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NOTE.

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The author hopes that it will be found useful to students as a guide and help in giving a systematic view of the subject to be studied in larger works and as a book for review giving a thorough outline of work which has been done.

CONTENTS.

ABBREVIATIONS.

ABBREVIATION.	LATIN.	ENGLISH.
āā,	Ana (G.),	Of each.
Ad saturand.,	Ad saturandum,	Until saturated.
Ad lib.,	Ad libitum,	At pleasure.
Aq.,	Aqua,	Water.
Aq. dest.,	Aqua destillata,	Distilled water.
Comp.,	Compositus,	Compound.
Ext.,	Extractum,	An extract.
F. or Ft.,	Fiat vel fiant,	Let there be made.
Garg.,	Gargarysma,	A gargle.
Gr.,	Granum, vel grana,	A grain, or grains.
Gtt.,	Gutta, vel guttæ,	A drop, or drops.
Infus.,	Infusum,	An infusion.
M.,	Misce,	Mix.
Mist.,	Mistura,	A Mixture.
O.,	Octarius,	A pint.
Pil.,	Pilula, vel pilulæ,	A pill, or pills.
Pulv.,	Pulvis, vel pulveres,	A powder, or powders.
q. s.,	Quantum sufficit,	A sufficient quantity.
℞.,	Recipe,	Take.
S.,	Signa,	Write directions.
Spts.,	Spiritus,	Spirits.
ss.,	Semis,	The half.
Syr.,	Syrupus,	Syrup.
Tinct.,	Tinctura,	A tincture.
lb.,	Libra,	A pound.
℥,	Uncia,	An ounce.
ʒ,	Drachma,	A drachm.
℈,	Scrupulus,	A scruple.
f℥,	Fluid uncia,	A fluid ounce.
fʒ,	Fluid drachma,	A fluid drachm.
♏,	Minim,	A drop.

DENTAL PATHOLOGY AND DENTAL MEDICINE.

ANATOMICAL AND PHYSIOLOGICAL INTRODUCTION.

DEVELOPMENT OF THE TEETH.

A Tooth.—It is sometimes difficult to give in a few words a satisfactory definition to a term. This it seems has been the case with the word tooth. Some writers say "a tooth is a hard substance situated in the anterior portion of the alimentary canal;" others define it as "a papilla of the mucous membrane of the gum, which has undergone a characteristic development." Again it is described "a bony structure implanted in the alveoli along the margins of the jaw." Broomell, in his excellent work on Dental Anatomy and Histology, says "a tooth is a specialized organ for the seizure and mastication of food, placed at the entrance of the alimentary canal." But as a little fuller and more satisfactory explanation of the term we might accept the following: "A tooth is a small organ, bony in character, which normally occupies an alveolar cavity of the upper or lower jaw. Collectively the teeth are the hardest portion of the body and are the principal organs of mastication." The development of these organs is a most curious and interesting process, commencing very early in fetal life.

The Enamel Organ.—During the seventh week of fetal life there appears on the border of the jaw a ridge of epithe-

lium, known as the dental ridge; from this the epithelial follicles are deflected inward, and later on form what is known as the Enamel Organ. Each follicle represents an individual

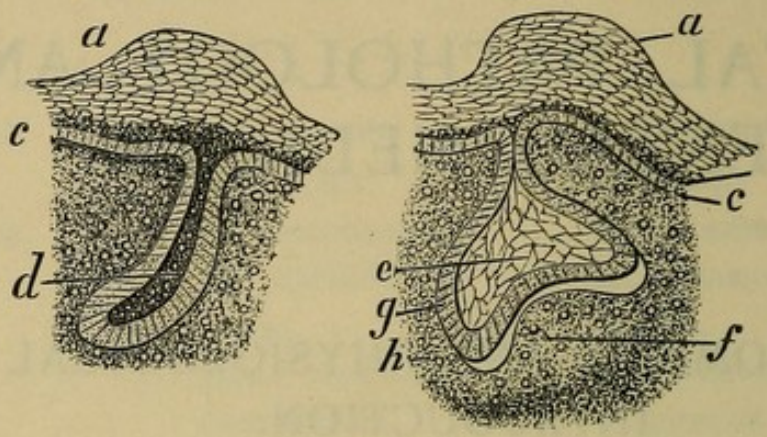


FIG. 1.

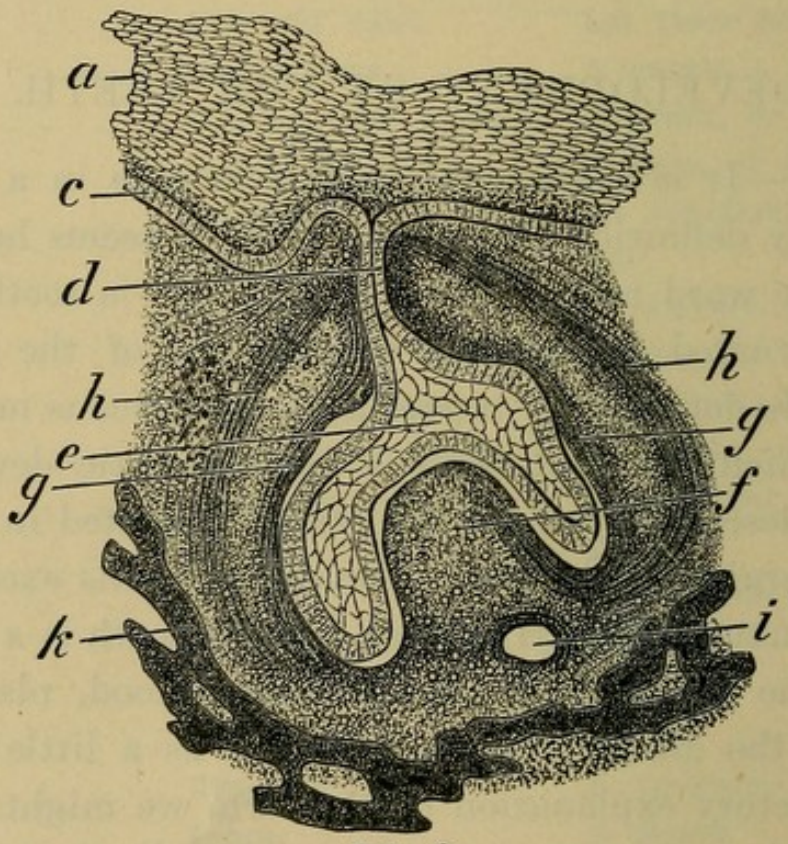


FIG. 2.

FIGS. 1 AND 2.—THREE STAGES IN DEVELOPING ENAMEL ORGANS.
a. Dental ridge. *c*. Infant layer of cells. *d*. Epithelial cord. *e*. Stellate reticulum. *f*. Dentinal papilla. *g*. Inner tunic. *h*. Outer tunic. *i*. Transverse section of vessel. *k*. Forming bone.

tooth. The cells active in the formation of the enamel are known as enamelblasts or amelloblasts.

The Dentine Organ.—A papilla arises in the dermal tissue,

at a point immediately in contact with the rounded portion of the enamel organ—that is, from below in the lower jaw, and from above in the upper jaw. Simultaneously, the bottom of the enamel organ is rendered concave, in correspondence to the form and size of the dentine papilla, covering it like an inverted cup; this dentine bulb begins to assume the form of the tooth from the ninth to the tenth week. (See Figs. 1 and 2.)

By the end of the twelfth week the follicles of the first, or deciduous, set of teeth are completed.

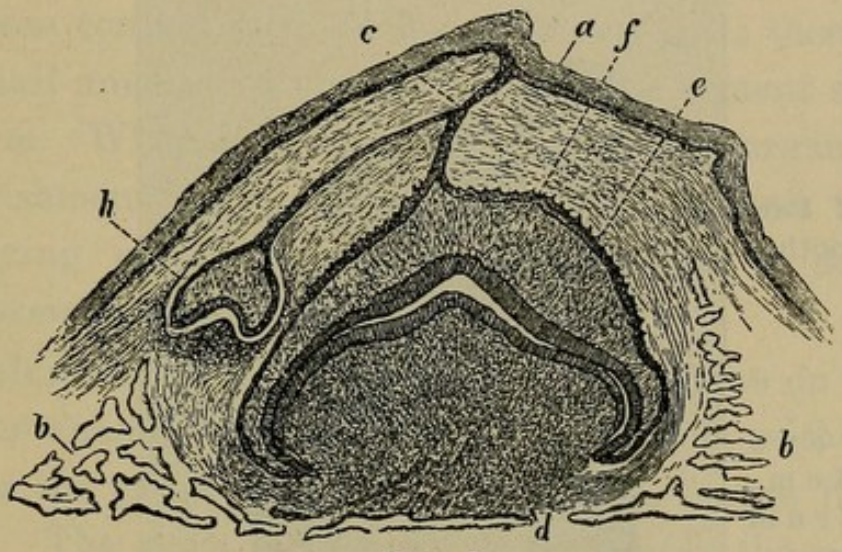


FIG. 3.

a. Outer layer of mucous membrane. *b, b*. Calcifying bone. *c*. Epithelial cord. *d*. Dentinal papilla. *e*. Calcifying enamel. *f*. Enamel germ. *h*. Permanent tooth germ.

When the follicle is completed, it is developed by vascular tissue, forming the dental sac; this is about the fourteenth week. During this process of dentification there appears in the jawbone a groove within which the dentinal follicles rest.

FOLLICULAR DEVELOPMENT OF THE PERMANENT TEETH.

The follicles of the permanent teeth begin to develop about the seventeenth week of embryo life; of these, the first to become completed are those of *the four first molars, at about the twentieth week;* these are followed by the follicles of the teeth anterior to them, which are completed before birth.

The ten anterior teeth originate from the necks of the primitive follicles, while *the bud of the follicle of the first permanent molar* originates from the epithelial lamina, as do the deciduous teeth, and back of all the follicles of the temporary set.

The follicle of the second permanent molar originates from the neck of the follicle of the first molar, and begins to

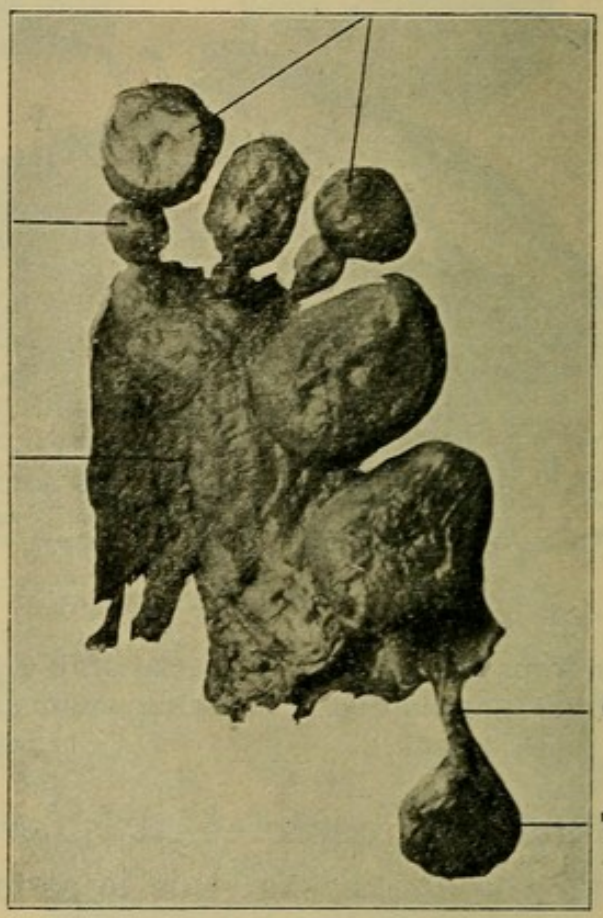


FIG. 4.—TOOTH-SACS OF DECIDUOUS TEETH.

form about the twelfth week after birth. This budding process is illustrated in Fig. 3. It is also very clearly shown in Fig. 4 which represents a dissection made by Prof. Broomell.

The follicle of the third permanent molar begins to develop about the third year after birth, budding from the neck of the follicle of the second molar, and is in its follicular evolution about three years, thus loosening its connection with the epithelial band at about the sixth year. It is then from

twelve to fifteen years coming to such maturity as to emerge from the gum.

Calcification.

The Calcification of the Enamel.—The deposition of lime salts, which gives the teeth their characteristic hardness and is termed calcification, commences at the surface of the dentine and proceeds outward, each enamel rod taking the form of the cell, which in their compactness take on various shapes, usually, however, hexagonal, and the lime salts from each are deposited in close contact with each contiguous cell; there being but a very small amount of animal matter, the cement material between them. When it is completed the enamel organ disappears and nourishment to the enamel can only be had through the surface lying nearest to the dentine, *which is accomplished through osmotic action.*

The calcification of the dentine commences on the surface next to the enamel organ, and progresses from without inward, this being the point where mineralization begins in the tooth structure. The working cells of the dentine, the *odontoblasts.* throw out processes around which the lime salts are deposited, the processes lengthening with the thickening of the cap of dentine; thus forming the tubular structure of dentine. The processes occupying the tubules of the dentine are simply protoplasmic prolongations. As age advances, both the tubuli and fibrilli decrease in size, and in old age the extremities are nearly or wholly obliterated.

The Cementum.—The cells active in the formation of the Cementum are termed *Cementoblasts.* This structure is formed from the pericemental membrane, remaining as the residue of the dental sac, and becomes adherent to the previously calcified dentine.

Calcification commences about the seventeenth week of fetal life, in the temporary incisors, and in the remaining temporary teeth during the seventh month; in the first permanent molars

during the eighth month; during the first year in the permanent incisors and cuspids; the third year in the bicuspids, the fifth year in the second molars, and during the eighth year in the third molars.

It requires about two years for calcification to become completed in a deciduous tooth, and about ten years in a permament tooth. The progress of calcification is shown in Fig. 5.

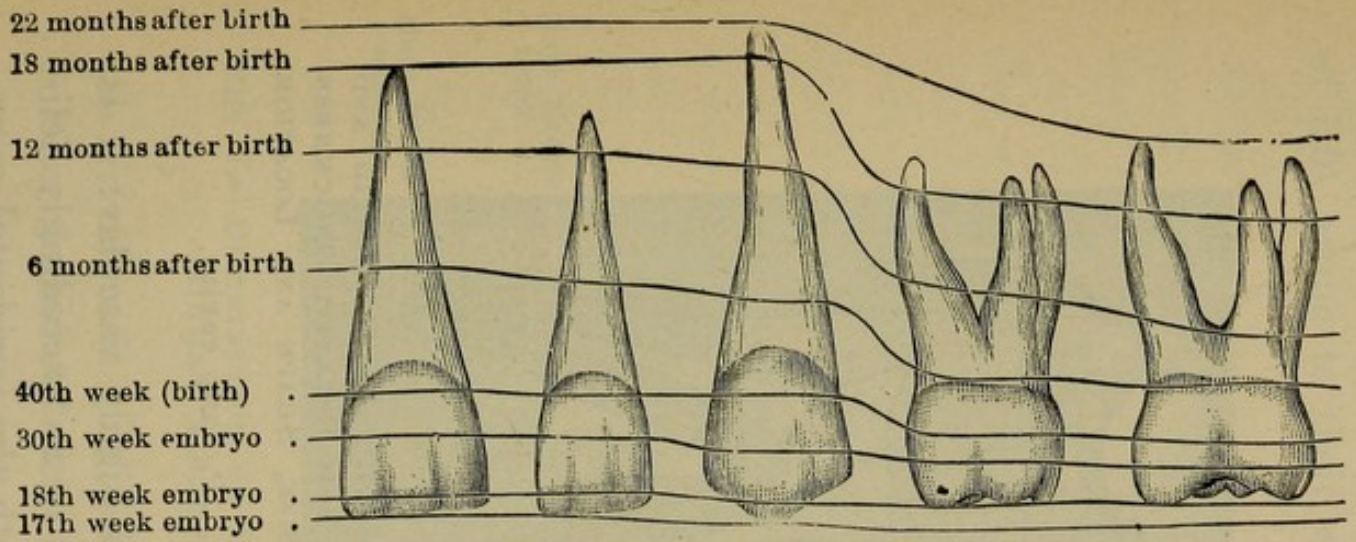
STRUCTURE OF THE TEETH.

Physiologically, the teeth are divided into the enamel, dentine, cementum, pulp, and pericemental membrane.

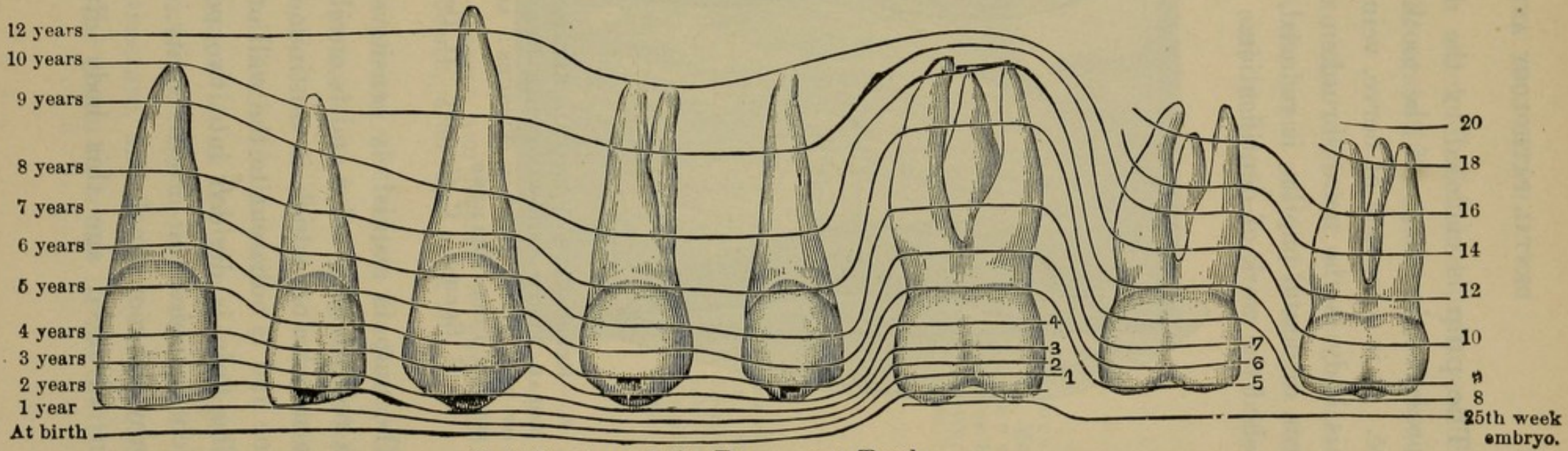
The enamel covers the crown portion of the dentine. It is the hardest and most dense of all organic substances, hence it serves as a protection to the dentine from abrasion, and forms a greater resistance to mechanical force and the action of acids as well as to beautify the teeth.

The dentine gives the typical form of the teeth. The chief characteristics which adapt it to constitute the main body of the tooth structure are its density and vitality. While it encloses within it the pulp, it is itself enclosed on the crown by the enamel and on the root by the cementum. Frequently imperfect dentine formations occur, known as interglobular spaces; these are found near the surface of the enamel and are due to malnutrition during the period of calcification. Pits in the enamel will very often be found accompanying these interglobular spaces, and are due to the same causes.

The cementum, a somewhat dense substance, covers the root portion of the dentine. Its special use is, by being intermediate in the density of its structure, to form a union of the soft tissue of the root membrane with the dentine, thus aiding the pulp in nourishing the tooth, and preserving, in a measure, the vitality of the tooth after the pulp may have been devitalized.



Calcification of the Deciduous Teeth.



Calcification of the Permanent Teeth.

FIG. 5.

(From a paper by Prof. C. N. Peirce, in the "Dental Cosmos," August, 1884.)

The pulp is enclosed by the dentine, and like the dentine represents the shape of the tooth only in a more diminished size. It is composed of nerve, vein, artery and formative tissue. This body is the mere shrunken condition to which the tooth germ, or dental papilla, is reduced, after it has normally accomplished the work of dentification.

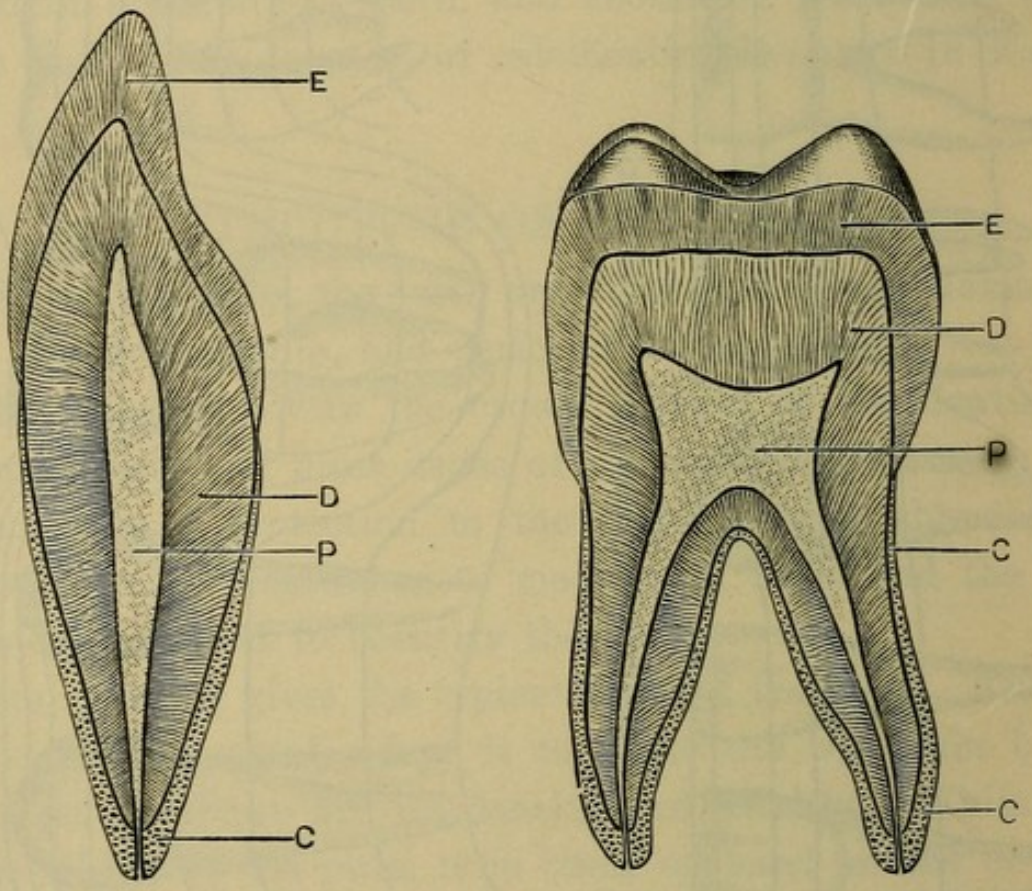


FIG. 6.—REPRESENTS VERTICAL SECTIONS OF THE UPPER CUSPID AND MOLAR TEETH, SHOWING THE RELATION AND RELATIVE THICKNESS OF THE HARD DENTAL TISSUES; ALSO SIZE, SHAPE AND LOCATION OF THE PULP CHAMBER.

E. Enamel. C. Cement. D. Dentine. P. Pulp cavity.

The pulp is exquisitely sensitive and highly vascular; it is of a reddish gray color and is enveloped in an exceedingly delicate membrane, which is continuous with the peridental membrane and is adherent to the wall of the pulp cavity.

The pulp is divided into two portions—the crown or body, which occupies the crown cavity, and the extremities, which occupy the root canal.

In advanced age this body often undergoes considerable

change; the size is sometimes much diminished or is entirely replaced by calcic matter, while again it is found as a shriveled and nearly insensitive mass.

This degeneration is due to the mild but almost constant irritation and shock to which the teeth are liable at this time of life, owing to their worn and abraded condition. If then,

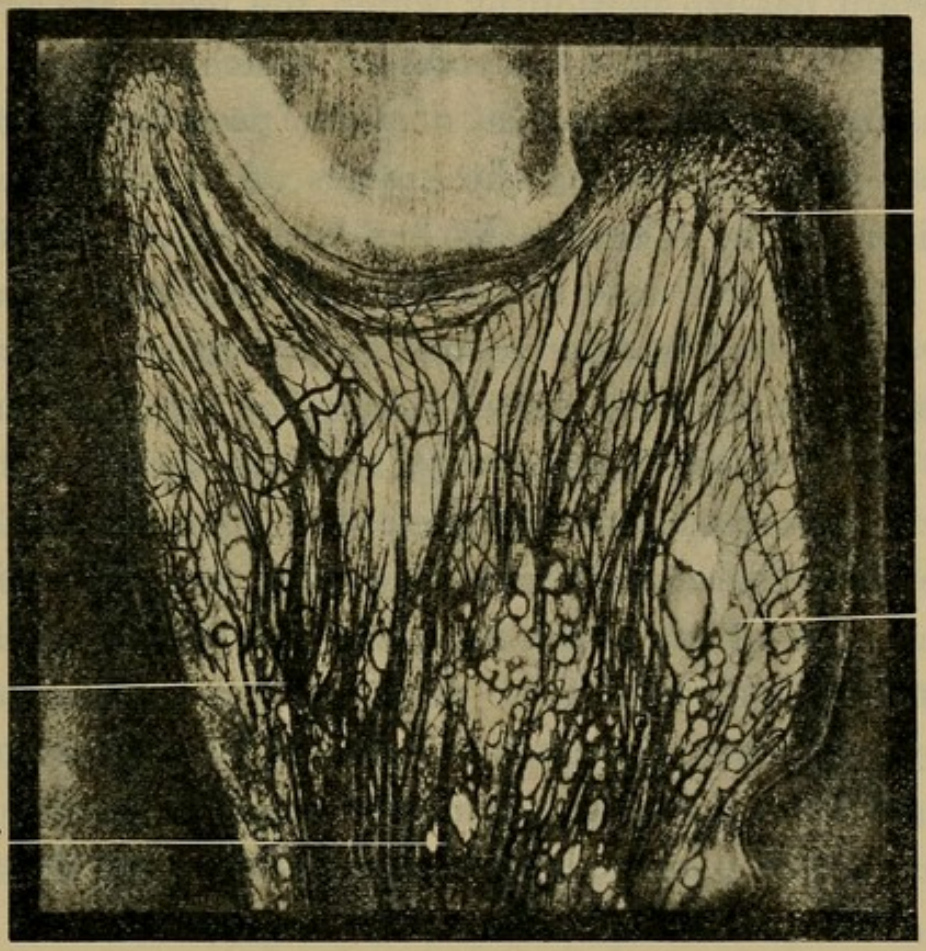


FIG. 7.—DISTRIBUTION OF BLOOD-VESSELS AND NERVES TO THE PULP OF HUMAN MOLAR.—(Broomell, after Gysi.) × 20.

the irritation is mild, and the patient of a calcic diathesis, this further deposit of lime salts is made, and the pulp diminished in size in consequence. *But where the irritation is more severe* it will result in congestion and death of the pulp.

The pericemental membrane is, as the name implies, the membrane which surrounds or invests the roots of the teeth. It is a richly vascular, fibrous structure, and is the nutrient organ of the cementum. It is also the organ of touch in the tooth, as

through the nerves of this membrane every impression upon the tooth is reported to the brain. It serves, too, to unite the tooth to the alveolus by its continuation throughout the alveolar cavities or sockets, and is connected at the dental foramen with the pulp, as previously stated.

The peridental membrane also serves as a cushion, permitting a certain passive motion by which the teeth are protected from injury by blows and concussions which they are apt to receive during the performance of their peculiar function of tearing and grinding during the process of mastication.

Nutrition of the Teeth.—As has been indicated, the pulp owing to its very intimate relation to the dentine, is the principle source of blood and nerve supply to that structure. Histologists show us that the dental tubules or tubuli open freely upon the walls of the pulp cavity, and are therefore brought into direct communication with the pulp. These tubuli as they radiate towards the enamel and cementum, gradually diminish in size and give off numerous branches which anastomose with those of neighboring tubuli, or they may gradually disappear; or, as they sometimes do, enter the enamel or cementum layers and through them, these tissues are nourished by osmotic action. It is through this plasmic material which invades the tubular substance, that the tooth receives its nourishment.

The cementum may be largely excluded from the above as this structure is principally nourished by the pericemental membrane. The cementum is but a slight modification of bone structure; it has the little lakes or lacunæ, filled with protoplasmic material, and small radiating canals or canaliculi, which communicate with the neighboring lacunæ. These little lakes are supplied with nutrient material principally from the arterial circulation of the pericemental membrane. As previously stated, however, the dentinal tubuli do sometimes enter the cementum and then unite with the nearby canaliculi and thus become involved in a measure in the nourishment of this structure.

ANATOMY OF THE TEETH.

Primary and Permanent Dentures.

Anatomically, the teeth are divided into three parts, the crown, neck, and root, the crown being that portion which projects freely into the mouth; the neck is surrounded by the gums, and the root is that portion covered by the alveolar process of the jaw and by which the whole tooth is held securely in position. In old age it is not unusual for the gums to recede, exposing the neck, and sometimes a part of the root is exposed in consequence of atrophy of the alveolar process. The teeth are classified into two general groups, the *simple,* those having but one root and cusp, and the *complex,* or those having two or more roots and cusps. Collectively as dentures there are also two divisions—the first is called the *deciduous* or *temporary* denture, designed to serve the needs of early childhood. The second is termed the permanent set or denture.

The temporary denture consists of twenty teeth, divided into three groups—the incisors, cuspids, and molars. The relative position and number these groups bear to one another is expressed in the following formula:—

$$M_2\ M_1\ C\ I_2\ I_1\ |\ I_1\ I_2\ C\ M_1\ M_2.$$
$$M_2\ M_1\ C\ I_2\ I_1\ |\ I_1\ I_2\ C\ M_1\ M_2.$$

In the temporary teeth the proportion of the length to the width is marked, they being somewhat shorter than their successors, the permanent teeth. The color of the temporary teeth is of a milky or bluish white, while that of the permanent presents a yellowish appearance. In determining between the temporary and permanent teeth the observer will be aided by the relative size and color, and by remembering that the former are somewhat loose, and have a marked depression at the neck, just at the union of the enamel and cementum.

The permanent denture consists of thirty-two teeth, which

are divided into four groups, namely: incisors (cutting), cuspids (tearing), bicuspids (crushing), and molars (grinding), according to the following formula:—

$$\begin{array}{l} M_3\,M_2\,M_1\,BC_2\,BC_1\,C\,I_2\,I_1 \mid I_1\,I_2\,C\,BC_1\,BC_2\,M_1\,M_2\,M_3 \\ M_3\,M_2\,M_1\,BC_2\,BC_1\,C\,I_2\,I_1 \mid I_1\,I_2\,C\,BC_1\,BC_2\,M_1\,M_2\,M_3 \end{array}$$

The relation between the permanent and temporary teeth is shown in the accompanying diagram, Fig. 8.

The anterior twenty teeth, namely, the incisors, cuspids, and bicuspids, each have one root, except the first upper bicus-

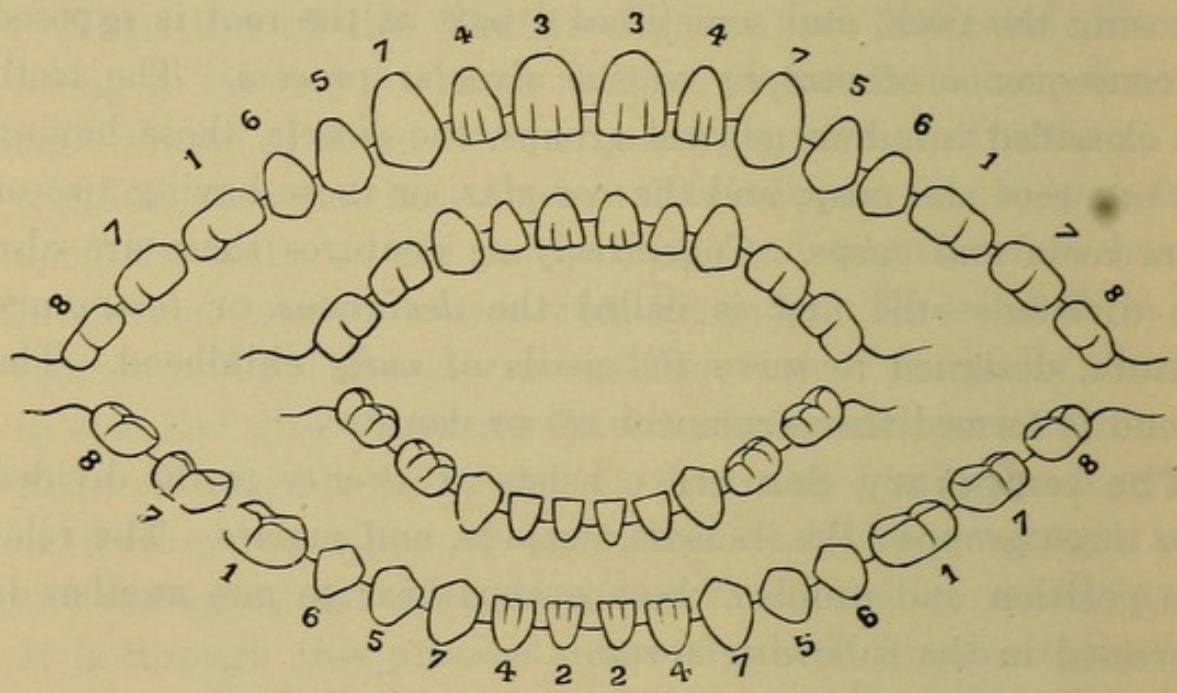


FIG. 8.*—THE FIGURES 1, 2, 3, ETC., INDICATE THE GROUPS OF TEETH AND THE ORDER OF THEIR APPEARANCE.

pid, which in about eighty per cent. has two roots, one labial and one palatine. The roots of the upper incisors are rounded; those of the bicuspids are flattened laterally. The roots of the lower incisors are the most flattened, while the root of the cuspid combines partially the roundness of the incisor and the flatness of the bicuspid. The upper molars have three roots each, two buccal and one palatine, which are usually of a round

*Taken from "Diseases of the Digestive Organs in Infancy and Childhood," by Dr. Louis Starr.

shape. While the lower molars have but two roots, one anterior and one posterior, these are laterally flattened, and extend from the buccal to the lingual surface of the tooth. The roots of the third molar or wisdom tooth are subject to the same rules as those of other molars, but they are subject to a great number of exceptions.

The crowns of the teeth present several surfaces for examination, which are named according to their position and use. Those of the incisors and cuspids presenting toward the lips are called *labial surfaces;* while the same outer surfaces of

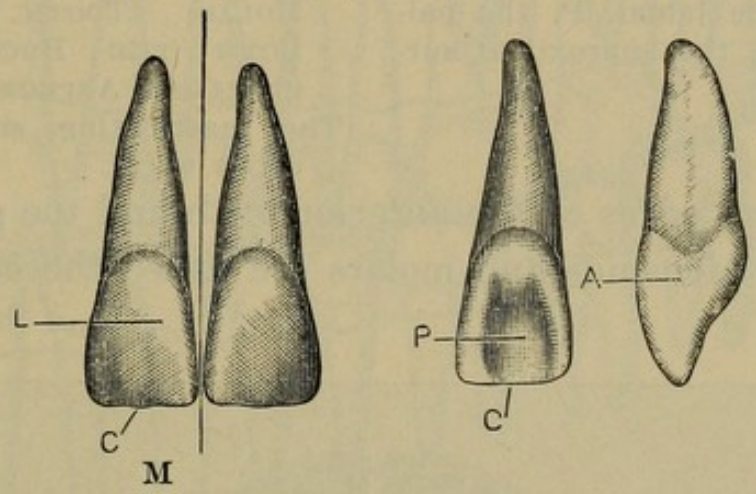


FIG. 9.—The medium line is shown at M, labial surface at L, cutting edge at C, palatal surface at P, and approximal surfaces at A, of typical superior central incisors.

the bicuspids and molars are called *buccal,* being next to the cheeks, and the opposite or inner surfaces of all the teeth, that portion presenting toward the tongue, are called the *lingual surfaces.* Some, however, use the term "palatine surfaces" for those of the upper jaw and "lingual" for those of the lower. While this is not necessary, it seems perfectly proper.

Those surfaces of the teeth that lie adjacent or next to the adjoining teeth are called proximate or proximal; these are more closely defined or divided by the terms *mesial* and *distal.* They are so named by their relative position to the central or median line of the face. Those proximate surfaces which face toward the median line are called *mesial surfaces;* and the opposite, or those most distant from this line, are called the *distal*

surfaces. These several surfaces are clearly shown in Figs. 9, 10 and 11.

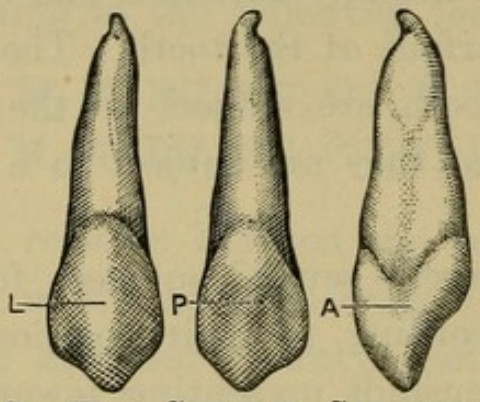


FIG. 10.—THE SEVERAL SURFACES OF A SUPERIOR CUSPID TOOTH.
L indicates the labial, P, the palatal, and A, the approximal surfaces.

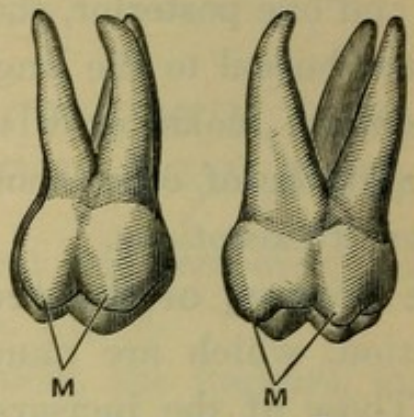


FIG. 11.—THE THREE ROOTS, NECK AND CROWN OF A SUPERIOR MOLAR TOOTH, PRESENTING BOTH THE BUCCAL AND APPROXIMAL ASPECT.
The masticating surface is indicated at M.

The cutting edges of the anterior teeth and the grinding surfaces of the bicuspids and molars are called the *occluding* surfaces.

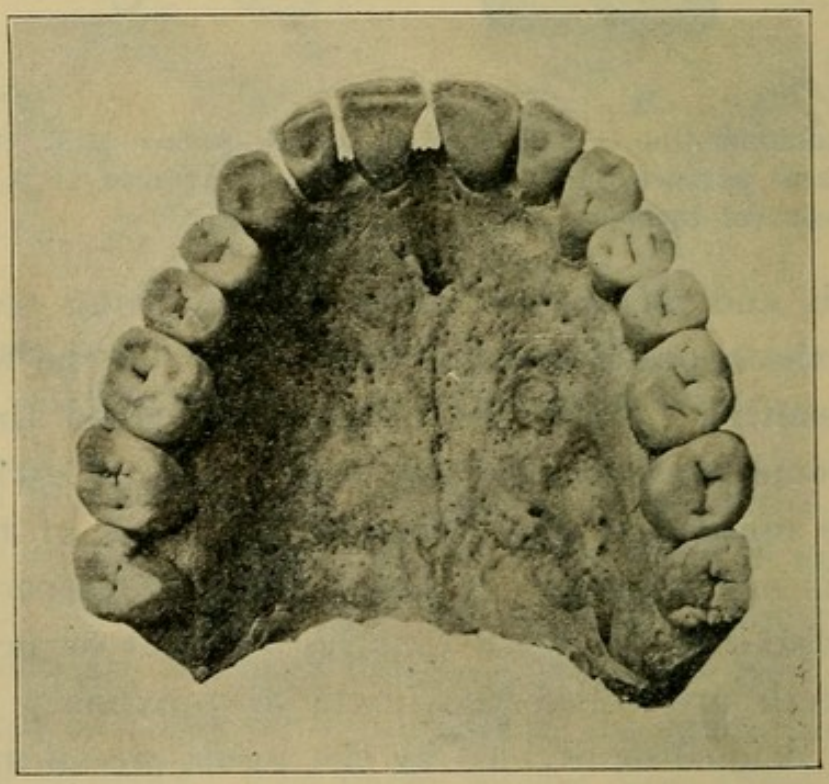


FIG. 12.

The arrangement of the teeth in the dental arch is represented in Fig. 12.

The Normal Articulation.—In the upper jaw the arch is larger than in the lower, especially in the anterior portion of it. The upper and lower teeth, therefore, do not meet perpendicularly in articulating; the lower incisors and cuspids articulate on the palatine surfaces of the corresponding teeth in the upper jaw. The cusps of the lower bicuspids and molars articulate in the grooves and furrows of the upper, and the teeth are so arranged in size and position that each tooth in the upper

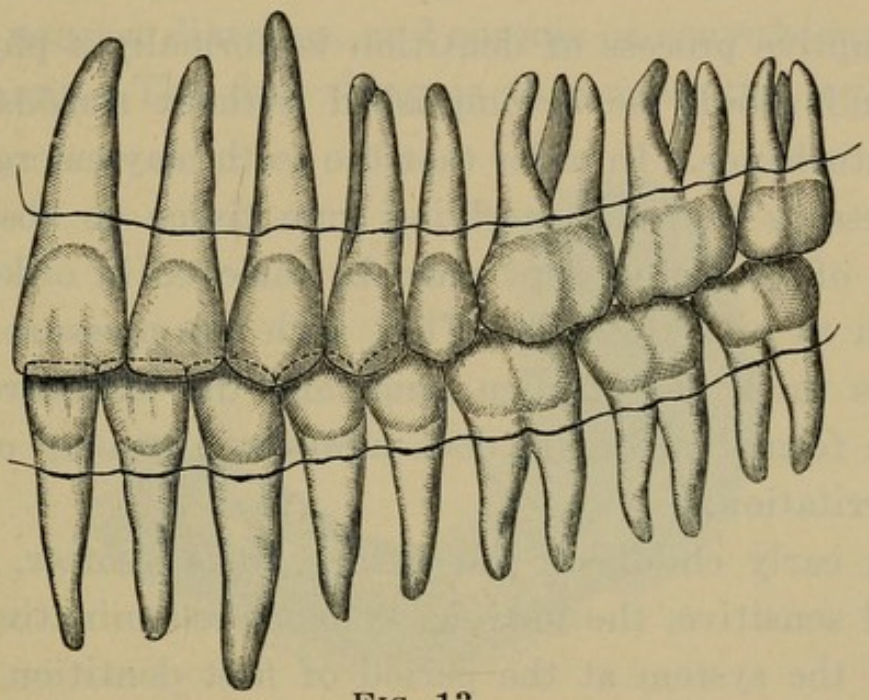


FIG. 13.

jaw when articulating occludes with two of the lower teeth. This is illustrated in Fig. 13.

PRIMARY DENTITION.

First dentition takes place, normally, in the order given in the following formula:—

Central incisors, ...	5th to 7th month.
Lateral "	7th to 10th "
First molars, ...	12th to 14th "
Cuspids, ...	14th to 18th "
Second molars, ...	18th to 25th "

Marked Exceptions.—Some children are born with a few teeth erupted, and there are cases reported where the entire

temporary set have been erupted at birth; there are also cases on record of adults who have been edentulous from birth. But these are rare exceptions.

The force which causes the teeth to emerge is called vital force, and operates by growth, developing first the neck, then proceeding gradually to the apical end of the root.

Lesions Incident to First Dentition.

The eruptive process of dentition is normally a physiological action, and should be accomplished without serious constitutional disturbance. In order that the teeth may emerge it is not only necessary that the overlying gum tissue be absorbed, but a portion of the bony crypt must be removed in order to allow the crown to pass through. This, with the pressure against a sometimes thick and swollen gum, and the backward pressure upon the formative organ, does however, in many cases cause serious irritation.

During early childhood the tissues are all softer, more vascular and sensitive, the nervous system predominating. Hence it is that the system at the period of first dentition is so susceptible to nervous impressions. In infancy, too, the system is less capable of combating diseases, and a large portion of the alarmingly great mortality of this period may be traceable to the irritation caused by dental evolution.

The indications of the eruption of the teeth are, first, an increased flow of saliva—a healthy manifestation, as it tends to keep the mouth moist and cool. This "drooling" is due to the irritation of the trifacial or fifth pair of nerves, which is sensory to the teeth and nutrient to the salivary glands. When the irritation becomes more pronounced, the secretions are somewhat checked and the mouth becomes hot and dry, the cheeks unusually red, eruptions appear upon the face, and, indeed, sometimes over the whole body; with ulcerations upon the tongue and mucous membrane of the mouth and inflammation

of the gum over the advancing tooth or teeth. A condition quite opposite to the above in appearance is a *white* and *hardened* gum overlying the advancing tooth or teeth. This offers a greater resistance than the inflamed condition and is often neglected, especially by physicians, owing to the absence of any appearance of congestion.

The child becomes wakeful, peevish, and cross, loses his appetite, and if relief is not then given this may be followed by persistent nausea, diarrhœa, and spasms or convulsions.

Treatment.—The first thing is to remove the irritation by

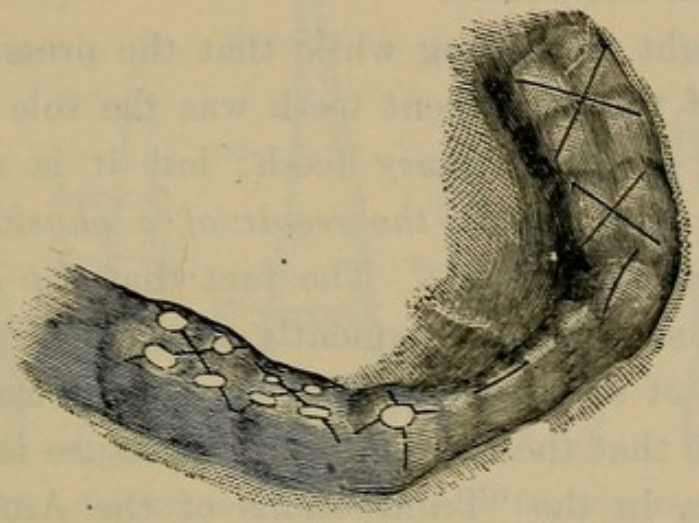


FIG. 14.

freely lancing the gums over the advancing teeth. The manner of doing this is admirably and fully shown in the accompanying illustration (Fig. 14), which is taken from a paper by the late Dr. James W. White, in the "American System of Dentistry." If the convulsive stage is reached, the patient's feet should be placed in hot mustard water, and cold cloths applied to the head, or the entire body put in a warm bath; such measures cause muscular relaxation and have a soothing effect upon the nervous system.

DECALCIFICATION OF THE TEMPORARY TEETH.

The temporary teeth must be removed before the permanent can erupt in their normal position; this, too, is a physi-

ological action though a somewhat obscure one, and takes place normally, by the resorption or decalcification of the roots.

This process usually commences at the apex of the root, on the side nearest to the successional tooth; this, however, is not invariably the case. Absorption may commence at several and distinct points, sometimes on the labial side—that most distant from the succeeding tooth.

The cause and manner in which the roots of the temporary teeth are absorbed has been the subject of much and careful study by such advanced investigators as Tomes, Peirce, Bödeker, Abbot, and others.

It was thought for a long while that the pressure caused by the advance of the permanent teeth was the sole cause for the decalcification of the primary teeth; but it is now generally conceded that *it is simply the result of a physiological action* and not a mechanical force. The fact that the decalcification of the deciduous teeth is frequently successfully accomplished in the absence of the corresponding permanent teeth adds much to the evidence that their presence and pressure is not essential.

Prof. Peirce, in the "Transactions of the American Dental Association," says: "The several conditions which are always present and essential are readily recognized, but the part each plays is not easily ascertained. The place of its commencement, at the end of the root, the retention of pulp vitality, and the presence of a vascular papilla in close proximity to the absorbing surface, with the fact that the surface of this papilla is rich in giant-cells, termed *'osteoclasts,'* are evidently essential accompaniments, and the absence of any one of them would certainly militate against the completion of the process."

And in another place the same writer says: "That the organ has served its purpose, and that the nourishment which had previously been appropriated by it is diverted or relegated to its successors, is probably the most plausible explanation we can give of this interesting physiological process."

Decalcification of the deciduous teeth commences in the central incisors at about the fourth year; in the lateral incisors in the fifth year; in the first molars the seventh year, the second molars the eighth year, and the cuspids the ninth year. After decalcification commences in a tooth, it takes about three years for it to accomplish its work. (See Fig. 15.)

Second Dentition.

In a harmonious development of the teeth and jaws, the indications of the time approaching for the development of the per-

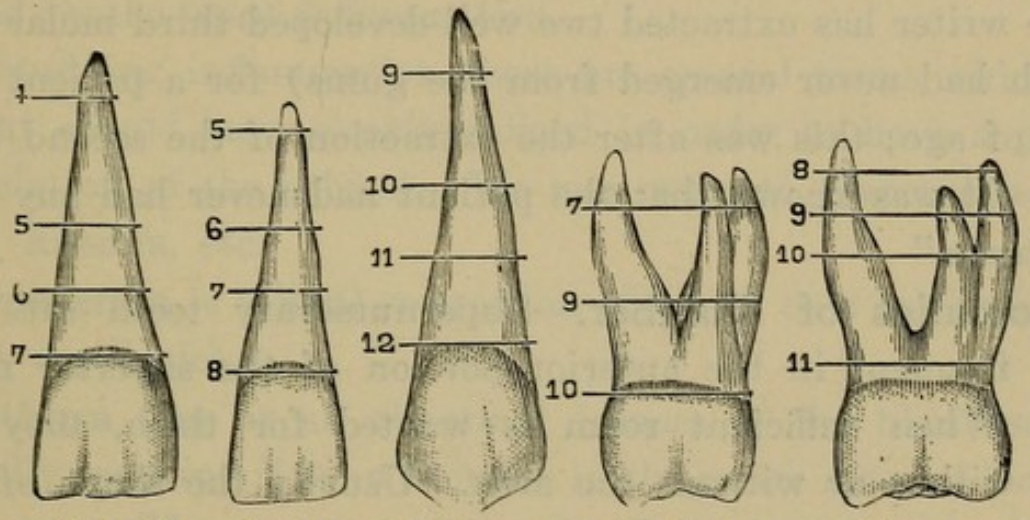


Fig. 15.—Decalcification of the Deciduous Teeth.
(From a diagram prepared by Prof. C. N. Peirce, 1884.)

manent teeth are the expanding of the alveolar ridge and the spreading apart of the deciduous teeth.

The emergence of the permanent teeth takes place, normally, in the order given below:—

First molars,	6 to 7 years.
Central incisors,	7 to 9 "
Lateral "	8 to 10 "
First bicuspids,	10 to 11 "
Second "	11 to 12 "
Cuspids,	12 to 13 "
Second molars,	12 to 13 "
Third "	16 to 25 "

Exceptions.—Deviations from the order of appearance and the respective ages as given above occur; it is usually in strong

children that the teeth appear at a later period, a scrofulous diathesis being indicated in premature dentition.

Third Dentition.

Cases of third dentition are reported by a number of writers, but undoubtedly the majority of these reports refer to teeth that in reality were part of the second set, which failed to emerge at the normal time, and had only appeared in old age when there was sufficient room for them, or the jaws had atrophied.

The writer has extracted two well-developed third molar teeth (which had never emerged from the gums) for a patient sixty years of age; this was after the extraction of the second molar roots. It was known that the patient had never had any "wisdom teeth."

Anomalies of Number.—Supernumerary teeth are especially frequent in the anterior portion of the superior maxillary. When sufficient room is wanted for them, they may stand within or without the arch. Usually the shape of both the crown and root of these teeth is conical, while the shape of the crown of those found in the posterior part of the mouth is cuboidal—resembling the molars.

Dentures from which normal teeth are missing are more frequent than those containing supernumerary teeth. Occasionally the space from which the permanent tooth is missing may be occupied by a temporary tooth. Sometimes temporary teeth may be seen in the mouth of persons twenty-five and thirty years of age; in these cases the permanent ones are generally retained in the jaw, and may erupt later.

DENTAL PATHOLOGY AND THERAPEUTICS.

Dental pathology treats of the origin and progress of the varous diseases to which the teeth and the surrounding oral tissues are liable.

Dental therapeutics considers the medicines and remedies used in the treatment of such diseases.

Disease, pathologically considered, is any abnormal condition in those processes which constitute perfect health. It is but the normal physiological force perverted, tearing down what it had before built up. Its chief manifestations are expressed by the word *inflammation.*

In studying inflammation there are several terms which the student should have clearly defined in order to have a proper appreciation of the subject. We may refer to Hyperemia, Plethora, Anemia, etc.

Hyperemia is a local congestion of blood, or a local plethora of the capillaries.

Plethora then is an abnormal fulness of the blood-vessels; generally speaking it is an increase in the entire mass of blood in the system. The converse of anemia.

Anemia indicates a deficiency in the volume of blood in the system, but particularly a deficiency in the red corpuscles. An anemic condition therefore indicates an enfeebled condition of system as a whole.

Ischemia (is-ke'me-ah) is the term used to indicate a local anemia. It implies a deficiency of the supply of blood to a part.

INFLAMMATION.

Inflammation may be defined as a disturbance of nutrition in a tissue accompanied by heat, redness, swelling, pain, and impaired function, modified only by peculiarities of the structure and intensity of action. It is a series of changing conditions, each the result of the preceding one. It is essentially a

destructive process and is the basis of many degenerative changes.

The usually accepted view of modern pathologists is that until the disturbed aria is invaded by septic organisms there can be no deteriorative action, and that the earlier stages therefore, is simply a condition of hyperemia. That is to say, until we have infection we are simply confronted with hyperemia or local congestion.

This is essentially the same in the pulp of a tooth, as in the peridental membrane, mucous membrane or elsewhere, slightly varying symptoms being induced, as already indicated, by structural peculiarities.

The first cause of any inflammatory condition is irritation; that is, the slightest foreign influence disturbing the harmony of the functions of the tissues. This is most readily traced in the vascular system.

The first stage may be accepted as congestion, in which the capillary vessels are excited into active contraction and relaxation, quickening the circulation of the blood, inducing warmth, and causing some discomfort.

Acute inflammation, or the second stage, is characterized by warmth, a sense of fulness, slight swelling, and increasing pain; the abnormal volume of blood in the parts presses upon the nerve filaments supplying the inflamed tissue, causing pain in accordance with the expansion of the vessels.

Chronic inflammation.—In prolonged inflammation, the functions of the parts become somewhat changed, adapting themselves to the surrounding conditions; thus, the tissues involved become less susceptible to the impression of an irritant, and comparatively little pain follows, this being one of the most noticeable characteristics of chronic disease.

Treatment.—In treating inflammation, after removing the cause, that is, the irritant, effort is made to effect resolution, or to hasten suppuration.

Resolution is the subsidence of inflammation and a return of the tissues to normality.

Suppuration, or pus formation, being the breaking down of the parts, the debris of which, with white blood corpuscles, forms *pus.*

The remedies used are, first, to remove the cause, to administer laxatives, and apply sedatives and stimulants.

The chronic stage of the inflammatory process, if not checked, may result in one of several degenerative changes; among these are hypertrophy, induration, tumefaction, or congestion of the tissues.

Hypertrophy.

Hypertrophy is an excessive growth of normal tissue by the multiplication of cell elements. Of the oral tissues, the gum

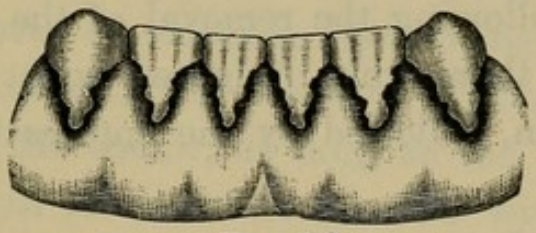


Fig. 16.

and mucous membrane are the most liable to this disease. The usual form recognized is in a growth of the free border of the gum, lying loosely against the teeth, in some cases extending to the cutting edges. Another form consists in the thickening of the entire gums, covering the teeth to such an extent that only the masticating surfaces are visible; the hypertrophied portion being firm and dense, protruding the lip to such an extent as to cause deformity; this latter form of hypertrophy of the gum, however, is rare.

The cause of hypertrophy of the gum tissue is usually lack of care on the part of the patient. Calcic matter is deposited about the cervical portion of the teeth, and this irritates the surrounding gum tissue sufficiently to stimulate it to abnormal activity. The consequence is a multiplication of the cell ele-

ments resulting in a local overgrowth or hypertrophy. This condition is illustrated in Fig. 16.

Treatment consists in cutting away the long points and borders of the gum down to the necks of the teeth, and then the abnormal growth being out of our way, the treatment obviously is the careful and thorough removal of the irritating deposits. The small particles of calcific matter lying deepest under the loosened gums, that is the spicules nearest the point of actual attachment are the most irritating. It is essential, therefore, that delicately formed instruments be employed to reach the point of attachment and dislodge all foreign substance.

Where the deposits are very difficult to dislodge, the work may be facilitated by applying a few drops of trichloricetic acid, 20 per cent., upon a small twist of cotton and allowed to remain a few minutes. Following the removal of the calcic matter the pockets should be thoroughly irrigated with warm water and peroxid of hydrogen, followed by the application of stimulants and astringents.

Other forms of hypertrophy are encountered by the dentist, however, and may be here referred to. Occasionally we find large hypertrophied areas of alveolæ process, induced by irritation in consequence of lack of occlusion. Another form is found in excementosis, hypercementosis or exostosis, as one may choose to term it. This will be treated in another place. We also find hypertrophy of the pulp tissue, resulting sometimes from dental caries, which will be taken up under diseases of the dental pulp.

Induration.

Induration is a circumscribed, hardened swelling; it is an enlargement of individual cells, and not a multiplication as in hypertrophy. In this condition the functions of the tissue involved are inactive, the circulation being very much retarded.

It may manifest itself in the gum, in the muscles of mastication, or in the muscles of the neck.

Treatment.—In induration of cheek or neck, apply hot cloths and an active stimulant, such as capsicum. When the disease is in the gum, apply capsicum plaster and lance freely.

TUMEFACTION.

Tumefaction is a condition of chronic inflammation, by which is produced an abnormal amount of tissue, of a *different* kind from the surrounding tissue, exhibiting a difference in color and texture. Tumefaction as found in the mouth is divided into *epulis, cystic, and vascular.*

Epulis tumors originate in the periosteum, and are usually found in the interspaces of the anterior teeth. They are fibrous in structure, and usually of a dark red color.

Treatment consits of excision, care being taken to remove all the abnormal tissue; the bistoury should be passed well around and under the tumor, as deep as the periosteum; after removing the growth as entire as possible with the knife, carbolic acid or trichloracetic acid should be applied, to destroy the vitality of any fibers that should remain.

Cystic tumors originate in the mucous membrane; they are membraneous in structure, of a lighter color than the normal mucous membrane, and are filled with a viscid fluid.

Treatment consists in lancing at the lowest points, and emptying the contents by pressure, after which applications of stimulants and astringents should be made.

Vascular tumors arise from some blood-vessel supplying the oral tissues. They are usually of a dark red color, and highly vascular; they have a smooth and shiny surface, and are more or less fibrous.

Treatment same as in epulis tumors.

Congestion is also often the result of inflammatory processes.

The prominent feature of congestion is *blood stasis,* causing severe pain with each pulsation of the heart. The capillary vessels in the inflamed parts being engorged, the blood rebounds at each pulsation of the heart, thus causing the throbbing pain. The pain, however, is sometimes intermittent, by the capillaries being broken through, relieving the pressure temporarily.

Treatment is to apply stimulants and sedatives.

Alveolar Abscess.

An abscess is a circumscribed collection of pus—circumscribed by the development of a soft membrane, forming a sac,

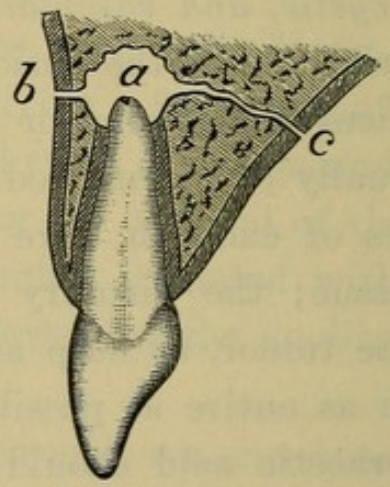


Fig. 17.—Result of an Abscess at the Root of an Incisor Tooth; a indicates abscess cavity; b, mouth of fistula on gum above labial surface of the tooth; c, mouth of fistula opening on the palatal surface.

restraining the pus from passing into the surrounding tissues, causing it to seek the surface at the point of the least resistance. The pus works its way through the tissue at this point, forming an escape called a *fistula.*

An alveolar abscess is, as the name indicates, an abscess originating within the alveolar walls. It is the result of inflammation of the pericemental membrane, consequent, usually, upon the death and septic decomposition of the tooth pulp.

Symptoms of alveolar abscess are congestion and inflammation of the gums about the affected tooth; severe pain which is often accompanied by considerable fever. There is also

apparent elongation of the tooth, caused by inflammation of the pericemental membrane and accumulation of pus in its socket; the pus formed, being confined about the apical end of the root, and between bony walls, causes considerable pressure as it accumulates. The bone in this neighborhood is not of a very hard nature, and in consequence is readily destroyed by the pus in its efforts to seek the surface. During the time the pus is penetrating the bone the patient suffers most; the pain at this stage being very severe and of a throbbing character.

The features become swollen and disfigured on the affected side; the eye is sometimes entirely closed, and the jaws so stiff that the mouth can not be opened to any considerable distance.

Treatment.—The surgical and local treatment consists in gaining free access to the diseased parts, and removing the cause, and breaking up the sac of the abscess. In securing ready access to the point of accumulation it is best to first open up the canals of the affected tooth. In doing this it is *better to sacrifice good tooth structure* than to attempt to work around corners and through too small a canal, being careful to follow the line of the canal, and not perforate the side of the root; after which the canal should be thoroughly irrigated with peroxide of hydrogen followed by a dressing of an effective antiseptic and germicide before filling.

Where the abscess has advanced to any considerable extent, it will sometimes be found necessary to more freely open or enlarge the fistulous canal by driling in through the gum and alveolar process over the affected tooth with a medium-sized rose-head burr revolved by the dental engine. In so doing the parts may be more thoroughly drained and treated, and the sac, when attached to the end of the root, can be more readily reached and broken up.

If the patient is in an otherwise healthy condition, nature will finish the work by throwing off the broken-down tissue and developing new granulations, without further treatment. It

would be advisable, however, to assist in throwing off the foreign matter by injecting peroxide of hydrogen and warm water freely into the enlarged fistulous opening and socket.

Where the patient is of low vitality, or the abscess of long standing, other therapeutic treatment must follow the surgical before a cure can be accomplished. After cleansing the canals thoroughly with peroxide of hydrogen, as before stated, some one of the more efficient antiseptic and disinfectant remedies, such as carbolic acid and iodine, or oil of cinnamon, should be applied on a strand of floss silk, or a few fibers of cotton, or asbestos, which should be carried to the apex of the root by means of a nerve canal-plugger, and the crown cavity closed with a temporary stopping. The gum tissue about the affected tooth should then be painted with tincture of iodine and aconite, which will aid in the reduction of the inflammation by counter-irritation. This treatment should be repeated in from two to three days, and continued according to the character and symptoms of the case in hand.

Other causes than that of the death and decomposition of the pulp may give rise to alveolar abscess; any foreign matter, such as *filling material,* being forced through the apex of the root, *calcic deposits* within the walls of the alveolus, *necrosed root or bone, impacted teeth, etc.,* may cause sufficient inflammation of the periosteum to produce an abscess, all the successive stages of inflammation being involved in the formation of an abscess, from irritation to suppuration. This is quite as true in connection with vital teeth when calcic deposits are made upon the pericemental membrane in sufficient quantity to cause inflammation of that structure.

Ulceration.

The terms ulcer and abscess are frequently confounded by students, and a general comparison may therefore be advantageous.

An ulcer forms upon the surface, that is, has its inception on a cutaneous surface. An abscess forms in some cavity within the body. An ulcer is never induced by pyogenic bacteria, while infection from these organisms is the primary cause of an abscess.

An ulcer is an open suppurating surface; an abscess is a circumscribed collection of pus.

An ulcer usually has its inception in some morbid structural change or old wound; an abscess is the result of some recent degenerative condition.

Treatment for ulceration consists in applying astringents and antiseptics, and *administering* a tonic.

Stomatitis.

The term stomatitis implies an inflammatory condition of the tissues of the mouth. It is sometimes employed to cover diverse conditions, though its usual application is to the tongue and mucous membrane. It is usually due to a lack of oral hygiene, and is more frequent in the mouths of infants, especially among the children of the very poor where nourishing foods and sanitary surroundings are not much in evidence.

It may be said then to be due to improper food, infected milk from lack of care in cleansing and scalding the nursing bottle, irritating fungi harbored by rubber nipples, and from other unsanitary conditions.

In adults a general neglect of the teeth and mouth may result in stomatitis. If food particles and mucous accumulations are allowed to remain between the teeth and about the free margins of the gums indefinitely the fermentation and putrefaction resulting will cause gingivitis, which by continuity of structure will spread over the entire mouth. Anemic persons are specially liable to inflammatory conditions of the mucous membrane, and where it continues for a considerable length of time may result in an ulcerative stomatitis.

Local inflammation of the gums, which can not be classed as general stomatitis—though it would contribute to a general inflammatory condition of the mucous membrane of the mouth where other unsanitary conditions are present—may result in a loosening and thickening of the gingivæ, a form of pyorrhea, or a serious hypertrophy of the gums. These several conditions will be treated under their proper classification.

DISEASES OF THE DENTAL PULP AND MEMBRANE.

Inflammation of the Pulp or Pulpitis.

As in other tissues, inflammation is induced in the pulp by irritation, and is similar to inflammatory conditions in other tissues except slight modifications owing to the surrounding conditions. The most marked of these conditions is the fact that the pulp is enclosed within close and unyielding walls. In addition to this the blood-vessels of the pulp are modified in structure in that they lack the muscular coats of other blood-vessels; while the nerves of the pulp lack the general structure of those of the general nervous system and have not the usual sheaths.

The most frequent cause is the encroachment of dental caries; this removes the normal covering of the pulp, allowing thermal, chemical and mechanical irritation to readily reach that soft and sensitive tissue.

Treatment.—If irritation has been mild and only for a few days, immediate filling will give relief. By mild we mean responsiveness to thermal changes, but passing away where the irritation is removed; paroxysmal and returning only upon provocation. *If the irritation* had continued for several days, and has been severe enough to cause actual pain, which condition may be designated as hyperemia of the pulp, *treatment*

consists in applying some stimulating antiseptic and filling with a good temporary stopping. If no further pain is felt within ten days, fill permanently. *When the irritation has continued* for a considerable length of time, the pulp being seriously involved though it may not be exposed, or in cases where the pulp *is* exposed from the disintegration of the dentine covering, we have a very different condition to cope with. Instead of having the quick, sharp flashes of pain, disappearing in a short time, the pain becomes almost continuous, accompanied with a boring sensation, indicating that the inflammation had passed to effusion, in which there is an extravasation or working out of the blood into the body of the pulp. Up to this time there is strong probability of the pulp returning to its normal condition if treated as indicated, but this point having been reached the probabilities are against its conservation, and it is generally preferred to devitalize and extirpate the pulp and fill the canals before attempting to fill the crown cavity.

In teeth that are not carious, inflammation of the pulp may arise from violent thermal changes, to which they are sometimes very sensative, and if repeatedly exposed to such changes death of the entire pulp may be the result. Or some slight mechanical injury, resulting from a fall or blow, may cause sufficient congestion to cause death of the pulp. Hence, we not infrequently find teeth with devitalized pulps that are otherwise sound.

Treatment in such cases is very simple. If the irritation is from thermal changes and has not been of long standing, the pulp will return to its normal condition by simply removing the irritant; that is, protecting the teeth from such marked thermal changes and applying a good stimulant, such as tincture of iodine, to the gum over the root of the tooth affected. If the pulp has been devitalized or the irritation has continued for such a length of time as to make devitalization necessary,—that is, where it will not respond to the treatment just described,—it

should be removed by opening the tooth at a point making the pulp chamber and canal of most easy access; and after the devitalized organ is removed the canals should be thoroughly filled.

Inflammation of Pulp Following Filling.—Occasionally inflammation of the pulp follows the filling of carious teeth. This may arise from *mechanical* irritation, that is, undue pressure upon the pulp by the capping or filling material; *chemical,* by the action of acids used in the capping or filling material; or *thermal,* by the conductibility of the filling material, readily carrying every impression to the pulp.

Treatment.—This can be readily diagnosed, and when the inflammation is only superficial the pulp may be restored to health by removing the irritant and treating as directed above. But when inflammation is more general (and every precaution has been taken in filling the tooth), a general engorgement of the blood-vessels and possibly effusion is indicated, there is no reasonable probability that it can be saved; the filling, therefore, should be taken out, the pulp destroyed and removed, the canals thoroughly closed and the tooth refilled.

Hypertrophy of the pulp is preceded by chronic inflammation, *and is indirectly the result of caries.* In hypertrophy of this organ the nerves do not retain the same degree of growth as the connective tissue; the pulp polypus is, therefore, not so painful as the normal or acutely inflamed portion; for this reason such growths are permitted to remain in the cavity for months before the patient calls for treatment.

Treatment consists in the extirpation of the polypus, then the devitalization and removal of the remainder of the pulp, before filling.

Secondary Dentine.

There are several manifestations of secondary dentine, which are classed as:—

(1) Dentine of repair, a physiologic process, wherein nature through the odontoblasts interposes a secondary deposition

of calcic matter. This is physiologic inasmuch as it is an attempt to repair a loss of covering through caries, or to protect the pulp from the encroachment of erosion or abrasion.

(2) **Osteodentine** or calcic degeneration of the pulp. This is where the process last referred to—the deposit upon the periphery of the pulp usually for self-protection,—is continued until the entire body of this organ is calcified. This secondary dentine differs somewhat from the primary dentine; it has fewer tubules, and is calcified from several centers which are finally fused together, making it quite irregular in form.

(3) **Nodular Dentine,** erratic growths or calcic exudations into the pulp tissue. In other words it is a formation of small nodules of calcified matter within the pulp cavity; they are generally confined to the body of the pulp, but at times nodules are found within the root canals. Since nodular calcifications sometimes occur in the pulps of teeth the crowns of which are perfect, there being neither abrasion nor decay, though decay may be and often is, found in connection with such formations, the presence of these bodies is evidently due to some other cause that is as yet unknown. These bodies give much trouble when connected with other diseases affecting the tooth pulp, and sometimes give serious trouble in themselves. This form of secondary dentine should therefore be classed as pathologic. When the bodies do occasion trouble, it is generally in the form of infra-orbital neuralgia, with paroxysms of pain in one or more of certain teeth. Patients with these symptoms sometimes present themselves. In these instances, where no carous or otherwise visibly diseased teeth are found, it may be presumed that the pain is caused by an odontinoid formation in the pulp of one of these teeth. To ascertain the affected tooth, the usual tests of cold water and percussion should be employed, when the patient will usually express some abnormal feeling in the tooth or teeth containing these formations.

Treatment.—When pulp stones are diagnosed, the tooth

should be drilled into, in the best position and direction for reaching the pulp; this done, arsenious acid should be applied for the devitalization of the pulp, which, of course, should be thoroughly removed and the root canals and tooth filled.

Gangrene of the pulp (death in a body without loss of substance, as in suppuration).—Gangrene of the pulp not infrequently is the result of acute inflammation; the over-supply of blood in the arteries compresses the veins at the dental foramen, interrupting the circulation so as to cut off all nutrition from this territory, causing death to the pulp *in a body*. Gangrene occurs in two forms, dry and moist. Dry gangrene is where the pulp becomes a dry and shriveled mass, or mummified. Moist gangrene is where, after death *en masse,* we have putrefactive decomposition of the pulp. *Treatment* consists in the removal of all remnants of pulp and in perfect disinfection of the root canals before filling.

Pericementitis.

Pericementitis (inflammation of the pericemental membrane) may arise from some one or more of the following irritants: inflammation of the pulp, putrescent pulp, excess of filling material, looseness of the tooth or root, salivary or sanguinary calculus, dental manipulation, mal-occlusion, want of occlusion, mercurial poisons, previous pericementitis, etc.

The pericementum serves as a cushion, breaking the force directed upon the tooth in masticating or other external violence, hence we find it subject to occasional irritation from this source. This tissue, too, is very vascular and not infrequently is it infected from a decomposing pulp; this is in fact the most fruitful source of pericementitis.

Symptoms.—There is sometimes confusion as to the symptoms which distinguish pulpitis from pericementitis. Therefore, that the student may have a clear conception of the differentiating symptoms they are compared in detail:

PERICEMENTITIS.

A knowledge of the presence of the tooth, there being no trouble to locate the one affected.

There is apparent elongation, the effected tooth being the first to strike in closing the mouth.

There is pain following the slightest pressure from occlusion of the jaws, or from the tongue or fingers, or from tapping the tooth.

The pain is dull and constant, not paroxysmal in character.

There is no material sensation from thermal changes.

PULPITIS.

Sometimes difficult at first to determine just which tooth is at fault, the pain being more or less fleeting.

There is no elongation, nor inconvenience in closing the teeth.

There is no pain upon tapping, and tooth can be used in masticating if thermal extremes are avoided.

The pain is sharp, and darting in character, and in earlier stages paroxysmal.

Tooth is extremely sensitive to thermal extremes.

Treatment.—First remove the irritants, vital or mechanical, then apply a good stimulant and sedative to the gum over the affected tooth, to hasten resolution. A hot foot-bath is also beneficial in relieving the blood pressure in the diseased parts. When gangrenous or putrescent pulp is diagnosed, the teeth should be thoroughly opened up, every vestige of the pulp removed, the canal roots thoroughly cleansed and disinfected as soon as the soreness will permit.

Pyorrhoea Alveolaris.

Pyorrhœa alveolaris is a term applied to a condition characterized by a breaking-down of the alveolar walls; formation of pus about the roots of the teeth; a deposit of calculi, either salivary, sanguinary, or both, upon the teeth; a destruction of the pericementum, inflammation of the surrounding tissues, and accompanied by a general calcic diathesis. This condition has been known by numerous names; for many years it was called "Rigg's Disease," expressing nothing. It was so called because Dr. J. M. Riggs, of Hartford, Connecticut, was first to give it much concern and to call public attention to it as a distinct pathologic condition.

Pyrrhoea alveolaris has been divided by Professor Peirce into two classes: (1) Those of local origin, and (2) those having their origin in a constitutional derangement. In writing upon this subject* Dr. Peirce stated that in the effort to reduce the

*For the Odontological Society of New York, November, 1893.

disease to the simplest factors and determine the primary origin of each, he should coin two terms, expressive as to the nature of the disease.

The first form, where the salt is deposited from the saliva, he has designated as *ptyalogenic calcic pericementitis,* expressing the idea that in its origin it is local, peripheral, and salivary. This is characterized by a loosening and driving back of the gum tissue, by the accumulation of calcic deposits; the gums becoming turgid and inflamed. A viscid, degenerate mucous may be forced from beneath the loosened gum, and it may be found, in more advanced cases, that the irritation has reached and involved the alveolar process and pericemental membrane. When this condition is reached it is usually followed by a more or less discharge of pus and loosening of the teeth. This form of pyorrhoea alveolaris may, therefore, be attributed to a general lack of oral hygiene. The irritation in some instances is contributed to by mal-occlusion or non-occlusion of affected teeth.

The second is designated as *hematogenic pericementitis,* expressive of the idea that in its origin it is constitutional, central, and associated with some modification of the normal composition of the blood plasma. This is the condition which may be termed *true pyorrhoea alveolaris.* This latter form of the disease has been demonstrated by Professor Peirce to usually accompany the gouty diathesis, and he has been misquoted by many in that it was the *result* of gout. His researches, however, show that it is not the result of this disease, as it may exist where there are no marked symptoms of gout, but that the predisposing cause, uric acid, or other waste products, are universally present. In other words it is another expression of the uric acid condition.

One of the conditions usually present in this form of the disease, is the accumulations of sanguinary calculi, very hard and dark colored nodules upon the roots of the teeth affected,

which concretions have repeatedly been found to contain uremic salts, indicating a constitutional derangement.

Clinical History.—The clinical history of pyorrhœa alveolaris is, as has been previously indicated, a deposition of calcic matter upon the necks or roots of the teeth; a loosening, swelling, and more or less inflammatory condition of the gums; an oozing of pus from beneath the gum margins; a resorption of the alveolar borders; and a progressive loosening and malposition of the affected teeth. The true form of pyorrhoea alveolaris being coincident with some of the familiar expressions of the uric acid diathesis, such as rheumatism and gout.

Treatment.—In this, as in all diseased conditions, the first effort should be to remove the cause—that is, the source of irritation. Where the exciting cause is purely local, that is, where lack of cleanliness and the irritation from foreign substances impinging on the gingival margin establishes a local gingivitis, the treatment is of a simple nature. It may be simply the removal, by suitable scaling instruments, of all calculary deposits from the necks and roots of the teeth, a very simple line of surgical procedure and should be most thoroughly and carefully carried out. This should be followed with local astringent and stimulating treatment for the gums, and enforced hygienic treatment of the mouth. If mal-occlusion or lack of occlusion play any part, this, too, should be corrected, if need be, by the insertion of a sufficient number of artificial teeth to overcome the difficulty; or, if any of the teeth become very loose, as we more frequently find the lower incisors, they should be securely bound together by some light mechanical appliance.

When the origin is in a systemic derangement which is usually found to be a uric acid diathesis, the general treatment is directed toward the elimination of waste products; a plain, wholesome diet and open-air exercise should be prescribed. In such cases the medicinal treatment should, as has been indicated, be directed toward the elimination of uric acid

and its compounds. For this purpose some of the various lithium preparations are indicated. And the free use of alkaline waters—Vichy, Carlsbad, Apollinaris, etc.

In these cases we find deep pockets about the affected teeth, formed by the breaking down of the surrounding alveolar wall; the pockets contain pus to a greater or less extent, a quantity of which can be forced out by a gentle manipulation of the gums. There is accompanying this condition a heavy, metallic-like odor to the breath, which is increased or diminished with the quantity of pus present.

By a careful exploration of these pockets we will detect well up toward the apex of the root, and closely attached to its side, hard and gritty nodules—the sanguinary deposits previously referred to.

In addition then to the above anti-gout régime, careful local treatment should be given these roots and pockets. The roots should be cleansed as thoroughly as possible from all calcic deposits, the pockets formed about the roots should be freely irrigated with peroxide of hydrogen in warm water, followed by the introduction of a few drops of pyrozone, 25 per cent., or trichloracetic acid, 50 per cent., or lactic acid, or zinc chloride, as some operators prefer, in each pocket. These drugs are best applied upon a thin, wedge-shaped piece of orange wood, or upon a small twist of cotton which may be forced to the extremities of the pocket, and allowed to remain for a few minutes, when the cotton should be withdrawn. This will "burn out" the pockets, stimulating the formation of new granulations; then the application of local stimulants, such as the tincture of iodine, should be made to the surface of the gums, and repeated at frequent intervals.

Dental Erosion.

Dental erosion is a chemical solution of the faces of teeth, and should not be confounded with dental caries or mechanical

abrasion. The labial surfaces of the teeth are usually attacked, resulting in the formation of cup-shaped excavations. The erosion, in some cases, progresses until the pulp area is encroached upon; in these cases, however, it is usually found that nature has caused a deposit of calcic matter to be made at the periphery of this organ in advance of the progress of the erosion, so that when the pulp is reached it is found to be entirely obliterated through calcification.

Cause.—Dental erosion is the result of the action of acid secretions from the labial glands, caused, probably, by the patient being of the uric acid diathesis.

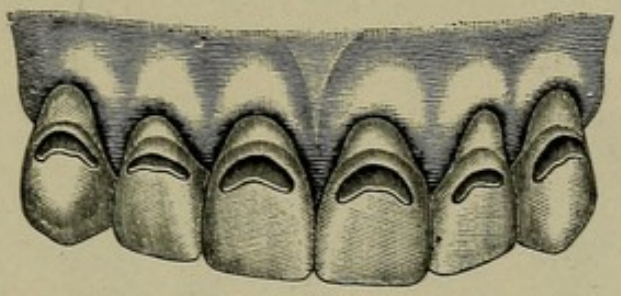


FIG. 18.—A TYPICAL CASE OF EROSION, SHOWING THE CUP-SHAPED CAVITIES ON THE FACE OF EACH OF THE ANTERIOR TEETH.

Treatment.—When the solution has proceeded to any depth, the cavities may be filled. At the same time an alkaline mouth-wash should be persistently used to counteract the acidity of the oral secretions; counter-irritants may be applied to the tissues surrounding the glands, and in extreme cises the destruction of the glands by the electric needle has been suggested by Professor Brubaker.

EXOSTOSIS.

Exostosis, or hypercementosis, is a disease common to all bones, but owing to the vascularity of the cementum of the tooth, it is oftener found there to a greaater or less degree than in any other part of the osseous structure. It consists of outgrowth of new tissue from the cemental layer covering the roots of the teeth. It sometimes takes the form of prominent nodules, and again will be found in regular layers or masses covering a large portion of the cementum.

The specimens of hypercementosis shown in Fig. 19 are from the practice of Dr. William Jarvie, and are teeth successively lost by one patient.

The cause of exostosis is inflammation of the pericemental membrane (pericementitis), which may be induced by malocclusion, want of occlusion, shock from severe dental operations, or other violence, such as biting thread—a habit formed by many seamstresses. Where any of the above conditions are continued for any length of time it causes an abnormal energy in the odontoblastic layer of the cementum, producing increase

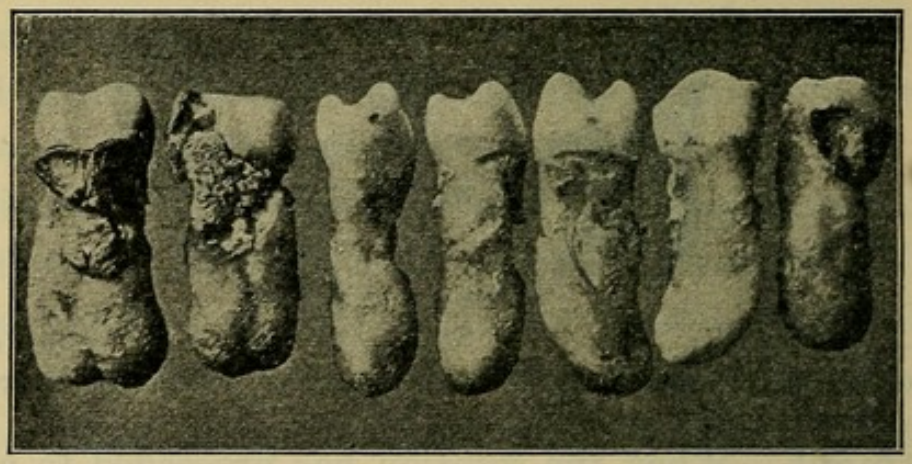


FIG. 19.

in the growth of the structure. The alveolus is in many cases enlarged or absorbed in proportion to the growth of cementum, and the patient experiences little or no inconvenience, but there are often instances where the enlargement of the cementum causes such pressure on nerve filaments as to give more or less discomfort, and sometimes excruciating pain; at times, too, it causes severe facial neuralgia quite remote from the seat of the trouble. It also happens in rare cases that the roots of adjacent teeth in this way become firmly united.

Treatment.—Where it is possible to discover this disease at an early stage, the frequent application of a good counter-irritant, such as tincture of iodine, over the affected root may interfere with its progress. But where the disease has established

itself, the extraction of the affected tooth or teeth is the only available treatment.

DISEASES OF THE HARD DENTAL STRUCTURE.

Dental Caries.

Dental caries is the gradual softening and molecular disintegration of the tooth substance, proceeding from the periphery toward the pulp. It first appears as a chalky, opaque spot in

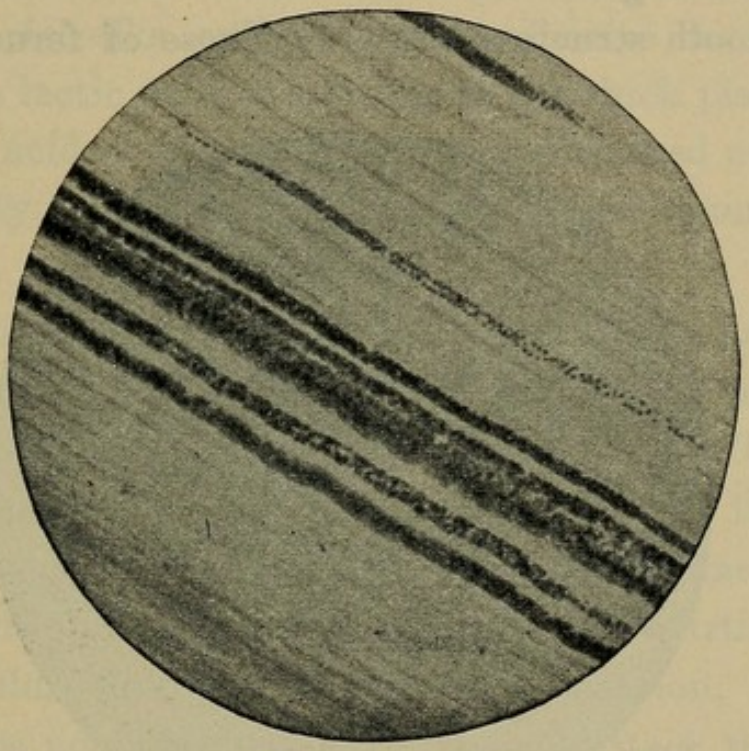


FIG. 20.—PENETRATION OF THE TUBULI BY MICRO-ORGANISMS. (Barrett after Mummery.)

the enamel in which the structure is loosened and gradually broken down.

In studying the causes of any disease they are divided into two general groups, predisposing and exciting. By "predisposing" we mean such causes as render the system or organ liable to attack, yet in themselves are not sufficient to cause the disease. By "exciting" we mean such causes as are actually responsible for the establishment of the disease. The etiology of dental caries will, therefore, be considered both from the predisposing and exciting standpoint.

The exciting cause of dental caries is (1) the action of lactic acid, resulting from fermentation of food debris, which attacks and breaks down the inorganic substance. (2) The destruction of the organic matrix through the solvent action of certain forms of micro-organisms. That is, after the enamel rods have been broken down (decalcified), the tubuli of the exposed area of dentine is invaded by, and forms a habitat for, many varieties of micro-organisms.

The micro-organisms active in the destruction or decalcification of tooth structure are: (1) Those of fermentation—the

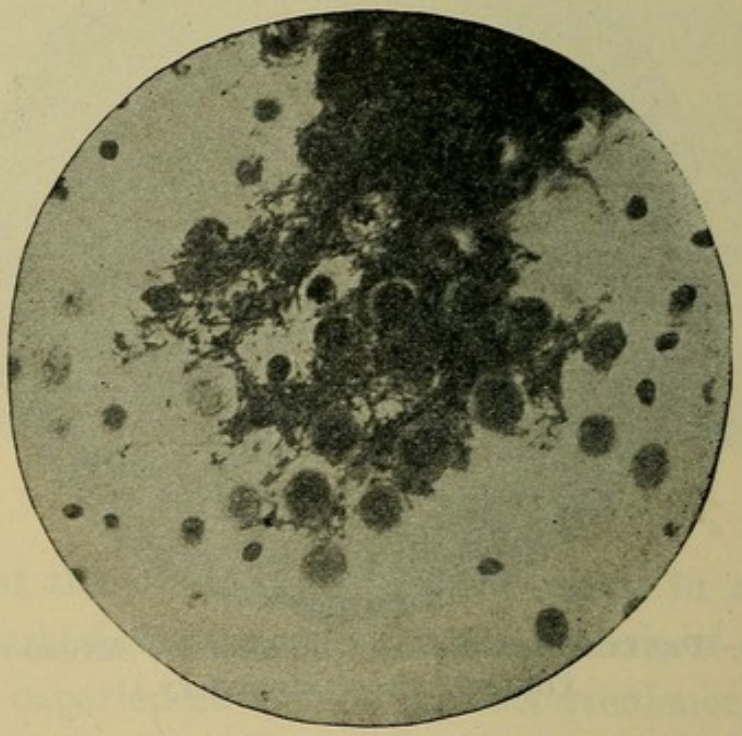


FIG. 21.—CROSS SECTION SHOWING A BREAKING OR MELTING DOWN OF INTERTUBULAR SUBSTANCE. (Barrett after Mummery.)

yeast-plant, a vegetable fungus; (2) those responsible for destruction of the dentine—the bacilli (a cylindrical or rod-like form of bacteria). These micro-organisms do not act directly upon the dentine, but *in the act of their multiplication*—and they multiply in a cavity of decay by the millions,—their product is an acid, which, in its turn, attacks and decalcifies and disorganizes the dentine.

Dental caries then may be accepted as a germ disease, resulting from infection. The germs are propagated and com-

municated to the interior of the tooth first by fermentation of food particles which, lodging between the teeth or in some irregularity of the surface of the enamel. This ferment combined with the moisture and temperature of the mouth, forms an excellent media for the proliferation of low forms of life, and at once becomes infested with certain acid producing fungi.

These germs form lodgment wherever they are not frequently disturbed, it may be in fissures or pits, under clasps of partial plates or ill-fitting crowns, or between the teeth. They form glutinous or felt-like masses, quite adhesive to the enamel, which excrete lactic acid and owing to the thick plaque or mass of fungi this acid is prevented from being washed away and has an opportunity to exert its full solvent action upon the enamel rods.

After decalcification once starts so as to give a depressed and softened area the destructive work progresses more rapidly, proceeding along the line of the enamel rods. The bacteria grow into the spaces formed by the destruction of the interprismatic cement, or the animal portion of the enamel, causing a breaking down and dislodgment of masses of partially decalcified enamel, thus hastening the cavity formation. The organisms, it will be noted, do not in themselves attack the tooth, but their product, lactic acid, being the solvent; they are therefore only indirectly responsible.

When the dentine becomes exposed through the process of caries the tubules at the exposed surface become infested with the bacilli referred to above, which in their multiplication produce or excrete lactic acid resulting in the decalcification, and in time the disorganization of the dentine. This process is shown in Figs. 20 and 21.

The predisposing causes of dental caries are numerous, and are in nearly all cases due to constitutional or systemic disturbances. The character of the structure of the teeth re-

garding both the quality and quantity of the several tissues is an important factor; this is well illustrated by the interglobular spaces frequently met with both in the enamel and dentine. These spaces are the result of some systemic disturbance during the period of calcification of the teeth, and later form weak points, or are predisposing causes of caries. The position of the teeth, too, is often a factor in the frequency of caries in these organs; that is, whether they stand so that all surfaces may be readily cleansed, or very irregularly, presenting numerous surfaces for the lodgment of fermentable substances. The general tone of the system, whether giving to these organs their needed nourishment, or a nerve or blood supply of a sluggish nature, the effects of illness, and the relation of sex also presents certain predisposing characteristics.

Dental Caries During Illness.—In severe illness, several conditions favor dental caries: 1st, the lack of nutrition causes the teeth to be less able to resist destructive influences; 2d, the abnormal acid secretion aids in the destruction of the tooth substance; 3d, fermentation often progresses about the tooth without hindrance, on account of the patient's inability to keep the surface properly cleansed.

During childhood, when the nervous system is in an exalted state, owing to the developmental changes of this period, and frequently from excessive mental strain following too close confinement and over study, we have a disturbance of the nutritive functions and a lowering of the general tone of the system, which must be recognized a predisposing cause of caries.

Dental Caries in Its Relation to Sex.—In the male adult the conditions are more favorable than in the female. The male usually uses his teeth more in mastication, and partakes of sweets less frequently between meals, there being a less desire for saccharine and farinaceous foods. Particles of food collecting about the teeth are readily converted into lactic acid, thus becoming injurious to the tooth substance.

M. Parreidt, in writing upon this subject, says:—

"The female is also at a disadvantage during pregnancy, at which time a large quantity of lime phosphates are essential to the growth of the fetus, and this supply is diverted from the teeth. It is well known that during pregnancy fractures heal less readily, because the lime phosphates are needed for the fetus. If, in a similar manner, the nourishment of the teeth is affected, as during the healing of fractures, one may readily conceive that their power of resistance against unhealthy influences must be materially diminished, and the reactions of the

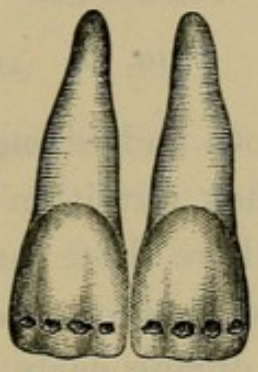


FIG. 22.

oral fluids during pregnancy are not infrequently acid. Finally, in these cases, the reflex disturbances of digestion should be considered also, for the acid eructations are also injurious to the teeth."

Poorly organized or "soft teeth" offer a strong predisposition to dental decay. Careful analyses may show one tooth to contain the same amount of the calcium salts as another, yet owing to the structural organization we may find in applying the burr or chisel, great differences in resistance, similar to that shown in chalk and marble. A tooth poorly organized, therefore, will succumb sooner than the one with a more completely organized structure.

Structural defects in the enamel, without reference to cause, is a predisposing factor in the decay of the tooth. These defects may be too small to be noticed by the operator, yet are of sufficient size to give lodgment to colonies of micro-organisms.

There are, however, other and more apparent defects frequently met with. Nutritive disturbance during the calcification of the teeth has been referred to; if this is the result of a prolonged illness it is apt to produce a line of pits or a groove

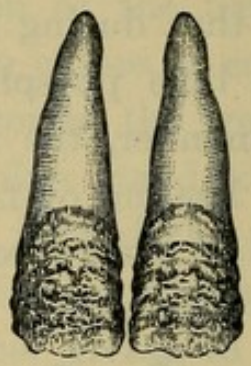


FIG. 23.

across the face of the tooth indicating the point where calcification was progressing when nutrition was disturbed. (Fig. 22.) Cases are also met with where there may be several rows of pits, or a completely roughened surface, indicating repeated seasons of nutritive disturbances during early childhood. (Fig. 23.)

Quite a different malformation of the face and edges of the teeth is that resulting from inherited syphilis. Teeth of this character are, owing to their very irregular surfaces, prone to caries. This effect of inherited syphilis was first called atten-

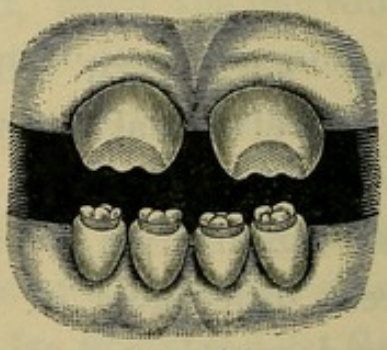


FIG. 24.

tion to by Jonathan Hutchinson, and today the condition is frequently referred to as Hutchinson's teeth.

This condition is illustrated in Fig. 24, which will aid the student in more readily distinguishing between these structural defects.

The proximal surfaces are convenient positions for the lodgment of fermentable substances; in consequence, fully 65 per cent. of the first appearances of caries occur on these surfaces of the teeth. From statistical examinations made by the writer of one hundred thousand permanent teeth, dental caries may be classified in the folowing groups:—

		Per cent.
Superior central incisors,	carious	.144
Inferior " "	"	.006
Superior lateral "	"	.14
Inferior " "	"	.008
Superior cuspids,	"	.07
Inferior "	"	.009
Superior first bicuspids,	"	.10
Inferior " "	"	.05
Superior second bicuspids,	"	.08
Inferior " "	"	.05
Superior first molar,	"	.16
Inferior " "	"	.145
Superior second molar,	"	.11
Inferior " "	"	.12
Superior third "	"	.025
Inferior " "	"	.03

RELATIVE LOCATION OF DENTAL CARIES.

	Approx.	*La.*	*Pal.*	*Mas.*	*Buc.*
Superior central incisors,	.95	.01	.04	..	..
" lateral "	.94	.01	.05	..	..
" cuspids,	.98	.015	.005	..	..
" first bicuspids,	.93	.005	..	.065	..
" second "	.92	.005	..	.075	..
" first molars,	.35	..	..	.61	.04
" second "	.20	..	..	.75	.05
" third "	.04	..	..	.95	.01

	Approx.	*La.*	*Lin.*	*Mas.*	*Buc.*
Inferior central incisors,	.99	.01	..	..	..
" lateral "	.98	.02	..	..	..
" cuspids,	.95	.045	.005	..	..
" first bicuspids,	.91	.01	..	.08	..
" second "	.91	.005	..	.085	..
" first molars,	.30	..	..	.64	.06
" second "	.16	..	..	.78	.06
" third "	.02	..	..	.95	.03

NOTE.—The above tables are made without respect to age or sex.

Therapeutics of Dental Caries.—The most effective treatment of caries consists in the removal of the diseased portions and the proper preparations of the cavity, followed by a well-inserted filling of the least destructible substance compatible to the case in hand. There are exceptional cases, however, where decay does not extend into the dentine—where the tooth may be preserved by removing the diseased parts with a fine stone, diamond disk, or diamond point, and leaving the surface thus treated well polished.

Prophylaxis.—From the time of the eruption of the deciduous teeth the mouth should be kept scrupulously clean. A soft or medium brush and water should be employed daily after each meal, and with a good powder upon rising in the morning and just before retiring at night. Where the teeth are so closely situated that the brush cannot be worked between them, so as to cleanse the proximal surfaces, floss silk or quill toothpicks should be used to remove any particles of food that become lodged between the teeth.

Mouth-washes.—Alkaline mouth-washes, such as milk of magnesia, lime-water, or bicarbonate of soda in solution, are sometimes used; not, however, as a substitute for the tooth brush and dentifrice, but as an adjunct. They temporarily neutralize the oral fluids when of an acid reaction.

Dental Abrasion.

Odontalgia (tooth pain) is not infrequently caused by sensitive dentine on the abraded or worn-down masticating surfaces of the teeth; the enamel covering being removed, irritation is more readily carried to the pulp. If the irritation is very severe, and is continued for a considerable length of time, it may cause *acute inflammation* and lead to the death of the pulp. This condition, however, usually shows itself when there is a strong calcic diathesis. That is, where there is superabundance of lime in the system, making the teeth hard, and some-

times more or less brittle. Owing to this excess of lime, the pulp, in these cases, generally responds to the irritation by throwing out a deposit of secondary dentine proportionate to the advance of the abrasion. Abrasion, as has been indicated, is a mechanical action, and should not be confounded with erosion, which is the result of a chemical action.

Treatment.—Apply to the abraded surface chloride of zinc crystals, or rub the sensitive points with nitrate of silver, and follow, when practicable, by building up the surface with gold; also make application of a counter-irritant and stimulant to the gums about the abraded teeth.

INJURIES AND DISEASES OF THE MAXILLARY BONES.

Fractures of the Lower Jaw.

Fractures of the lower jaw are usually the result of direct violence, such as a kick from a horse, fall from a height upon the face, the unskillful application of the dental "key" and forceps, etc. Professor Pancoast, however, met with a case in which the neck of the bone was fractured by a violent fit of coughing.*

The Most Frequent Location.—Fractures occur most frequently in the neighborhood of the cuspid tooth, this position being determined by the weakness of the bone at this point, in consequence of the depth of the alveoli.

Fractures of the alveolus are frequently unavoidable during the extraction of teeth. The displacement of portions of this bone, however, gives little inconvenience, and hastens the resorptive process; but, should the fracture affect the alveoli of the adjoining teeth, a troublesome exfoliation may follow. Since accidents of this kind are due to the natural conforma-

*Gross' "Surgery."

tion of the parts, legal proceedings against the operator for this mishap are most unjust.

Diagnosis.—fractures of the lower jaw are readily recognized; the regularity of the dental arch is altered, and the mobility of the fractured portions is shown when pressure is applied to the teeth or alveolar process at the site of pain.

Crepitation is discernible during the first week after fracture. Its absence, after this time, is due to formations of granulations and of the partial union of the fractured ends.

The gums, also, are usually lacerated at the point of fracture, accompanied by considerable inflammation and swelling.

Fracture of the ramus of the jaw is less frequent than in the body, and is not so readily diagnosed, as the upper portion cannot be grasped with the fingers, and crepitation is difficult to make out.

Treatment.—The appliances used for the maintenance of the fractured portions in position may be divided into two classes:—

External and internal to the mouth, though it may be, in a few instances, necessary to combine the two methods. The simplest form of apparatus for external use is the ordinary four-tailed bandage or sling, with a split for the chin to rest in. It is made from a piece of muslin, about a yard in length and two or three inches broad; this should have "a slit four inches long cut in the center of it, parallel to, and an inch from, the edge. The end of the bandage should then be split to within a couple of inches of the slit, thus forming a four-tailed bandage, with a hole in the middle. The central slit can be readily adapted to the chin, the narrow portion going in front of the lower lip, and the broader beneath the jaw, and the two tails corresponding to the lower part of the bandage are then to be carried over the top of the head, while the others are crossed over them and tied round the nape of the neck. The ends of the two bandages may then be knotted together" (Heath).

Hamilton has devised a sling for which he claims superiority; we give it in his own words: "The advantage of this dressing over any which I have yet seen consists in its capability to lift the anterior fragment vertically, and at the same time it is in no danger of falling forward and downward upon the forehead. If, as in the case of most other dressings, the occipital stay had its attachment opposite the chin, its effect would be to draw the central fragment backward. By using a firm piece of leather as a maxillary band, and attaching the occipital stay above the ears, this difficulty is completely obviated."

The interdental splint is an apparatus used in common among dentists for an internal appliance in the treatment of fractured maxillæ. It is usually made of vulcanite rubber, and gives very satisfactory results. In 1866, Mr. Gunning, of New York, gave a description of this contrivance as then used by him.*

Method of Making Single Interdental Splint.—Take impression in wax or modeling compound, using as small an amount as will insure a good impression of the teeth and gums. An assistant should stand behind the patient and hold the broken bone as near in place as can be done with any degree of comfort to the patient, while the operator stands directly in front and takes impression. After the casts of both jaws have been secured, they should be carefully articulated. This is done by cutting with a small saw the lower cast at the point or points of fracture, and rearranging the sections thus made, so as to bring the teeth into correct articulation. The pieces should then be secured in this position with plaster-of-Paris, and the two models placed in an articulator. The casts are then covered with No. 60 tinfoil; this makes the cavities in the splint a little larger than the corresponding teeth, making it easily adjusted, and leaves it with a smooth surface. Use two thicknesses of base-plate wax over the tinfoil, allowing it to pass down a trifle

*New York Medical Journal and British Journal of Dental Science.

below the necks of the teeth. Flask and vulcanize in usual manner for rubber work.

When the fracture is of an obstinate vertical nature, a splint that will enclose the teeth and gums of the upper jaw as well as the lower should be used. When the proper treatment is employed, a cure is effected in from six to eight weeks, according to the age and physical condition of the patient.

Fractures of the upper jaw are less frequent and less difficult of treatment than those of the lower jaw. In recent cases a simple replacement of the parts is all that is necessary, and occasionally the application of a simple retention splint is employed.

Angle's Method of Fixation.—A more recent method for treatment of fractures of the maxillæ is that devised by Dr. E. H. Angle. For a detailed description of this method, together with that of the interdental splint, the student is referred to Richardson's "Mechanical Dentistry," seventh edition.

Necrosis of the Jaws.

Necrosis of the jaw is indicated by inflammation, similar to that of dental periostitis. The gum about the affected part is swollen and of a dark-red or purple color, pus oozing from the edge of the gum between the teeth, or through one or more fistulous openings; this discharge is not always confined to the mouth; we find the pus escaping sometimes through an opening on the cheek or neck, as low down at times as the clavicle.

The effect of necrosis of the jaw upon the teeth is obvious, since great pain is produced by the least pressure, and in cases of entire necrosis they become loose and discolored; in the majority of such cases the teeth prove such an annoyance to the patient that they are extracted, if they do not drop out of their own accord.

Treatment.—Remove the dead portions from around the living bone,—here the dental engine and burrs are useful,—

syringe with tepid water and peroxide of hydrogen to cleanse the parts, followed by stimulants, tonics, and nourishing diet.

New bone is produced in the lower jaw if the periosteum is preserved, this with the surrounding tissue being active in producing new bone to take the place of the lost portion.

In the superior maxillary there is a development of fibrous tissue in the young subject. In the adult, nature does not do this much. When a part of the superior maxillary is necrosed, the periosteum ordinarily makes no effort to renew the lost bone. (For an elaboration upon this subject see Heath's "Diseases of the Jaw.")

Dislocation of the Lower Jaw.

The causes of dislocation of the lower jaw are yawning, shouting, vomiting, the introduction of the stomach pump, etc. Sometimes it occurs during operations upon the teeth; in all cases the patient's mouth is opened to its fullest extent. The capsular ligament, being very large and tenacious, is not ruptured.

The manner in which dislocation takes place is as follows: When the mouth is opened to its fullest extent, each condyle of the jaw leaves the true articular eminence of the interarticular fibro-cartilage, which is drawn forward of the external pterygoid muscle. A cavity is thus left behind the condyle; when the jaw is in this position, but very slight force is needed to carry the condyle over the articular eminence, producing a dislocation.

Symptoms of Dislocation.—The mouth is open and the jaw fixed, mastication being impossible, as the lower teeth project beyond those of the upper jaw. Saliva dribbles from the mouth, and speech is indistinct. A careful examination reveals a concavity immediately in front of the ear, and the condyle may be both seen and felt in front of this. The masseter muscle is firmly contracted and very prominent (see Fig. 25).

Treatment.—Reduction is made by placing the thumbs (protected by napkins) as far back upon the molars as possible (see Fig. 26), depressing the back part of the jaw, followed at once by the raising of the chin, which results in sliding the the dislocation the jaws should be secured by a bandage extending under the chin and over the top of the head. The patient capitulum backward into the condyle fossa. After correcting

FIG. 25.—DISLOCATION OF LOWER JAW.—(Bryant.)

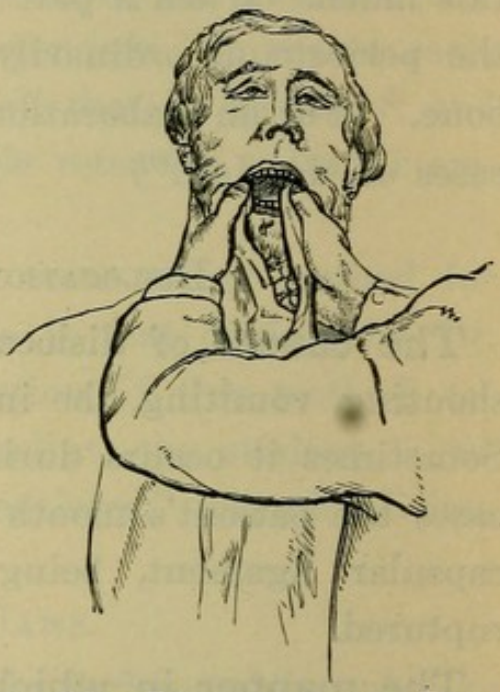


FIG. 26.—REDUCTION OF DISLOCATION OF LOWER JAW.—(Bryant.)

should be recommended to take care, for some weeks, not to open the mouth too far, as a disposition to a recurrence is great.

INFLAMMATION OF THE TEMPORO-MAXILLARY ARTICULATION.

Serious inflammation of the temporo-maxillary articulation is infrequent; when such complaint arises, it is usually found that some derangement of the teeth is the seat of the trouble; however, when by a close examination we find the teeth and their surrounding tissues in an apparently good condition, inflammation of this articulation may be surmised.

Symptoms.—The parts in the vicinity of the joint are sensitive to pressure; they present a swollen appearance and cause considerable pain when the mouth is opened and closed.

Treatment.—First, comparative rest must be given the joint, the patient partaking only of liquid or soft food. An application of some good stimulant, such as tincture of iodine, followed by ice-water compresses, to decrease the heat of the inflamed parts.

Abscess of the Antrum of Highmore.

The Maxillary Sinus or so-called Antrum of Highmore is separated from the apices of the superior molars by a very thin lamella of bone, which is sometimes penetrated by the roots of a tooth; usually the first molar. This sinus or cavity, situated in the body of the superior maxilla is connected with the air passages of the nose through small openings in the sides of this organ. By this portion of the bone being hollow contour is given to the face without adding to the weight of the bone. Its principle value, however, is in giving resonance to the voice; in fact it is sometimes referred to as the sounding chamber of the human voice.

The mucous membrane lining this cavity is continuous with that lining the nose—the Schneiderian membrane. Hence very serious nasal inflammation may through this continuity of tissue, induce antral disorders. Then we may have quite the reverse, nasal inflammation and discharges caused by suppuration in the antrum.

At times, inflammation from alveolar periostitis extends to the mucous membrane of the antrum. Again, abscesses are formed in the antrum by the septic decomposition of the pulp of a tooth the roots of which extend into the cavity, or the accumulation of pus about the apical portion of the root has caused resorption of the floor of the antrum sufficiently to allow the pus to enter this chamber. Fig. 27 shows an alveolar abscess at the root of an upper molar discharging into the Antrum of Highmore.

When this takes place, the natural opening between the antrum and the nose becomes diminished by the swelling of the

lining mucous membrane. Inflammation becomes excessive, and a large collection of pus takes place, which at length escapes into the nose, or burrows alongside of the root of a tooth and discharges into the mouth. Or a fistula may be established upon the cheek; and in protracted cases the floor of the orbit may give way, and pus discharge along the lower eyelid.

Symptoms.—Whatever the source of the antral disease, the phenomena presented are about the same, and are distinctive. The patient complains of a feeling of fullness or pressure, dull,

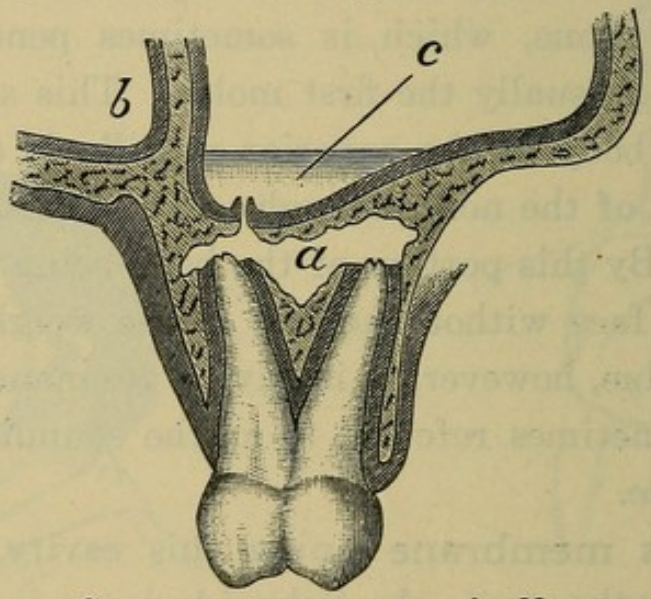


FIG. 27.—a, ABSCESS CAVITY IN THE BONE; b, NOSTRIL; c, PUS IN THE ANTRAL CAVITY.

heavy pains on the affected side of the face, and if the trouble has continued for a considerable length of time, there will be a discharge of pus into the nose, especially while in a recumbent position. This pus is usually accompanied by a bad odor, and at times causes severe local and constitutional suffering. The cheek is hot, flushed, and somewhat swollen; and when the antrum becomes filled with pus, the malar bone is elevated, with an apparent depression beneath it; the palate in severe cases loses its concavity and becomes convex, and the floor of the orbit is pushed up, forcing the eye partly from its normal position.

Treatment.—If it is found that a devitalized pulp is the exciting cause, the tooth being in an otherwise good condition, effort should be made to preserve it. The pulp should be re-

moved, roots cleaned and temporarily filled with some antiseptic dressing.

The antrum should then be opened by penetrating the walls with a suitable drill revolved by the dental engine. After determining the lowest point the parts should be anesthetized with chloride of ethel spray, or the patient may be given nitrous oxide of gas. The drill then being revolved rapidly will enter in a few seconds. In selecting the drill for this purpose one giving an entrance large enough to admit the nozzle of a good-sized rubber syringe should be employed.

Good drainage having been secured, the cavity should be washed with warm water to which a little salt has been added. The nozzle of the syringe is carefully placed in the opening until it reaches the antrum when firm and steady pressure will throw the contents into the cavity. The syringe should be quickly withdrawn so that the operator's hands will not interfere with free drainage through the nose. This may be repeated until the cavity is quite clean, when it may be followed with water containing a little peroxide of hydrogen. Full strength peroxide of hydrogen, or even 50 per cent., would cause severe pain owing to the violent foaming in a pent-up cavity.

The opening may be maintained for treatment by the insertion of a platinum drainage tube or a plug of some nature. This treatment should be renewed every second day for a short time, then gradually decreased as the case demands.

In instances where the condition of the tooth at fault is such as not to warrant an effort to save it, the tooth should be extracted and the antrum entered through one of the root sockets. Where there are complications, such as serious necrosis the case had best go to the general or oral surgeon.

DEFECTS OF THE PALATINE ORGANS.

Cleft Palate.—One of the most distressing deformities to which the human frame is liable is that defective condition of the palatine organs known as Cleft Palate.

It is indicated by a fissure extending through the soft, or both the soft and hard, palate, causing an impairment of mastication, of deglutition, and of speech. They are divided into two classes—Acquired (by accident or disease), and Congenital (dating from birth).

Congenital cleft palate is the result of a lack of development of the maxillary bones, which may be caused by hereditary disease, or malformation from lack of nourishment of the tissues involved during embryonic life.*

These defects are sometimes accompanied by more or less deformity of the alveolar arch and of the teeth, which are usually of a soft texture, with imperfectly developed roots. The cleft is not always confined to the palate bones and the soft palate, but may be complicated with complete fissure of the alveolar process and with harelip.

Acquired cleft palate includes all losses of tissue in either soft or hard palate that are not congenital, whether occasioned by disease or accident. The faculty of distinct articulate speech is impaired, and deglutition is performed with much inconvenience; acquired lesions coming generally in adult life, the individual has not the advantage of the training of the parts during infancy, as in cases of congenital defects.

The infant resorts to a very curious expedient to secure the nourishment necessary for subsistence and growth. The nipple, instead of being taken between the tongue, upper lip, and gum, is taken between the lower surface of the tongue, and the lower lip and gum. This habit being acquired, it is applied later in the mastication of solid food. The food being conveyed between the tongue and movable floor, is brought back between the teeth for deglutition, which is usually performed in this way without any food entering the nose through the cleft palate.

Treatment.—The remedy for these deformities must be the closing of the passage in such a way as to restore, as far as

*See article on "Physiology of Voice and Speech," "American System of Dentistry," Vol. III.

possible, to the organs, their functions. This may be done by a surgical operation or by the insertion of an artificial palate.

Staphylorrhaphy.

The surgical operation sometimes resorted to is an exceedingly painful one for the patient and difficult for the operator, and which, after all, often proves a failure. Indeed, it is claimed by some writers that failures of closure in these operations are in the majority. However this may be, there are many cases on record where such operations have been performed with a marked degree of success.

Staphylorrhaphy is derived from a Greek word signifying suture of the uvula. It consists in freshening or paring the edges of the palate and passing ligatures or sutures through, drawing the edges together, and closing the gap by tying the sutures.*

It is claimed that the idea of this operation was first conceived by one Le Monnier, an ingenious French dentist, and was successfully performed by him as early as 1764. It does not seem to have been recognized by the medical profession, however, for more than half a century afterward; it was then, in 1820, practiced by M. Roux, in France, and in America by Dr. J. C. Warren, of Boston.

Dr. Warren's methods were considered simpler, and his operations are generally regarded as the basis of the various modifications that have since aided in perfecting the procedure, and it is now classed among the regular operations of surgery.

Artificial Palates.

Artificial palates, according to some writers, were employed by the Greek physicians, but the first description was given by the celebrated French surgeon, Ambrose Paré, in the early part of the sixteenth century. Many improvements upon

*For full treatment of this operation see "American System of Dentistry," Vol. III.

these primitive forms have been made. They are divided into two distinct classes—obturators and artificial velum.*

An obturator is a non-elastic and stationary cover or stopper for those defects in the hard or soft palate which have a complete and well defined boundary.

An artificial velum† is a movable valve, made to supply the loss of the posterior soft palate; being under the control of the surrounding muscles, opening or closing the passage at will.

EXTRACTION OF TEETH.

The extraction of teeth is an operation that need seldom be resorted to. It is, in nearly all cases, from negligence of the patients or their fear of dental operations that the teeth are permitted to remain in diseased conditions until they reach such a state that extraction is necessary. It is not surprising that the operation is usually approached with apprehension, since frequent accidents occur in its performance; this, however, is generally due to the neglect, awkwardness, or unskilfulness of the operator. It very often occurs in the hands of medical practitioners, and is a subject that should receive more attention from physicians, by whom, though not belonging to their province, it is frequently performed.

Indications Justifying the Operation.—*First,* with the teeth of first dentition, it is sufficient to state that when a tooth of replacement is about to be erupted, or has actually made its appearance, either in front or behind the corresponding deciduous tooth, the latter should at once be extracted; and when these teeth have been so neglected that they, together with the surrounding tissue, have become seriously diseased, it is best that they should be removed. It is desirable, however, whenever they can be retained in a fair state of health, to do so, retaining the shape of the arch until it is time for their successors to replace

*See Richardson's "Mechanical Dentistry," seventh edition.

†Velum: a veil, a cover; hence, "a pendulous veil of the palate."

them, as well as giving the child their service in mastication.

Second. In regard to the propriety of extracting the permanent teeth, it should first be stated that none of these should be sacrificed unless called for by some urgent necessity. Uncontrollable pain and incurable disease surrounding the tooth are instances.

Third. Extensive loss of surrounding tissue, leaving the tooth or root very much loosened, acting as in irritant and becoming a source of disease to the adjacent parts.

Fourth. Where a tooth is the cause of an incurable alveolar abscess, the offending member should not be allowed to remain; such cases, however, are rare.

Fifth. To prevent or correct irregularity in the arrangement of the teeth.

Sixth. In preparing the mouth for an artificial denture it is sometimes found that the loss of one or more remaining teeth may be advantageous.

There are other cases presented at times, to which fixed rules would not be applicable, where experienced judgment must determine the practice to pursue.

In conclusion, it is scarcely necessary to say that whenever a tooth can be restored to a healthy condition it should always be done, and that we should not for any reason be too hasty in extracting the first tooth from an unbroken arch. As all teeth, except the central incisors and upper third molars, have normally two antagonists in articulation, the loss of one tooth would place two others partially without function, and the adjoining teeth would soon become irregular by gradually leaning into the spaces.

Hemorrhage after Extraction.—*In cases where extraction is followed by excessive hemorrhage,* or where the tendency to hemorrhage exists, the application of some reliable styptic should be made, the following being the most powerful of these agents: tannic acid, solution of persulphate of iron, and the powdered sulphate of iron (Monsel's powder), or adrenalin.

Some of the simple local remedies are spider web or a pledget of cotton or sponge saturated with sandarach varnish as *mechanical obstructors;* this packing should be allowed to remain until all danger of a return is past.

DEPOSITS UPON THE TEETH.

The simplest form of deposit upon the teeth is the white, soft accumulations which are frequently found just at the gum margins. It is composed of partially fermented food débris, mucous and micro-organisms. These organisms are without doubt acid producers, though slower in action than those involved in caries, as when this deposit is allowed to remain for a considerable length of time, the enamel surface immediately beneath it will be found to be decalcified.

Green stain, more frequently found in the mouths of children, is another form of soft deposit, composed of certain forms of chromogenic (color producing) bacteria, intermixed more or less with a growth of leptothrix buccalis.

This fungus, as it grows, attaches itself to roughened surfaces of the enamel, or to surfaces not kept scrupulously clean and polished. Some claim that its attachment and action simply involves the so-called Nasmyth's membrane, but clinical experience would indicate that where it is allowed to remain for a long while it has a solvent action upon the tooth, as the enamel directly beneath it will be more or less roughened from decalcification.

While these deposits are called green stain, there are several gradations of color, which is caused by the color forming bacteria. In older persons it is more nearly black or bronze in color. These deposits are readily removed with disks, and a revolving brush and pumice. After its removal any eroded surface of enamel should be dressed down and polished.

There are two varieties of calculus, or tartar, as it is most commonly called, found upon the teeth; namely, salivary and serumal or sanguinary.

Salivary calculus is deposited from the saliva upon the crowns or any exposed surfaces of the teeth. It varies in color from a light cream to a dark brown or black, depending upon its age and the habits and general health of the patient. The characteristics of the substance, therefore, furnish diagnoses of importance to the physician and dentist.

Composition.—Salivary calculus is composed of mineral and animal matter; about 75 and 25 per cent. respectively. Phosphate of lime, and in some cases a little magnesia, carbonate of lime, mucus, and a small quantity of animal fat, are its principal ingredients. The relative proportions of its constituents very according to its density. A fair average is expressed in the following table:

Calcium phosphate, ...	65
Calcium carbonate, ...	8
Ferric phosphate, ...	2
Organic matter, leptothrix, mucus, etc., . .	25

All persons are subject to salivary calculus to a greater or less extent, but its physicial characteristics are exceedingly variable. Hence it is that analyses made of it by different chemists differ.

Origin and Deposition.—It is generally conceded that this concretion is a deposit, chiefly from the saliva, with an admixture of mucus.

Saliva is the mixed fluid from the different salivary glands and mucous follicles, and in its normal state is either alkaline or neutral. On exposure to the atmosphere, and the decomposition liable to occur in the mouth, it may be found strongly acid or strongly alkaline, holding salts of lime in solution. On the formation of acids in the mouth, and by the action of the carbonic acid exhaled,* decomposition takes place, and the salts

*_Carbonic acid_ having a strong affinity for lime, unites with it in the salivary solution, forming carbonate of lime.

of lime are deposited upon the teeth. Naturally, it is precipitated in great quantities upon the surfaces of the teeth opposite the ducts from which the saliva is emptied, upon the lingual surfaces of the inferior incisors and cuspids (opposite Wharton's duct), and the buccal surfaces of the superior molars, in the region of the mouth of the duct of Steno. The necks of the teeth about the free margins of the gum afford favorable points for its collection. A nucleus once being formed, it deposits particle by particle, rapidly encroaching upon the crown, where it is deposited more abundantly. In the mouths of uncleanly persons it sometimes accumulates in such quantities that nearly all the teeth are encrusted; and sometimes several of the teeth become bound together in one mass.

Salivary calculus is not deposited upon the soft tissues, but upon some substance that forms nuclei, such as the natural and artificial teeth, plates, etc.; though it is found sometimes in the ducts of the salivary glands, owing, no doubt, to a sluggish condition of the saliva. It has no special pathological significance further than its being a mechanical irritant to the gum tissue and alveolar process and interferes with the hygienic care of the mouth.

Treatment.—The removal of salivary calculus is an operation of importance to the health of the gums and alveolar process, and the preservation of the teeth. For its removal, instruments (scalers) that may be readily applied to every part of the tooth should be employed. Considerable tact and practice are necessary to perform the operation skillfully. The scaler should be passed well down beneath the margin of the gums—that is, below the edge of the deposit—until it is brought in contact with the surface of the tooth, and the mass scaled off in the direction of the cutting or masticating surface. Every particle of the deposit should be removed, care being necessary that the tooth substance is not roughened by the edge of the instruments, and the surface polished, lest nuclei for immediate reaccumulation be left.

Chemical agents are employed by some for the removal of salivary calculus. This should be scrupulously avoided, as any acid capable of dissolving this accumulation is more or less injurious to the teeth. "Their careless administration by physicians is a fruitful source of injury to the teeth, and they certainly should form no part of any dentifrice, or be in any way used for the removal of stains of any kind from the teeth." (Harris.)

Salivary calculi are concretions sometimes found in the ducts above referred to. These deposits are formed in concentric layers, are more or less irregular in shape and vary in color from a light yellow to brown. These calculi do not contain the mucus and leptothrix found in the ordinary calculus of the mouth, having about the following composition:

Calcium phosphate, ...	75.0
Calcium carbonate, ...	12.5
Organic matter, ...	12.5

Sanguinary calculus is deposited upon the roots of the teeth, and not upon their crowns, as with salivary calculus. It is precipitated from the liquor sanguinis of the blood, following hyperemia, which may be caused by any local irritation. It is in the form of dark granulations, approaching crystallization. It is much harder than salivary calculus, and adheres more firmly. The attachment is so close sometimes, as to practically make it necessary to chisel it away.

Composition.—Sanguinary calculus is composed chiefly of lime salts, colored with the hæmatin of the blood, which increases its tendency to take crystalline form.

It should be remembered that while salivary calculus causes inflammation, sanguinary calculus is a result of the inflammatory action.

It is, however, in itself distinctly irritating to surrounding tissues, and local inflammatory troubles cannot be controlled until this deposit is thoroughly removed.

DENTAL MEDICINE.

Dental materia medica is an embodiment of the nature, medicinal properties, and therapeutical action, of all substances used as medicine in dental practice.

The classification of medicines is made according to their action upon the animal economy.

The different classes in common use by dentists are as follows: Narcotics and hypnotics, analgesics or anodynes, anesthetics, stimulants, tonics, sedatives, antipyretics, irritants, astringents, styptics, and hæmostatics, caustics, escharotics, antizymotics, or antiseptics, and disinfectants and laxatives.

NARCOTICS AND HYPNOTICS.

Narcotics (stupor) are medicinal substances which, by impairing or destroying nervous action, lessen the relationship of the individual to the external world. They at first, however, have a stimulating effect, to which their therapeutic efficacy is largely due, which is followed by profound sleep and stupor. If the dose be sufficient, death will ensue by paralysis of the centres of the medulla, which govern respiration and the other functions of organic life.

Hypnotics (sleep) belong to the class of narcotics, but are capable of causing sleep without any preliminary cerebral excitement, by bringing the brain into a favorable condition for it.

The principal narcotics are opium (see Anodynes), alcohol (see Stimulants), belladonna (see Anodynes), chloroform, ether (see Anesthetics), etc.

The hypnotics are opium, the bromides, chloral, etc. When administered to relieve pain, they are termed anodynes.

Bromine, Br.—Bromides.

Derivation.—Bromine is obtained from sea-water and certain saline springs.

Properties.—Bromine is a dark brownish-red, liquid, non-metallic element. It has an offensive, suffocating odor, somewhat resembling chlorine and iodine. In its pure state it is an active escharotic and internally a violent poison. The salts of bromine are cerebral and cardiac depressants and are highly valued as hypnotics.

The Principal Preparations:

Ammonium Bromide, NH_4Br.—Colorless, prismatic crystal. Dose, gr. v-xx.

Calcium Bromide, $CaBr_2$.—A white, granular, deliquescent salt. Dose, gr. v-ʒj.

Lithium Bromide, LiBr.—A white, granular, deliquescent salt. Dose, gr. v-xx.

Potassium Bromide, KBr.—Colorless, cubical crystals. Dose, gr. v-ʒj.

Sodium Bromide, NaBr.—Colorless, monoclinic crystals. Dose, gr. v-ʒj.

Zinc Bromide, $ZnBr_2$.—A white, granular, deliquescent powder. Dose, gr. ss-ij.

Syrup of Bromide of Iron.—Contains 10 per cent. of ferrous bromide, $FeBr_2$. Dose, ʒss-j.

Therapeutic Uses.—The bromides are used as sedatives to the nervous system to produce sleep, and in affections of the heart or cerebrum, when shown by increased action, in neuralgia, spasmodic cough, etc.

Dental Uses.—Bromide of potassium is a useful remedy in convulsions from the irritation of dentition, in neuralgia, also in cases of extreme sensitiveness of the soft palate. Dose, gr. 10-20 every hour for several hours before taking impression.

Chloral, C_2HCl_3O.

Derivation.—Chloral is obtained by the action of chlorine gas on absolute alcohol. It is a colorless, unstable, oily fluid, which readily combines with water and forms *chloral hydrate,* the official "chloral" having the formula $C_2HCl_3OH_2O$.

Properties and Actions.—The official body, chloral hydrate, is in the form of a white, crystalline substance, having a pungent odor and taste, and is soluble in water, alcohol, and glycerine.

It is hypnotic, antispasmodic, and to a limited degree anesthetic. It is serviceable in fevers, accompanied by cerebral excitement, convulsions, delirium tremens, etc. Dose, from gr. v to gr. xxx. Liebreich claims to have produced profound sleep, lasting from five to fifteen hours, with twenty-five to thirty grains.

The hypnotic action is preceded by a stage of excitement of short duration, which is followed by sudden calm and refreshing sleep, from which the patient can be easily aroused to partake of nourishment and will readily fall asleep again—differing in this respect from narcotism, which is marked by profound stupor.

Dental Use.—Hydrate of chloral is sometimes used in dental practice for the relief of odontalgia from pulpitis, from one-half to one grain being applied to the inflamed body. It has also been thought a serviceable agent by some in the treatment of putrescent pulp-canals, and as a stimulant and antiseptic injection in chronic alveolar abscesses.

ANALGESICS OR ANODYNES.

Anodynes are agents which are capable of relieving pain. They are divided into two classes, general and local.

General anodynes, when taken internally, affect the whole organism, by depressing the cerebral centers of perception and sensation.

Local anodynes, when applied, affect the parts either by impairing the conductivity of the sensory nerve-fibres, or by reducing the local circulation. Some of the most efficient anodynes act either general or local. The principal agents of this class are as follows:—

General Anodynes.—Opium, morphia, belladonna, aconite, ether, and chloroform (see Anæsthetics).

Local Anodynes.—Opium, belladonna, carbolic acid (see Escharotics), cocaine (see Anæsthetics), aconite, etc.

Opium.

Source.—Opium is obtained from the white poppy, an annual herb grown in Asia Minor.

Nature.—It is a gummy exudation which follows the incising of the unripe capsules. It should yield not less than nine per cent. of morphine when in its normal moist condition.

Opium contains seventeen alkaloids, the most important of these being *morphine*—dose, gr. $^1/_{20}$-½—hypnotic, narcotic, and anodyne.

Principal Preparations of Opium:—

Pulvis opii, powdered opium. Dose, gr. $^1/_6$-ij.

Tinctura opii, (laudanum), composed of powdered opium, oz. iiss; and diluted alcohol, oj (pint). Dose, ♏xij, or 25 drops, equivalent to 1 gr. of opium.

Tincture opii camphorata (camphorated tincture of opium, paregoric) is prepared by macerating "sixty grains of opium in two pints of diluted alcohol, with sixty grains of benzoic acid, a fluidrachm of oil of anise, two ounces of clarified honey, and forty grains of camphor." Dose, f℥j-f℥j. Dose for infant, v to xx drops (gtt.)-℥ss. contains about gr. j. It therefore contains $^1/_{20}$ the strength of the tincture.

Pulvis ipecacuanhæ et opii (Dover's powder), composed of ipecac 1 part, opium 1 part, sugar of milk 8 parts, triturated to a fine powder. Dose, gr. v to gr. xv.

Belladonna.

(*Deadly Nightshade.*)

Source and Composition.—It is an European plant, the leaves and root being the medicinal portions. It contains two alkaloids—atropine, the active principle, and belladonnine.

Preparations of Belladonna. From the leaves:—

Tincture of Belladonna.—Dose, ℥j-℥ss.

Extract of Belladonna.—Dose, gr. ¼-½.

From the root:—

Abstract of Belladonna (powdered).—Dose, gr. ⅛-½.

Fluid Extract of Belladonna.—Dose, ℥j-v.

Sulphate of Atropine.—Dose, gr. $^{1}/_{100}$-$^{1}/_{60}$.

Therapeutics.—Belladonna is especially useful in the pain of inflammation, particularly that of rheumatism, neuralgia, etc., and is used locally in connection with morphine to relieve the pain of abscesses, boils, etc.

Atropine is used by ophthalmologists to lessen pain, dilate the pupils, paralyze the accommodation, etc.

Aconite.

Source and Composition.—It is obtained from the tuberous root of *Aconitum napellus,* a perennial plant, found in the mountainous regions of Europe and Asia. The leaves are sometimes used, but the root makes the most powerful drug.

The active principle is the alkaloid aconitine, a sedative poison.

Principal preparations:—

Extract of Aconite.—Dose, gr. ½-j.

Fluid Extract of Aconite.—Dose, ℥¼-ij.

Tincture Aconite.—Dose, ℥ss-iv.

Medical Properties and Action.—Aconite is a powerful sedative to the nervous system. In large doses it acts as a cardiac, respiratory, and spinal depressant.

It proves fatal in poisonous doses by paralyzing the heart and respiration. It is also diaphoretic and antipyretic.

Dental Therapeutics.—Aconite, in the form of a tincture, is administered in inflammatory affections and in chronic cases of neuralgia. It is an active antagonizer of the fever process, and has been termed the "therapeutic lancet."

When applied locally, it checks inflammation in its first stages, by paralyzing the peripheral ends of the nerves in the parts, and favoring resolution; also limits the extent of an abscess where pus has already formed.

In combination with the tincture of iodine, in equal parts, it acts very promptly in the incipient stages of dental periostitis, relieving the inflammation, retarding the circulation, and stimulating lymphatic action.

In such cases the gum over the affected tooth should be thoroughly dried and then painted with this combination, protecting the lip or cheek until the remedy is absorbed. It is also considered useful by many in the dressing of pulp canals, preventing the formation of inflammatory products. When applied to a large surface, or where the skin is abraded, care should be exercised, or dangerous constitutional effects may result.

The physiological antagonists are atropine, morphine, digitalis, and ammonia. *In aconite poisoning* the stomach should be evacuated, stimulants administered, warmth applied to the extremities, and the recumbent position maintained.

ANESTHETICS.

Anesthetics are agents which temporarily destroy sensation and relieve pain. They are employed for this purpose during surgical operations, to relieve severe neuralgia and other pain, and are sometimes used to relax the muscular system in case of spasms. They are divided into two groups: general and local.

General anesthetics are volatile substances, capable of producing (when inhaled) complete unconsciousness, loss of sensi-

bility, and lessened motor power. When complete, general anesthesia includes muscular relaxation.

Partial Anesthesia is sometimes employed where only the loss of conscious sensation is desired. Here only the cerebrum is controlled; the reflex centers of the spinal cord are still sensible. This is easily demonstrated by the muscular activity whenever a sensory nerve is irritated.

Full anesthesia, or surgical anesthesia, is where both the cerebral cortex and the reflex centers of the spinal cord are paralyzed. Happily the centers of consciousness are first affected, and those of respiration and circulation, which are so essential to life, last.

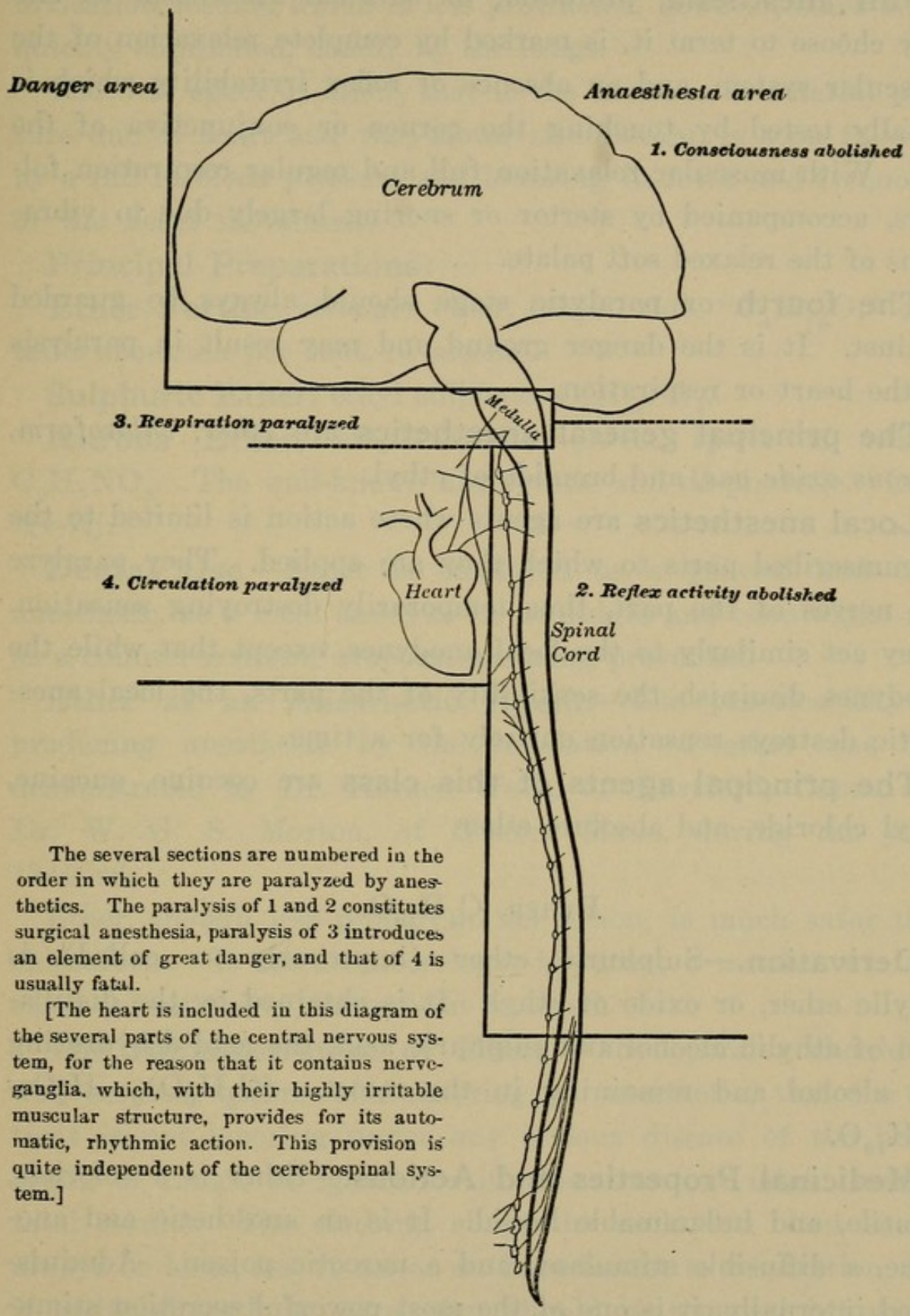
The accompanying diagram from Long's Materia Medica and Therapeutics, shows very clearly a division of the central nervous system, numbered in the order as paralyzed by anesthetics. It is now accepted that anesthetics produce their essential effects by a direct action upon these nerve centers.

Stages of anesthesia may be divided into the following four distinct divisions:

(1) Stimulation.
(2) Primary anesthesia.
(3) Full anesthesia.
(4) Paralysis.

The phenomena of each stage follow each other in apparent sequence and are readily distinguished. The most significant associated with the first stage is general functional excitation. The early action upon the cerebrum producing disturbed nerve function, such as laughing or crying, incoherent talking, uncontrolled muscular movements, holding the breath, etc.

The second stage or primary anesthesia is manifest by the abolition of conscious sensation of pain, though there may be marked reflex irritability, and respiration may be interrupted by spasms or rigidity of the respiratory muscles. Surgical operations should not be undertaken during this stage owing to the dangers of reflex impressions upon the vital ganglia.



The several sections are numbered in the order in which they are paralyzed by anesthetics. The paralysis of 1 and 2 constitutes surgical anesthesia, paralysis of 3 introduces an element of great danger, and that of 4 is usually fatal.

[The heart is included in this diagram of the several parts of the central nervous system, for the reason that it contains nerve-ganglia, which, with their highly irritable muscular structure, provides for its automatic, rhythmic action. This provision is quite independent of the cerebrospinal system.]

FIG. 28.

Full anesthesia, profound, or surgical anesthesia as one may choose to term it, is marked by complete relaxation of the muscular system, and an absence of reflex irritability which is usually tested by touching the cornea or conjunctiva of the eye. With muscular relaxation full and regular respiration follows, accompanied by stertor or snoring largely due to vibrations of the relaxed soft palate.

The fourth or paralytic stage should always be guarded against. It is the danger ground and may result in paralysis of the heart or respiration.

The principal general anesthetics are *ether, chloroform, nitrous oxide gas,* and bromide of ethyl.

Local anesthetics are agents whose action is limited to the circumscribed parts to which they are applied. They paralyze the nerves of the part, thus temporarily destroying sensation. They act similarly to the local anodynes, except that while the anodynes diminish the sensibility of the parts, the local anesthetic destroys sensation entirely for a time.

The principal agents of this class are cocaine, eucaine, ethyl chloride, and absolute ether.

Ether, $C_4H_{10}O$.

Derivation.—Sulphuric ether (improperly so called) is ethylic ether, or oxide of ethyl. It is obtained by the distillation of ethylic alcohol and sulphuric acid, the acid dehydrating the alcohol and remaining in the retort. $(C_2H_6O)_2—H_2O= C_4H_{10}O$.

Medicinal Properties and Actions.—Ether is a colorless, volatile, and inflammable liquid. It is an anesthetic and anodyne, a diffusible stimulant, and a narcotic poison. Administered internally, it is one of the most powerful secretion stimulants known. The action of the heart, and hence the circulation is increased, flushing and warmth of the surface soon follow. The senses are more keen, and the phenomenon of alcoholic in-

toxication results, which is less protracted, however, ether being quickly eliminated, chiefly by the lungs.

The first effect of ether, that is the increase in arterial pressure due to heart and vaso-motor stimulation, is soon followed by a fall in blood pressure and lowering in force and frequency of the heart movements.

Principal Preparations:—

Ether Fortior, stronger ether, ethyl oxide, "$C_4H_{10}O$," contains about six per cent. of alcohol.

Sulphuric Ether, ethyl sulphate, $C_4H_{10}SO_4$.

Nitrous Ether, ethyl nitrite (sweet spirit of nitre), $C_2H_5NO_2$. The well-known antipyretic and diaphoretic. Dose, ℥v-℥ij.

Dental Use.—Ether is employed as a general and local anesthetic, as a local anodyne in neuralgia and odontalgia, and as a counter-irritant, evaporation being prevented.

Ether as an Anesthetic Agent.—The practicability of producing anesthesia by the inhalation of ether was first demonstrated by Dr. Horace Wells, of Hartford, Conn., and Dr. W. G. S. Morton, of Boston, Mass., during the years 1844-'46.

Ether, though less prompt in its action, is much safer than chloroform. It has its necrology, however; a number of fatal cases (about thirty) have been reported.

The Administration of Ether.—The operator should be well assured, before administering an anesthetic, that the patient is not laboring under any serious disease of the heart, brain, or lungs, as ignorance in this direction might lead to fatal results. The clothing about the neck and chest should always be loose, lest it act as an impediment to respiration, and if artificial teeth be worn, they should be removed before the administration of the anesthetic.

For the inhalation of ether and chloroform a number of instruments have been devised, but the simplest and probably

the best method is from a sponge, napkin, or handkerchief, placed within a cone, formed of a towel or stiff paper, with a small opening at the apex for the admission of air; or a small piece of lint can be held in the palm of the hand and on these pour the anesthetic agent.

The inhalation should be commenced cautiously, the patient should be directed to breathe quite naturally, and to obey any instructions given, as the rasing of the hand, etc. The towel or napkin should be held six inches from the patient's face, aproaching it gradually, thus overcoming the irritating effect and a sense of strangulation, which follow when the agent is placed at once to the mouth and nostrils.

Action of Ether.—The first stage of anesthesia is stimulant, the second is tetanic or convulsive, the third, complete relaxation.

During complete anesthesia the face is cool, there being a profuse perspiration; the eyes are closed, insensible to the touch, and the pupils are somewhat contracted. The respiration and pulse are somewhat slower than normal, as shown in the following table:—

Normal pulse, 72 a minute.

Pulse on administration of ether:—

1st min.	2d min.	3d min.	4th min.	5th min.
92	109	110	94	69

Normal respiratory movements average about 20 a minute.

Respiration on administration of ether:—

1st min.	2d min.	3d min.	4th min.	5th min.
23	24	26	18	15

Order in Which Nerve Centers Are Acted Upon.—First, the cerebrum; second, cerebellum; third, the spinal cord, fourth, the medulla oblongata.

The Quantity of Ether Required.—Largest quantity, 9 ozs.; minimum, 2½ ozs.; average quantity to produce anesthesia, 5 ozs.

The Time Required for Full Anesthesia.—Longest time required, 24 minutes; shortest time, 3½ minutes; average time, 8 minutes.

The Dangers of Anesthesia.—There are conditions rendering general anesthesia dangerous, and the practitioner, whether medical or dental, should be well assured, before administering ether or chloroform, that none of these are present. They are fatty degeneration of the heart, valvular lesions, kidney disease, brain tumors, respiratory obstructions from enlarged tonsils, thoracic tumors or aneurism, and chronic alcoholism. It should be born in mind that ether is irritant to the air passages and kidneys, lessening the elimination power of the latter. An anesthetic should never be administered on a full stomach, as sickness would likely follow that would interfere with the operation, and anesthesia of the glottis prevents the expulsion of vomited matter in case it enters the larynx by regurgitation; neither should it be given after long fasting, as an absence of nutrition would tend toward cardiac paralysis; excitement should be avoided, instruments should be kept out of sight, and too many spectators should not be present. A painful operation should not be commenced before the stage of complete anesthesia is reached, or it may cause death from shock, as the result of peripheral irritation.

Treatment of Dangerous Symptoms.—In case of the suspension of the heart's action, the agent should be withdrawn, the body placed in a reclining position, and, if need be, inverted, and air freely admitted. The failure of respiration requires the drawing forward of the tongue, by a finger being thrust deeply into the mouth; the inhalation of a good stimulant, nitrite of amyl, gtt. ij to gtt. v; but care is necessary in its use, and not more than two or three drops should be administered to patients

who have never inhaled it. The inhalation of ammonia is possibly as efficient, and can be used with more freedom than nitrite of amyl. Galvanism, too, has been successfully employed as a cardiac and respiratory stimulant, "the positive pole being placed to the nostril and the negative pole over the diaphragm, to excite a reflex action between the fifth pair and the pneumogastric, or the poles may be applied directly over both phrenic nerves, or on a line with the fourth cervical vertebra, in order to stimulate respirations; or one pole may be placed over the upper dorsal spinous process and the other pole over the apex of the heart, to induce cardiac contraction."* And if necessary, artificial respiration should be employed (see Appendix) and warmth applied. The extremities should also be rubbed briskly, rubbing upward.

NOTE.—It should be remembered that ether vapor is heavier than air, and forms therewith a highly explosive mixture. Therefore, if a light must be in the room, it should be high above the patient. A grate fire, gas stove, etc., in the vicinity are very dangerous.

CHLOROFORM, $CHCl_3$.

Derivation.—Chloroform (Ter-chloride of Methyl, or Methylic Ether) is obtained by distilling alcohol with chlorinated lime. It was discovered in 1831, by Samuel Guthrie, of Sackett's Harbor, N. Y.

The form for medicinal use is Chloroformum Purificatum, or Purified Chloroform.

Medicinal Properties and Action.—When inhaled, chloroform is an anesthetic, and when administered internally, it is an anodyne and antispasmodic. If swallowed undiluted, it excites great inflammation of the mucous membrane and causes violent gastritis.

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*Gorgas' "Dental Medicine."

Its effects are similar to those of ether, but more rapidly produced, and it is more powerful in its action; hence requiring more care in its administration.

When first administered (internally) it causes a feeling of warmth in the stomach, which is soon followed by a sense of coldness. It increases the action of the heart, producing excitement of the brain, followed by depression and deep, heavy sleep. In large doses it causes stupor and insensibility, and has caused death.

Therapeutic Uses.—Chloroform is used for the same purposes as is ether, and is much employed locally in liniments. Administered by inhalation, it is a general anesthetic, and when administered internally, in substance, it is an anodyne and antispasmodic, and is used as such in cases of nausea, sea sickness, sick headache, and in cases of cholera. In the last named it has probably proven more efficacious than any other single remedy. Dose, ♏j-℥ss, diluted, internally.

Spirit of chloroform (chloroform, ℥j; diluted alcohol, ℥ij), ℥ss-℥j.

For inhalation, ℥j-℥j. Average, ℥iij.

Dental Use.—Chloroform is employed by some in dental practice as a general anesthetic; its use, however, is growing less every year, in favor of ether and nitrous oxide gas. It is also used as a local anesthetic; in this case it is generally combined with other substances, as aconite, alcohol, ether, opium, etc.

For administration as an anesthetic, treatment of dangerous symptoms, etc., see Ether.

Chloroform Narcosis.—

Shortest time,	2 minutes	30	seconds.
Longest time,	14 "	30	"
Average time,	6 "	24	"

Chloroform mortality is 1 in 3,000; over 500 fatal cases are reported, none of which, however, were in obstetrical practice. The apparent safety of chloroform in obstetrics has been

explained by the theory that death from chloroform is due to vasomotor paralysis, and as pregnancy increases the vasomotor tension, pregnant women are in consequence less liable to fatal results.

Compared with ether mortality, 1 in 16,000.

The physiologic action of ether and chloroform compared is as follows:

Organs, Tissues, etc., affected.	Ether.	Chloroform.
Arterial tension and blood-pressure, ...	Greatly increases both. Followed by fall.	Gradually decreases both.
Heart, ...	Stimulates and large doses paralyze. Zone between these quite large.	Depresses and large doses paralyze; zone between these two, small.
Lungs, ...	Has slightly direct irritating effect, causing increased tracheo-bronchial secretion. Stimulates respiratory center and large doses paralyze. Zone very large.	Slows respiration and large doses paralyze. Zone small.
Mouth, nose and pharynx, ...	Greatly increases all secretions. Large doses paralyze muscles of tongue, epiglottis and palate. Both above favor aspiration.	Scarcely any effect on secretions. Large doses also paralyze tongue, etc.
Stomach and intestines,	Considerable nausea and vomiting.	Less nausea than ether; in large doses causes some fatty degeneration of muscles.
Liver, ...	No effect.	Prolonged administration causes fatty degeneration with decreased glycogen, icterus, and in fatty liver may cause acute yellow atrophy.
Kidneys, ...	In normal kidneys transitory effect (casts and traces of albumin), decreased amount of blood and secretion. In diseased kidneys has a bad effect, may cause anuria and uremia.	In ordinary administration and normal kidneys but slight transitory effect. In prolonged administration causes considerable fatty degeneration.
Temperature, ...	Lowers it.	Lowers it less than ether.
Pupils and corneal reflex, ...	Pupils contracted some and respond. Corneal reflex of some value.	Pupils somewhat contracted but respond. Secondary dilation of pupil, bad sign. Corneal reflex of little value.

Nitrous Oxide Gas, N_2O.

History.—Nitrous Oxide, or "Laughing" Gas, was discovered by Dr. Priestly in 1776, and its respirability demonstrated by Sir Humphry Davy, though the results were not published until some twenty years afterward. In 1844 Dr. Horace Wells practically demonstrated the value of its anesthetic property for the relief of pain during surgical or dental operations.

Nitrous oxide gas is manufactured by slowly melting and boiling the salt nitrate of ammonia in a glass retort, dissolving it into a vapor of water and a permanent gas (NH_4NO_3+Heat $=N_2O+2H_2O$). The gas should pass through three wash bottles, the first containing a solution of the sulphate of iron or caustic potash, and the other two pure water, for the purpose of purifying it before it enters the receiver, from which it is administered to the patient through an inhaling tube. A pound of the salt will generate about thirty gallons of the gas. It is perfectly fused at 226° F., white fumes are emitted at 302° F., and gas begins to evolve at 460° F. If the temperature is raised to 500° F., a dangerous impurity, nitric oxide, is given off; this need not be generated, however, if the proper care is observed, not allowing the temperature to rise above 480° F.

Liquefied Nitrous Oxide.—The most convenient form for use is the liquefied gas, it being liquefied and solidified under intense cold and great pressure. It is then secured in strong iron cylinders, from which it is allowed to escape into an inhaling bag when needed for use.

The advantages of this form of gas are its purity, convenience for use, the large supply which can be kept on hand, and its comparative freedom from deterioration, notwithstanding its age.

Properties and Actions.—Nitrous oxide gas is an elastic, colorless gas, with a very slight and agreeable odor. It will freeze into a beautiful, clear, crystalline solid, at about 15° F. below zero.

"By the evaporation of this solid, a degree of cold may be produced far below that of carbonic acid bath *in vacuo,* or lower than 17° F."*

Nitrous oxide gas supports combustion with nearly the same promptness as oxygen.

As an Anesthetic.—Nitrous oxide gas is the most pleasant and the safest general anesthetic known. The shortness of the anesthetic stage is the greatest objection to its administration for surgical operations, though its rapid action, comparative safety, and the transient nature of its effects on the system render it the most useful anesthetic agent for all minor operations, such as the extracting of teeth, removal of nerves from the teeth, where the tooth substance is lost to such an extent that a devitalizing agent could not be retained, for the lancing of abscesses, etc.

The administration of nitrous oxide gas for dental operations, should be conducted with the same care that is given to ether and chloroform, though it is a comparatively safe anesthetic. The patient should be seated in an operating chair which will admit of the back being lowered to such a degree that the patient could at once be placed in a horizontal position. The dress about the throat and waist, if tight, should be previously loosened, and the patient should not have partaken of food for at least two hours previous to the inhalation of the gas.

A mouth prop, of which there are several patterns manufactured, *should be placed between the teeth,* to prevent the closure of the jaws, as the muscles become rigidly contracted during the administration of this gas. The most suitable prop is one made of India rubber—the ordinary lead-pencil eraser, cut in proper lengths, answers the purpose very nicely—or a firm cork, as it prevents injury to the teeth or fillings, which sometimes occurs when a mouth prop of a hard substance is

*Gorgas' "Dental Medicine."

used. The patient is then directed to take full, regular, and deep inspirations of the gas, the nose being held or covered, to prevent the admixture of atmospheric air. Its anesthetic effects are soon made manifest by strong, involuntary respirations, accompanied by snoring, this being caused by the relaxation of the muscles of the pharynx, and paralysis of the tongue, causing it to fall back toward the throat, interfering with breathing, and a livid appearance of the lips, cheeks, and finger nails, due to the discolored blood in the capillaries. But the most delicate test for complete anesthesia is, as in ether and chloroform, the loss of sensibility to the touch in the conjunctiva of the eye.

The amount of gas required to produce complete anesthesia varies, from five to fifteen gallons being the usual amount. Out of several administrations the writer has had one case where 65 gallons were required, and another where 80 gallons were inhaled before the anesthetic stage was reached.

The first stage under nitrous oxide gas is muscular activity.

The second stage is muscular rigidity. It can not be continued until complete muscular relaxation, lest the patient die of asphyxia.

Nitrous Oxide Gas Mortality.—There is about one death to each 125,000 administrations.

Dangerous Symptoms, with Treatment, etc.—See Ether.

Bromide of Ethyl, C_2H_5Br.

Derivation.—Bromide of ethyl, or hydrobromic ether, is obtained by distilling bromide of potassium and sulphuric ether, and redistilling with chloride of lime.

Properties.—It is a colorless, volatile fluid, possessing an agreeable ethereal odor and a pungent taste. It is not inflammable, caustic, nor irritant; in this respect it is preferable to chloroform or ether as an anesthetic agent.

The Administration.—Bromide of ethyl is administered as is ether or chloroform, or in a folded starched napkin, so as to

cover the face, as directed by Prof. Gorgas. A soft linen handkerchief is placed inside the napkin, and upon this the agent is poured; one drachm should be used at first, directing the patient to take deep, full inspirations. At the end of two minutes the second drachm should be added; this should be repeated at intervals of two minutes, until complete anesthesia is produced. The quantity differs according to the susceptibility of the patient.

Action.—The administration of bromide of ethyl is attended with some danger, and clinical experience has not demonstrated to careful operators that it is as safe as some other and older agents of this class. It has a toxic action on the centers of respiration. The heart force is decreased and its action is more frequent, which contributes to the paralysis of the respiratory centers. Several deaths occurred in a very limited number of administrations of this agent.

Precautionary measures in administering anesthetics: That respiration may in no way be hampered, the operator should see to it that the respiratory tract is not encroached upon either by a collar at the throat, or by corset stays about the chest. It is quite as important to test the freedom of respiration before administering an anesthetic as it is to take the pulse or listen to the heart's action. Where enlarged tonsils are noted and post-nasal growths indicated or enlargement of the glands of the neck, goitre, severe bronchitis or any other local trouble which might interfere with respiration, or where there is apparent existence of serious disease of the vital organs, as indicated under the dangers of anesthesia, a general anesthetic should not be administered without consulting the family physician, and possibly securing his co-operation.

The neurotic patient may be at first misleading. Mental disquietude frequently causes an accelerated action of the heart, or such a patient may at first hold the breath or breathe apparently with much effort. These should be noted and not accepted as normal conditions.

Some operators prefer the admixture of ether and chloroform, or alcohol, ether and chloroform, while others adhere strictly to the separate drug; and claim that the various mixtures are to be depreciated owing to the uncertainty as to the exact proportion of the separate ingredients the patient would appropriate.

Cocaine.

Source.—Cocaine is the active crystalline alkaloid of Erythroxylon coca, a small Peruvian shrub. The leaves resemble those of Chinese tea, and in South America thy are used by eight millions of people much as we use tea or coffee.

In the preparation of the alkaloid, it is necessary that the leaves be carefully gathered, as the best quality only should be used. They should be dried, and not injured by age or exposure to the air, as moisture deprives them of value.

Preparations of Erythroxylon:—

Extractum Erythroxyli Fluidum, fluid extract of erythroxylon. Dose, ℥ss-ij.

Salts of cocaine.

Cocaine Hydrochlorate, $C_{17}H_{21}NO_4$.—Dose internally, gr. ⅛-ij; most commonly used as a local anesthetic in aqueous solutions, 2-5 per cent.

Cocaine Oleate, cocaine and oleic acid, 5-20 per cent. solutions for external use.

Cocaine Hydrobromate, cocaine and hydrobromic acid, 2-10 per cent. as a local anesthetic.

Cocaine Wines, Pastes, Lozenges, etc., are made in great varieties.

Medicinal Properties and Action.—Cocaine, when applied locally, acts as an anesthetic; when taken internally in small doses, it is a general stimulant, improving digestion, stimulating the respiration, circulation, etc. It produces wakefulness and a marked diminution of the sense of fatigue and hunger. For

this reason the leaves are chewed by the Peruvian Indians to sustain them during long journeys or arduous labor.

A toxic dose, or long-continued use (cocaine habit) produces insomnia, decay of the moral and intellectual powers, hallucinations, insanity, and death.

Dental Use.—The salts of cocaine have proven very efficient for their local anesthetic and anodyne effects; their power as a local anesthetic is very great over a limited area, and hence it is of special value to the dentist, for operations upon the submucous tissues and the extraction of teeth, where it should be used by hypodermic injection, or applied to the gum on either side of the tooth to be extracted, the latter method being the safer; two or three applications should be made at intervals of about two minutes each, when a painless operation is generally secured. It has been found to act very happily, also, in connection with arsenious acid, for the devitalization of dental pulps, the pulp dying without giving the patient any discomfort. But as for its use as a pain obtundent in hypersensitive dentine, its practical benefits are questionable.

A warning, however, should be given, that a potency for evil lurks in this most valuable drug. In many cases where it has been injected into the gum tissue for extraction of teeth, toxic results of an alarming nature have occurred and patients have been rendered ill for several weeks. This, however, is not apt to follow when the patient is of a sanguine temperament and in good health. The writer has made a record of many cases where toxic results have followed the use of this drug, and finds them all to be of a nervous or hysterical temperament, or pregnant women. The lesson is that we should use judgment and discrimination in its application.

Dangerous Symptoms.—The extremities usually become cold and rigid, the eyes staring and glassy, and the face pallid, while the pulse is weak, the heart beats faint, and respiration slow and weak—the symptoms of an impending collapse.

Treatment of Dangerous Symptoms.—Fresh air should be admitted and some good stimulant administered, such as brandy, or aromatic ammonia and nitrate of amyl—by inhalation, or ether in case of convulsions, and if need be the battery. As soon as the patient is able, assist him to stand up and promenade.

Chloride of Ethyl, C_2H_5Cl.

Properties.—Chloride of ethyl is a colorless liquid possessing a strong ethereal odor, and is very volatile and inflammable in ordinary temperature. Its boiling point is about 50° F. It is due to this low boiling or vaporizing point that it is so exactly adapted to the special requirements of a local anesthetic. It is put up in convenient glass tubes, drawn out to a fine point, and hermetically sealed.

The point of the tube is marked by a file scratch at its smallest part. Here the point is broken off when ready for use, either by the fingers or the forceps. Immediately the chloride in a gaseous state escapes from the small opening, and if the tube is partially inverted, a small jet of the liquid is projected; this is further accelerated by allowing a good portion of the tube to come in contact with the hand, the warmth of which hastens the vaporization of the liquid.

The preparation of chloride of ethyl, as spoken of above (in glass tubes), is a patented process. As the chloride evaporates in ordinary temperature and is very inflammable, the point has to be drawn out and sealed while the tube and its contents are immersed in ice water.

The Application and Action.—When about to apply, the parts to be anesthetized should be thoroughly dried, by means of absorbent cotton or napkin, then the point of the tube should be broken, or the screw-cap removed as the case may be, as previously directed, and the fine jet of chloride directed upon the surface.

If teeth are to be extracted, a napkin should be placed in the mouth back of the teeth to be operated upon, and the patient directed to breathe entirely through the nose; the liquid should then be projected upon the mucous membrane around the tooth or root and upon the cheek over the track of the inferior maxillary nerve for the lower, and on the temple over the emergence of the fifth nerve for the upper teeth. This application upon the face, however, need not be made unless the teeth are very difficult to extract, and prolonged anesthesia is desired.

It is seldom necessary to use the entire contents of a tube for a single operation; one-quarter of it will usually produce complete anesthesia of the parts. The opening in the tube can then be closed and the contents preserved for a subsequent operation.

The writer has employed chloride of ethyl in over three hundred minor surgical operations with uniform success. It is a most satisfactory local anesthetic in the extraction of teeth, lancing of abscesses, removal of small tumors, opening the maxillary sinus, extraction of the tooth pulp, and in the preparation of roots of teeth and the fitting of bands and caps in crown- and bridge-work.

Eucaine Hydrochlorate, "A."

Derivation.—Eucaine hydrochlorate "A" is obtained by the action of one molecule of ammonia upon three molecules of aceton which forms triacetonamin. This is then transformed into dry triacetonamincyanhydrin by hydrocyanic acid.

This compound when saponified becomes triacetonalkamin-carbonic acid, ammonia being given off in the process.

When benzylated and methylated we get n-methyl-benzoyl-tetramethyly-oxypiperidincarbonic acid-methylester, or eucaine.

As will be apparent from this synthesis, eucaine is *not* a coal-tar product.

Properties and Actions.—Eucaine (A) is a white, neutral, crystalline powder, soluble in ten parts cold water, making about nine per cent. solution. This solution is stable and may be boiled without suffering deterioration. It may be employed in all cases where cocaine is used and in similar strength or stronger, since the two drugs are quite similar as regards the rapidity, intensity, and duration of anesthesia; eucaine, however, being much less toxic.

Therapeutics.—Eucaine is employed as a local anesthetic for minor surgical operations, and, as has been indicated, the only important difference of this drug and cocaine, physiologically or therapeutically, is the difference in their toxic effects. It is claimed, after many careful experiments, that the pulse is not materially affected by the use of eucaine, either in rate or character. Some writers have stated that unpleasant disturbances of sensation follow the use of this drug, particularly when used upon the pharynx. These disturbances, however, are less unpleasant and less marked than those produced by cocaine, and are more transient, and, speaking generally, after the lapse of an hour from the time of application, the subjective sensations may be described as normal.

Dental Uses.—In dental practice, eucaine, from two to five per cent. solution, is employed as a local anesthetic in the extraction of teeth; it is applied locally, by freely bathing the parts, for lancing painful abscesses; is injected hypodermatically in minor surgical operations in the mouth, such as the removal of small tumors, necrosed bone, and in operations upon the antrum of Highmore. Eucaine may also be employed, cataphorically, for the obtunding of sensitive dentine, the removal of the dental pulp, etc. The writer has secured very satisfactory results with a ten per cent. solution of the drug, both as a local anesthetic in operations upon the antrum, and in conjunction with cataphoric instruments in the usual dental operations.

STIMULANTS.

Stimulants are medicinal agents which increase organic activity. The most powerful and rapid in action, though transient in effect, are termed diffusible stimulants, while the local stimulants, which are of a vegetable nature, containing a volatile oil, are termed aromatic.

Among the first class are such agents as the alcoholic preparations, ammonia, camphor, ether, nitrite of amyl, myrrh, normal saline solution, coca, caffine, etc.

The principal members of the class of aromatic stimulants are capsicum, oil of cloves, peppermint, etc. Heat and cold also act as local stimulants.

Alcohol, C_2H_6O.

Derivation.—Alcohol is obtained by repeated distillations from the product of fermented grain or starchy substances, easily converted into grape sugar, which in the presence of and by the growth of low vegetable organisms (the yeast plant, etc.) splits up into alcohol and CO_2. Commercial alcohol contains about 90 per cent. of absolute alcohol with 10 per cent of water.

Properties and Action.—Alcohol is a colorless, inflammable fluid, wholly vaporizable by heat, and unites in any proportion with water and ether. It possesses a pungent odor and burning taste. All of the alcoholic preparations are powerful diffusible stimulants, causing general exhilaration of spirits.

In large doses, however, it is a depressant, producing muscular inco-ordination and the effects of narcotic poisons, ending in delirium, coma, and death.

The Most Important Alcohols are:—

Methylic Alcohol, C_2H_4O, methyl hydrate, wood spirit.

Ethylic Alcohol, C_2H_6O, ethyl hydrate, grain spirit.

Amylic Alcohol, $C_5H_{12}O$, amyl hydrate, potato spirit, also occurs with the ethylic alcohol, in excessive distillations of fermented grain.

Principal Preparations of Alcohol:—

Absolute Alcohol, rarely obtainable in the shops, however, stronger than 98 per cent.

Alcohol contains about 91 per cent. of absolute alcohol.

Alcoholis Dilutum contains equal parts of alcohol and water.

Spiritus Frumenti, whisky from rye, corn, barley, and potatoes, contains from 45 to 50 per cent. of alcohol.

Rum, obtained by the distillation of fermented molasses.

Wines—port wine, sherry white wine (made by fermenting the juice of the grape without the seeds, stems, or skins); red wine (from the juice of grapes with their skins); champagne, claret, Rhine, etc. These contain from 5 to 40 per cent of alcohol.

Beer by slow fermentation,	contains	2 to 3	per cent. alcohol.
Ale, by rapid "	"	2 to 6	" "
Porter and stout	"	4 to 6	" "

Therapeutic Uses.—The alcoholic preparations are most valuable agents in disease, for appropriate cases; they are employed as stimulants in acute inflammations, such as pneumonia, pleurisy, bronchitis, phthisis, and in the last stages of typhoid fever, diphtheria, acute neuralgia, etc. In insomnia from cerebral anæmia, small doses of some alcoholic stimulant at bedtime are found beneficial. In poisoning by cardiac depressants and snake venom, alcohol, freely sustains the heart. In chloroform anesthesia, an ounce of whisky beforehand will sustain the heart and prolong narcosis.

Dental Uses.—In the administration of nitrous oxide gas, a small quantity of wine taken beforehand will often be found beneficial, increasing the heart's action at about the time the effects of the anesthetic are passing off. In painful operations upon the teeth, I have found small doses of sherry or brandy to be very beneficial.

As a styptic, it arrests hemorrhags by coagulating the blood by its effects upon albumin, and contracts the mouth of the vessels by its astringent properties.

For suppurating wounds it is a useful antiseptic dressing.

For the treatment of soft and sensitive dentine, and for drying cavities preparatory to filling, absolute alcohol is generally an efficient agent; after drying the cavity with cotton or bibulous paper, it should be bathed with alcohol, which evaporates rapidly and causes the almost perfect absorption of moisture from the dentine.

Treatment of Acute Alcoholism.—Evacuate the stomach, administer ammonia cautiously by inhalation, apply warmth to the extremities and cold affusion to the head, and, if need be, artificial respiration.

Ammonia.

Medicinal Properties and Action.—It exists most commonly in the form of ammonia gas, NH_3; which, dissolved in water, is the aqua ammoniæ of commerce. It is intensely alkiline, and is an irritant to the mucous membrane. When inhaled it acts as a stimulant, especially as an antagonist of cardiac depressants. Prolonged inhalation induces spasmodic coughing, a sense of suffocation, and inflammation and œdema of the glottis; when swallowed, the aqua sets up violent inflammation of the passages and stomach.

The salts of ammonia, in medicinal doses, are stimulating expectorants, and stimulate the heart's action; while in large doses or continued use they produce rapid emaciation, by impairing digestion and increasing tissue waste. In large doses they also injure the red blood corpuscles.

Principal Preparations:—

Aqua ammoniæ, water of ammonia, containing 10 per cent. of the gas in water. Dose, ℥v-xxx, diluted.

Aqua ammoniæ fortior, containing 28 per cent. of the gas in solution.

Ammonium carbonate. Dose gr. ij-x.

Ammonium chloride, sal ammoniac. Dose, gr. j-xx.

Ammonia spirits (a 10 per cent. solution of aqua ammoniæ in alcohol). Dose, ♏x-℥j, diluted.

Aromatic spirits of ammonia, the carbonate with aromatics (oil of lemon, lavender, etc., and alcohol and water). Dose, ♏x-℥ij.

Ammonia liniment, aqua ammoniæ, 30 per cent., and cotton-seed oil, 70 per cent.

Ammonium nitrate, used in preparing nitrous oxide gas.

Ammonium sulphate, used in preparing other ammonium salts, etc.

Camphor, $C_{10}H_{16}O$.

Source.—Camphor is a white, concrete, and translucent gum, obtained from the volatile oil of the camphor laurel, an evergreen tree indiginous in China, Japan, Formosa, etc. Refined camphor is prepared in large circular cakes, one to two inches thick.

Properties and Action.—Camphor is slightly soluble in water (about 1 to 1300), but freely in alcohol, ether, chloroform, oils, and milk. Alcohol forms a 75 per cent. solution. It has a penetrating, fragrant odor, a bitter, pungent taste, leaving a slight sense of coolness. It is a stimulant, anodyne, diaphoretic, antiseptic, and irritant.

In medicinal doses it temporarily increases the heart's action, stimulates respiration and mental activity, promotes perspiration, and allays pain and spasm.

Large doses depress the heart and excite narcotic symptoms, and have proved fatal.

Principal Preparations:—

Aqua camphoræ, camphor water (8 parts of camphor to 1000 of distilled water, with 16 parts of alcohol to aid in the suspension of camphor). Dose, ℥j-iv.

Spiritus camphoræ, spirit of camphor (camphor, ℥iv, alcohol, Oj). Dose, ♏v-xx.

Linimentum camphoræ, camphor liniment (camphor 1 part to olive oil 4 parts).

Linimentum saponis, soap liniment (soap 10 parts, camphor 5, oil rosemary 1, alcohol 70, water 15). Is an anodyne and mild irritant for sprains, rheumatic pains, etc.

Dental Use.—In dental practice the spirit of camphor is sometimes employed by local application to allay the pain of sensitive dentine, and that which sometimes follows the extraction of teeth, and the wounding of pulps of teeth. Camphor is also employed in the treatment of putrescent root canals of teeth. It is also one of the ingredients of the celluloid base for artificial teeth.

Nitrite of Amyl, $C_5H_{11}NO_2$.

Derivation.—Nitrite of amyl is produced by the action of nitric or nitrous acid upon amylic alcohol.

Properties and Action.—Nitrite of amyl is a clear, yellowish, oily liquid. It has an ethereal odor, and is very volatile and inflammable; it is insoluble in water, but soluble in alcohol, ether and chloroform. It is used by inhalation, causing great cardiac activity, vascular dilatation, flushing of the face, a sense of fullness of the brain, and complete resolution of the muscular system. It is a muscle poison, and when the vapor is applied directly to the muscular or nervous tissues it arrests their functional activity.

Dental Use.—Nitrite of amyl, being a powerful stimulant to the heart, is employed in syncope and chloroform narcosis. It is also used in epileptic attacks and other convulsive or spas-

modic diseases. Cases are reported where nitrite of amyl has restored the patient after artificial respiration had failed. Care, however, must be observed in its use, as it is a powerful and dangerous agent.

Dose of nitrite of amyl by inhalation is from ℥ij to ℥v. Not more than two or three drops should be administered to weak and nervous patients who are susceptible to its influence.

Myrrh.

Source.—Myrrh is a resinous exudation from a small tree grown in Arabia and the northeastern coast of Africa, known as the *Balsamodendron myrrha.* It is a spontaneous exudation from the stems of the tree, which collects in small masses upon the bark.

Properties and Action.—Myrrh is brittle and is easily pulverized. It is of a reddish-yellow color, translucent, with an aromatic taste and a peculiar fragrant odor. When pulverized the powder is of a light yellow color, if pure. In medicinal doses, myrrh is a stimulant and astringent. It stimulates the digestive organs and improves the appetite, but in larger doses it acts as an irritant to the gastro-intestinal membrane. It is employed externally as a local application to inflamed, ulcerated, and relaxed tissues, for stimulating and astringent effect.

Dose—Powdered myrrh, gr. x to ʒss, in pill form or suspended in water. **Tincture of myrrh,** ʒss to j (myrrh ʒiij, alcohol Oij).

Dental Use.—The tincture of myrrh, diluted, forms an excellent gargle and mouth-wash, and a stimulating lotion for spongy and inflamed gums. The powder is employed as an ingredient of many dentifrices for its astringent properties.

Capsicum.

Source.—Capsicum, or Cayenne Pepper, is the fruit of *Capsicum fastigiatum,* a plant of tropical Africa and America. Its

pungent odor and hot taste are due to its very acrid and volatile principle, called capsicine.

Medicinal Properties and Actions.—Capsicum in medicinal doses is a powerful stimulant. It produces a sensation of warmth in the stomach, and a general glow over the body; it stimulates the circulation and digestive process, but in excessive doses it acts as an irritant poison.

Preparations:—

Tincture Capsicum. Dose, ♏v-℥j.

Powdered Capsicum. Dose, gr. v-x in pills.

Emplastrum Capsicum. A most excellent plaster.

Dental Use.—Capsicum in tincture or plaster form, preferably the latter, is very serviceable in dental periostitis, as it aids in establishing resolution or hastens suppuration. It is also an excellent stimulating gargle, tinct. capsicum, ℥ss to rose water, ℥viij.

Oil of Cloves.

Source.—The oil of cloves is obtained from the dried, unexpanded flowers of the *Eugenia caryophyllata,* an evergreen tree of the myrtle order, a native of the Indies.

Properties and Actions.—The oil of cloves, when fresh, is a clear and colorless preparation; it has a pungent, spicy taste, and a fragrant odor. Is an aromatic stimulant, irritant and antiseptic. It is sometimes administered to relieve nausea, and prevent griping when combined with purgatives, also to modify the action of other medicines. Dose, ♏j-v.

Dental Use.—The oil of cloves is employed in dental practice to relieve odontalgia, by introducing two or three drops into the carious cavity of the aching tooth, relieving the pain by its stimulating effect upon the pulp. It is sometimes used for the same purpose in combination with other agents, and has the effect of rendering carbolic acid more pleasant, without interfering with its action. It is used also by microscopists to clarify preparations for mounting.

Eugenol ($C_{10}H_{12}O_2$) is an active principle of oil of cloves. It is sometimes called an acid, as it possesses some acid qualities. It is a clear, colorless oil, and its odor and taste resemble those of the oil of cloves. It is an excellent antiseptic for dental uses.

Peppermint.

Source.—Mentha piperita, or peppermint, is grown everywhere, and as a plant is familiar to every one. The leaves and tops are used for medicinal purposes.

Properties and Actions.—The properties of peppermint are due to a volatile oil, in which form it is generally used. It is an aromatic stimulant, carminative and antispasmodic, and local anodyne and anesthetic when evaporation is prevented after being applied to the surface.

Preparations:—

Oil of Peppermint (consisting largely of menthol). Dose, ♏j-v.

Peppermint Water (2 parts of the oil to 1000 of distilled water). Dose indefinite.

Essence of Peppermint (10 per cent. of oil with 1 per cent. of the powdered herb in alcohol. Dose, ♏x-xxx.

Dental Use.—Local anodyne and anesthetic.

Sodium Chloride.

Normal saline solution (0.6 per cent. sodium chloride). In emergency cases it is sometimes necessary to inject a stimulant directly into the vein, and as this saline solution corresponds so closely in salinity to the blood serum it is regarded today one of the most important means of stimulation. Serious loss of blood, and extreme depression or collapse would indicate its use.

Normal saline solution is prepared by dissolving 6 parts sodium chloride in 1000 parts of sterile water, and as has been indicated is injected intravenously.

TONICS.

Tonics are agents which give healthful activity and vigor to the functions, gradually imparting strength and tone to the system, that is, without preternatural excitement. They are divided into vegetable and mineral tonics.

Principal among the vegetable tonics are cinchona, nux vomica, digitalis, cimicifuga, and eucalyptus.

While the principal mineral tonics are the preparations of iron, arsenic, zinc, sulphuric acid, nitric acid, muriatic acid, etc.

Cinchona (Peruvian Bark).

Source.—Cinchona is the bark of any variety of cinchona. The different species of this tree are natives of the mountains of western South America, especially in Peru and Bolivia, though they have been planted and are grown in India, Ceylon and Burmah.

The medicinal properties of these barks depend upon the alkaloids they contain, which are in varying proportions, usually from 3 to 4 per cent., at least 2 per cent, of which is quinine, this being the most important.

Principal preparations of cinchona and its alkaloids are as follows:

Powdered cinchona. Dose, gr. x-℥iij.

Tincture cinchona (strength 20 per cent.). Dose, ℥j-℥ss.

Extract cinchona (in pill). Dose, gr. j-x.

Sulphate of Quinine. Dose, gr. j-xx.

Sulphate of cinchonidine (one-half the strength of quinine). Dose, gr. ij-xxx. Much used in hospital and dispensary work.

Properties and Actons.—The different varieties of cinchona are named according to their color. Yellow cinchona—cinchona flava; pale cinchona—cinchona pallida; red cinchona—cinchona rubra. The powder from the yellow bark is of an

orange color; has a more bitter taste than the other barks, containing more of the alkaloid quinine. Cinchona is a bitter tonic, astringent, antipyretic, and antiseptic. The alkaloid quinine is preferable for ordinary use, as a much larger quantity of the powdered bark is necessary to obtain the full effects, often causing derangement of the stomach, headache, and constipation.

Dental Uses.—In dental practice quinine is employed in from five to ten grain doses as a tonic, and in the treatment of neuralgia when due to malaria. Cinchona is also used as an antiseptic. "The powder dusted over unhealthy wounds will arrest putrefaction and promote healthy cicatrization. Quinine will destroy minute organisms, and preserve substances from decomposition."* Cinchona is also employed for its antiseptic and tonic properties as an ingredient in certain dentifrices.

Nux Vomica.

Source.—Nux vomica is the seeds of the *Strychnos nucis vomica,* a tree of the family Strychnoides, which grows in India. These seeds have been long sold in the shops under the names of nux vomica, bachelor's buttons, poison nuts, etc., and for a long time were used only for such purposes as poisoning rats.

Medicinal Properties and Actons.—Nux vomica contains two alkaloids, strychnine and brucine, to which its medicinal properties are chiefly due. Brucine has only $^1/_{12}$ the strength of strychnine, but they are otherwise identical, physiologically and therapeutically.

In small doses nux vomica is a bitter tonic, exciting the secretions and stimulating the functions of the body.

In full doses (strychnine gr. $^1/_{10}$) the function of the spinal cord is exalted, causing tetanic spasms of the extensor muscle,

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*Gorgas' "Dental Medicine."

the lower jaw is stiff, the pupils dilated, and the face wears an unmeaning smile.

In toxic doses (strychnine gr. ½) the function of the spinal cord is paralyzed, respiration is arrested, death following from asphyxia; consciousness is preserved, however, until CO_2 narcosis takes place.

Treatment of Strychnine Poisoning.—The antidote is tannic acid, which forms an insoluble tannate; then the stomach pump should be employed or emetics administered, after which the patient should be kept perfectly quiet.

The antagonists are chloral, chloroform, and potassium bromide; the last named, though, is rarely used, on account of its being so slow of action.

The bladeer must be evacuated frequently, lest a reabsorption of the poison take place.

Preparations:—

Abstract of Nux Vomica.—Dose, gr. ½ gradually increased to gr. j.

Tincture of Nux Vomica (20 per cent. of the drug). Dose, ♏j-x.

Extract of Nux Vomica. Dose, gr. ⅛-j.

Fluid Extract of Nux Vomica. Dose, ♏j-v.

Sulphate of Strychnine. Dose, gr. $^1/_{100}$-$^1/_{20}$.

Dental Uses.—Where a cardiac or nerve tonic is required, nux vomica and its chief alkaloid hold the first rank.

Digitalis.

Source.—Digitalis, or foxglove, is the leaves of *Digitalis purpurea,* or purple foxglove; the leaves of the second year's growth are considered the best. The plant grows wild in Europe, and is cultivated in this country, where it is sometimes seen in private gardens, grown for its beautiful spike of purple flowers. The Shakers cultivate it quite extensively for the drug market.

Medicinal Properties and Actions.—Digitalis is chiefly used in disease for its tonic and diuretic properties, its tonic effect upon the heart, principally; though the heart is slowed by its action, its force is at the same time increased. For the full cardiac effects the recumbent posture should be maintained. *When the doses are large,* severe gastric disturbance is caused. *In toxic doses,* the muscles and peripheral nerves are paralyzed; respiration is first slowed and then becomes rapid and feeble; coma and convulsions followed by death from the sudden paralysis of the heart.

Preparations and Doses:—

Digitalis (the leaves). Dose, gr. ss-iij.

Abstract of Digitalis. Dose, gr. ¼-j (strength 200 per cent.).

Extract of Digitalis. Dose, gr. $^{1}/_{6}$-j.

Fluid Extract of Digitalis. Dose, ♏j-iij.

Tincture of Digitalis (15 per cent.). Dose, ♏v-xx.

Cimicifuga.

Source.—Cimicifuga, or the black snakeroot, is the root of the *Cimicifuga racemosa,* a common plant in the United States.

Medicinal Properties and Actions.—Cimicifuga has a bitter and nauseous taste, somewhat resembling that of opium. It is an efficient cardiac tonic, antispasmodic, diaphoretic, and diuretic. It is feebler in its action than digitalis, and should be used more frequently when the latter drug is indicated.

Preparations and Doses:—

Fluid Extract of Cimicifuga. Dose, ♏v-xxx.

Tincture of Cimicifuga (20 per cent. in strength). Dose, ♏xx-lx (℥j).

Eucalyptus.

Source.—Eucalyptus is obtained from the leaves of the *Eucalyptus globulus,* or "blue gum tree," a native of Australia, but is now grown in Northern Africa, Southern Europe and in the United States.

Properties and Actions.—The leaves are the only portion of the tree which possesses medicinal qualities, the fresh being more active than the dried leaves. Their medicinal properties are due to a volatile oil, called oleum eucalypti, which contains three oils, eucalyptene, turpene, and cymol, which distilled over at different temperatures, the first product being the most important. Eucalyptus promotes appetite and digestion, and increases the heart's action.

In large doses it causes indigestion, nausea, diarrhœa, and great muscular weakness, and if continued will cause irritation and congestion of the kidneys. It is eliminated by the skin, bronchial mucous membrane, and kidneys, the secretions of which become strongly odorous, owing to the presence of the oil. Eucalyptus is also an antiseptic, disinfectant, sedative, and diaphoretic, "and has anti-malarial properties, absorbing noxious germs, as well as enormous quantities of water from the soil, and by its emanations purifying the atmosphere in the vicinity. It is largely cultivated in malarial districts for these properties, and has rendered habitable a portion of the deadly Roman Campagna."*

Preparations of Eucalyptus:—

Extract. Dose, gr. j-xv.

Fluid Extract. Dose, ℥xx-℥j.

Tincture. Dose, f℥ss-ij.

Oil. Dose, ℥v-xx in emulsion or capsules.

Dental Use.—In dental practice the oil of eucalyptus is employed either alone or combined with iodoform, for its antiseptic properties, in the treatment of putrescent pulps of teeth and chronic alveolar abscesses. This combination has also proven very efficient in the treatment of necrosis and caries of the bone of the jaws.

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*Potter's "Materia Medica."

By taking advantage of the solvent effects of eucalyptol upon the gutta-percha, it will be found of great benefit in the insertion of fillings of this material.

Iron.

Ferrum, or *iron,* is a metal of a bluish-gray color, fibrous in texture, is hard, ductile, malleable, and magnetic. Chemical analysis demonstrates the presence of iron in the blood, 1 part to 230 of red corpuscles, also in the gastric juice, chyle, bile, lymph, urine, milk, and pigment of the eye.

Properties and Actions.—Iron taken into the stomach in the metallic state, meeting with the acids of that cavity, is dissolved, which causes an evolution of hydrogen gas, and gives to the iron molecular activity. *Given medicinally in small doses,* the salts of iron act through and upon the blood, improving its quality and increasing the number of red corpuscles; they also promote the appetite and improve digestion, and hence it is recognized as one of the most efficient tonics.

In large doses these salts cause nausea and vomiting and act as irritants. Or the prolonged administration of small doses exhausts the gastric glands by over-stimulation.

Monsel's preparations of iron are principally used externally, for hemorrhage, and are considered to be among the very best styptics in use. When internally employed it is for their hemostatic effect in hemorrhage from remote organs. In administering iron care should be exercised, as nearly all the preparations are more or less astringent, and act injuriously on the teeth.

Contra-indications.—Iron should never be given when plethora (a superabundance of blood) exists, especially when accompanied with a hemorrhagic tendency.

Principal Preparations:—

Tincture of the Chloride of Iron. Dose, ℥v-xx.

Powdered Sulphate of Iron, Monsel's Powder. Dose, gr. ss-iij, in pill; used also as a styptic.

Solution of Subsulphate of Iron, or Persulphate, Monsel's Solution. Possesses powerful astringent properties; used only as a styptic.

Dental Uses.—In dental practice the chief indications for iron are where hemorrhage follows the extraction of teeth, or from any other cause, such as wounds of the gums and mucous membrane. Monsel's solution or powder is employed for this purpose. *See chapter on Extraction of Teeth.*

Arsenic, As.

Properties.—Arsenic is a brittle, granular metal, of steel-gray color, is very combustible, and volatilizes before melting, the vapor having an odor like that of garlic. It is a powerful poison, not of itself, however, but by virtue of the facility with which it absorbs oxygen. It is generally found in cobalt ore. It is not employed as medicine in its native state.

Preparations:—

Arsenious Acid (?), White Arsenic, "Ratsbane." Dose, gr $^1/_{60}$ to $^1/_{10}$.

Solution of Arsenious Acid, 1 per cent. solution (strength, $^1/_{100}$) with hydrochloric acid and distilled water. Dose, ♏ij-x, after meals.

Solution of Potassium Arsenite, Fowler's solution (strength $^1/_{100}$). Dose, ♏ij-x, after meals.

White Oxide of Arsenic (As_2O_3), Arsenious Acid, is in the form of irregular solid lumps, having a chalky appearance externally, though it is often perfectly transparent internally. It is usually furnished in the shops, however, in the form of a fine white powder, and is often adulterated with chalk or lime. It is odorless and has a faint sweetish taste.

Physiological Actions.—*In small doses,* arsenic is a general tonic, promoting the appetite, digestion, and cardiac action,

stimulates mental activity, and causes rotundity of form and clear skin. *In large doses* it becomes a violent corrosive poison, creates skin eruptions and itching of the eyelids, nausea, dysentery, and an irritable and feeble heart, death following from narcotism. *Externally,* it is a powerful escharotic.

Toxicology.—The antidote to arsenic is the hydrated oxide of iron. After the prompt evacuation of the stomach this should be administered, the dose being eight times the quantity of the poison taken. This should be followed by mucilaginous or oily drinks, to protect the mucous membrane, and iodide of potassium or alkaline mineral waters, to promote elimination.

Tests for Arsenic.—There are a number of tests for arsenic, the following being considered the best: If in a solid state, place the suspected material on burning charcoal, when the arsenic, if present, will become deoxidized and emit the garlic odor spoken of above. When in an aqueous solution, it may be detected by adding sulphide of ammonium, which produces a yellow sulphide of arsenic, or the addition first of ammonia, then a small quantity of nitrate of silver, will produce a light yellow arsenite of silver. Again, the addition of potassa and sulphate of copper produces a light green arsenite of copper.

Marsh's Test.—The most delicate test for arsenic consists in subjecting the material to the action of nascent hydrogen.* The arsenic is deoxidized and forms with the hydrogen arseniuretted hydrogen gas; this also has the peculiar odor of garlic, burning with a bluish-white flame, which deposits metallic arsenic in the form of a black spot on the surface of a cold plate if held directly in the flame.

Reinsch's test consists of boiling the material suspected of containing arsenic with hydrochloric acid and copper foil, when, if arsenic is present, it will manifest itself in the form of a coating of gray metallic arsenic upon the foil.

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*Nascent hydrogen is evolved by the action of diluted sulphuric acid on zinc.

Dental Uses.—Arsenic is employed in dental practice for its devitalizing power in destroying the vitality of the pulps of teeth. It is generally combined with other agents, in the form of paste or fibre, for this purpose. But I have found the white arsenic alone to act very happily when applied to the pulp and retained by a small pledget of cotton which had been *previously saturated with cocaine.* The cavity should be completely secured, that none of the arsenic come in contact with the part outside of the tooth.

The **quantity** to be used for this purpose is about the $^{1}/_{25}$ of a grain, and the time required is usually about 24 hours, though there are instances where 48 hours or more are required to thoroughly destroy the vitality.

Zinc, Zn.

Properties.—Zinc is one of the metallic elements—it is very hard, has a bluish-white color, and the fresh surface has considerable lustre, but is soon dulled, from the facility with which it oxidizes.

Principal Preparations:—

Zinci Oxidum. Dose, gr. j-x, insoluble in water.

Zinci Acetas. Dose, gr. ¼-ij; as a lotion, gr. ij to ℥j of water, in which it is very soluble.

Zinci Sulphas. Dose as a tonic and astringent, gr. $^{1}/_{10}$-j. As an emetic, gr. vj in ℥iv of water, in tablespoonful doses, repeated every few minutes until emesis takes place.

Zinci Carbonas Præcipitatus. As ointment, or dusted over wounds as a protection.

Zinci Iodidi. Dose, gr. ss-v, in the form of a syrup.

Zinci Chloridum, tonic and escharotic. Dose, gr. ss-ij, well diluted.

Zinci Chloridum Liquor, solution of chloride of zinc, ½ to 1 per cent. in strength.

Physiological Actions.—The salts of zinc are more or less poisonous, the soluble salts, the acetate, sulphide, and chloride being corrosive poisons. *In small doses* they are tonic and astringent, while in larger quantities they are strong emetics.

The sulphate is a specific emetic, acting without much depression.

The chloride is a powerful and penetrating escharotic. It is also a useful deodorizer and disinfectant. "When applied to malignant and indolent ulcers, it promotes healthy granulations, and when topically applied it not only destroys the diseased structure, but excites a new and healthy action of surrounding parts."

The antidotes for zinc poisoning are, the white of an egg, carbonate of soda, magnesia, etc.

Dental Uses.—In dental practice the *chloride of zinc* ($ZnCl_2$) is a valuable agent. It is employed as an obtunding agent for sensitive dentine—the sensitive surface being previously bathed with chloroform, which will modify the painful action of the chloride. It has also been employed as a styptic to arrest superficial hemorrhage from a wound of the gum during the filling of the teeth. It induces union of the wounded parts by first intention, by its effect upon the glutinous matter, also as an injection for chronic alveolar abscess, and in diseases of the antrum of Highmore. It is also used in the recession of the gum and the absorption of the alveolar process from the necks of the teeth. The application can be conveniently made by means of a piece of orange wood, so shaped as to permit of its being introduced beneath the gums.

The chloride of zinc, in solution, is also used as one of the ingredients of the filling material known as the oxychloride of zinc, the other ingredient being the oxide of zinc.

The combination of these two forms of zinc makes an excellent capping material, and is probably one of the best materials for root filling.

The oxide of zinc, ZnO, is sometimes employed, combined with carbolic acid, in the form of a paste, for capping exposed pulps; it is also one of the ingredients of the zinc filling materials, and of the celluloid base of artificial teeth.

The sulphate of zinc, $ZnSO_4 7H_2O$, is sometimes employed in disease of the antrum of Highmore, and ulcerations of the mucous membrane, for its stimulant and astringent properties.

Sulphuric Acid, H_2SO_4.

Properties.—Sulphuric acid, or oil of vitriol, is a dense, inodorous, colorless, oily, and corrosive liquid. It consists of not less than 96 per cent. sulphuric anhydride and about 10 per cent. of water.

Preparations:—

Sulphuric Acid. Used as an escharotic or caustic.

Diluted Sulphuric Acid (10 per cent. of the acid to 90 per cent. of water). Dose, ℥v-xv, well diluted.

Aromatic Sulphuric Acid (Elixir of Vitriol). Sulphuric acid diluted with alcohol and flavored with ginger and cinnamon (strength 20 per cent.). Dose, ℥v-xxv, well diluted.

Action.—The action of sulphuric acid in its different forms is as follows: *Aromatic sulphuric acid,* tonic and astringent; *diluted sulphuric acid,* tonic, astringent, and refrigerant (in fevers); *sulphuric acid,* escharotic.

Treatment of Sulphuric Acid Poisoning.—Being a corrosive poison, sulphuric acid causes death from asphyxia (the suspension of vital phenomena, from the non-oxygenation of the blood—an excess of carbon dioxide). Administer alkalies, as washing soda, magnesia, lime water, soapsuds, etc., to neutralize the acid, and mucilaginous drinks freely, to protect the mucous membrane. Stimulants, opium, ammonia intravenously, to combat the depressed condition of the vital powers.

Dental Uses.—The concentrated sulphuric acid is employed in dental practice as a caustic; in the laboratory, in a diluted

state, for the cleansing of metals before and after soldering ("the acid bath"). It is also used in the manufacture of pyroxylin—gun cotton.

Aromatic sulphuric acid is more agreeable for use in the mouth, while its action resembles that of diluted sulphuric acid. It is a valuable agent in the treatment of pyorrhœa alveolaris and necrosis of the maxillary bones, stimulating the parts to healthy action. It is also employed in the treatment of chronic alveolar abscesses, in combination with a few drops of tincture of capsicum.

Nitric Acid, HNO_3.

Properties.—Nitric acid, or aqua fortis, is a highly caustic liquid, very volatile, its fumes being corrosive and suffocating, and in the pure state is colorless and transparent, but that usually found in shops is of a yellow color, owing to the presence of nitric peroxide. *Strong nitric acid* is never given internally; it is used in the form of the *diluted nitric acid,* 10 per cent. absolute acid. Dose ♏iij-x, well diluted.

Action.—Pure nitric acid is a powerful caustic and escharotic, and is rarely used except as an application to foul, indolent ulcers, or to warts. The diluted acid is a tonic, alterative, and refrigerant, used as a drink in fevers. It is, as are most mineral acids, injurious to the teeth; hence, care should be taken in its use. It should be taken through a glass tube or quill, and followed by an alkaline mouth wash. It is not as agreeable to the stomach as diluted sulphuric acid.

The antidotes for nitric acid poisoning are magnesia or soap and mucilaginous drinks.

Dental Uses.—Nitric acid is employed in dental practice as a caustic for malignant ulcers of the mouth, and has been used for devitalizing pulps of teeth when nearly exposed by mechanical abrasion. It is also used in combination with hydrochloric acid (aqua regia) as a solvent for gold.

Phosphoric Acid, H_3PO_4.

Properties.—Phosphoric acid is a solid, colorless compound, soluble in water and vitrifiable by heat (converted into glass). It is obtained from bones, where it exists in combination with lime. *Diluted phosphoric acid* is the form in which phosphoric acid is usually employed in medicine. It contains 10 per cent. of the absolute acid. Dose, ℥v-xx.

Action.—Phosphoric acid is tonic and refrigerant, and in large doses an irritant poison. It has been employed externally in the treatment of osseous tumors and caries of the bones.

Glacial phosphoric acid, $HOPO_3$, is obtained from calcined bones. They are first treated with sulphuric acid, "which produces an insoluble superphosphate of lime, then dissolving out the latter salt and saturating it with carbonate of ammonia, which generates phosphate of ammonia in solution, and, finally, obtaining the phosphate of ammonia by evaporating to dryness, and then igniting it in a platinum crucible. The ammonia and all of the water, except one equivalent for each equivalent of the acid, are driven off, and the glacial phosphoric acid remains. It is a white, transparent, fusible solid, generally in the form of sticks, inodorous, and sour to the taste. It slowly deliquesces, and is sparingly soluble in water, but freely soluble in alcohol."*

Dental Uses.—Phosphoric acid has been employed in dental practice as a local treatment of osseous tumors and caries of the maxillary bones.

Glacial phosphoric acid is employed as one of the ingredients of the plastic filling material, known as oxyphosphate of zinc, the other ingredient being the white oxide of zinc.

Hydrochloric Acid, HCl.

Properties.—Hydrochloric or muriatic acid is nearly colorless when pure, but that usually found in the shops is of a pale yellow color, being contaminated with chlorine, iron, and other

*Gorgas' "Dental Medicine."

substances. It is volatile, emitting a dense white and suffocating vapor; taste very acid and caustic.

Actions.—Hydrochloric acid is caustic, escharotic, and disinfectant. The diluted acid administered internally is tonic, refrigerant, and astringent.

Diluted Hydrochloric Acid (ten per cent. solution of absolute acid and water). Dose, ℥v-xx.

Dental Uses.—It is sometimes a useful application for treatment of ulceration and inflammation of the mucous membrane and gums. "The strong acid is employed in the laboratory for dissolving zinc, in the preparation of a flux for soldering certain metals."

SEDATIVES.

Sedatives are agents which exert a soothing influence—that is, diminish pain—by lessening the functional activity of organs.

The principal agents of this class are opium and aconite (see Anodynes), digitalis (see Tonics), alcohol (see Stimulants), chloroform (see Anesthetics), etc.

ANTIPYRETICS.

Antipyretics are agents which reduce the temperature of fever. They act either by lessening heat production or by radiation of heat.

The most prominent of this class are antipyrine, quinine (see Tonics), aconite, alcohol (by increasing heat radiation), also cold bath, ice to the body, etc.

ANTIPYRINE, $C_{20}H_{18}N_4O_2$.

Derivation.—Antipyrine is an alkaliodal product of the destructive distillation of coal-tar oil.

Properties.—It is a whitish, crystalline powder, soluble in water (one-half its weight of hot and its own weight of cold

water); less soluble in alcohol, chloroform, and ether; is slightly bitter and odorless. It may be administered hypodermically; is non-irritant to the stomach or the tissues. When combined with ferric chloride it gives a bright-red color, and with nitric acid a beautiful green color.

Actions.—Antipyrine is a powerful and popular antipyretic, a general anodyne, hæmostatic, and also possesses mild anesthetic and hypnotic powers. A full medicinal dose (gr. xxx) produces a stimulant stage of short duration, which is soon followed by profuse sweating, coolness of the surface, slowed pulse, and more or less depression. The temperature in fevers is reduced from 2 to 10 degrees in from 1 to 5 hours, according to the size and continuance of the dose. In health the reduction of the temperature is very slight, and it gives rise to slight nausea and depression. It is eliminated by the kidneys, appearing in the urine a few hours after taking.

"In toxic doses its principal influence is exerted upon the blood, altering the shape of the red blood corpuscles, separating the hæmatin, and causing decomposition of that fluid."*

Dose, for adult, gr. v-xxx; children, gr. j-x.

Dental Uses.—Antipyrine may be employed in dental practice for its hæmostatic, anesthetic, and anodyne powers.

IRRITANTS.

Irritants are agents which produce more or less vascular excitement or inflammation. They may be either chemical, mechanical, or nervous.

Chemical irritants are those which act by virtue of their affinity for organic tissue, exciting the action of the capillaries, and causing an afflux of vascular and nervous power to the part to which they are applied. Included in this class are

*Potter's "Materia Medica."

iodine, capsicum (see Stimulants), turpentine, ammonia (see Stimulants), etc.

Mechanical irritants are agents or means that cause lesions or inflammation by mechanical operation. Filling material or other foreign substances being forced through the apical foramen of the root of a tooth will cause sufficient irritation to produce an abscess; and cuts, contusions, etc., are included in this class.

Nervous irritants act through the medium of the nerves, as nervous shock, depression, or sympathetic inflammation.

Iodine.

Derivation.—Iodine is obtained principally from marine plants, though it occurs in cod-liver oil and shell-fish to a limited extent.

Properties.—Iodine is a non-metallic element, is usually in the form of bluish-black crystalline plates or scales, having a metallic lustre, a peculiar odor, hot, acrid taste, and is of neutral reaction. It volatilizes at a low temperature, giving off a beautiful purple vapor, is slightly soluble in water (1 in 7000), readily soluble in alcohol and ether (1 in 12), also in a solution of chloride of sodium and iodide of potassium.

Principal Preparations:—

Tincture of Iodine, 8 per cent. in alcohol. Dose, ♏j-v.

Compound Tincture of Iodine (iodine, 5 per cent., potassium iodide, KI, 10 per cent., and water 85 per cent.). Dose, ♏j-x diluted.

Potassium Iodide. Dose, gr. v-xxx.

Iodoform, CHI_3. Dose, gr. j-v, in pill form.

Actions.—Iodine in its elementary state is an irritant to the skin, and is much used in the form of tincture to produce counter-irritation.

Internally in small doses it is a stimulant and tonic; it excites a sensation of heat or burning in the stomach, and in

large doses acts as an irritant poison. If continued for any length of time, iodine induces great waste and rapid elimination of waste products, causing anæmia and depression.

The local irritant effect is diminished when combined with potassium; hence, potassium iodide (aqueous solution of potassa and iodine) is usually employed for internal use, which allows the administration of larger doses and for a greater length of time.

Toxicology.—*The antidote* for iodine is starch, forming an iodized starch, which should then be evacuated from the stomach.

Colorless Iodine.—There are a number of methods for bleaching iodine; among them are the following: 1st. Add to a drachm of tincture of iodine six ounces of hot water and twelve grains of phenol; stir with a glass rod. 2d. Iodine is bleached by mixing with carbolic acid; this, carbolate of iodine, combines all the advantages of both agents.

Dental Uses.—Iodine is a very valuable agent in dental practice, the tincture being employed locally in the treatment of periostitis, inflammation and ulceration of the gums, fungous growths, suppurating pulps of teeth, alveolar abscess, and for ulcerations of the mucous membrane; it is often combined with carbolic acid, and for dental periostitis it is generally combined with tincture of aconite; this combination forms an excellent treatment for the incipient stages of this affection, as well as those of alveolar abscesses.

Turpentine.

Derivation.—Turpentine is a concrete, oleo-resinous exudation from various species of pine, but principally from the "yellow pine."

Properties.—Turpentine is in the form of tough, yellowish masses, more or less transparent, inflammable, having a strong, unpleasant odor, and warm, pungent taste.

It is composed entirely of resin and the essential oil known as oil of turpentine, $C_{10}H_{16}O$. It is soluble in alcohol. The oil is the form mainly used.

Actions.—Turpentine is a stimulant, diuretic, antispasmodic, and rubefacient (counter-irritant), and antiseptic externally.

Principal Preparations:—

Oil of Turpentine, Spirits of Turpentine, a volatile oil distilled from turpentine. Dose, ℥v-xv in emulsion as a stimulant.

Turpentine Liniment.—Resin cerate (a composition of wax, oil, or lard), 65 per cent., oil of turpentine, 35 per cent.

Pitch is a resinous exudation from the stem of certain pine, fir, and spruce trees. It melts at the boiling point of water, and softens by the heat of the human body. It is of a dark-brown color, and possesses a well-known odor and taste. It is used principally as the base of plasters.

Dental Uses.—Turpentine may be used in dental practice for its rubefacient and antiseptic properties.

ASTRINGENTS.

Astringents are agents which produce contraction and condensation of organic tissues, with a tendency to remove morbid affections, arrest hemorrhage and excessive secretions from the mucous membrane. They are divided into two classes, known as vegetable and mineral.

The principal vegetable astringents are tannic acid and gallic acid, the chief elements of these being tannin, *while the mineral astringents are* persalts of iron (see Tonics), alum, sulphuric acid, nitric acid, etc.

Tannic Acid, $C_{27}H_{22}O_{17}$.

Derivation.—Tannic acid is obtained from nut galls. *Galls* are the excrescence on the twigs of the Dyer's oak, grown in

Asia Minor and Persia, caused by the punctures and deposited ova (egg) of an insect.

Properties.—Tannic acid is obtained in the form of thin, yellowish crystals, inodorous, very soluble in water, less so in alcohol and ether.

Actions.—Tannic acid is the most powerful of all vegetable astringents and styptics. It is especially active upon albumin, gelatin, and fibrin, forming therewith insoluble tannates, thus protecting the parts beneath until resolution occurs. Dose, gr. j-xx, in pill.

Dental Uses.—Tannic acid is a very valuable agent to the dental practitioner. It is used locally in the treatment of hemorrhage following the extraction of teeth, wounds of the mucous membrane, fungous growths of the tooth pulp, hypertrophy of the gums, and to many it has proven beneficial in the treatment of sensitive dentine, a strong solution of tannin being mixed with alcohol. *In mercurial salivation,* the powdered tannic acid, moistened with water, will check the tendency to absorption and the consequent loosening of the teeth, and will render the gums firmer and more comfortable.

Glycerite of Tannic Acid (tannin, ℥ij; glycerin, ℥viij), for external use.

Ointment of Tannic Acid (tannin, ℥j; lard, ℥j), for application to ulcers, etc.

Gallic Acid, $C_7H_6O_5$.

Derivation.—Gallic acid is prepared from nutgalls. The powdered galls, in water, are left to the action of the atmosphere, when the acid, in the form of fine, almost colorless, crystals are deposited.

Properties.—Gallic acid is obtained in the form of very fine, silky, and almost colorless crystals. It is slightly soluble in cold water (100 parts), and rapidly so in hot water, glycerine, or alcohol. It has a slightly acid and astringent taste.

Action.—Gallic acid is a powerful astringent, styptic, and disinfectant. It is given directly for internal hemorrhage profuse perspiration (night sweats), and excessive expectorations of phthisis and chronic diarrhœa. Dose, gr. v-xx, in pill form.

Dental Uses.—in dental practice gallic acid may be used as a styptic in superficial hemorrhages; it is not so efficient, however, as tannic acid. It is employed in the form of a gargle, in acute inflammation of the mucous membrane, etc. For hemorrhage following extraction of teeth, Dr. Bartholomew claims that a teaspoonful of gallic acid in a glass of water, internally administered, is very efficacious.

Alum.

Source.—Alum is found native in Italy, in the neighborhood of volcanoes. It is also obtained from aluminous slate or shale by roasting and exposure to the air.

Formula.—The official alum (potassic-aluminic-sulphate) has the formula $K_2AL_24SO_4+24H_2O$. Dried or "burnt alum" has the water of crystallization, $24H_2O$, driven off by gentle heating, which leaves it in the form of a soft, white powder.

Properties.—Alum is a white, transparent salt, crystallizing easily in octahedrons (having eight equal and equalateral triangles). It dissolves easily in hot water, and by about fifteen times its weight in cold water; is insoluble in alcohol. It possesses an astringent and sweetish taste.

Actions.—When taken internally in large doses, it causes vomiting, purging, and inflammation of the gastro-mucous membrane. As an emetic, powdered alum, in teaspoonful doses is very efficient. Applied locally, it is an excellent astringent to relaxed or bleeding parts. Dose, in powder or solution, gr. x-xl (2ʒ).

Dental Uses.—In dental practice, alum is employed as a styptic in alveolar hemorrhage, superficial hemorrhage of the mucous membrane, ulcers of the mouth, etc. It also serves an

excellent purpose as a gargle in ulceration and sponginess of the gums.

STYPTICS AND HEMOSTATICS.

Styptics are agents which arrest hemorrhage by local application. They are divided into chemical and mechanical, according to their action.

Chemical styptics coagulate the exuding blood, and at the same time stimulate the tissues to contraction.

The principal members of this class are, tannic and gallic acids (see Astringents), persulphate of iron—solution, subsulphate of iron—powdered (see Tonics), alum (see Astringents), and adrenalin.

Mechanical styptics are agents which promote clot formations in the mouths of bleeding vessels. They retard the flow by detaining the blood in their meshes, or absorb it until it coagulates.

The principal mechanical styptics are spider's web, plaster-of-Paris, sandarach varnish, cotton, etc.

Adrenalin.

Derivation.—Adrenalin is the active principle of the adrenal or suprarenal gland. Adrenalin chloride, 1:1000, is a definite product, composed of 1 part adrenalin with 999 parts normal saline solution, and may be diluted to any degree desired by the adding of this solution. This preparation is practically permanent if kept in well stoppered bottles. Under continued exposure to air the liquid becomes brown in color and a sediment is thrown down, when it should be discarded. The manufacturers say that adrenalin is about a thousand times as powerful as adrenal or suprarenal gland, making the 1:1000 solution of the chloride approximately the same strength of the original gland, but freed from all inert matter.

Dental Uses.—The adrenalin chloride solution, applied locally is an excellent styptic, and astringent. Its action is

local upon the muscular tissue of the small blood vessels. It does not coagulate albumen. Its use is indicated in the treatment of persistent hemorrhage following the extraction of a tooth, or the removal of a pulp; and in the fitting and setting of crowns, etc., to render the field bloodless. Adrenalin has more recently been recommended for the extirpation of pulps, but extended clinical experience must determine just what value it has in this direction.

Hemostatics are agents capable of arresting hemorrhage by internal administration, such as ergot, antipyrine (see Astringents), the diluted mineral acids (see Tonics), etc.

Ergot.

Source.—Ergot is obtained from a parasitic fungi replacing the grain of rye. It is a diseased state of the grain, occasioned probably by a hot summer succeeding a rainy spring. *Corn ergot* is obtained from a similar growth upon the Indian corn.

Principal Preparations:—

Fluid Extract of Ergot. Dose, ℥ss-ij.

Extract of Ergot. Dose, gr. j-xx.

Medical Properties and Actions.—Ergot is a hemostatic, aiding coagulation by slowing the blood current. It is also used to stimulate the contraction of unstriped muscular fibre, particularly those of the uterus, causing continuous labor pains. It has been much used for this purpose in obstetrics, and very often injuriously, causing laceration of the perineum and paralysis of the fœtal heart, the natural intermitting contraction being the most desirable.

Dental Uses.—Ergot may be used in dental practice for its hemostatic properties in alveolar or other hemorrhages.

ESCHAROTICS OR CAUSTICS.

Escharotics or caustics are agents which are capable of destroying the life of the tissue with which they come in contact, producing an eschar or sloughing of the tissue. Fire itself is

the actual cautery, while the potential cautery (caustic substances) is represented by silver nitrate, arsenious acid (see Tonics), carbolic acid, zinc chloride (see Tonics), and the mineral acids (see Tonics), etc.

Nitrate of Silver, $AgNO_3$.

Derivation.—Nitrate of silver, or "lunar caustic," is made by dissolving silver in nitric acid, and evaporating the solution. The reation being $Ag_3+4HNO_3=3AgNO_3+2H_2O+NO$.

Properties.—Nitrate of silver is in the form of colorless, shining crystals, but is readily blackened by mixing with organic matter or by exposure to the light, is very soluble in water, and has a strong metallic and styptic taste. It is often cast in sticks, by first being melted (fusing at 426° F.) and then poured into suitable moulds.

Actions.—Nitrate of silver is a powerful caustic and astringent, a heart and nerve stimulant, antispasmodic and sedative. When applied locally to the mucous membrane, ulcers, etc., it first turns the surface white, owing to its union with the coagulated albumin, but finally turns to a black color, which is due to the partial reduction of the silver by the sulphuretted hydrogen contained in the atmosphere. *Continued use* of nitrate of silver will cause a peculiar blue line in the gums, similar to that from lead poisoning; this is followed by a blue appearance of the skin. The remedy should be discontinued at once when this discoloration is observed.

Dose of nitrate of silver, gr. $^1/_6$ gradually increased to gr. j, in pill form. Never should be given with tannin or a vegetable extract; an explosive compound may result. The fused or solid form is used externally.

The antidote for nitrate of silver is chloride of sodium (common salt) freely; it precipitates it in the insoluble chloride of silver; also acts as an emetic.

Dental Uses.—Nitrate of silver is employed in dental practice for obtunding sensitive dentine, especially where the cause is mechanical abrasion, or from the fracture of a tooth, exposing the healthy and sensitive dentine, the stick form being employed, or the end of a silver wire may be immersed in nitric acid and carefully applied. It is also a valuable application for ulcerated conditions of the mucous membrane of the mouth, also as a treatment for caries in deciduous teeth.

Carbolic Acid, C_6H_5O.

Derivation.—Carbolic acid, phenylic alcohol or phenol, is obtained as an alcoholic product of the distillation of coal tar, between the temperatures of 338° and 370° F. Carbolic acid, though the universal name, is inappropriate. It does not belong to the acid series (it will not turn blue litmus paper red), being neutral in its reaction.

Properties.—Carbolic acid, when pure, is in the form of colorless or pinkish acicular (needle-like) crystals. It becomes an oily liquid at 95° F., or, if exposed to the air, the crystals readily absorb moisture and are thus liquefied. Five per cent. of water liquefies it; any further addition simply forms a mechanical mixture. It is freely soluble in alcohol, ether, chloroform, glycerine, and the essential oils. It has a strong aromatic odor and taste, resembling creasote somewhat.

Actions.—Carbolic acid in its pure state is escharotic; when diluted, it is a powerful antiseptic, germacide, rubefacient, and is a violent poison; internally, it is a sedative and carminative, allaying vomiting and gastric irritability.

It resembles creasote closely in many of its medicinal properties, but is probably more efficacious, and its odor is surely less objectionable.

Dose, gr. ¼, for relief of nausea, etc.

Dental Uses.—Carbolic acid is a valuable agent in dental therapeutics, it being one of the best escharotics, styptics, anti-

septics, sedatives, etc. It is used to obtund sensitive dentine, to relieve odontalgia, when caused by the exposure of the tooth pulp, by applying it to the exposed surface; it arrests putrefactive changes, is a valuable agent in the treatment of alveolar abscess; is also used to bathe cavities in the teeth, both for its obtunding effect upon the sensitive dentine and to destroy any low organisms that may be in the softened dentine.

In a form known as phenol sodique, carbolic acid is very useful as a styptic for the treatment of superficial hemorrhage after the extraction of teeth, and forms an excellent antiseptic mouth-wash.

"Combined with glycerine (1 part to 12 of glycerine) it will stimulate the mucous secretion, and hence has been applied to the palate, in cases of deficiency of this secretion, to promote the suction of the upper dentures."*

Acetic Acid, $C_2H_4O_2$.

Derivation.—Acetic acid is produced from wood by destructive distillation.

Properties and Actions.—The purified acid contains about 28 per cent. of anhydrous acetic acid. The diluted acid, the only form employed internally, is composed of one part acetic acid to seven parts distilled water.

It is a stimulant, astringent, diaphoretic, escharotic, etc. The strong acid, when applied to the skin, causes considerable redness and pain, which rapidly results in a blister (vesication).

Dose.—Acetic acid, dilute, ℥j-ij.

Therapeutic Uses.—Acetic acid is sometimes employed in fevers, night sweats, hemorrhage of the lungs or stomach. Externally, the strong acid is used in the treatment of cancer, corns, warts, or fungous growths. The dilute acid is sometimes employed externally to gangrene, ulcers, and sprains or bruises.

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*Prof. Gorgas.

Dental Uses.—Acetic acid is sometimes applied to indolent ulcers of the mouth, and to fungus growths of gum or dental pulp; for the latter the concentrated form is employed. Gorgas gives the following formula for indolent ulcers, cancrum oris, etc.: Acetic acid three fluid ounces to distilled water five fluid ounces; apply with camel's-hair brush.

Trichloracetic Acid.

Derivation.—Trichloracetic acid is formed from acetic acid, three atoms of the hydrogen of which is, in the new acid, replaced by chlorine. It is one of a group of three acids, having similar properties; the difference in their composition is due to the proportion of chlorine they contain. The others referred to are monochloracetic and dichloracetic acids.

Properties and Actions.—Trichloracetic acid is in the form of colorless, deliquescent crystals, having an agreeable odor, and is readily soluble in water and alcohol. Its concentrated solutions are powerful caustics, while the weaker solutions make a good antiseptic.

Therapeutic Uses.—As an antiseptic it is used in putrid and indolent wounds and erysipelas. Diluted with water to a 3 per cent. strength it is an effective stimulant and astringent.

Dental Uses.—It is used in dental practice as an escharotic; 10 per cent. solution is often employed in the treatment of pyorrhœa alveolaris, acting, it is claimed, as a solvent on calculi upon the roots of teeth. A one per cent. solution is recommened as a mouth-wash, owing to its astringent and stimulating qualities.

ANTIZYMOTICS.

Antizymotics are agents which arrest or prevent fermentative processes; they are divided into antiseptics and disinfectants.

Antiseptics are those agents which prevent or retard septic decomposition, either by destroying the bacteria upon which putrefaction depends, or by arresting their development.

The most important of this group are bichloride of mercury, peroxide of hydrogen, carbolic acid, (see Escharotics), potassium permanganate, iodoform, phenal sodique, alcohol, eucalyptol, etc.

Disinfectants are those agents which destroy the germs of infectious diseases.

The principal members of this group are carbolic acid (see Escharotics), zinc chloride (see Tonics, Zinc), potassium permanganate, iodine (see Irritants), aromatic sulphuric acid (see Tonics, Sulphuric Acid).

Bichloride of Mercury, $HgCl_2$.

Derivation.—Bichloride of mercury, mercuric chloride, or "corrosive sublimate," is obtained by distilling* a mixture of sodium chloride and mercuric sulphate; a double decomposition takes place, forming mercuric chloride and sodium sulphate.

Properties.—Bichloride of mercury is in the form of colorless crystalline masses. It is inodorous, fusible, soluble in 16 parts of water, 7 parts of alcohol and ether, and has an acrid, styptic taste.

Actions.—Bichloride of mercury is one of the most active salts of mercury. It is one of the most efficient of all the antizymotics in the strength of 1 part to 2000 parts of water. It is internally employed in chronic diarrhœa, dysentery, and syphilis.

Dose, gr. $^1/_{30}$-$^1/_{10}$ in pill form.

Antidotes to bichloride of mercury are albumin, wheat flour, milk, etc.

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*The double process of vaporization and condensation of the vapor.

Dental Uses.—For prophylactic treatment of the oral cavity, particularly of the teeth, bichloride of mercury, 1 to 10,000, is most effective. It should be carefully used, however, on account of its poisonous character.

It is also used extensively in dental practice, in treatment of alveolar abscesses, and in diseases of the antrum of Highmore, in a solution of 1 to 2000, to 1 to 5000.

Peroxide of Hydrogen, H_2O_2.

Derivation.—Peroxide of hydrogen is obtained by combining an extra molecule of oxygen with hydrogen monoxide, H_2O (water), the result being a water-like liquid, H_2O_2. "As when barium dioxide is dissolved in dilute hydrochloric acid:—

$$BaO_2+2HCl+H_2O=BaCl_2+H_2O+H_2O_2."*$$

Properties.—Peroxide of hydrogen is in the form of a colorless, transparent liquid, is inodorous, and almost tasteless.

Actions.—Peroxide of hydrogen is one of the most efficient and at the same time the least harmful of all antiseptics and disinfectants. The second molecule of oxygen, spoken of above, is very loosely combined, and the mixture is always on a strain to break up into water and oxygen; for this reason it should be kept in a cool and dark place, and it is owing to this fact (that peroxide of hydrogen generates "ozone," O_3) that pus and the bacteria of diseased surfaces, when treated with this agent, are at once destroyed. "As soon as ozone has accomplished its cleansing effects upon the infected surface, it is readily transformed into ordinary oxygen, owing to its instability." *It is employed as an internal remedy* in fevers, whooping cough, bronchitis, consumption or phthisis, diphtheria, dyspepsia, catarrh of the stomach, etc.

Locally Employed.—Peroxide of hydrogen may be employed for its antiseptic and pus-destroying properties in the

*Leffmann's "Chemistry."

treatment of abscesses, ulcers, carbuncles, wounds, both fresh and putrid, catarrh of the nose, hay fever, diphtheria, etc. It is also the base of most hair-bleaching solutions.

Dose of peroxide of hydrogen, ℥ss-ij.

Dental Uses.—It is one of the most valuable remedies in dental therapeutics, being especially valuable as a cleansing agent, and is employed also in the treatment of alveolar abscesses, pyorrhœa alveolaris, inflammation and ulceration of the oral mucous membrane, fungous growths, etc.

Pyrozone.

Derivation.—Pyrozone solutions are aqueous or ethereal fluids, containing exact percentages of hydrogen peroxide. The solutions are prepared in two strengths, aqueous 3 per cent. solution, and ethereal 25 per cent. solution.

Properties and Actions.—Pyrozone 3 per cent. solution is a rapidly acting, harmless antiseptic, which can be employed externally or internally without danger of toxic effects. It may be used in all cases where carbolic acid or other disinfectant is indicated. The 25 per cent. solution is a bleaching agent, and when applied to diseased parts acts as a powerful caustic, bringing about resolution in a short time.

Therapeutic Uses.—The 3 per cent. solution is used in certain forms of indigestion or dyspepsia, ulcers of the stomach, and gastritis; 25 per cent. solution is applied to ulcers, syphilitic patches, pus-generating surfaces, and for chronic eczema.

Dental Uses.—Pyrozone is used in the 3 per cent. solution as a mouth-wash; it is non-poisonous, and in cases where the micro-organisms of the mouth threaten septic invasion of the stomach, it forms a perfect gargle or spray. It completely destroys pus and mucous secretions, and renders the mouth aseptic. The 25 per cent. solution is, as has been indicated, employed principally as a bleaching agent, and is proving a most valuable drug for that purpose.

Peroxide of Sodium.

Derivation.—Sodium peroxide is obtained by adding hydrogen peroxide to an excess of caustic soda, 20 per cent. solution, which is then poured into alcohol.

Properties and Actions.—Sodium peroxide is the chemical analogue of hydrogen peroxide, and is dispensed as a yellowish white powder, which is soluble in water, which action produces an increase in temperature and evolves a certain amount of oxygen. It is a strong caustic alkaline, which properties it retains after the loss of part of its oxygen, becoming Na_2O, which in combination with water, is ordinary caustic soda.

Dental Uses.—It is used in dental practice as a bleaching and sterilizing agent. It is claimed that sodium peroxide removes more completely than any other drug, the dental tubular contents; and it is further claimed that the normal translucency of the tooth is more fully restored.

Permanganate of Potassium, $K_2Mn_2O_8$.

Derivation.—Permanganate of potassium is prepared by fusing the black oxide of manganese with chlorate of potassium and caustic potassa.

Properties.—It is in the form of dark purple crystals; it is very soluble in water, forming a beautiful lilac-colored solution; inodorless, and has a sweetish, astringent taste.

Actions.—Permanganate of potassium taken internally is a stimulant, and is given with benefit in dyspepsia; is a mild escharotic, and a powerful disinfectant and deodorizer. The solution is decomposed by organic matters, sulphides and sulphites, yielding up its oxygen readily (on which property its use depends), and is converted into a colorless solution.

The most important uses for this agent are external, where it is employed as a deodorizer and disinfectant in abscesses, ulcers, cancers, caries of the bone, etc., in the form of a lotion and spray, while the powder may be sprinkled on gangrenous

surfaces, acting as a local stimulant as well as a deodorizer.

Dose, for internal use, gr. ¼-j. For external use, f℥j to water, f℥v-x.

Dental Uses.—It is employed in dental practice in the treatment of foul abscess, in diseases of the antrum, necrisis of the maxillary bones, ulcers of the mouth attended with fetid discharges, offensive breath, etc.

Iodoform, CHI_3.

Derivation.—Iodoform is a preparation of iodine. It is "obtained by the action of chlorinated lime upon an alcoholic solution of iodide of potassium, heated at 104° F., the product being iodoform and iodate of lime, the iodoform being separated by boiling alcohol."

Properties.—Iodoform is in the form of small yellow crystals, which are soft to the touch, of a sweetish taste; is volatile, and has a very unpleasant odor (which may be covered with oil of rose, etc.); is insoluble in water, but is soluble in alcohol, ether, chloroform, and the essential oils.

Actions.—Iodoform is an efficient antiseptic, inhibiting and destroying the microbes of putrefaction and suppuration; it has also slight local anesthetic properties.

Internally in small doses it is a tonic, alterative, anodyne, and antiseptic.

In large doses it causes a form of intoxication, followed by convulsions, collapse, and death.

Dose, gr. j-v, in pill form.

Dental Uses.—In dental practice iodoform is a valuable agent; it is an excellent antiseptic for the treatment of alveolar abscesses, putrescent pulps, especially when combined with oil of eucalyptus. Prof Peirce recommends iodoform ground with equal parts of oil of cloves and oil of eucalyptus, a portion of which may be introduced to the inflamed part on the point of a small broach.

Iodoform is also serviceable as a packing for the pockets of pyorrhœa alveolaris, and as a dressing or packing for wounds, where it may be used in the powdered form or in the form of a gauze which is prepared for the purpose.

Aristol.

Derivations.—Aristol is a preparation of iodine, and has gained a position in recent therapeutics as a perfect substitute for iodoform. It is a thymol iodide, and is "produced by treating an aqueous solution of iodine in iodide of potassium with an aqueous solution of thymol in the presence of caustic potash."

Properties.—Aristol is in the form of a reddish brown powder; is volatile, and has a slight aromatic odor, though when compared with iodoform we may say it is practically inodorous. The quantity of iodine contained in it is from 45 to 50 per cent.

Aristol is insoluble in water and glycerine, slightly soluble in alcohol, but is readily soluble in ether, chloroform, collodion, and the fixed and ethereal oils.

Actions.—Aristol is an efficient antiseptic; it is particularly applicable as a dressing for wounds, ulcerations, and abrasions of the skin and mucous membrane.

It may be dusted over the wound, or applied in the form of aristol ointments (compounds of vaseline or cold cream) or in combination with collodion. All of these are excellent and easy of application. Its efficiency as an antiseptic and alterative is largely due to the fact that it slowly gives off its iodine, and it is also due to this fact that it does so decompose, when exposed to the light or undue heat, that it should be kept in a colored bottle or a closed box and in not too warm a place. If this is not done, the loss of iodine will be readily noticed by its gradually becoming paler in color.

Dental Uses.—Aristol is a welcome addition to our catalogue of therapeutic agents. I have found it an excellent agent

for treating root-canals from which putrescent pulps have been removed and for alveolar abscesses. It can also be used advantageously in combination with root-filling materials; it may be used by mixing the powder with chloro-percha, or, where gutta-percha cones are to be used, the cone may be dipped in a solution of aristol and chloroform and immediately carried to position. Dr. Kirk says of it in this connection: "I have made use of aristol in connection with root-filling materials by another method. A strong solution of aristol is made in the oil known to house-painters as 'Japan dryer,' sufficient of the drug being added to make the liquid somewhat thinner than glycerine; into this is worked with a spatula freshly calcined oxide of zinc until the mass is like putty, in which condition it is to be worked into the root-canals. The mass becomes quite hard, and seems to fulfill admirably the requirements of a root-filling."

Formalin.

Derivation.—The name formalin has been given to a 40 per cent. solution of chemically pure formaldehyde in water. Formaldehyde (CH_2O), as is well known, is a gaseous body which is prepared by subjecting methyl-alcohol to oxidation. It is readily absorbed by water; for this reason it is put on the market in the form of an aqueous solution termed "formalin." It mixes with water in all proportions, making it easy, therefore, to prepare any dilution required.

Properties and Actions.—Formalin can be used either in a gaseous or liquid form; it is non-poisonous, of a peculiar, penetrating odor. When brought into contact with the animal skin, undiluted formalin exerts a kind of tanning effect, making the skin impermeable and finally brings about necrosis. The tissue is destroyed with suppuration or formation of a wound.

Therapeutic Uses.—Formalin is an ideal germicide, disinfectant, deodorant, and antizymotic, possessing the same germicidal power as corrosive sublimate, without its toxicity. It is

used in aseptic and antiseptic surgery, for inhalations, in ophthalmic practice, in bacteriology, as a hardening and preserving medium, and in the recognization of the typhoid bacillus.

Dental Uses.—It may be used in dentistry for destroying the nerves of teeth, and as an antiseptic agent.

Gaultheria.

Derivation.—Gaultheria is obtained from the leaves of the gaultheriæ procumbens (*Ericaceae*), a small plant common to North American woods. These leaves contain tannic acid, urson, arbutin, ericolin, a volatile oil, etc.

Properties and Actions.—Gaultheria has an aromatic, bitter, and astringent taste. The volatile oil is composed principally of methyl salicylate and gaultherilene, which produce pure salycilic acid.

Therapeutic Uses.—The oil of gaultheria is antipyretic and antiseptic, and is used in wounds, and administered internally for auricular rheumatism. The spirit of gaultheria is used as a flavoring extract.

Dental Uses.—Gaultheria, being one of the essential oils, is useful to the dentist for its antiseptic properties, either alone or combined with other medicines for the treatment of alveolar abscess and putrid root canals; it is also an ingredient of local anesthetic mixtures.

Creasote.

Derivation.—Creasote is one of the products of the distillation of wood-tar, and consists principally of such phenols as phloral, creasol, methyl-creasol, and guaiacol. It can also be obtained from crude pyroligneous acid. That made from beechwood, however, is the better form for medicinal use.

Properties and Actions.—Creasote is a colorless, oily fluid, with an odor somewhat resembling carbolic acid, and has a burning taste. It is a stimulant, antiseptic, styptic, sedative,

and rubefacient. In large doses it is a narcotic poison, causing death by coagulating the albumen of the blood, preventing its circulation through the arteries. It is used in small doses, generally, for its astringent qualities.

Therapeutic Uses.—Internally, creasote is administered for pulmonary consumption, chronic bronchitis, vomiting and gastric troubles, diarrhœa, diabetes, etc. Externally, applied to hemorrhages from wounds, etc., diseases of the skin, eruptions, ulcers, etc.

Dental Uses.—Creasote has for many years been employed in dental practice for relieving odontalgia, as an obtundant, for alveolar abscess, ulcers of the mouth, etc. Its antiseptic powers render it valuable for offensive purulent discharges; and its styptic properties are sometimes taken advantage of in the treatment of hemorrhage after extraction of teeth.

Naphthol.

Derivation.—Naphthol is derived from naphthalene ($C_{10}H_8$) which is a coal-tar product and in the form of white crystals, having a strong, unpleasant odor; soluble in alcohol, but not in water. This alcoholic solution is known as naphthol.

Properties and Action.—There are two forms of naphthol, α-naphthol and β-naphthol; the latter, owing to its less irritating effects, is generally employed medicinally. It is a light-brown crystal, soluble in hot water.

Therapeutic Uses.—Owing to its antiseptic properties it is used in parasitic diseases of the skin; it is given internally, and applied externally as an ointment.

Dental Uses.—Hydronaphthol, supposed to be a form of β-naphthol, is most generally used in detal practice for treating canals and pulpless teeth, pericemental inflammation of septic origin, especially in early stages before pus has formed. Professor James Truman recommends a solution of 1 : 1000 of water for injection into pulp canals. It is also recommended as an

ingredient for a mouth-wash for diseased gums and mucous membrane.

Campho-phenique, $C_8H_{11}O$.

Derivation.—Campho-phénique is obtained from the chemical union of carbolic acid and camphor. It is prepared as follows: Nine parts of carbolic acid to one part of alcohol are mixed with twenty-five parts camphor. The clear oily solution is the result.

Properties and Actions.—Campho-phénique is a limpid, volatile fluid, having an aromatic taste and the odor of camphor. It is an antiseptic, a mild local anesthetic, and germicide; is non-irritant, non-poisonous; insoluble in water or glycerine, but will mix in all proportions with alcohol, ether or chloroform.

Dental Uses.—As a dressing in the treatment of putrescent pulp-canals it has given quite satisfactory results. It has been employed hypodermically as a local anesthetic, causing no constitutional disturbance. It is also recommended for the relief of pain following the extraction of teeth, in which case it is introduced into the sockets upon pledgets of cotton.

Cinnamon (Cassia Bark).

Source.—The commercial cinnamon is the prepared bark of a tree of the natural order *Lauraceae*. The best varieties of this bark are obtained from Ceylon. It contains a volatile oil, an acid peculiar to itself—*cinnamic acid*—a trace of tannic acid, mucilage, etc.

Properties and Actions.—Cinnamon is placed upon the market in the form of long, thin, cylindrical pieces, having a yellow-brown color, a fragrant odor, and a sweetish, aromatic, and mildly-astringent taste. It is more powerful as a local than as a general stimulant. Its medicinal virtues, however, reside in a volatile oil, *oleum cinnamomi,* or oil of cinnamon.

Therapeutics.—Cinnamon is sometimes employed to allay nausea and vomiting, and in combination with chalk and with other astringents it is used for the treatment of diarrhœa. The oil of cinnamon is often employed to conceal the taste of other medicines, and is a strong local stimulant.

Oil of Cassia.—Oil of cassia is prepared from the bud of the same order of tree, and the oil of cinnamon from the bark. The oil of cassia is preferred by many as an antiseptic for local treatment.

Dental Uses.—Oil of cinnamon and oil of cassia are employed by many as antiseptics in dental practice. In the treatment of putrescent root-canals the writer has secured very satisfactory results from both these drugs. Applied to exposed and inflamed dental pulps, they will give temporary relief, and have been recommended for the treatment of pyorrhœa alveolaris, combined with iodoform. Dr. Black's "1, 2, 3 mixture" is composed of oil of cinnamon, 1 part; carbolic acid (crystals), 2 parts; oil of gaultheria, 3 parts. This is employed in the local treatment of pyorrhœa alveolaris, and for alveolar abscesses, etc.

Electrozone.

Derivation.—Electrozone is the product of sea-water specially treated by electrolysis. It has been so named from the fact that it is manufactured with the aid of the electric current, and the oxidizing agent being ozone. The result of electrolysis thus performed is the formation of new compounds, consisting of the hypochlorites, hypobromites, etc., and, it is claimed, the substitution of free oxygen and peroxide of hydrogen for the air between the molecules of water.

Properties and Actions.—It is a clear, colorless liquid, having an unpleasant, salty taste, and an odor resembling chlorine. It is a non-poisonous and efficient antiseptic, germicide, and disinfectant.

Therapeutic Uses.—It is much used for diphtheria, catarrh, and fevers, and is applied to burns, scalds, and wounds of any nature.

Dental Uses.—It is valuable to the dentist for its antiseptic and germicidal qualities, and is very efficacious in the treatment of acute pulpitis, giving almost instant relief. The writer has also found it very valuable in the treatment of root-canals, as a mouth-wash, and wherever a harmless germicide and deodorizer is desirable.

CATHARTICS.

Cathartics, or purgatives, are agents which hasten the intestinal evacuations; they comprise such substances as magnesia preparations (Epsom salts), senna, rhubarb, fruits of various kinds, etc.

Magnesia, MgO.

Derivation.—Magnesia, or magnesium oxide, is obtained by subjecting magnesium to a red heat in the open air, when it will burn with a bright light and produce MgO.

Properties.—Magnesia is a very light, white powder, odorless, has an earthy taste, is freely soluble in water—more so in cold water—and neutralizes acids.

Actions.—Magnesia is an efficient aperient (mild purgative), is antacid—hence an excellent remedy for great acidity. of the stomach—and is the antidote for poisoning by mineral acids. When it is desirable to administer magnesia in large doses and for a considerable length of time, it may be given in connection with lemonade, which will render it more soluble, avoiding its accumulation in the bowels.

Chief Preparations:—

Sulphate of Magnesia, "Epsom salts," "salts." Dose, ʒj-ℨj, in water, a popular purgative.

Liq. Citrate of Magnesia (magnesium carbonate), citric acid, potassium bicarbonate, and water. Dose, ℥iv-vj.

Dose of Magnesia as an aperient, gr. x-℥j. As an antacid, gr. 20 (℈j).

Dental Uses.—The form of magnesia usually employed in dental practice is known as *magnesium hydrate,* or *milk of magnesia,* and consists of precipitated magnesium hydrate held in suspension in water, and is employed for counteracting the injurious action of acid secretions, especially in cases of erosion. It is applied in the same way that lime-water or precipitated chalk is used for the purpose of bringing about an alkaline condition of the oral fluids, by neutralizing the excess of acids present. A teaspoonful of the preparation taken into the mouth and allowed to float about the teeth coats them with a slight alkaline film, which protects the tooth surface from the acid action for several hours.

MISCELLANEOUS DRUGS.

Glycerin.

Derivation.—Glycerin is a production of the saponification of fixed oils and fats; it also contains a small percentage of water.

Properties and Actions.—It is a colorless, syrupy liquid, having a sweet taste but no odor; soluble in water or alcohol. It is a solvent, preservative, emollient, and nutrient.

Therapeutic Uses.—It is used to dissolve iodine, iodide of potassium, borax, tannic acid, creasote, carbolic acid, etc. It is much used in poultices and for roughness of the skin, as one of the ingredients for dressings for wounds and ulcers, erysipelas, and small-pox (to prevent pitting). Glycerin is used in cases of earache and deafness. It should be mixed with a little water before applying to abraded or cut surfaces to prevent smarting.

Dental Uses.—Glycerin is much used in detal practice as a solvent and emollient. It is used in the treatment of diseases

of the mucous membrane of the mouth, such as ulcers, stomatitis, alveolar abscess, etc. Combined with lime-water, rose-water, gum tragacanth, etc., it forms ointments and emollients. Combined with atropine, acetate of lead, morphine, etc., it is used as an anodyne and emollient.

Collodion.

Derivations.—Collodion is a solution of pyroxylin, stronger ether, and alcohol, in the proportion of 4, 70, and 26 respectively. Pyroxylin, or common gun-cotton, is a mixture of nitric and sulphuric acids added to cotton freed from impurities.

Properties and Actions.—Collodion is a colorless, inflammable liquid, of the consistency of syrup, with an ethereal odor. It is used to protect abraded or cut surfaces from the air, by means of the film which it forms. Owing to its astringent tendencies it draws together and holds in apposition divided parts.

Therapeutic Uses.—It is applied to ulcers, abraded surfaces, fissures, and is also used in skin diseases and erysipelas.

Dental Uses.—Combined with carbolic acid it is applied for odontalgia. With iron, etc., it forms a styptic preparation. When a number of layers are applied, it will sometimes prevent an alveolar abscess from discharging on the face, causing it to open in the mouth. It is useful in the dental laboratory for coating plaster models, protecting the surface. Should it become too thick, dilute with a solution of ether and alcohol, 3 to 1.

Sandarach.

Derivation.—Sandarach is derived from an evergreen tree common to Northern Africa.

Properties and Actions.—Sandarach gum is in the form of small, irregular drops, of a light yellow color, occasionally brown; brittle, and slightly transparent. It has an agreeable

odor and a resinous, acrid taste. It is inflammable, and when melted by heat throws out a strong balsam odor. It dissolves readily in alcohol or ether.

Dental Uses.—The alcoholic solution of sandarach is much used in dental practice as a varnish for coating plastic fillings, etc.; and applied on cotton as a temporary stopping, and for a coating for cotton used for separating purposes.

ANTACIDS.

Bicarbonate of Soda, $2NaHCO_3$.

Sodium bicarbonate is a white powder, having a mildly alkaline, cooling taste. It is soluble in water, insoluble in alcohol. Alkaline in reaction.

Dental Uses.—Sodium bicarbonate is used in dental practice to counteract the actions of acids, and is sometimes employed as an antacid ingredient of dentifrices, etc.

Borax, $Na_2 2B_2O_2$.

Borax, or sodium borate, is a white powder having an alkaline taste and reaction. It is both alkaline and antiseptic and may be used in a saturated solution where these qualities are desired.

Dental Uses.—It is sometimes employed in mouth-washes, particularly in the treatment of stomatitis or thrush. The latter trouble occurring usually in the mouths of infants, a saturated solution of glycerin has been suggested for the treatment of same. Borax is also useful in blow-pipe analysis, as a flux in soldering metals, in solution for hardening plaster casts, etc.

Lime Water.

A saturated solution of calcium hydrate in water. It is a colorless, nearly odorless liquid, alkaline in reaction. Lime

water is readily prepared by treating freshly slaked lime with distilled water.

Dental Uses.—Lime water may be used freely as an antacid mouth-wash and gargle. It may also be used to correct acidity of the stomach, and is frequently added to the food of infants for this purpose.

MAGNESIA (see Cathartics).

PREPARED CHALK, $CaCO_3$.

This substance is a form of calcium carbonate. It is a white powder, sometimes moulded into small blocks or cones, almost tasteless, very slightly soluble in water and insoluble in alcohol; it is antacid, absorbent and astringent. It is prepared by freeing chalk from impurities and gritty substances by elutriation (e-lu-tre-a′shun).

Dental Uses.—The insolubility and antacid property of prepared chalk gives it special value as a basis for tooth powders and as a packing between teeth over night where there is a strong tendency to acidity. It is employed by some dentists to relieve sensative dentine in cavities of decay or erosion. In such cases it is employed for several days before operating. It is used in the laboratory for polishing purposes.

APPENDIX.

EMERGENCIES.

Preliminary Remarks.

Nothing, of course, can take the place of the advice and service of an experienced physician in time of emergencies; but the physician is not always at hand, and accidents of various kinds may occur in the dental office, or patients in distress present themselves to the dental practitioner for immediate relief; or some one may be burned, cut, poisoned, or suffocated, where, if we possess presence of mind and sufficint knowledge, it may be our privilege to save an endangered life. It is, therefore, expedient that the dental student should have a more thorough knowledge of what to do in case of such emergencies; it is for that purpose that this chapter of practical suggestions is prepared.

Apoplexy is the rupturing of a blood-vessel in the brain. The symptoms are stupor, heavy snoring breathing, slow pulse, flushed face, followed by paralysis usually of one side, this being marked by the drawing up of one side of the face.

Treatment.—Loosen clothing about the neck, make cold applications to the head, and keep the patient in a sitting posture until the physician arrives.

Burns or Scalds.—Not infrequently does some one's clothing take fire, usually that of women, on account of the character of their clothing. The first thing to do in time of such an accident is to have the patient lie down, but if she loses her presence of mind and will not obey instructions, she must be quickly placed upon the floor or ground and then covered or enveloped at once with the first article you seize that will ex-

clude the air and smother the flame—a breadth of carpet, rug, blanket, or coat will serve the purpose.

After the fire is extinguished, or after an extensive scald, if there is much of a burn or blister, the clothing, as much as need be removed, should be carefully clipped away, so as not to break the blisters that may have formed. These may be punctured at one edge and their contents discharged, when the outer skin will fall back in place. Then a dressing of pure sweet oil or castor oil should be carefully applied on strips of soft linen. When the skin is destroyed, the air may be excluded by applying at once any of the following: sweet oil, linseed oil, collodion, vaseline, etc. Dr. Charles Dulles, in his manual on accidents and emergencies, says: "In case of a person severely and extensively burned, the entire body may be immersed in a bath, which shall be kept, as long as necessary, at a temperature of 100°. Where the shock of a burn is great some stimulant should be given, and laudanum, in twenty-drop doses to an adult, and half as much to a child, to allay the suffering."

For Slight Burns or Scalds, an excellent dressing is to quickly sprinkle the parts with bicarbonate of soda and cover same with wet cloth, or they may be painted with white lead, or covered with the white of an egg or carron oil (equal parts of linseed oil and lime water)—in fact, anything that will exclude the air and prevent friction, and will not prevent after-examination, may be used. Aristol ointment (aristol in cold cream or vaseline) is also being used with good results, while for small burns on the hand, arm, leg, etc., immerse instantly in cold water, and let it remain for some length of time.

Burns with Acids or Caustic Alkalies, such as soap lye, should be deluged with water, and followed by an application of bicarbonate of soda for the former and vinegar for the latter, to be followed by an application of oil.

Catalepsy in appearance somewhat resembles death. The patient becomes unconscious, the muscles rigid, and the skin

pallid. In itself it is by no means dangerous, and it affords time enough to summon a doctor, which is the only sensible thing to do under these circumstances.

Choking is usually caused by the lodgment of some foreign substance in the trachea or œsophagus. When the body is lodged in the trachea, there is great irritation and coughing, though it does not materially interfere with deglutition. While, on the other hand, when the œsophagus is closed, it is usually impossible to swallow, and there is little or no coughing.

Treatment.—Hold the head low and slap the back quite forcibly. Blow into the ear, which will excite a reflex action that will aid the patient in expelling the foreign body. The removal of pins, needles, splinters, fish bones, etc., from the throat is usually an extremely delicate operation. They should be grasped with a small pair of forceps or tweezers, or a blunt pair of scissors may be used for the same purpose.

Convulsions are usually caused by some irritation of the digestive apparatus, or *by some interference in the eruption of the teeth.*

Treatment.—When the physician's coming is delayed, the child should be placed in a hot bath; the head at the same time should be kept cool by cold applications. This should be continued for about ten minutes, when the child should be wrapped in warm blankets and put to bed. *If there should be one or more teeth endeavoring to erupt at this time, the gums should be freely lanced.*

Dislocations can be easily detected. There is always deformity, pain, and stiffness of the joint affected.

Dislocation of the lowerjaw, with treatment for same, is fully treated upon pages 62 and 63.

Dislocation of the fingers can easily be corrected by strong pulling and at the same time pressing the parts into place, where they should be retained for several days by a splint and bandage.

Dislocations of other joints had better be left for the surgeon's hands. "The risk of doing injury by injudicious efforts

to set a joint is greater than that of waiting until a surgeon can be summoned." The patient, however, should be placed in the most comfortable position and hot fomentations should be applied.

Drowning.—It is important to remember that the body as a whole, is a very little lighter than water; therefore, a person who is in danger of drowning should lie flat on the back and keep the entire body, with the exception of the mouth and nose, under water. The arms should be stretched at full length above the head, and the lungs should be kept filled with air as much of the time as possible. This would very materially aid both the one in danger and the rescuing party.

Resuscitation.—*Avoid delay.* Do not wait to carry the patient to a house or hospital, but treat him on the spot. "Remember that the patient is suffering from two things, want of air, or oxygen, and loss of heat from the body." The first thing to do, then, is to free the body from any clothing that may interfere with respiration—that is, about the neck, chest, and waist. If natural breathing has ceased, artificial respiration should be commenced as soon as possible. First, hastily make a roll from clothing, blankets, or anything that may be at hand, place the patient over this, *face downward,* allowing his forehead to rest upon one hand to keep the mouth and nose clear of the ground. Place the hands, well spread, upon the patient's back, over the stomach and base of thorax. Then, with a forward motion, throw all the weight upon them that the age and sex of the patient will justify. Repeat this three or four times, which will cause the water and mucous to run out of the mouth, throat and trachea. (See Fig. 29.) Wrap a handkerchief around the forefinger and pass it into the mouth and remove any mucus that may remain. Turn the patient on his back, grasp the tongue and draw it forward and down onto the chin; lay a strip of the handkerchief or other material across the tongue and pass the ends behind the neck and tie, or have some

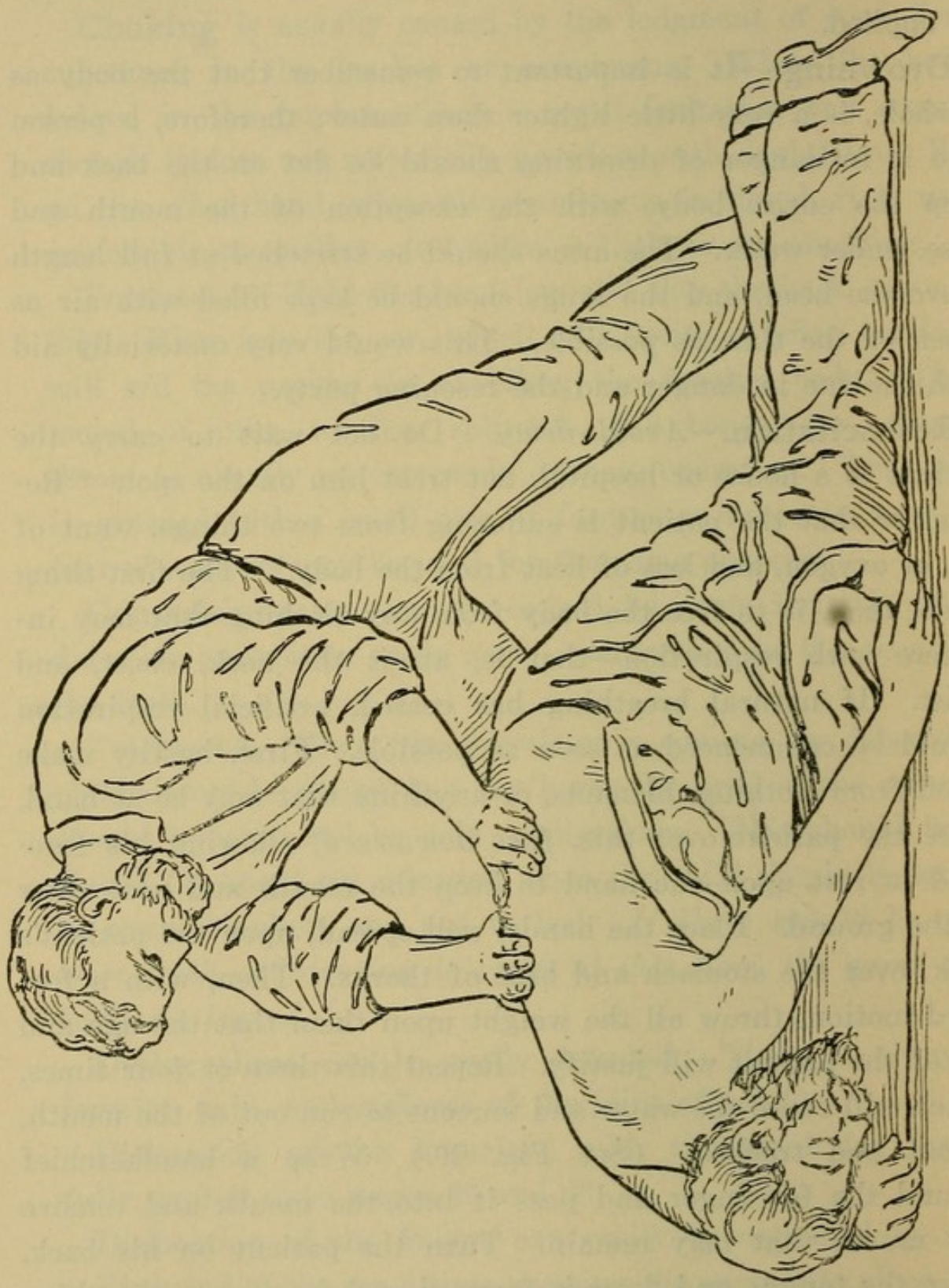

FIG. 29.—FORCING WATER AND MUCUS OUT OF THE LUNGS AND THROAT.

one to hold the tongue to keep it from falling back and closing the throat. Then begin artificial respiration.

Howard's Method.—The patient is placed upon his back, his arms extended backward and outward, where they should be held by an assistant. A roll of something (clothing, a folded blanket, coat, or stick of wood, if nothing better is at hand) is then placed under the false ribs so as to throw them prominently forward. The operator should then kneel astride the patient's abdomen, placing both hands so that the fingers will press into the intercostal spaces on each side, and the base of the thumb rest upon the anterior margin of the false ribs. The operator should then place his elbows firmly against his sides, and throw himself forward, bringing his weight to bear upon the patient's false ribs, forcing them inward and upward toward the diaphragm, then suddenly let go and return to the erect position. Repeat these movements ten to twelve times a minute until natural breathing begins, which may gradually take the place of the artificial. Fig. 30 illustrates this method.

Sylvester's Method.—After the patient has been placed upon his back, with folded clothing under his shoulders, the operator should kneel behind his head and go through the following manipulations:—

First, to induce inspiration: Grasp both arms just below the elbows and swing them around horizontally until they nearly meet above the head, with the back of the hands or elbows touching the ground; hold them there for three or four seconds. This draws the ribs up so as to expand the chest and allows the air to enter the lungs. (See Fig. 31.)

The second movement is to induce expiration. Bend the arms at the elbows, and carry them down so that they rest upon either side of the chest. Bring the weight of your body upon them, pressing forcibly and steadily, which pressure, if continued for a few seconds, will force the air out of the lungs.

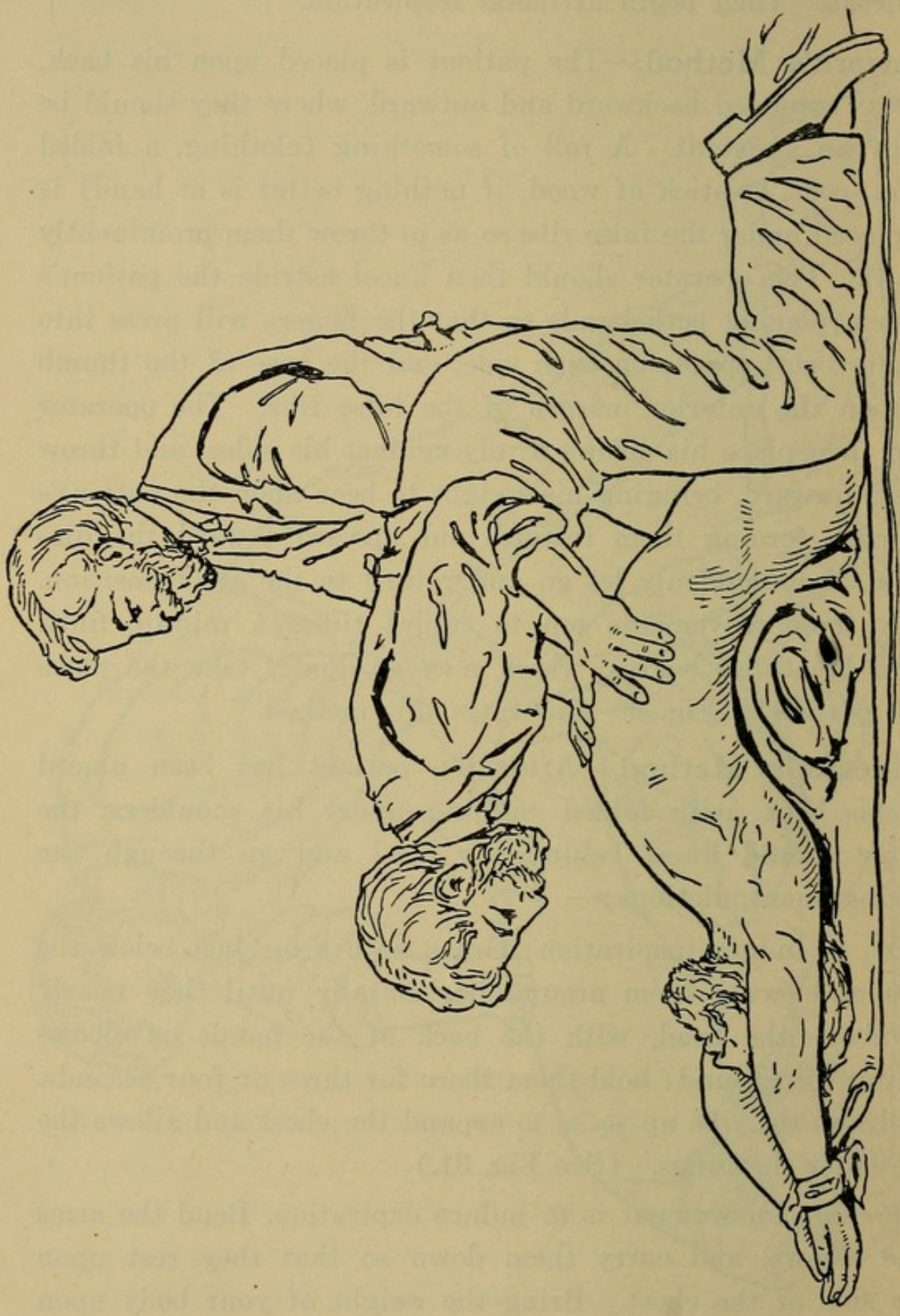

FIG. 30.—ARTIFICIAL RESPIRATION—HOWARD'S METHOD.

(See Fig. 32.) These movements should be continued alternately twelve to fifteen times a minute.

When natural breathing is attempted, it may be stimulated by applying smelling salts or ammonia to the nose, or by slapping the chest. When the patient is able to swallow, some stimulant should be given every few minutes until the danger-point is passed—such as a teaspoonful of whisky or brandy, or double the quantity of hot water. After the patient is resuscitated he should be wrapped in warm blankets and carefully carried, *with the head low,* to a warm bed.

Epileptic Fits are characterized by sudden loss of consciousness and power of co-ordination of motion; there is a rigidity of motion which is followed by violent convulsions of short duration, usually accompanied by more or less foaming at the mouth. There is also a peculiar cry that accompanies these attacks, caused by laryngeal spasms.

Treatment.—There should be no struggling with the patient, but an effort should be made to regulate the movements so that the patient will not do himself any harm. A folded napkin or towel or a soft piece of wood should be placed between the teeth to prevent biting the tongue. As soon as the convulsions are passed, the patient should be allowed to rest quietly in bed for some time. Dr. Dulles says: "It would be a good plan if every one who is subject to epileptic attacks had his or her name and address placed inside the coat or in some place where it could be seen at once when the clothing is loosened to give relief, as is almost invariably done when such attacks occur. Epileptics should not, except where it is absolutely unavoidable, go about alone, or go into crowded places. They have no right, on their own account and for the sake of others, to incur risks involved in such conduct, except under stress of necessity."

Exhaustion, Heat.—This is not a serious illness. It is usually caused by physical overwork in hot and badly ventilated rooms or in the heat of summer,—the latter is apt to be confounded with heat or sunstroke. In heat exhaustion, however,

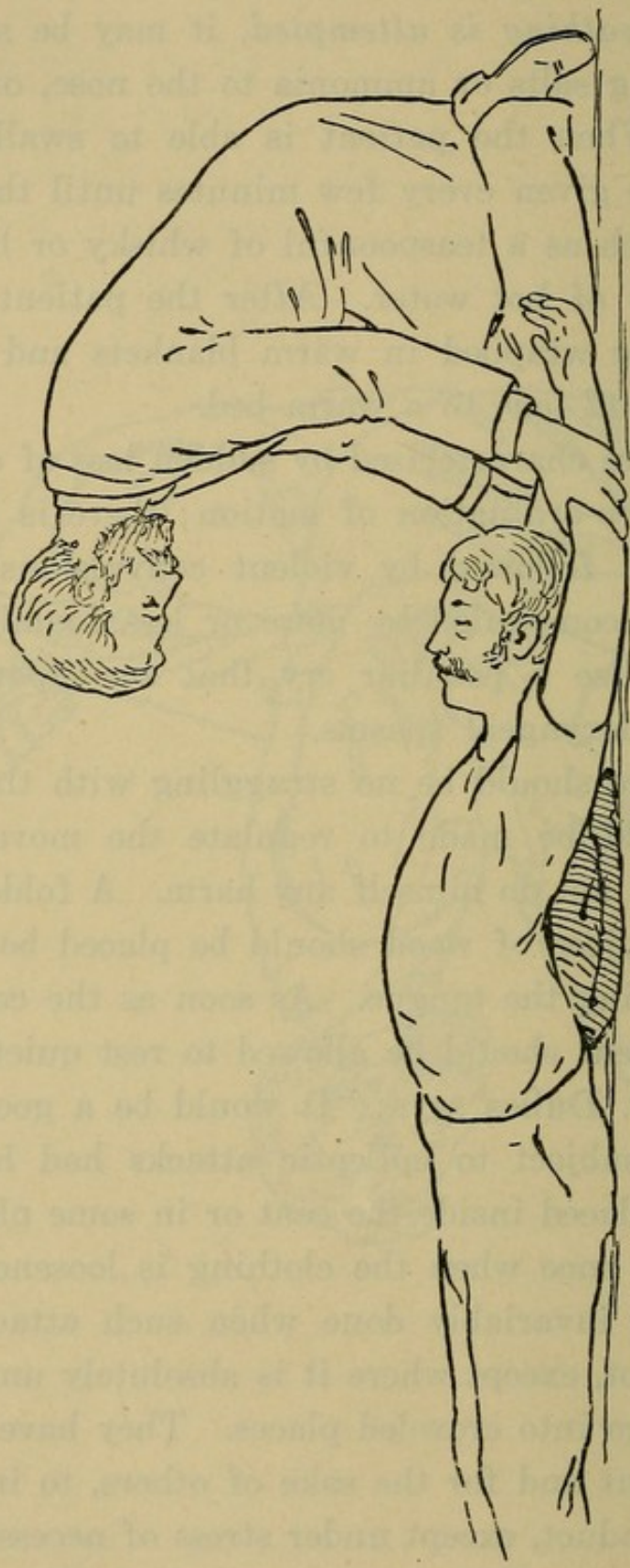

FIG. 31.—ARTIFICIAL RESPIRATION—SYLVESTER'S METHOD. First Movement—Inspiration.

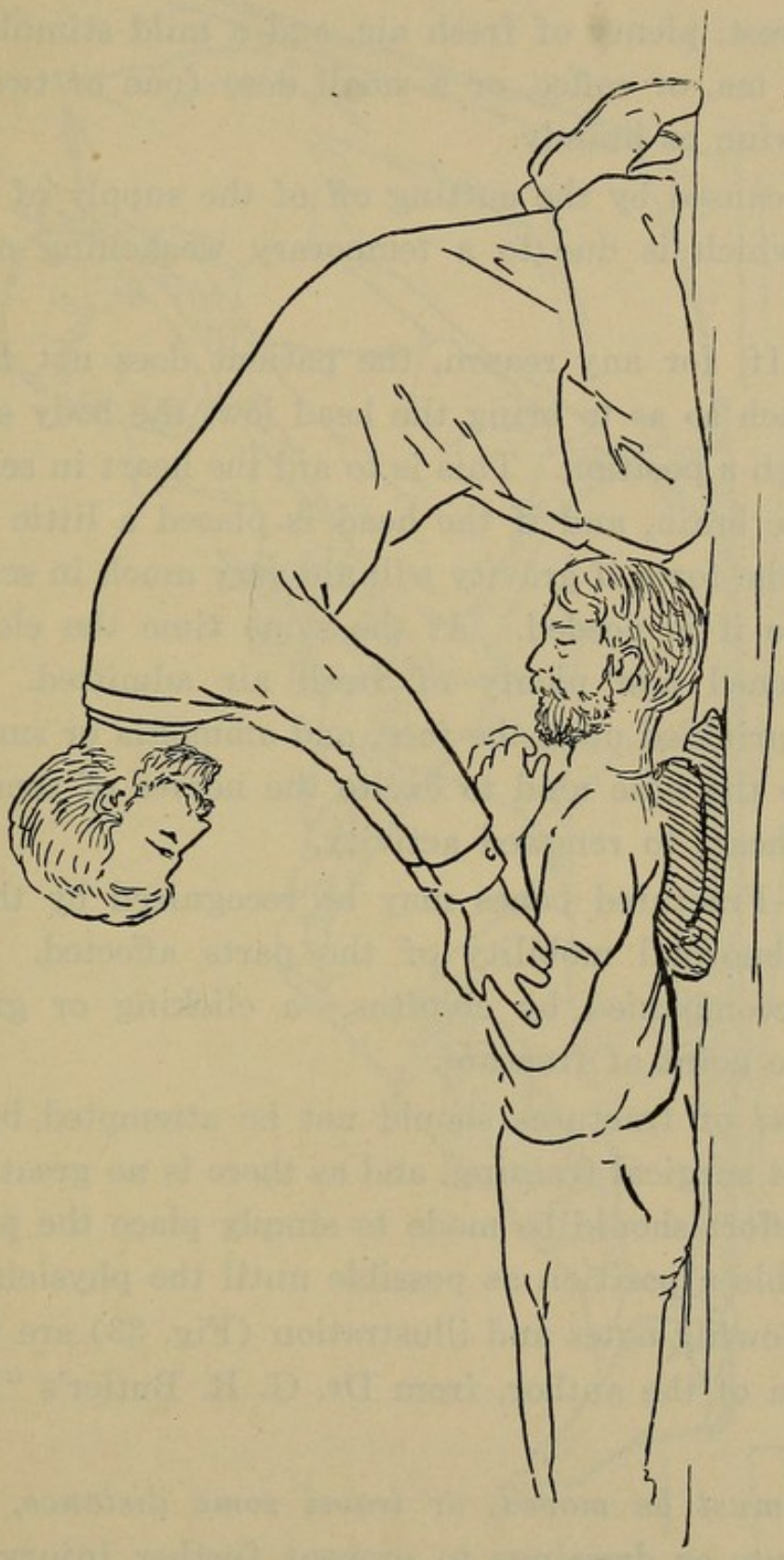

FIG. 32.—ARTIFICIAL RESPIRATION—SYLVESTER'S METHOD. Second Movement—Expiration.

there is a cool, moist skin, while in sunstroke the bodily temperature is raised and the skin is quite dry.

Treatment of heat stroke is very simple. The patient should have complete rest, plenty of fresh air, and a mild stimulant—hot soup, milk, tea, or coffee, or a small dose (one or two teaspoonfuls) of wine or brandy.

Fainting is caused by the cutting off of the supply of blood to the brain, which is due to a temporary weakening of the heart's action.

Treatment.—If, for any reason, the patient does not fall to the floor or couch so as to bring the head low, the body should be placed in such a position. This is to aid the heart in sending the blood to the brain, and if the head is placed a little lower than the body, the force if gravity will aid very much in sending the blood where it is needed. At the same time the clothing should be lossened and plenty of fresh air admitted. Cold water may be sprinkled upon the face, and ammonia or smelling salts applied to the nose tend to excite the nerves of sensation and rouse the heart to renewed activity.

Fractures.—Fractured bones may be recognized by the deformity and abnormal mobility of the parts affected. It is also usually accompanied by crepitus,—a clicking or grating sensation at the point of fracture.

The treatment of fractures should not be attempted by any one who has not surgical training, and as there is no great haste necessary, an effort should be made to simply place the patient in as comfortable a position as possible until the physician arrives. The following notes and illustration (Fig. 33) are taken, with permission of the author, from Dr. G. R. Butler's "Emergency Notes":—

"If patient must be moved, or travel some distance, apply temporary splints or dressings to prevent further injury from movement.

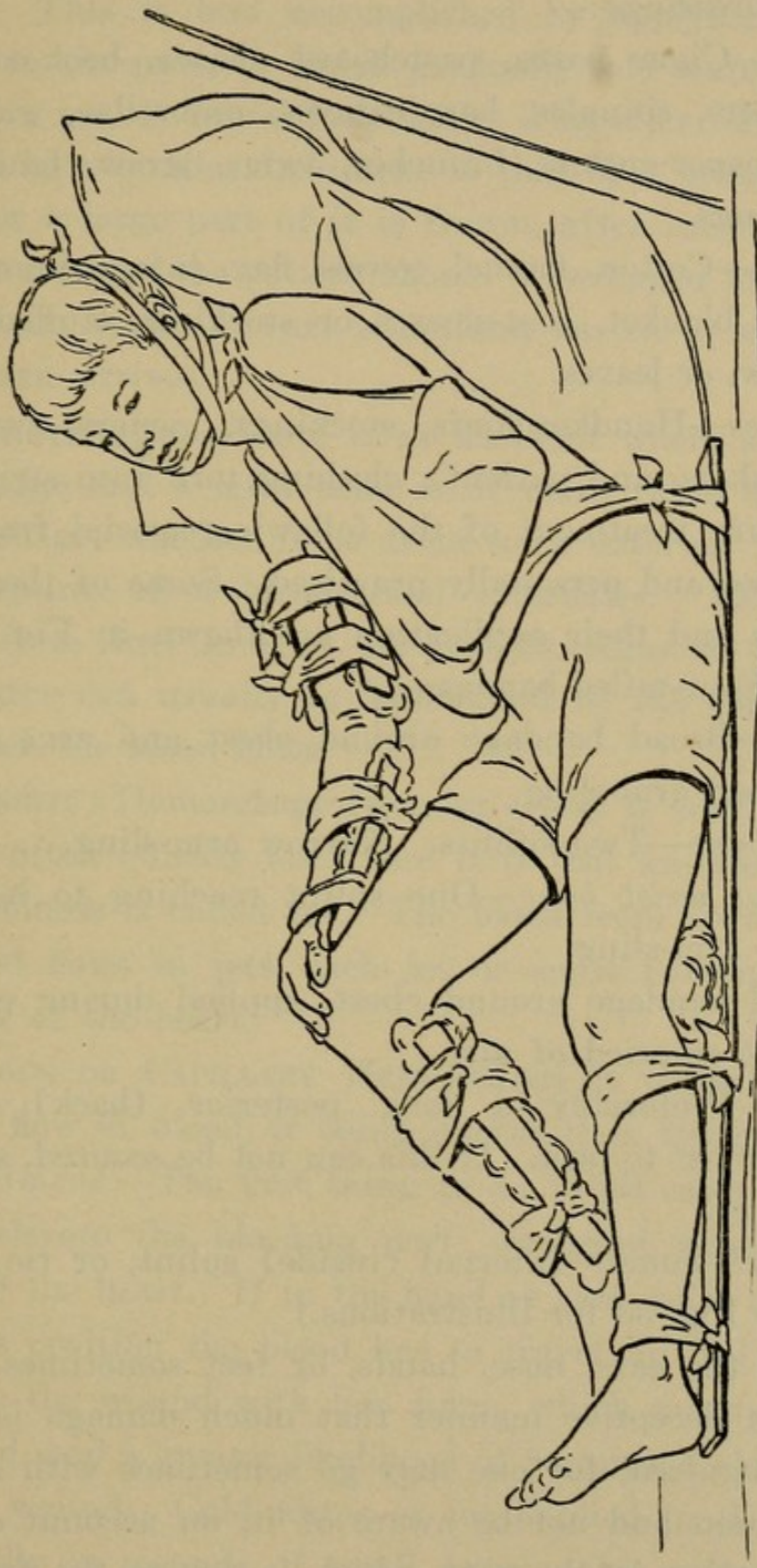

FIG. 33.—IMPROVISED SPLINTS AND DRESSINGS FOR FRACTURES OF JAW, UPPER ARM, FOREARM, THIGH-BONE AND LEG.

"In city or country one of the following list of materials may usually be found, and, by the aid of a little ingenuity, utilized for temporary dressings:—

"*For splints*—Cigar boxes, pasteboard (boxes, book-covers), folded newspapers, shingles, barrel-staves, umbrellas, walking-sticks, rulers, paper-cutters, branches, twigs, straw, fence-palings, spoons, tongs.

"*For padding*—Cotton, flannel, towels, flax, jute, oakum, hay, moss, pieces of blanket, coat-sleeves or stockings stuffed with grass, hay, straw, or leaves.

"*For bandages*—Handkerchiefs, stockings, garters, suspenders, sheets, blankets, and patient's clothing torn into strips.

"The temporary treatment of the following special fractures should be studied and personally practised. Some of these improvised splints and their application are shown in Fig. 33.

"*Jaw-bone*—Four-tailed bandage.

"*Collar-bone*—Broad bandage around chest and arm of injured side. Broad arm-sling.

"*Upper arm-bone*—Two splints. Narrow arm-sling.

"*Forearm and wrist bone*—One splint reaching to base of fingers. Broad arm-sling.

"*Ribs*—Broad bandage around chest, applied during expiration—*i. e.*, chest emptied of air.

"*Thigh-bone*—Preferably a long posterior (back) splint reaching from waist to heel. If this can not be secured, simply tie limbs together.

"*Leg and ankle-bones*—Internal (inside) splint, or tie limbs together." (See Fig. 33 for illustrations.)

Freezing of the ears, nose, hands, or feet sometimes takes place in such a deceptive manner that much damage is done before it is recognized, for one may go sometimes with a part of the body frozen and not be aware of it, on account of the absence of sensation in the part, which is due to the freezing of the nerves.

Treatment.—Warmth and circulation is the first demand, and this should be restored gradually until normal (98° Fahrenheit). This is best accomplished by applying snow or cold water to the part, to which gradually add warm water; gentle friction, too, is found beneficial. The after effects, if serious, should have similar treatment to that of a burn. If the whole body or a large part of it is frozen, after the normal temperature is restored the patient should be wrapped in warm blankets and given some internal stimulant, as tea or coffee, until the physician arrives.

Hemorrhage.—There is no accident where a little accurate knowledge and a level head is of more value than in case of hemorrhage, whether it be from some external wound or from the rupture of a blood-vessel internally. Hemorrhage may occur from three sources, the arteries, veins, or capillaries; and its source can usually be determined by the color and manner in which the blood flows.

Arterial: Hemorrhage from an artery is very dangerous, and life is often quickly lost; here it is that knowledge, judgment, and coolness is called for. The blood from an artery is bright red and flows in jets, each jet or spurt corresponding to the beating of the heart.

Venous or Capillary Hemorrhage is marked by the slow, steady flow of blood, it being darker than the arterial blood.

Treatment.—The first thing to do in all cases of hemorrhage is to elevate the bleeding part, whenever possible, above the level of the heart. If in the hand or arm, raise above the head. In this position the blood has to travel up hill, and therefore reaches the wound with less force, which means slower escape of blood, and a greater likelihood of forming a clot at the mouth of the wound. Cold water or ice applied to the parts assists, especially in wounds of small arteries, by contracting the vessels. Styptics should be applied to contract the bleeding sur-

face* and to aid in forming a clot. Probably the best remedies for this purpose are tannic acid, subsulphate of iron, or a mixture of vinegar and water, about one part of the former to four of the latter. Pressure on the artery at the wounded point or above the wound is a very simple expedient and will, in nearly all cases, prove of very great value in controlling the flow of blood until more permanent means can be employed. Several methods follow:

Pressure with the fingers is made by placing one finger just above and one below the wound, and crowding the edges together firmly.

Pressure by compress and bandage consists of making a compress of some soft material, such as muslin, linen, cheese cloth, etc., folded into suitable shape and bound securely upon the wound with a bandage.

Pressure above the wound may be made by the finger, or when the wound is in a limb a tourniquet may be employed, which is readily made by tying a handkerchief around the limb loosely, with secure knots, then pass a pencil or knife through the handkerchief and twist in such a manner as to tighthen it sufficiently to stop the bleeding. This may be continued until a surgeon has ligated the artery, which, if necessary, should be as soon as possible.

Hemorrhage from the Nose is not infrequent and is usually not dangerous. It is generally due to the rupture of some of the capillaries of the lining membrane of the nose. But there are times when the bleeding is due to the rupture of a small artery, possibly from ulceration, when it is so profuse as to threaten life. In some cases, which are very rare, medical aid should be summoned at once.

Treatment.—Have the patient to sit upright, and to hold the hands above the head, at least the one on the bleeding side.

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*See page 126.

Take a towel and wring out of ice water or place in it finely cracked ice, and wrap it around the neck. If bleeding continues, have patient snuff up from the hand or inject into the nostrils, with a small syringe, ice water and alum, a teaspoonful of alum to a half-glass of water. Vinegar, too, used in the same manner, will usually stop the flow of blood. But if these means should fail, Dr. Butler's plan will be found very good. He says: "Take a piece of cotton wool as large as the first joint of the thumb, tie a thread around its middle, soak it in alum water, or, if that is not at hand, oil it with sweet oil or vaseline and plug the nostril. This is best done by pushing the cotton with a screwing or twisting motion until firmly lodged. The thread serves to draw it out when required."

HEMORRHAGE FROM THE GUMS can usually be controlled by syringing the mouth or sockets (if teeth have been extracted) with warm water to remove clots, then rinse the mouth freely with ice water and alum. If this should fail, some good styptic should be applied. (See page 69, "Hemorrhage after Extraction.")

HEMORRHAGE FROM THE STOMACH may be caused by inflammation, cancers, corrosive poisons, etc., or may occur without any apparent cause. It is, however, not a very frequent occurrence. The blood in such cases, when vomited, is usually of a dark brown color, resembling coffee grounds, unless it has very recently and suddenly escaped into the stomach, when it is of a bright red color. Bleeding from the stomach should not be mistaken for bleeding from the lungs. It is therefore important to remember these facts: that blood from the stomach is usually of a dark brown color and is vomited and not frothy, while blood from the lungs is of a *bright red color and is frothy,* also *that it is coughed up, not vomited.*

Treatment.—Rest in bed should be insisted upon. Keep the patient calm, as excitement increases the heart's action and the amount of blood; for the same reason stimulants should not be administered. The patient should be given small pieces of ice

to swallow, and teaspoonful doses of vinegar may be given every ten minutes. Also ice-cold cloths may be placed over the stomach.

HEMORRHAGE FROM THE LUNGS is usually caused by consumption and is rarely if ever fatal, except sometimes in the last stages of the disease. It is, therefore, not necessary to apprehend immediate death, as is so often done.

Treatment.—The best treatment to pursue until a physician arrives is to place the patient in a reclining position, but not with the head low, give small lumps of ice to be swallowed, and let him eat a teaspoonful of salt with the same quantity of vinegar. Salt absorbs water from the blood, and thus tends to relieve hemorrhage by thickening the blood. Also, if patient is not too weak, cloths wrung out of ice water may be applied to the chest and neck.

Intoxication is usually caused by an excessive use of alcoholic beverages. It sometimes resembles apoplexy, and great care should be taken in determining the disease, as this mistake has been made with very embarrassing results. It should be remembered that in drunkenness there is a helplessness on both sides alike, but no paralysis; that there is usually some sensation displayed by touching the eyeball, and that the patient can be aroused from the stupor; also, that the odor of liquor can be detected upon the breath, though this might be the case in apoplexy.

Treatment.—A teaspoonful of aromatic spirits of ammonia in a half or two-thirds of a glass of water is a useful corrective and stimulant. If this is not at hand, a large draught of vinegar often does much toward sobering an intoxicated person. In an extreme case, where respiration has ceased, or where there is evidence of collapse, artificial respiration should be resorted to, heat should be applied to the body, and copious draughts of hot coffee should be administered.

Nausea, if caused by slight indigestion, can usually be corrected by taking a teaspoonful of baking soda and the juice of

one lemon in a half of a glass of water; stir and drink while foaming. Or take a teaspoonful of aromatic spirits of ammonia in a third of a glass of water. If the nausea is due to something objectionable to the stomach, the soda and water will usually give relief by causing vomiting.

Poisons.—The old maxim, "an ounce of prevention is better than a pound of cure," is surely applicable to the subject of poisons. In the first place, all dangerous articles should be kept out of the way of children; then, all bottles, etc., containing anything of a toxic nature should be distinctly marked "poison." A very good plan is to have such bottles marked by a ball and chain, which may be procured at the drug store; this will give warning in the dark as well as in the light. When it is discovered that a poison has been swallowed, some one should be dispatched for a physician at once; meanwhile, treatment must be directed toward getting rid of the poison before it takes effect.

First administer a prompt emetic. Some poisons, by their irritating effect, naturally produce vomiting, so that with a little encouragement the stomach will be thoroughly evacuated. Where this is not the case, the emetic will provoke expulsion of the matter. A very good emetic for such an emergency is lukewarm water in quantity, or a tablespoonful of mustard or salt to a pint of warm water. As this is no occasion for fastidiousness, any water that is at hand may be used; if soapy, and the hands have been washed in it, use it, as by its very repulsiveness it may act more quickly than anything else; the patient should be urged to drink freely until he can contain no more, and be made to vomit over and over again.

This sometimes leaves the patient much depressed in body, and mind, showing signs of collapse. In such a case, some mild stimulant may be given; hot tea is probably one of the best, as it is also a chemical antidote to many poisons. Strong, hot coffee is also good. To either of these a teaspoonful of brandy may be added. The patient will, of course, be in bed, and it

should not be forgotten that warm coverings are indispensable. Hot bricks and hot-water bags or bottles, may be brought into requisition. Again, where it is known that poison has been taken, and especially if it is one of the more active and corrosive, an antidote to counteract the action of the poison should be administered before or after the emetic. The following list of the more common poisons, with their antidotes, etc, will be useful for ready reference.

SPECIAL POISONS AND READY ANTIDOTES.

Poison.	Treatment.
Acids—Sulphuric, Nitric, Acetic, Oxalic, Muriatic, or Hydrochloric, ...	Give an alkali, such as powdered chalk, plaster, lime-water, as much as patient can swallow; or lime scraped from the plaster or white-washed wall, stirred in a cup of water. A tablespoonful of strong soapsuds, etc.
Alkalies—Potash, Lye, Soft Soap, Strong Ammonia or Hartshorn, ...	Give an acid—vinegar, lemon-juice, sour Cider, etc. Acids and alkalies neutralize each other—that is, combine to form harmless salts.
Arsenic, ...	Milk or raw eggs, or flour and water, or lime-water and oil, and after patient has vomited freely, follow with a dose of castor oil.
Carbolic Acid, ...	There is no chemical antidote, but the stomach should be protected and vomiting encouraged by giving mucilaginous drinks, flour and water, and oil freely—olive, linseed, or castor.
Chloral, ...	Treatment same as opium.
Chloroform, Ether, etc.,	Loosen clothing; sprinkle cold water on the face; suspend the patient by the legs; artificial respiration, as for drowning.
Iodine,	Starch and water; boiled or baked potatoes.
Lead—Sugar of Lead, ...	Epsom salts; after vomiting freely, give dose of oil.
Mercury—Bichloride of Mercury or "Corrosive Sublimate,"	Albumen, uncooked white of eggs, wheat flour, milk, etc.
Opium—Morphine, Laudanum, Paregoric, ...	Induce vomiting first. There is no chemical antidote, but strong coffee, pain, motion, counteract its effect. In extreme cases, in addition to above treatment, cold water should be dashed on the face and chest, and artificial respiration and the battery resorted to.
Phosphorus, ...	Provoke vomiting. Teaspoonful doses of turpentine, mixed with magnesia; but no oil, it favors the action of phosphorus.
Prussic Acid, ...	Induce vomiting first, and give teaspoonful of ammonia in water.
Silver—Nitrate of Silver, "Lunar Caustic,"	Large teaspoonful of salt in a glass of water; vomiting.
Strychnine, ...	Induce vomiting first; give a purgative; secure absolute quiet in a dark room.

There are other poisons, such as Alcohol, Aconite, Belladonna, etc., which need not be classified here, as vomiting thoroughly, followed by a mild stimulant and rest, is all that is needed.

Poisonous Bites.—By this we mean bites of rabid or venomous animals and the stings of insects.

Snake Bites.—Tie a cord, or a handkerchief twisted into a cord, tightly around the part just above the wound. Enlarge the wound by making a cross cut through the center of the bite with a pen knife. This will encourage bleeding, and will expose the wound more thoroughly for the later steps in treatment, which are as follows: Draw the poison from the wound by means of suction with the mouth, unless the mouth be sore, or by taking a wide-mouthed bottle, and after saturating a piece of cotton or paper with alcohol or benzine, set it on fire and dip it into the bottle. As soon as the flames begin to die out, quickly invert the bottle over the wound and press tightly against the skin to prevent the admission of air. This will extract the venom and blood from the exposed vessels. Then heat a knitting needle, a piece of wire, or small blade of a knife to a white heat, and thrust it into the wound. At the same time large doses of whisky or brandy should be given and the patient kept under the influence of the stimulant until medical aid can be secured. Some, however, prefer to use aromatic spirits of ammonia instead of whisky, one drachm to a wineglassful of water.

Mad Dog Bites.—There are some physicians who claim that there is no such disease as hydrophobia; one author puts it in this way: "So-called hydrophobia exists exactly in proportion to the common belief in it," that is to say, the trouble is altogether mental. There is no doubt but that a great many deaths have been caused by fright and anxiety, but that all cases are spurious we are not prepared to believe, and think that prompt and heroic treatment should always be given.

As dogs are, with many persons, daily companions, it is important to know the various symptoms of madness. The following is a resumé of the instructions issued by the Council of Hygiene, of Bordeaux.

Signs of Madness in Dogs.—"1. A short time after the disease has been contracted, the dog becomes agitated and restless, and turns continually in his kennel. If unchained, he roams about aimlessly; he seems to be seeking something; then stands motionless, as if waiting; he starts, snaps at the air, as if catching a fly, and dashes himself, barking and howling, against the wall. The voice of his master recalls him and he obeys, but slowly, with hesitation and seeming regret.

"2. He does not try to bite, is gentle, even affectionate, and eats and drinks; but gnaws his litter, the ends of the curtains, the padding of cushions, bed-coverlids, carpets, and anything which happens to be in his reach.

"3. From the movement of his paws along the sides of his open mouth, one might suppose him trying to free his throat of a bone.

"4. His voice is changed so markedly that it is impossible to overlook it.

"5. He becomes surly, and begins to fight with other dogs."

The symptoms, however, vary in different cases, and a change in the habits or manner of a pet dog should always be looked on with suspicion, and the animal should be chained for a while.

The probability of hydrophobia being communicated to persons bitten by a mad dog varies with the location of the bite. If it be in a part unprotected by clothing, inoculation is almost certain; in other parts, the chances depend on the thickness of the clothing, which wipes the virus from the teeth.

Treatment.—The treatment in case of mad dog bite must be altogether preventive, as after the specific symptoms manifest themselves the only thing to do is to keep the patient quiet by the administration of hypnotics, until death ensues. But this,

of course, belongs to the physician. When one is bitten by a rabid dog, the same course should be pursued as directed for snake bite, *excepting the stimulants.* Then start at once for a hospital, where the patient can receive Pasteur's treatment by inoculation.

Bites and Stings of Insects.—Despite the current belief that the bite of a tarantula, centipede, and other insects are dangerous to life, experience proves that they are in nearly all cases comparatively harmless, causing only temporary pain and annoyance.

Treatment.—They may be treated with cold, wet applications; if nothing better is at hand, wet earth is good. The application of a few drops of hartshorn at the point where the sting entered will also give relief. It sometimes happens that a wasp or bee is swallowed in taking a drink of water hurriedly in the dark. In such cases the fauces swell rapidly from the moment the sting enters the throat, which places the patient in danger of suffocation. This should be treated by the free use of a gargle of hot water and salt, pending the physician's arrival.

Sea-Sickness.—Sickness occasioned by the motion of a vessel at sea is often most distressing. The most efficient preventive or treatment is to take a seat near the center of the vessel (if inclined to keep up) and, as the ship descends, take a full breath; wear a wide firm belt around the stomach, eat lightly, plainly and often; if the stomach is much disturbed, take the juice of one lemon in half a glass of water, with one teaspoonful of baking soda; stir and drink while foaming.

Sprains.—A sprain is a sudden overstretching and tearing of the ligaments which enter into the formation of a joint, as well as the tendons and muscles about the joint.

Treatment.—The joint should be soaked in water as hot as the patient can bear for twenty minutes or more, then rub gently with cosmoline, and apply a snugly fitting, but not tight, flannel bandage, and give the part as near perfect rest as possible.

Starvation.—When a person is found exhausted from starvation, he should be placed in a comfortable position and given stimulating, fluid food. Warm milk, soup, and hot coffee are among the best, given a little at a time, but often.

Strangulation.—In cases of strangulation—that is, compression of the windpipe from the outside, as in hanging, etc.—the treatment to be pursued is to remove the pressure at once, and re-establish the respiration, as in drowning.

Suffocation.—Suffocation from foul air, noxious gases, etc., is caused by a poisonous gas known as carbonic acid. When it is desirable to enter a cellar, well, mine, etc., where there is a suspicion of foul air, a thorough examination should be made. Man can not live in an atmosphere where a candle will not burn, animal life and flame being both supported by oxygen. The best test, therefore, is to lower an unprotected light where foul air is suspected; if the flame flickers and goes out, by no means enter.

Carbonic acid gas, being heavier than air, can readily be removed by the use of a pump, but if this is not at hand, quick lime (lime freshly burned), scattered about in large quantities, will accomplish the purpose.

Treatment.—In case of asphyxiation from noxious vapors the patient should be removed as soon as possible to fresh air, and natural respiration re-established, as directed for drowning.

Sun Stroke does not necessarily arise from undue exposure to the direct rays of the sun, but may proceed from a prolonged elevation of the bodily temperature, or from excessive heat encountered when the vital forces are near the point of exhaustion. It is generally preceded for some time, usually from one to three days, by pain in the head, a feeling of weakness, disturbance of the sight and nausea. This attack, however, culminates, usually after the third day, in a loss of consciousness. The skin is intensely hot and dry, the temperature rising as high is 112. In fevers, if the temperature rises to 105 or 106, it is considered

a severe case. It is, therefore, apparent that the patient is suffering from an excess of heat in the body. The thing to be done, then, is to lower the temperature as soon as possible. Every minute being valuable, the following treatment should be pursued:—

Treatment.—Send some one for a physician. Remove as much of the clothing as possible, and place the patient in a cool and airy place, indoors or out. Cold must then be applied to the head and body, not dashed or sprinkled, as that would only cause a needless shock; but towels wrung out of ice-water, and frequently renewed, should be placed upon the head, cracked ice placed in the arm-pits, and the body may be wrapped in cold, wet blankets. Continue this treatment until the physician arrives or the patient shows signs of consciousness, then discontinue, unless consciousness should again be lost or the surface of the body becomes very hot. *Never in such cases administer a stimulant.*

Wounds.—In surgery, wounds are divided into three classes according to their cause, namely, *incised, lacerated* and *contused.* There is a subdivision of this classification, of course, but this is all that is necessary for our present purpose.

Incised Wounds are those made by sharp-cutting instruments, making what are called clean cuts; that is, there is no tearing or bruising, but the edges are clean cut and the surface smooth.

Treatment.—If the wound is simple and small, the only treatment that is required is to cleanse the edges and apply adhesive plaster and perhaps a bandage. But where the wound is more extensive and serious, the edges should be brought firmly together, if possible, and held in that position by adhesive plaster and bandages. But when this will not answer, hold the parts together with the hands until the physician arrives. Dr. Dulles says: "In case an entire part be cut off, as an ear, or a nose, or a toe, or a finger, it should be cleansed with lukewarm water

and put in its place, leaving to the surgeon the decision whether or not it would be worth while to try to save it. Some very remarkable cases of reunion of such parts are in record, and an attempt to save them is not to be lightly rejected."

Lacerated Wounds are made by blunt tearing instruments, such as dull tools, pieces of machinery, nails, hooks, etc. These wounds are rough and ragged and usually bleed but little. They should be given surgical skill, but until this can be secured the torn parts should be cleansed by a stream of lukewarm water, then brought as near to their natural position as possible and covered with a cloth soaked in phenol sodique, tincture of marigold, or laudanum, and wrapped lightly. If no good remedy is at hand, wrap in cloth wrung out of cold water. If the patient seems much depressed, administer a little brandy or wine.

Contusions are what are commonly known as bruises; they are usually caused by some blunt instrument or a fall; the skin is not torn through, but is often discolored, which is due to the rupture of the capillaries, allowing the blood to escape into the surrounding tissues—the familiar black and blue appearance of a bruise.

Treatment.—Such wounds are best treated by directing upon the wounded part a stream of water, as hot as the patient can bear it, for several minutes. This will favor the carrying off of the escaped blood. Then, after bathing the part freely with phenol sodique or laudanum, wrap in hot, wet cloths.

WEIGHTS AND MEASURES.

APOTHECARIES' WEIGHT.

20 grains (gr.)	make 1 scruple,	. . . . .	sc. or ℈
3 scruples	make 1 drachm,	. . . . .	dr. or ʒ
8 drachms	make 1 ounce,	. . . . .	oz. or ℥
12 ounces	make 1 pound,	. . . . .	lb. or ℔

SCALE OF COMPARISON.

lb		oz.		dr.		sc.		gr.
1	=	12	=	96	=	288	=	5760
		1	=	8	=	24	=	480
				1	=	3	=	60
						1	=	20

APOTHECARIES' OR WINE MEASURE.

60 minims (℥)	make 1	fl. drachm, ...	fl. dr. or f℥
8 fl. drachms	make 1	fl. ounce, ...	fl. oz. or f℥
16 fl. ounces	make 1	pint, ...	O.
8 pints	make 1	gallon, ...	C.

SCALE OF COMPARISON.

Gallon.		Pints.		Fl. ounces.		Fl. drachms.		Minims.
C.		O.		f℥		f℥		℥
1	=	8	=	128	=	1024	=	61440
		1	=	16	=	128	=	7680
				1	=	8	=	480
						1	=	60

TROY WEIGHT.

24 grains (gr.)	make 1	pennyweight, ...	dwt.
20 pennyweights	make 1	ounce, ...	oz.
12 ounces	make 1	pound, ...	℔
3½ grains	make 1	carat (diamond weight), ...	k.

SCALE OF COMPARISON.

℔		oz.		dwt.		gr.
1	=	12	=	240	=	5760
		1	=	20	=	480
				1	=	24
				1 k.	=	3½

AVOIRDUPOIS WEIGHT.

16 drachms (dr.)	make 1	ounce, ...	oz.
16 ounces	make 1	pound, ...	℔.
25 pounds	make 1	quarter, ...	qr.
4 quarters	make 1	hundredweight, ...	cwt.
20 hundredweight	make 1	ton, ...	T.
100 pounds	make 1	cental, ...	C.

SCALE OF COMPARISON.

T.		cwt.		qr.		℔.		oz		dr.
1	=	20	=	80	=	2000	=	32000	=	512000
		1	=	4	=	100	=	4000	=	25600
				1	=	25	=	400	=	6400
						1	=	16	=	256
								1	=	16

A gallon contains eight pints.
A pint contains sixteen fluid ounces.
A fluid ounce contains eight fluid drachms.
A fluid drachm contains sixty minims (℥).

APPROXIMATE MEASUREMENT.

A wineglass contains two fluid ounces.
A teacup contains four fluid ounces.
A teaspoon of powder contains one-half drachm.
A tablespoon of powder contains two drachms.
One drop of essential oils contains one-half minim.
One drop of water contains one minim.

From Gould's Medical Dictionary.

The following table of approximate and exact equivalents of the metric and common weights and measures may prove serviceable:

LENGTH.

Unit of Measurement.	*Approximate Equivalent.*	*Accurate Equivalent.*
1 inch,	2½ cubic centimeters,	2.539
1 centimeter ($^1/_{100}$ meter),	0.4 inch,	0.393
1 yard,	1 meter,	0.914
1 meter (39.37 inches),	1 yard,	1.093
1 foot,	30 centimeters,	30.479
1 kilometer (1000 meters),	⅝ mile,	0.621
1 mile,	1½ kilometer,	1.609

SURFACE.

Unit of Measurement.	*Approximate Equivalent.*	*Accurate Equivalent.*
1 hectare (10,000 sq. meters),	2½ acres,	2.471
1 acre,	$^2/_5$ hectare,	0.404

WEIGHT.

Unit of Measurement.	*Approximate Equivalent.*	*Accurate Equivalent.*
1 gramme,	15½ grains,	15.432
1 grain,	0.064 gramme,	0.064
1 kilogramme (1000 grammes),	$2^1/_5$ lbs. avoirdupois,	2.204
1 pound avoirdupois,	½ kilogramme,	0.453
1 ounce avoirdupois (437½ grains)	$28^1/_3$ grammes,	28.349
1 ounce, Troy or apothecary (480 grains),	31 grammes,	31.103

BULK.

Unit of Measurement.	*Approximate Equivalent.*	*Accurate Equivalent.*
1 cubic centimeter,	0.06 cubic inch,	0.061
1 cubic inch,	$16^1/_3$ cubic centimeters,	16.386
1 liter (1000 cubic centimeters),	1 U. S. Standard quart,	0.946
1 United States quart,	1 liter,	1.057
1 fluid ounce,	29½ cubic centimeters,	29.570

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