dental root. It is an exostosis of the dental cement. *a*, vascular canaliculi of the osseous substance of the tumor (Havers' glands). The tumor is traversed by these as in the normal osseous substance,—only they are more rare, more scattered, and more irregularly distributed. *b*, osteoplasts disposed circularly, or nearly so, in a concentric manner around the Haversian canal, but less exact and evident than in the normal condition. *c*, the osseous substance, properly so called, in which the osteoplasts, or characteristic cavities of the osseous tissue, are excavated.

For further illustration, see *Odontomata*.

CHAPTER VIII.

THE TEETH AND THEIR DISEASES.

CARIES.

CARIES of the teeth being a disease so destructive to comfort and to health, and withal so common as to possess its illustration in almost every human mouth, makes the subject felt as one claiming earnest investigation and attention.

Caries of a tooth, most simply expressed, is corrosion of its substance: the disease may occur on any part of the surface of the crown or even on the root, but as a rule is found to originate on parts possessed of the least self-cleansing characteristics. Thus, it is most common to the sulci on the grinding faces of the molars and bicuspidati, to the posterior depressions met with so frequently in the superior incisor teeth, and to approximal faces of the teeth generally.

Caries is a disease of chemico-vital relation, and is unfortunately most markedly of congenital association and predisposition: indeed, so true is this latter, that it is to be prognosed that the offspring of parents afflicted in this way will be in like manner affected, and that, on the other hand, the children of parents possessing good teeth will be in like manner favored. So constant is an analogy in the teeth of parents and child, that in most instances it extends to the very shape and arrangement of the organs, deformity insuring deformity, regularity regularity. One parent alone may influence for good or for evil.

Hereditary dental caries finds its explanation in likeness of condition, this being of local or constitutional signification, or more commonly a conjoining of these; such teeth being not only imperfect in development in one or more directions,—in shape, in deficiency of enamel-covering, in non-calcification as exhibited in the existence of interglobular spaces, in position, in tubular circulation, in nerve endowment,—but in an equal number of cases in lack of physiological harmony, either in surrounding secretions or in the offices of nutrition: any or all of these may be the conditions, as indeed, resultant from them are all cases of caries.

Health in the dental organism depends:

1. On circumstances associated with the original formation.
2. On the shape of the teeth, their relation to each other, and their self-cleansing features.
3. On constitutional conditions.

4. On character of agents in contact with the teeth.

5. On the absence of mechanical destructives, as salivary calculus, the bands of artificial dentures, etc.

6. On accidental influences.

CONDITION 1. *On circumstances associated with the original formation.*

To appreciate the reasons explaining the inability on the part of certain dentures to fulfil the intentions of their creation, we are compelled to consider, not infrequently, influences and associations apparently far remote from them. That the student may be made familiar with the principles involved, without which, indeed, he might not otherwise than mechanically treat carious teeth, it is proposed to invite his attention to that study and understanding of the subject which practice will demonstrate as the exhibition of it in a clinical fulness.

It is to be assumed, as a premise, that like begets like; therefore may unhealthy parents not fail to impress upon their offspring that which is of their own constitution. Of these impressions, some are readily appreciable; others are obscure. As examples, we may refer to cachexiæ, evident enough in their individuality as exhibited over the general system; again, to a transmission which illustrates itself alone in the direction of the teeth, the individual at large being otherwise healthy. These two type conditions exhibit themselves to every observer.

Of the cachexiæ pertaining markedly to the matter of our investigation, we have three,—scrofulosis, rickets, syphilis; cachexiæ so widely associated with asthenic conditions, so adverse to the healthy performance of the nutritional functions, that without an understanding of their expressions one might not hope to antidote their multitudinous sequelæ. Because, therefore, of the marked importance of the cachexiæ, viewed in hereditary association, the student is invited to complete, by reference to the proper works, the epitome here presented.

DISTINCTIVE FEATURES IN TYPICAL CASES OF EACH CONDITION.

Scrofulosis.—Temperament lymphatic; abdomen tumid; complexion flat and pasty; lips and alæ tumid; saliva stringy; breath insipid and offensive; mucous membrane markedly deficient in circulating activity, and much disposed to degenerative inflammatory action; lymphatics enlarged and prominent, especially those of the cervical and mesenteric regions, with great disposition to suppuration; bones very loose and spongy in their areolar tissue, often fatty, breaking down on slight provocation into caries and necrosis; teeth, alike with the bones, deficient in inorganic material, loose in the character of the intertubular structure, more or less deficient in the integrity of the enamel cap; the animal matter very susceptible to the irritating influences

of the unduly alkaline oral fluid; the pulp pabulum cacoplastic to an extent which almost completely stagnates the tubular circulation, thus antagonizing nutrition; conditions of dental health adverse without and within.

Rickets.—Physical force deficient; habits sluggish; mentality small, with precocity; large head, more commonly broad than long; abdomen prominent and heavy; leanness; general debility, with indigestion; puffiness of the extremities; skin muddy; thinning of cranial bones, together with a plastic thickening of other flat bones and enlargement of the extremities of the long bones; tendency to aplastic infiltrations of the viscera; the teeth late in erupting, slightly attached to their alveoli, non-resistive of external offences, easily acted on by chemical agents, apt by slight causes to be pushed from their sockets.

Syphilis and Mercurio-Syphilis.—Stagnant complexion; leanness; atony of the skin and muscles; susceptibility to skin affections; poor and scanty hair; interstitial keratitis, with interlaminal corneal lymph effusions; stomatitis; tendency to iritis; the teeth more or less notched on their cutting edges, with pittings of the enamel; mucous membrane passively congested and easily breaking down into ulcers, which ulcers have pasty bottoms; seroplastic effusions into the submucous Schneiderian tissue, interfering with respiration, inducing in the patient constant snivelling; eruptions on the skin of a coppery-red color; periosteal indurations, with subperiosteal aplastic exudates; suppuration of organs, as the liver, thymus, testes; caries and necrosis of bones, particularly the turbinated and the maxillæ, and of the teeth.

SCROFULOSIS—SCROFULA—LYMPHANGITIS.—This is a constitutional condition having its recognition in the cacoplastic conditions common to it and begotten of it, the manifestations of malnutrition being most frequently met with in the skin, mucous membrane, hip- and knee-joints, and in the lymphatic glands, which latter, in their suppuration, present most markedly the feature of a cheesy degeneration. These malconditions arise out of lymphangitis, disturbing in turn tissue metamorphosis.

Scrofula is commonly an inherited cachexia, but may, through depressing circumstances, be engrafted into any constitution. Bad and ill-nourishing or insufficient food, continued exposure to impure air, intemperance, excessive venery, mental anxiety, the effects of severe courses of medication, secondary effects of poisons,—these and similar causes may induce the cachexia.

A marked scrofulous hereditary transmission has its expression in the type case given, but from this it is to be esteemed as shading into the greatest variety of aspect. Two primal expressions are clearly to be recognized. These are the fair and the dark; to be again subdivided into the fine and the coarse. The fine is the disease as existing and exhibiting itself in the sanguine temperament; the coarse is the typical case, as exhibited in the slug-

gish lymphatic. It is well just here for the reader studying this disease from the stand-point of dental caries to exclude the fair variety, and to place it under the head of Tuberculosis,—a distinction in the conditions which one most practically recognizes as relation with the health of the teeth and general digestive apparatus is concerned; the typical form being markedly provocative of dental disease; the fair variety exhibiting its manifestations in the viscera, and most particularly by deposits in the lungs, leaving the teeth quite exempt from any impression. Hence in persons affected with phthisis it is not uncommon to find the most beautiful and perfect dentures. It is to be remembered, however, we are writing of predispositions, and not of manifestations from active or recent conditions; of impressions made on the teeth during the stage of formation and development, and not of impressions made by the acquired disease on teeth whose period of growth might have been associated with such vigorous and health-yielding life that the result is not to be easily overcome.

Scrofulosis of the lymphatic type expresses that condition of a system in which morbid action results on the slightest provocation. Every part seems lax and incapable of self-sustenance. The slightest injury produces inflammatory action, yet of a grade requiring for its control stimulation rather than depression. In a word, it is a condition in which the vitalizing principle has no proper proportionable correspondence with the matter of the body. Hence the characteristic sluggishness,—the body is only half living, and was so born, —the parents, before it, lacking that fulness of force necessary to the vitalization of the offspring. No single tissue has been harmoniously constructed, the production being to an extent an abortion.

Perhaps the student will possess himself of a clearer conception of scrofulosis if we deny to it the name of a disease, and associate it alone with the idea of cachexia; and this, if we exclude from the relation tuberculosis, with its peculiar deposit, one inflicts no violence in doing. It is thus, from clinical observation, the writer has been led to consider it, and such understanding seems best to conduce to antagonizing its relations. We view the house as one ill built and of poor materials, and do what we can to remedy the deficiency. It is a condition in which attempts at specific treatment have no signification: there is no special condition to combat.

In conjoining the axioms that "excitement must terminate in exhaustion," and that "from nothing nothing comes," we may undeniably find the precedents and conditions of scrofulosis. In an animal body are so much matter and so much vitality. As the *vis vitæ* may be abstracted from one part to minister to the excitation of other parts, so necessarily must both come to suffer; the first from an over-stimulation which begets hypertrophic degenerations, morbid plastic formations capable of organization, thus compelling alteration in physiological expression; the second, from exhaustion through the absence of its correlating force, thus denying the changes necessary to the fulfilment of functional life,—breeding, of necessity, debility.

Over-stimulation, with its consequent exhaustion, finds examples in the intemperate, the venal, and the gluttonous. Children begotten of these in the days of their exhaustion, are apt to be possessed of evidences of the vices.

Exhaustion, on the other hand, is found a primary condition, being a result of exposure to influences debilitating in themselves; as, for example, to poisons, deprivation of proper food, insufficiency of clothing, to lack of cleanliness, being ill housed, unhealthy employment, continuous subjection to mental disquietude or oppression, excessive secretions and discharges, deprivation of light and sunshine, etc. We are to assume that the disease we study is not a materia peccans in the blood, but, as Billroth expresses it, "a debility of the organization." Dr. C. J. B. Williams, while admitting no distinction between scrofulosis and tuberculosis, yet describes the condition as "a degradation of the nutritive material from which old textures are renewed and new ones formed, in that in its origin it differs from the normal plasma or coagulable lymph, not in kind, but in degree of vitality and capacity of organization."

What cacoplastic lymph is, we appreciate. What tubercle is, we do not know; the highest authorities, in such direction, are still at issue concerning not only its origin, but even its nature, and whether, therefore, tubercle is or is not an expression of struma, we are, in our present connection, not concerned to discuss.* Protoplasm, lymph, is the basal nutritive agent; plasma is not self-creating or of itself, but a product of vital force acting on materials taken for the nourishment of the body. That organs be normal, protoplasm must be healthy. The diseased protoplasm of degraded parents—more particularly, perhaps, that of the mother—may not afford that nourishment which is the proper life of a child; on the contrary, it associates its own degradation with all with which it may come in association.

Following such line of view, it will be recognized that we may not have any marked distinction between scrofulosis and the hereditary manifestations of syphilis, of the mercurial vice, or of other parental adynamic transmissions; and, therapeutically viewed, this premise we believe to be the proper one,—the principle of treatment being found the same,—this being tonic medication, and having no specificity to which it is to be directed. If, however, special organs be specially affected, this would of necessity direct to them particular attention, and the treatment, as the part affected is concerned, would, in local requirements, differ,—as, for example, whether we might have to combat caries of the bone or caries of the teeth; the constitutional treatment may, however, only be the same, and from such aspect,

* Since originally publishing the above assertion concerning tubercle the author has pursued a course of investigation which makes him quite willing to here commit himself to the conviction that lymphatic stasis will eventually be recognized and admitted as the source of phthisis tuberculosis. Koch's bacillus is to a tuberculous lung exactly what the micrococcus is to a carious tooth, or what oidium albicans is to an aphthous ulcer. (See these subjects.)

what would be the cure of the one would necessarily tend to the same result in the other. Unfortunately, however, as the teeth are concerned, from the low grade of their vitality, and, consequently, the inactivity in their molecular changes, counter-impressions are long in being made; therefore, in the constitutional caries of these organs, too much attention cannot be given to the local relations. The fluids of the mouth are, if adverse, to be neutralized to the required non-antagonism. Cleanliness is to be particularly insisted on, and all cavities are to be filled or filed away, as may seem indicated.

Rachitis—Innutrio Ossium.—A constitutional disease, having its predisposition in hereditary transmission: characterized by non-solidification of the growing layers of bone, by the formation of medullary cavities in the older or more mature bones, thus rendering the bony laminæ thin and brittle (Virchow), and by excess in the formation of phosphoric and lactic acids, with great excess of the earthy phosphates.

It is not to be maintained that rickets is a constitutional disease, save in the sense of predisposition. Neither is it to be affirmed that it possesses a constancy of expression which allows of a common formulary for a description of its diagnostic signs; on the contrary, the expressions vary from the most simple manifestations of a disturbed nutrition to a specific alteration in the bones, which renders them, from lack of inorganic constituents, incapable of performing their functions. Indeed, it is probable that degrees of rickets may quite frequently present themselves and yet be overlooked. While, as suggested by Hillier, the secondary diseases, such as bronchitis, collapse of the lungs, atrophy, measles, whooping-cough, or convulsions, are recognized, the primary disease, which renders these secondary conditions fatal, is quite ignored.

As rachitis is congenital, or as it associates itself with the dentitional periods, so are manifested the effects of the condition upon the health of the teeth,—these organs being delayed in their development, disposed to caries, and not infrequently of such loose relation to their sockets from aplastic softening of the peridental tissue as to be displaced by slight force: the periodonteum, and also the pulp, may be affirmed to present evidences of the common amyloid degeneration as seen in the viscera, particularly in the liver and spleen. The delay in the cutting of the teeth is simply delay in development, the albuminoid pulp lacking organic force to secrete dentinal tissue; while, as is to be inferred, that which is made is of such imperfect organization, so mottled with uncalcified spots,—interglobular spaces,—as to be rendered quite incapable of resisting that excess of lactic acid found in the secretions coming in contact with it.

History.—Rachitis is a disease having perhaps in all cases the association of hereditary predisposition, yet, like scrofulosis, existing in such variety of aspects and in such states of modification as to make it not easy of recognition through any constant signs. These modifications are of a twofold

nature. First, the character of the hereditary impression. Second, the associative surroundings and conditions of the patient. Sir William Jenner, whose lectures on the subject are worthy of all respect and attention, speaks of this disease as "without question the most common, the most important, and, in its effects, the most fatal of all that exclusively affect children." Hillier (Meigs and Pepper) presents a table showing the proportion borne by the number of cases of this disease to the total number of out-patients treated at the Hospital for Sick Children, London, from which calculation exhibits that of 128,656 children treated during thirteen years (1854–66) not less than 8419, or 6.5 per cent., were rachitic; and in some years the proportion of such patients rose as high as 9 per cent. In London hospitals and in the other great hospitals gathering in the poverty and degradation of any large city, such percentage does not strike us as at all a matter for surprise. It must be recognized, however, as is to be inferred from home observation, that such statistics designate the disease as included in its diversified phases.

The cachectic state preceding the osseous manifestations of rickets is not generally to be noticed at birth, but develops commonly during the process of the first dentition, seldom appearing at a later period than during the time of the active stages of the second. The incubation precedes, however, the manifestations of the cachexia, residing, as we incline to believe, in an original molecular impression: at least it is only thus that we find explanation of the organic impressions found in the structure of the deciduous dentine and enamel.

The relation of rickets with scrofulosis is found in the pre-association of the two conditions. Thus, "Whatever tends to produce debility and anæmia in a mother, as too frequent pregnancies or prolonged lactation, renders it probable that her next-born children will be rickety." Jenner states "that it is very common for the first, or the two or three first-born children, to be free from any signs of rickets, and yet for every subsequent child to be rickety;" which he explains by the fact "that among the poor the parents are generally worse fed, worse clothed, and worse lodged the larger the number of their children; and among the rich and poor alike, the larger the number of children, the more has the constitutional strength of the mother been taxed, and the more likely is she to have lost in general power."

Predisposition in a child may be overbalanced by its prophylaxis. Thus, children of wealthy parents, even where the antecedents are very unfavorable, may escape the evident expressions of rickets as the result of hygienic antagonisms, just as adverse conditions are found to prove exciting causes to its development. It is indeed because the most characteristic expressions of this disease—namely, affections of the skeleton—are so influenced by outward circumstances, that eminent observers have in some instances come to deny its existence among the better classes; though this differs much from the statement of Jenner, who asserts that he has very often met with it among the children of the very wealthy. We think, however, that it is to be made

a cardinal point that the disease is not necessarily to exhibit its osseous complication to have existence, and that its prodroma are as much the condition (*in abstracto*) as is the observable softening itself.

The relation of rickets with hereditary syphilitic disease is affirmed by Vogel, who professes to base the deduction from wide clinical inquiry. Such relation is, however, denied by Sir William Jenner, the denial being founded mainly on the following facts: "The parent who infects his offspring (with syphilis) has usually contracted the syphilis before marriage, and the children first begotten after infection are those who suffer (from inherited syphilis); while, as a rule, it is only the younger children of a family that suffer from rickets." Sir William Jenner is also doubtful as to the health of the father affecting the child, but throws the weight of his influence in that scale which attributes the disease to insufficient nutrition; thus suggesting the inference of the direction in which lies its prophylaxis, and as well indorsing, without intention, the oneness of cachexia. Mr. Lonsdale expresses himself as having invariably found "that in all rickety children the parents have had little or no milk for their supply, and have been obliged to feed them either partially or wholly with food other than their own milk. The mothers observe that the children never grew properly from the first, and it is mainly the improper nature of the supplementary food given by hand which impairs the health of the child." The rearing of the children of the poor in London is thus described by Sir William Jenner:

For the first two or three days after birth their tender stomachs are deranged by brown sugar and butter, castor oil and dill-water, gruel and starch-water. As soon as the mother's milk flows, they are, when awake, kept constantly at the breast; and well for them if they are not again and again castor-oiled and dill-watered, and even treated with mercurials. After the first month, bread and water sweetened with brown sugar is given several times a day, and during the night the child is, when not too soundly asleep, constantly at the breast. As soon as the little ill-used creature can sit erect on its mother's arm, it has, at parents' meal-time, "a little of what we have,"—meat, potatoes, red herring, fried liver, bacon, pork, and even cheese and beer daily, and cakes, raw fruit, and trash of the most unwholesome quality as special treats, or as provocatives to eat, when its stomach rejects its ordinary diet. Then, instead of being weaned when from ten to twelve months old, the child is kept at the breast when the milk is worse than useless, to the injury of the mother's health, and to the damage of its after brothers and sisters, in the hope that thus keeping it at the breast may retard the next pregnancy. (Holmes)

According to M. Guérin, there will commonly be in rickets a period of at least six months before the practitioner may feel assured of the exact character of the case, or fairly distinguish it from other diseases to which the prodroma are common.

The incubative stage is characterized by irritations of a gastro-intestinal

character. The stools are irregular, being sometimes scanty, but more commonly profuse, marked by absence of bile, not infrequently being of leaden color and most offensive in odor. Sometimes, however, and this more particularly in the beginning, the discharges are greenish, of a serous or watery consistence, with a smell which has been compared to that of rotten meat. The child is found to run down as from a chronic diarrhœa.

A marked symptom soon supervening, and one which is not infrequently the first that suggests to the practitioner the peculiar nature of the disease, is profuse perspiration of the head. These perspirations weaken the child very rapidly, and, when in progress, the evidences of congestion are to be observed in all the neighboring vessels,—veins and arteries.

Associated with this sweating, and more or less synchronous with it, is a general soreness of the body, the little patient in many cases lying motionless for hours, rather than endure the discomfort of moving. Such soreness has always more or less connected with it a desire on the part of the child to be cool, even in winter; such patients seeming most comfortable when lying entirely uncovered,—a fact sufficiently demonstrated in hospital wards.

The deformities of the head in rickets are thus distinguished by Sir William Jenner:*

1. By thickening of the bones. This is usually most perceptible just outside the sutures, the situation of these being indicated by deep furrows.

2. By the length of time the anterior fontanelle remains open. In the healthy child, it closes completely before the expiration of the second year. In the rickety child, it is often open at that period.

3. By the relative length of the antero-posterior diameter of the head.

4. By the height, squareness, and projection of the forehead. The first two of these peculiarities of the rickety head are the result of the affection of the bones; the last two are chiefly due to disease of the cerebrum.

The succeeding conditions are those which associate themselves with bone disease.

The process of dentition (Holmes) is invariably arrested or delayed; and if the teeth be formed, they soon decay, or they early fall from their sockets, the incisors frequently being lost before the second molars of the first set have made their way through the gums. So important is the knowledge to be derived from the progress of dentition, that Sir William Jenner lays down the following rule of practice:

If a child pass over the ninth month without teeth, you should carefully inquire for the cause. It may be that an acute illness has retarded dentition. It may be (and this is infinitely the most common cause of late dentition) that the child is rickety. Fail not, then, when called to a child in whom the teeth are late in appearing, to look if it be rickety, for if you do fail to look for rickets, you will most likely attribute to the irritation of teething symp-

* Medical Times and Gazette, 1860. See also Holmes's System of Surgery, vol. i.