic side, stimulus is recognized as what?

A. Hunger.

Q. What is this kind of process where stimulus is an indispensable factor?

A. It is more special and limited than the more general process of assimilation plus movement, etc., but has characteristics which favor it greatly in the struggle for existence.

Q. How is the greatest saving of material obtained?

A. By the most complete self-regulation of functionation.

Q. What becomes of the parts that are used?

A. They are strengthened and grow.

Q. What becomes of the parts that are unused?

A. They degenerate and the material for their sustenance is saved?

Q. How does the union of the greatest economy with the highest functioning of the whole affect the parts?

A. At the cost of the independence of the parts.

Q. What is the result of differentiation?

A. Senescence, in which the parts exist merely on account of the function which they perform for the whole.

Q. What fact allows a fresh start in development?

A. The senescing organ withers and may even descend in this condition from generation to generation.

Q. What is the progress of the organism during life?

A. The organism moves from a more general, more easily impressible, condition to one more perfectly mechanized. Through a long period it becomes, through the continuous working of a given stimulus, more completely adapted to itself and also more differentiated, and thereby more stable, so that an always increasing opposition is formed to the additional development of new forms and characteristics.

Q. Does the law of economy of growth hold good?

A. Not only as an organic unit but as a compound organism even as a social unit.

Q. What is degeneracy?

A. Degeneracy is a gradual change of structure by which the organism becomes adapted to less varied and complex conditions of life.

Q. What is elaboration?

A. It is a gradual change of structure by which the organism becomes adapted to more varied and complex conditions of existence.

Q. What occurs in elaboration?

A. There is a new condition of form corresponding to new perfection of work in the animal mechanism.

Q. What, in degeneracy?

A. In degeneracy there is a suppression of form corresponding to the cessation of work.

Q. Are elaboration and degeneracy ever found in one individual?

A. Elaboration of some one organ may be a necessary accompaniment of degeneracy in all the others.

Q. Does this often occur?

A. It is very generally the case.

Q. When can the individual be regarded as an instance of degeneracy?

A. Only when the total results of the elaboration of some organ and the degeneracy of others is such as to leave the whole mass in a lower condition, that is fitted to less complex action and reaction to its surroundings than is the type.

Q. Since degeneracy is a process of evolution, leading to alteration of form because of cessation of inhibition in certain directions resultant on diminished work, what follows?

A. Since diminishing functionating precedes change of structure, increased functionating must check the change of structure in its biologic stage.

Q. Why do the degenerate races sometimes rise higher in evolution?

A. Because of the utilization of the beneficial varieties due to degeneracy.

Q. Why is the influence of this principle increased?

A. Because the majority of children of degenerates inherit a tendency to degeneracy rather than degeneracy itself.

Q. Can structural elaboration due to degeneracy be retained?

A. It is evident that structural elaboration due to degeneracy may be retained while the degenerate structures resume their higher functions.

Q. Upon what do intra-uterine periods of stress depend?

A. Since certain parts disappear in the evolution of organs, and certain organs during the evolution of organisms, and since the disappearance and developing tendency must center around the time when certain functions will be lost by the disappearing and others gained by the developing, periods of stress must occur, around which the law of economy of growth will center, the struggle for existence between the parts of organs and between the organs.

Q. When are the struggles for existence on the part of the different organs and systems of the body most intense?

A. During the periods of intra- and extra-uterine evolution and involution.

Q. When are these periods?

A. During the first dentition, during the second dentition (often as late as the thirteenth year), during puberty and adolescence (fourteenth to twenty-fifth), during the climacteric (fortieth to sixtieth), when uterine involution occurs in women and prostatic involution in man, and finally, during senility (sixtieth and upwards), mental or physical defects may occur, a congenital tendency to which has remained latent until the period of stress.

Q. When systematic balance, the result of evolution, is disturbed by change in environment, what takes place?

A. The organs do not pursue their usual growth.

Q When are such disturbances apt to occur?

A. They are peculiarly liable to occur during periods of stress, because of the then varying relation of the different organs.

Q What is the weight of the brain during the first extra-uterine period of stress between birth and three months?

A. It is one-fifth the weight of the body, while in the adult it is but one thirty-third.

Q. How does the brain grow during the first six months?

A. It doubles in weight.

Q. What would be the effect of stress during this period?

A. Under the law of economy of growth, it would either be felt in diminution of quality or quantity of the brain or the preservation of these at the expense of more transitory structures.

Q. What structure would be likely to become involved?

A. The jaws, alveolar process, and teeth.

Q. During the period between two years and six, what would take place?

A. The same factors, to a lessened degree, are present, while between seven and fourteen the brain has quadrupled in weight.

Q. What is the size of the heart at birth?

A. It is small, relatively to the arterial system, but this disproportion gradually disappears until at puberty, when the relation is changed.

Q. What advantages has a heart relatively larger in regard to the blood vessels?

A. The higher the blood pressure, the earlier, stronger and more complex the development of puberty.

Q. What is the weight of the heart from birth onwards?

A. It increases twelve and one-half times.

Q. What occurs from strain during this period?

A. Strain interfering with heart growth would either affect it,or under the law of economy of growth the more transitory structures for its benefit.

Q. What do periods of stress resemble?

A. To a certain extent periods of stress resemble ancestral states.

Q. Do these periods summarize ancestral progress?

A. Yes. Evolution may take place without leaving traces of the various stages.

Q. Where is this most noticeable?

A. In complex organs which have been produced by many lines of evolution converging in a single structure; a structure which thus becomes the seat of a special function or set of functions.

Q. Give an example.

A. The neuron, for instance, the nerve-cell unit of the human brain cortex, passes successively through stages corresponding to those which are to be found in adult fish, frog, bird, and mammal.

Q. Wherein does development appear?

A. In an increasing complexity of the cell, with no formation of unnecessary rudimentary parts.

Q. Does this appear in man?

A. Yes. When the human brain development is compared with the probable ancestral stages evident in the vertebrate series.

CHAPTER V.

DEVELOPMENT OF THE CRANIUM AND FACE.

Q. How is the human skull developed?

A. It has a double origin. There are really two skulls, one inside of the other.

Q. Were these originally distinct?

A. Yes, but in the process of evolution the union between them became more and more intimate.

Q. Wherein is this development evident?

A. In the changes which embryologically occur in man.

Q. What is the primary skull?

A. It is practically an extension of the vertebræ, which send out side growths to cover the brain, as the backbone covers the spinal cord.

Q. Describe this process.

A. The primary skull extends in front of the notochord (the spinal cord of the human embryo and the permanent spinal cord of the lancelet), where it gives off two trabeculæ cranii (front skull plates). Behind it, the primary skull or chondrocranium gives off two occipital or rear skull plates. It also gives off two plates (midway between the trabeculæ and occipitals), which, as they gradually enclose the primitive hearing apparatus (the otocysts, permanent in fish and embryonic in man) are called periotic capsules.

Q. What is the nature of this primary skull?

A. It is at first cartilaginous, as in sharks.

Q. What occurs in consequence of increase in the size of the brain in evolution and in human embryology?

A. This cartilaginous primary skull becomes insufficient to roof over the brain, and thus are produced the gaps called fontanels, which are the result of failure of the chondrocranium (primary skull), to cover the gains of the nervous system in the struggle for existence.

Q. How is this deficiency overcome?

A. The skin of the mammal retained a bone making function inherited from the reptiles and bony fishes.

Q. How were these cavities filled?

A. With dermal bones, which, at first serving merely as armour in the skin of the head, came ultimately to be protectors of the nervous system.

Q. What bones represent the dermal bones in the embryonic human skull?

A. The frontals, whose sutures normally disappear in the adult, so that the forehead seems to be but one bone. This union may not occur when, as in the case of the philosopher Kant, the frontal suture remains during life. The sutures are replaced by solid bone through synostosis. In the frontal bone, synostosis is normal, and in the line of advance. Elsewhere in the skull it is often an expression of a premature senility that may give rise to various cranial states either absolutely degenerate in type or degenerate only when present in certain races. The parietals and interparietals are dermal bones so united by synostosis as to form the parietals or side bones of the normal adult skull.

Q. What other bones of the head are dermal bones?

A. The nasal bones, which, together with the vomer, form the nose, are likewise dermal bones, and so are the pterygoids and palatines. The maxillaries and præmaxillaries, which (with the mandibles) form the jaws, are dermal bones. The mandibles are in part derived from the chondrocranium.

Q. What becomes of the mouth cavity in the head bend of the embryo?

A. It is brought between the forehead and the heart and upon the ventral surface.

Q. Upon what does the development of the face depend?

A. The enlargement and fusion of the mouth and nose cavities, and upon the later partial separation of the nose and mouth and nose cavities, leaving the posterior nose open.

Q. On what does it depend further?

A. The growth and specialization of the face region, of which elongation is the most prominent indication, and finally upon the development of a prominent external nose.

Q. What takes place when the medullary tube of the notochord enlarges to form the brain?

A. The head bends over to make room for that enlargement.

Q. What becomes of the mouth plate in the bending of the head?

A. The mouth plate, which is to be the mouth, is carried over to the front of the head.

Q. What changes take place in the development of the mouth cavity?

A. The growth of the brain and increase in size of the heart cavity, which expands in front, leaving the mouth cavity between them.

Q. What does the mouth cavity represent?

A. Two gill-slits united in the front line.

Q. How is the nose formed?

A. The nose is formed from two olfactory plates, situated just in front of the mouth, and in contact with the fore brain.

Q. How do these olfactory plates grow?

A. They grow in size by the increase of tissue, and the resulting pits pass away from the brain.

Q. With what do these pits communicate?

A. Freely with the mouth.

Q. What do the nasal processes include?

A. The origin of the future nose and the future intermaxillary region of the upper lip.

Q. How are the nasal pits developed?

A. By the upgrowth of the ectoderm and mesoderm and the olfactory plate.

Q. Where does the upgrowth take place?

A. On the medial, upper and lateral side of each plate, and hence forms two pits with a partition (the future nasal septum) between them.

Q. How do the nasal pits communicate?

A. Along their whole lower side, directly with the mouth cavity. The nasal pit is at first very shallow.

Q. How many changes are there during their growth?

A. Two. First, growth of the tissue occurs around the olfactory plate, and then the pits migrate away from the brain.

Q. How are the nasal pits separated?

A. By a projecting mass of tissue, called the nasal process, which includes the partition between the two nasal chambers in outline of the future nose and of the future intermaxillary region of the upper lip.

Q. Where does the maxillary process extend?

A. Between the mouth and eye, toward the nasal pit, and by joining the rounded end of the nasal process, begins the separation of the nasal and buccal chambers and completes the upper border of the mouth.

Q. What takes place as development proceeds?

A. The lateral ridge grows forward and covers in the nasal pit from the sides, forming the outline of the wing of the adult nose. There are now two external nares.

Q. Do the nasal chambers enlarge?

A. They enlarge as the whole face enlarges, and occupy an increasing space, opening widely into the mouth cavity above the palate split.

Q. From what is the so-called labyrinth of the nose formed?

A. From the nasal pits proper.

Q. When does it begin to develop?

A. It begins with the appearance (third month of embryonic life) of three projecting folds on the lateral wall of each nasal chamber.

Q. What are they called?

A. Upper, middle, and lower turbinal folds. They very early contain cartilage.

Q. How does the formation of the labyrinth advance?

A. By the formation of the outgrowths, which become the ethmoidal sinuses by the appearance, during the sixth month, of the antrum of Highmorii, or expansion of the nasal cavity into the region of the superior maxillary, and finally by evaginations to form the sphenoidal and frontal sinuses, which, however, do not arise in man until after birth. The separation of the olfactory plate from the brain does not take place until the olfactory ganglion develops from the epithelium.

Q. When does the separation of the olfactory plates from the brain take place?

A. Not until the olfactory ganglion develops from the epithelium. The fibers lengthen, the olfactory and neural epithelium separate and finally osseous cribriform plate is developed between them.

Q. When does the external nose develop?

A. Toward the end of the second month of embryonic life, by a growth of the nasal process.

Q. What is the shape of the external nose at the third month of embryonic life?

A. It is at first short and broad, having very nearly the shape which is permanent in certain negro races. Later the external nares and wings of the nose are carried forward with a general nasal upgrowth.

Q. What takes place as soon as the external nose is separated from the mouth?

A. There is a partition between the nasal pits and the mouth.

Q. How is the upper part of the mouth covering formed?

A. The partition in which the intermaxillary bone is differentiated later, is supplemented by another partition, the true palate, which shuts off the upper part of the mouth cavity from the lower, thus adding the upper part of the nose chambers.

Q. What is the palate?

A. It is a secondary structure, which divides the mouth into an upper respiratory passage and a lower lingual or digestive.

Q. How is the palate developed?

A. The palate arises as two shelf-like growths of the inner side of each maxillary process and is completed by union of the two shelves in the median line.

Q. How are these arched?

A. So as to descend a certain distance into the pharynx.

Q. Are these growths arrested?

A. Yes, though they may be still recognized in the adult.

Q. Where do the palate shelves continue growing?

A. In the region of the tongue, which, rising between them, seems in sections which pass through the internal nares, to be about to join the internasal septum.

Q. What becomes of the tongue as the lower jaw grows?

A. The floor of the mouth is lowered, and the tongue is thus brought further away from the internasal septum.

Q. What becomes of the palate shelves?

A. They take a more horizontal position and pass toward one another, above the tongue, and below the nasal septum to meet in the middle line, where they unite.

Q. How do the shelves unite?

A. From their original position, the shelves necessarily meet in front toward the lip first, and unite behind toward the pharynx later.

Q. What time do they unite in the human embryo?

A. Union begins at the eighth week, and is completed by the ninth for the hard palate, and by eleven weeks for the soft.

Q. Where do the palate shelves extend?

A. Back across the second and third brachial arches.

Q What time does the uvula appear?

A. During the latter half of the third month, as a projection of the border of the soft palate.

Q. When does the nasal septum unite with the palate?

A. Soon after the palate shelves have united with one another, the nasal septum unites with the palate also, and thereby the permanent or adult relation of the cavities are established.

Q. What value is degeneracy of the face?

A. The fact that the human face is modified backward from the vertebrate type excellently illustrates the degeneracy of a series of related structures for the benefit of the organism as a whole.

Q. Why is the process of development of the vertebrate face checked in man?

A. Because the upright position renders it unnecessary to bend the head, as in quadrupeds, and because the enormous cerebral development has rendered an enlargement of the brain cavity necessary.

Q. How has this taken place?

A. By extending the brain cavity over the nose region as well as by enlarging the whole skull. Because development of the face is arrested at an embryonic stage. The production of a long snout is really an advance of development, which does not occur in man.

Q. What depends upon the variations of the dermal bones?

A. Not only the race variations in skull and jaw types, but also the variations produced by agencies acting on the individual during the periods of bodily stress and by the degenerative influences.

Q. What do craniologists generally assume?

A. Two fundamental skull types, dolichocephalous, or long-headed, and brachycephalous, or round-headed.

Q. How are these types determined?

A. By the so-called cephalic index, which is determined by the relation of the antero-posterior diameter (measured from the glabella to the farthest point of the occiput) to the transverse diameter from side to side. The former being taken at 100, the latter will range from about 60 to 95, or even more, increasing with the greater degree of brachycephaly and vice versa.

Q. What are the extremes, excluding artificial deformities?

A. Excluding artificial deformation, the extremes appear to lie letween 61.9 (Fijian, measured by Flower) and 98.21 (a Mongolian, described by Huxley). This last approaches the perfect circle, which is never presented by the normal head, though exceeded (103-105) by pathologic, teratologic or deformed specimens.

Q. What are most people now?

A. Most people are now mesaticephalous and hence of mixed descent.

Q. When did race intermingling begin?

A. In the neolithic period.

Q. Is the horizontal index greater or less than it was?

A. It is considerably less in the primary than in the secondary divisions of mankind.

Q. Are there exceptions?

A. The alleged normal dolichocephaly of African negroes has numerous exceptions. The Eskimo, who seemingly ought to be brachycephalic, are extremely dolichocephalic.

Q. To meet the endless transitions between the two extremes, what table did Broca devise?

A. 1. Dolichocephali, with index No. 75 and under.
2. Sub-dolichocephali, with index No. 75.10 to 77.77.
3. Mesaticephali, with index No. 77.78 to 80.
4. Sub-brachycephali, with index No. 80.10 to 83.83.
5. Brachycephali, with index No. 83.34 upwards.

Q. What cranial measurement is of great importance to the dentist?

A. That which determines the varying gnathism or greater or less projection of the upper jaw, which depends upon the angle made by the whole face with the brain cap.

Q. How is this applied?

A. The more obtuse the angle the greater will be the maxillary projection (prognathism), the more vertical the face the less the projection (orthognathism); hence gnathism (best seen in profile), as indicated by the facial angle, is accepted by anthropologists as a race criterion.

Q. What has been the effect of evolution upon the face?

A. The evolution (intimately associated with the dentition and change from raw to cooked food) has been from the extreme projection of the higher apes and of primitive man to the seemingly vertical position of the Mongolic and Cau casic groups.

Q. What does prognathism and orthognathism indicate?

A. Prognathism is hence characteristic of the lower and orthognathism of the higher races.

Q. Give an illustration.

A. The profile of the Calmuck face is almost vertical, the facial bones being thrown downwards and under the forepart of the skull. The profile of the face of the negro is differently inclined; the front part of the jaws projecting far forward beyond the level of the fore part of the skull. In the former the skull is orthognatous, or straight-jawed, in the latter it is prognathous.

Q. What other features have been added?

A. Combining this feature with eurygnathism (that is, lateral projection of the cheek bones) the Caucasic face is oval with vertical jaws, the Mongolic broad (eurygnathous), the negro prognathous, and the Hottentot, both pro and eurygnathous.

Q. How does Topinard distinguish between a superior and anterior angle?

A. The former (general facial gnathism) is fallacious as a guide; the latter (that is, sub-nasal gnathism,) being trustworthy.

Q. How have anthropologists erred?

A. By giving so much importance to the projection of the whole maxilla, or the whole face. There is no uniformity of results in a given case. The most flagrant contradiction occurs between averages in allied races.

Q. What is the best method of measurements?

A. The sub-nasal, or true prognathism, furnishes the differential character of the various human types.

Q. How are these determined?

A. By the angle formed by a line drawn from the nasal spine (sub-nasal point) to the anterior extremity of the alveolo-condylean plane.

Q. What does this plane give?

A. The total projection of the skull is about parallel with the horizontal line of vision, coinciding with a line drawn from the alveolar point (medium point of the alveolar arch) at right angles to a perpendicular line falling from the occipital condyles.

Q. Give a few illustrations?

A. Individual extremes, 89 to 51.3.
White races, 82 to 76.5.
Yellow races, 76 to 69.5.
Black races, 69 to 59.5.

Q. What does this indicate?

A. From this it is evident that absolute orthognathism does not exist.

Q. What is the gnathism of most of the races?

A. All are more or less prognathous, the European least, the negro most, the Mongol and Polynesian intermediate. In Europe the most orthognathous were the Gauls, Corsicans and Neolithic men. The Finns were the least.

Q. What does orthognathism mean in anthropology?

A. As the term is used in anthropology, it simply applies to the sub-nasal type.

Q. What other factors in dentistry must be taken into account?

A. The relation of the inferior maxilla must likewise be taken into consideration, since around this turns the struggle for existence between the jaws and teeth.

CHAPTER VI.

DEVELOPMENT OF THE JAWS.

Q. Where does the vertebrate mouth belong in the primitive stage?

A. On the under side of the head.

Q. How do constitutional disorders and infectious diseases influence growth and development of the maxillaries?

A. The hypophysis, or pituitary body, has much to do with the osseous development of the body. If it be affected, anomalies result.

Q. How does this affect the jaws?

A. Since the face, including the jaws, are transitory structures, changed glandular action may produce either excessive or arrest of development.

Q. To determine jaw width, where are measurements taken?

A. From the outer surface of one first permanent molar to the outer surface of the other.

Q. Why at that locality?

A. Because the first permanent molar erupts at the sixth year. It is developed independently of the other teeth. It is a fixture in the jaw, and it gives the most accurate width, being situated midway from before, backward.

Q When are the best results obtainable?

A. Between twenty-five and thirty-five.

Q. Why?

A. Because the jaws, like the rest of the body, continue to grow until that period.

Q. Why is such a wide distinction made in the ages?

A. A normal, healthy individual usually obtains his growth at twenty-five. A neurotic or degenerate may not obtain his growth until thirty-five.

Q. What instrument is used to obtain these measurements?

A. The ordinary mechanical callipers.

Q. Do jaws differ in size in different races and peoples?

A. Yes.

Q. Why?

A. All things considered, the size of the jaws correspond with the size of the bony framework. This, however, only holds true so far as the primitive races are concerned.

Q. How about modern and mixed races?

A. Owing to inheritance, to disease, to climate, soil, and environment changes, excessive and arrested development occurs, modifying the size of the jaws.

Q. Give examples.

A. The jaws of the European races are larger than those of the European-American. The jaws of the American Indian are larger than those of the English or American. The jaws of peoples living in the older parts of the American Continent are smaller than in the newer parts.

Q. Of what does the antero-posterior diameter consist?

A. The distance at the median line from a line drawn across from the posterior surface of the last molars to the anterior alveolar process between the central incisors.

Q. How do the jaws of the female compare in size with those of the male?

A. Those of the female are smaller.

Q. How is room secured for the eruption of the second and third molars?

A. The development of the jaws is from before, backward.

Q. What effect has human evolution upon the jaws and face?

A. It arrests development. The jaws are growing shorter.

Q. Under what circumstances does marked arrest take place?

A. In cases where there is an unstable nervous system. It also frequently occurs from exanthematous diseases.

Q. What local condition will arrest jaw development?

A. Premature extraction of the first permanent molars.

Q. What effect does this have upon the jaws?

A. The jaws shortening naturally from an evolutionary standpoint, and developing backwards sufficiently merely to receive the second and third molars, the removal of the first permanent molar allows the second and third (should there be one) to move forward.

Q. What other local conditions will arrest jaw development?

A. When the child inherits small teeth from one or the other parent, or when the child, owing to disease, develops teeth smaller than normal.

Q. Under what conditions do the jaws differ in normal individuals?

A. Two types of jaws are observed: in brachycephalic the broad, square jaws; in dolichocephalic, the long, narrow jaws.

Q. Do these comparisons always exist?

A. No. Only in relatively pure races.

Q. Why not?

A. Because the tendency of both extremes is towards the mesocephaly. Should a long-headed person marry a round-headed individual, the offspring might have a round head and long jaws, another a long head and a square jaw.

Q. What is the law of economy of growth?

A. It is that law whereby an organ or structure is sacrificed for the benefit of the organism as a whole.

Q. Give illustrations.

A. The vermiform appendix was much larger and longer in lower mammals. It was used to assist vegetable digestion. Now it is not required, and is disappearing. The muscles of the ear are largely developed in the lower animals to move the ear in different directions. In man they are not required. The jaws and teeth in early races were used for grinding foods. Now food is cooked soft. Large teeth and jaws, with powerful muscles, are not required. In these cases and many others under this law, unnecessary organs and structures are disappearing.

Q. Do the jaws of peoples whose ancestors have long lived in a given environment differ in size?

A. They do not.

Q. Why?

A. Because they are reduced almost to their lowest size without causing deformity.

Q. What difference exists between jaws of ancient Britons and Romans and those of modern English and Italians?

A. There is from .24 to .36 of an inch difference.

Q. How do the New England jaws differ from English?

A. The English jaw is relatively smaller.

Q. How is development harmonizing the long diameter of the teeth with the size of the jaw?

A. By reducing the size of teeth or causing their disappearance.

Q. In primitive races is the third molar well developed?

A. It is. It also has ample room.

Q. How is the alveolar process assisted in development?

A. When all the teeth are in the jaw, they wedge the alveolar process outwards, thus expanding it.

Q. Is the third molar larger or smaller in the Orang, or Chimpanzee, than in man?

A. Larger.

Q. How is it in man?

A. The reverse. The first molar is largest, and they decrease in size from before, backwards.

Q. Is the loss of teeth often in harmony with arrested jaw development?

A. It is not.

Q. What is one of the great causes of arrested jaw development?

A. Disuse, which prevents blood from being carried to the parts for nourishment.

Q. How do the two jaws differ in this respect?

A. The upper jaw is more frequently arrested, owing to the fact that it is a fixed bone.

Q. Under what circumstances are the jaws liable to become excessively developed?

A. In neurotics and degenerates the nervous system is unstable, thus carrying more than the usual amount of nourishment to the parts.

Q. Which jaw is the most liable to become excessively developed?

A. The inferior maxilla, because it is mobile.

Q. When the inferior maxilla is developed in excess of the superior, what mistake is sometimes made by the dentist?

A. It is supposed that the patient has "jumped the bite."

Q. Are teeth more liable to decay upon the upper jaw than upon the lower?

A. Yes.

Q. Why?

A. Because the upper is degenerating faster than the lower.

Q. Is degeneracy (or arrest of development) of the jaws and teeth a cause of decay?

A. Yes. It is the principal cause. In the evolution of tooth structure, the closing of the apical end of the root, the malformation of tooth structure cuts off nourishment, and with the lost art of mastication, tends to produce malnutrition.

Q. How do these conditions mentioned hasten decay?

A. Defective enamel and low vitality allow lactic acid ferments an easy prey upon tooth structure.

Q. Do constitutional conditions produce marked effect upon the teeth?

A. They do. Syphilis, tuberculosis, pregnancy, Bright's disease, and all diseases with disturbances in nutrition, as well as senility, predispose to tooth decay.

Q. If evolution of the jaws and teeth be underlying cause of tooth decay, then do marked differences result in decay of individual teeth?

A. Yes. Because of the fixedness of the upper jaw and its proneness to degeneracy, these teeth are more susceptible to decay, according to Magitot, in the proportion of 3.2, according to Hitchcock 1.9, or very nearly two to one.

Q. How about the teeth on each jaw?

A. The molars are more liable to decay than the bicuspids, the bicuspids than the cuspids or incisors. The evolution of the jaws and the lost art of mastication directly affect the molars or grinding teeth first.

Q. Is it true that if a tooth remain in the jaw before it erupt, the longer will the individual have it, and the stronger will the tooth become?

A. This is but partially true. Thus degenerate conditions and loss of the third molars are along the line of evolution. Owing to its degeneration, its vitality is reduced, and it almost always decays early. Its power of resistance depends much upon its shape and number of roots, meaning blood supply.

Q. Does the mechanical arrangement in the eruption of the teeth and the movement of the jaw assist in enlargement?

A. It does. Thus want of mastication, as in idiots, may cause arrest of development and irregularities of the teeth.

CHAPTER VII.

DEVELOPMENT OF THE ALVEOLAR PROCESS.

Q. What is the alveolar process?

A. It is the part of the jaw bone that contains the teeth.

Q. Where is it located?

A. Upon the upper border of the inferior maxilla and upon the lower border of the superior maxilla.

Q. How does it differ from the jaw bone proper?

A. The jaws proper are composed of dense, hard bone structure, which remain throughout life for the purpose of attachment of muscles, while the alveolar process is made up of cancellated bone structure, which comes and goes with the teeth.

Q. When does it first make its appearance?

A. When the first teeth erupt.

Q. What becomes of it when the first teeth are shed?

A. It absorbs away.

Q. When does it reappear?

A. When the permanent teeth erupt.

Q. Does the process always follow the teeth?

A. Yes. No matter how irregularly they may erupt, the process builds itself about the roots of the teeth.

Q. Do alveolar processes differ in length and width?

A. Yes. The length of the alveolar process depends upon the length of the roots of the teeth, and the length of the rami. The teeth continue to erupt until they reach occlusion. The width also depends upon the length of the rami; if short, the alveolar process is short and thick.

Q. What causes some small vaults to be high and others low?

A. The length of the alveolar process.

Q. Is the process between the teeth growing thinner?

A. It is. This is due to the change in the shape of the crowns of the teeth. Once they were bell-shaped, now they are almost straight, thus lessening the width of the septum.

Q. Of what is the alveolar process composed?

A. The alveolar process is composed of a fibrous mesh, filled with lime salts, loosely put together. When treated with acids, the lime salts are destroyed. When treated with heat, the fibrous tissue is removed. In both cases the shape of the structure is retained.

Q. How are the teeth held in position?

A. By a process called gomphosis, which resembles the attachment of a nail in a board, by their exact adaptation to the tissue. When bent or irregular, they receive support from all sides, and by the peridental membrane.

Q. Does absorption of the alveolar process occur when the teeth are in position?

A. Yes. Sensile absorption, or osteomalacia, may occur at any period after the person has obtained his growth. Should man live long enough, he would lose his second set of teeth normally.

Q. What becomes of the alveolar process after the second set of teeth are removed?

A. The process absorbs entirely away.

Q. When the dental arch expands, does the alveolar process move?

A. Yes, to a certain extent. When teeth are regulated, the process will move and build about them to a limited extent.

Q. Does the alveolar process vary in position?

A. Very materially. The eruption of the teeth is purely mechanical, depending upon the number and size of the jaw bone and manner of eruption. The position and shape, therefore, depends entirely upon the shape assumed by the teeth.

Q. Will the alveolar process develop if the teeth are not present?

A. It will not.

Q. Is there excessive and arrested development of the alveolar process?

A. It is very common. Owing to the transitory nature of this structure, it is easily affected by nutrition changes. A normal development is noticed when one or more teeth do not antagonize with those on the opposite jaw. The alveolar process will lengthen until they meet resistance. Arrest of development is noticed in cases of rickets, hydrocephalous, anæmia, syphilis, tuberculosis, etc.

Q. Is excessive development frequently observed in degenerates?

A. Yes. Owing to the unstable nature of the nervous system, the alveolar process is easily affected.

Q. When is hypertrophy found?

A. It is very common among neurotics and degenerates. It may affect only one tooth, such as the third molar, or one side of the mouth, or the entire alveolar process may become involved.

Q. How does the alveolar process appear under the microscope?

A. Not unlike bone. It contains Haversian canals of two kinds, one with the regular lamellæ system surrounding it, the other the small vessels of Von Ebner, which have no surrounding lamellæ.

Q. Describe them.

A. The Haversian canals are large, round, smooth spaces, containing a single artery. The dark spots circling each are the lacunæ. The thread-like spaces are canaliculi, which run from one lacuna to another, and from one Haversian canal to a lacuna. The spaces between are filled with lime salts. The vessels of Von Ebner are little blood vessels, running in all directions and penetrating the layer of bone. They are for the purpose of nourishing the bone structure.

CHAPTER VIII.

DEVELOPMENT OF THE VAULT.

Q. What names has the roof of the mouth?

A. The arch, the dome, the palate, the vault.

Q. Which is the most common?

A. The arch.

Q. Why should this term not be used?

A. Because it conflicts with the use of the established term, dental arch. When speaking of a V, or saddle arch, the dental and not the roof of the mouth is meant.

Q. What are better terms?

A. The vault, or palate.

Q. What constitutes the vault?

A. The vault is composed of the hard and soft palate and the alveolar process.

Q. Of what does the hard palate consist?

A. The hard palate consists of two horizontal plates of bone extending from the superior maxillary bones upon either side, and uniting at the median line, and from the anterior alveolar process in front, it extends back and unites with the soft palate.

Q. What bones constitute the vault?

A. It is composed of two incisive bones, two palate plates of the superior maxilla and two horizontal plates of the palate bones.

Q. At what period does ossification of the median suture occur?

A. It varies in different individuals, sometimes as early as the third and fourth years, and in neurotics and degenerates as late as the fifteenth and sixteenth years.

Q. How can this wide difference in years be determined?

A. In widening the arch by the jack-screw, or other means. It is not uncommon to open the suture in children from fourteen to sixteen years of age.

Q. Is this detrimental to the operation?

A. No. It is of great advantage. It produces greater harmony in appearance with very little expense to the tissues.

Q. What two cavities does the vault separate?

A. The mouth and nasal cavities.

Q. With what structure is the vault connected?

A. The alveolar process.

Q. What bones are connected with the upper border of the vault?

A. The nasal bones and vomer.

Q. Describe the vomer.

A. This bone is situated (in its normal position) in the center of the nose, extends from before, backward, the entire length of the vault. It divides the nasal cavity into two complete cavities. The bone is thinnest at the median line. As it extends downwards it thickens. When it reaches the floor of the vault it gracefully curves to the right and left, making a broad foundation for the superior structure to rest upon.

Q. Describe the surface of the vault.

A. The palatal surface is very uneven; at the suture is often found a ridge of bone resembling a rope-like section, extending a short distance, or, in some cases, the entire length.

Q. In what people are these irregularities found most frequently to-day?

A. Among people whose nervous systems are unstable.

Q. What do they seem to be?

A. Exostoses of the bone along the line of the suture, due to irritation in mastication before ossification takes place.

Q. Is there evidence of atavism?

A. In lower animals, such as the hare and the camel, there is a permanent slit in the lip. The tendency to cleft-palate is also an atavistic condition. The ossification of this suture, therefore, is very unstable in character. The result is, therefore, a tendency to late ossification, resulting in exostosis.

Q. What covers the vault upon both surfaces?

A. Both surfaces are covered by mucous membranes. They extend backward and form the soft palate.

Q. Does the hard palate vary in thickness?

A. Yes. When it unites with the alveolar process it is quite thick, and also at the median line; while about midway between, and at the posterior surface, it is as thin as tissue paper.

Q. How does the soft palate differ in different individuals?

A. In a dolichocephalic head the soft palate will curve slowly backward, thus giving a long sweep from before, backwards. On the other hand, in brachycephalic heads, the soft palate will curve abruptly. In some cases the soft palate will drop straight down, thus limiting the distance from before, backward, the length of the hard palate.

Q. Is the vault in connection with the first teeth ever deformed?

A. Only very rarely and in extreme cases. Until the sixth year the vault is in most cases well formed. The curves are all graceful in outline and the contour of the dental arch is well formed. This could hardly be otherwise, for the reason that the jaw is growing rapidly for the purpose of containing the permanent teeth.

Q. Are any two vaults just alike?

A. They are not. They are neither alike in height, width nor contour, although each may be normal in itself.

Q. How is the vault held in position?

A. On the sides by the walls of the antrum, backed by the malar process, and the alveolar process and maxillary bones.

Q. At what period does the great change take place in the shape of the vault?

A. Between the period when all the temporary teeth are in place and all the permanent teeth have erupted.

Q. Is there not a more definite time?

A. The vault generally makes its greatest change after the eruption of the first permanent molars, and becomes fixed at the time of the eruption of the second permanent molars.

Q. What change takes place?

A. Externally the rami is quite important. If the person is developing normally the rami will grow in harmony with other structures, and the face will elongate. The alveolar process will grow up and down upon the jaws, carrying the teeth with it, until they antagonize. The teeth being larger and the roots longer, the alveolar process lengthens; this makes the vault higher.

Q. Does the angle of the jaw change in other directions?

A. From before, backwards, it grows from an obtuse to a right angle.

Q. How can the height of the alveolar process upon the lower jaw be judged?

A. Early in life the mental foramen is located upon the upper border of the jaws. At the middle life it is situated midway, and sometimes two-thirds below the upper border.

Q. When the rami do not develop in harmony with the other bones of the face, what happens?

A. In neurotics and degenerates there may be arrest and excessive development of the rami, or one side may grow longer or shorter than the other. In such cases there is a marked change in the shape of the face.

Q. What changes take place in the mouth?

A. If the rami do not develop when the first and second molars come into place, the jaws are open in front, the molars only touching. When the mouth is closed, the vault is high. If the alveolar process does not develop, the face is very short, giving a youthful appearance to an adult face. If the rami are long, it gives a long appearance to the face, the alveolar process elongates, and the vaults are always high.

Q. The high vault, then, is not due to its being pushed or pulled up by pressure exerted through the vomer.

A. No, that is a physical impossibility; nor can the shape of the base of the skull in any way affect it.

The height is due entirely to the lengthening of the alveolar process.

Q. What difference is there in the height of vault in children and adults?

A. In 317 children, under five years of age, it measured .17 lowest, .62 highest, with an average of .42 inches. In 4,614 adults, the lowest vault was .21, the highest .84, with an average of .58.

Q. How is this demonstrated?

A. By an instrument made for the purpose. The measurements are taken from the gum margin, at the neck of the second temporary molar, to the center of the vault; in the permanent set at the gum margin, between the second bicuspid and first permanent molar, to the center of the vault.

Q. In comparing the height of vault of present peoples, and those of ancient skulls, how do they differ?

A. They are a little higher than the ancient.

Q. Can any race, sect, or intellect claim a type of vault?

A. They cannot.

Q. What does the width of the vault depend upon?

A. The development of the jaw bone and alveolar process.

Q. After an examination of thousands of skulls, having normal dental arches, and no two alike, how can a normal arch be defined?

A. A normal vault is one where the dental arch is regular, and the different outlines possess graceful curves, regardless of height, width and length.

Q. Are narrow arches found among early races?

A. They are not.

Q. Where are they found?

A. Among modern neurotic people.

Q. What is the direct cause of narrow arches?

A. A neurotic, unstable brain, due to conditions producing arrested development of the jaws. The eruption of the teeth is purely mechanical, wedging their way into place as best they can. The arch becomes broken, and a V or saddle arch, or some one of their modifications, develops.

Q. Does the alveolar process depend upon tooth arrangement for its shape?

A. It does, and in this way the vault becomes narrow, and in a measure gets its shape. The height of vault is of little importance.

Q. In contracted dental arches, may the vaults be high or low?

A. Yes.

Q. Is high vault ever due to contracted jaw?

A. It is not. The vault appears to be high, owing to the contraction of the dental arch and the alveolar process.

Q. On what does the width of the vault depend?

A. On the development of the maxillary bones and alveolar process.

Q. How must vaults be classified?

A. By taking a large number of measurements and obtaining an average.

Q. What was the result?

A. The highest was 1., the lowest .25, with an average of .55.

Q. What would be the average width of vault?

A. By measuring a large number of jaws between the second bicuspid and first permanent molar; maximum, 1.87; minimum, .75, with an average of 1.19.

CHAPTER IX.

DEVELOPMENT OF THE PERIDENTAL MEMBRANE.

Q. What is the peridental membrane?

A. It is a fibrous tissue covering the roots of the teeth and lining the inner walls of the alveolus.

Q. From what layer is it derived?

A. From the mesoblastic layer.

Q. How does it differ from the periosteum?

A. There is very little difference between them; both come from the mesoblastic layer.

Q. Of what does the peridental membrane consist?

A. It consists of four kinds of fibers: an outer layer of coarse, white, fibrous tissue, an inner layer of fine, white fibrous tissue, elastic fibers, and penetrating fibers (fibers of Sharpey).

Q. How do the fibers of the periosteum differ from those of the peridental membrane?

A. Those of the periosteum are coarse, and run parallel with the alveolar process over the border and extend as far as the union of the epithelial layer and the periosteum. [The Dental Ligament. Black.]

Q. Where do the fine fibers extend?

A. They extend in all directions, and enter the alveolar process at every point.

Q. How do they look under the microscope?

A. If a section of the alveolar process be treated with acids, or a section affected with osteomalacia be placed under the microscope, the fibers will be seen to retain the original shape of the bone.

Q. Are the fibers continuous throughout the peridental membrane, alveolar process and periosteum?

A. They are.

Q. Has the periosteum a blood supply?

A. It is very rich in blood vessels. They anastomose with each other and enter the alveolar process in all directions through the Haversian canals and vessels of Von Ebner.

Q. Are they more numerous in this locality than in connection with other bones?

A. Owing to the transitory nature of the peridental membrane and alveolar process, they are.

Q. What function has the peridental membrane?

A. It fills the space between the root of the tooth and the alveolar process, being a cushion for the teeth to rest upon. It is present when the teeth are present to furnish nourishment. It holds the teeth in their sockets.

Q. What other functions have the fibers of the peridental membrane?

A. It is a mesh which holds the lime salts in position.

Q. Where does calcification commence?

A. At the center of the jaw. It gradually fills in until the fibers of peridental membrane become very thin, and in old age it is almost entirely lost.

Q. What are the "fibers of Sharpey?"

A. They are fibers of connective tissue that penetrate radially from the peridental membrane, or periosteum, or outer lamellæ of bone into the deeper layer.

Q. How are the fibers of Sharpey arranged?

A. The fibers extend in all directions, but do not enter, as claimed by Gray, like so many tacks driven into a board, uniformly and regularly. In some localities they penetrate in large quantities, and almost surround a piece of bone; again, a few fibers penetrate only a short distance. In other places they can be traced a long distance.

Q. How do these fibers compare with those in lower animals?

A. They are much finer in man.

Q. Are the fibers elastic?

A. They are. A tooth can be turned half way around by stretching the fibers, without breaking.

Q. When are the fibers most elastic?

A. In youth, becoming less so as age advances, when the membrane grows thinner, and almost a bony union has taken place.

Q. When inflammation sets in, what becomes of the earthy substance?

A. When inflammation sets in as a result of death of pulp or from auto-intoxication, it becomes interstitial in character, and the lime salts are absorbed. Nothing is left but fibrous tissue. This holds the tooth in place, although it moves backward and forward.

Q. Do blood vessels exist in the alveolar process?

A. Yes. Some run in straight from the peridental membrane and periosteum, others run diagonally, others lengthwise. They run in all directions, close to the bone rather than near the root of the tooth.

Q. Why?

A. There are no arteries normally penetrating the sides of the root; nourishment is not required at that part of the membrane.

Q. How may these blood vessels be seen?

A. By injecting the carotid artery of a dog, and placing a section of alveolar process under the microscope.

Q. Are the alveolar process and surrounding tissues rich in vascular supply?

A. Yes. Especially in the young, owing to the transitory nature of the structure.

CHAPTER X.

DEVELOPMENT OF THE TEETH.

Q. What were the teeth at their origin?

A. They were primitive organs of the skin. According to Minot they were placoid scales, which were dermal teeth of the shark.

Q. What became of the scales in the advance of evolution?

A. They became cartilaginous in the human embryo and assisted in development of the skull bones.

Q. What became of them later?

A. They dipped into the epidermis, and calcifying, formed the enamel of the tooth, which fitted around a soft core or pulp. The tooth departs from the primitive method of development since it does not arise from the surface, but deep down in the tissue.

Q. How is the tooth formed?

A. The structure grows down into dermis, forming an oblique shelf, which is a special tooth-forming organ. On the under side of the shelf the teeth are developed the same way as over the skin, although they are very much larger.

Q. Do the teeth develop as in man?

A. They do not They are in various stages of development, and only one is fully exposed at a time. When one tooth has exceeded its usefulness, it falls out and another tooth takes its place. Thus they continue to develop indefinitely.

Q. What is this condition called?

A. It is called polyphyodontia.

Q. How many sets of teeth have mammals, as a rule?

A. Two sets. The condition is called diphyodontia.

Q. How are the teeth united in the shark?

A. By a small plate of dermal bone at the base.

Q. How do the teeth develop in mammals, as a rule?

A. By a modification of the jaws, the epidermis dips down into the dermis, and the enamel is developed. The first indication is a thickening of the mucous membrane at the sixth week of embryonic life. This ridge dips downward from the epithelial cord. This expands, forming the dental shelf. The papilla, comprised of blood vessels and fibrous tissue, develops beneath, taking the shape of the tooth that is to form. The dental shelf forms around the papillæ and forms the enamel.

Q. Where are the dental sacs located?

A At the inner border of the jaw. This gives room for the germs of the second set to develop at the outer border.

Q. Where are the enamel organs for the last molars obtained?

A. The dental shelf is prolonged from the last teeth without retaining the direct connection with the epithelium.

Q. In the order of evolution, how do the teeth evolve?

A. The mammal teeth pass in evolution from the simple types of the oviparous edentates to those of the indeciduous ancestors of the sloths and armadilloes and their descendants, including the dolphin and whales, whose teeth (in the fœtal Greenland whale and adult sperm) preserve the old type. In the edentates these teeth may be few; in insectivorous mammals, approximating those of the reptilian in number, sixty or seventy on a side.

Q. How are the human teeth evolved from the primitive cone tooth?

A. They are evolved by both concrescence and differentiation.

Q. Has the tooth received much attention from anthropologists and ethnologists?

A. It has not. Flower has constructed a dental index by multiplying the dental length by 100, and dividing by the basio-nasal length.

Q. What are his results?

A. Caucasic races are microdont (with small teeth and small dental index); the Mongolic races mesodont (middle teeth and index); the Negroid races are megadont (great teeth and index). The anthropoid apes have still larger teeth and indices.

Q. After the teeth are formed, what becomes of the rudiments of the enamel organ?

A. These remain in the deeper structures. When the teeth push their way through the gum, these epithelial cells are pushed to one side, and they remain encased in the peridental membrane.

Q. What has lately been claimed in regard to these epithelial cells?

A. It has been alleged that they are glands.

Q. What theory was advanced by Kollman and Gegenbauer?

A. That they are abortive rudimentary survivals from an ancestral condition in which the teeth are numerous, as observed in the shark.

Q. What theory did Robin and Magitot advance?

A. They claimed that they were epithelial debris, a view perfectly compatible with that of Gegenbauer and Kollman.

Q. What other views have been advanced?

A. The other views corroborate those of Robin and Magitot, since epithelial cells may be found imbedded in the derma in all parts of the body.

CHAPTER XI.

SOCIAL CONSANGUINITY, NEAR-KIN, EARLY AND LATE MARRIAGE.

Q. Has the influence of intermarriage in families been overestimated as a factor in producing defect?

A. From the general principles of heredity, already laid down, it must be obvious that the influence of inter-marriage in families has been overestimated as a factor, *per se*, in the production of defect.

Q. Is there an advantage in cross-breeding?

A. The idea of the advantage of cross-breeding, which seemingly appeared in the practice of exogamy (marriage outside the tribe, or more often outside those having the same totem or coat-of-arms) arose from observation of deformities following intermarriages contracted after the killing of girls for economic reasons had led to exogamy.

Q. What was the origin of incest?

A. It was of religious origin rather than innate, since the totemic relationship (which was chiefly prohibited) was often far from being consanguinous.

Q. What was the totem?

A. It was a mark indicating descent from a supposed animal ancestor endowed with occult powers.

Q. Could the children with the Bear totem of one tribe marry those having the same totem in another tribe?

A. No.

Q. What notions sprang from this practice?

A. The medical, theologic and legal notions anent the danger from marriage of consanguinity, which was insisted upon from time to time by medical writers, has been recognized by ecclesiastic authority, civil law and by popular feeling.

Q. Has the marriage of near relations been forbidden?

A. By ecclesiastic and civil law, marriage of those very nearly related has been forbidden on other grounds than that of alleged danger to offspring.

Q. Does the justice of such laws receive support?

A. Such laws receive support from medical observations, which tend to show that intermarriage may produce degeneracy, idiocy and insanity.

Q. Has this evidence been analyzed?

A. Yes. There is more than one explanation of the facts.

Q. Where lies the chief danger in intermarriage?

A. With a perfectly healthy stock, as every breeder of animals knows, "in-and-in" breeding may be practiced with impunity, but where the stock is tainted with disease or imperfection, safety is only to be found in "crossing."

Q. What was the error of the old doctrine?

A. The error of the old doctrine upon which was founded the prohibition of consanguinous unions lay, not in asserting that disease and deformity were more often met with in children of these than those of other unions, for such is the fact, but in attributing these unhappy results merely to parental blood kindred.

Q. Is there a physiologic reason why these marriages should not take place?

A. Over and above the fact that these consanguinous marriages are almost certain to transmit, in an accentuated form, defect or tendency to disease, already present in the family, there is no physiologic reason why such marriages should not take place.

Q. Can prize stock in-and-in breeding be beneficial?

A. Breeders of prize stock frequently breed in-and-in, not only with impunity, but with marked benefit.

Q. Does this prove that degeneracy found in children of consanguinous marriages does not result from this?

A. But this fact, while going to prove that it is not the mere blood relationship of the parents which induces the degeneration so often found in the children of consanguinous marriages, can but rarely be advanced as an argument in support of the marriage of blood relations.

Q. How does the stock raiser propagate the same kind?

A. The stock raiser only permits the more perfect members of his flock and herds to continue their kind; for this reason "in-and-in" breeding is innocuous, just as it would be in the human family under like conditions.

Q. Do acquired characters disappear with intermarriage?

A. Recently acquired characters, whether physiologic or pathologic, are very liable to disappear when the individual having such characters intermarries with another not having the same character.

Q. What is the natural tendency of the offspring?

A. In all such cases, to revert to the normal type, so that unless the new character be very deeply impressed upon the parental organism, it is almost certain it will not appear in the offspring of the other parent having nothing of the character.

Q. Is the character often repeated in an accentuated form in the offspring?

A. When both parents are possessed of the character, whether it be physiologic or pathologic, this natural tendency to revert to the original is often overborne, and the character is repeated in an accentuated form in the offspring.

Q. What happens in the case of consanguinous marriages?

A. This accentuation of family character always takes place.

Q. Will taint be inherited?

A. Each member will inherit more or less of it from the common ancestor.

Q. Cite the case of cousins.

A. The descendants of a common grandparent, insane and of insane stock, are certain to have inherited more or less of the insane diathesis. Even if the taint have been largely diluted in their case by the wise or more likely fortunate marriages of their blood related parents, yet, still they have inherited a certain tendency to nervous disease, and if they marry they must not be surprised if that taint appear in aggravated form in their children.

Q. Can parents always account for the imperfections?

A. The blood kindred parents of idiotic, epileptic, dumb or lymphatic children often marvel whence come these imperfections.

Q. Is there always evidence to show that tendency to disease may be inherited?

A. In some cases the parents, and possibly the grandparents, of the unfortunate children have not displayed any obvious evidence of the tendency to disease, which they have inherited and handed on to their descendants.

Q. Will parents deny the inheritance of certain diseases?

A. Yes. Not looking farther back, parents assert that insanity, epilepsy, scrofula, etc., are unknown to their family. They have never been so afflicted; why should their children? In like manner children may be epileptic, blind, deaf mute, lymphatic, cancerous, criminal, drunkards or deformed from direct inheritance, and yet the family line be honestly declared healthy in these particulars.

Q. Is the truth of Sir William Aitken's maxim obvious?

A. Yes. A family history, including less than three generations, is useless, and may even be misleading.

Q. Is social consanguinity a potent factor in hereditary degeneration?

A. Similarity of temperament, induced by a common environment, called "social consanguinity," is a potent factor in the production of all hereditary degeneration.

Q. Will similar customs, habits, surroundings, etc., produce like diseases?

A. Yes. They tend to engender like diseases and degenerations, irrespective of any blood relationship.

Q. Do socially consanguinous people, not even distantly related, often resembled each other?

A. Yes. They are in reality much more nearly related in temperament than cousins, or even nearer blood relations who have experienced widely different modes of life.

Q. What is social consanguinity?

A. The curse that dogs every exclusive tribe and class and hurries them to extinction. It is the chief factor in the production of the disease and degenerations which have stamped themselves upon royal families.

Q. Is this condition found in neurotic marriages?

A. This social consanguinity appears likewise in the tendency of the neurotic to intermarry, popularly expressed in the proverb that "like clings to like." The marital tendency from this likeness in mental characteristics has been shown to be present, by recent medical writers, so far as Germany, France, and the United States are concerned.

Q. What is the statistical evidence?

A. There are in Illinois, according to the most recent estimates, in round numbers, about 6,000 insane, or one to a little over 500 of the population. Even if we double, treble, or quadruple this frequency, to include all that have been, or are to be insane, as well as those insane at the present time, it would not appear that there was much probability of two insane persons being married, according to any ordinary law of chances. In fact, we find four out of 104 with insane heredity where both father and mother were insane. In one of these cases the insane heredity involved both parents and grandparents on each side, though in the case of the latter the histories show it only as collateral. Besides these three patients, two had direct maternal and collateral paternal heredity, and in one case there was collateral heredity of insanity on both sides. This makes altogether nearly ten per cent. of those with insane heredity with it on both sides, maternal and paternal, and thus favored with a double opportunity to inherit mental disease. If to this be added the instances where, with insanity of one parent there is either epilepsy, hysteria, or drunkenness, brain disease, nervousness, etc., of the other, the ratio of double inheritance rises to over twenty per cent.

Q. Is much taint required to cause degeneration of the face, jaws, and irregularities of the teeth?

A. Since the jaws and face are transitory structures, relatively little taint is needed in a family or community to cause degeneration of the face and jaws, and irregularities of the teeth.

Q. Is this factor overestimated in deformities of neurotics?

A. The influence of these neurotic and social consanguinity tendencies in the production of deformities of the face and jaws and irregularities of the teeth cannot well be overestimated.

Q. Cite a test of these influences.

A. A test of these influences is alleged to exist in the Polynesian population of the Pacific Islands, where race admixture can be excluded for a relatively long period. It was claimed that here was a people isolated from all others for at least 1,400 years, with no admixture of races, yet irregularity of the teeth of both maxillæ was almost as common as it is among the mixed races of to-day.

Q. What is to be peculiarly reckoned with the Polynesians?

A. Excessive licentiousness shown in societies for the practice of extreme sexual indulgence like the Areoi.

Q. What do these societies create?

A. They create neurotic states and tendencies, and produce more marked degeneracy of the face, jaws and teeth than intermixture of race or consanguinous marriage.

Q. Can the factors of racè admixture be excluded from the ancient Hawaiians?

A. As the Polynesians and Malays are great navigators, it cannot be completely excluded from consideration.

Q. Will leprosy, like syphilis, check development without causing infection in utero?

A. This factor has likewise to be taken into consideration.

Q. Has the mortality among Hawaiian babies been large?

A. Yes.

Q. What are the conditions as to hygiene?

A. Hygiene is practically unknown.

Q. What is the medicinal agent of the Kahuna (sorcerer-medicine man)?

A. An intoxicant, kava-kava (the fermented juice of the awa).

Q. Is syphilis common?

A. Yes. Especially the non-venereal type.

Q. Do the habits of the natives aid the spread of the disease?

A. Yes.

Q. What is the result?

A. Under such conditions, irregularities are frequent.

Q. Is the age of the mother at pregnancy ignored in dealing with defects?

A. Yes. It was pointed out two decades ago that the offspring of early and senile marriages were defective and multiple, and too nearly repeated pregnancies were of frequent occurrence.

Q. What often determines degeneracy?

A. In all degenerate forms, age of the parent must be taken into consideration.

Q. What investigations have been made as to the age of parent upon degeneracy?

A. The age of mothers of degenerates is often below twenty-five years. In an investigation of the influence of the age of parents on the vitality of children, found that the proportion of deaths among children from unhealthy constitutions or maladies traceable to the mother was twice as large among the children of mothers under twenty as among the children of mothers over thirty. The healthiest offspring are born of mothers between twenty and thirty, united to husbands between thirty and forty. Where either husband or wife was under twenty, the offspring usually proved weakly. This is particularly the case even in Hungary, where the girls become women at thirteen. In that country, in twenty-five per cent. of the number of marriages, the brides are under twenty years of age.

Q. What has been found in regard to criminals?

A. Among all classes of criminals there is an excess of immature parents (under twenty-five) or senile parents (over forty-two).

Q. What is a well-known fact?

A. It is a well-known fact that children of the aged exhibit degeneracy.

Q. Does premature and late marriage have an influence in the production of idiocy?

A. They have been recognized as having great influence.

Q. At what stage may arrest of fœtal development take place in idiocy?

A. Factors capable of the production of idiocy may arrest fœtal development at all stages.

Q. Cite a case.

A. In a Nova Scotian family, of Scotch extraction, the mother still continued to bear children until she was sixty-three years old. There had been no pregnancy between fifty and fifty-six. At fifty-six a son was born, who had ear, jaw and skull stigmata, and became a periodical lunatic at twenty-five. A son, born a year later, was a six-fingered idiot, with retinitis pigmentosa. Three of the next children were paralytic idiots in infancy. One of the next children was a periodical sexual invert female. The last child was an epileptic. The children born before the age of fifty were normal and averaged sixty years of age.

CHAPTER XII.

ENVIRONMENT, CLIMATE, SOIL AND FOOD.

Q. Was the influence of climate, soil and food, and other factors early observed?

A. Yes.

Q. What seeming modifications have been produced?

A. Even skeptical biologists admit that "the possibility is not to be rejected that influences continued for a long time (that is for generations and generations, such as temperature, climate, kind of nourishment, etc.), which may affect the germ plasm as well as any other part of the organism may produce a change in the constitution of the germ plasm. But such influences would not then produce individual variations, but would necessarily modify in the same way, all the individuals of a species living in a certain district. It is possible, though it cannot be proved, that many climatic varieties have arisen in this manner. Possibly other phenomena of variations must be referred to a variation in the structure of the germ plasm produced directly by external influences."

Q. Upon what does climate depend?

A. The influence of climate depends upon more than the mere range of temperature and meteorologic elements.

Q. What does transferral from a sub-temperate to a sub-tropic clime mean?

A. It means not merely a change in the necessity for adaptation to temperature alterations, but also change in the ease with which food is secured and the stress of struggle for existence to which man has been exposed.

Q. What has soil and climate produced on one people?

A. The Wurtemburgers settled thirty-two years ago near Tiflis, Russian Georgia. They originally had fair or red hair, light or blue eyes, and coarse, broad features. In the first generation, brown hair and black eyes became the rule, while the face acquired a noble, oval form.

Q. Were these changes due entirely to surroundings?

A. Yes. There is no record of intermarriage with the Georgians.

Q. Did the Wurtemburgers continue to speak German?

A. Yes.

Q. Who were the Wurtemburgers?

A. A mixed race, in whom the surroundings in Wurtemburg tended to develop one type, while those in Georgia developed another.

Q. Were there changes in the face, jaws and teeth?

A. Yes. These changes in type became clearly evident.

Q. What was the original Wurtemburger type?

A. Arrested facial development and prognathism, which disappeared under the favorable conditions of Russian Georgia.

Q. What similar changes is alleged elsewhere?

A. The alleged transformation of the Britisher into the Yankee, charged to the effects of climate and soil.

Q. What is this alleged change?

A. The Yankee presents features of Indian type. The glandular system is reduced to the minimum of its normal development. The skin becomes like leather. The cheeks are sallow, the head smaller, rounder, and covered with stiff, dark hair. The neck is longer. The cheek bones and masseters are more developed. The temporal fossæ become deeper, the jawbones more massive, the eyes lie in deep approximated sockets. The iris is dark, the glance is piercing and wild. The long bones, especially in the superior extremities, are lengthened, so that the gloves manufactured in England and France for the American market are of a peculiar make, with long fingers. The male pelvis approaches that of the female.

Q. Has America thus produced a new white race?

A. According to Quartrefages, Pruner Bey, and others, this production of the Yankee from the English might be called a new white race.

Q. Is this hypothesis correct?

A. No. The reverse is true.

Q. Does this admit demonstration?

A. Yes. The following instance is one of many that could be mentioned. In a New England family, with a Scandinavian patronymic, the first generation (born in 1761) is represented by a dolichocephalic head, with massive jaws and lips (especially the upper) prominent. The nose is long. The eyes are set close together. The forehead is very high and straight. In the second generation the face is not so long. The lateral diameter is larger. The forehead is more prominent. The eyes are a little farther apart. The nose is about the same length. While there is a general resemblance about the mouth and chin, the distance from the front of the chin to the tip of the nose is not quite as long. In this the shortening of the chin has played apparently the chief part. In the third generation, the forehead is broader and less retreating than in the second. There is less prognathism and less prominence in the supra-orbital region. In the fourth generation appears a brachycephalic type of head. It is nearly round. The forehead is full. The eyes are set in the head to correspond with its width. The nose is broad. The upper lip is short. The lower jaw is much broader than in the first generation, and is evidently shorter, in a perpendicular line. These changes result from the formation of a protruding forehead, receding chin, and delicate features.

Q. What must also be taken into consideration besides climate?

A. Modes of life.

Q. Is the distinction once made by anthropologists between tropic and non-tropic races now tenable?

A. No. Experience of the British in India, and of the Hollanders in Java, has shown that with change of habits and food suited to environment, Europeans may not only live in the tropics with impunity, but may improve under the advantages these have over sub-arctic and temperate zones.

Q. To what are these possibilities due?

A. To the consequence of sound sanitation.

Q. What effects has hygiene had?

A. "The fairest laurel practical hygiene may boast of to-day is," as Gihon remarks, "doubtless the laurel acquired in ameliorating the sanitary conditions of the European in tropical climates."

Q. What did James Lind remark a century ago?

A. Much more than to climate you are indebted to your own ignorance and negligence for the disease from which you suffer in tropical climates.

Q. What do modern researches tend to show?

A. That the vital resistance of the different races in tropical climates depends more on external conditions than on race.

Q. What must be observed by strong, healthy Europeans of both sexes to live in tropical climes?

A. They must assiduously observe hygienic rules.

Q. What has been shown in regard to sterility of Europeans in tropical regions under unchanged habits of life?

A. That Europeans are not able to produce more than three or four generations of true European blood, and that from the third or fourth generation onward, sterility is the rule.

Q. Is there an opportunity to test this statement?

A. The permanent establishment of an American colony in the Philippines will decide this.

Q. What other important factors must be considered in connection with climate?

A. Dietetics, as well as moist and dry heat.

Q. What effects are these last liable to produce?

A. Neurasthenia, with co-existing and complicating auto-intoxication.

Q. How do these two affect the tissues of the mouth?

A. They alter nutrition of the alveolar process, producing interstitial gingivitis and absorption.

Q. Cite an illustration of this.

A. A twenty-three-year-old man has been in the

Philippines for a year and seven months. He was one of the first volunteers to reach Manilla after the naval battle. Nineteen months' life in the tropics on the usual army rations has resulted in the loss of nearly every tooth. While the climate undermines the nutrition of the alveolar process, and tropical fevers have the same effect, improper diet increases the defect. The teeth dropped out, one by one, as is commonly the case with Americans in the Philippines.

Q. How has the English-speaking race demonstrated its ability to endure all climates?

A. The types now forming in South Africa and Australia recall the New England and Kentucky type of the eighteenth century, but will doubtless pass, like it, into a type resembling that of the fourth generation illustrated.

Q. Is this race, in its own home, mixed?

A. Yes. In its colonies it is still more so, but despite this, preserves relatively permanent mental and physical racial characteristics.

Q. What effect does the struggle to maintain mental states produce?

A. The variations in the teeth and jaws noticeably present in the English-speaking races.

Q. Where are similar effects observable?

A. The Scandinavian speaking races, who resemble them in racial admixture and adaptability to climate, have the same tendencies in relation to jaws and teeth.

Q. How is it evident that climate does not exercise the influence once claimed for it?

A. Thirty years ago, government authorities claimed it was impossible for human beings to live the entire year in Minnesota, owing to the extreme cold in winter. Now, not only is the soil cultivated throughout the entire state, but still farther north, in Manitoba, a large city has sprung up, surrounded by a very considerable farming population. The influence of climate, therefore, can be guarded against by man much more than any factor of his environment.

Q. What effect has altitude on physiologic characteristics?

A. While, as a rule, residents at high altitudes are strong, robust, buoyant, and of great mental and physical endurance, there are numerous exceptions. Thus "the engineers and workmen on the Jungfrau railway, obliged to remain a considerable time at altitudes of about 2,600 meters above the sea-level, are liable to a disagreeable complaint. After eight or ten days they are seized with violent pains in several teeth, on one side of the jaw, the gums and cheek on the same side becoming swollen. The teeth are very sensitive to pressure, so that mastication is extremely painful. These symptoms increase in severity for three days, and then gradually and entirely disappear. It seems to be purely a phenomenon of acclimatization. All newcomers pass through the experience, and the disorder never recurs." The influence of heat, of cold, and of barometric pressure shown in a lesser degree in "mountain fever" produces systemic disturbance of metabolism, which, causing auto-intoxication, markedly affects the alveolar process, producing interstitial gingivitis.

Q. Where are effects of soil upon growth most obvious?

A. In goitre and cretinism.

Q. Are primitive races affected?

A. Unsanitary surroundings, depressing constitutional conditions, improper and excessively nitrogenous diet, produce, among Indians, goitre and bone changes often associated with it.

Q. How may the influence of food producing systemic changes which involve interference with proper osseous development be divided?

A. Into two factors. One involving the quality of the food, and the other its quantity and variety.

Q. What is one most striking illustration of the first factor?

A. The constitutional skin, nervous and mental disorder, pellagra, found in France and Italy.

Q. How is the disorder produced?

A. While unhygienic surroundings play a part, pellagra is chiefly due to spoiled maize, taken as a food.

Q. Wherein are its osseous effects evident?

A. The frequency of jaw and teeth stigmata demonstrates the effect of pellagra.

Q. What other conditions of diet affect the osseous system?

A. Monotony of diet is likewise an emphatic cause of constitutional nervous disorders, such as distort osseous development.

Q. What other conditions are brought about by monotony of diet?

A. Monotony of diet and surroundings undoubtedly produce a large amount of degeneracy in families of pioneers in the United States, and of farmers in secluded valleys of Norway, Switzerland, and elsewhere.

Q. What effect has it upon the farmer families?

A. There is an unusual quantity of insanity in families, traceable to this condition.

Q. Cite an illustration.

A. The mother, a member of New England stock, of tireless energy, to whom work was a pleasure and rest an abhorrence, lived on a farm, miles from the town. She did all her own work and brought up a large family, chiefly on maize, potatoes, and bread, pork being the meat diet. At fifty this woman removed with her husband, who had grown wealthy, to a small country town. Here she conducted the work of the household without a servant. At fifty-two she broke down with neurasthenia, which rapidly passed into periodical gloomy spells, in one of which she committed suicide. Her youngest daughter, who had a symmetrical face, has the gloomy tendency of the mother, alternating with periods of restlessness, which evince themselves unnecessarily in doing the work of the servants and other labors inconsistent with her husband's social status. She had at times suicidal and homicidal impulses. She has three children; one exhibits no special abnormality; the eldest, a boy of eleven, dislikes to play with boys, because they are rough, plays with girls, to whom he is at times mischievously cruel. He likes to sew dolls' clothing and purchase dolls, while there are other indications of sexual abnormality. The youngest, a girl, has frequent attacks of epileptic-like fury, although between these she is kind-hearted, good-humored, and very affectionate.

Q. What does the fungus on maize (ustilago) like the fungus on rye (ergot) produce?

A. A rather long-lasting neurosis of epileptic character, susceptible of transmission to the offspring of women poisoned with fungi.

Q. What effect does a vegetarian diet have?

A. It seems to be deteriorating to the races who are restricted to it alone. These races are cowardly, meanly cruel, extremely mendacious, untrustworthy, weak in stamina, and readily yield to morbid influences.

Q. What effect does potato diet have upon the Irish Celt?

A. The influence of potato diet in degenerating the Irish Celt in comparison with the Scottish Celt, under the same conditions, is difficult at present to determine, for lack of data. Certainly the descendants of this class of Irish Celts rapidly regain a handsome, healthy status under mixed American diet, even though the hygienic surroundings in the great cities be not the best.

Q. What does the physician find who undertakes to treat a class of neurasthenics, in whom starch digestion is impaired?

A. He finds that a diet of potatoes (undoubtedly through the auto-intoxication it produces) will increase certain nervous symptoms, and hence the tendency to transmission to the next generation.

Q. How is this widespread influence of nutrition excellently illustrated?

A. In the conditions produced in children, and in the insane, by improper food, and the reaction of these to hygienic diet.

Q. What may improper diet produce in the child?

A. It will produce all possible nervous disorders, including those involving the trophic processes.

Q. In what diseases is this peculiarly evident?

A. Scurvy and rickets and their effects on the general osseous development. Improper maternal diet during pregnancy may produce similar effects.

Q. Has the influence of maternal environment upon the fœtus been much underrated?

A. Yes. Because of the belief that the placenta, by its filtering and poisoning-destroying functions, protected the fœtus.

Q. Has this been shown to be an error?

A. Yes. Especially in arrests of development produced by the toxins of the great contagions.

Q. What did later investigations show?

A. That not only did organic poisons, like opium, pass through the placenta, but that mineral poisons, like lead, did also. Children of opium using mothers died in the first months after birth, unless given opium. It was later shown that in such cases the umbilical cord contained large quantities of morphine.

Q. What is known as to children of mothers working in tobacco factories?

A. They exhibited very little vitality, and much deformity.

Q. What effect has tobacco-working on maternity?

A. Maternal work in tobacco factories is a cause of frequent miscarriage, of high infantile mortality, of defective children, and of infantile convulsions.

Q. What has been observed in regard to mineral poison?

A. Lead and phosphorus pass through the placenta and enter the child's circulation.

Q. What is the effect upon the system?

A. It has been found that those exposed to its fumes have systemic nervous exhaustion, characterized by local paralysis about the wrist, as well as the general symptoms of profound systemic nerve-tire.

Q. What may happen?

A. This may result in acute insanity of the confusional type, followed very often by forms of mental disorder of a chronic type resembling paretic dementia.

Q. What may follow should there be a recovery?

A. Epilepsy; in other cases, an irritable suspicional condition results, in which the patient may live for years, marry, and leave offspring. This last condition and the epileptic are the most dangerous as to the production of degeneracy.

Q. Give an example.

A. Women employed in the pottery factories suffer from a form of lead poisoning, which produces decidedly degenerative effects upon the offspring. These women have frequent abortions, often produce deaf-mutes, and very frequently macrocephalic idiots.

Q. What effect does brass dust have upon workmen?

A. They suffer from a very similar condition to that produced by lead. Grave forms of nervous exhaustions occur among brass workers.

Q. Do women become exposed to these conditions?

A. Yes. The effect produced, so far as the offspring has been observed, are frequent abortions and infantile paralysis.

Q. What effect has mercury upon the system?

A. It produces systemic nervous exhaustion, in which the most marked symptom is tremor, amounting at times to shaking palsy.

Q. What effect does this have upon the offspring?

A. Like all other nervous exhaustions, the mercurial one may appear as degeneracy in the offspring.

Q. What is the effect upon women who work in match factories?

A. The chief toxic effect of phosphorus is not the localized jaw necrosis. This is an evidence of the progressive system-saturation with phosphorus. It bears the same relation to the dangerous effect of phosphorus that "blue gum" does to the systemic effects of lead.

Q. What is the effect of carbon bisulphide?

A. Those who come in contact with it have been noted to suffer from the initial stages of interstitial gingivitis. Recently cases are reported where twenty young women, employed in rubber factories, exhibited a necrotic process in the jaws and teeth similar to that resultant on phosphorus.

CHAPTER XIII.

RACE ADMIXTURE.

Q. Is race admixture slight?

A. It has been greatly underestimated.

Q. To what is this due?

A. Ethnic researches have lately thrown much doubt on the standards set up as race tests.

Q. What has been assumed?

A. That a clear distinction can be made on philologic grounds between different races, and that even Aryan-speaking races can be easily separated.

Q. Can this be accomplished?

A. Ethnology has shown this to be an error, and that speech is no test of race.

Q. Are the races of Europe pure?

A. No. Not merely are the Aryan-speaking races of Europe mixed together, but the blood of all has a pre-Aryan and a Turanian dash.

Q. How far back do these admixtures date?

A. To palæolithic times, when, although the predominant type of skull was dolichocephalic (or long-headed), brachycephalic (round-headed type) had begun to appear in America, then connected by land with both Africa and Europe. In subsequent neolithic times, while the type is at first generally brachycephalic, it soon becomes mesocephalic (mixed long and round headed), pure brachycephalic and dolichocephalic becoming rare.

Q. Is this race admixture true of American Indians?

A. Even the race type called the American Indian still so retains traces of the race elements forming it in the pleistocene period that these elements are yet distinguishable by ethnologists.

Q. Toward what does the American Indian lean in nose types?

A. Its proto-caucasic, rather than its proto-mongolic or proto-negroid elements.

Q. How many types appear in Great Britain and Ireland?

A. These types and traces of their blood are still detectable in living man. The neolithic race in Great Britain was dark, of feeble build, short stature, with dolichocephalic skulls. This race remained to the historic period as the Silures in Great Britain and the Firbolgs in Ireland. It had high cheek bones and oblique eyes. Toward the middle of the neolithic period this race was conquered by a brachycephalic, tall, long-armed, muscular race, with florid complexion and yellowish or red hair. The third race which invaded Great Britain was of fair complexion with prognathous jaws, dolichocephalic skull, of tall stature, great bones, great chest development, and massive jaws.

Q. Are there any pure races at the present time?

A. As the intermingling of races began early, the question of the existence of pure races to-day, or even during the historic period, is an open one.

Q. Are the Hebrews pure?

A. They have been comparatively pure since the return from the captivity. Before that, as the history of Solomon's foreign marriages demonstrates, they were a raceless chaos, the Semitic element predominating.

Q. Who were the Copts, or ancient Egyptians?

A. They were a mixture of Turanian, Hamite, Aryan and Semite peoples imposed on a negroid basis.

Q. What occurred when these elements were finally fused?

A. The race bred relatively true, although the lower classes tended to the negroid type and the higher to the Caucasic.

Q. Of what do the Coreans consist?

A. A mixture of two primitive races, one white, the other yellow.

Q. The Japanese?

A. Their ancestors emigrated to Japan from Corea. They are products of the addition of two distinct types to that forming their Corean ancestors. The Polynesian, to a great extent, and the Malay, to a greater, are mixed with the original Corean.

Q. The Chinese?

A. The Chinese are neither a homogenous people nor a pure race, albeit the relatively few Mantchus are dominant.

Q. The Indian Aryans?

A. They are known to be, despite a rigid caste system, a non-Aryan race, feebly infused with a modicum of Aryan blood.

Q. What of the so-called "Gypsy?"

A. The so-called "Gypsy" seems, of all the races of India, to have retained most Aryan speech and type as well as original Aryan semi-nomadic wagon-journeying in the midst of settled civilization. Ghetto seclusion long helped to preserve relative purity of race in the Jew, but despite vagabond surroundings, the "Gypsy" has remained even purer.

Q. With the three races described as mingling in Great Britain and Ireland, has not even greater admixture occurred at a later period?

A. Yes. The so-called Scotch-Irish (whose blood enters so largely in the dominant race of the United States), despite their speech (much more Teutonic and monosyllabic than English) are a raceless chaos of Gælic and Cymric Celts, Lowland Scotch, French Huguenots, Danes (Celto-Teuto-Slavs), Palatinate Germans, Magyars, English Puritans, Hollanders, Swedes, Protestant Italians, Poles, and Spaniards.

Q. How has a marked variation in type been produced in the British Isles?

A. The intermixture of the dark, small-boned, dolichocephalic, orthognathous (with-in-drawn jaws) race, with the brachycephalic, prognathous, big-boned, red-haired, and then with dolichocephalic, prognathous, deep-chested, big-boned, fair race, produced in the British Isles as marked variations in type as now occur from the admixture of the Indian and the Negro.

Q. What exerted a great influence in the British Isles?

A. While religion played a part, war, commerce and art also exerted an influence. Thus Bunyan, the author of the "Pilgrim's Progress," was the descendant of Bunyano, an Italian architect, imported to build Melrose Abbey. The destruction of the Spanish Armada introduced Spanish elements all along the West and East coasts of England, Ireland and Scotland. The capture of Calais by the French from Mary Tudor added a French colony to London.

Q. What of the Scandinavian race?

A. The primitive race called the Quens was of Esquimo type. This race was first intermixed with a tall, long-armed, brachycephalic, muscular race with florid complexion and yellowish or red hair. The race resultant on this mixture was later fused with a third having prognathic jaws, large dolichocephalic skulls, tall stature, great bones, great chest development, but small hands and high arched feet. After these race admixtures had formed the Scandinavians, who became the sea kings, the intermixture with other races still continued. Around Bergen, Norway, was an Irish colony with well formed, delicate features, brunette complexion, oblique blue eyes and black hair. The influence of this colony is still demonstrable.

Q. What effect did these different types of skull and face have upon the English-speaking and Scandinavian-speaking peoples?

A. The contest for existence (between the organs of men) centered itself with peculiar intensity on structures which, like the jaws and teeth, are so variable with rise in the scale of evolution.

Q. What would be the effect on the scion of an orthognathic mother and prognathic father?

A. He would have marked irregularities of the jaws and teeth, destitute of the significance of the depth of degeneracy implied by the same irregularities in a purely prognathic or orthognathic race.

Q. What caused an intense struggle for existence in such a mixed race?

A. Food which exacted less active functions on the part of the jaws and teeth in such a mixed race would imply an intense struggle for existence between the different teeth, and this struggle would proceed with greater or lesser intensity as the organism was or was not affected by that constitutional nerve strain which precedes general degeneracy.

Q. What effect do the different factors produce on the constitution?

A. They create a general loss of nerve tone which relieves the local nerve systems of control by the central nerve system.

Q. What becomes of these local nerve systems?

A. They take on feverish activity in consequence and become themselves exhausted.

Q. In what way would this affect the jaws and teeth?

A. In proportion, therefore, as the general nervous system has control would the evolution of the teeth and jaws, in their relation to the organ struggle for existence, proceed with regularity.

Q. What influence would food have under these conditions?

A. The influence of food, while beneficial to the organism as a whole, may, as already pointed out, introduce a struggle for existence between the teeth, causing local degenerations of these and the jaws.

Q. If man used his jaws and teeth as a weapon of offense and defense, would the soft foods alone cause degeneracy?

A. The employment of the teeth and jaws as weapons would prevent that degeneracy as a jaw otherwise consequent upon decreased use resultant on a change from vegetable and nut diet to the more easily digested and masticated meat or fish diet.

Q. What indicates that such use of the jaw interfered with degeneracy?

A. The persistence of prognathism in races as high as those described, even when brachycephalic, is an indication that the use of the jaw as a weapon interfered with its degeneracy consequent on improved food.

Q. What does the vermiform appendix indicate?

A. While man was a vegetable feeder, the atrophic tendency of the vermiform appendix shows that he early became a user of animal food, albeit not to the extent of carnivorous mammals, in whom the appendix has disappeared.

Q. How did this change affect the jaws and teeth?

A. This change initiated a tendency to variability in the jaws and teeth.

Q. Are such changes demonstrable in America?

A. This variability is excellently shown in four generations of so-called "Anglo-Saxon" Americans of the Knickerbocker type. The first is a probably neolithic Hollander type with low, receding negroid forehead, small, sunken eyes, protruding nose and upper lip, cheek bones prominent, receding lower jaw. The second was born of the previous type, settled in New York. The change in climate has altered the face considerably. The forehead is higher, broader and more prominent. The eyes are large and not so deeply set. The cheek bones are not so prominent, nose and upper jaw less prominent, upper lip longer, chin the same. Admixture of race types has produced a forehead broad and full, eyes less sunken, recession of cheek bones, nose and upper jaw; upper lip same; lower jaw broader, anterior position same. Here the forehead is still broader, more prominent, higher; large round eyes. There is more recession of the cheek bones. The nose and upper jaw are the same. The face is broader, lower jaw broader and anterior position same.

Q. Of what is this variability an expression?

A. The law of economy of growth whereby an organ, under the influence of the struggle for existence, degenerates from the ideal type of the organ as an organ for the benefit of the organism as a whole. This variability along local lines of degeneracy seeks peculiarly the line of least resistance in the jaws and teeth.

Q. What is the tendency in race admixture?

A. The tendency in race admixture (when the new blood is of stocks with large jaws and regular teeth) is to stamp out local influences which tend to produce arrest of development and irregular teeth. By constant race admixture the jaws retain their normal regular shape. The tendency of the child to inherit the small jaws of one and the large teeth of the other, or vice versa, is a fruitful source of facial and jaw deformity.

CHAPTER XIV.

CONSTITUTIONAL DISORDERS.

Q. From what two standpoints must the influence of constitutional disorders on the development of the skull and face be viewed?

A. First, from the standpoint of the mother affected during pregnancy; and second, from the standpoint of the fœtus affected during intra-uterine life, or of the child affected precedent to or during the periods of stress.

Q. How may constitutional disorders, especially the infections, affect the mother?

A. In the bony mal-development shown to occur in animals by Charrin and Gley, and in man by Coolidge.

Q. Are facial bones jaws, and teeth peculiarly liable to this?

A. They are.

Q. What will be the effect upon the fœtus, even if the disease in the parent be but temporary?

A. Fœtal development may be checked as to higher tendencies; thus mothers have borne moral imbeciles, epileptics, lunatics, or deformed children after a pregnancy during which they were attacked by contagious disease. The children of subsequent and previous pregnancies were normal.

Q. What has been observed in regard to children before and after contagious diseases?

A. The children of pregnancies previous to the one complicated by contagious disease may be healthy, while those of subsequent pregnancies are defective.

Q. How may contagious and infectious diseases affect bodily strength?

A. Any contagious and infectious disease may not only interfere temporarily with the bodily strength, but may produce complete change in the parent's system, extending even to the highest acquirement of man.

Q. How are the nerve centers affected?

A. The nerve centers controlling nutrition, growth, repair, secretion, and excretion are often as deeply affected as those checks constituting morality. At the periods of physiologic stress these effects are especially noticeable.

Q. Specify them?

A. Moral insanity, intellectual insanity, unequal mental balance, hysteria, precocious sexuality, unconscious mendacity, mental parasitism (the germ of pauperism), epilepsy, neuroses, and all types of nutritive and constitutional defects result.

Q. Where may the nutritional defects appear?

A. Chiefly in the walls of the blood vessels and lymphatics, as in scurvy, mercurial poisoning, etc.

Q. While these occur in the chronic infections and contagions, where do they also result?

A. In acute typhoid fever, scarlatina, diphtheria, whooping cough, etc.

Q. How do these affect the blood?

A. Proper blood supply, utilization and elimination of waste are thus prevented.

Q. Can organs then perform their functions?

A. They cannot. They are predisposed to disease from disuse and from weakness of the disease-fighting phagocytes and antitoxins.

Q. What results?

A. Irregularity of organ functions, which is hereditarily transmissible.

Q. What becomes of the weakened vessel-walls?

A. They yield to strain, and thus produce local stomach, bowel, liver, gland, and kidney disorders.

Q. Is this weakness completely transmissible?

A. It alone may be transmissible to the offspring.

Q. May the ductless glands be affected?

A. The functions of the great ductless glands (thyroid, thymus, adrenals, pituitary body, bone-marrow, etc.), which secrete principles necessary to the equal balance of nutrition, are perverted.

Q. What effect does perverted nutrition have upon the system?

A. The liver in the acute, but more particularly in the chronic, contagions, paralyzed in nerve tone, fails in its functions, nutritive and poisoning-destroying, as for the same reason the kidneys fail in their power of ejecting hurtful waste.

Q. What effect does nerve exhaustion have?

A. Nerve exhaustion, with its suspicion, its capricious hopefulness and gaiety, is practically continuous in tuberculosis, syphilis, and leprosy.

Q. How is the bony and dental development affected?

A. In a general way the influence resembles that of syphilis.

Q. How is this influence exerted?

A. In two ways. First, on the individual, which may affect development of the bones or teeth if it occur during the periods of evolutionary stress. Syphilis contracted during infancy thus affects the development of the teeth. The same is true of all infectious diseases to a greater or lesser extent, and is likewise true of conditions like scurvy and rickets. In a general way also, the influence of the contagious diseases, as exerted on the descendants, is of two types. Firstly, the direct transmission of the disorder, which must be regarded as intra-uterine, and secondly, the transmission from the ancestor to the descendant of sundry pathologic characters having nothing specific per se, but consisting perchance in native inferiorities of constitution, of temperament, of vital resistance, perchance in retardations, arrests, or imperfections of development, mental, physical, or manifested in organic changes; either malformations of organs or monstrosities.

Q. What is the first of those heredities properly called?

A. Syphilitic, typhoid, or small-pox heredity.

Q. What is the second called?

A. The second has received several synonymous titles; parasyphilitic (typhoid, etc.) heredity, dystrophic heredity, or toxaemic heredity.

Q. In the last the toxins produced by germs, or the poisons produced by maternal nutritional defects, cause what?

A. The arrests, retardations, imperfections of development seen in the children of otherwise healthy mothers suffering from the infections and contagions, or from nutritional disorders or defects, just precedent to or during the period of pregnancy or during the period of lactation.

Q. During the periods of stress what effect have these toxins or allied substances?

A. They cause the bony and dental arrests, retardations, and imperfections of development so frequently noticed after scarlatina, pneumonia, cerebro-spinal meningitis, etc., as well as rickets and allied conditions occurring during infancy and childhood.

Q. How are the regenerative processes affected?

A. All the tissues are below par in constitutional diseases. Hence wounds do not heal as readily in a person the subject of constitutional diseases.

Q. What relation has embryonal tissue to repair?

A. The development of tissue from an embryonal type to mature tissue is identical with the regenerative process in the healing of wounds.

Q. How is the energy of the organism expended?

A. In repelling the advances and barring the further progress of the micro-organisms or other causes of constitutional diseases.

Q. What is the consequence?

A. Warfare between the cells and microbes. The tissue cells that are regenerated do not increase the size of the organs as in normal development.

Q. What do these constitutional diseases cause?

A. Arrest of development which may become permanent from the time of the disease.

Q. What effect does this sometimes have upon the child?

A. It stops development for one or more years, and frequently development will not proceed until the child is taken to another climate.

Q. What effect does it have upon the jaws and teeth?

A. Anomalies of the jaws and teeth result. When arrest of development of the teeth takes place, pits and furrows are often found in the enamel.

Q. What do these pits and furrows indicate?

A. The exact period when the arrest of development took place.

Q. What kind of teeth especially result?

A. Hutchinson's teeth.

Q. What effect do the eruptive fevers have upon children?

A. They tend to leave the system in a neurotic condition.

Q. Do children always recover?

A. Children who before were apparently healthy are after these diseases sickly and ailing for years, and sometimes never wholly recover.

Q. How are they affected?

A. The eyes and ears and not infrequently the organs of speech are affected. The eyes remain weak, occasionally the patient becomes nearly or quite blind. The hearing is frequently permanently impaired; occasionally the nerve centers which preside over the development of the osseous system. There is a general arrest of development of the whole body. Such persons not infrequently remain sickly, neurotic, or morally imbecile. While they may regain health, the body ceases to develop normally.

Q. Cite illustrations.

A. A young girl, now twenty, born of apparently healthy parents, had a severe attack of scarlet fever at the age of seven years. Arrest of development of the upper jaw, and a V-shaped arch developed; she has been near-sighted ever since and now has very weak eyes; stopped growing for three years. She was taken to California and Europe and has now regained her full growth. A boy, now fourteen, had pneumonia at the age of four. Arrest of development of the bones of the face is very marked; he has stopped growing and is now very small for his age. A young lady, now twenty-three years of age, had scarlet fever at the age of four, with a resultant deaf-mutism. The bones of the face and jaws are undeveloped. She possesses a marked V-shaped arch. The pits and grooves upon her teeth denote the age when she had the disease. She has developed into a very handsome, full grown woman. A lady, now forty-five years of age, had scarlet fever at three years. Her eyes became inflamed and she lost her sight for twenty-four years, when they gradually grew better. The bones of the face were arrested in development.

Q. When may this arrest take place?

A. At any period up to the time of full growth.

Q. When must arrest of the jaws take place to produce dental deformities?

A. Arrest of development of the jaws due to constitutional diseases must occur prior to the sixth year.

Q. How is this modified?

A. By the influence of the constitutional disorders of the hypophysis, which may lead to the excessive development of bony tissue anywhere, occur to an extreme extent in acromegaly, giantism, etc.

Q. To what are arrests of development, charged to specific diseases, sometimes due?

A. They are in reality due to toxæmic or nutritional causes.

Q. To what is the "old man" appearance of congenital syphilis of the child due?

A. It is due to arrest of development of the fœtus at the 4½ month of intra-uterine life; the so-called senile period.

Q May not this arrest of development be caused by conditions other than syphilis?

A. Yes.

Q. What other expression of degeneracy is particularly apt to occur around the period of stress?

A. That condition known as hæmophilia, which is an hereditary constitutional defect evincing itself from deficient coagulability in a tendency to uncontrollable bleeding, either spontaneously or from slight wounds.

Q. What is it sometimes associated with?

A. Sub-oxidization conditions like arthritis and lipomatosis. This diathesis has long been known.

Q. What rule did Nasse give?

A. As a rule the mother of the hæmophile is not a "bleeder" herself, but is the daughter of one. The daughters of a hæmophile, though healthy, transmit the diathesis to the male offspring.

Q. When does hæmophilia generally appear?

A. After slight injuries during the period of the first dentition.

Q. Give some illustrations.

A. The Appleton Swain family of Reading, Mass., has had "bleeders" for two centuries. Osler has reported instances in the seventh generation. Kolster, who has investigated hæmophilia in women, reports a case in the daughter of a female hæmophiliac. On his analysis of fifty genealogic trees of hæmophiliac families, it is evident that Nasse's law of transmission is not absolute. In fourteen cases the transmission was direct from father to child and in eleven cases it was direct from mother to infant.

Q. How are hæmorrhagic symptoms of bleeders divided?

A. Into exterior bleedings, either spontaneous or traumatic, interstitial bleedings, petechiæ, ecchymoses, and joint affections. External bleedings are seldom spontaneous, but generally follow cuts, bruises, scratches.

Q. Are operations on bleeders dangerous?

A. Yes. A minor operation may prove fatal. So slight an operation as extraction of a tooth has been followed by the most disastrous consequences. Gum lancing is equally dangerous.

Q. What can be said of bleeding families?

A. They are often multiparous, healthy looking and have fine skins. They are hence not suspected of "bleeding" tendencies by the practitioner who sees them for the first time.

CHAPTER XV.

INTELLECTUAL AND MORAL DEFECTS.

Q. Upon what do most mental and moral defects depend?

A. Upon brain malformation. There is a complete transition from the durencephalic monster, the microcephalous, the idiot, the imbecile, and the feeble-minded to the normal person.

Q. What neurotics approximate the normal?

A. Sentimentalists, pessimists, neurotics, hysterics, neuropaths, epileptics, drug habitués, tramps, and prostitutes.

Q. Are jaw and tooth defects found in these classes?

A. Yes. Because of the struggle for existence between the brain and the face, defect is more or less shown in the face structures.

Q. What expressions of defects are found in these classes?

A. The prostitutes, while furnishing a larger proportion, furnish the same types as all the other classes. In them skull types present deformities to the extent of 44½ per cent. This is less than the percentage among idiots, but greater than the percentage among the other defective classes. There were 42½ per cent. of face deformities, which would probably be the average of the other classes. There were 42 per cent. of the ear anomalies and 54 per cent. of tooth and jaw anomalies. As in the insane, idiots, criminals, and hysterics, there was marked anomaly of the external occipital protuberance. Among the abnormal skull types presented three were prominent. In the first the head was flattened at the vertex, the forehead was hydrocephalic, the nose flat, and the lobe of the ear was much developed. In the second, the head was elevated at the vertex and the nose flat. In the third type the parietal region was asymmetrical. The anomalies of the face were marked asymmetry, subnasal prognathism, and disproportion of different parts. There was deviation of the nose and deep excavation of its root. The nose, being often strongly flattened, the Gothic palatine vault occurred very frequently. There was frequently complete division of the palate. There were teeth defective, irregular in growth, riding over each other or widely separated. The teeth were often notched and grooved (Hutchinson's and Parrot's teeth). The teeth often encroached outside of the dental arch, the parabola of which was thus rendered irregular. There was atrophy or complete absence of the superior lateral incisor.

CHAPTER XVI.

INTER-OPERATION OF CAUSES AND PREDISPOSITIONS.

Q. How do forces tending to changes in the organism act?

A. It will be seen that forces tending to changes in existing organism, act in various ways as part of the environment of the individual, and through its influence on him produce changes in the complex union of checks, balances, forces, and material bases which constitutes the human organism as inherited.

Q. What must any unusual change in complex unity be?

A. Abnormal, so far as the organism existing prior to the change is concerned. The question whether such abnormality be of benefit or injury is another matter.

Q. Why is it not necessarily evil?

A. A metaplasia, a change from one species into another, whether in individual animals or plants or individuals or their tissues, cannot take place without anomaly, for if no anomaly appear this new departure is impossible.

Q. Is the physiologic norm hitherto subsisting changed?

A. Yes. This change cannot well be called anything but an anomaly.

Q. What was an anomaly formerly called?

A. It was called pathos, and in this sense every departure from the norm is a pathologic event.

Q. What must occur if such pathologic event be ascertained?

A. This forces investigation as to what pathos was the special cause of it.

Q. What may this change be?

A. An external force or a chemical substance or a physical agent producing in the normal condition of the body a change, an anomaly (pathos).

Q. What can this become?

A. A foundation for certain slight hereditary characteristics propagated in a family. In themselves these belong to pathology, even though they produce no injury.

Q. What is disease in Greek?

A. It is nosos, and it is nosology that is concerned with disease.

Q. May the pathologic under some circumstances be beneficial?

A. It may be of advantage to the inheritor.

Q. What determines its character?

A. It is obvious that the fact whether a given change in the organism shall prove a defect or not is determined by the conditions of periods of stress during intra- and extra-uterine life.

Q. May defect so affect the organism as a whole as to survive the periods of stress?

A. According to general observations this must be so.

Q. What must be taken into consideration in dealing with the origin of any defect?

A. In dealing with the origin of any defect or gain in the animal organism, several factors must be taken into account, independently of the simple element of heredity.

Q. What is an uncomplicated agent?

A. Heredity, which is usually regarded as producing certain effects.

Q. What must be considered in dealing with heredity?

A. The influence of the intra-uterine stress of the fœtus.

Q. What effect will unusual strain upon the mother during gestation have?

A. It may produce an unfavorable effect upon the fœtus.

Q. Does a healthy ancestry add any weight?

A. The mother then would be less liable to ill effect from such a strain.

Q. What effects do unusually favorable conditions produce during gestation?

A. It may correct defects observable in previous pregnancies.

Q. How are periods of stress constituted?

A. By the different periods of embryonic development, as well as by those extra-uterine.

Q. Can sex be determined by condition of stress after a certain period?

A. Yes.

Q. What effect has nutrition?

A. Poor maternal nutrition will determine an excess of males, while good will determine an excess of females.

Q. What effect will arrest produce at certain periods of intra-uterine life?

A. It will produce prematurely senile states;

since, as already stated, there is a period in intra-uterine life during which the fœtus wavers between the senile appearance of adult anthropoid apes and that of mankind in youth.

Q. What may maternal nerve exhaustion do?

A. General nervous exhaustion of the mother, first affecting checking influences of the central nervous system, finally leads to unchecked excessive nervous action of the part of the local nervous systems of the organs, leading secondarily to exhaustion of these.

Q. What may result?

A. In consequence the mother is unable to either manufacture proper elements of nutrition or to excrete waste material.

Q. What effect does this have upon the fœtus?

A. The fœtus, thereby starved and poisoned, fails to pass through the periods of stress in a complete, well-balanced manner.

Q. On what structures does stress bear the strongest?

A. Those which are transitory or variable in type.

Q. What maternal influence may affect the fœtus?

A. Mental stress of the mother. The human fœtus exhibits very decided reaction to sensory impressions on the mother.

Q. What occurs at these periods of stress?

A. The forces which determine the variations of the individual from the race, and those which tend to preserve the race type, are in constant conflict.

Q. What determines whether or not the fœtus shall pass through the complex embryologic evolution determined by the race type, and whether or not individual variations presented in the parents shall be transmitted successively through these periods of stress?

A. Conditions affecting nutrition of the ovum prior to fecundation (as derived from the mother), and conditions affecting the fecundation of the ovum (as derived from the father), as well as those derived from both father and mother after fecundation, will determine whether or not the fœtus shall pass through the complex embryologic evolution determined by the race type, and whether or not individual variation present in the parents shall be transmitted through these periods of stress.

Q. What local conditions enter greatly into these factors as regards the jaw?

A. While all the factors enumerated enter into jaw degeneration, a greater factor is extraction of the temporary and permanent teeth.

Q. Is this extraction frequent?

A. Yes. It is a universal habit abroad.

Q. What effect does it produce?

A. Constant extraction of the teeth produces variations (arrests of development) which are transmitted from one generation to another. In the evolution of the jaws, nothing could be easier accomplished than this. One period of stress is marked by eruption of the temporary and the next period of stress by the eruption of the second set. The first permanent molar is the first tooth to erupt in the permanent set. It is situated in the center of the jaw. Permanent teeth erupt anteriorly and posteriorly to this tooth. This tooth, because it is larger, requires more room. The first molar is the first tooth to decay. As soon as it aches it is removed. When the other permanent teeth erupt they move forward and fill the space made vacant by the lost first molar. Since the jaw expands and grows for the purpose of containing the teeth, in their absence the jaw ceases to develop. What is true of the first molar is also true of the other teeth. In many countries one tooth after another is sacrificed as soon as it begins to ache. Not infrequently whole sets of teeth are removed in young life before the jaws have fully developed. The habit of early extraction of the temporary and permanent teeth from one generation to another causes arrest of development in two ways.

Q. In what two ways does early extraction of the temporary teeth from one generation to another cause arrest of development?

A. First, through the inheritance of acquired defects; second, by natural selection. Since the jaws and teeth are so unstable in their development they are easily affected.

Q. What influence has civilization on the jaws and teeth?

A. By its economy as regards food production and preparation it has lessened markedly the function of the jaws and teeth. Food no longer needs the grinding and tearing required from primitive man, or even from types as high as the "pile dwellers," whose food is still to be found, even to coarse breads and cakes. Under the law of economy of growth, lessened muscular action leads to lessened blood supply. Lessened blood supply produces conditions in the offspring tending to under-nutrition of certain parts for the benefit of the body as a whole, and to diminish in size of unused parts. As the jaws, alveolar process, and teeth are comparatively unstable in all mammals, these of necessity are peculiarly affected by disuse.

Q. Is there a similar condition in the lower animals?

A. The dog, to whom domestication plays the part of civilization, has from a carnivore become an omnivore. In the mongrel dogs, race admixture and other factors producing change in man are to be found. In the dog peculiarly, does domestication play the part of civilization. In him jaw and tooth irregularities ascribed to other causes occur. Facility for securing food under domestication has played a part. Disuse of the jaw as a weapon by man has done its share in the changes comparatively early in development. To a certain extent this last change is still going on in the dog. In cases predisposed to advance in evolution, irregularities of beneficial type would occur with great facility. In cases predisposed in the opposite direction, changes would result of opposite effect.

Q. Where are the fewest contracted jaws and irregularities of the teeth found in European countries?

A. In Greece and Russia.

Q. Where are the greatest number found?

A. Among the English-speaking people and the Scandinavians.

Q. Why?

A. Both peoples have passed through very similar phases of race evolution and both contain at bottom the same race elements.

Q. What is evident from this?

A. That the struggle for existence between the organs, dependent on race evolution and race admixture, has in the higher races resulted in the triumph of the brain and skull at the expense of the face, hence the higher the intellectuality the greater the tendency to local anomalies of the face, jaws, and teeth.

CHAPTER XVII.

DEVELOPMENTAL NEUROSES OF THE FACE.

Q. Who was the first to study the face in a scientific manner?

A. Camper, whose results gave his name to the facial angle by which is judged the rank of the face.

Q. What is Camper's facial angle?

A. A line drawn from the super-orbital ridge to a point at the nasal spine, and from this point to the auditory meatus.

Q. What do the facial angles of Camper, Cuvier, Cloquets, Jacquarts, the Munich-Frankfort angle, and those of Topinard involve?

A. Merely the bones of the head and face.

Q. With what do most authors deal in discussing prognathism and orthognathism?

A. With the skull, including only the superior maxilla.

Q. What must medical specialists include?

A. The inferior maxilla.

Q. Why?

A. Because only by the improved facial angle can correct bases be obtained upon which to compare deformities of the jaws.

Q. Are there racial differences in the facial angle at the present time?

A. There are. In the evolution of man every race may be included at some degree between the prognathous and orthognathous type of jaw.

Q. Is there a race type?

A. Only in a general way. There may be cases of extreme protrusion and recession of jaws in each nationality, due to an unstable nervous system, a result of excesses.

Q. In the countries of Europe how do the jaws differ?

A. In most countries the jaws are broad and protrude, while in some recession is the rule.

Q. In what countries is orthognathism most common?

A. In Stockholm, Sweden, an examination of 5,000 people showed the following results. A perpendicular line dropped from the supercilliary ridge showed only 2 per cent. outside, 14.70 per cent. on the line and 83.00 inside the line or orthognathous. In London an examination of 10,000 revealed 4.13 per cent. outside the line, 12.87 on the line and 83.00 inside the line. In an examination of 3,000 English school children (about ten years of age) 93 per cent. possessed jaws inside of the line. Prognathism as a rule was a prominent feature in other nationalities.

Q. What significance has this?

A. In a general way it is possible to decide, without an examination of the mouth, the frequency of irregularities of the teeth; when prognathism is present there is plenty of room for the teeth, and *vice versa*.

Q. Is there not a quicker and easier way to arrive at this result?

A. There is. The evolution of the American negro is an apt and striking illustration.

Q. Give examples.

A. Dr. W. E. Walker made an examination of 357 of the lowest negro type in New Orleans. His results were protrusion in 97.5 per cent., on the line 2.5. Those made in Baltimore show 8 per cent. outside the line, 36.5 on the line, 55.5 inside. Those made in Philadelphia, 686 in all, 83.57 outside, 15.95 on the line, and 1.13 inside. In Boston, of 1,000, 45.5 outside the line, 39.5 on the line, 15.1 receding. In Chicago, of 1,085, 51.06 presented protrusion, 31.08 on the line, and 16.6 inside the line. It will be seen, therefore, although the negro is from a marked dolichocephalic race with excessively protruding jaws, climate, soil, and intermixture have made a wonderful change in a very few years.

Q. How does the change in the jaws compare with that of the teeth?

A. Evolution of the teeth is a much slower process. The teeth do not grow smaller in proportion to the jaws.

Q. How does the evolution of the jaws compare with the weight?

A. In the same proportion. Ward has shown by weight that absolute size of the lower jaw is greater in primitive races. Of nine aborigines the mean weight of the jaw was 102.4 grams. Of eighteen white males the mean weight of the jaw was only 83.4 grams. Yet the weight of the skull was nearly alike in both cases.

Q. What is the weight of the lower jaw compared with that of the cranium?

A. It is 15.6 from aboriginal man as against 12.16 from white men. It is 46.2 from anthropoid apes.

Q. What does this prove?

A. It proves a progressive degeneracy in the jaws.

Q. Are changes taking place in the shape of the head?

A. Yes. An examination of eighteen negroes taken at random revealed five with a cephalic index below seventy, six between seventy and eighty, and seven about eighty. In an examination of 2,000 negroes in Chicago only six dolichocephales were found.

Q. What do these figures indicate?

A. They show that, allowing for slight admixture of brachycephaly from the negro race themselves, change in climate and admixture of Indian and Caucasic races in America have completely changed the shape and physique of the negro.

Q. What characteristic feature has a tendency to increase prognathism?

A. The excessive development of the inferior maxilla. The rami and body of the lower jaws, together with the muscles of mastication, are very large and massive as compared with those of the white. The constant force of the larger lower jaw against the light upper causes the teeth and alveolar process to be carried forward, producing prognathism.

Q. How do the jaws of the negroes living in the Northern states compare with those of the whites?

A. Their jaws are not unlike those of the Caucasic races. The zygomatic arches are smaller. The muscles are less dense and rigid, the lower jaws less massive, and orthognathism in lieu of prognathism occurs to a certain extent.

Q. What do degeneracies imply?

A. Deficiencies in constitution, not only mental and moral, but neurosal and structural.

Q. How do these deficiencies manifest themselves?

A. By expression of imperfect advance, evincing itself in the unequal balance between hypertrophy, excessive development, *statu quo*, and atrophy.

Q. Which structures of the body are more liable to become affected than others?

A. Transitory structures.

Q. Name some of them.

A. The vermiform appendix, the ears, the head, face, jaws, and teeth.

CHAPTER XVIII.

DEVELOPMENTAL NEUROSES OF THE NOSE AND INTERIOR FACIAL BONES.

Q. Does the embryonic development of the bones of the nose and internal facial bones differ from that of other structures of the head and face?

A. No. The interior bones of the face are as transitory in their nature and development as the jaws and teeth.

Q. Are deformities of the vomer, turbinated bones, and the maxillary sinuses associated with other deformities of the face and jaws?

A. Nearly always. Deformities of the internal bones of the face may occur, however, without face and jaw deformities, and vice versa.

Q. What is the frequency of vomer deformities?

A. Theile found the septum normally placed in twenty-nine out of 117 skulls. Semeleder examined forty-nine skulls and found deflection to the left in twenty, to the right in fifteen, and sigmoid deformity in four. Harrison Allen in fifty-eight skulls found narrowing to the left nineteen, to the right twenty-one.

Q. Are dry skulls available according to Zuckerkandl?

A. Dry skulls do not accurately illustrate the condition of the septum.

Q. What were Zuckerkandl's results from researches on the cadaver?

A. Out of 370 he found 123 symmetrical and 140 asymmetrical. In the deformed specimens the septum was inclined to the right in fifty-seven cases, to the left in fifty-one, sigmoid in thirty-two.

Q. What results had Mackenzie?

A. He examined 2,152 skulls in the museum of the Royal College of Surgeons, London. He found 1,657 deformed septa, 834 deflected to the left, 609 to the right. In 205 the deflection was sigmoid, while in five the irregularity was zigzag, showing 70 per cent. of deformities in the dry skulls, and only 40 in the cadaver.

Q. What did Heyman's examination show?

A. Ninety-nine per cent. of deformities in living subjects.

Q. How do these compare as regards races?

A. Zuckerkandl found in 103 cases of primitive and semi-primitive races twenty-four were asymmetrical. Mackenzie in 430 skulls of superior races 22.0 per cent. of deformities. He confirms the observations of Zuckerkandl.

Q. What are Harrison Allen's observations?

A. He found in ninety-three negro skulls deformities of the septum in 21.5 per cent.

Q. What are the results of Talbot's researches?

A. He examined 11,000 skulls in this country and Europe, including the collection in the museum of the Royal College of Surgeons, and 347 living individuals. He confirms the report of Mackenzie. Owing to the fragility of the septum the whole or anterior part was lost in 3,400 skulls. Of the 7,600 skulls, 5,762 showed marked deformities. Out of 687 ancient Peruvian skulls, 147 possessed deflection of the septum. In sixty-nine Stone Grave Indians thirty-five were normal, thirty-four deformed. In eighteen Mound Builders, eight were normal and ten deformed. In six California Indians four were normal. In twenty-eight skulls of ancient Hawaiians deflection of the septum was noticed in twenty-three cases.

Q. Were other deformities noticed in Hawaiian skulls?

A. Yes. In two cases where the inferior turbinate bones were undeveloped the septum deflected to that side. There were projections which seemed to take the place of the missing turbinates.

Q. What was the condition of the vomer in living persons?

A. One hundred and seven showed deflection of the septum.

Q. Does Zuckerkandl's theory that dried specimens are unsatisfactory in studying deformities of the septum hold true?

A. It does not seem plausible, for the reason that the two points of attachment are fixed at puberty. The septum, green or dry, cannot change its position; in the dry the deformity may not be quite as marked.

Q. Is not deflection of the septum in the living subject or the cadaver more difficult to diagnose than in the dry skull?

A. Certainly. This no doubt accounts for the small percentages of deformities reported by Zuckerkandl and Talbot.

Q. Are there not deflections in the posterior nares that are difficult to discover?

A. Yes. Deflections in the middle and posterior nares are quite difficult to detect.

Q. What shapes do these deformities usually take?

A. The sigmoid (S-shaped), again like the letter C, and often like the small italic letter *f*. The fact that it is attached throughout at its upper and lower border to a solid framework, its middle portion is liable to bend in any direction like a loose sail in the wind.

Q. May septum fracture be easily differentiated from deflection?

A. Yes.

Q. What are some of the theories as to the cause of deformities?

A. The use of astringents was one of the older theories. Morgagni's was that they were due to excessive development of the vomer. Trendelenburg believed they were due to crowding up of a high arched palate, since the two conditions are frequently connected. Jarvis having seen four cases in the same family believed it due to direct heredity. Schaus and Walker believed it due to faulty development of the facial skeleton. Bosworth believed it due to traumatism.

Q. Is it possible for traumatism and low forms of inflammation to produce all, or nearly all, of these deformities?

A. It does not seem possible. If, however, by traumatism is meant inhalation of air, this would account for fracture.

Q. What proportion of those examined seem to be fractures?

A. Of the entire number examined, 2,684 appeared to be fractures.

Q. Where were these fractures located?

A. Most were at the middle, while some were at the posterior part to the vomer. This fracture or roughening was always in the convex surface of the bend.

Q. How was this repaired?

A. Frequently ribs of bone would be thrown out to support this curvature.

Q. Could a blow reach the point?

A. No. Most of them were located from .75 to two inches inside the nose from the nasal spine.

Q. Does the inflammatory theory seem logical?

A. No. The inflammatory condition must extend upon both sides, since the bone (should one be present) is very thin.

Q. How about a high, contracted vault forcing the septum out of place?

A. While high vaults and deflected septums most always go hand in hand, it is impossible for the vault to be carried upwards owing to the strong support of the nasal bone. The vault is developed downwards, not upwards.

Q. Would not the suture assist in preventing the vault being carried up?

A. Most certainly. The suture at the median line is like the keel of a ship, only upside down.

Q. At what period does the vault obtain its shape?

A. Not until after the sixth year. The high vault is never seen before that time, since it forms with the second set of teeth.

Q. Are deflected septa found at that period?

A. A large majority of cases are found to commence to form before that time.

Q. Could the vomer pull up or push down the vault?

A. No. In either case the vomer would become taut.

Q. It has been claimed the ridge frequently found in the roof of the mouth is due to the downward movement of the vomer.

A. In an examination of 1,367 skulls in which this was partially or fully developed, a corresponding depression could not be found in the floor of the nose.

Q. What is the relation between deflected septa and high vaults?

A. All who have made investigation have shown that deflected septa are common among early and relatively pure races. High vaults and contracted arches are never seen in such people.

Q. What is the most plausible theory?

A. That advanced by Morgagni, that the septum has developed beyond normal, and in order to accommodate itself it must deflect to the right and left.

Q. Would not obstruction to the nose assist in developing the vomer?

A. Yes. The inhalation of air would cause a vacuum, drawing the bone in and causing it to develop in either direction.

Q. Are not the turbinated bones often either excessively developed or arrested?

A. Yes. The inferior turbinates are rarely if ever normal. Sometimes they are so large as to fill the lower part of the nose, again they are not developed. Again one side will be hypertrophied, the other arrested.

Q. When asymmetry of the skull and face are observed are stigmata apt to be found in the nasal bone?

A. Yes. Almost invariably. The two sides of the face are unlike, one orbit may be smaller than the other and one maxillary bone contain a smaller antrum than the other side.

Q. Will arrest of development of one side cause the teeth to be forced out of the arch?

A. Yes, and the roots of the teeth in many cases protrude through the outer plate of the alveolar process.

Q. Are the mastoid processes involved?

A. One or both may be excessively developed or arrested.

Q. When the turbinated bones are excessively developed or arrested, what position does the vomer assume?

A. It usually takes the curve of the turbinates so that it will stand about midway in all directions.

Q. Are the nasal cavities often arrested?

A. The nasal cavities are sometimes arrested with hypertrophy of the turbinates, deflection of the septum, and hypertrophy of the mucous membrane, preventing the child from breathing through the nose.

Q. Does not arrest of the nasal cavities mean arrest of the superior maxilla and vice versa?

A. When one is involved the other is also apt to be.

Q. Is it common to find arrest of development of the inferior turbinate bone in ancient skulls?

A. Yes. It is quite common in Alaskan races and Peruvian skulls.

Q. What other stigmata may be seen in connection with the nasal cavities?

A. Occasionally one nasal cavity will be lower than the other, again both cavities may be carried over to one side.

Q. With such deformities of the bones of the nose and maxilla, there must be marked deformities in the antra.

A. Such is the case. Sometimes the internal bones of the face will be deformed to the extent that a very large antrum will develop upon one side and none upon the other. Again, one side will be made up of eight or more small cavities like the ethmoidal cells, while the antrum upon the other side will be large.

Q. Does this make it difficult to enter the antrum by carrying a drill up through the alveoli?

A This is very unsafe procedure. Operators have often carried the drill into the floor of the nose.

Q. Are projections or spurs often found in the nose?

A. They are very common. They may be situated at almost any locality, but seem to be found at any point where there is considerable space.

Q. What is the most common location for them?

A. Upon the vomer, projecting midway between the turbinated bones.

Q. What is the width of the external nasal cavity?

A. It varies greatly. In 2,000 skulls the greatest width was 1.25 inches, the smallest was .75. The length from the nasal spine to the outer border, greatest width 1.54, smallest 1.20. These skulls, however, were those of Peruvian Stone Grave Indians, Mound Builders, Cliff-Dwellers, Hawaiians, etc. In neurotics and degenerates, where arrest of development of the face and nose takes place, the width measured .50 to .60 inches, .80 to .90 of an inch in length.

Q. If both sides be not alike, will there be free circulation?

A. No. If one side is filled with excessively developed bones, the other side will have to take air enough to supply the required amount. This will cause the open side to enlarge.

Q. What were Ziem's experiments?

A. He showed that if one nostril of a rabbit be permanently closed, and the animal killed, when it had attained its full growth, the nasal cavity of the affected side will be found to be undeveloped, and face asymmetry occur.

Q. What was the condition of the opposite side?

A. The air passages in the opposite side were enlarged.

Q. What effect does a greater quantity of air have upon the developed side?

A. The turbinates enlarge, owing to the stimulation, and the vomer is carried to the weaker side.

Q. Does the septum ossify as early as the other bones of the nose?

A. It does not, and therefore it is more easily moved out of normal position.

Q. At what period does this occur?

A. At or about the sixth year.

Q. Are these bones vascular?

A. They are.

Q. For what reason?

A. For the purpose of warming the air before it is taken into the lungs.

Q. Owing to this vascularity are they more liable to excessive development?

A. They are. The turbinates being exceedingly unstable, with considerable vascularity, the slightest stimulation causes them to develop.

Q. Does the condition of the turbinates determine the future shape of the vomer?

A. Yes. These develop first and the vomer ossifying last is molded into position by inhalation and exhalation of air as nearly as possible into two equal cavities.

Q. Are both sides always equal?

A. Not always; owing to inflammation of the mucous membrane of one or both sides, due to colds and other causes, one side will become filled up. This not infrequently causes the vomer to become attached to the turbinates.

Q. In what class of patients do these conditions usually occur?

A. In neurotics and degenerates, since tissue building is very unstable.

Q. Is it in them that atrophy, hypertrophy, and adenoid growths usually occur?

A. Yes. Arrest of development of the face, including the upper jaw and bones of the nose, first takes place, the nose fills up on account of the arrest, and hypertrophy of the bones of the nose results, filling the nasal cavities, the result of which mouth-breathing takes place.

Q. Is nasal catarrh associated with such cases?

A. It almost always occurs in such unstable conditions.

Q. What is the general appearance of the nose?

A. In neurotics and degenerates the face is arrested from the supercilliary ridges down to and including the teeth of the upper jaw. It has a hollowed-out appearance. The nose is long and thin.

Q. Does inhalation interfere in such cases?

A. Very markedly. When the person inhales air the sides of the nose close like a bellows, causing the person to breath through the mouth.

Q. What peculiar characteristic is nearly always noticed in persons who possess arrest of the nose and face?

A. Arrest of chest walls and lung tissue almost always takes place.

Q. What significance has this?

A. Such people are liable to become infected with tubercle bacilli, because of mouth-breathing; the germs are taken into the mouth and are easily passed into the undeveloped lungs.

Q. What precaution should be taken in such children?

A. Children who have arrest of nose, face, jaws and chest walls should live out of doors as much as possible, eat nutritious food, and have the best of hygienic attention.

Q. What is the antrum?

A. It is a cavity situated upon either side in the superior maxillary bone.

Q. Describe it.

A. Gray speaks of it as being a large triangular-shaped cavity; its apex, directed outward, is formed by the malar process; its base by the outer wall of the nose. This description does not hold good in all cases, since the antrum (which depends on variation in evolution of the face, and further variation dependent on the nature of the transitory structure with which it is connected, as well as on the periods of evolutionary stress) must be entirely variable. It is hence not surprising that the variability of the antrum cannot be overestimated.

Q. What may be said of it in a general way?

A. That the height, length, width, and location are governed by the shape of the face, and by the type of the nose, and of the superior maxilla. The shape and position, therefore, vary widely.

Q. Describe some of these.

A. One may be very small and resemble a crescent with the concavity toward the nasal wall, its convexity toward the malar process. It may not be large enough to admit the end of the little finger, and may not extend laterally to the inferior orbital opening. Sometimes the antrum upon one side will be very long, while upon the other it is very short and small. Usually the nasal cavity will be carried over nearly one-half its size to the side of the smallest antrum.

Q. Is it not sometimes almost obliterated?

A. Occasionally the locality of the antrum will be filled with soft cancellated bone, again it will be divided into small cavities, with cancellated bone between them. These resemble the ethmoidal cells.

Q. In most cases what shape does the antrum assume?

A. Although the antrum is usually regarded as a triangle, it assumes even in normal subjects a great variety of shapes. In degenerates, therefore, a greater variety of shapes and positions are assumed.

Q. Should great care be exercised in making openings into the antrum in operations?

A. Yes. The cavity is sometimes situated entirely outside of the alveolar ridge. In such cases the floor of the nose is usually over the alveolar process. A drill passing through the alveolar process would enter the floor of the nose. In some cases the antrum is so large that it extends from about midway the face, including the inner surface of the malar process, with a very thin wall for the floor of the orbit. In drilling an opening through the alveolar process care should be exercised not to allow it to pass through the floor into the orbital cavity.

Q. Is it not possible for the antrum to become obliterated with such malformations?

A. When the cavity is extremely large upon one side the chances are that it is very small, or nearly or quite obliterated, in the other side. In such cases a drill would not reach it when passed through the alveolar process.

Q. In these cases was the antrum clear and free of all obstruction?

A. In 963 cases septal projections were found ranging all the way from simple ridges to partitions extending two-thirds the height of the cavity; again several septa or partitions could be seen dividing the cavity into many smaller ones.

Q. Did they completely separate the cavity?

A. In no case was the cavity entirely separated.

Q. Do the roots of the teeth ever penetrate the antrum?

A. In an examination of 11,000 skulls, 3,000 were broken so that the antra could be examined, making 6,000 antra in all. Of this number 1,274, or about twenty-one per cent., had abscessed teeth; of this number seventy-six, or about six per cent., extended into and discharged into the antrum. Dr. M. H. Fletcher, of Cincinnati, examined 500 skulls, making 1,000 antra, with the following results: Two hundred and fifty-two upper molars were abscessed, making twenty-five per cent. in the locality of the antrum. In these, abscesses in the antrum were found twelve times, or one in every twenty-one.

Q. Are many cases of diseased antrum due to abscessed teeth found?

A. In a thirty years' practice, 367 cases of pulpless molars (less than one per cent.) were found. In 224 cases of pulpless molars, Dr. M. H. Fletcher found only one case of pus in the antrum. Dr. Bonwill had never seen a case in his practice. Antral disease is very rarely the result of abscessed teeth.

CHAPTER XIX.

DEVELOPMENTAL NEUROSES OF THE EYE.

Q. Are the eyes in the embryo larger than in the adult?

A. They are. They resemble the eyes of the lemurs, thus retaining an embryonic tendency.

Q. Are the large orbits liable to remain?

A. Embryonic large sockets may remain, or they may pass through the lemurian stage, to reach and even exceed the anthropoidia in smallness and closeness together.

Q. Do the eyes, like other structures, embryonically pass through the different zoologic phases?

A. The eyes, like the brain and other structures of the body, pass through the different vertebrate stages of development.

Q. What causes these changes?

A. If growth be interfered with by the law of economy of growth, the eye assumes lower forms, as in persistent hyaloid, colobomata, microphthalmia, etc.

Q. Do these structures resemble exactly those of the lower animals?

A. Neither the degenerate human brain nor the undeveloped eye resemble exactly the brain or eye of the lower animals.

Q. What are the views as to the primitive eye type of the vertebrates?

A. There are two claims, one that the eyes were derived from the median eye of the ascidian lancelet, the other that existing vertebrate eyes represent the paired eyes of a hypothetic annelid precursor. Both views are reconcilable through study of the ascidian and lancelet eye collated with cyclopian and triophthalmic (three-eyed) degeneracies in man, the human eye and the third eye of reptiles, like the hatteria of New Zealand.

Q. Does the eye of the ascidian tadpole agree fundamentally with the type of eye peculiar to the vertebrates?

A. Yes, in that the retina is derived from the wall of the brain. On this account it is called a myolonic eye.

Q. How does the typical invertebrate eye differ?

A. The retinal cells are differentiated from the external ectoderm.

Q. How does the ascidian eye differ essentially from the paired eyes of the skulled vertebrates?

A. In that the lens, as well as the retina, is derived from the wall of the brain.

Q. How is the lens of the lateral eye of the vertebrates derived?

A. From an invagination of the ectoderm, which meets and fits in the retinal cup of the end of the optic vesicle.

Q. How does the ascidian eye, as to lens origin, agree with the parietal or pineal eye of the lizard?

A. The lens is likewise derived from cells which form part of the wall of the cerebral outgrowth that gives rise to the pineal body.

Q. What is the pineal body?

A. It is a remarkable rudimentary structure, whose constant presence in all groups of vertebrates forms such an eminently characteristic median outgrowth from the dorsal wall of the brain (thalamencephalon). The distal extremity of this dilates into a vesicle and becomes separated from the proximal portion.

Q. What becomes of the distal vesicle?

A. It becomes entirely constricted off from the primary epiphysial (pineal) outgrowth of the brain, and the parietal nerve does not represent the primitive connection of the pineal eye with the roof of the brain, but arises quite independently of the proximal portion of the epiphysis.

Q. What did the remote ancestors of the vertebrates possess?

A. A median unpaired myolonic eye, which was subsequently replaced in functon by the evolution of the paired eyes.

Q. Do cyclopic conditions occur frequently?

A. Yes. More frequently among human monstrosities than among animals.

Q. Why?

A. This is due to the fact that human monstrosities are much more frequently recorded. Of the 120 cases of human cyclopia fifty-six presented other evidences of degeneracy than cyclopic conditions, and sixty had neuropathies or other taint in the ancestry.

Q. How is a cyclops produced?

A. Production of a single eye, the changes in the structure of the mouth, the strophy and abnormal situation of the olfactory apparatus and of the vesicle of the hemispheres, all result from arrest of development, as Dareste has shown. The determining influences must be exerted very early in the life history of the embryo.

Q. Cite instances of cyclops.

A. A female, born alive, to a negro multipara, which died two hours after birth. The eye was centrally located in the forehead on a line with the nose. The brow was a complete arch, as was the upper eyelid. The lower lid had a mark midway, indicating an attempt at division. The nasal bones were wanting. The soft part of the nose, destitute of the orifice, hung over the mouth, which was completely covered. The chin was recedent. In another case the nose was wanting. Its place in the median line was occupied by a single eye; on the horizontal diameter were two pupils separated by a narrow space.

Q. What does Landolt claim?

A. Discussing a case by Valude, he claims that while in cyclopic eyes all the parts may be doubled or unite in every degree, there is never a single lens or double vitreous.

Q. Is this borne out by other cases?

A. Bock describes cases in which the eye had not been formed by the conglomeration of two separately developed eyes, but is a single developed eye; the other being wanting entirely. A cyclops, in which there was a single socket for the eye, of a lozenge-shape, situated in the lower middle of the forehead. The socket was furnished with two pairs of eyelids, upper and lower. The eye was found to consist of two rudimentary retinæ, apparently springing from a single optic vesicle. The nose was represented by a short process, attached to the forehead, above the median eye.

Q. What dental deformities may a cyclops present?

A. In a cyclops, born living, but killed by pressure on the funis, the mouth contained an ivory tusk-like tooth at each corner. There was mane-like hair around the neck.

Q. What accompanies cyclopia?

A. Absence of both the internal and external ear, and synotia (joined ears). In the triophthalmic cases the three eyes are usually separate; two occupying the usual position, while the third is situated in the center of the forehead.

Q. How many cyclops did ninety families of degenerates average?

A. In an average of eleven children each, there were five cyclops.

Q. How does degeneracy affect the eye?

A. Degeneracy, which affects so deeply the development of the eye, naturally tends to evince itself in other anomalous states in the organ. As excessive asymmetry of the body is one of the most noticeable of the stigmata of degeneracy, it is not astonishing to find that this asymmetry expresses itself both in the position as well as in the size and structure of the eye. Asymmetrical irides are exceedingly frequent in the types of insanity due to hereditary defect.

Q. What other anomalies are found in the eyes of degenerates?

A. The conditions of the eye, known as microphthalmia (small eyes), macrophthalmia (big eyes), and anophthalmia (absence of eyes), are found quite frequently in degenerate families. Corectopia (displacement of the pupil so that it is not in the center of the iris) often exists. Coloboma (eye fissure) is also not infrequent among degenerates.

Q. How do these vary?

A. These vary greatly in situation and general results. The iris is sometimes completely absent on one or both sides (aniridia). Beside these anomalies, morbid conditions, like retinis pigmentosa, congenital cataract, and macular degeneracy are far from infrequent expressions of degenerate taint of the eye. The organ in this particular obeys the general law that degeneracy may show itself in the minute change, resulting in disturbances of functions or that producing disease or finally atavism. The defects of the eye requiring glasses are exceedingly frequent in degenerates and aggravate their morbidity.

Q. Cite instances of eye degeneracy.

A. Female, age fourteen. Patient's people are exceedingly poor and so ignorant as to make it impossible to get any reliable family history. There are four sisters and three brothers, all poor and ignorant. The patient is idiotic. She has a retreating forehead and exceedingly crooked nose, a very long, thin neck, and an exceedingly small, retrusive jaw, the lower incisors striking at least one-half inch behind the upper. The teeth are exceedingly irregular. The two left upper incisors are large, the two others very small. Of the lower incisors, the two central ones are like mice teeth, pointed and sharp. They are separated at their bases, but come together at their tops, at an acute angle. The other two are conical and lie each parallel to its neighbor. Examination of eyes reveals V—fingers in one-half M. Eyes small. Nystagmus. Fundi apparently normal. Diagnosis, microphthalmus.

Female, age seventeen. Father is deaf. Could obtain no history of degenerate stigmata in mother.

Has four sisters living, nine dead. Has four brothers living and one dead. Had to depend on patient for family history. The patient is exceedingly dull. It is impossible for her to learn. She has jaws that, at the junction of the premaxillary and maxillary bones, present a well marked angle. Her teeth are conical. The incisors are sharp and pointed; are like mice teeth. The ears are small, and placed high upon the head; she is an almost typical degenerate, both physically and mentally. Examination of the eyes reveals V—cannot count fingers, but sees large objects.

CHAPTER XX.

DEVELOPMENTAL NEUROSES OF THE BONES OF THE EAR.

Q. Are ear deformities frequently found?

A. They are very common. Total absence of the external as well as embryonic internal ear occurs.

Q. Does it affect the hearing?

A. The exceedingly primitive structure of the internal auditory mechanism necessitates abnormal or defective hearing power.

Q. Can congenital deaf-mutism be thus accounted for?

A. There is no question but that arrest of development of the auditory mechanism places if in a condition not to appreciate sound.

Q. Does this affect the child, though he may not have been born deaf?

A. Deaf-mutism from inability to appreciate sound occurs, and the whole auditory apparatus subsequently furthers degeneration.

Q. Does mental weakness aggravate the condi tions?

A. It has much to do with such cases.

Q. Are closure of the Eustachian tube and absence of external ear infallible signs of deafness?

A. No.

Q. Must the complicated mechanism of the ear bones necessarily be a rich field for degeneracy?

A. Yes. Many ear lesions are no doubt due to such deformities.

Q. Are deformities of the jaws and teeth common among deaf-mutes?

A. Of 143 congenital deaf-mutes, ninety-three per cent. had deformities of the head, face, jaws, and teeth.

CHAPTER XXI.

DEVELOPMENTAL NEUROSES OF JAWS OF THE SEEMINGLY NORMAL.

Q. What did the examination of 1,000 seemingly normal school children show?

A. They showed normal 76 per cent., large jaw 1.9 per cent., protrusion lower jaw .7 per cent., protrusion upper jaw .7 per cent., high vault 5.6 per cent., V-shaped arch 1.1 per cent., partial V-shaped arch 6.1 per cent., saddle-shaped arch 3.3 per cent., small teeth 3.0 per cent.

Q. What did 1,000 seemingly normal adults show?

A. They showed normal 61 per cent., large jaw 3.2 per cent., height of vault 11.0 per cent., V-shaped arch 3.5 per cent., partial V-shaped 7 2 per cent., semi V-shaped arch 1.8 per cent., saddle arch 4 3 per cent., partial saddle 5.1 per cent., semi-saddle 3.4 per cent.

Q. What variation is noticed in different ages?

A About fifteen per cent. more deformities in the adult.

Q How may this be explained?

A In two ways· (1) That as people grow older slight irregularities of the teeth may become sometimes more prominent, owing to movement and permanent arrangement of the teeth later in life. (2) Some of those examined are patients who presented deformities that alarmed them. The percentage of deformities compares favorably with the percentage of deformities of the face. Taken as a whole, they give an approximate idea of the percentage of deformities, in this community at least.

Q. How do defectives compare with normal as regards deformifies?

A. The percentage is from twenty-five to thirty-three per cent. less than found in institutions for defectives.

CHAPTER XXII.

DEVELOPMENTAL NEUROSES OF THE MAXILLARY BONES.

Q. Are excessively developed jaws often seen?

A. Yes. Either from natural growth or disease.

Q. At what time does the jaw attain its growth?

A. It has attained its full size at from twenty-five to thirty-five years of age.

Q. Why so late?

A. Because in neurotics and degenerates partial arrest takes place at different periods, after which the jaw will start up again and continue to grow. Assimilation is often slow, and the building up of structure is not complete until thirty to thirty-five.

Q. Does the jaw usually correspond with the shape and size of the head?

A. Other things being equal, a large head will contain a large jaw, a small head a small jaw, a broad head a broad jaw, a long head a long jaw.

Q. Does the opposite sometimes occur?

A. Yes. Occasionally a very small jaw is observed in a very large head, and vice versa.

Q. Are both jaws uniformly affected?

A. They are not. The upper jaw is more subject to morbid influences than the lower.

Q. Why?

A. Because it is connected with the bones of the head, of which it is a part. As a fixed bone the blood supply is reduced.

Q. How about the lower?

A. While the lower rarely exceeds the average, a constant use and mobility has a tendency to keep it normal The influence which tends to check the upper is in the lower, thus overbalanced by its mobility

Q. Does use increase the size of the jaw?

A. Constant use increases the size, as in acrobats, tobacco chewers, singers, public speakers, and in the early races, which lived upon shells, roots, etc.

Q. Does enlargement of the maxillaries occasion dental irregularities?

A. Yes. The teeth of one jaw may extend inside or outside of those on the opposite jaw.

Q. What diseases may cause this enlargement?

A. Hypertrophy on the one hand, hyperplasia on the other, as well as osteitis and periostitis.

Q. Will diseases of the antrum cause enlargement of the upper jaw?

A. Yes. Diseases of the antrum and nasal fossæ will produce the same result.

Q. Does syphilis affect the jaws?

A. Yes. Hereditary syphilis has a special predilection for the bones of the face and jaws. This is no doubt due to their transitory nature. Especially is this true of the alveolar processes.

Q. Is the same form of irregularities of the teeth found in large jaws as small?

A. V and saddle-shaped arches, with their modifications, are never found in large arches.

Q. In what disease of children are jaw abnormalities liable to occur?

A. In rachitis, whether due to syphilis or not, hypertrophy and hyperplasia may be localized in some portion of the jaw, causing it to be unevenly developed.

Q. Is there jaw as well as face asymmetry?

A. Yes. It is very common among neurotics and degenerates, and among the offspring of mixed races.

Q. Why?

A. Each lateral half of the body develops independently of the other. The same is also true of the jaws. Each has its own peculiarities. Asymmetry, therefore, is caused from the inharmonious lateral development of the parts.

Q. Is it common?

A. Extreme asymmetry of the lateral halves is often seen. Although it may not affect the contour of the face, it causes faulty articulation of the teeth upon that side of the face.

Q. What is a local cause of asymmetry of the face?

A. A full set of teeth upon one side with mastication upon that side alone; on the other side one or more teeth may have been extracted, or they may not erupt, or they may have moved forward upon one side. In any of these conditions the alveolar process and jaws would become shorter on one side than on the other.

Q. What is this deformity called?

A. Haskell's deformity.

Q. Why?

A. Because Dr. L. P. Haskell first called the attention to it.

Q. In this deformity what produces marked depression on the side of the face?

A. It is properly due to asymmetry in the development of the two halves of the face. In mastication and in the eruption of the teeth they are forced into a larger circle; in this manner the circle of the alveolar process becomes larger than the circle of the jaw proper.

Q. Is it customary to masticate upon both sides of the mouth?

A. Yes. Although just as a person is right and left handed, so may he masticate either upon the right or left side.

Q. Are these deformities apparent to the casual observer?

A. They are not. Only when artificial teeth are inserted, or an irregularity corrected, can these deformities be detected.

Q. Are not the rami frequently abnormally developed?

A. They are. It is not uncommon to find one ramus from one-fourth to one-half, and sometimes three-fourths of an inch shorter than that on the other side.

Q. What effect does it have upon the body of the jaw and the teeth?

A. It throws the jaw and teeth to one side, making a marked deformity.

Q. May not the body of the jaw be longer and larger upon one side than upon the other?

A. It is not uncommon to find one side longer than the other.

Q. How can this be detected?

A. By the position of the median line, and also by the occlusion of the teeth.

Q. Where the inferior maxilla is normal or excessively developed, the superior maxilla quite small, and the alveolar process thin, what may occur?

A. This condition will force the lower jaw and teeth against the upper, carrying the teeth and alveolar process forward, producing a marked protrusion of the process and teeth.

Q. What effect has this condition in negroes?

A. It has a tendency to perpetuate the prognathism of the jaws.

Q. What other cause may produce this deformity?

A. A short rami.

Q. What effect does such a deformity have upon the face?

A. It usually produces marked depression of the face at the alæ of the nose.

Q. When the superior maxilla is fully developed, and the lower jaw cannot force the teeth and alveolar process forward, what results?

A. The first molars erupt normally and occlusion is perfect until the second teeth come into place. Owing to the short rami the harmony is lost, and the second molars only articulate. The anterior part of the mouth remains open.

Q. When excessive development of the rami takes place, what occurs?

A. The body of the lower jaw may be brought forward, so that it protrudes quite a distance beyond the upper.

Q. Can the rami be normal while the body is excessively developed?

A. Yes. Such a case was observed in a School of Idiocy in Hamburg. The inferior incisors extended one inch beyond those of the upper.

Q. When the mobility of the lower jaw is favorable to a healthy, normal development, does the jaw ever become arrested?

A. It is not uncommon to find the jaw arrested; when this is the case the person has the appearance of having lost the chin.

Q. What peculiar feature has the Yankee or American type of jaw?

A. It has a short rami, long slim, body and protruding chin. The face is thin. The alveolar process and teeth are normal. Delicate muscles and tendons are associated with such bones.

Q. Will not such a jaw become easily dislocated?

A. Dislocation is liable to occur while yawning or during dental operations. Great care should be used to avoid too much leverage.

Q. Does not the superior maxilla sometimes shut inside of the lower?

A. Occasionally the upper jaw will become arrested to the extent that it will entirely close inside the lower, as in the case of Charles V. of Germany.

Q. Do extreme cases of abnormal jaw development occur?

A. Complete absence of the interior maxilla occurs, but is rarer in man than in animals. It has been most noted in sheep. On the other hand, excessive development of the lower jaw in the bull-dog is quite common.

CHAPTER XXIII.

DEVELOPMENTAL NEUROSES OF THE VAULT.

Q. Who first called attention to the relation of the palate or vaults in idiots?

A. Dr. Langdon Down. After careful measurement of the mouths of the congenitally feeble-minded and of intelligent people he found that there was a markedly diminished width between the posterior bicuspids of the two sides. One result, or rather accompaniment of the narrowing is the inordinate vaulting of the palate. It assumed a roof-like form. The vaulting is not simply apparent from the approximate; it is absolute. The line of juncture between the palatal bone occupying a higher plane.

Q. What did he conclude?

A. That the condition of the mouth is important in determining whether the lesion on which the mental weakness depends is of intra-uterine or post-uterine origin. In the event of the mouth being abnormal, it indicates a congenital origin, while if the mouth is well formed, and the teeth are in a healthy condition, it would lead to the opinion that the condition had occurred subsequently to embryonic life.

Q. What do these, when found in children, indicate, according to Dr. Down?

A. Idiocy. But while many idiots and imbeciles have low, narrow vaults, many sane people have high vaults, and V-shaped and saddle arches.

Q. What did Clay Shaw decide?

A. His researches showed that while there is no necessary connection between a high palate and a degree of mental capacity of the individual, a high palate is invariably associated with narrow pterygoid width and a narrow skull.

Q. On examination of Clay Shaw's results, what conclusion was arrived at?

A. That the intellectual standard adopted was too limited to admit of his sweeping assertion as regards mental capacity.

Q. What was further shown?

A. The claim anent narrow skull and high palate is a sweeping assertion, based on a few selected cases. Examination of the skulls in any moderately-sized anthropologic collection will disprove this assertion.

Q. What is Cuylitz's theory?

A. The claim of the connection of high vaulted palate with mental deficiency, asserted in explanation that the brain tends to develop transversely, but meets in some cases a resistance in the parietal region, which crowds it back. This pressure is transmitted by the zygomatic, temporal, and malar processes pushing together; the alveolar borders of the superior maxillary, like a workman's tongs, bring the ends together.

Q. Does this theory seem plausible?

A. While this explanation is exceedingly ingenious, it is as yet in the earliest stages of a working hypothesis.

Q. What is idiocy?

A. It is but a bud on the tree of degeneracy, and many conditions of checked development found in idiocy are found in other forms of degeneracy as well.

Q. What has been the theory since Imrie's time?

A. The theory that rabbit-mouth is due to keeping the thumb in the mouth for hours after going to sleep, has, with various modifications, but without careful analysis, been repeatedly reiterated in parrot-like fashion.

Q. Who was the first to corroborate Imrie?

A. Thomas Ballard claimed that "as in idiots are seen the worst forms of deformed growth, so also do they exhibit the most aggravated forms of deformed jaws and teeth, the habit of sucking being retained by them to advanced age."

Q. Why is thumb-sucking an illogic theory?

A. When the size of the vault, especially its anterior-posterior diameter, is compared with the thumb, lip, tongue, sugar teat, etc., it is evident that depression made by them could not produce uniform width and height throughout the entire length of the vault.

Q. How early do children commence to suck their fingers?

A. Soon after birth. As absorption and deposition of bone cells take place faster at that time than at any other in life, high, narrow, deformed vaults would be expected in connection with the first set of teeth or before the sixth year, but such is not the case. Children with the habit of finger-sucking often have very low vaults.

Q. What were Clouston's conclusions?

A. He divides vaults into three groups, typical (or normal), neurotic, and deformed. The first has a low, but regular wide dome. The second type is designated as neurotic, because, according to Clouston, the "deformity of the palate occurs during the brain growth early in life, probably in utero," and the third is designated as deformed.

Q. Are these conclusions of value?

A. They are not, since they are largely based on preconceived notions, which ignore the researches of comparative anatomists, of alienists of world-wide fame, of embryologists, of ethnologists and of criminal anthropologists.

Q. In a general way, what are the theories of Clouston, Langdon Down, and Cole?

A. That excessive vaulting of the palate is due to arrest of development of the sphenoid bone and premature ossification of the sutures at the base of the skull.

Q. What precludes these theories?

A. If the intervening space between the base of the brain and the vault were solid, a change in shape of one might exert an influence upon the other. The space occupied by the nares being located between the two, with two strong pillars of the superior maxillary bones upon either side as a resistance, precludes such a theory. That any force produced by the development of the bone at the base of the skull, or early or retarded ossification of suture in that locality, could exert an influence through the vomer is not well taken.

Q. What are other evidences that influences in this direction cannot change the shape of the vault?

A. The fact that the vomer does not ossify until puberty, the thinness of the bone after ossification, and that it is always crimped or deflected in one direction or another, is evidence that no effect could be produced upon a vault of bone, supported by the anterior alveolar process, and with a rib or suture extending its entire length, which ossified years before any change in the vault was noticed.

Q. Does the theory of Clouston that "the deformity of the palate occurs during brain growth early in life, probably in utero," seem plausible?

A. It does not. The brain continues to grow until the sixth or seventh year. The vault does not change very much until after the second teeth erupt, after the sixth year, hence a high vault cannot be said to develop early in life, much less in utero.

Q. What is Ivy's theory?

A. That dental and facial types are a part of the morphology of the temperaments. That the vault is indicative of the several temperaments. That the vault of the bilious temperament is about flat, the dome of the mouth is high and about square. The sanguine vault resembles a horse-shoe in shape, the dome of the mouth is high and semi-circular. The nervous-temperament vault is Gothic, from its pointed character. The lymphatic vault is also semi-circular, and somewhat resembles that of the sanguine temperament.

Q. Do these theories seem plausible?

A. They do not. The mouths of each class, bilious, sanguine, nervous, or lymphatic, may range from 2.50 inches across from one second bicuspid to that of the other side, down to .96 inches in width, and the antero-posterior diameter from 2.43 down to 1.86 inches. The height of vault from .86 down to .25 inches. These figures in themselves preclude any such classification.

Q. How would heredity affect the vaults?

A. Two individuals, one a nervous, the other a lymphatic, bilious, or sanguine temperament, are married, the offspring inherits the jaws of one, the teeth of the other; the temperament of the child is changed. One child may possess a broad dental arch, but very short, another a very narrow, long dental arch. Hence classification of the dental arch and vault by temperaments is out of the question.

Q. Is there further evidence that such classification is impossible?

A. Investigations were carried out upon brachycephalic, mesocephalic, and dolichocephalic individuals, which demonstrated that classification of vaults by the shape of the head could not be accomplished.

Q. What other theories have received much encouragement?

A. Mouth-breathing has been advanced as a cause of high vaults, and is still held by medical men and dentists.

Q. How is mouth-breathing produced?

A. That mouth-breathing is caused by sleeping with the mouth open, by enlargement of the tonsils, by adenoid growth, by hypertrophy of the mucous membrane of the nose and turbinated bones, and by arrest of development of the nose and upper jaw.

Q. What theory has been advanced as to the effect upon the jaws and teeth?

A. The mouth being open, pressure is brought upon the jaws and teeth by the buccinator muscles, causing contraction of the dental arches.

Q. Is such a theory in harmony with the facts?

A. It is not. The buccinator muscle is a voluntary muscle, penniform in shape. It has its origin and insertion along the body of the jaws, above and below the alveolar process. It extends from the first bicuspid anteriorly to the third molar posteriorly. Its chief function is to convey and hold food under the teeth in mastication. Being a voluntary muscle it could not contract during sleep.

Q. Does mouth-breathing commence very early in life?

A. Yes. Contracted jaws and vaults are never seen until after the sixth year. If they exist they are premature senilities or due to traumatic causes.

Q. Are high vaults and contracted arches always present in mouth-breathing?

A. Only in a very small percentage.

Q. How the mouth opened in mouth-breathing?

A. The lower jaw drops just enough to allow the same volume of air to enter that would pass through the nose, about one-half inch.

Q. Do old people sleep with the mouth open?

A. They do. Not from closure of the nostrils, however, but on account of relaxation.

Q. If mouth-breathing were the cause of contracted dental arches, would it have any effect upon the jaws and teeth in old age?

A. It would not, because the deformity is always complete by the twelfth year.

Q. Is there tension upon the dental arches when the mouth is opened?

A. There is not. When the mouth is open there is a slight sense of tension of the orbicularis oris, but not of the buccinator, no matter how wide the mouth is opened.

Q. If it were possible for the buccinator to exert pressure, would it produce the V-shaped arch?

A. It is an impossibility, because it does not extend forward far enough.

Q. Having disposed of the V-shaped vault, what effect would the buccinator muscle have upon the saddle-shaped dental arch?

A. As has already been said, this muscle is a penniform structure. The center of contraction is at, or about, the first molar tooth. The first permanent molar and the teeth posterior to it are never involved in either deformity, only the teeth anterior to the first permanent molar.

Q. That being the case, could not one-half of the muscles act upon the bicuspids and cuspids?

A. Suppose one-half of the muscles could contract upon these teeth, the result would be that the deformity would be uniform upon both sides, and always alike on each side.

Q. Is not that the case?

A. It never is the case. Frequently only one tooth is inside of the arch; again one is on the outside.

Q. Does the theory seem tenable?

A. It is perfectly absurd; since the dental arch is not unlike the arch of a bridge, or the arch in a building, pressure exerted upon the outside would have no effect upon it. If such a theory were correct, what would be the cause of the partial V and saddle, and the semi-V and saddle arches?

Q. Is there further evidence that mouth-breathing is not the cause of these deformities?

A. In the mouths of twenty-four mouth-breathers not a single complete V or saddle arch was observed. Partial V and saddle and semi-V and saddle arches were common, but in no case were there any two alike.

Q. How are deformed vaults accounted for?

A. By studying their development, the production of normal and deformed vaults can be understood.

Q. How was this accomplished?

A. First, by settling the question that deformed vaults are not observed among children with temporary teeth. The jaw grows from birth until the second period of stress, about the sixth. It is at this period that the second set erupt. Second, thirty-six impressions of the mouths of children, ranging from six to twelve years, were taken and casts obtained.

Q. Were the children picked cases?

A. They were not, only so far as age was concerned. The impressions were taken in modelling compound to get an accurate impression of the soft palate. Measurements were first taken, and then the models were sawed at the median line.

Q. How were the lines traced?

A. They were placed upon paper and traced. They were then glued together and sawed transversely anterior to the first permanent molar. They were again placed on paper, and traced transversely. In this way the illustrations were accurately outlined.

Q. Were the plates made of the models before they were cut into sections?

A. They were, and may be found in the third edition of Talbot's work. These, together with plates one to twelve in the appendix, give a very good idea of the progress of development of the permanent teeth and alveolar process.

Q. Were the changes very great at first?

A. There were three models at six years, and three at seven. The changes in the vault are so slight that more would be useless.

Q. What does this signify?

A. That only the first permanent molars were in place, and that the change in the alveolar process only takes place when the second teeth come into place.

Q. What is the condition of the vault at this time?

A. In a general way the vaults are quite low and without character.

Q. What does a cross section show?

A. It shows that the vault is quite narrow at the upper portion, and the lines in either direction diverge until the teeth are reached. The teeth also diverge outward.

Q. What is the condition of the alveolar process?

A. The alveolar process is quite thick at six and seven years, but lengthens and becomes thinner as age advances.

Q. What causes the thickness?

A. The antrum is situated between the inner and outer plate of bone, and the scanty alveolar process contains not only the roots of the temporary teeth but also the crowns of the permanent teeth.

Q. Is advance in height of vault very rapid?

A. It is not. The advance is very gradual from year to year, yet taken as a whole, from the sixth to the twelfth year there is quite an advance in height.

Q. When is the normal height attained?

A. When all of the permanent teeth are in position and the alveolar process has developed about them.

Q. Do the two sides develop the same length?

A. With but few exceptions they will be nearly alike.

Q. Does the vault along the median line change its shape in any way while this development is going on?

A. It does not. The change is always at the alveolar process.

Q. When does the greatest change take place in the alveolar process and vault?

A. Between the ninth and twelfth year, when the bicuspids come into place. It is at this period that the vault takes on character in outline.

Q. When do the changes which produce deformities in the vault begin?

A. About the tenth or eleventh year, or when the bicuspids erupt, the change takes place, and from that time on until all are in place.

Q. Is the vault deformity due to erupting teeth?

A. Yes.

Q. Does the character of the deformed vault depend entirely upon the shape of the alveolar process, and the shape of the alveolar process upon the shape and position of the teeth?

A. This is true.

Q. What determines the shape of the dental arch?

A. The eruption of the teeth is purely mechanical. The size of the jaw is the basal principle. The character and severity of the deformity depend upon the order of development.

Q. What is meant by the size of the jaw being the basal principle?

A. If the jaw be smaller than the long diameter of the teeth, or in other words, if arrest of development has taken place, then the teeth will come in irregularly?

Q. What are the types of the dental arches?

A. The two principal types are V and saddle arches; all other forms are modifications of these two forms.

Q. What effect have local irregularities of the teeth?

A. The vaults often become deformed from local irregularities.

Q. Does the suture become excessively developed?

A. It does. It may develop as early as the second and as late as the thirty-sixth year.

Q. What is the cause of excessive development?

A. It is due to irritation in mastication; ossification varies in different persons.

Q. Does this excessive development vary in different individuals?

A. It does. It takes different shapes and forms. This in 228 Peruvian skulls, 240 Stone Grave skulls, and twenty-one Mound Builders' skulls, sixteen Peruvians, thirty-nine Stone Grave and one Mound Builder had rope-like projections extending the entire length of the suture. This development was unlike the excessive development of modern skulls. It had the appearance of having been made and then glued upon the suture.

Q. How do these sutures differ?

A. They vary in proportion to the width of the arch. In narrow arches the suture is low or thick, which in a normal arch is flat. The grooves on either side of the suture are not uniform, one side being deeper than the other.

Q. What are some of the theories as to cause?

A. Clouston says, "those palates where the deformity consists in a ridge down the center antero-posteriorly, seem to show that in them the deformity took place at a later period than in the other deformed palates." When the nasal septum was getting strength and kept the center of the palate down, while on each side of it the palate was drawn up, making two vaults, side by side, instead of one?

Q. Is hypertrophy more common in neurotics and degenerates than in normal people?

A. Yes, since the suture is slower in ossifying.

Q. Are they visible as early as two years of age?

A. Yes, they are very distinctly seen.

Q. Does the depression on the side of the ridge vary in shape?

A. The ridge takes so many different shapes that when a number of models containing it are examined, the theory that the sides are drawn or pushed up appear more and more untenable.

Q. Where are these grooves located?

A. Sometimes in the posterior third, again in the middle third, and still again in the anterior third, including deep grooves in the alveolar process. The vomer certainly could not have any effect upon the ridge or depression in that part of the mouth.

Q. Will hypertrophy account for all the depressions in the vault?

A. No. Some result from hypertrophy of the alveolar process.

Q. May a deep groove occasionally be seen along the line of the suture?

A. Yes. It seems due to arrest of development of the suture with hypertrophy of the bone and mucous membrane.

Q. Is it always uniform?

A. No. Sometimes it is shallow, again deeper, sometimes broad, and again narrow, dependent upon the extent of the hypertrophy.

Q. How are these deformities produced?

A. The lower jaw develops laterally faster than the upper, thus crowding the superior maxillary bone apart in mastication.

Q. Can this spreading be demonstrated in another way?

A. The space between the central incisors is a marked illustration. The development of bone in the suture is so hard that it is difficult to draw the teeth together. It is more difficult to keep them in position.

Q. What conditions of the jaws are noticed when grooves are present?

A. When grooves are found in the vaults, there are most always small contracted jaws. The alveolar process is nearer the center of the vaults. This, together with the ridge, produces the grooves.

CHAPTER XXIV.

DEVELOPMENTAL NEUROSES OF THE PALATE.

Q. In embryonic life how are the nares separated from the mouth?

A. By a partition between the nasal pits and the cavity of the mouth.

Q. What becomes of this partition?

A. It becomes the true hard palate, containing the intermaxillary bones.

Q. What two cavities are then found?

A. Above this partition are the two nasal cavities; below, the oral cavity.

Q. What structure is then added?

A. The soft palate.

Q. What cavities does it separate?

A. The upper respiratory passage and a lower lingual or digestive passage.

Q. How are they developed?

A. By two shelf-like growths on the inner side of each maxillary process.

Q. Where do they unite?

A. The union is completed at the median line.

Q. What becomes of these palate shelves?

A. They descend a certain distance into the pharynx, but in the pharynx their growth is arrested.

Q. What becomes of them?

A. At first they project obliquely downward toward the floor of the mouth. The tongue rises high between them and appears in sections, which pass through the internal nares, to be about to join the internasal septum.

Q. What becomes of the floor of the mouth?

A. As the lower jaw grows the floor of the mouth is lowered, and the tongue is thereby brought farther away from the internasal septum.

Q. What becomes of the palate shelves?

A. They take a more horizontal position, and have turned the median line above the tongue and below the nasal septum to meet and unite.

Q. Where do the shelves meet first?

A In front, toward the lip, and then behind toward the pharynx later.

Q. At what period of the embryo does this union begin?

A. At eight weeks, and at nine weeks is completed for the hard palate; at eleven weeks for the soft palate.

Q. Where do the palate shelves extend?

A. Back across the second and third brachial arches, by the migration of the first gill cleft, or in other words, of the Eustachian tube.

Q. Where is the Eustachian opening?

A. It lies above the palate (uvula), while the second cleft remains lower down, and lies below the palate as the anlage of the tonsil.

Q. At what time does the uvula appear?

A. During the latter half of the third month, as a projective of the border of the soft palate.

Q. At what time does the nasal septum unite?

A. Soon after the two palate shelves have united;

thereby the permanent or adult relations of the cavities are established.

Q. What are the views of Beaunis and Bouchard in regard to the development of the mouth and surrounding parts?

A. "Beginning of third week — first pharyngeal arch; buccal depression. End of third week—coalescence of the inferior maxillary protuberances; formation of the three last pharyngeal arches. Fourth week—olfactory fossæ. Fifth week—ossification of lower jaw. Sixth week—the pharyngeal clefts disappear, the tongue, the larynx, and germs of teeth. Seventh week—points of ossification of intermaxillary bone; palate and upper jaw (its first four points). Eighth week—the two halves of the bony plate unite. Ninth week—osseous nuclei of vomer and malar bone; the union of the hard palate is completed. Third month—points of ossification for the sphenoid and nasal bones; squamous portion of temporal orbital center of superior maxillary bone; commencement of formation of maxillary sinus; epiglottis. Fifth month—osseous points of lateral masses of ethmoid; ossification of germs of teeth; appearance of germs of permanent teeth."

Q. What may occur at the fifth month from malnutrition?

A. At or about this time is the first period of stress. As a result of hereditary defect or mal-nutrition, arrest of development may check the growth of tissue and the various types of degeneracy result.

Q. Is cleft palate common?

A. It is comparatively rare in proportion to other forms of nutritive degeneracies.

Q. Is palate embryology a good study for certain symptoms?

A. It throws certain light on etiology and prognosis.

Q. What points may be derived?

A. Since most cleft palates occur in defective individuals, and since cleft palate predisposes to death by infectious disease, whose local manifestations are in the mouth and throat, those in whom cleft palate most occurs are liable to die before the completement of the sixth year.

Q. Was cleft palate early associated with other defects.

A. Early in the nineteenth century. Tiedmann noticed that in certain cases of cleft palate the olfactory nerve was absent or abnormal. He concluded, therefore, the deformity was resultant upon atrophy of the nerve origin of the olfactory organ. M. J. Weber, after a careful analysis of all accessible cases, failed to find one in which the olfactory nerve was absent.

Q. What conclusions may be drawn at the present time?

A. Coincidence of cleft palate and olfactory nerve atrophy discovered by Tiedmann probably result from the same central mal-development. They bear no causal relation to each other.

Q. When coalescence of structure fails to occur, what takes place?

A. Certain deformities are produced, chief of which are cleft palate and hare-lip.

Q. Does this condition run in families?

A. According to Bland Sutton it has been known to appear in several members of the same family, and to occur in the offspring of affected members.

Q. Is cleft palate ever observed in animals?

A. Instances of the transmission of this deformity have been traced from an affected pug bitch to her offspring.

Q. Could a race of men, with hare-lip and cleft palate, be produced?

A. There is no question that if it were possible to practice selective breeding in man, as in dogs, such a race could be produced.

Q. What relation between brain and cleft palate has been claimed?

A. That cleft palate results from excessive development of the anterior portion of the brain and skull, such as produces hernia cerebri, ventricular atrophy, or excessive anterior cerebral lobe development.

Q. Does this theory hold good?

A. This mixed patho-teratologic theory is not warranted by either embryology or clinical observation.

Q. What is Langdon Down's theory in regard to cleft palates?

A. He found a constant relation between brain deformity, cleft palate, and deformed vaults, and suggests that "it is possible that it may arise, as has been suggested, from sphenoid, arrest of development, or vomer defects in development."

Q. What has been shown on the other side?

A. It has been plausibly shown that the contracted high vault is not due to the condition, and there can be no relation between contracted vaults and cleft palates. The cleft occurs before the tenth week of fœtal life, while the contracted vault does not appear until after the sixth year.

Q. Are cleft palates becoming more frequent during the present century?

A. This opinion was supported by Oakley Coles on the ground that palatal vault deformities are more frequent, and that a relation exists between them and cleft palate. The relation between a high state of civilization and a high proportion of palatal deformities is something more than a mere matter of consideration.

Q. What error did Coles make?

A. In dealing with the influence of civilization he ignored all but its degenerative influences. Under civilization the defective classes are preserved; furthermore, this preservation extends particularly to those under five years of age, who would be destroyed under primitive conditions.

Q. How may cleft palates be divided?

A. Into two classes, congenital and acquired.

Q. What is meant by congenital?

A. That it existed at birth.

Q. What is acquired cleft palate?

A. The result of disease.

Q. How is congenital cleft palate divided?

A. Into two kinds, complete and partial.

Q. What is complete cleft palate?

A. Here the fissure extends the entire length from the uvula to and including the anterior alveolar process and lip. It is partial when only a part of the structures are involved.

Q. May only the anterior part be involved?

A. The cleft may extend through the anterior alveolar process, involving only the incisive bones, which is very rare; when present, single or double hare-lip almost invariably exists.

Q. What other deformities occur?

A. Cases occur where only a small part of the anterior alveolar process and jaw are involved, together with one or two teeth. The hard palate may be involved to the extent of a small fissure, or the whole bone may be wanting. The soft palate may only contain the cleft or simply the uvula. Cases are on record in which the non-development of the maxillary bones produces fissures in the lip.

Q. Is cleft palate inherited?

A. The view expressed by Bland Sutton and Oakley Coles would lead to that conclusion. Sufficient data have not been forthcoming to show that the actual presence of the deformity in the parent has had a direct predisposing influence upon the child.

Q. Could maternal mental impression cause the deformity?

A. It may be confidently stated the deformity cannot be produced from any impression received by the mother during pregnancy.

Q. What are the chances of inheritance of cleft palate?

A. In most cases which have come immediately under notice, when one of the parents had cleft palate all the children have been born perfectly developed, even though dread of transmitting the deformity was always present in the mind of the mother. In one case, curiously enough, there were three members of one family with cleft palate, one seventeen years of age, one thirty, and one thirty-five. The first and last are ladies, the other a gentleman, who is married, and has a family without the father's defect.

Q. Was there any trace of cleft palate in the ancestor?

A. No defect could be found either among the ancestors or collateral branches of the family.

Q. Are there evidences of inherited cleft palate?

A. Another family has the following remarkable history: G. H. C., born 1853, perfect. L. C., born 1855, single hare-lip and cleft palate. J. F. C., born 1856, perfect. F. W. C., born 1860, double hare-lip and cleft palate. H. E. C., born 1863, perfect. The paternal grandmother likewise had cleft palate.

Q. What is the percentage among degenerates?

A. Knecht found five per cent. of 1,200 criminals examined to have cleft palates, and fourteen per cent. of the prostitutes examined by Pauline Tarnowsky had cleft palates. Langdon Down, among congenital idiots, found only half a per cent. of cleft palates. Grenser found nine cases in 14,466 children, or one in 1,607. Talbot examined 1,977 feeble-minded children without finding a single case. In 207 blind but one case was observed. In 1,935 deaf mutes, two cases, or about one in 1,000. The percentage among the defective classes is undoubtedly much larger than among normal individuals, but early deaths explain the small numbers.

Q. What is the history among animals?

A Ogle found that ninety-nine per cent. of the lion cubs born in the London Zoological Gardens had cleft palates. This he ascribes to the artificial diet as the result of enforced captivity. Similar results in other gardens in Europe were charged to feeding the mother with meat without bone, since feeding with the whole carcass of small animals greatly diminished these deformities. If cleft palate were sometimes attributable to this cause, other bony structures should likewise be involved. It is, hence, not astonishing to find many lions in captivity were rickety. Cleft palate has been observed among dogs, sheep, goats, etc. The question, however, whether domesticity does not play in them the alleged part of civilization in man can be solved only by knowledge of the frequency of the condition among wild animals of the same family.

Q. In dealing with etiology what must be taken into consideration?

A. The influence of shock on the mother's nervous system cannot be excluded in the cases charged to feeding.

CHAPTER XXV.

DEVELOPMENTAL NEUROSES IN TEETH POSITION.

Q. Are the jaws subject to arrest of development?

A. They are.

Q. Why?

A. They are transitory structures.

Q. Do periods of stress affect both jaws alike?

A. They do not.

Q. Which is the most subject to deformity?

A. The upper.

Q. Why?

A. Because it is a fixed bone, and influenced by other bones of the head.

Q. How do the periods of stress affect the jaw?

A. They cause excessive and arrest of development.

Q. Why do they produce both?

A. Because of the law of economy of growth, which causes gain in one direction at the expense of another.

Q. What deformities are produced?

A. V and saddle shaped dental arches.

Q. What local condition produces the same results?

A. Premature extraction of the temporary teeth, thus allowing the first permanent molars to move forward and to diminish the space, thus causing tooth irregularities.

Q. What structures are involved in these deformities?

A. The structures involved in the formation of these deformities are the jaws and alveolar process on one hand and teeth on the other.

Q. What is the nature of these structures?

A. The alveolar process is soft and yielding, while the jaws and teeth are composed of hard, dense substances. The alveolar process adapts itself to the teeth, no matter what position they take.

Q. What constitutes the dental arch?

A. All the teeth when in position.

Q. Do the teeth upon both sides of the jaw depend upon each other?

A. They do not. The jaws and teeth, like the lateral halves of the body, develop independent of each other. Each possesses its own peculiar characteristics as regards irregularities of the teeth.

Q. How can the classification of irregularities be simplified?

A. By dividing each jaw at the median line into right and left superior, right and left inferior dental arches.

Q. Is such classification strictly correct from an architectural point of view?

A. It is not, but for clinical purposes it is admirably adapted.

Q. To what is the construction of these deformities comparable?

A. To the construction of an arch, each tooth representing a stone.

Q. Are development of the teeth and these peculiar formations purely mechanical?

A. The time and movement of the teeth determine the character of the deformity, just as in chess or checkers, time and movement determine the result.

Q. What does each lateral arch contain?

A. It contains teeth which correspond to the stones of an arch.

Q. How are these stones laid?

A. Their laying depends on the time of normal eruption of teeth.

Q. Build a normal lateral arch.

A. The first stone laid will correspond to the first permanent molar, and is called the "posterior base." The next stone laid is the central incisor, and is called the "anterior base." The next stone is located upon the anterior base and corresponds to the lateral incisor. The next stones are the first and second bicuspids, and are laid upon the posterior base. The stone corresponding to the first bicuspid is usually in position first, but sometimes the stone corresponding to the second bicuspid is placed first. To complete the arch it is necessary to place the keystone in position—the cuspid. If the stones have been properly proportioned and measurement correct, the keystone will fit into its proper place, and the arch will be completed. On examining the posterior foundation two more stones are found, these correspond to the second and third molars. These stones beneath the base and the stones above the base make a very strong abutment.

Q. What constitutes a normal dental arch?

A. There are three characteristics of a normal dental arch. Independent of temperament peculiarity, the lines extending from one cuspid to another should be the arc of a circle, not an angle or straight line; the line from cuspids to the third molars should be straight, curving neither in nor out, the sides not approximating parallel lines.

Q. Should both sides be alike?

A. Absolute bilateral uniformity is not implied, since the two halves of the human jaw are rarely if ever alike.

Q. What does a uniform arch necessitate?

A. Uniformity of development between the arch of the maxilla and the arch of the teeth, and a correct relation of the individual teeth to each other.

Q. What must occur when disharmony results from inheritance of the small jaw of one parent and the large teeth of the other?

A. Irregularities.

Q. What are these called?

A. Constitutional irregularities.

Q. When there is a difference in the diameter what takes place?

A. The line formed by the teeth must either fall outside or within the arch of the maxilla, and irregularities of a grave nature must result.

Q. What happens in the construction of an arch if the diameter of the stones be too small for the curve on the bases, or be set too far apart?

A. The keystone will not find support, and will drop through toward the center.

Q. Is this very common?

A. Yes. The cuspid points into the vault, or remains imbedded in the jaw.

Q. Suppose the arch be too small, or the posterior base and foundation stones have been brought forward to the extent that there is no room for the keystone, what happens?

A. The keystone remains outside the arch.

Q. What happens if the arch be partly or wholly closed and the keystone be very heavy (has great leverage)?

A. The keystone will force the foundation or break the arch or both. The posterior base, with foundation, being so strong, it resists the force. The anterior base being weak, and without support, bulges out, and in this way the semi-V arch is produced.

Q. How is the V arch produced?

A. The posterior base is seldom, if ever, carried backwards, owing to the number of roots upon each tooth, and the broad, thick alveolar process to hold them. The anterior teeth all have round single roots, and are located in a thin alveolar process, easily bent out of position. The keystones, coming into place, crowd against the posterior base and carry the anterior bases and teeth forward, thus producing the V-shaped arch.

Q. How many teeth are involved in the construction of the V-shaped arch and its modifications?

A. The ten anterior teeth. These teeth are all wedge-shape; the bases being thin cutting edges, and the apices at the end of the roots. They are also nearly round and conical, the points of antagonism being nearly or quite at the cutting edges.

Q. Do these approximate surfaces assist in producing irregularities of the teeth?

A. They constitute the fulcrum of the lever, which, when force is applied to the teeth, causes them to rotate and move out of position, thus producing more varieties of deformities than it is possible to demonstrate upon the stone arch.

Q. How is the germ of the cuspid located in relation to the other germs in the jaw?

A. It is outward and above on a line of a larger circle.

Q. How does its root compare with that of the other teeth?

A. It is much longer.

Q. What results in eruption from this position and length of root?

A. It is the most powerful tooth. Downward and inward movement, together with some pressure from the lips, will cause it to descend until it meets obstruction great enough to resist further descent, locking the arch and holding the teeth in the proper position.

Q. Where does the break occur when the cuspids come into place and there is not sufficient room?

A. Always at the weakest point.

Q. Where is this naturally?

A. Anterior to the cuspid teeth.

Q. Does the break always take place at the one locality?

A. No. The break depends upon the weakness of the part and the position of the anterior teeth. It may be between the centrals, centrals and laterals, laterals and cuspids.

Q. Do teeth always take the same position?

A. They do not. They may point outward or in, thus modifying the shape of the V.

Q. Are two deformities absolutely alike?

A. Although it is claimed that these deformities are a direct inheritance, and therefore alike, this is not the case. They are never directly inherited, and because they depend on mechanical environment they are never absolutely alike.

Q. What is a partial V-shaped arch?

A. When a line is drawn through the vault and the median line, if the incisors do not come to a point, in other words, if the anterior arches about half way between a V and normal, it is a partial V-shaped arch.

Q. What is a semi-V-shaped arch?

A. It is one where one side is V-shaped, and the other normal or nearly so.

Q. Does the lower jaw ever assume a V-shaped arch?

A. Never when the teeth of both jaws articulate normally.

Q. Why?

A. Because the anterior inferior teeth close inside of the upper, and forward movement is thus prevented.

Q. Should the inferior dental arch be divided like the other?

A. Yes. It should be divided into right and left like the upper, because the forward movement of the posterior column and the eruption of the cuspid exert the same influence as on the upper. Each lateral half has its bases and keystone.

Q. Is the break in the arch the same?

A. It is not, because the anterior base (the central incisors) is held in position by the superior incisors, and the break usually takes place at the cuspid teeth. The cuspids are carried forward.

Q. Are the upper incisors sometimes carried forward?

A. Yes. Sometimes the superior alveolar process is very weak, and the anterior force of the lower jaw is very great; in such cases the superior incisors are carried forward and spaces will appear between the teeth.

Q. Are saddle-shaped arches as common as the V-shaped?

A. No.

Q. Have they properties common to the V-shaped arch?

A. They have many.

Q. Name some.

A. They may include one or both lateral arches. They may be partial on one side and normal on the other. Each lateral arch produces its own deformity independent of the other. The vault may be high or low. The deformity, like the V-shaped, is favored by the high arch.

Q. How is the saddle-shaped arch produced?

A. Like the V-shaped, there is the right and left lateral arches of stone. Each stone corresponds in size and location to the natural teeth. The first stone laid in the arch corresponds to the first permanent molar, and like the stone in the V-shaped arch, is denominated the posterior base. The next stone laid corresponds to the central incisors, then the stone which stands for the lateral incisor. The natural order now changes, and the next stone laid corresponds to the keystone of the V-shaped arch — the cuspid. This stone (the cuspid) forms the fixed anterior base, and is backed by the central and lateral teeth. The next stone laid corresponds to the first bicuspid, followed by those representing the second bicuspids and the second and third molars. The stones being in position, the anterior and posterior columns are nearly equal in strength and resisting power.

Q. Does forward movement of the posterior column take place under the same local conditions as in the V-shaped arch?

A. In precisely the same manner.

Q. Does the keystone (the cuspid) play the same part here?

A. It does not, it is now a fixture.

Q. Which are the weakest stones in this arch?

A. They correspond to the bicuspids, and are the stones which are always displaced when the forward movement of the posterior column occurs.

Q. Does this account for existence of fewer saddle arches than V-shaped?

A. Yes. The change in the anterior base also accounts for the fact that the anterior teeth do not protrude in the saddle arch, while they always do in the V-shaped arch.

Q. What great factors assist in the development of the saddle arch?

A. The shapes and points of contact of the individual teeth. Their surfaces are not flat, but rounded, while the surface of the first permanent molar is an incline with the decline inward.

Q. Why are the bicuspids not carried outward as well as inward?

A. They are occasionally, but their eruption and environment are favorable to the inward movement, which is the natural case.

Q. Are there other reasons for inward movement?

A. Yes. The crowns of the bicuspids are situated between the roots of the temporary teeth, where the first permanent molar erupts. It develops outside and on a larger circle than the temporary set. When the temporary molar is extracted, the first permanent molar moves forward, and the incline holds the crown of the second bicuspid from taking the larger circle.

Q. Having explained the local conditions, describe the method of formation of the saddle arches.

A. The anterior and posterior bases being in place, the stones corresponding to the first and second bicuspids being on a smaller circle, the posterior column moves forward, crowding the two teeth against the anterior base, both bases inclining inwards, carries the bicuspid inwards. This lateral movement continues until the teeth are locked tightly together.

Q. How is the partial saddle arch formed?

A. If the locking of the arch takes place between the cuspid and molar, the bicuspids are carried in a great distance and a partial saddle-arch is formed.

Q. What is the semi-saddle arch?

A. It is an arch where the deformity is only on one side.

Q. Is a bicuspid occasionally carried into the vault?

A. Yes. Usually the second. The second temporary molar holds the bicuspid on a smaller circle until all the other teeth are in place. When this is removed, the inclination of the crown is inward, the first permanent molar moves forward, and the incline pushes the bicuspid into the vault. The first molar continues its forward movement until it touches the first bicuspid, thus closing the arch.

Q. How may a V-shaped and saddle arch be combined upon one side?

A. Given a thin alveolar process, early or late extraction of the temporary molars, the posterior column moves forward, carrying the bicuspids inward. The cuspid comes down and from want of room the incisors are carried forward, the V-shaped arch will be developed forward, and the saddle arch at the side.

Q. What shape will the opposite side take?

A. It may be a V-shaped, saddle, or normal, depending upon the manner of eruption of the teeth and the amount of room provided for them.

Q. Does the saddle arch occur upon the lower jaw?

A. Saddle arches are observable upon the lower jaw. They form in the same manner as upon the upper. The force of the posterior column is often so great that the anterior base, the cuspid, is carried forward over the side of the arch. The laterals are carried inward.

Q. In a general way what do these two forms resemble?

A. Both are atavistic. The V-shape reverts to the reptilian type of jaw, while the saddle arch reverts to the carnivora.

Q. Are these deformities in perfect harmony with the laws of evolution?

A. They are. Given a small jaw, the order of eruption of the teeth could not produce other than these two types of jaws or their modifications.

CHAPTER XXVI.

LOCAL CAUSES OF TEETH IRREGULARITIES—UPPER JAW.

Q. How are local irregularities formed?

A. In malposition and malocclusion of individual teeth, as a result of an accident (such as premature or tardy extraction of the temporary teeth) or malposition and malocclusion resultant on constitutional causes.

Q. What is the principal cause?

A. Relative position of the first permanent molar.

Q. How does it affect the position of the teeth?

A. If the temporary molars be extracted prematurely, the forward movement of the posterior column follows. The teeth in the anterior column are more or less influenced by vicious position, relation and occlusion.

Q. Are temporary teeth moved forward by the permanent molars?

A. Sometimes. Even the permanent cuspids at times yield.

Q. What tooth is next in importance as to vicious influence?

A. The cuspid. It asserts itself above the rest because of its vital force, length of root, peculiar shape and location in the jaw. The length of its root allows it to deviate most of any teeth from its original position.

Q. Which is next?

A. The central incisor comes next in importance while the lateral is the most passive of teeth.

Q. Why?

A. Because it is the smallest and situated between the two strongest in the anterior part of the mouth.

Q. Is it very easily displaced?

A. Yes. Because of its weakness and short, round root.

Q. What effect has the forward movement of the posterior column forcing the anterior column forward?

A. Pressure brought to bear upon both sides makes the arch of the upper maxilla greater than the lower.

Q. What effect does that produce?

A. The result is that occlusion is wanting or defective, and flexion must take place according to position assumed in the eruption of each individual tooth.

Q. Does the cuspid exert much influence?

A. The force of the cuspid is spent upon the incisor.

Q. Are the incisors quite large?

A. They are at times owing to inheritance or vigorous growth.

Q. Do they then exert more influence?

A. They do; not so much in relation to position of the axes as in irregularities of the cutting edges. These from the excessive diameter overlap.

Q. Do the temporary incisors when retained too long produce irregularities?

A. If retained too long the permanent tooth is embarrassed in its eruption. It seeks its way out as best it can and as erupting in straight lines is out the question, it slips around the root of the temporary tooth and is thus forced out of position.

Q. Are not all anterior teeth influenced more or less in this way when temporary teeth remain too long?

A. Yes. Great care should be exercised in removing the temporary teeth at the proper period.

Q. What is the most common form of irregularities connected with the central incisor?

A. That found in connection with the V-shaped arch. The force is applied from behind, the mesial edges touch and the teeth revolve upon their axis, the cutting edges are not in line but form an angle and point forward.

Q. Is not this the most natural form for the flexion to assume?

A. It is. The arch is simply broken in, its weakest point following the general direction of the pressure.

Q. Do these teeth ever overlap?

A. It is a very common deformity. The edge being round sometimes the force in both directions is not alike, in which case one incisor is carried a little forward this causing the teeth to lap.

Q. What other forms of deformity do the incisor teeth assume?

A. When the cutting edges form an angle which is directed backward the pressure is from behind as in the other variety of deformities.

Q. What forms do the laterals?

A. When the cuspids come into place they crowd the laterals forward. It depends upon the occlusion with the centrals whether they remain in position or whether they pass in front or behind the centrals.

Q. What different positions are assumed by the laterals?

A. 1. Mesial surface of lateral overlapping distal surface of central, while distal surface is in a line with cuspid.

2. Mesial surface of lateral overlapping distal surface of central, while distal surface is behind the cuspid.

3. Mesial surface of lateral behind the distal surface of the central, while the distal surface is in a line with the cuspid.

4. Lateral in a line anterior to that of central and cuspid.

5. Lateral in a line posterior to central and cuspid.

6. Lateral at right angles with the line of the incisor and cuspid.

7. Lateral wholly inside the arch.

Q. Is the lateral often out of normal position?

A. The lateral is more frequently out of position than any other tooth because it is the weakest in the arch and has the shortest root.

Q. Upon what does its position depend?

A. Upon the environment of its own side of the arch, independently of the other.

Q. Besides its weakness, what also produces change of position?

A. First, shortness and conical shape of its root. Second, its wedge shape crown. The shortness of its root, together with its conical outline, causes it to be more easily impinged upon by the root of the incisor which will produce partial rotation. The wedge shape of its crown facilitates rotation.

Q. What results when diameter of cutting edge is greater than that of the root?

A. The greater the degree of rotation must be before the lateral finds a resting place.

Q. Are the laterals found wholly inside the arch?

A. Sometimes. When the lateral is tardy in eruption the cuspid comes into position and crowds the lateral into the vault.

Q. Is the cuspid a very important tooth?

A. It is the most important tooth in the anterior part of the mouth on account of its durability and influence on expression. Its durability is due to its hardness of tissue, its slowness of development and simplicity of shape.

Q. Is it liable to decay?

A. Because of shape and smoothness, it is less liable to caries.

Q. Does it possess great strength?

A. Yes. Owing to its position, length of root, together with its order of evolution.

Q. Does position give it importance?

A. Being placed between the anterior and posterior column, it forms the keystone and on account of its prominence gives expression to the face.

Q. To what may be due deviation from the normal?

A. To malposition of the germ or crowding out of place.

Q. How does time of eruption affect this tooth?

A. It is late in erupting, therefore it must crowd its way into position.

Q. Is its crypt on a line with the other crypts?

A. It is outside and above those of the other teeth.

Q. What benefit results?

A. It being above and on a larger circle, it can crowd in between the other teeth and crowd them apart, thereby spreading the arch, giving it a parabolic outline and forming a keystone.

Q. What effect has it upon the jaw when it remains inside or outside the arch?

A. The expanded contour is lost and a small pinched condition results, usually producing a V or partial V-shaped arch.

Q. What results when the germs are misplaced in the arch?

A. The cuspids may erupt in the vault, in the floor of the nose or they may remain imbedded crosswise in the bone.

Q. May one erupt normally and the other irregularly?

A. That is not uncommon.

Q. Is bicuspid shape liable to interfere with normal development?

A. Yes. The antero-posterior diameter of its outer cusp is greater in proportion than the inner, producing a wedge shape space on the palatal side. This causes the tooth in front and back to touch at one point.

Q. Which bicuspid is most liable to irregularities?

A. The second.

Q. What may cause irregularities of the bicuspids?

A. Constitutional causes; lack of accord between the size of the jaw and that of the tooth or local causes.

Q. What are local causes?

A. Tardy eruption, deflection due to the retention of the temporary teeth, forward movement of the molar and rotation from want of occlusion.

Q. Explain why.

A. The natural order is first bicuspid, second bicuspid, cuspid. This is sometimes so changed that the first bicuspid is followed by the cuspid, thus pushing it backward. From lack of space the second bicuspid is crowded either without or within the arch.

Q. What effect has deflection?

A. When a temporary molar is retained too long or its roots are not absorbed as fast as the bicuspid is erupted, it is deflected or caused to rotate more or less upon its axis.

Q. What effect has the forward movement of the molar upon the bicuspids?

A. It necessarily diminishes the space left for the bicuspids and cuspids and when the first bicuspid and cuspid erupt before the second bicuspid, this may be crowded out of its proper place.

Q. Does rotation produce a deformity?

A. A rotation of the bicuspid from want of proper occlusion is not rare. The cusps of the bicuspids are designed to articulate with those upon the opposite jaw. When its two cusps fail to find an opposing cusp to keep it in place its function is lost.

Q. Do not all these causes often work together?

A. Frequently more than one of these causes are at work or one implies another.

Q. How do irregularities of the teeth attract attention?

A. They attract attention by their deformity and not by their interference with function. It is easy to observe displacement of individual teeth in the anterior dental arch.

Q. Does the removal of a tooth cause irregularities?

A. As soon as a tooth is removed from a normal dental arch improper occlusion and articulation must result.

Q. Which tooth is most often injudiciously extracted?

A. The first permanent molar.

Q. Is it universally removed when decayed?

A. Not in all countries.

Q. Should it be removed?

A. No.

Q. What reasons are given for its removal?

A. That the dental arch is small and by its removal it will give room for the other teeth to come into place. When removed early the other molars will move forward and fill the space.

Q. Is this good reasoning?

A. It is not. Malocclusion more or less will occur in every case.

Q. What has been the cause of the removal of the first permanent molar?

A. Its early decay brought about by the tax upon the growing child and neglect for which the teeth suffer during the period of its development. The parent usually does not know of its existence until the child complains of toothache. It is also removed to correct an overcrowded arch.

Q. Does its extraction relieve the crowded arch?

A. It does. More room is produced than is required. As a result the remaining teeth are out of position and their surfaces do not articulate properly with those upon the opposite jaw.

Q. Has wholesale extraction of the first permanent molar had a beneficial effect?

A. It has not. It is hastening arrest of development of the jaws and alveolar process since development of these depends largely upon the function of the teeth and their articulation for the motion stimulates nutrition and enlarges the arch.

Q. What shows that arrest of development of the jaws takes place when the teeth are extracted?

A. In every case when the germ of the teeth is not present or when a tooth becomes imbedded in the jaw, arrest of the bones takes place.

Q. What effect does the loss of the first permanent molar have upon the individual?

A. The loss of the first permanent molar impedes mastication and produces vicious occlusion and is detrimental to the contour of the face.

Q. What effect does malocclusion have upon the general health?

A. The food is not properly masticated and the health may become seriously impaired.

Q. In what other way is mastication interfered with?

A. When teeth here and there are extracted, the arch is broken and the teeth are liable to move forward and backward, thus causing them to occlude between each other. These elongate and have no occlusal surfaces; mastication is impossible.

Q. May teeth extracted upon one side interfere with symmetry?

A. When the first permanent molar is prematurely extracted upon one side, the position of that side is interfered with. The length of the rami, body, depth of sulci of the masticatory surfaces may be affected to such an extent that bi-lateral asymmetry results.

Q. Should the first permanent molar be extracted when decayed?

A. No. It would be better to fill the roots and replace the tooth with a gold crown until all the teeth have developed and articulate properly.

Q. Should there not be room for the third molar to come into place, what is indicated?

A. All the other teeth will have erupted and found their proper positions by the time the third molar is ready to erupt; if there be not room, extract the third molar

CHAPTER XXVII.

LOCAL CAUSES OF TEETH IRREGULARITIES—LOWER JAW.

Q. Are the two jaws alike?

A. The jaws are distinct in character, function and course of development. The upper jaw when normal describes a larger circle, the teeth overlapping the lower. It is fixed and depends for its function on the activity of the lower.

Q. Are irregularities as common upon the lower as upon the upper?

A. Owing to the immobility of the upper, irregularities are more markedly constitutional than on the lower. Thus various abnormal dental arches are not seen in the lower while the high and narrow vault and inward curve of the alveolar process occurs. The lower is restrained by the overlapping of the upper. Motion of the lower jaw prevents deformities.

Q. Are the lower teeth more liable to local irregularities than the upper?

A. Yes, because the lower arch articulates inside of the upper.

Q. How are the anterior inferior teeth arranged?

A. The points of contact are at the cutting edge. The mesial and distal edges are rounded, which enables them to crowd easily past each other when force is applied.

Q. How are their roots arranged?

A. The roots are flattened to the sides so that when pressure is brought to bear upon them they move with readiness over a considerable distance.

Q. Are the incisors carried forward by the posterior column?

A. They are not. The line of force is in straight lines alone.

Q. What effect does the force produce?

A. The force is direct upon the cuspid; meeting with slight resistance at the side by the incisor, they are carried forward.

Q. Are local irregularities common back of the cuspids?

A. They are not.

Q. What are the most frequent forms?

A. They occur in connection with the incisors.

Q. Why?

A. The teeth and jaws are not in harmony. The teeth of the lower jaw are forced inward by occlusion and the forward movement of the posterior column.

Q. Do the two lateral arches produce common deformities?

A. Like those upon the upper jaw, they are never alike.

Q. What pressure is brought to bear upon the anterior teeth?

A. When the second and third molars erupt the pressure is directed forward.

Q. What effect does the forward movement have upon the teeth?

A. Owing to the incline upon the lateral surfaces of the incisors, the forward movement of the cuspid pushes against the lateral and carries it inwards.

Q. Do these teeth always stand in the same position?

A. They do not. They stand at different angles depending upon the local peculiarities. Thus a cuspid or lateral may strike outside of its antagonist of the opposite jaw

Q. When both posterior columns move forward what position do the incisors sometimes take?

A. Both lateral incisors are carried inward; a V-shaped arch is prevented by the central coming in contact with the superior incisor.

Q. What should be borne in mind in correcting such a deformity?

A. If the force and mode of application be borne in mind, it will be understood why extremes of a lower lateral or central render this irregularity worse inasmuch as they disarrange occlusion of the cuspid.

Q. If the central stands just a little inward and force is applied what results?

A. The cuspid pushes against the lateral and the central is carried backward.

Q. When the inferior cuspid develops out of line where is it located?

A. It is always anterior to its normal position.

Q. Where does the cuspid usually erupt when malposition of the germs takes place?

A. Either outside of the incisor or in line with them.

Q. What is the cause when the bicuspids are either outside or inside the arch?

A. It is due to the retention of the temporary teeth.

Q. What takes place when the second temporary molars are retained too long?

A. The first permanent molars may move forward, thus confining the cuspid and preventing its eruption.

Q. Do teeth move about in the alveolar process?

A. Yes. Where there is no occlusion or antagonism, they will move up, down or laterally until they rest against something, it may be tooth, gum or artificial resistance.

Q. How is this motion best corrected?

A. By perfect occlusion and proper relation between waste and repair.

Q. What is perfect occlusion?

A. Each tooth is kept in place by its adjoining neighbor and the opposing tooth, and dislodgment is impossible.

Q. Does this occlusion differ in different teeth?

A. Yes. The upper and lower incisors overlap each other, producing what is termed the overbite. In the normal relation they strike in straight lines which pass through the roots. The teeth are thus held in position. The relation of cuspids is similar.

Q. What is the relation of the bicuspid and molars?

A. The cusps of one tooth strike direct upon half of two of the opposite jaw. When one of these teeth are extracted, the order of the mouth is distributed and re-arrangement of the teeth takes place. What this will be, depends upon a variety of circumstances.

Q. Give an example.

A. By extraction of the first permanent molar, forward movement of the second molar necessarily follows. The tooth tilts forward. The posterior cusp of the first upper molar strikes the anterior cusp of the second lower and exerts its whole force, which was meant to be distributed over its entire surface.

Q. What is understood by perfect relation between waste and repair?

A. The alveolar process is a transitory structure; building up and tearing down of bone cells is going on very rapidly. This is illustrated in the eruption of the deciduous teeth and again in the eruption of the permanent and after the teeth are extracted the process is again absorbed away. Position of the teeth in the alveolar process is determined by the tissue about them.

Q. What else demonstrates the deposition and absorption of bone cells?

A. Pressure on a tooth in a given direction will remove bone cells in one direction and deposit them in another.

Q. Does every tooth exert a pressure of its own?

A. Yes. Did it not, elongation of a tooth when its opponent is extracted could not be accounted for.

Q. What follows when the two fundamental laws of good occlusion and balanced waste and repair are violated?

A. Movement of individual teeth in straight lines. Rotation of individual teeth upon their axis and forward movement of groups of teeth.

Q. What sometimes causes the space between the central incisors?

A. It is due to a continuous growth of the suture. This usually begins at an early period of life and continues until growth of the osseous system has ceased. Irritation is kept up by mastication.

Q. May not irritation sufficient to produce absorption be of artificial creation?

A. Yes. As in wedging to obtain room for filling teeth. Correcting irregularities of the teeth will set up irritation, sometimes continuing indefinitely and causing a tooth or teeth to migrate.

Q. Do the teeth of one jaw sometimes press too hard upon those of the other causing migration?

A. The teeth of the lower jaw (especially the incisors) pushing against the upper centrals may cause them to move out of position.

Q. What common irregularity is due to deposit of bone cells?

A. That in which the inferior incisors impinge upon the mucous membrane of the vault.

Q. What causes this?

A. There is an unbalanced nervous system. There may be arrests of the inferior maxilla or excessive development of the superior. In either case excessive development of the inferior alveolar process results, developing the incisors beyond their normal position.

Q. What effect does this have upon the vault?

A. It causes irritation of the mucous membrane, causing a deposition of bone cells. These carry the superior alveolar process and teeth forward, causing the teeth to protrude between the lips. This deformity is common in neurotics and degenerates.

Q. Does the forward movement increase the spaces between the teeth?

A. It does. The teeth being carried to a large circle the spaces between the teeth naturally enlarge.

Q. Does lack of functionation encourage deposition of lime salts around tooth roots?

A. Yes. When teeth are removed from one jaw the alveolar process about the teeth on the opposite jaw will elongate until the tooth or teeth meet resistance.

Q. Does inflammation build up as well as tear down bone tissue?

A. Inflammation due to local as well as constitutional causes may build up or absorption of tissue may ensue.

Q. Is inflammation from constitutional causes likely to affect the alveolar process?

A. Interstitial gingivitis therefore may set in, producing absorption of the alveolar process without at first affecting the gums.

Q. Does infection take place?

A. Pus infection readily results with deposit of the bone absorption upon the roots of the teeth.

CHAPTER XXVIII.

LOCAL CAUSES OF TEETH IRREGULARITIES—FINGER-SUCKING.

Q. To what has the high vault been attributed?

A. To thumb-sucking.

Q. Can the high vault and V and saddle shaped arches be ascribed indiscriminately to thumb-sucking?

A. Yes.

Q. What is the vault shape where there is finger-sucking?

A. It may be high or low.

Q. Are the teeth and alveolar process involved?

A. Yes. The teeth are sometimes carried out fan-shaped with spaces between them.

Q. Which teeth are involved?

A. Sometimes upon one side and sometimes upon the other. Sometimes those in the center are affected. This depends entirely upon which finger and hand and the position used.

Q. How do these deformities differ from the V-shaped arch?

A. In the V-shaped arch, the teeth are crowded and pointed toward the center owing to the force applied by the posterior column and spent upon both halves toward the median line. The vault may or may not be arched.

Q. How does it compare with the saddle arch?

A. In saddle-shaped arches the teeth are crowded (except in cases due to hypertrophy) and the teeth stand perpendicular. The vault may be high or low.

Q. How are they arranged where there is thumb-sucking?

A. The teeth of the inferior maxilla do not articulate with the upper and are often turned inward which is caused by the pressure of the thumb upon the cutting edge.

Q. Where are the evidences of thumb-sucking?

A. The spreading of all or a part of the anterior teeth and the lower teeth are usually turned inward. When the vault is high the deformity may be quite marked in the anterior portion of the vault. This, however, is by no means characteristic.

Q. Is the thumb-sucking habit prolonged until the second teeth erupt?

A. Not as a rule. It usually terminates before their eruption.

Q. How early do infants begin to suck their fingers?

A. Within a few hours after birth. In a majority of cases not later than the first week. The habit is fixed before the temporary teeth begin to erupt.

Q. Are the alveolar process and first teeth only affected?

A. If the pressure be continuous they are.

Q. To what extent?

A. The shape and location of the irregularity depends upon the hand employed and the position of the thumb and finger used. The right or left side is affected according to the hand used, though occasionally it is found at the median line.

Q. Are the permanent teeth often involved?

A. As the child usually discontinues the habit before the time of eruption of the permanent teeth, deformities produced by thumb-sucking are usually confined to the temporary set.

Q. Is the superior alveolar process involved?

A. If the child continue to suck its thumb or finger while the second set are erupting, arrest of the alveolar process will take place and the teeth will be separated.

Q. What position do the teeth take?

A. They take the position of the thing sucked.

Q. Is the vault carried up by thumb-sucking?

A. No. The high vault is not formed until all the second teeth are in position. It is impossible for the child to carry the thumb or finger the entire length of the vault.

CHAPTER XXIX.

THE DEGENERATE TEETH.

Q. What were the teeth originally?

A. They were primitive organs of the skin which developed over the surface of the body.

Q. What change took place?

A. They became dermal bones like those which went to form part of the skull. The placoid scales which were dermal teeth in the shark helped out deficiency of the brain case.

Q. Why did the placoid scales or dermal teeth undergo this change?

A. Because in vertebrate evolution the cartilaginous brain case was hardly sufficient to cover the developing brain.

Q. How did the teeth of sharks change the primitive method of development?

A. Instead of developing upon the surface, the dermoid tissue dipped down deep into the structure below.

Q. Is this a degeneration?

A. The method of tooth formation converting epithelial cells without vascular supply into enamel was a degeneration in itself.

Q. What takes place down in the deeper tissues?

A. A papilla forms in the dermis which eventually becomes the dentine of the tooth.

Q. After the epidermis dips into the tissue below, enlarges and adds the enamel, what becomes of the debris?

A. The debris resulting therefrom as observed in animals and man forms degenerations or "abortive rudiments" of tooth succession as observed in sharks, some whales and reptiles.

Q. Where does the tooth obtain its shape and size?

A. From the pulp which develops deep down in the tissue.

Q. Where does calcification first take place?

A. It first takes place upon the periphery while the blood vessels and connective tissue recede until finally the root is completely formed; only a minute opening is left for the passage of an artery, nerve and vein.

Q. For what purpose are these structures?

A. For nourishment of the pulp as well as tooth structure.

Q. What is tooth formation as compared with that of the placoid scales?

A. The method of formation of the tooth itself is a degeneration and intended for temporary use alone.

Q. What effect do morbid states have upon the teeth?

A. Diseases and traumatism which affect the human body as well as the embryo must necessarily affect structures so poorly nourished as the teeth and their germs.

Q. What takes place in the evolution of the alveolar process?

A. Change in the shape of the alveolar process, neglect of hygiene causes interstitial gingivitis and endarteritis obliterans (thus preventing circulation and nourishment of the teeth) and removes resistance, thus furnishing a suitable medium for micro-organisms.

Q. What are some marked degenerations of the enamel?

A. Interglobular spaces and enamel defective in quality and quantity.

Q. Is tooth decay degeneration?

A. Tooth decay is a marked degeneration, but sometimes a normal process (normal senility) for the carrying out of which osteomalaciary methods are provided.

Q. In what animals are the teeth continuous?

A. In polyphyodont (continuous tooth) animals, the teeth come and go. Periods of stress are not involved in individual teeth.

Q. How is it in man?

A. Tooth degeneration is normally a continuous one, and since man has only two sets, they undergo degeneration through the periods of stress.

Q. How many teeth has man?

A. At his present stage of evolution he has twenty in the temporary and thirty-two in the permanent set.

Q. If there is any deviation in these numbers at what period must it take place?

A. Any change in number is the result of embryonic change occurring between the sixth and fifteenth week for the temporary set and the fifteenth week and birth for the permanent set.

Q. When teeth erupt late in life what are they called?

A. They are called third sets.

Q. Are they third sets?

A. Properly not, because the germs must develop with those of the other sets.

Q. Why are they so tardy in eruption?

A. For want of dynamic force to propel them into place.

Q. Are they ever obstructed or mal-imposed?

A. They are frequently misplaced in the jaw, and again they are frequently held in the jaw by the other set.

Q. What does it denote when there are more than twenty in the temporary or thirty-two in the permanent set?

A. Atavism.

Q. When did man reach his highest physical development?

A. When well developed jaws held twenty temporary and thirty-two permanent teeth.

Q. When there is a decrease in number what does it mean?

A. Decrease in number from the dental standpoint means degeneracy of the jaws and teeth.

Q. What does such jaw and tooth degeneracy mean?

A. It means a marked advance in the man's evolution as a complete being.

Q. What was the dental formula of most generalized primate?

A. In the New Mexican lower eocene occur a few representatives of the lowest primate, such as the lemurarius and limnotherum, each the type of a distinct family. The lemurarius most nearly allied to the lemurs is the most generalized primate yet found.

It had forty-four teeth in continuous series above and below.

Q. What do supernumerary teeth indicate?

A. An atavism which demonstrates that man during his evolution from the lowest primates has lost twelve teeth.

Q. How many forms do supernumerary teeth assume?

A. Two. They either resemble adjoining teeth or are cone-shaped. They rarely are exactly counterparts. Each tooth may be duplicated.

Q. What shape do teeth that fail to approximate normal neighbors assume?

A. They always assume the cone-shape of the primitive tooth.

Q. Where are supernumerary teeth usually located in the mouth, and what significance has this?

A. In a majority of cases either in the extreme anterior or posterior part of the mouth. This demonstrates that the teeth resemble in number those of the primates and that they have been dropped off at either end of the jaw.

Q. Do they occur elsewhere?

A. Yes, but when present they are not usually cone-shaped but take normal shapes.

Q. What is indicated by the fact that the cone-shaped tooth as a rule is perfect in construction?

A. It is of much value in outlining tooth and jaw evolution, especially from degeneracy aspects.

Q. What is taking place in the evolution of the jaw?

A. It is shortening in both directions.

Q. How long will this shortening continue?

A. So long as the jaw must be adjusted to a varying environment.

Q. What shows that the jaw is undergoing transition?

A. The jaw of man originally contained more teeth than at present. Lack of adjustment to environment produces from the shortening, degeneracy of the jaws and atavism of the teeth.

Q. What does this indicate?

A. While degeneracy of the jaws indicates general advance it also demonstrates that man is not yet adjusted to his new environment.

Q. What does shortening of the jaw cause?

A. It causes supernumerary cone-shaped teeth to erupt in mass at the extreme ends of the jaw.

Q. Are cone-shaped teeth often seen on the lower jaw?

A. No. Mobility of the lower jaw prevents mal-adjustment to environment present in the upper.

Q. What effect has shortening upon the third molars?

A. It causes them to be so wedged in between the angle of the jaw and the second molar that eruption is impossible. It may tip forward and strike the second molar in an abnormal position or it may be missing altogether.

Q. What per cent. are missing?

A. In 670 patients forty-six per cent.

Q. From the shortening of the mal-adjustment and disappearance, what inference results as to this tooth?

A. This tooth seems destined to disappear.

Q. Is it more often absent upon the upper than the lower?

A. Yes.

Q. When it is absent, what general conditions exist?

A. The jaw is small and teeth irregularities are frequent, nasal stenosis, nasal bone and mucous membrane hypertrophy, adenoids and eye disorders co-exist.

Q. After the third molar which tooth is next destined to disappear?

A. The lateral incisor.

Q. What per cent. are lost?

A. Of 670 persons, fourteen per cent. were missing.

Q. How many laterals have the lower mammals?

A. Two laterals, and the other is destined to disappear.

Q. Are other teeth sometimes missing?

A. In degenerates, it is not uncommon to find centrals, cuspids, biscuspids and even molars missing. In markedly degenerate jaws, second as well as third molars are frequently absent.

Q. What do missing teeth indicate?

A. Lack of development of germs, due to either heredity or defective maternal nutrition at the time of conception or during early pregnancy.

Q. What teeth tend to conation?

A. Crescent-shape bitubercular, tritubercular as well as deformed teeth tend to the cone-shape.

Q. Why do these malformations take place?

A. They result from pre-congenital trophic changes in dentine development.

Q. In what does it consist?

A. In dwarfing and notching the cutting and grinding edges of the second set of teeth.

Q. What is one of the marked deformities of the teeth?

A. Hutchinson's teeth. Because Hutchinson first described them in connection with syphilis.

Q. What are Hutchinson's teeth?

A. They consist of incisors drawn together (cone-shape) at the edges and hollowed out at the center.

Q. Are these teeth pathognomonic of syphilis?

A. They are not without other diagnostic signs. They alone would not decide a case of lues.

Q. Did Hutchinson claim that these teeth were pathognomonic?

A. No. He admits that in at least one-tenth the cases luetic etiology could be excluded. Lues only plays the part of a diathetic state profoundly affecting the material constitution at the time of dentine and enamel development.

Q. Are these marked deformities of the teeth due to other causes than lues?

A. Yes. Any marked constitutional disturbance such as scarlet fever, typhoid fever, pneumonia, etc., will produce like results.

Q. What do these teeth resemble from an atavistic standpoint?

A. The coincidence in form between Hutchinson's and malformed teeth and those of the chameleon, demonstrate that tropho-neurotic changes produce atavistic teeth.

Q. Do all teeth sometimes conate?

A. In marked forms of degeneracy, the teeth upon both upper and lower jaws will sometimes conate.

Q. In the evolution of the teeth, what theories have been advanced?

A. Two. The differentiation and concrescence theories.

Q. Who advanced these theories?

A. The first was advanced by Osborn and Cope in America; the second by Magitot in 1877, and later by Schwalbe, Carl Rosa, and Kurkenthal.

Q. What is the differentiation theory?

A. In the triassic period, the first mammals possessed conical, round, reptilian or dolphin-like teeth. Some aberrant types had complex multitubercular teeth. Descending the scale, cusps were added here and there forming a triangle. In the primitive carnivore *miacis*, a heel is found which from the grinding surface seems to have spread out broad as the triangle. The three molars in this animal show that the anterior triangular portion of the crown has been simply leveled down to the posterior portion of the crown. In this way the human molar tooth with its low quadritubular crowns has evolved by addition of cusps and by a gradual modeling from a high crowned, simple, pointed tooth. By this budding all the teeth are developed.

Q. What is the concrescence theory?

A. Cone teeth placed as they lie in the jaw of the whale, would represent primitive dentition. In the course of time a number of these teeth become so clustered together as to form two cusps of a bicuspid and four cusps of a human molar. Each one of the whale tooth points takes the place of one of the cusps of the mammalian tooth. In other words by concrescence, four teeth are so brought into one as to constitute the four cusps of the molar crown.

Q. From the degeneracy standpoint which of these theories seems to be correct?

A. In degenerate jaws both the differentiation and concrescence theory are beautifully illustrated. From an atavistic standpoint every tooth in the jaw at one point or another may display rudimentary cusps. Teeth are found joined together quite frequently, especially in the anterior and posterior part of the mouth. Thompson remarks that there is a graduation from central incisors towards the bicuspids in evolution.

Q. Is this graduation observed from cuspid to bicuspid in man?

A. The general opinion is that it is not. There are indications, however, of an inner cusp or cingulum that often presents itself in bicuspid form in the lower mammals, like the mole and that the first premolar or bicuspid is then more caniniform.

Q. Is the rudimentary cingulum or inner cusp seen in man?

A. They are, although variable and erratic as to position. The condition appears in degenerates as far front as the centrals and is often present on the lingual face of laterals and cuspids of man.

Q. Is not the lingual cusp of the inferior bicuspids often fully developed?

A. Yes.

Q. Is it quite deficient in some lower apes and semi-apes?

A. Yes. Especially in the lemurs.

Q. When does it attain its highest development?

A. In the anthropoids and in man.

Q. Are the changes noted by Osborn in the level-ing of the cusps to form the molar ever observed in man?

A. Yes. In marked degenerates.

Q. Do indications of the concrescence theory occur in the tooth types of man?

A. Yes. It is not uncommon to find incisors and cuspids with two roots, bicuspids with two or three roots and molars, especially the third, with three, four, five and six showing an atavistic tendency.

Q. Are there other evidences of atavism in the molar teeth?

A. Yes. Dr. S. H. Guilford first called attention to "compressed or flattened crowns," as later did Dr. W. B. Pearsoll of Dublin, Ireland.

Q. Are they frequently seen?

A. They are very common in arrested and degenerate jaws.

Q. Which teeth are involved?

A. Always the last one. If the third molar is in place, it is the tooth, if it is missing then the second molar.

Q. What position do they take?

A. The crowns and roots seem to retain the original "triconodont" type with cusps and roots in line.

Q. Are the roots close together or separated?

A. The roots are sometimes separated containing two or three, or these may be flattened upon the sides with a number of markedly deformed pulp canals.

Q. What other anomalies are observed in degenerate jaws?

A. Through the operation of the law of economy of growth, producing arrest and excessive development, edentulousness and excessive dentition occur.

Q. What did Darwin find as to hair and teeth?

A. That hairless dogs have imperfect teeth. Here the dermic defects affected the animal as a whole, other organs profiting by the deficiency of hair and teeth.

Q. What did Magitot determine?

A. That in most cases of hairy men, there is defective or irregular dentition.

Q. What did Thurman report?

A. The case of a man fifty-eight years of age who was almost devoid of hair. All his life he possessed only four teeth. His skin was delicate. There was absence of sensible perspiration and tears.

Q. What did Williams report?

A. The case of a fifteen-year-old girl who had scarcely any eyebrows or hair on head and who was destitute of eyelashes. She was edentulous and had never sensibly perspired.

Q. Are there cases on record with few or no teeth?

A. Yes. Fox reports a woman who had but four teeth in both jaws. Tomes cites several similar instances. Hutchinson reports a child who was perfectly edentulous as to temporary teeth, but whose permanent teeth duly and fully erupted. Guilford describes a man of forty-eight years congenitally and permanently edentulous who had no sense of smell and almost without taste. The surface of the body was covered with fine hair. He had never visibly perspired. Otto observed two brothers who were edentulous.

Q. How does excessive dentition show itself?

A. In many varieties. Those which constitute a return to the polyphyodontia of the lower vertebrates.

Q. State some of these.

A. O. Hildebrand of Gottingen, Germany, in 1889 reported a case of a child of twelve which after various operations had been relieved of about two hundred teeth of various sizes. Two years later (July, 1891) at the Surgical Clinic, it was found that both sides of the lower jaw were much thickened and also the right upper. There were found seventeen teeth, part of them normally developed, others in an undeveloped condition. The position was irregular. From the upper and lower jaw there were again some masses of teeth removed which represented about one hundred and fifteen. There were also found two glassy bodies about the size of two peas which under the microscope showed tooth structure.

Q. What does this indicate?

A. Return to the polyphyodontia from arrest of development very early in foetal life.

Q. Are there other illustrations of polyphyodontia?

A. Yes. In the Paris Dental School Museum are several milk teeth both of the superior and inferior maxilla fused together. Black cites a case where there were two rows of teeth in the superior maxilla. Hellwig has observed three rows of teeth. The ephemerides contain an account of a similar anomaly.

Q. Are teeth found about the head elsewhere than in the mouth?

A. Yes. Gould points out that teeth have been found in the nose, orbit, palate, and exceptionally, as in a case reported by Carver, they may grow from the lower eyelids. Arrest of development proceeding from checked development at the senile period of foetal life may evince itself in senility of the alveolar process, as in the case reported by Bronzet where a child of twelve had but half its teeth, the alveolar process having receded as in old age.

Q. Do not arrests of development produce polyphyodont conditions in man?

A. Yes. Catching reports the case of a girl who had all her teeth at six months and shed them at nine. At fifteen months she had a full set once more. In six weeks thereafter these were shed. At thirty months she had a full set again, which remained until her fourth year, when came another set. These remained until another set began to erupt at eleven and became the permanent set at fifteen.

Q. Is there a relationship between dental and dermal tissues?

A. Dr. A. H. Thompson points out that these structures are governed by the same laws, subject to the same influences and possess the same phenomena of character as allied tissues. The relationship and homology of the teeth with the derm and its varied appendicular productions are established by demonstration. Teeth, spines, scales, dermal plates, feathers, hair, nails, bristles, horn, hoof, etc., varying in form and apparent purpose as much as tissue can well attain, are very closely related in structure and function.

Q. Of what does the enamel consist?

A. It consists of decalcified epithelium cells elaborated from the endurance of an appointed work and service in the economy.

Q. What else does it possess?

A. Enamel like the epithelium and all corneous structures yields keratin.

Q. What would result from this under certain conditions?

A. In such unstable structures in evolution as the teeth, arrest of development would produce for this reason horny structures in place of enamel. This occurs physiologically. In the oviparous mammal the duck-bill, true teeth appear in the embryonic state to give way later by what Thompson calls suppressive economy or the degenerative results of the struggle for existence between the organ to horny structure. Irregular enamel is found normally in wombats.

Q. What other instances may be cited?

A. Those of the toothed birds of the tertiary.

Q. Do these conditions exist in man?

A. In neurotics and degenerates, arrest of development occurs, hence very little or no enamel upon the teeth.

CHAPTER XXX.

SURGICAL DIAGNOSIS.

Q. What is necessary to a successful result in treatment?

A. Knowledge of the origin of disease as well as of the symptoms.

Q. What happens when the symptoms are removed without ascertaining the cause?

A. Treatment fails utterly in the main object, the removal or amelioration of the disorder.

Q. Should the dentist go outside the mouth if necessary to find the origin of the disorder?

A. The dentist should be trained to seek the cause wherever it may be.

Q. Will general examination of the face and jaws show the character of the deformity?

A. The contour of the face, the facial angle and general appearance will often decide the extent and character; whether there be a V or saddle arch, excessively developed alveolar process or an underhung jaw.

Q. What is the first principle a dentist should adopt?

A. He should learn what constitutes a normal face in a given individual or nationality.

Q. Do nationalities differ as to shape and contour of the face?

A. Most decidedly. The dentist should see the jaw has a normal outline or belongs to the V or saddle-shaped variety.

Q. What other structures are involved?

A. The vault and alveolar process and the occlusion (let the patient open and close the mouth slowly). The beginner should familiarize himself with tooth individuality as to class, outline and occlusion.

Q. What takes place with asymmetry of the upper and lower jaws?

A. Occlusion from the cuspid back is usually wrong. In such cases the upper cuspid generally strikes in front of the lower cuspid instead of between it and the bicuspid disarranging the articulation of every tooth.

Q. Is the difficulty in local irregularities easily detected?

A. Yes. It is either found in the alveolar arch or the malposition of the individual tooth.

Q. What would be the first inquiry?

A. The family history. It has been claimed that it is useless to try to correct an irregularity due to family type. That the type returns despite long continued efforts. This is an error. Especially in this country from change in climate and intermarriage do shapes of heads, faces, and jaws pass from one extreme to the other in four generations. Evolution in face and jaw goes on so rapidly that the tissues are too unstable to present fixed forms.

Q. Is there a family type?

A. No, while the child may inherit a family type of face still irregularities cannot be said to be inherited since the order and manner of their eruption and position are purely mechanical and the influence of environment comes into play.

Q. Can the character of the jaw and irregularities of the teeth always be settled?

A. No. It is often well to wait until the patient is of an age when the permanent type can be determined.

Q. Why?

A. Correction of tooth irregularities before that period often gives unsatisfactory results.

Q. Can all cases be benefited?

A. If taken in time all cases may be made less unsightly.

Q. What will assist such operations?

A. Knowledge of evolution and of its reverse phase, degeneration, as well as of heredity and atavism, are necessary factors in the skill of the operator.

Q. Before operating, what should be done?

A. A study of the models should be made. In prognosis, extent of deformity must be taken into consideration.

Q. Will not many cases correct themselves?

A. Cuspids and bicuspids not infrequently erupt out of position but gradually find their proper places. Deformities during second dentition are common, while some deciduous teeth remain in the mouth. These often right themselves.

Q. Should the operator state absolutely to the patient or parent the ease or difficulty of correction or time required?

A. No. Many cases which seemingly present no difficulty often give much trouble since the resistance cannot be determined.

Q. Should a case be hurried?

A. It should not. Time spent in careful examination of the case is well spent. Haste here, as elsewhere, makes waste.

Q. What must be studied?

A. Every particular. The operator must forecast in his mind appliances to be used, the different steps to be taken and time required before prognosis can be given with approximate exactness.

Q. What is the best time to regulate teeth?

A. This will depend upon the nature of the irregularity. Approximately from the twelfth to the fourteenth year.

Q. Is not this a very critical period in the life of the individual?

A. It is. It is one of the periods of stress and the period most impressible in the growth of the individual. The transitional period between childhood and puberty.

Q. Why then select this time?

A. Because all the teeth are erupted, general nutrition is most active, the osseous system is in the constructive stage and formative processes are in operation. The roots of the teeth are not fully developed and are more or less loosely confined in the alveoli. The apical foramina are large, which lessens liability of blood supply, impairment, and consequent destruction of the pulp.

Q. What are the chances of good results after that period?

A. Chances of success in regulating decrease yearly after puberty and after twenty-six are very meager. In a majority of cases, the osseous system is fully developed at this period.

Q. Is it possible to regulate deformities as late as the thirtieth year?

A. It sometimes can be done. The resulting pain is, however, so severe and the mechanical force necessary to produce absorption of the alveoli so great that the results hardly justify the procedure.

Q. When regulated so late in life, is ossific material easily deposited to hold the teeth?

A. It is not. Corrective plates must be worn sometimes for years before they become strong.

Q. When teeth are regulated late in life, especially when extensive operations are performed, is there ever a compensating ossific deposit?

A. In such cases the inflammatory process is almost never restored. Chronic inflammation of the alveolar process and peridental membrane (a veritable interstitial gingivitis) sets in with excessive absorption of the alveolar process and gum contraction.

Q. What precaution should be taken if teeth must be regulated late?

A. The patient should be impressed with a doubtful prognosis. It must be remembered that the alveolar process is a transitory structure. It is simply to hold the teeth in place. It is removed when the teeth are extracted or from too violent irritation (auto-intoxication or senile absorption). Hence the older the patient the less liable to restoration.

Q. What should be done if the patient insist?

A. The patient must assume the responsibility of failure.

Q. How does the process of repair after regulation differ from repair of fracture?

A. In the osseous system two parts of homogeneous structure are united. In repair of regulation, the tooth root, a dense structure, is enclosed in a spongy structure, the alveolus. There is no bony union.

Q. Is alveolar nutrition very active?

A. It is during first and second dentition until the roots are perfectly formed or until the final growth of the alveolar process.

Q. What happens afterward?

A. The blood supply being less, waste and repair do not go on so rapidly when the alveolar process is injured.

Q. How is lowered nutrition sometimes shown?

A. In the separation of the teeth and recession of the alveolar process and gums in rapid wedging, as well as in interstitial gingivitis.

Q. What illustrates the difference between fracture in bone and tooth movement?

A. The fact that the attachment of a tooth to the alveolus later in life cannot be compared to the union of a fractured bone is evident in the aptitude of teeth when regulated to return to their original place.

Q. Is new tissue as strong as the original?

A. Unlike bone and cicatricial tissue it is not as strong as the original.

Q. In undertaking regulation should the general health be taken into consideration?

A. It should; as the majority of cases are in youth, the state of general health is of no slight importance. The most favorable period for operation is unfortunately one of the most critical in the life of the patient.

Q. What are the dangers?

A. From the age of twelve, the beginning of one of the most important periods of stress, the rapidly growing boy or girl is subject to many marked physical changes entailing profound disturbances of the tropho-nervous system.

Q. What other conditions are liable to cause disturbance?

A. Prolonged and injudicious worry, over study, over exertion, impure air, improper food, sexual irritation, auto-intoxication, as well as other disturbing factors tend to become prominent in the life of the individual.

Q. What is the strongest factor at this period?

A. Sexual disturbance is of special importance on account of the periods of stress. When to physiologic perturbation of this important period of evolution are added influence of environment, perversions of nutrition like rachitis and allied states consequent upon congenital weakness, improper dietetics, hereditary syphilis or the exanthemata, the necessity of taking into account the influence of the general health upon operative procedure is self evident.

Q. Under such conditions what is best to do?

A. Operations upon young persons in delicate health should not be done until the constitution has improved.

Q. Should the dentist be able to recognize these conditions?

A. He should possess a general knowledge of medicine so that he can recognize any physical defect and have it properly treated.

Q. What is the general condition of all children who require this kind of treatment?

A. They are children with unstable nervous systems and whose physical development is a departure from the normal.

Q. What are some of the disturbances?

A. The mucous membranes are badly developed, especially bowels, rectum, and other mucous tracts. The digestive and assimilative functions are faulty. The glandular system is weak. The excreta are not properly eliminated. From an undeveloped nervous system, strain at this period is often attended with disastrous results.

Q. What is the process of absorption?

A. It was thought that when mild pressure was applied this was physiologic, now it is known to be pathologic.

Q. Explain this.

A. When pressure is applied, irritation and pressure set up inflammation which is interstitial in character. Inflammation causes deposition of lime salts just as it does in fracture.

Q. What effect do extensive operations or rapid movement of the teeth have upon the alveolar process?

A. Not infrequently in such patients later in life it is found that the alveolar process is not restored. Interstitial gingivitis sets in early, the trabeculæ are destroyed, the teeth loosen, separate or crowd together, elongate and are finally lost.

Q. What is the character of the patient who usually requires dental regulation?

A. They are generally neuropaths and degenerates. This increases the danger from careless procedure.

Q. How should the patient be treated?

A. His assimilation must be normal. He must have enough unstimulating food to suit the particular case. He should have abundance of sleep in a well-ventilated room. He should be in the open air as much as possible. The mind should be placid and agreeably occupied so as to aid him to forget the irritation during the process.

Q. Does irritation with absence of pain affect the nervous system?

A. It does. Irritation without physiologic response is a greater tax on the nervous system than pain itself.

Q. Should dentists therefore be satisfied that everything is going well if the patient does not complain?

A. They should not. They should encourage the patient to give expression to his feelings. This aids in deciding the time required for each step.

Q. Should the patient go to school while under treatment?

A. This will depend upon the patient. School strain to some children is a tax in itself. Therefore, it may be necessary to take the patient out of school or to diminish his task. Schools are badly ventilated. Exercise during school hours is almost impossible.

Q. Is not school-room discipline detrimental to some children?

A. Routine discipline of the school-room added to strain of regulation is detrimental to health and spirits when multiplied by the other cares of puberty and adolescence.

Q. Is not the mind in a morbid state during puberty?

A. Children during puberty and adolescence are morbidly conscientious, ambitious, and reserved. They suffer much and say little. This is particularly true of girls who do not find the relief boys do in outdoor play.

Q. Is not more care required of girls?

A. Her life is more circumscribed and she is more liable to passive suffering.

Q. Should co-operation of a skillful physician be secured as to the general welfare and as a share of the responsibility?

A. Yes. Cases occur where girls are invalided for years solely by shock to a primarily unstable nervous system from prolonged operations in regulation.

Q. What should be done before such an operation?

A. The patient should be weighed at the time the appliances are adjusted and noted every two weeks throughout the operation.

Q. What is necessary on the part of the operator?

A. Knowledge of human nature, quick, judicious sympathy, an agreeable presence and tact are very essential. If the dentist work in harmony with the laws of mental and physical health, half is gained.

Q. Are people anxious to have their teeth regulated?

A. This depends somewhat upon the social status of the patient, sex, and age. People not well-to-do even if they have a decided æsthetic sense are so hampered with pecuniary consideration of a more urgent nature that little attention is paid to irregularity.

Q. How do those in better circumstances look upon such operations?

A. Life assumes large proportions. Their lot in life may be materially changed by an attractive mouth.

Beauty is of the greatest importance. Society taking these things for granted acts upon them.

Q. Are operations more likely to be performed upon the well-to do than upon the poorer?

A. Such children seek the dentist for relief Mothers usually are alive to the appearance of their children and encourage them to endure the strain.

Q. Are parents likely to hinder results by indifference or careless remarks?

A. Frequently they do not co-operate by enforcing wearing of appliances and regular visits. The dentist should determine the attitude of parents before his task is undertaken since without their co-operation his best efforts will be thwarted and his reputation suffer.

Q. What is the first step in regulation?

A. Taking the impression of the mouth.

Q. Why?

A. The position of the teeth, their relation to one another and the conformation of the jaws can be more easily studied, and an accurate conclusion more readily deduced.

Q. What is necessary in such operations?

A. Teeth should not only be moved to their proper places but must be in harmonious relation to one another.

Q. What occurs if they be not in harmony?

A. They tend to return to their faulty position. Their normal relation can best be determined by studying the model.

Q. What material should be employed in taking impressions?

A. The material depends upon the shape of the jaws and position of the teeth; if the teeth are but slightly irregular and the crowns short, plaster of Paris should be used. On the other hand, if the teeth are irregular and long and the arch deep, plaster of Paris will be likely to adhere to the teeth. In such cases modeling compound should be used.

Q. How should the patient sit to have an impression taken?

A. He should sit low in the operating chair or in an ordinary chair. The operator can thus better control the patient.

Q. How should the clothing of the patient be protected?

A. By placing two towels under the chin, one fastened to the clothing, the other loose, and a newspaper in the lap.

Q. How should the impression cup be prepared?

A. One should be selected large enough to enclose the teeth. This should be built up with wax so that it will extend beyond the margin of the gum. The center of the cup should be filled with soft wax to conform to the vault. In this way the plaster will be carried to all parts of the mouth.

Q. What is the next step?

A. Plaster should be mixed in a bowl with sufficient water to make mixture of the consistency of cream; add a little salt to hasten the process of setting. After stirring until the air bubbles have disappeared and the plaster has begun to set, the cup and outer edge should be filled.

Q. How should this be applied to the mouth?

A. The operator should stand to the right and just behind the patient with his left arm around the left side of the head and the fore finger inserted into the mouth. The cup should be carried to the mouth with the thumb and fore finger upon the handle and the middle finger in the center to steady it. After it has been inserted into the mouth with a rotary motion of the right hand it should be pressed up into place with the middle finger. At the same time the lips should be raised, the cheek pressed out with the left fingers. When the cup is in position it should be held firmly with the middle finger in the center of the plate against the teeth. The head should be inclined toward the breast to prevent the plaster's passing back to the fauces.

Q. What is to be done if the stomach become disturbed?

A. By holding the fingers in the center of the cup as suggested, the contents of the stomach can be evacuated without interfering with the impression.

Q. When is the impression ready to be removed?

A. Test the plaster in the bowl or upon the side of the cup; when it breaks with a clean fracture, it is time to remove the cup.

Q. What should be done with it?

A. It should be placed in the outer towel held by the assistant. Carefully examine the mouth and if pieces of plaster are seen, put them into the towel on the proper side of the impression, afterwards arranging the pieces in the proper places.

Q. What is the second towel for?

A. It is for the purpose of removing plaster that may remain about the face.

Q. Should the operation be explained to the patient?

A. It is well so to do. Otherwise the patient might anticipate serious experience.

Q. Are such details necessary?

A. The slightest detail should be so strictly attended to as to insure perfect impressions.

Q. In taking an impression of the lower jaw, how should the patient sit?

A. He should sit higher so that the mouth will be on a level with the elbow of the operator who stands in front of the patient.

Q. How is the tray for the lower jaw manipulated?

A. The fingers of the left hand should push out the cheek and lips while the cup is rotated into place with the right hand. The first and second fingers of each hand should rest upon the cup over the bicuspids and molars, the thumbs under the jaw on either side, thus holding the cup firmly in place until the plaster sets, which should be removed and placed in the towel as before.

Q. What is the next procedure?

A. After a few minutes' hardening the impression should be placed under running water to remove mucus, saliva, blood, or particles of plaster. Should the plaster be broken the pieces can be placed in position indicated by the arrangement on the towel, and when perfectly dry fastened together with melted wax.

Q. How is the model separated from the impression?

A. A clean separation of the model is obtained by covering the impression with a lather of soap and washing off the surplus, or by coating the surface with shellac and oiling to prevent sticking.

Q. How is modeling compound used?

A. Place boiling water in a bowl and dip the compound into it until it is soft enough to use.

Q. How should it be applied?

A. Place a sufficient quantity into the impression cup and proceed as with plaster, cooling it off with cold water applied with a napkin.

Q. How are the models obtained?

A. Mix the plaster the consistency of cream. Place a few drops of water in the cavities made by the teeth to exclude the air, when the plaster is introduced tap the cup on the bench, thus driving out all the air, build up the plaster to make body for the model. Such models had better stand from twelve to twenty-four hours so that they may be perfectly hardened.

Q. What should be done with them after removal?

A. Trim the model roughly. After articulation trim it so that the body of the model will be parallel with the line of the teeth and made presentable for inspection.

Q. How should the models be marked?

A. Place the name of the patient and the date of beginning operation upon the surface of the lower model and the patient's initials upon the upper. The surface should now be varnished; an elastic band will hold them together.

Q. Could they not be placed upon the articulator?

A. A wire articulator may be used to a good advantage at little expense.

Q. What should be done with the models?

A. They should be placed conveniently so as to improve spare moments by studying physiologic conditions of the teeth before arriving at conclusions as to the pathology of the case.

Q. What is necessary?

A. In determining the character and extent of a deformity a criterion is necessary.

Q. How would a standard be obtained?

A. In the skull on taking the two cuspids for a starting point, the arc of a circle is found on dropping a line from one cusp of the cuspid to the center of the third molar, the posterior part is seen to diverge considerably from the central line. The inferior incisor should close inside of the superior incisor. The buccal cusps of the bicuspids and molars should occlude at the center line or sulci of the superior bicuspid and molar.

Q. What should be the curve of the teeth from the side?

A. It should be a gentle curve downwards from the cuspid to the second bicuspid rising until the third molars are reached.

Q. How should the teeth lock?

A. The superior cuspid should stand at the point of occlusion of the inferior cuspid and first bicuspid. If the teeth are all in position, each tooth will lock between two teeth of the opposite jaw. The median line of the upper incisors should correspond with the median line of the lower incisors.

Q. What is to be done if the irregularity is complicated and more room is required?

A. It is best to enlarge the arch. The changing of a well articulated set of teeth so that the cusps of the opposite will strike is an unpardonable error.

Q. What should be the size of the arch?

A. The arch of the superior and inferior maxilla should have a diameter of sufficient width to prevent an impression of the teeth on the sides of the tongue or as large as the jaws will admit. Any deviation of the jaws and teeth from this outline is a deformity which should receive the attention of the dentist.

Q. What do the models reveal with this standard in mind?

A. Careful consideration shows that one of two conditions exists, either the teeth are in a crowded and irregular condition inside of the proper line or they are isolated and irregular outside.

Q. What teeth are almost always involved?

A. In a majority the irregularity involves the teeth anterior to the first permanent molar.

Q. What arises under such conditions?

A. Whether to enlarge the arch by force or to extract one or more teeth.

Q. What will decide this?

A. The age of the patient.

Q. If the temporary teeth are in the mouth causing the irregularities what should be done?

A. They should be removed.

Q. When the removal of the second teeth becomes a necessity which tooth should be sacrificed?

A. A tooth should be selected which is the least prominent or which will least affect the expression. In selecting teeth for removal each case must be taken as a law unto itself requiring its own special treatment.

Q. What is generally practicable?

A. A good rule is to retain, if possible, the six anterior teeth; as the cuspids on the upper jaw are the most prominent and give expression to the face, they should not be removed. If a tooth must be sacrificed, the selection lies between the first or second bicuspid and the first molar.

Q. How should the teeth be removed, if at all?

A. If the bicuspids be decayed they should be removed. If a first molar be decayed and it can be crowned, it should not be removed. The removal of a first molar will secure more room than is required. It has served from the sixth year, which fact—in connection with its solidity in the jaws and its central position, argues for its keeping.

Q. Should the incisors ever be extracted?

A. It occasionally happens that the articulation posterior to the cuspids is perfect, nearly approximating the central and the laterals locked inside or outside of the arch, whether sound or decayed, it may be best in such cases to remove one or both laterals.

Q. Will the general appearance be injured?

A. It will not.

Q. Are the inferior incisors ever irregular?

A. Yes. If the articulation be normal in the posterior part of the mouth almost any of the incisors that are out of position may be removed.

Q. Do they resemble each other?

A. They resemble each other so evenly in size and shape and are so nearly concealed by the lip their loss will not be observed.

Q. Is it necessary to be careful in selection of the teeth and mode of treatment in such cases?

A. Yes. Since an actual increase of the deformity may be produced by a hurried operation.

Q. May the cuspids be removed on the lower jaw?

A. If the arch is complete with the cuspids out or inside they may be removed with excellent results.

Q. Which bicuspid should be removed if necessary?

A. The one which is the most decayed, if by so doing the irregularity can be corrected.

Q. If both bicuspids be sound, which one may be removed?

A. The first one if the anterior teeth are crowded. This makes room for the cuspid.

Q. Is the Roentgen ray of value in diagnosis of tooth deformities?

A. Nowhere in medicine is it of such importance.

Q. Under what conditions may it be used?

A. Delayed eruption, early extraction, abnormal and broken roots of teeth, location and position of third molars, absorption of roots of teeth and of the alveolar process and the roots can be easily outlined.

Q. What affect do these conditions have upon the teeth?

A. They affect occlusion and impair mastication.

Q. How are impacted and imbedded teeth located?

A. By cutting down upon the locality and exploring for missing teeth. This is easily done with very little pain to the patient.

Q. Is it easy to obtain skiagraphs of the jaws?

A. At the present time it is somewhat difficult for the reason that the jaws cannot be kept quiet.

Q. Which teeth are the easiest?

A. The molars and bicuspids.

Q. If the vault be high, can better results be obtained?

A. Yes.

Q. What are some of the various methods?

A. Dr. Kells' method is as follows: A cast is made of the portion of the mouth to be skiagraphed and a small piece of modeling compound molded over the crowns of the teeth thereon.

A piece of aluminum, this metal being almost transparent to the rays, of about twenty-six or twenty-eight gauge, is cut to the desired size and shape and bent to fit the cast as well as possible. This is slotted along the edge toward the crowns of the teeth and thereby attached to the modeling compound above referred to. This forms a convenient little film holder, which when placed in the mouth will allow the patient to close the teeth upon it and thus hold it securely in position, without danger of its moving for a much longer time than is necessary to take the picture.

The next step is to cut the plate or celluloid film, whichever is to be used, to the proper size and envelop it neatly in black paper, gluing down all the edges with paste and securing it to the plate holder by two or three small aluminum clamps.

This is all that is usually necessary, but if it is deemed advisable to protect this from moisture, as is sometimes the case, more especially for lower teeth, then the black envelope is covered with thin tin foil or waterproof paper neatly pasted down, care being taken not to have the foil, if that is used, doubled upon the side to be exposed. While this may appear to be a long process, it is quickly accomplished and the invariably satisfactory results obtained warrant the trouble taken.

The patient is then seated in a chair with a photographer's head-rest to hold the head, the Tesla screen should be adjusted in place, the tube brought to about ten or twelve inches from the face and placed so as to throw the best shadow of the parts upon the film. The length of exposure depends upon the thickness of the parts to be penetrated, the working condition of the apparatus and the distance of the patient from the tube, the time being proportional to the square of the distance.

From sixty to ninety seconds are necessary for ordinary cases, ranging perhaps up to one hundred and twenty seconds for third molars in heavy jaws, while twenty to forty seconds are sufficient for some favorable cases in thinner bones.

Q. Give Dr. J. N. M'Dowell's method.

A. Dr. J. N. M'Dowell recommends the following method: "In taking X-rays of the teeth it was found impossible to conveniently cut glass sensitive plates to correctly fit the different parts of the mouth without the spoiling of many plates. To overcome this difficulty, it was necessary to have something that could be easily cut and shaped to fit the mouth for each occasion and at the same time transmit light as a negative in making photographs. Celluloid prepared with sensitive chemicals has been found to answer this purpose best.

"No special preparation of the mouth in the way of washes, etc., is necessary, as the plate is protected by a covering. Cut a piece of cardboard to fit the part of the mouth that is to be photographed. In the dark room lay the cardboard on the sensitive celluloid plate and cut to the same shape. Figs. 258 and 259, etc., of the X-ray pictures show the original shape of the cut celluloid. This is then wrapped in black paper to protect the plate from light and the moisture of the mouth. The head is so placed as to be immovable and the sensitive celluloid placed in the mouth directly back of the teeth to be taken. The usual time of exposure is about a minute with Crookes' six-inch tube. This tube should be stationed some six or eight inches above and in front of the teeth to be taken, in order to secure the outlines of the roots. If the tube is held directly opposite the teeth the roots are not taken, as the plate cannot be inserted high enough, owing to the shape of the roof of the mouth."

Q. What is an element in tooth regulation?

A. The fee.

Q. How is this estimated?

A. The dentist should have so prepared himself that he fully understands and appreciates the requirements of any case which he may undertake to correct. This will take much time and anxious thought, for which he should receive just reward.

Q. What condition of the patient should be studied?

A. The temperament and disposition as well as the ossific condition of the jaws.

Q. What frequently happens in these cases?

A. Mouths exhibiting very similar deformities on account of mental and physiologic idiosyncrasies and differences in density of tissue occur requiring different treatment and length of time to accomplish favorable results.

Q. Should there be an understanding between the patient and the operator as to the fee before commencing the operation?

A. Yes, as correct an estimate should be made as possible. This is difficult to do, therefore maximum and minimum prices should be given.

Q. What are some of the difficulties encountered in regulation?

A. One of the greatest is to persuade the patient to submit to the annoyance of wearing the appliance, secondly to impress upon the patient the necessity of being prompt and faithful in visits to the dentist.

Q. Do children ever become discouraged?

A. Not appreciating the importance of these operations, patients, especially children, frequently become discouraged and are anxious to abandon the treatment before completion.

Q. Does the parent often sympathize with the child?

A. They do, and without regard for the labor or expense which the dentist has assumed or the real interest of the patient, abandon the operation.

Q. What is always a good plan?

A. In every case the dentist should demand and receive at least one-half the proposed fee before the work is begun. With this money invested in the operation the parent will be loth to allow the case to be abandoned before it is finished.

Q. What is the dentist's responsibility?

A. With due regard to the comfort and good of his patient, the dentist should expedite his operation so that suffering and expense may be as light as possible. All should be done with an intelligent understanding of the physiologic and pathologic condition under care.

Q. What is expected of the patient?

A. By obedience to the dentist's instructions can facilitate the correction which will of course greatly reduce the expense of the operation.

Q. Is it well to go into the details of the operation?

A. Here as elsewhere in surgery, it is better not to give too minute details as to plans to be followed and the appliances used, since it frequently happens that the most carefully planned procedure has to be varied during the operation.

Q. What effect does this have upon the patient?

A. In this case disappointment and dissatisfaction may be engendered in the mind of the patient or relatives with a suspicion as to the dentist's ability to accomplish the results.

CHAPTER XXXI.

PHYSIOLOGIC AND PATHOLOGIC CHANGES.

Q. What elements of change enter into the alveolar process?

A. Development and absorption in its relation to eruption and loss of the teeth.

Q. What is the function of the process?

A. The process is to support the teeth while in place and finally after their removal it is lost.

Q. What should this tissue be called?

A. Transitory. The osteoblasts and osteoclasts are always present to build up or tear down structure as may be required, by the exigency of environment.

Q. What other factor increases the transitory nature of the alveolar process?

A. Evolution of the jaws.

Q. Do these osteoblasts and osteoclasts act rapidly?

A. Their rapidity of action depends upon age and the condition of the system.

Q. When is the most active period?

A. During youth.

Q. What causes the activity?

A. The vascularity and want of density of bone structure.

Q. What will produce absorption of the process?

A. Light constant pressure.

Q. Are teeth constantly changing their positions?

A. Absorption and deposition of bone is going on simultaneously and continuously.

Q. When is this especially noticeable?

A. At the first eruption of the teeth. Again, when the first permanent molar has been removed and the second and third molars have moved forward and filled the space. Teeth that have erupted out of their position will often find their way back into place.

Q. Can the teeth be placed in their proper positions by mechanical devices?

A. By removing obstruction, regulation of malposition becomes simple.

Q. Can absorption be hastened?

A. Equable reproduction and absorption will depend upon the amount of pressure exerted and the condition of the individual. In cachexiae distintegration is favored while tissue building is retarded.

Q. In what conditions is tissue building retarded?

A. This notably occurs in auto-intoxication and senile absorption.

Q. What must be taken into consideration in applying pressure?

A. The degree of pressure and the constitutional condition of the patient.

Q. How must pressure be applied?

A. It must be evenly distributed and constant, pain will not be experienced when once the teeth begin to yield.

Q. What will happen if the force be not constant?

A. When the force is applied, removed and reapplied spasmodically pain necessarily results.

Q. Illustrate the two methods.

A. When teeth have been separated to facilitate the filling of proximate cavities, tooth vibration due to preparing the cavities and application of gold produces an intense pain relieved by inserting a wedge to steady the teeth, when no pain will be felt.

Q. Does increased pressure imply greater pain?

A. It does, especially when alveolar process hypertrophy is present.

Q. Is hypertrophy very common?

A. It is. The operator must be on the alert to discover its location at the outset of the operation because heavier appliances and unusual pressure are required to produce bone absorption.

Q. What should be done in such cases?

A. Cutting away the alveolar process is always indicated.

Q. What effect does it produce?

A. It relieves the strain upon the nervous system.

Q. What causes pain?

A. The pressure of the tooth upon the alveolar process sets up inflammation. When the pressure is greater than the absorption pain results, or where the pressure is intermittent pain ensues.

Q What was once supposed to be the sole type of bone absorption?

A. Osteoclast or lacunar absorption.

Q. To what may bone absorption be due?

A. It may be due to either lacunar or osteoclast, halisteresis, Volkmann's perforating canal or osteomalacia (or senile) absorption.

Q. What is lacunar or osteoclast absorption?

A. Lacunar or osteoclast absorption depends on large specialized cells which liquefy bone and are situated in Howship's lacunae.

Q. What is halisteresis absorption?

A. Halisteresis (from the Greek meaning salt deprivation or decalcification) arises in irritation and inflammation in the Haversian canals. As the salts are absorbed, commencing at the canal margins these enlarge.

Q. To what is Volkmann's perforating canal absorption due?

A. To irritation and inflammation set up in the blood vessels of Von Ebner causing absorption of the bony walls which perforate the bone from one part to another.

Q. What is osteomalacia or senile absorption?

A. It is called juvenile when it occurs during pregnancy. The senile type may occur at any period of stress. It is a morbid decalcification whose origin is at present unknown. It has been charged to many causes; to lactic acid, to increased amount of carbonic acid in the blood. According to Eisenhart it is due to diminished alkalinity of the blood. According to Von Recklinghausen it is due to irritation of the vascular mechanism of the bones. Talbot is of the opinion that it is due to auto-intoxication.

Q. How were these different absorptions shown to occur in regulation of teeth?

A. By experiments made upon dogs.

Q. How was this done?

A. Impressions of the mouth were taken in modeling compound. Models were secured and caps of German silver were made for the cuspid teeth. A jackscrew was soldered to the caps with soft solder.

Q. How were the appliances fastened to the teeth?

A. The dogs were securely fastened into a V-shaped box with cotton bandages. When chloroformed the appliances were placed upon the teeth and cemented into place.

Q. How was the dog prevented from removing the appliance?

A. A muzzle was placed upon the head and the fore feet tied with cotton bandages to prevent removal of the appliances. The muzzle and bandages were removed twice a day for the purpose of feeding.

Q. How often was the screw turned?

A. The screw was given one-fourth, one-half and one full turn every day. The screws were sixty threads to the inch. The teeth of three dogs were moved 1-240, 1-120 and 1-60 of an inch respectively per day as suggested by Farrar.

Q. How long was the muzzle allowed to remain?

A. At the end of three days the muzzle and leg bands could be removed, the dogs having become accustomed to the appliance. In the cases where the screw was turned one-fourth and one-half per day, was continued for seven days. In those in which the screw was given a full turn it was continued for two weeks, the object being to set up pathologic changes in the alveolar process. The dogs were killed at the end of the periods mentioned.

Q. How were the jaws prepared?

A. The jaws were placed in sixty-five per cent. alcohol for twelve hours, then in absolute alcohol for forty-eight hours. They were then transferred to five per cent. nitric acid and water. This was changed every two days for a week or until the tissues became so soft as to be easily penetrated by a pin. They were then placed in running water to remove acid.

This took from twelve to twenty-four hours. The tissues were then placed in sixty-five per cent. alcohol six hours; then in ninety-five per cent. six hours, and then in absolute alcohol twenty-four hours. The tissues were then imbedded in thin celloidin twenty-four hours, then in thick celloidin twenty-four hours. They were then mounted on blocks of wood and hardened in eighty per cent. alcohol from six to twenty-four hours. The specimens were cut, stained in haematoxylin, eosin.

Q. What had occurred in the cases when the screw was turned one-fourth turn?

A. The inflammatory process had commenced around the Haversian canals with halisteresis and osteoclast or lacunar absorption, medullary cavities arising from absorption of the trabeculae.

Q. What was the difference between cases where the screw was turned one-half turn each day and those turned only one-fourth turn?

A. The results were about the same, only more intensified, round cell infiltration was quite marked. The medullary cavities are larger.

Q. Were there any marked changes in those cases where the teeth were given a full turn in fourteen days?

A. All conditions noticed in the other slides were prominent. Volkmann's perforating canals were marked.

Q. What is the difference between the absorption of the alveolar process from movement of the teeth and interstitial gingivitis?

A. The absorption is precisely the same.

Q. Does absorption of the alveolar process in the eruption of the teeth differ?

A. No. A young monkey died from burns. The upper cuspids were erupting. The temporary cuspids were still in place. The jaws were prepared in the usual way for the microscope. The slides show like results.

Q. If absorption of bone in such conditions be inflammatory, what is the process of absorption of the alveolar process when the teeth are removed?

A. In moving the teeth of dogs, only the upper jaw was used. Teeth on the lower were extracted to note the change in the alveolar process. The teeth had been extracted seven days. Active round cell inflammation occurred in and about the Haversian canals, osteoclast absorption, Volkmann's perforating canal absorption and absorption of the trabeculæ was also present.

Q. What is the common opinion as to absorption of bone, especially in regulating teeth?

A. That it was osteoclast or lacunar absorption, and that if pressure was greater than the tissues could stand, inflammation set in and absorption ceased.

Q. What do these investigations show?

A. Careful study of the process of absorption reveals that different results could hardly be expected in tooth movement. The surroundings of the alveolar process are the same in all cases. Absorption is the same, though the propelling forces be different—interstitial gingivitis, irritation, screw pressure, the eruption of a tooth and the extraction of a tooth—in every case the absorption takes place by inflammation.

Q. In rotating teeth, does absorption take place?

A. To a slight extent inflammation takes place. The fibers elongate and take the direction of the tooth.

Q. Does pressure upon the tooth detach the peridental membrane?

A. It does not.

Q. What becomes of the fibrous tissue when teeth are moved in straight lines or rotated?

A. The fibers stretch. If pressure be removed, the elasticity of the tissues returns the tooth to its original position.

Q. What change occurs when a tooth has been forced into a new position?

A. The fibrous tissue is reinforced by new tissue. Osteoblasts build up new bone and in this way the teeth are held in their new position.

Q. If the alveolar process has obtained its growth or if the fibrous tissue (trabeculæ) is destroyed, what are the chances of restoration?

A. They are very slight.

Q. In the light of these experiments and the ease with which inflammation and absorption are produced, can the alveolar process be bent in regulation?

A. It is doubtful if such a thing be possible. In any case, should the process yield to pressure, absorption must continue until the pressure is relieved.

Q. Is not the continuous pressure, producing inflammation in children whose nervous systems are unstable, pernicious practice?

A. It is not good practice to cause continuous pain for any length of time by forcing the teeth through the alveolar process when it can be accomplished by the much more rapid scientific method of cutting away the bone.

Q. How does osteomalacia or senile absorption affect the alveolar process.

A. While other forms of absorption must await the onset of the inflammatory process, osteomalacia or senile absorption sooner or later ensues in every individual.

Q. Why is this?

A. Instability of the alveolar process renders this a normal absorption.

Q. To what is this absorption due?

A. It is readily produced by slight irritation like heat, auto-intoxication, drugs, etc. It naturally occurs after the process has obtained its growth.

Q. When does it occur at an early period?

A. When pathologic factors such as malnutrition, drugs, etc., suffice to overcome cell building.

Q. Does the unstable nature of the alveolar process render interstitial gingivitis common?

A. It may be found in almost every mouth, particularly neurotics and degenerates.

Q. To correct irregularities of the teeth, should the operator understand the laws of degeneracy?

A. He should. Rapidity in irregularity correction implies lack of knowledge of the structures upon which he operates.

Q. Is it good practice to move the tissues rapidly?

A. No. If force be so great as to destroy the trabeculæ, tissue building cannot restore the process. If great but not steady pressure be applied, and if nutriment be poor, the alveolar process will not be restored.

Q. Should teeth be regulated in persons whose nutrition is poor?

A. No. Malnutrition of the alveolar process should preclude operation, or if it must be performed, slow, steady pressure should be used to prevent excessive interstitial gingivitis. Patients with scrofulous, syphilitic or tubercular tendencies should be treated with great consideration.

Q. Should many teeth be treated at a time in such cases?

A. No; one or two only.

Q. Should teeth be regulated late in life?

A. Only in emergencies. The results are in proportion to the strain upon the system. The tendency is toward osteomalacia, although other forms of absorption may occur. Permanent absorption may ensue.

Q. Should extended operations be performed late in life?

A. No. Even if successful and if the teeth be retained in their positions, the alveolar process cannot be depended upon to remain throughout life. The older the patient, the greater the pressure required, the greater the amount of inflammation set up and the less chance of success.

Q. From the transitory nature of the jaws and the alveolar processes, the density of bone in hypertrophy, the terminal structure and the ease with which inflammation and absorption ensue, when and how is regulation of teeth justified?

A. The cutting away of the alveolar process will relieve excessive pressure, reduce the inflammation to a minimum and prevent extensive absorption. Correction of the teeth at all periods produces structural change in the alveolar process, the extent of this ever remains a predisposing factor to interstitial gingivitis.

CHAPTER XXXII.

SURGICAL CORRECTION.

Q. What science does surgical correction of deformities of the jaws resemble in its relation to dentistry?

A. Orthopedic surgery.

Q. Is deformity correction a necessary result of dental practice?

A. It is not. Special training is needed for its practice.

Q. What is required?

A. The person who practices surgical correction of the jaws and teeth should have mechanical ingenuity, be familiar with mechanical movements, and well versed in pathology; in fact, medically educated.

Q. Can fixed systems of appliances be depended upon for the purpose of correcting a given line of cases?

A. Only partially.

Q. Is the claim that appliances rapidly and successfully hasten correction absolutely true?

A. No. Centuries of experience in surgery have demonstrated that appliances must be adapted to the case and not the case to the appliances.

Q. Is it expedient to keep certain parts on hand?

A. Certain simple pieces may be kept on hand to be attached to parts formed to the case, but even these must be adjusted to the special case.

Q. Is not such teaching misleading?

A. The victim of such teaching frequently fails in his cases by relying too much upon a "system" rather than upon general principle.

Q. Do appliances frequently have to be changed?

A. One kind of appliance may be used to start the operation, but the skilled, unbiased operator is forced to observe that a different appliance can be used to a better advantage, especially in connection with one already in use.

Q. Will a specialist who confines himself to a system ever become a skilled operator?

A. No.

Q. Taking the constitution and health into consideration, will one set of appliances always answer in similar cases?

A. An appliance theoretically adapted to a given case may be wholly unfit because of the patient's physical condition. An appliance suitable to one period in life will not be to another.

Q. What is necessary to obtain the best results as to mechanical force?

A. A knowledge of the mechanical forces, their powers and limitations of ease, and the methods of application.

Q. How do all forces act?

A. They act either continuously like the lever or interruptedly like the screw, but in either case their action diminishes with the yielding of the tooth.

Q. Of what modifications are all the mechanical powers?

A. They are modifications of two primary principles, the inclined plane and the lever. From these other forces are derived.

Q. What are the forces?

A. The screw, the lever, the pulley, wheel and axle, the inclined plane, the wedge, and elasticity.

Q. Can all of these forces be applied in regulation?

A. All of these forces have their places in the correction of deformities of the jaws and teeth. Appliances cannot be made which do not include one or more of these forces, and all forces may be successfully used in regulation.

Q. How should they be taught?

A. Principles rather than systems. Each may be used to a good advantage in given cases when judgment has been employed in selection and adjustment and in adopting the methods of using them.

Q. Having the foundation principles of force and its application to the teeth, can the operator select the force necessary?

A. With these laws and their application firmly fixed in mind the operator can select the one which should properly be applied or if more than one is necessary can so combine them as to accomplish the desired result.

Q. What will aid in the selection of appliances?

A. The degree and line of force.

Q. What is the object of an appliance?

A. Every appliance for regulation of the teeth aims at the object to exert pressure upon the teeth to be moved.

Q. Of what should an appliance consist?

A. An appliance for this purpose should be small as compatible with effectiveness and strength. It should be so constructed it can be applied inside of the arch in such a manner it will not interfere with speech or mastication, and can be removed for cleansing as far as possible. It should give as little annoyance as possible and should not necessitate frequent visits to the dentist for adjustment.

Q. What must always be considered in regulation?

A. Whether the teeth be forced out or drawn in, there must always be considered a body to be moved (the tooth) and a fixed point of resistance.

Q. Does the study of the models always determine the amount of force required?

A. It does not, although models should be studied. While a point opposite can be chosen for anchorage of the appliance, this is not always true. Each case is a problem in itself.

Q. Which must be the strongest, the point of anchorage or the point to be moved?

A. The point of anchorage must offer greater resistance than the point to be moved.

Q. Is it sometimes difficult to find such a point?

A. Yes. Especially the case when a cuspid is to be moved.

Q. Does it happen that the opposite is accomplished to what was anticipated?

A. It frequently happens that the dentist finds to his chagrin he has moved his point of resistance rather than the tooth. Constant vigilance must hence be exercised in noting occlusion.

Q. While the operation is under way, what is a good plan to do?

A. The patient should be asked at each sitting, in which tooth he suffers most when the nut is turned, if a screw be used.

Q. What is a good practice when teeth to be moved possess great resistance?

A. In moving teeth that afford great resistance, it is often best to loosen first by simple wedging with orange wood or even cotton, proceeding slowly.

Q. What effect does this have?

A. This causes inflammation, then absorption of the alveolar process around the tooth or teeth to be moved, giving the tooth decided advantage over the fixed point when force is applied. Thus resistance is lessened and the tooth or teeth to which the appliances are attached will now afford greater resistance in proportion than at first.

Q. Is it ever desirable to construct a plate or combine two or more teeth for a fixed point?

A. This is desirable (1) where there is not a tooth conveniently located for attachment, (2) where it is expedient to avoid the additional irritation, (3) where the mechanism is such as to require it.

Q. What should be considered in adjusting the appliance to the tooth?

A. Its position in the jaw should be observed and the inclination of the root or roots must be ascertained to decide whether they stand perpendicularly in the alveolar process or on an incline.

Q. Should obstructions be removed?

A. Obstructions should be removed by extraction or by lateral pressure.

Q. How should the force be applied?

A. The force should be applied to the tooth to be moved either at right angles to the long axis of the root or at an angle of forty-five degrees.

Q. What benefit is derived by this method?

A. The tooth is prevented from rising from the socket.

Q. Should holes be drilled in the teeth for anchorage?

A. Most cases can be treated by securing a band or cap of thin gold or platinum to the teeth with zinc oxyphosphate, in which bands holes may be drilled or hooks or loops or tubes soldered at any required point.

Q. How should the force be applied?

A. If possible the force should be uniform and steady, but this while possible with certain appliances like elastic bands, ligatures, strings and the like, is impossible with the screw.

Q. How do these forces act?

A. All forces act either slowly and constantly like the above, diminishing in their action in proportion to the yielding of the tooth, or else they act by impulse like the screw.

Q. How much pressure should be applied?

A. The force exerted should be enough to produce inflammation and absorption of bone. Too rapid movement of the teeth, especially in patients over twenty years of age, is unadvisable. Extensive inflammation from extreme force required prevents restoration of bone.

Q. When great pressure is required, are not the appliances unsightly and inconvenient?

A. Appliances adjusted to the head are then so unsightly and embarrassing that the patient is deterred from an operation which could otherwise have been undertaken had some method been adopted that would not detract from personal appearance.

Q. When appliances are attached to the molars for the purpose of moving the cuspids and incisors backward, do the molars often move forward instead?

A. Very often.

Q. What are difficult problems to solve?

A. How to carry a cuspid into place that has erupted in the vault or an inferior cuspid that is outside and forward of its normal position back into place. The rotation of teeth, especially the incisors and cuspids. Movement of teeth through hypertrophied alveolar process. Many other situations present themselves other than those mentioned.

Q. Are the present methods scientific?

A. The long, tedious methods of plowing through the alveolar process regardless of the density of bone by absorption is pernicious and implies tedious days, weeks and months of suffering.

Q. Should not methods be employed which avert strain upon the nervous system at the periods of stress?

A. The periods most acceptable for the correction of these deformities are at twelve to sixteen years of age. This time is the most critical in the patient's life. Nervous prostration of years standing may result and the patient be permanently injured by such nerve strain.

Q. How can operations in these cases be made easy?

A. To obviate excessive pressure as well as unsightly appliances, after the appliance has been adjusted (no matter of what nature) and pressure applied, proceed as follows: Remove the alveolar process in the line of travel of the tooth to be moved, leaving a small amount about the tooth root holding intact the peridental membrane.

Q. How is this accomplished?

A. By using round, coarse-cut engine burs, or those which cut in all directions. They can be used as drills. If a cuspid requires to be carried backward, extract the first bicuspid and adjust the appliance. Then resting the thumb against the cuspid, cut out the lingual and buccal V-shaped plate, making a concave surface of the alveolar process.

Q. How can the incisors be carried back?

A. Cut semi-circular spaces just posterior to the teeth to be moved.

Q. What procedure is to be adopted in carrying a cuspid into place which has erupted in the vault?

A. Remove the alveolar process in the direction of the line of travel.

Q. In moving teeth laterally by the jackscrew when one tooth moves faster than the other, how should this be adjusted?

A. To bring both into their proper positions, cut out the alveolar process in front of the slowest moving tooth.

Q. How should a tooth be rotated?

A. Cut a circular groove as deep as possible around the tooth, leaving enough process to hold the peridental membrane intact. In this manner teeth can be moved rapidly and comparatively without pain.

Q. What appliance should be used in such operations?

A. The screw, by this appliance the teeth are completely under control.