GORGAS

QUESTIONS AND ANSWERS

FOR DENTAL STUDENTS

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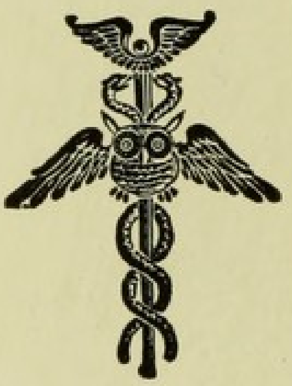

Questions and Answers

Embracing the Curriculum

OF THE

DENTAL STUDENT

DIVIDED INTO THREE PARTS

BY

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Preface.

REFERENCE to the Contents and Index will show the subjects to which the "questions and answers" of this work refer. The success which attended the publication of the first work of this nature was such that the author has determined to present a second one much more voluminous, and embracing the entire curriculum of the dental student. That the first work was appreciated, it is only necessary to state that an edition of four thousand five hundred copies were printed, of which but few remain unsold; also to add to this preface the following commendations from eminent members of the dental profession throughout the country, the majority of them connected with Dental Colleges, others with Boards of Dental Examiners, concerning the first work, the present one not only embracing all that was contained in it, but also many additions and new subjects:

"The work will be a valuable one for students, and should be used in all our Colleges. I will recommend the work to our students, and suggest that each one provides himself with a copy.

PROF. J. TAFT,
Dean, University of Michigan, College of Dental Surgery."

"They are the best books of the kind I have seen, and I am recommending students to purchase them.

FRANK ABBOTT, M. D.,
Prof. and Dean, New York College of Dentistry."

"Your books of Questions and Answers for Dental Students received. I have looked over the parts connected with my College Department—Operative Dentistry, and Dental Physiology and like them very much. I trust the series will meet with much favor, as of it they are worthy.

C. N. PIERCE,
Dean and Prof. of Dental Physiology, Dental Pathology, and Operative Dentistry, Penn., College Dental Surgery."

"Dr. Garretson begs to acknowledge the Publishers' kindness in sending him Prof. Gorgas' "Questions and Answers." The work of compilation is admirably done, and there can be no doubt that students will make large use of the books as aids to preparation for graduation examinations. Practitioners should find in them hints directing to free and wide reading. Dr. Garretson asks that his compliments and congratulations be given to Prof. Gorgas.

DR. JAMES E. GARRETSON,
Prof. of Anatomy and Surgery, and Dean of Philadelphia Dental College."

"We will place the 'Questions and Answers' before our students, and call their attention to them, as we believe they are a good thing, not only for Students, but for older members of the profession.

PROFS. L. P. HASKELL, Pres., and A. M. MARKLE, Vice Pres.,
The Haskell Post Graduate School of Prosthetic Dentistry, Chicago, Ill."

"I think all of the work will meet with approval everywhere.

W. H. WHITSLAR, M. D., D. D. S.,
Secretary, and Prof. Dental Anatomy and Pathology, Western Reserve Univ. Dent. Dept."

"Everything coming from the pen of Prof. Gorgas is always good, and I shall take pleasure in recommending the work for the use of the student.

PROF. A. O. HUNT,
Dean and Professor of Metallurgy, Dental Prosthesis, and Supt. of Clinics, Dental Department of State University of Iowa."

"Myself, as well as the members of the Dental Faculty, were greatly interested in the work, because at this time the tendency towards text-book instruction is more and more apparent, so that every effort along that line is of great practical interest. Therefore, after looking it over carefully, I have passed it over to members of the Dental Faculty for examination; thus the delay. We are all pleased with them, and there should be no doubt of their wide adoption.

E. R. EGGLESTON, M. D.,
Registrar, Cleveland Homœopathic Hospital College, Dent. Dept."

"I have given the book "Questions and Answers" a careful examination and consider it a most valuable work for students.

TRUMAN W. BROPHY,
Dean of Chicago College of Dental Surgery."

"Am very favorably impressed with the work, and think it will be of great assistance as a book of reference, both to the practitioner and teacher, as well as the student.

A. P. SOUTHWICK,
Dental Department University of Buffalo."

"It is just what every graduate needs to put him in tune with the times. It is just what every Dental College student needs as a means of final review. I take great pleasure in recommending this series to my classes.

W. H. DEFORD, D. D. S., M. D.,
Lecturer on Pathology and Hygiene, Dental Dept. State Univ. of Iowa."

"I have looked over them carefully and am much pleased with them. I think they are the best books of the kind yet published, and we shall use them in our college classes.

H. T. SMITH,
Secretary, Ohio College of Dental Surgery."

"I have had time to examine them, they seem well adapted for the purpose intended, and will without doubt prove a valuable addition to the text-books of the Colleges. I reserve further notice for the *International Dental Journal.*

JAMES TRUMAN, D. D. S.,
Editor, *Philadelphia International Dental Journal.*"

"They have been placed at the College and the attention of the students have been called to them. I have been very favorably impressed, and think they will be well received by our students.

EDGAR D. SWAIN,
Dean, Northwestern University Dental School."

"Will at once introduce to the class and recommend the work in the future. As President of the Board of Dental Examiners for the District of Columbia I have recommended and the Board will purchase the work to be filed in its archives. The work is in every particular the need of the dentist as well as the student, concise, and the most handy production of the kind. I think it will meet a full sale.

J. ROLAND WALTON, D. D. S."

"Of their kind, they appear to be very complete and comprehensive and might be made a very valuable adjunct to students.

J. A. FOLLETT,
Dean, Boston Dental College."

"They are valuable works and I offer the thanks of the Indiana Dental College.

J. N. HURTY,
Secretary, Indiana Dental College."

"At first sight I think they are books which no student, whether attending school, or in general practice, can afford to do without.

W. A. SPAULDING,
Dental Department, Minneapolis Hospital College."

"I am pleased with the books, am using them in my lectures and some of our students have, I think, already ordered them. In next issue of the *Western Dental Journal*, I will give the books a suitable notice. Thanking you, I am very truly,

J. D. PATTERSON,
Editor, *Western Dental Journal* and Dean of Kansas City Dental College."

"Am convinced that it is one that will be of great benefit to the student as well as to the practitioner and teacher. I will take pleasure in bringing it to the attention of our class.

A. H. FULLER, M. D.,
Secretary, Missouri Dental College."

"These books outlining the three courses of dental study are more thorough and comprehensive than anything that has been placed before the student heretofore. Each department seems to have received special and careful attention, and while the teachings of the different colleges differ somewhat, still a work of so high character cannot but stimulate general collegiate work to a higher standard of excellence.

The large experience of Dr. Gorgas, as a teacher, has enabled him to see the usefulness of this compilation for students, and for those practitioners who would keep well up with the present teachings of dentistry.

The reputation of the author through his previous works, will be a ready recommendation for this one."—*Chicago Dental Review.*

"This is a timely contribution to dental literature. The first book for the Freshman's course is easily digested, but gives a good idea of the foundation work of dental knowledge in anatomy, dentition and a general training. It is a fine preparation for college life. Book second takes up these subjects in a more advanced aspect, adding two or three departments; and book three in a still more thorough manner treats of dental pathology, oral surgery and practical dentistry. There are few practitioners who might not study all of them with interest and profit.

T. B. W.,
Editor, *Items of Interest.*"

The object of the author is to furnish a work that will answer as a preparatory text-book for those who are preparing themselves for a college course of dentistry: also to assist the dental college student during his studentship, in reviewing the subjects that compose the curriculum of each of the various dental schools, and also to assist him, after graduation, in preparing for the examinations required by the State Boards of Dental Examiners.

This work has been divided into three parts to conform as nearly as possible, with the Freshman, Junior, and Senior courses of the different colleges of dentistry, and should such divisions as the author has made of the subjects, not conform to the division of the curriculum of every dental school in regard to the three courses taught, yet the hope is indulged that a reference to other parts of the work will show that no subject taught in any dental school has been omitted.

FERDINAND J. S. GORGAS.

Contents

Part I.

Anatomy.

QUESTION. Define Anatomy?

ANSWER. The science relating to the structure of organized bodies.

Q. Define Osteology?

A. That part of anatomy which describes the bones.

Q. Number of bones of the head?

A. Twenty-two, eight cranial and fourteen facial bones.

Q. Names of the bones of the head?

A. *Cranial*—1 Frontal, 2 parietal, 1 occipital, 2 temporal, 1 sphenoid and 1 ethmoid. *Facial*—2 Superior maxillary, 2 malar, 2 nasal, 2 lachrymal, 2 palate, 2 inferior turbinated, 1 vomer, and 1 inferior maxillary.

Q. Give the composition of Bone?

A. Organic or animal matter and inorganic or mineral matter.

Q. Give the quantity and composition of each?

A. Organic matter about $\frac{1}{3}$, consisting of gelatin, fat, and vessels. Inorganic matter about $\frac{2}{3}$, consisting of phosphate and carbonate of lime (calcium), fluoride of lime, phosphates of magnesium, sodium, and chloride of sodium.

Q. What is the structure of bone?

A. An outer compact layer, and an inner cellular or spongy structure.

Q. What does a transverse section of bone, examined microscopically, show?

A. Haversian canals, Canaliculi, Lacunæ.

Q. What are Haversian canals?

A. Canals for the passage of vessels.

Q. What are Canaliculi?

A. Minute canals connecting the Haversian canals with the lacunæ.

Q. What are Lacunæ?

A. Irregular dark spaces arranged circularly around the canals and containing the bone-cells.

Q. What are Sharpey's Fibres?

A. Transverse or perpendicular fibres that appear when the superficial lamellæ of decalcified bone are forcibly torn off. They are periosteal fibres that have failed to ossify.

Q. What is the medulla or marrow of bone ?

A. Matter of a yellow color, consisting of fat and extractive matters, occupying the medullary canal, the cancellous texture, and the large Haversian spaces.

Q. What vessels are found in bone ?

A. Arteries and veins, and according to some authorities, lymphatics.

Q. Describe the *Superior Maxillary Bone?*

A. Two hollow bones which together form the upper jaw, each bone consisting of four processes and a body.

The processes are : the *Malar* which is triangular in shape extending outwards from the body of the bone, its surface being rough for articulation with the malar bone ; the *Nasal*, which is thin anteriorly and serrated at its upper portion for articulation with the nasal bone, but smooth posteriorly, articulating with the lachrymal bone. The nasal process also presents superior and inferior turbinated crests, the superior articulating with the ethmoid bone. The outer surface of the nasal process affords origin to the orbicularis palpebrarum and levator labii superioris alaque nasi muscles and the tendo oculi. There is a groove on the posterior border which assists in forming the nasal duct.

The *Alveolar process* forms the curved ridge for the accommodation of the upper teeth, and presents corresponding cavities or sockets called *alveoli* for eight adult or permanent teeth, and for five child's or temporary teeth. The *Palate* process forms a part of the floor of the nasal cavity and the roof of the mouth. It articulates with the vomer, the palate bone, and with its corresponding process, and in it are the incisive foramen for the anterior palatine vessels, the foramina of Scarpa for the naso-palatine nerves. The groove on the under surface of this process is for the protection of the vessels and nerves. The orifice of the posterior palatine canal is at the posterior end of the process, and what is known as the nasal crest is situated at the articulation of the two processes with the vomer. The anterior extremity of the nasal crest is known as the anterior nasal spine.

The superior maxillary bone articulates with the frontal, ethmoid, vomer, nasal, lachrymal, malar, palate, inferior turbinated, and the corresponding superior maxillary bones.

The body of the Superior Maxillary bone which is quadrilateral in form, has four surfaces as follows: the *facial* externally, the *zygomatic* posteriorly, and the *internal* which forms part of the outer wall of the nose and the cavity of the mouth. It has also the incisive and canine fossæ, the former situated on the facial surface above the incisor alveoli, and gives origin to the depressor alæ nasi muscle; the canine fossa is for the origin of the levator anguli oris muscle. Above the canine fossa is the infra-orbital foramen for the passage of the infra-orbital vessels and nerve from the infra-orbital canal.

About the centre of the zygomatic surface are several apertures leading to canals in the substance of bone which are called the *posterior dental canals*, they transmit the posterior dental vessels and nerves. The *maxillary tuberosity* is a rounded eminence situated at the lower part of the zygomatic surface, which becomes more prominent after the formation of the third molar tooth. Its rough inner surface articulates with the tuberosity of the palate bone.

The *posterior palatine canal* is formed by the articulation of the superior maxillary with the palate bone.

The following muscles are attached to the Superior maxillary bone: orbicularis palpebrarum, levator anguli oris alæque nasi, levator labii superioris, levator anguli oris, compressor naris, depressor alæ nasi, orbicularis oris, inferior oblique of eye, buccinator, masseter and external pterygoid.

The superior maxillary bone presents in its body a large pyramidal cavity called the *Antrum* of *Highmore* or *Maxillary Sinus*, which opens into the middle meatus of the nose by a very small opening. Its walls are very thin and are lined by a mucous membrane, and its apex, directed outwards, is formed by the malar process, and its base by the outer wall of the nose; its roof is formed by the orbital plate; and its floor by the alveolar process, bounded in front by the facial surface and behind by the zygomatic surface.

The antrum in the articulated skull communicates with the middle meatus of the nose, usually by two small apertures; in the recent state. There is generally but one small opening in the upper part of the cavity, the other being closed by the lining membrane. Projecting elevations of bone, in the shape of conical processes, corresponding to the roots of the first and second molar teeth, are found on the floor of this cavity, and in some cases the floor is perforated by roots of such teeth. On the posterior wall of the antrum are the posterior and dental canals. (See Maxillary Sinus.)

Q. Describe the *Inferior Maxillary Bone?*

A. The Inferior Maxillary is the largest and strongest bone of the face, and accommodates the inferior teeth. It is composed of a body and two rami, and is shaped somewhat like a horseshoe. The alveolar portion in the adult jaw, contains cavities for sixteen permanent teeth, and in the child ten cavities for the inferior temporary teeth. A vertical ridge on the median line is known as the *symphysis*, and indicates the junction of the two portions of which this bone originally consists.

The prominence forming the chin is known as the *mental process.* The opening below the position of the 2d bicuspid alveolar cavity, is known as the *mental foramen* for transmitting the mental artery and nerve, branches of the inferior dental artery and nerve. Above the chin is a depression known as the *incisive* fossa for the origin of the levator menti muscle. Along the outer surface of the body of the bone, dividing it into a superior or alveolar portion, and an inferior or basilar portion, is the *external oblique line*, which gives origin to the depressor labii inferioris and depressor anguli oris muscles.

A *groove* located on the border of the bone near the angle is for the accommodation of the facial artery. Four prominent points, or, in some cases an irregular eminence on the internal surface back of the symphysis, are the *genial tubercles*, which give attachment to the genio-hyoglossi and genio-hyoidei muscles. The *oval depression* on either side of the genial tubercles, known as the *sublingual fossa*, accommodates the sublingual gland, and the rough depression beneath this fossa gives attachment to the anterior belly of the digastric muscle. On the inner surface of the body of the bone is the *mylo-hyoid ridge* which is very prominent opposite the second and third molar teeth, and gives attachment to the mylo-hyoid muscle. The alveolar ridge is wider and its margins much thicker in the posterior part containing the cavities of the molar teeth. The two ascending portions of the inferior maxillary are known as the *rami* and are of quadrilateral form. The external surface of each ramus is flat and irregular, giving attachment to the masseter muscle. About the centre of the internal surface is the opening of the *inferior dental canal*, situated behind a sharp projection of bone known as the *spine*, which gives attachment to the internal lateral ligament of the lower jaw, or temporo-maxillary articulation. At its lower or back part is a notch leading to a groove, known as the *mylo-hyoidean groove*, for the accommodation of the mylo-hyoid vessels and nerves; back of this groove is a rough surface for the insertion of the internal pterygoid muscle. The *inferior dental canal* passes obliquely downwards and forwards in the substance of the ramus, and then horizontally forwards through the body of the bone under the alveoli, communicating with each alveolus by a small opening. When this canal arrives at the incisor cavities it communicates with the *mental foramen*, ending at last in two small canals which extend forward in the cancellous tissue of bone beneath the incisor teeth. The thin upper border of each ramus presents two processes, the anterior or *coronoid* and the posterior or *condyloid*, separated by a deep concavity known as the *sigmoid notch*. The *coronoid process* is thin, flattened, and triangular in shape, and its internal surface gives attachment to the temporal muscle; its external surface gives attachment to the masseter as well as to the temporal muscle. A longitudinal ridge on the internal surface of the coronoid process, continues to the posterior portion of the alveolar process, having on its outer side a deep groove, both ridge and groove giving attachment above to the temporal muscle, and below to the buccinator muscle. The *condyloid process* by its condyle articulates with the glenoid fossa of the temporal bone, and its neck affords attachment to the external lateral ligament of the lower jaw or temporo-maxillary articulation. The anterior surface of this process contains the depression known as the pterygoid fossa, for the attachment of the external pterygoid muscle. At the junction of the posterior body of the ramus with the inferior border of the body is the *angle of the jaw*, where the masseter and internal pterygoid muscles, and the stylo-maxillary ligament are inserted.

Q. With what bones does the inferior maxillary articulate?

A. With the two temporal.

Q. What muscles are attached to the inferior maxillary?

A. The temporal, masseter, internal and external pterygoids, genio-hyoglossus, genio-hyoid, mylo-hyoid, digastric, superior constrictor, depressor labii inferioris, depressor anguli oris, levator menti, orbicularis oris, platysma myoides, and buccinator.

Q. What articulation between the lower jaw and temporal bone?

A. The Temporo-Maxillary.

Q. What parts form the Temporo-Maxillary Articulation?

A. The anterior part of the glenoid cavity of the temporal bone and the eminentia articularis above, and the condyl of the lower jaw below, with the following ligaments; external lateral, internal lateral, stylo-maxillary, capsular, interarticular fibro-cartilage.

Q. What movements does this articulation permit so as to assist in the mastication of food?

A. The jaw may be depressed or elevated, or it may be brought forwards or backwards, or from side to side.

Q. Number, position and form of the *Palate Bones?*

A. Two; situated at the back part of the nasal fossae, one on each side, wedged in between the superior maxillary and the pterygoid process of the sphenoid bone, each one resembles the letter L, in shape.

Q. What cavities does each palate bone assist in forming?

A. Roof of the mouth, floor and outer wall of the nose, and the floor of the orbit of the eye.

Q. Describe the *Anterior Border* of *the Palate Bones?*

A. Serrated and joins the superior maxillary bones.

Q. Describe the *Posterior* Border of the Palate Bones?

A. Free and concave, for the attachment of the soft Palate.

Q. Describe the *Inner* Border of the Palate Bones?

A. Thick, and each articulates with its fellow, forming a groove for the reception of the vomer.

Q. With what bones do the palate bones articulate?

A. Sphenoid, superior maxillary, inferior turbinated, vomer, ethmoid and with each other.

Q. To what muscles do the palate bones give attachment?

A. Tensor Palati, Azygos Uvulæ, Internal and External Pterygoids.

Q. What are *Muscles?*

A. The active organs of locomotion.

Q. What do they consist of?

A. Bundles of reddish fibres, endowed with the property of contractility, and chemically consisting of muscular fibrin.

Q. How are muscles divided?

A. Into *Voluntary* or *Striped*, which are under the control of the will; and *Involuntary* or *Unstriped*, those not under such control. The voluntary are the muscles of animal life, and the involuntary the muscles of organic life.

Q. What are *Tendons* and *Aponeuroses?*

A. Tendons are white, glistening cords or bands, and serve to connect the muscles to bone, &c., on which they act. Aponeuroses are fibrous membranes, of the same structure and appearance and perform the same function.

Q. What are *Fasciæ?*

A. Laminæ of variable thickness which invest the softer structures.

Q. Name the principal *Oral Muscles* or muscles of expression and functions?

A. Orbicularis Oris—to close the mouth; Levator Labii Superioris alaque Nasi—to elevate upper lip and wing of nose; Levator Labii Superioris—to elevate the lip; Zygomaticus Major—to raise lip outwards; Zygomaticus Minor—to raise lip outwards; Platysma Myoides—to depress the mouth and wrinkle the skin; Levator Labii Inferioris—to elevate lower lip; Depressor Labii Inferioris—to depress lower lip; Depressor Anguli Oris—to depress the angle of mouth; Buccinator—to compress the cheeks; Risorius—to perform act of laughing.

Q. Name the Muscles concerned in the movements of the lower jaw, and functions?

A. Temporal—to bring the incisor teeth together; Masseter—to raise back part of lower jaw; Internal Pterygoid—to raise and draw forward the lower jaw, a triturating muscle of mastication; External Pterygoid—to draw the lower jaw forwards, also a triturating muscle of mastication; Digastric—to raise hyoid bone and tongue; Omohyoid—to depress and draw backwards the hyoid bone; Mylo-hyoid—to elevate and draw forwards the hyoid bone and to form floor of mouth; Genio-hyoid—same as mylo-hyoid.

Q. What are the *Arteries?*

A. Cylindrical vessels which convey arterial blood from the heart to the organs of the body.

Q. What is the structure of the Arteries?

A. Dense and elastic, composed of three coats, an *internal* or serous; a *middle* of muscular and elastic tissue; and an *external* of connective tissue.

Q. What are the *Capillaries?*

A. Minute vessels between the terminating arteries and commencing veins.

Q. What are the *Veins?*

A. Vessels for returning blood to the heart.

Q. What are their walls composed of?

A. Three coats—an *internal*, serous; a *middle*, muscular; and an *external*, fibrous.

Q. What kind of blood do the veins carry?

A. Carbonized or Venous, except the pulmonary veins which bring oxygenated blood to the left side of the heart. The deep veins accompany the arteries and have the same names.

Q. Describe the Aorta?

A. It is the main trunk of the systemic system commencing at the left ventricle of the heart, arching over the left lung into the thorax, where it descends on the left of the spinal column and terminates in the right and left common iliac arteries, opposite the 4th lumbar vertebra.

Q. What are the first branches given off by the aorta?

A. The *Coronary*, two in number which supply the tissue of the heart.

Q. Describe the *Innominate Artery?*

A. It arises from the summit of the arch of the aorta on right side of body, and divides into the Right and Left Common Carotid arteries and the Right Subclavian artery. These arteries on the left side of the body arise directly from the arch of the aorta.

Q. Describe the *Common Carotid Arteries?*

A. The left is longer and deeper than the right one. A line drawn from a point midway between the angle of the lower jaw and the mastoid process of the sterno-clavicular articulation will indicate their course. The common carotids terminate opposite upper border of thyroid cartilage.

Q. Describe the course of the *External Carotid Arteries?*

A. They are given off from the common carotids in the carotid triangles. From upper border of thyroid cartilage they pass up the neck to a point opposite neck of inferior maxilla, where each divide into two branches, the Internal Maxillary and Superficial Temporal.

Q. Describe the course of the *Internal Maxillary Arteries?*

A. They are given off from the external carotids in the parotid glands a little below and behind the condyles of the lower jaw, on a level with lower part of lobes of the ears. They pass upwards at right angles to the external carotids, and pursue a torturous course between the inferior maxillary bone and internal lateral ligament, then obliquely upwards and forwards, when they turn inwards opposite heads of external pterygoid muscles into the spheno-maxillary fossæ.

The branches of the Internal Maxillary supplying the muscles of mastication are the pterygoid, masseteric and buccal, and the branches supplying the teeth are the *alveolar* which is given off by a common branch with the infra-orbital just as the trunk is passing into the Spheno-maxillary fossa. Passing downwards upon the tuberosity of the superior maxillary bone, it divides into numerous branches, one being the *superior dental* which supplies the molar and bicuspid teeth, its branches penetrating the foramina in the alveolar process. The *infra-orbital* branch passes along the infra-orbital canal with the superior maxillary nerves, and emerges on the face at the infra-orbital foramen. While in the canal it gives off branches to supply the antrum and the canine and incisor teeth of the upper jaw. The *Inferior Dental* branches of the Internal Maxillary artery descend with the dental nerve to the foramen on inner side of ramus of the jaw, and pass along the dental canal in the substance of the bone, accompanied by the inferior dental nerve, giving off small branches to the molar and bicuspid teeth; opposite the bicuspid cavities, it divides into two branches *incisor* and *mental*, each incisor artery continuing forwards beneath the incisor teeth as far as the symphysis where it anastomoses with its fellow of the opposite side; the mental branch passes out of the mental foramen and supplies the structures of the chin and anastomoses with the submental, inferior labial and inferior coronary arteries.

Q. What blood vessels supply the Roof of the Mouth or Hard Palate, and where do they make their exit?

A. The blood-supply is principally derived from the Posterior or Descending branch of the Internal Maxillary or Deep Facial, which passes downwards in posterior canal and emerges through posterior palatal foramen, where it divides into anterior and posterior branches, the anterior passing forwards in a groove to anterior palatal foramen, where it anastomoses with the naso-palatal; the posterior branches pass backwards and downwards to supply soft palate; the palatal alveolar walls, mucous glands, mucous membrane and gums are supplied by the same branches.

Q. What does the Infra-orbital artery anastomose with?

A. Branches of Facial artery.

Q. What is the course of Facial artery?

A. It arises from the external carotid, crosses border of inferior maxillary bone at anterior angle of masseter muscle to the face.

Q. Name its branches?

A. Ascending Palatine, Tonsillar, Submaxillary, Submental, Muscular, Inferior Labial, Coronary, Lateralis Nasi, Transverse Facial and Angular.

Q. What artery supplies the Cheeks?

A. The Facial, and its branches—Coronary and Transverse Facial.

Q. What arteries supply the Lips?

A. Superior and Inferior Coronary of Facial, and the Inferior Labial also a branch of facial, and the *Mental*, a branch of Inferior Dental.

Q. What are the blood vessels of Tongue?

A. Lingual, Facial and Ascending Pharyngeal.

Q. What are *Nerves?*

A. White fibrous cords of various sizes extending between nerve-centres and peripheral end-organs.

Q. How do nerves act?

A. As conductors, like the wires of a galvanic battery in the transmission of electricity.

Q. Where is nerve-force generated?

A. In nerve-cells, in a manner analogous to that of a galvanic cell or battery in the generation of electricity.

Q. How is the *Nervous System* divided?

A. Into the *Cerebro-Spinal*, of animal life; and the *Sympathetic*, of organic life.

Q. What two substances form the structure of the Nervous tissue?

A. *White or Fibrous matter* and *Gray or Vesicular matter.*

Q. What two classes of Nerves of the Cerebro-Spinal system?

A. *Motor* and *Sensory Nerves.*

Q. What are *Motor Nerves?*

A. Those which conduct nerve force from the nerve-centre outwards to the muscles.

Q. What are *Sensory Nerves?*

A. Those which convey the impression received at the peripheral end-organs to the nerve-centres.

Q. What are Compound Nerves?

A. Those composed of motor nerves and sensory filaments.

Q. How many pairs of *Cranial Nerves?*

A. Twelve pairs.

Q. Name the Cranial Nerves and their Functions?

A. 1st Pair—Olfactory: nerve of smell. 2d. Optic: nerve of sight. 3d. Motor Oculi: motor of eye. 4th. Patheticus: motor of eye. 5th. Trigeminus: nerve of sensation, motion and taste. 6th. Abducens: motor of eye. 7th. Facial or Portio Dura: motor of face, ear, palate, and tongue. 8th. Auditory, or Portio Mollis of the 7th: nerve of hearing. 9th. Glosso-pharyngeal: nerve of sensation and taste. 10th. Pneumogastric: nerve of sensation and motion. 11th. Spinal Accessory motor nerve. 12th. Hypo-glossal motor of tongue.

Q. What Cranial Nerves supply the teeth?

A. The 5th, *Trigeminus* or *Trifacial Nerve.*

Q. What is the origin of the 5th Pair?

A. The Pons Varolii and Medulla Oblongata.

Q. Describe the Pons Varolii?

A. A great transverse commissure at base of brain in front of medulla oblongata; its fibres connect the hemispheres of the cerebellum with each other and the medulla oblongata.

Q. Describe the Medulla Oblongata?

A. The upper enlarged part of spinal cord, extending from upper border of atlas to the Pons Varolii.

Q. Describe the 5th Pair of Nerves and its general distribution?

A. A compound nerve with three large divisions which are distributed to forehead, eyelids, lachrymal glands, conjunctiva, iris, ciliary ganglion, palate, muscles of mastication, auditory meatus, otic and submaxillary ganglions, tongue, lingualis muscle and teeth.

Q. Where is the *Gasserian Ganglion* situated?

A. In a depression on the anterior surface near the apex of the petrous portion of the temporal bone.

Q. What is the form of this Ganglion?

A. Broad, flattened and somewhat semilunar or crescent shaped.

Q. What are the three large divisions of the 5th Pair?

A. *Ophthalmic*—smallest; *Superior Maxillary*, and *Inferior Maxillary*—the largest.

Q. What branches of the Superior Maxillary supply the upper teeth?

A. The *Posterior*, *Middle* and *Anterior Dental.*

Q. Describe the course of the Superior Maxillary Nerve?

A. It commences at the middle of the Gasserian Ganglion as a flattened band, and passes through the foramen rotundum, crosses the Spheno-maxillary fissure, and through the infra-orbital canal to foramen of same name, where it emerges on the face and divides into 3 terminal branches—Palpebral, Nasal and Labial.

Q. What branches does the Superior Maxillary give off in the Spheno-Maxillary fossa?

A. Orbital, Spheno-palatine and *Posterior Dental.*

Q. What branch does it give off in the Infra-Orbital canal?

A. The *Anterior Dental.*

Q. Which of these branches supply the Superior Teeth?

A. The *Posterior*, *Middle* and *Anterior Dental.*

Q. Describe the *Inferior Maxillary Nerve?*

A. The larger or Sensory root of this compound nerve arises from the inferior angle of the Gasserian Ganglion and passes downwards through the foramen ovale in the Sphenoid bone, when the motor branch unites with it forming one nerve. It then descends vertically and divides into anterior and posterior branches. The anterior or smaller of the two branches, divides into the deep temporal, masseteric, pterygoid and buccal. The posterior branch divides into the auriculo-temporal, the gustatory or lingual and Inferior Dental.

Q. Describe the course of the *Inferior Dental Nerve?*

A. It passes downwards with an artery of same name, first beneath the external pterygoid muscle, and then between the internal lateral ligament and ramus of jaw to the dental foramen, which it enters, and then passing through the substance of the bone, sends off small branches to the molar and bicuspid teeth. On arriving at the mental foramen it divides into *incisor* and *mental* branches, the former after supplying the inferior canine and incisor teeth, anastomosing with its fellow on the opposite side, and the latter emerging from the foramen and supplying the integuments of the lower lip and chin.

Q. What are the Nerves of Hard Palate or Roof of Mouth?

A. Anterior or large Palatal, and branches from Naso-Palatal, both of which are branches of the Spheno-palatal (or Meckel's) ganglion.

Q. What are the nerves of the Soft Palate?

A. The Posterior Palatal, the External Palatal—both being branches of Meckel's ganglion, and branches of the Glosso-pharyngeal.

Q. What are the nerves of the Lips?

A. Infra-orbital for upper lip, and Mental for lower lip; Buccal and Superior Maxillary to facial muscles.

Q. What are the nerves of the Cheeks?

A. The facial and its branches, and Infra-orbital, distributed to labio-buccal region.

Q. What are the nerves of the Tongue?

A. Lingual, Glosso-pharyngeal, lingual branch, and Hypo-glossal.

Q. What nerves supply the Superior Teeth?

A. Posterior Dental, Middle Dental, Anterior Dental—branches of Superior Maxillary.

Q. What nerves supply the Inferior Teeth?

A. Inferior Dental and Incisive—branches of Inferior Maxillary.

Q. What nerve supplies the Chin?

A. Mental—branch of Inferior Dental.

Q. What are the *Lymphatics?*

A. Very delicate, transparent vessels with three coats like the arteries and veins, and convey lymph to the blood.

Q. What are the *Lacteals?*

A. The lymphatics of the small intestine which convey the chyle therefrom into the blood.

Q. What are the *Lymphatic Glands?*

A. Small solid bodies placed in the course of the absorbent vessels, and are named after the region in which they are situated.

Q. Into how many parts may the *Mouth* be divided?

A. Cavity, Roof, Floor and Posterior Border.

Q. How is the cavity of the mouth bounded?

A. Above by the Palatine arch; below by tongue and mylo-hyoid muscle.

Q. What is the shape of the *Mouth?*

A. Paraboloid, opening behind and below.

Q. What forms the *Roof* of *Mouth?*

A. *Hard Palate.*

Q. What composes the *Hard Palate?*

A. The Palatal Processes of the 2 Superior Maxillary Bones, and the Palate Bones.

Q. What is the shape of the Mouth?

A. Arched in front and flattened behind.

Q. Describe the Posterior Border of the Hard Palate?

A. Free and thin, and divided into 2 portions by the *posterior nasal spine*, on each side of which the border is concave, terminating latterly in the pyramidal process of the palate and hamular process of the Sphenoid Bone.

Q. What ridge on Inferior Maxillary Bone forms the circumference of the floor of the mouth?

A. The Mylo-hyoid.

Q. What form the lateral walls of the mouth?

A. Alveolar Process and Upper and Lower Teeth.

Q. What form the external parts of the mouth?

A. The Lips and Cheeks.

Q. What is attached to posterior border of Hard Palate?

A. The *Soft Palate*, or *Velum Pendulum Palati.*

Q. Describe the *Tongue?*

A. Consists of muscles, a hyo-glossal membrane, a mucous membrane, medium fibrous septum, vessels and nerves; its *base* is attached to hyoid bone, epiglottis, soft palate and pharynx; its *under surface* is attached to hyoid bone, and inferior maxillary; its *mucous surface* is reflected over floor of mouth to inner surface of gums, forming in front a fold—*frænum linguæ;* the *dorsum* is the posterior part of tongue.

Q. Name its *Papillæ?*

A. *Filiform* along sides, closely packed in rows; *fungiform*, scattered over anterior $\frac{2}{3}$ of its dorsum; *circumvallate*, 7 to 12 in number, in 2 rows forming a V at base, meeting at the foramen cæcum, which contains the central papilla.

Q. Name its *Glands?*

A. Follicular and Racemose.

Q. What are its muscles?

A. Extrinsic—Stylo, hyo-, genio hyo- and palato-glossus; Intrinsic—several fibres of lingualis,—superior, inferior, transverse, and perpendicular.

Q. Name its *Arteries?*

A. *Lingual*, branch of external caratid,—with its branches—dorsalis lingual, sub-lingual, *Ranine; sub-mental*, branch of facial-anastomoses with sub-lingual; *Ascending Pharyngeal*, branch of external carotid,—sends some small branches to pharynx and tongue.

Q. What *Nerves* are distributed to tongue?

A. Gustatory of 5th, Chorda Tympani of 7th, Glosso-pharyngeal of 9th, Hypoglossal or 12th, Pneumogastric or 10th; Gustatory is very near last molar tooth.

Q. What are the *Special Organs of Taste?*

A. The *taste-buds*, small flask-shaped bodies, each about $\frac{1}{300}$ inch long, situated in fungiform and circumvallate papillæ; the seat of sense of taste is in the mucous membrane covering dorsum, the upper portion of pharynx, soft palate, and fauces.

Q. What are the *Special Nerves of Taste?*

A. Chorda Tympani branch of facial, for its anterior $\frac{2}{3}$; Lingual branch of Glosso-pharyngeal for its posterior third.

Q. What are the *Tonsils?*

A. Two glandular bodies situated between the anterior and posterior arches of the soft palate on each side of the oro-pharyngeal space: each has 12 or 15 openings leading to follicular depressions in the gland. They resemble the outside of an almond shell, and are composed of tissue fibres and lymph follicles. The tonsils secrete a mucus the retention of which causes the breath to become fetid. They lie close to the internal carotid arteries.

Q. What are *Glands?*

A. Organs whose function is to elaborate the various products of secretion from the blood and to perform offices connected with absorption and assimilation, and maintain the blood in a normal condition.

Q. Name the Salivary Glands on each side of the head?

A. *Parotid*, *Submaxillary* and *Sublingual*.

Q. Describe the *Parotid Gland?*

A. The largest, situated on side of face, below and in front of ear, limited above by the Zygoma and below by the angle of jaw. Its duct is known as *Steno's* 2½ inches in length opening on inside of cheek opposite the 2d molar tooth. The weight of this gland is ½ to 1 ounce.

Q. Describe the *Submaxillary Gland?*

A. The second in size, situated below the jaw in a depression of the bone under the mylo-hyoid ridge in anterior part of submaxillary triangle of the neck. It is irregular in form and weighs 2 drachms; its duct is known as *Wharton's*, 2 inches long, which commences on the summit of a small papilla at side of frænum of the tongue.

Q. Describe the *Sublingual Gland?*

A. The smallest, situated beneath mucous membrane of floor of the mouth on either side of the frænum of tongue, in contact with inner surface of lower jaw back of the symphysis. It is narrow and flattened like an almond, and weighs one drachm. Its excretory ducts are known as *Ductus Riviniani*, and are from 8 to 20 in number, opening on elevated crests of mucous membrane, caused by the projection of the gland on either side of frænum of tongue. Several of these ducts join to form a tube, known as the *Duct of Bartholine* which opens into Wharton's duct.

Q. At what age do the Salivary Glands become active?

A. At 4 to 6 months.

Q. Of what parts does the structure of a Salivary Gland consist?

A. Of Lobes, Lobules, and Ducts; the lobes and lobules are joined together by loose areolar tissue.

Q. Where are the *Labial Glands* situated?

A. Between the mucous membrane and the orbicularis muscle.

Q. Where are the *Buccal Glands* situated?

A. Between the mucous membrane and the buccinator muscle.

Q. Where are the *Palatine Glands* situated?

A. In the deep portion of the muco-periosteum of the hard palate on each side of roof of mouth.

Q. Where are the *Lingual Glands* situated?

A. On the different surfaces of the tongue.

Q. What do the secretions of all these glands form?

A. The *Oral Fluid*.

Q. What is the *Peridental Membrane?*

A. A modified form of the periosteum which covers bone.

Q. What does the Peridental Membrane line, cover and coalesce with?

A. Lines alveolar cavities, covers roots of the teeth and coalesces with gums at necks of teeth, and periosteum of alveolar processes.

Q. What strong union does it form?

A. That between the teeth and their cavities.

Q. Where is it thickest?

A. About necks of the teeth, and near to ends of their roots, slightly wavy, and downward from alveoli to root of tooth.

Q. What is its origin?

A. The outer layer of the sacculus enveloping the enamel organ and dentinal papilla.

Q. What is the course of its fibres?

A. Transverse, from alveolar walls to cementum of root.

Q. From what point do the nerves and vessels enter the membrane?

A. From the walls of the alveolar cavity; at the apical space; and through gingival border below the margin of the alveolus.

Q. Is the blood-supply very abundant?

A. Yes, in the young, but diminishes as age advances.

Q. From what three sources is the blood-supply derived?

A. From the gums, vessels of alveolar walls, and vessels leading into pulp canal at end of root of tooth.

Q. Which is the most abundant source?

A. From vessels which supply pulp of tooth in apical space.

Q. Is this membrane readily deprived of its blood-supply?

A. No.

Q. Do the nerves enter this membrane along with the vessels?

A. Yes. (See Dental Histology.)

Q. What is the *Alveolar Process?*

A. The projecting portion of the maxillary bones within which the roots of the teeth are lodged in *alveoli* or sockets, accurately fitted to them.

Q. Upon what does the form of the alveolar process depend?

A. On the teeth, the conformation of their roots, and their arrangement in the arch, regular or irregular.

Q. How much of the root of each tooth does the alveolar process envelop?

A. To within a short distance of the gingival line.

Q. Describe the margins of the alveolar process?

A. They are reduced to a thin edge about the necks of the teeth on both the labial and lingual surfaces of the incisors and canines of upper jaw; also about the lingual surfaces of the necks of the bicuspids and molars, becoming thicker about the 2d and 3d molars, especially the latter. On the buccal surfaces of the latter teeth, the process thickens from between the 1st and 2d bicuspids and the thickness extends to the distal surface of the 3d molar. It forms a margin which projects from the necks of the teeth, and then becomes so thin that the buccal roots have but a thin covering of bone. The anterior wall of the process over the incisors in its middle portion, is very thin in some cases, but usually it is progressively thickened from the neck to the apex. The alveolar wall of the cuspids is thin owing to the prominence of these teeth towards the lip. The process on the palatine surfaces of the upper teeth progressively thickens from the gingival margin towards the apex, to a considerable degree, so that the alveoli appear to extend towards the labial and buccal surfaces of the process. Even the greatly diverging palatine root of a 1st upper molar seldom forms a prominence on that surface. The margins of the alveolar processes of the inferior teeth over their labial surfaces are somewhat thicker than in the upper jaw, often forming a decided ridge, while the middle portion of the walls is thin. The margin of the process is very thin, but a ridge near the margin of the bone, corresponding to that of the upper jaw, but not so prominent, begins at the 1st or 2d bicuspid and extends to the second molar; this, however, becomes thin over the middle portion of the walls of the bicuspids and 1st molar. At the second inferior molar the external oblique ridge causes a thickening of the process, while at the 3d molar this ridge rises to a level with the gingival margin of the process, the thickness being about ¼ of an inch. The margins of the partitions or septi of the alveoli of the anterior teeth are convex from the outer to the inner surfaces, but less so in the case of the cuspids; between the molars the septi pass in a straight line or present but a slight concavity, so that the highest points are generally on the buccal and inner surfaces.

Q. What is the *Oral Mucous Membrane?*

A. The membrane lining the cavity of the mouth and extending to the palate, pharynx, &c.

Q. What are the different layers of mucous membrane?

A. Epithelium, Basement Membrane, Corium; under which is Submucous tissue.

Q. What layers are connected with the development of the teeth ?

A. Epithelium, Basement Membrane and Corium.

Q. What is the external layer of Mucous Membrane, and of what two strata does it consist ?

A. The Epithelium, consisting of Corneous and Malpighian strata.

Q. What is the nature of the Basement Membrane ?

A. Very thin, structureless, and situated between the epithelium and the corium.

Q. What is the *Corium ?*

A. The true Mucous Membrane consisting of two strata—the Papillary and Reticulary.

Q. Where is the *Sub-mucous tissue* situated ?

A. Beneath the Corium and next to the bone, and has been termed the Muco-Periosteum.

Q. What fluid does the Mucous Membrane secrete ?

A. *Mucus*, the secretion of which is due to stimulation.

Q. What is the function of *Mucus ?*

A. The protection of the membrane from deleterious matter, as it is both viscid and lubric.

Q. What comprises the *Gums ?*

A. That portion of the Mucous Membrane which covers the greater part of the alveolar process, and surrounds the necks of the teeth.

Q. In what respect does the Gum tissue differ from Mucous Membrane in other parts of the mouth ?

A. In possessing a greater degree of density.

Q. What is the free margin of the gum called ?

A. The *Gingival Margin* or *Border.*

Q. What is the Blood-supply of the upper gum ?

A. Superior Coronary Artery.

Q. What of the Lower gum ?

A. Submental and Sublingual Arteries.

Q. What is the Nerve-supply of upper gum ?

A. Anterior and Posterior Dental branches of the Superior Maxillary Nerve.

Q. What of the Lower gum ?

A. Gustatory or Lingual, and Mental Nerves.

Q. Physiologically the teeth are divided into how many Structures ?

A. Into Enamel, Dentine, Cementum and Pulp, with the Peridental membrane investing the cementum.

Q. What is the nature of the Enamel ?

A. It is the hardest and most dense of all organized substances.

Q. Function of the Enamel?

A. It serves as a protection to the dentine from abrasion, and forms a greater resistance to mechanical force and the action of acids; it also serves to beautify the denture.

Q. What is the *Enamel*, *Dentine* and *Cementum* composed of?

A. Organic and Inorganic substances.

Q. Do the proportions of organic and inorganic matter vary at different periods of life?

A. Yes, there is an increase of inorganic.

Q. What is the structure of the *Enamel?*

A. Solid hexagonal prisms or rods, arranged side by side, with their ends upon the surface of the dentine.

Q. How does Enamel and Dentine calcify?

A. Enamel from within outwards, and Dentine from without inwards.

Q. How much of the tooth does the Dentine form?

A. Nearly the entire solid structure; it gives the typical form of the teeth.

Q. What does the structure of the dentine consist of?

A. *Tubes* and *Intertubular tissue.*

Q. What properties does the dentine impart to the tooth?

A. Density and vitality.

Q. What are the Interglobular spaces of the Dentine?

A. Imperfect formation in the form of irregular cavities like the lacunæ of bone, and found near the inner surface of the enamel.

Q. What does the *Cementum* cover?

A. The root portion of the Dentine.

Q. What does it resemble?

A. Bone, but somewhat more dense, and contains canaliculi and lacunæ, especially in its thicker portions.

Q. What is its function?

A. The Cementum being intermediate in the density of its structure as compared with dentine and bone, it forms a union of the peridental membrane with the root of the tooth, and thus aids the pulp in nourishing the tooth, and preserving its vitality after the pulp is devitalized.

Q. What is the *Dental Pulp* composed of?

A. Cellular elements imbedded in a semi gelatinous matrix, blood vessels and nerves; no lymphatics.

Q. Location and form of the dental pulp?

A. It is enclosed by the dentine in a cavity in the centre of the crown, and one or more canals extending through the long axis of the root, or roots, to the apex.

Q. How is the central cavity in the tooth divided?

A. Into a coronal portion, known as the *Pulp Chamber*, and a root portion, known as the *root canals;* the pulp chamber being comparatively large, and the root canals small, tapering from the crown or pulp chamber to a minute opening at the apex of the root, known as the *apical foramen.*

Q. What are the functions of the Pulp?

A. It is the formative organ of the dentine, nourishes the dentine, and also its own substance.

Q. What does the *Temporary Denture* consist of?

A. Of twenty teeth, divided into incisors, canines and molars.

Q. Name the points in which the Deciduous Teeth Differ from the Permanent Teeth?

A. The deciduous teeth are smaller and shorter, but less firm and solid, than the permanent, and their prominences are less strongly marked. The deciduous molars are larger than the bicuspids of the permanent set; and the roots of the deciduous are flatter, thinner and more concave on their inner surfaces, and diverge more. The color of the deciduous is of a milky-white, often opaque, while the permanent teeth have a yellowish appearance. The deciduous have a marked depression at the necks, at the union of the enamel and cementum.

Q. At what period have the 20 deciduous teeth taken their place in dental arch?

A. By close of 2d year; their roots fully calcified and apical foramens completed.

Q. They remain perfect how long, or when does decalcification begin?

A. About 4th year, at apical extremities of roots and gradually progresses in direction of crowns.

Q. In what order does decalcification proceed?

A. Commencing about 4th year it proceeds in the order of their eruption, the lateral incisors following the centrals, the 1st molar following the lateral incisor, etc.

Q. When does this resorptive process cease?

A. With the loss of vitality of the pulp; the pulp retains its vitality during the entire period of root decalcification, and is involved in the destructive process.

Q. Of what does the Permanent Denture consist?

A. Of thirty-two teeth, divided into incisors, canines, bicuspids and molars.

Q. Describe the *Roots* of the different classes of permanent teeth?

A. The Incisors, Canines and Bicuspids each have one root except the upper first bicuspids, which, in the majority of cases, have two roots, a labial and palatine. The roots of the upper incisors and canines are rounded, the latter being both round and somewhat flattened. The roots of the bicuspids are flattened laterally. The roots of the inferior incisors are considerably flattened. The upper molars have three roots, two buccal and one palatine, and are round. The lower molars have but two roots, one anterior and one posterior, and they are flattened laterally and extend from the buccal to the lingual surface. The roots of the third molars are frequently so joined as to form one root of a conical shape.

Q. Describe the arrangement of the upper and lower teeth?

A. Owing to the difference in shape, size and position of the teeth and the upper arch of the jaw being larger than the lower, each tooth in the upper jaw when articulating comes in contact with two teeth of the lower jaw, thus affording mutual assistance in mastication, and preventing the loss of antagonism when a single tooth of either jaw is lost.

Q. How is space provided in the jaws for the greater number and larger size of the permanent teeth?

A. By the bones of the jaws elongating.

Q. What portion of the tooth remains to be completed after the eruption of the crown?

A. A considerable portion of the root.

Q. Describe the different surfaces of each group of teeth?

A. The surface towards the lips is the *labial;* that towards the cheeks is the *buccal;* that towards the palate is the *palatine;* that towards the tongue in lower jaw, is the *lingual;* those next to each other are the *proximate;* those looking towards the centre are the *mesial;* those looking from the centre are the *distal.* The edges of the front teeth are called *cutting edges*, and the masticating surfaces of the posterior teeth are called the *grinding* or *occlusal* surfaces.

Q. What are the *occluding* surfaces?

A. The cutting edges of the anterior teeth and the grinding surfaces of the posterior teeth.

Q. How are the deciduous teeth placed in the jaws?

A. Vertically.

Q. How are the permanent teeth placed in the jaws?

A. The incisors have an oblique direction towards the lips, and the bicuspids a vertical position.

Q. The upper teeth projecting over the lower, what compensates for the difference in the two jaws?

A. The crowns of the inferior molars being larger than the superior, the arches are brought out almost even.

Q. Why are the Sixth-year molars often mistaken for deciduous teeth?

A. Because they are in position before the loss of any of the deciduous teeth.

Q. How may parents be instructed in this respect?

A. That there are 20 deciduous teeth, and to commence at the central incisors and count 5 on each side of the arch, all back of that number being permanent teeth.

Q. Are the deciduous and permanent teeth similar in regard to composition?

A. Yes, but the deciduous are not so dense in structure, and the pulp-canals are larger in proportion to size of crowns.

Q. What are the natural relations of the upper teeth to the lower teeth-antagonism?

A. The upper incisors and canines project slightly over the same teeth in the opposite jaw. The superior central incisors cover the corresponding inferior centrals, and also ½ of the crowns of the inferior lateral incisors; the same occurs in regard to the superior lateral incisors, canines and bicuspids. The cusps of the superior bicuspids and molars fit into the depressions of the inferior teeth, each superior 1st molar covering ⅔ of the crown of the inferior 1st molar and ⅓ of the crown of the inferior 2d molar. The Superior 2d molar covers ⅔ of the crown of the inferior 2d molar, and ⅓ of the crown of the inferior 3d molar. The crown of the superior 3d molar being smaller than that of the inferior 3d molar, covers the remaining ⅔ of the crown of the latter tooth.

Q. What connects the teeth with their alveolar cavities?

A. The peridental membrane, gums, and the vessels and nerves entering the apical foramen of the roots of the tooth.

Q. What *Arteries* supply the Teeth?

A. Derived from alveolar and infra-orbital branches of Internal Maxillary, for upper teeth, and from Inferior Dental, for lower teeth.

Q. What *Nerves supply the Teeth?*

A. Anterior, middle and posterior dental branches of Superior Maxillary Division of 5th pair, for upper teeth; and Inferior dental branch of Inferior Maxillary Division of 5th pair.

Q. Give a minute description of the *Maxillary Sinus or Antrum?*

A. A cavity in the body of the Superior Maxillary bone, pyramidal in form its base at the nasal fossa, and its apex towards the maxillary tuberosity; it communicates with the cavity of the nose by an irregular opening in the external wall of the middle meatus, and through this opening the Schnerderian, or mucous membrane of the nasal fossæ passes to line the antrum; it has five walls—*internal*, the lateral wall of nasal cavity and forms its base; *antero-external*, the antero-external portion of body of superior maxillary bone; *superior*, the floor of orbit of eye; *posterior*, the part of superior maxillary which articulates with pterygoid process of sphenoid bone; *inferior*, the part of superior maxillary from which the alveolar process arises; thinnest and lowest portion of wall; the floor of antrum has an uneven surface with prominences corresponding to the roots of teeth immediately below it. The roots of the 1st and 2d molars at times penetrate the floor. Bony septa often cross the floor but do not usually extend very high; this cavity will contain from two drachms to more than an ounce of fluid. Cryer claims that the infundibulum often discharges directly into antrum and in other cases so near to the osteum maxillare that it might discharge into it, and Fillebrown asserts that in certain obstinate chronic cases of engorgement of antrum, the frontal sinuses are also affected and that secretions (inflammatory) from these sinuses drain into the antrum, and thus keep up the inflammatory conditions of the latter.

Dental Physiology and Histology.

Q. What is *Physiology?*

A. The science which treats of the development, structure, functions and laws which govern organized bodies.

Q. On what particular phenomena does the study of physiology depend?

A. On those of life and function.

Q. What is *Structure?*

A. Matter arranged in definite form.

Q. What are *Organic Structures* or *Bodies?*

A. Those endowed with such structural forms and forces as adapt them to the spontaneous performance of functions.

Q. What are *Inorganic?*

A. Such as are destitute of organs, and perform no functions.

Q. What is meant by *Function?*

A. The office or service, an organism or part performs.

Q. What is *Life?*

A. The difference between an organized body capable of motion from a source within itself, and the same organism incapable of such motion.

Q. Define *Tissue?*

A. A name applied to all the different forms and parts of organized structure considered separately, such as the membranous organization of parts.

Q. Define an *Organ?*

A. Any part of the body with special function.

Q. What are *Osteoblasts?*

A. Bone Cells; the germinal cells deposited in bone-development.

Q. What are *Osteoclasts?*

A. Cells that absorb bone.

Q. What are *Ameloblasts?*

[1]General Physiology appears in Part II.

A. The germinal cells deposited in the development of Enamel.

Q. What are *Odontoblasts?*

A. The germinal cells deposited in the development of Dentine.

Q. What are *Cementoblasts?*

A. The germinal cells deposited in the development of Cementum.

Q. What is *Ossification?*

A. The development and formation of Bone tissue.

Q. What is *Calcification?*

A. The deposit of lime salts, or other insoluble crystalline matter, within the tissues of the body.

Q. What is *Amelification?*

A. The development of Enamel.

Q. What is *Dentinification?*

A. The development of Dentine.

Q. What is *Cementinification?*

A. The development of Cementum.

Q. In what form are lime salts deposited?

A. In solution.

Q. By what process does the hardening occur?

A. By crystallization.

Q. How is Bone formed?

A. By calcareous matter deposited within the interspaces of cellular tissue.

Q. How is Dentine formed?

A. By a deposit of lime salts by the odontoblasts arranged along the periphery of the pulp.

Q. How is Enamel formed?

A. By a deposit of lime salts by the peripheral cells of the *enamel organ* in immediate contact with the cap of dentine on the surface of the pulp.

Q. How is Cementum formed?

A. Like bone, as it is of periosteal origin.

Q. In what tissue do the Teeth have their origin?

A. In the *Mucous Membrane.*

Q. What does Dental Histology refer to?

A. The development and formation of the bones of the head and of the teeth.

Q. What is the first definite form developed in the Embryo?

A. The rudimentary spinal column, its earliest trace being a faint streak or groove known as the *Primitive Trace or Groove.*

Q. What is the *Chorda Dorsalis* or *Nota-chord?*

A. A delicate fibril which appears when the primitive trace or groove deepens into a furrow.

Q. How does the Chorda Dorsalis terminate?

A. In a pointed extremity extending as far forward as the Sphenoid bone.

Q. From what is the embryonal cranium developed?

A. From the primitive vertebral disks which surround the upper extremity of the chorda dorsalis, these disks developing in the form of a membranous capsule which molds itself on the cerebral vesicles so as to form the membrane in which the vault of the skull is developed, and which is replaced by cartilage in the part corresponding to the base of the skull.

Q. What becomes of this primitive cartilage?

A. A portion atrophies and disappears, while another portion remains and forms the cartilage of nose, the articulations, part of occipital bone, greater part of sphenoid, the petrous and mastoid parts of the temporal, and the ethmoid bones, and septum of nose.

Q. From what are the four *Pharyngeal Arches* developed?

A. From anterior end of the Chorda Dorsalis, and meet in the middle line.

Q. What are developed from these Arches?

A. All of the secondary bones, so called to distinguish them from those already referred to, and which are formed from the primitive cranium.

Q. Where is the *Buccal Depression* (afterwards the mouth) situated in the embryo?

A. Between the 1st Pharyngeal Arch and the Frontal Prominence.

Q. Into what does the first of the pharyngeal arches divide at its anterior extremity?

A. Into the two superior and the two inferior maxillary protuberances, the two inferior uniting very early to form the lower jaw.

Q. In what form is the Lower Jaw first developed?

A. As a cartilaginous band, known as "Meckel's Cartilage."

Q. At what embryonal period does it appear?

A. About the 25th day, some say 15th to 18th.

Q. What is the condition of the embryo when the cartilage appears?

A. Nothing but a gelatinous mass, ½ inch in length.

Q. In what form does it first appear?

A. In two faint processes, which approach each other in the form of a semicircle, and which unite on the medium line about the 28th day.

Q. What is the appearance of Meckel's Cartilage at the end of the 1st month of embryonal existence?

A. That of a symmetrical glistening cartilaginous band.

Q. What is its appearance at the end of the 2d month?

A. A hard cord of the size and appearance of a hog's bristle.

Q. What is the size of the Embryo and Meckel's Cartilage at the end of the 2d month?

A. The embryo is little more than one inch long, and the cartilage about ¼ of an inch across its circular extremities.

Q. What does this Cartilage rest in?

A. A bed of soft, transparent tissue.

Q. How long does Meckel's Cartilage last?

A. Until the 7th or 8th month, subject to constant changes.

Q. How far back does it extend?

A. From the medium line to Malleus of ear on either side.

Q. What bones of the ear does it form?

A. Malleus and Incas.

Q. What part does Meckel's Cartilage perform in the development of the Lower Jaw?

A. A transitory part only. It gives form and stability to the jaw, and is the first solid structure found in the maxillary arch.

Q. What is its condition when it begins to waste away?

A. It has attained its full development, a period which corresponds to the ossification of the malleus, and it finally wholly disappears.

Q. When is ossification first observed in the Lower Jaw?

A. Between the 35th and 40th days of embryonal life.

Q. Where are the first slight traces observed?

A. Midway between the Symphysis and angle, extending along outer face of Meckel's Cartilage.

Q. At what period is the rudimentary Lower Jaw formed but not completed?

A. About the 2d month of gestation.

Q. Of how many parts does the Superior Maxillary Bone consist in fœtal life?

A. Of 4—2 maxillary, and 2 intermaxillary.

Q. What teeth are developed in each?

A. In each of the intermaxillary—2 incisors, central and lateral; in each of the maxillary—1 canine and 2 molars.

Q. At what period do the intermaxillary and maxillary bones unite?

A. Before birth, at birth the intermaxillary suture is visible on the palatal surface but not on the labial surface.

Q. What does the Buccal Cavity at first comprise?

A. The mouth and nose.

Q. At what period is the Septum between the nose and the mouth completed?

A. About the 9th week of fœtal life.

Q. What is the first indication of the *Development of the Teeth?*

A. About the 6th or 7th week of fœtal life, a groove appears in the corium of the rounded portion of the two Maxillary arches called the *Dental Groove*. This groove is so completely filled with a bed of epithelial cells as to form a ridge on the surface of each maxillary arch.

Q. What occurs in the progress of the development at the beginning of the 2d month?

A. The living cells (*columnar*), which form the inner layer of the epithelium form a deflection downward into the corium at the bottom of the dental groove, carrying the basement membrane with it. This deflected portion of the epithelium with the ridge over it, or from which it comes, is generated by the rapid proliferation of the cells which compose the *Malpighian layer* of the epithelium, and the crowding out of the older and effete cells which form the Corneous or outer layer of the epithelium.

Q. What is the origin of the *Enamel Organ?*

A. The deflected or dependant portion of the epithelium into the corium is the *Enamel Organ*.

Q. What does the *Enamel Organ* consist of?

A. Of Prismatic or Columnar Cells common to the inner layer of the Epithelium, and which, in the enamel organ, become, towards its extremity, Stellate Cells, these again, at its extremity, changing into Hexagonal Cells, the latter being the true cells (ameloblasts) which deposit the enamel on the periphery of the dentinal papilla arising from the corium to meet the enamel organ.

Q. What occurs in regard to the formation of the *Dentine*, during the evolution of the enamel organ?

A. Simultaneously with the development of the enamel organ, a dentinal papilla or germ arises in the Corium at a point which eventually brings it into immediate contact with the most dependant portion of the enamel organ; the latter at the time when its cells are ready deposit lime salts, assuming a hood-shaped instead of the convex extremity it possessed up to this stage of its development. The *Dentinal Papilla*, which first arises from the corium in the shape of a "nipple," also undergoes a change of form becoming club-shaped by constriction at its base. At the base of the dentinal papilla, a process is developed, which is attached to the neck of the papilla like a cord, and which increases in growth until it proceeds so far over both the dentinal papilla and enamel organ, as to enclose them in a sac; this process is known as the *Follicular Wall*, and its formation is the completion of the Dental Follicle.

Q. What composes the *Dental Follicle?*

A. The *Enamel Organ*, *Dentinal Papilla*, and *Follicular Wall.*

Q. What is the relation at this stage of the Enamel Organ and Dentinal Papilla?

A. The hood-shaped extremity of the Enamel Organ envelops the hemispheric surface of the Dentinal Papilla like a cap.

Q. Describe the nature of this hemispheric surface of the Dentinal Papilla, which occupies the lower central portion of the sac?

A. It is composed of a layer of fully formed dentine cells (odontoblasts), which compose the surface of the papilla.

Q. Describe the evolution of the Follicular Wall?

A. It grows from the base of the papilla to such a degree as to close over the enamel organ and dentinal papilla, and at length isolates the dental follicle by compressing the epithelial cord which up to this time connects the enamel organ with the epithelium.

Q. What is the *Epithelial Cord?*

A. The upper portion of the deflection of the epithelium, which connects the enamel organ with the surface until this organ is isolated by the severance of the cord.

Q. What is the difference in the form of the epithelial cords of the deciduous and permanent teeth?

A. The cords of the permanent teeth are longer and spiral in form.

Q. Why are they spiral?

A. To enable the dental follicles of the permanent teeth to take a position under the deciduous teeth, without the undue stretching of their cords.

Q. What is the position of the Basement Membrane?

A. It separates the Enamel Organ and the Dentinal Papilla.

Q. What is the Membrana Eboris, or Ivory Membrane?

A. The peripheral layer of odontoblasts of the dentinal papilla.

Q. What is the direction of the Dentinal Papilla at the time it has assumed a hemispheric form by becoming constricted at its base?

A. As it increases in height, it assumes a slightly oblique direction in relation to the axis of the follicle, the neck of the papilla being at the line where the enamel organ is reflected back upon itself.

Q. What is the rupture or severance of the Epithelial cord directly due to?

A. To the growth of the follicular wall, which closes over the top of the enamel organ, the union of the edges of this wall (which union converts the follicle into a sac) causing compression and strangulation of the cord at that point.

Q. What is the *Membrana Præformativa?*

A. The transparent stratum which invests the dentinal papilla, and reflects itself back, thus lining the whole inner surface of the follicular sac.

Q. What is *Nasmyth's Membrane?*

A. The remains of the inner tunic of the enamel organ, the columnar cells of which become flattened and horny; it envelops the crown of the tooth on its eruption but is soon worn away.

Q. What is the *Stratum Intermedium?*

A. A portion of the enamel organ consisting of cells intermediate in character between those of the bordering epithelium and the stellate reticulum (layer of stellate cells), and is formed by the extremities of the prismatic cells directed towards the centre of the enamel organ, forming slender processes which either unite or become continuous with filaments from surrounding cells.

Q. What is the *Stellate Reticulum?*

A. A radiating network, due to the transformation of the central cells of enamel organ, which at first are polygonal cells.

Q. What is the *Narceous Layer of Sudduth?*

A. The granular layer which covers the outer ends of the enamel rods, giving the outer surface of crown of tooth its smooth polished exterior.

Q. How are the Enamel Prisms or Rods placed on the dentinal surface?

A. On end, minute depressions receiving the pointed ends of the prisms.

Q. What is the form of the Dental Follicle?

A. Ovoid, and varies in size according to the class of tooth.

Q. How is the osseous groove joined in which the dental follicles are accommodated?

A. By the ossification of the external and internal plates of the jaw, and the union at their base.

Q. What is the form of the *Odontoblasts?*

A. Large, elongated, multi-polar, nucleated cells.

Q. What is the arrangement and progress of the Odontoblasts?

A. The mature cells are arranged along the periphery of the papilla (the membrana eboris), and they form the dentine by throwing out processes from their external extremities. Around these processes the lime salts are deposited, each process becoming longer as the cap of dentine thickens.

Q. What are the contents of the dentine tubes called?

A. *Dentinal Fibrillæ.*

Q. As soon as a thin cap of dentine is formed, what occurs in the case of the Enamel Organ?

A. The cells on the periphery of this organ and in immediate contact with the newly formed dentine, become greatly elongated, and send out from their inner extremities long processes to unite with similar processes of the stellate cells in the centre of the enamel organ.

Q. When the Ameloblasts are compacted together, what form do they assume?

A. Hexagonal at the base of each, with pointed extremities towards the interior of the organ.

Q. How are the Enamel Prisms or Rods formed?

A. The lime salts are first deposited at the base in contact with the newly formed dentine, each enamel rod assuming the exact form of the cell, which becomes hexagonal, the lime salts from each cell being deposited in immediate contact with the lime salts deposited from each adjoining cell.

Q. What becomes of the severed portion of the epithelial cord?

A. It atrophies and disappears as a general rule.

Q. What peculiar formations may occur on the rupture of the Epithelial Cords?

A. The cells of the epithelial lamina increase in number, and irregular proliferations or "buddings," as they are termed, may occur, which wander by different courses into the deeper portions of the embryonal tissue. These buddings are of cylindrical or globular form, and frequently become absorbed before the tooth is fully developed. Or some of these "buddings" may in their wanderings, come in contact with the dentinal tissue and be instrumental in developing malformed teeth.

Q. Where do the Dental Follicles of those Permanent Teeth which have deciduous predecessors, originate?

A. From the Epithelial Cords of the Deciduous Teeth just above the point where these cords merge into the enamel organ.

Q. Where do the Dental Follicles of such Permanent Teeth as have no deciduous predecessors originate?

A. From the Epithelium direct; like those of the deciduous teeth.

Q. What is the direction of the Permanent Epithelial Cords?

A. Vertical, passing between alveolar wall and deciduous follicle, and then along inner face of follicle.

Q. What is the course of the Permanent Dental Follicle?

A. It sinks to the bottom of the dental osseous groove, where it soon loses connection with the primitive cord, but still retains it with the epithelial lamina until it becomes a fully matured follicle.

Q. What is the origin of the Epithelial Cords of the 1st, 2d and 3d Permanent Molars?

A. The cord of 1st Permanent Molar originates from the Epithelium, like those of the deciduous teeth; the cord of the 2d Permanent Molar is derived from the cord of the 1st Permanent Molar; and the cord of the 3d molar is derived from the cord of the 2d Permanent Molar.

Q. What is the Epithelial cord supposed to decide?

A. The place of development, and also the class of tooth, which may account for the transposition of teeth sometimes occurring.

Q. What is the nature of the Enamel Organ?

A. Non-vascular, but a network of vessels is furnished to the follicular wall and dentinal papilla.

Q. At what period are the follicles of the deciduous set of teeth completed?

A. About the end of the 12th week.

Q. How early do the follicles of the permanent teeth commence to be developed?

A. As early as the 15th or 16th week of fœtal life.

Q. The follicle of what permanent tooth is first developed?

A. That of the first molar; followed in about one week by the follicles of the anterior teeth.

Q. At what time does the follicle of the 2d Permanent Molar begin to form?

A. About the 4th month after birth.

Q. At what time does the follicle of the 3d molar begin to form?

A. About the 3d year after birth and its formation continues 3 years.

Q. At what time are the alveolar cavities formed?

A. About the fourth month of fœtal existence cartilaginous processes project from the sides of the osseous dental groove, which unite and ossify, forming transverse septa of bone, which separate the alveolar cavities from each other.

Q. What is the origin of the *Cementum?*

A. From a layer of Cementoblasts generated on the inner surface of the follicular wall of dental follicle as the root of tooth is developing.

Q. What is its structure similar to?

A. That of Bone.

Q. Describe the *Dental Pulp?*

A. It is composed of a mucous-like protoplasmic matrix of embryonal connective tissue, containing delicate fibres, numerous nucleated cells, blood vessels and nerves.

Q. What is a *Cell?*

A. The minutest part of matter capable of the manifestation of life. A structural element which under favorable conditions is able to nourish itself, develop, and reproduce other cells.

Q. Of what does a cell consist?

A. Of a semi-fluid, albuminous mass (protoplasm), and a more solid mass floating in the semi-fluid, which is called a *nucleus.*

Q. What is the *nucleus* of a cell?

A. A minute vesicular body generally located near the centre of the cell; round, oval, or irregular in shape; one or more in number.

Q. What is the function of the Nucleus?

A. The reproduction of the cell, and is essential to the growth and nutrition of the protoplasm.

Q. What is the *Nucleolus?*

A. A minute, highly refracting body within the nucleus; its function is not well determined; it is often absent.

Q. Do cells differ in size?

A. Yes, from 1.6000 in. in diameter to that of an egg.

Q. What is *Protoplasm?*

A. A soft, greatly distensible semi-fluid substance, which forms the larger portion of the cell.

Q. What are the essential parts of a cell?

A. The protoplasm and the nucleus.

Q. What is meant by *Proliferation* in connection with cells?

A. The continued formation and development of cells by multiplication.

Q. What was formerly called the *Cell Wall?*

A. The membrane surrounding the cell, not always present.

Q. What may the form of a cell depend on?

A. Any shape due to the absence or presence of pressure.

Q. Name the various forms?

A. Spherical, columnar, cylindrical, stellate, hexagonal, polyhedral, spindle-shaped, cubical, discoid.

Q. What is Metabolism?

A. The process by which the cell assimilates those substances necessary for its nutrition and function.

Q. How do cells grow?

A. By *metabolism.*

Q. How are cells reproduced?

A. By direct division and by indirect division.

Q. How do cells move?

A. By cilliary motion; amœboid activity.

Q. What is Differentiation of Cells?

A. The change in cells as they develop to accord with their future destiny.

Dentition.

Q. What does the term "*Dentition*" imply?

A. The emergence of the teeth from the alveoli and gums, teething.

Q. What is *First Dentition?*

A. The emergence of the Deciduous Teeth.

Q. What is *Second Dentition?*

A. The emergence of the Permanent Teeth.

Q. What is *Third Dentition?*

A. The emergence of teeth at an advanced age which do not belong to the 1st or 2d dentitions, and which cannot be classed as malformed teeth, although the teeth of 3d dentition are often imperfectly developed.

Q. Is Dentition naturally a pathological or a physiological process?

A. A physiological process.

Q. When may dentition be considered morbid or abnormal?

A. When it is performed with difficulty, and attended with serious and occasionally alarming effects.

Q. What are the symptoms of a morbid or difficult dentition?

A. Skin hot, gums red and swollen; considerable fever; frequent diarrhœa; eruptions on head and face; ulcerations on lips, inside of cheeks, gums, and tongue; itching of nose; twitching of muscles, disturbed sleep; general wakefulness; dilatation of pupils; loss of appetite; great thirst; irritability of temper; convulsions; and, at times, death.

Q. What are the average periods of *Eruption of the Deciduous Teeth?*

A. Central Incisors	5 to 8	months.
Lateral incisors	7 to 10	"
First molars	12 to 16	"
Canines	14 to 20	"
Second Molars	20 to 36	"

Q. What are the average periods of *Eruption of the Permanent Teeth?*

A.

First Molars	5 to 6	years.
Central Incisors	6 to 8	"
Lateral Incisors	7 to 9	"
1st Bicuspids	9 to 10	"
2d Bicuspids	10 to 11	"
Canines	11 to 13	"
2d Molars	12 to 14	"
3d Molars	17 to 21	"

Q. Why is the body predisposed to disease during the period of First Dentition?

A. On account of the increased susceptibility to nervous and digestive troubles, slight causes producing serious effects.

Q. In what organs are important changes occurring in the organization of the infant at such a period?

A. In the stomach and intestinal tract.

Q. What common causes may bring about an abnormal dentition?

A. Exposure to cold, indigestion, and any derangement of health.

Q. What does the degree of irritation depend upon in such cases?

A. Upon the number of teeth emerging simultaneously, although one tooth may, in some instances, cause more irritation than a number will in others.

Q. When the teeth are about to erupt, what benefit is derived from the increased flow of saliva?

A. It keeps the mouth moist and cool.

Q. What are the usual indications of the emergence of the teeth?

A. Increased heat, redness, swelling and hardness of gums, an increased flow of saliva, and later a peculiar whiteness caused by the pressure on the tissue by the advancing tooth.

Q. How may convulsions be brought on by the irritation of teething?

A. By the Superior and Inferior Maxillary Divisions of the 5th Pair of nerves conveying the painful impressions to the brain, and through it by the motor nerves acting on the voluntary muscles, causing muscular contractions.

Q. When the absorption of the tissues proceeds in proportion to the development of the teeth, what is the result?

A. Little or no irritation, as slight pressure only is exerted.

Q. What effect has health and strength upon dentition?

A. It may progress with less irritation; and in all such cases the irritation present is better borne.

Q. What effect have the Seasons on dentition?

A. Dentition progresses easier in winter than in summer, as the child during the winter is not so much predisposed to certain affections peculiar to the hot months.

Q. To what is the irritation of an erupting tooth due?

A. To the downward pressure of the developing root upon the nerves and vessels, owing to a difference in the growth of the tooth and the absorption of the tissues over it.

Q. How may the Respiratory System indicate its disturbance?

A. By cough, catarrh, bronchitis, pneumonia, or spasmodic croup.

Q. How may the Alimentary Canal?

A. By nausea, vomiting, loss of appetite, diarrhœa.

Q. How may the Skin?

A. By such symptoms as eczema, acne, etc.

Q. What should be the rule during the period of first dentition?

A. The mouth should be examined daily, and be washed out with pure cold water; pure air, cleanliness, proper food and clothing, are also indispensable.

Q. What is the treatment for tenderness and swelling of the Gums?

A. Demulcent and soothing lotions, such as mucilage of acacia, marshmallow, or flaxseed; mild astringent lotions, such as Mel-boracis —borax, one ounce, honey, one ounce; if much restlessness, a small quantity of paregoric may be added to the lotion, or may be administered separately. Ulceration may be treated by the light application of nitrate of silver, or hydrochloric acid in honey of roses; or hydrochlorate of cocaine (4 per ct. solution).

Q. Why is diarrhœa a common accompaniment of Dentition?

A. Because at this period the follicular apparatus of the intestines is developing, increased sensitiveness and proneness to indulgence in improper food, or over-feeding, etc., and reduced digestive power.

Q. What form of Diarrhœa may be regarded as an effort of nature to relieve irritation?

A. Watery, though frequent, stools, differing but little except in consistence and frequency from the natural evacuations.

Q. What form of Diarrhœa is regarded as most unfavorable?

A. Evacuations of greenish matter in a dirty-brown, offensive fluid mixed with purulent mucus and blood; the putridity due to the decomposition of the albumen in the serum.

Q. What is a favorable prognosis?

A. Thicker and more homogeneous stools, although very offensive.

Q. What is the treatment for Diarrhœa of Dentition?

A. Correct diet, if improper; prevent exposure to cold. For simple cases: a teaspoonful of equal parts of castor oil and gum syrup, several times a day. For severe: one to three drops of wine of opium added to the castor oil and gum syrup emulsion; or camphorated tincture of opium 10 to 30 drops, first giving 1 or 2 teaspoonfuls of aromatic syrup of rhubarb. When great emaciation, add 2 or 3 drops of brandy. If much vomiting, 2 or 3 drops of sal volatile; also diminish quantity of food, but let child have food more frequently, warm applications to abdomen, such as poultice of linseed meal, to which a little mustard may be added, until skin is reddened only.

Q. What is the treatment of Convulsions of Dentition?

A. Place child in warm bath; lance the gum; and such therapeutical treatment as chloroform or hydrate of chloral as abortives, carefully administered; an emetico-cathartic, such as syrup of ipecac, combined with ½ grain of calomel.

Q. Describe method of *Lancing Gums?*

A. Let the nurse be seated on a low chair holding child across her lap, so that its head may come between knees of operator who is seated a little higher, when the child may be held securely.

Q. What form of incisions with the lancet should be made?

A. A simple incision for the incisors; several simple incisions crossing at right angles for the canines; and either a crucial incision or cutting out a section of gum over grinding surfaces for the molars.

Q. What are the contra-indications against lancing the gums?

A. Hemorrhagic Diathesis; Mercurial Diathesis.

Q. How may the Hemorrhage be controlled?

A. By giving the breast or ring; the application of styptics; the internal administration of chenopodium or erigeron; placing infant in erect position; hot foot-bath.

Q. What is the treatment of *Cutaneous Eruptions?*

A. For erythematous eruptions, starch mixed with cold water to the consistence of cream will relieve the irritation and itching. When on the head, castor oil may be applied, and a wash of dilute solution of borax in water. When crust is large, a poultice of linseed meal followed by an astringent lotion. For acute eczema, oxide of zinc powder dusted over part; for a thick purulent discharge, a salve of equal parts of vaseline and lead plaster, or a salve of oxide of zinc gr. v. and simple salve one ounce.

Q. What is the process of Eruption of the Deciduous Teeth?

A. A double process, consisting of the elongation and advancement of the teeth to the surface, and coincident absorption of the overlying tissues. The alveolar borders dissolve away at their approximate edges, also the front wall of alveolus to about one-half its depth, and a wide opening is made; the roots lengthening, the crowns press upon the overlying gum, which becomes thinner until the cusp of the tooth can emerge.

Q. What occurs when the growth and absorption are not equal?

A. The tooth is mechanically held in place and irritation and inflammation are set up with induration of gums, and reflex nervous disorders and constitutional disturbances follow.

Q. Do the lower teeth precede the upper of the same class?

A. Yes, but sometimes this order may be reversed.

Q. Are the teeth erupted in pairs or groups?

A. Yes, with an interval between the different groups, but there is no absolute uniformity as to time or order of eruption.

Q. Are the roots of the teeth completed at their emergence?

A. No, instead of the finished conical termination, they present an unfinished large concave extremity, with sharp margins, occupied by the voluminous pulp.

Q. What symptoms may be present even in normal dentition?

A. Increase of restlessness, slight failure of appetite, slight elevation of temperature of mouth: shown by constantly putting fingers in mouth.

Q. What is the position of deciduous teeth at birth?

A. Situated in open cavities beneath membranous coverings, the crowns being on a level with margins of alveolar cavities.

Q. What is the condition of Roots of Deciduous Teeth when their crowns are fully erupted?

A. The roots of the incisors are completed; the roots of cuspids about two-thirds formed; the roots of first molars four-fifths formed; the roots of second molars one-half formed.

Q. What is the best food for infants?

A. Milk from the breast of a healthy mother.

Q. If child is weaned?

A. Milk, oatmeal, wheaten grits, barley flour, rice, farina, sago, bread-crumbs, yolk of egg and milk, chicken or mutton broths.

Q. After 1st year of age?

A. Bread and butter, baked potatoes; and ripe fruits may be gradually added.

Q. What is the effect of the premature extraction of Deciduous Teeth?

A. Imperfect mastication; imperfect development of jaws; irregular position of the permanent teeth.

Q. What effect has the premature extraction of the deciduous molars?

A. Injury to the bicuspids.

Q. How long is the preservation of the Deciduous Teeth especially necessary?

A. Up to the 9th or 10th years.

Q. What is the effect of the premature extraction of the Deciduous Canines?

A. Irregularity of the permanent canines.

Q. What is the effect of the premature extraction of a Deciduous Second Molar?

A. The permanent 1st or sixth year molar tips over forward, and there is not sufficient space for the anterior permanent teeth.

Q. What is the effect of the removal of a Sixth-year Molar before the 10th year?

A. Irregular arrangement of the teeth yet to be erupted.

Q. If the Sixth-year molar is removed after the 11th or 12th years what is the effect?

A. The space is never perfectly closed, and the adjoining teeth may lean towards the vacancy, and this tipping over is still further increased by the occlusion in mastication; the gum is liable to recede and the process to absorb, the teeth to become painful and loose, and eventually lost, and the adjoining tooth may be in like manner injured.

Q. When the loss of the Sixth-year molar is inevitable, at what time should it be removed?

A. Just before the eruption of the 12th year molar, when the latter may take its place and the antagonism be uninjured.

Q. Does much irritation attend the Eruption of the Permanent Teeth?

A. No, except in the case of the 3d molars, as the tissues offer but little resistance, and the child is stronger and less susceptible to irritation.

Q. Are newly erupted permanent teeth firm in their cavities?

A. No, and therefore easily turned from a proper position in the arch.

Q. What has much to do with irregular and unsightly permanent teeth?

A. The premature or tardy extraction of deciduous teeth.

Q. When does the replacement of the deciduous by the permanent teeth begin?

A. When the 1st permanent molar is fully in position.

Q. How do the permanent centrals and laterals find sufficient room as they are so much wider than their predecessors?

A. The difference is made up by the development of the maxillæ; some think that the space for the four larger incisors is gained by the bicuspids being smaller than the temporary molars.

Q. What evils may result from extraction of temporary laterals before the permanent centrals have attained their proper height in erupting?

A. The continued development of the maxillary will cause the permanent centrals to stand apart, as they have not the laterals to force them towards the median line: the permanent laterals when erupting have not the required space and they fail to push the centrals over to the median line, and turning on their axis, present their mesial and distal surfaces labio-lingually.

Q. When may the deciduous laterals be extracted without injury?

A. When the permanent centrals are fully erupted.

Q. What may result from the premature extraction of deciduous cuspids?

A. Although permanent laterals may be crowded, to extract such cuspids will destroy the space necessary for the permanent cuspids.

Q. Although there may not be room enough for the permanent lateral when it erupts, how is sufficient space gained for it, and in what length of time?

A. By development of maxilla within five years.

Q. How long should the deciduous cuspid be retained?

A. Until all the other deciduous teeth have been replaced, when the permanent cuspid, as the keystone of the arch, will come in and crowd all the teeth into position.

Q. What will follow the premature extraction of the second temporary molar?

A. The 1st permanent molar will tip forward and the permanent cuspid may feel the effects of the irregularity resulting.

Q. What may result from the extraction of the 6th year (1st permanent) molar before the temporary teeth have been replaced?

A. Arrest of development of maxillary, and the result will be a faulty occlusion and irregular alignment of the teeth.

Q. What causes the destruction of the roots of the Deciduous Teeth?

A. A process of absorption due to the action of a secretion from a fleshy mass or tubercle developed from the sack of the permanent tooth.

Q. What is the fleshy tubercle composed of?

A. Nucleated giant cells and free nuclei; it is very delicate, of slight thickness and very vascular.

Q. Describe the process of *Absorption of Roots of Deciduous Teeth?*

A. It is a physiological action (not a mechanical one through pressure) due to the presence of a vascular papilla in close proximity to the absorbing surface, the surface of the papilla being rich in giant cells termed *Osteoclasts* or *Odontoclasts.*

Q. Where does the absorptive process begin and terminate?

A. Usually begins at apex of root on side nearest to the succeeding tooth; but this is not invariably the case, as it may commence at several and distinct points, sometimes on the labial side, the most distant from succeeding tooth, and proceeds until the entire root is destroyed and a considerable portion of the coronal dentine, if the connection of the crown to gingival membrane is maintained.

Q. What is the order of Decalcification of Deciduous Teeth?

A. The order in which they are developed and erupted.

Q. What is meant by *Second Dentition?*

A. The eruption of the Permanent Set of Teeth.

Q. At childhood, which commences with the period of Second dentition, what changes occur in face and other parts?

A. Owing to enlarged size of Maxillary bones, the face assumes a greater breadth and depth, and the character of the countenance is materially changing; all parts of body are acquiring more perfect development; the bones are more completely ossified, and those portions which were united by cartilage, are, during this period, consolidated with the body of bone; the muscles are becoming stronger; digestion and nutrition are extremely active; respiration is fuller and deeper in consequence of greater expansion of chest; and articulation is becoming more perfect.

Q. What change in the food is necessary?

A. From soft substances easily masticated, to more strengthening food requiring a larger and stronger set of teeth for its mastication.

Q. Is the number of teeth in the jaws ever diminished before any of the deciduous are displaced?

A. No, for the four permanent first molars are then in position, the bones of the jaws elongating for their reception.

Q. Give number and classes of Permanent Teeth ?

A. Thirty-two, 16 in each jaw, namely 4 incisors, 2 cuspids, 4 bicuspids and 6 molars.

Q. Name the number of permanent teeth which are not represented in the deciduous set ?

A. Twelve, namely 8 bicuspids and 4 molars.

Q. What characterizes the cutting edges of the permanent incisor teeth when first erupted ?

A. Small points like teeth of a saw, which facilitate their passage through overlying tissues, and which are soon worn away and straight cutting edges follow.

Q. Are the corresponding teeth of both jaws singly opposed to each other ?

A. No, owing to position, shape and size of the permanent teeth, each tooth comes in contact with two in opposite jaw.

Q. What are the objects of such an arrangement ?

A. To afford mutual assistance in masticating and to prevent loss of antagonism on the removal of a single tooth.

Q. Is there any repair or renewal of structure after tooth-tissues are destroyed ?

A. No, except the formation of secondary dentine.

Q. How are the teeth placed in the jaws ?

A. In close contact to afford mutual support, forming arches, the superior arch being larger than inferior, and owing to this difference in size, and also owing to the teeth occupying a curved line with outer surfaces wider than the inner, the incisors and cuspids of upper jaw close in front of the corresponding teeth in lower jaw.

Q. Does much irritation attend the eruption of the permanent teeth ?

A. No, with the exception of 3d molars, for the dentition of the permanent teeth is more gradual than that of the deciduous, and the overlying tissues offer but little resistance, and a number of the permanent have deciduous predecessors ; the child is also much stronger, and less susceptible to effects of irritation than the infant.

Q. What may render the eruption of the inferior 3d molars difficult and painful ?

A. Obstruction to their eruption caused by want of space between 2d molar and ascending portion of jaw.

Q. What symptoms may attend the difficult eruption of a 3d molar?

A. Headache, earache, disordered vision, neuralgia, hysteria, chorea, epilepsy; and even death has been recorded as due to such a cause.

Q. What may be demanded in some of these cases?

A. The extraction of offending 3d molar; in some cases that of the 2d molar where the removal of the 3d is impossible.

Q. What may afford relief in some cases?

A. Lancing the gum over offending tooth, either by making a crucial incision, or by removing an oval piece of the gum.

Q. What is meant by *Third Dentition?*

A. The eruption of a third set of teeth after the loss of the permanent. A large number of cases of the eruption of such teeth have been recorded, and although there is good reason to believe that some of these reports are authentic, and a process which must be regarded as a freak of nature has really occurred, yet there is no doubt but that many of the cases ascribed to a third dentition occurring at an advanced age, were only the emergence of teeth which from some cause failed to appear at the normal periods. There is no doubt but that such a development is possible, as we sometimes see that of an extra thumb on the hand, or of supplemental, supernumerary, or other abnormally formed and misplaced teeth, and it may be ascribed, in the well authenticated cases, to an accidental misplacement of such organs as are instrumental in tooth-development, their activity occurring at a time when sufficient space was afforded by the loss of opposing teeth, or an atrophied maxilla for such an eruption; when it occurs at an early age the same causes may be advanced for it as for anomaly of an extra thumb or other organ.

Q. What effect has the loss of vitality of the deciduous tooth upon the absorbent action of the tubercle on their roots?

A. Its action ceases.

Q. How is destruction or removal of roots of deciduous teeth carried on after the action of vascular papilla ceases owing to loss of vitality of pulp?

A. By a purely physiological action such as affects other dead tissue.

Q. What may the difficult eruption of an inferior 3d molar be due to?

A. Want of space between the 2d molar and the ramus of jaw.

Q. In what respects are Teeth characteristically different from Bone?

A. Every tooth has the crown portion exposed, while bone is surrounded by periosteum and cartilage; the structure of the teeth is much harder than that of bone; the cavity of a tooth contains a pulp, while that of bone contains marrow; the development and growth differ; the duration of teeth is less than that of bone, and once during life they are renewed.

Q. What advantage is derived from the conical shape of the roots of the teeth?

A. It enables them the better to bear the shock of occlusion and mastication, gives more stability, and renders them easier of removal.

Q. To what is the strength of attachment of the teeth due?

A. To each having a separate alveolus; divergence or convergence of roots, and connection with peridental membrane and gum.

Q. Is an abnormal shape more common to the roots or to the crowns of the teeth?

A. To the roots.

Q. What teeth are more commonly irregular in position?

A. The Canines.

Q. What teeth are more commonly malformed?

A. The 3d Molars.

Q. What are *Odontomes?*

A. Masses of dental structure which result from a morbid condition of the formative pulp.

Q. What are *Supernumerary Teeth?*

A. Irregular teeth which exceed the normal number and do not belong to either dentition.

Q. What are *Supplemental Teeth?*

A. More than the normal number of regular teeth of each class, such as two sup. lateral incisors on one side of arch.

Q. What are *Geminous Teeth?*

A. Two teeth fused together with a common pulp.

Q. What is meant by an *Osseous Union of Teeth?*

A. Teeth joined together by a fusion of their cementum but with separate pulps.

Q. What are *Attached Teeth?*

A. Teeth joined together by a strong connection of their peridental membrane.

Q. What does *Microdont* signify?

A. Having small teeth.

Q. What are *Nodular Teeth?*

A. Teeth to the necks of which small nodules composed of enamel and dentine are attached.

Q. What are *Exostosed Teeth?*

A. Teeth with enlarged roots, due to hypertrophy of the cementum.

Q. What are *Dentine Excrescences?*

A. Small nodules of osteo-dentine connected with the pulp; called *Pulp Nodules.*

Q. What is the condition of Inferior Maxillary at Birth?

A. The two halves are united by cartilage which later ossifies.

Q. When does ossification begin in Inferior Maxillary?

A. About 6th week of intra uterine life.

Q. What part develops earliest?

A. The alveolar portion to afford protection to advancing teeth.

Q. How is the backward growth of Inferior Maxillary accomplished?

A. By a process of addition and also one of absorption, the external oblique line indicating the backward movement of coronoid process, and the mylo-hyoid ridge that of the condyloid process.

Q. How is the elongation of the articular processes accomplished?

A. By the development of cartilage beneath the articular cartilage.

Q. How is the external arc of the jaw increased?

A. By the prolongation of the horizontal portion in a semi-elliptical direction, owing to a deposition of bone on the external surface.

Q. How does the Inferior Maxillary widen?

A. In accordance with the increasing width of the base of skull.

Q. How is lengthening of Superior Maxillary accomplished?

A. By deposition of bone at tuberosities.

Q. Describe a *Superior Central Incisor?*

A. Four surfaces—labial, palatal, mesial, distal; 2 angles—mesial and distal; a cutting edge; form of crown—wedge shape; labial surface—convex; palatal surface—concave; labial surface presents a cervical line, cervical ridge, mesial and distal angles, and 2 labial grooves; palatal surface presents a cervical line, cervical ridge, distal and mesial marginal ridges, mesial and distal angles, and a palatal fossa; neck between crown and root; root conical in form.

Q. Describe a *Superior Lateral Incisor?*

A. The same 4 surfaces as the superior central; crown is also similar in form but smaller; labial surface presents a cervico labial ridge, mesial and distal angles, and two labial grooves; palatal surface presents palatal and cervical ridges, mesial and distal marginal ridges, and 2 palatal grooves; neck marked by a constriction greater than that of central; root conical in form, and more flattened laterally than that of central.

Q. Describe a *Superior Cuspid?*

A. Crown cone-shaped, 4 surfaces same as incisors; 2 margins—cervical and cutting-edge; mesial and distal angles; labial surface presents cervical line, cervical ridge, mesial and distal angles, mesial and distal cutting edges, and a labial ridge; palatal surface presents a cervical ridge, mesial and distal marginal ridges, 2 palatal grooves, and one palatal ridge; a single cusp; neck decidedly constricted; root—larger and longer than that of any other tooth, one-third longer than the central incisor, and one-fourth longer than that of the lateral incisor.

Q. Describe a *Superior First Bicuspid?*

A. Crown—irregularly quadrilateral; 4 surfaces—buccal, palatal, mesial, distal; 2 cusps—buccal and palatine, the buccal largest and longest; 4 ridges, 2 buccal grooves; buccal surface presents a buccal ridge, mesial and distal angles, distal cutting-edge, and 2 buccal grooves; palatal surface presents a cervical line, 2 palatal grooves, one palatal cusp; neck is convex on buccal and palatal surfaces, and flattened and slightly concave on mesial and distal; roots—usually with 2, sometimes with one only, the buccal slightly longer than palatal, with point of bifurcation some distance above the neck; a single root is usually flattened laterally.

Q. Describe a *Superior Second Bicuspid?*

A. This tooth is similar to first bicuspid, with but few points of difference, generally on occlusal surface, which presents a central groove, mesial marginal ridge, 2 triangular grooves; a greater convexity on buccal surface than that of a first bicuspid; neck is not as constricted as that of the first bicuspid; buccal grooves shallow; greatest difference between the two bicuspids is in the root-formation, as the first has two roots generally while the second has usually but one, rounded on buccal and palatal surfaces and flattened on distal and mesial surfaces.

Q. Describe a *Superior First Molar?*

A. Crown is irregularly quadrilateral and has five surfaces—occlusal, buccal, palatal, mesial and distal; angles of crown more or less rounded, and two sides convex and two flattened or slightly concave; occlusal surface presents a mesio-buccal cusp, a disto-buccal cusp, a buccal groove, oblique ridge, distal fossa, mesio-palatal cusp, a fifth cusp at times, distal marginal ridge, disto-palatal cusp, and disto-palatal groove, 3 roots—two buccal and one palatal, buccal surface of crown presents two longitudinal ridges; palatal surface presents 2 lobes with a longitudinal groove between them, the mesial surface of crown is smooth and flat; the distal surface of crown is convex; neck constricted; the palatal root is the largest of the three, with a sharp-pointed apex.

Q. Describe *Superior Second Molar?*

A. Resembles 1st Superior Molar, with same number of surfaces and roots. Crown, however, is smaller, but has same outline except it is compressed; occlusal surface presents a central fossa, buccal groove, disto-buccal and mesio-palatal cusps, triangular ridge, mesial and disto-palatal grooves, and mesial marginal ridge, 4 lobes or cusps two on buccal and two on palatal side; the buccal groove is irregular and not constant in position; the palatal surface is more convex than that of the 1st molar, and the palatal groove is less straight, the mesial surface is smaller than that of 1st molar, and the distal is more convex, and the neck is more constricted; same number of roots as a 1st molar—two buccal and one palatal, but smaller and converge more.

Q. Describe *Superior Third Molar?*

A. Presents more variety of form than any other tooth; general outline of crown is not similar to those of either 1st or 2d molars, but generally more rounded; occlusal surface presents a buccal groove, buccal marginal ridge, mesio-buccal cusp, distal marginal ridge, central fossa, distal fossa, mesial marginal ridge, disto-palatal cusp, two of the cusps are upon buccal and one upon palatal half of surface, great variety of fossæ and grooves on occlusal surface; the three roots are at times distinct, at others joined together, presenting an irregular conical form.

Q. Give the *Periods of Complete Calcification of Superior Permanent Teeth?*

A. Central Incisors—10th to 11th year; Lateral Incisors—10th to 11th year; Cuspids—12th to 13th year; 1st Bicuspids—11th to 12th year; 2d Bicuspids—11th to 12th year; 1st Molars—9th to 10th year; 2d Molars—16th to 18th year; 3d Molars—18th to 20th year.

Q. Describe *Inferior Teeth* generally?

A. As a rule the Inferior teeth correspond in outline of crowns to Superior; the crown of an inferior incisor is more slender and angular, roots more slender, more flattened laterally and generally straight, and crowns vary little except in size; the outline of cuspids same as that of superior cuspids except that they are more slender; bicuspids are smaller with their cusps less developed, and seldom have more than one root; crowns of inferior molars larger than those of the superior, and have 5 cusps instead of 4, and they have 2 instead of the 3 roots of superior molars.

Q. Describe *Inferior Central Incisor?*

A. Like superior central, the inferior lateral incisor presents 4 surfaces, a cutting-edge, and 2 angles—mesial and distal; on labial surface a cervical line, cervical ridge and two labial grooves; the lingual surface presents 2 lingual grooves, mesial and distal marginal ridges, a prominent cervical ridge, and a lingual fossa; cutting edge in young tooth has 3 primitive cusps which are soon worn away to a straight line, labial margin of edge is slightly convex while lingual is concave; neck much constricted laterally; labial and lingual surfaces of neck are round and narrow; root smaller than that of any other tooth, and single; labial surface of crown convex—lingual surface concave.

Q. Describe *Inferior Lateral Incisor?*

A. The crown larger than that of central incisor—broader from mesial to distal surfaces; the labial and mesial surfaces like those of central incisor,—same number of angles, grooves, and line, and ridge, as central; cervical margin is concave towards root; lingual surface is concave from cutting edge to cervical ridge; cervical of mesial surface is concave; the distal surface is like the mesial; margin of cutting edge is slightly convex, but the lingual is concave; neck greatly constricted laterally; a single root which is smaller than that of any other tooth except the inferior central.

Q. Describe *Inferior Cuspid?*

A. Very much like superior; a single cusp, from which descends mesial and distal cutting edges; presents a labial, lingual, mesial and distal surface; labial surface presents 2 labial grooves, mesial and distal cutting edges, mesial angle, labial ridge, and cervical ridge; lingual surface presents 2 lingual grooves, lingual ridge, distal angle, distal marginal ridge, mesial marginal ridge and cervical ridge; distal surface of crown near angle is convex, but near cervical line is often slightly concave; cusp and cutting edges resemble those of superior cuspid; neck constricted; root is single, but is shorter and more flattened on mesial and distal surfaces than the root of superior cuspid, while the labial and lingual surfaces are convex.

Q. Describe *Inferior First Bicuspid?*

A. Inferior bicuspids are generally similar to superior bicuspids, but shorter and smaller, crowns more rounded, and with less pronounced cusps; also, unlike the superior, the buccal and lingual cusps are connected by a transverse ridge; roots are less flattened laterally, and seldom bifurcated. The crown of inferior bicuspid is more rounded and smaller than that of a superior bicuspid; buccal surface is more convex; the occlusal surface presents a buccal cusp, buccal ridge, buccal groove, mesial pit, distal pit, triangular ridge and lingual ridge; lingual cusp is smaller than buccal—more or less flat; buccal surface of crown presents a buccal ridge, buccal groove, distal-buccal angle, cervical ridge, and cervical line; lingual surface of crown presents a buccal cusp, triangular ridge, distal pit, mesial pit, lingual ridge and cervical line; mesial surface is convex, but flattened as the surface recedes to cervical margin; distal surface of crown is like the mesial; neck is constricted; root is single and usually straight, tapering gradually to apex.

Q. Describe *Inferior Second Bicuspid?*

A. Contour like that of first inferior bicuspid; occlusal surface presents a buccal cusp, buccal groove, triangular ridge, mesial and distal pits, and a lingual cusp; buccal surface presents a buccal ridge, buccal groove, distal buccal angle, cervical ridge, and cervical line; the lingual surface presents two buccal grooves, distal marginal ridge, and summit of lingual cusp, and is larger than same surface of first bicuspid; mesial surface is convex, but towards cervical line is somewhat flat; distal surface resembles the mesial; neck is smaller and root is larger and longer than root of 1st bicuspid; single root; mesial and distal sides of root flattened.

Q. Describe *Inferior First Molar?*

A. Occlusal surface has 5 cusps separated by 5 grooves; the crown is somewhat larger, and the outline more angular than that of the superior first molar; it is wider mesio-distally than bucco-lingually. Occlusal surface presents a buccal cusp, buccal groove, distal-buccal cusp, mesial-buccal cusp, distal groove, central fossa, distal pit, mesial groove, distal-lingual cusp, lingual groove, and mesial-lingual cusp; buccal surface is convex from mesial to distal, and also from occlusal surface to cervical line; buccal surface of crown presents a buccal groove, distal-buccal cusp, mesial-lingual cusp, mesial-buccal cusp, and buccal pit; lingual surface of crown presents a smooth and convex surface, divided into mesial and distal portions and separated by lingual groove either deep or shallow, and lingual surface of crown presents a distal-lingual cusp, mesial-lingual cusp, and lingual groove; mesial surface of crown is flat with a convexity near centre, also smooth and unbroken; distal surface of crown is very convex, and is often broken by the distal groove; neck is larger in circumference than crown at occlusal margin; roots two in number, one beneath the mesial and the other beneath distal half of crown, called mesial and distal roots, mesial root is larger and longer than distal root, the mesial usually slightly crooked, the distal straight.

Q. Describe *Inferior Second Molar?*

A. No fifth cusp; occlusal surface presents a central fossa, distal-lingual cusp, distal groove, distal-buccal cusp, lingual marginal ridge; buccal-marginal ridge, mesial-lingual cusp, mesial-buccal cusp, mesial groove, and mesial-buccal angle; buccal surface of crown presents a buccal groove, distal-buccal cusp, mesial-buccal cusp, mesial margin, distal margin; lingual surface of crown presents a lingual groove, distal-lingual cusp, central fossa, mesial-lingual cusp; 2 roots—mesial and distal; mesial surface of crown like that of 1st molar; also the lingual surface of crown resembles that of the same tooth.

Q. Describe *Inferior Third Molar?*

A. Of greater variety of form than any other tooth except superior 3d molar; two common varieties, in one variety crown is like that of inferior second molar with 4 cusps separated by 4 grooves; in the other variety crown like that of inferior first molar, with 5 cusps and 5 grooves; in other varieties six or eight cusps are seen, but a central fossa is common to all; the occlusal surface presents a central fossa, lingual groove, lingual marginal-ridge, distal marginal ridge, distal-lingual groove, buccal marginal ridge, mesial groove, mesial marginal ridge, and buccal groove; the crown is often circular; an inclination to two roots, but roots variable—a single conical root, or a mesial and distal root, or again 3 roots, or 4 or 5 roots; when more than two roots, they are usually crooked.

Q. Give the *Periods of Complete Calcification of the Inferior Permanent Teeth?*

A. Inferior Central Incisors—10th year; Inferior Lateral Incisors—10th to 11th year; Inferior Cuspids—12th to 13th year; Inferior 1st Bicuspids—11th to 12th year; Inferior 2d Bicuspids—11th to 12th year; Inferior 1st Molars—9th to 10th year; Inferior 2d Molars—16th to 17th year; Inferior 3d Molars—16th to 20th year.

Dental Pathology.

Q. What is Pathology?

A. The Science of disease.

Q. What is Dental Pathology?

A. The study of the origin and progress of the various diseases which affect the teeth and oral tissues.

Q. What does the term *Symptom* imply?

A. The phenomenon or sign of disease.

Q. What is meant by *Diagnosis?*

A. Recognition of disease from its symptoms.

Q. What is meant by *Prognosis?*

A. Prediction of course and result of disease.

Q. What is meant by *Diathesis?*

A. Constitutional predisposition to disease.

Q. What is meant by *Etiology?*

A. The science which teaches the causes of disease.

Q. What is meant by *Semeiology* or *Symptomatology?*

A. The Science of the symptoms of disease.

Q. What is *Morbid Anatomy?*

A. The science which describes the changes which have occurred in tissues as the result of disease.

Q. What is meant by *Clinical History* of disease?

A. The history of the first symptoms of disease, and its natural progress to the termination.

Q. How are the causes of disease divided?

A. Into predisposing and exciting.

Q. What are *Predisposing Causes?*

A. Influences which lessen the resistence of a part or organ, to attacks of disease.

Q. What are *Exciting Causes?*

A. Those which give direct origin to a disease.

Q. What is the clinical division of diseases?

A. General—those which exhibit widespread symptoms. Local—those which affect a limited area of tissue.

Q. Define Inflammation?

A. A condition of nutritive disturbance characterized by hyperemia, with proliferation of the cells of a tissue or organ, and attended with one or more of the symptoms peculiar to the condition (which see).

Q. What are the common symptoms of Inflammation?

A. Heat, Redness, Swelling and Pain, with disordered function.

Q. What is the first cause?

A. Irritation which is usually first manifested in the vascular system, the capillary vessels being stimulated into active contraction and relaxation, causing a more rapid circulation of the blood inducing warmth with some uneasiness and discomfort.

Q. What characterizes *Acute Inflammation?*

A. Warmth, sense of fulness, some swelling and increasing pain, the undue volume of blood in the parts pressing upon the nerve filaments of the inflamed tissue, causing pain in proportion to the expansion of the vessels.

Q. What characterizes *Chronic Inflammation?*

A. The symptoms are not so active but more prolonged, the affected tissues becoming less susceptible to the influence of an irritant; and much less pain than in the acute form.

Q. What does the Treatment of Inflammation consist of?

A. In bringing about *Resolution*, or hastening *Suppuration.*

Q. What is Resolution?

A. The subsidence of inflammation, and the return of the tissues to a normal condition.

Q. Describe Pus?

A. A thick cream-like liquid of specific gravity 1030, the product of suppuration, without odor, and consisting of degenerated leucocytes—white blood corpuscles, living and dead, liquor sanguinis, granular detrius from broken-down cellular structures, fat globules, and, at times, coagulated fibrin, with many micro-organisms.

Q. What micro-organisms produce suppuration?

A. Staphylococcus pyogenes aureus, Staphylococcus pyogenes albus, Streptococcus pyogenes, and Micrococcus pyogenes tenuis.

Q. Describe Sanious Pus?

A. Thin, reddish and mixed with blood.

Q. What is Muco-pus?

A. Mucus mixed with pus—thin, watery.

Q. What is Sero-pus?

A. Thin, watery, containing much fibrin.

Q. What is Gummy pus?

A. The thick, ropy pus of syphilitic abscesses.

Q. What is the most common termination of acute inflammation?

A. Suppuration.

Q. How does suppuration take place in the tissues?

A. By virtue of the peculiar peptonizing or digestive action which the micro-organisms exert upon them.

Q. What is Suppuration?

A. The formation of Pus; the tissues breaking down, and the products with white blood corpuscles generating pus.

Q. What is the direct cause of *Suppuration?*

A. The action of certain specific micro-organisms—the pus microbes (pyogenic), upon the tissues, the leucocytes, and the embryonal cells; but pus may also be generated by the action of chemical irritants, without the presence of micro-organisms.

Q. How does suppuration spread?

A. By the dissolving action of the pus breaking down the tissues, the débris of which, with white blood corpuscles, forms pus.

Q. What is the Prophylactic treatment of Inflammation?

A. So protecting any locality susceptible to inflammation through loss of its natural covering or exposed to its attacks, that pathogenic micro-organisms cannot enter, by securing an aseptic condition and maintaining it by sterilization, or antiseptic methods. To prevent infection is to prevent inflammation.

Q. What is Sterilization?

A. The destruction of germs.

Q. What is the Curative treatment of Inflammation?

A. Consists in destroying, eliminating, or rendering inert the exciting cause; in the case of diseased teeth, extraction if it is impossible to restore such to a healthy condition; in other cases, evacuation of confined secretions, removal of foreign and deleterious substances, relieving strangulated tissues, rendering non-irritant any infective or acrid discharges, destroying pathogenic micro-organisms, with antiseptic and germicidal solutions—such agents as carbolic acid, corrosive sublimate, permanganate of potash, nitrate of silver, iodine, iodol, aristol, etc., etc. Adjuncts—Rest, Elevation of inflamed part, Cold, Heat. The constitutional treatment consists in the administration of cathartics to remove unwholesome injesta and acrid fecal accumulations, and stimulate the secretions, and eliminate toxic elements from the blood. Diuretics and diaphoretics to eliminate toxic substances through kidneys. Diffusible stimulants, on development of sepsis, to prevent heart failure. To sustain the strength, a nutritious diet; after acute symptoms have subsided, tincture of chloride of iron.

Q. What is Chronic Inflammation generally preceded by?

A. The acute form which has not passed beyond partial stasis, suppuration or ulceration.

Q. What is the treatment of Chronic Inflammation?

A. Removal of cause, stimulating applications, such as tincture of iodine, ammonia liniment, counter-irritants, massage, hot and cold douches, rest, etc. The constitutional treatment: Compounds of mercury and iodine, if from blood-poisoning, tonics, stimulants in some cases, nutritious food, cod-liver oil and iodine, salicylic compounds for gouty and rheumatic conditions.

Q. What may the Chronic Stage of Inflammation, if not checked, result in?

A. In Hypertrophy, Induration, Swelling, or Congestion of the affected tissue.

Q. What is Hypertrophy?

A. Excessive growth of tissue by great increase of cell elements.

Q. What is *Induration?*

A. A circumscribed, hard swelling, due to an enlargement of individual cells as a result of chronic inflammation.

Q. What is *Tumefaction?*

A. A condition of chronic inflammation due to an abnormal quantity of tissue of a different character from that of the surrounding tissue, especially in color and texture.

Q. What is *Congestion?*

A. A condition of blood stasis causing severe pain with each pulsation of the heart. The capillary vessels of the affected part are engorged, and the pain resulting may be either throbbing owing to the blood rebounding at each pulsation of the heart, or intermittent by the bursting of the capillaries temporarily relieving the pressure.

Q. What is *Ulceration?*

A. An open surface or sore in a condition of suppuration, with no inclination to heal.

Q. What is an *Abscess?*

A. A collection of pus in a sac formed by soft membrane which restrains the secretion from escaping into the adjacent tissues, causing it to escape at the surface or point of least resistance.

Q. What is an *Alveolar Abscess?*

A. A collection of pus located within an alveolar cavity, generally at the apex of the root of a tooth, and owing to the devitalized condition of the pulp.

Q. Treatment of *Alveolar Abscess?*

A. To gain free access to the sac by opening the root canals, or by drilling through gum and alveolus, and remove all dead tissue and break up the secreting sac; followed by the application of antiseptics, such as peroxide of hydrogen, and bichloride of mercury, and escharotics, such as creosote or carbolic acid, or iodide of zinc, oil of eucalyptus, eugenol, oil of cassia, iodoform paste, peroxide of souium, etc., etc.

Q. What is a *Fistulous Opening?*

A. The tube made by the escape of pus of an abscess through an opening formed by its separating the tissue, and which gives vent to pus.

Q. What is *Pulpitis?*

A. Inflammation of the dental pulp.

Q. What is it generally due to?

A. The encroachment of dental caries permitting thermal, chemical and mechanical irritation to affect the pulp. If the irritation is slight, filling the cavity may give relief; if pain is somewhat severe, the application of a stimulating antiseptic and the insertion of a non-conducting filling; if the irritation has been of long continuance and the pulp seriously involved, it is better to devitalize and remove it, and fill both crown and pulp cavity.

Q. What is the *Treatment of Putrescent Pulps?*

A. Thoroughly open root canals, and remove all remains of pulp; cleanse and disinfect such canals with peroxide of hydrogen, pyrozone, peroxide sodium; antiseptics such as iodoform, aristol, eugenol and the essential oils.

Q. What is *Dental Caries?*

A. A gradual softening and disintegration of the tooth-structures, caused generally by the action of lactic acid generated by micro-organisms.

Q. What is the first appearance of caries?

A. A chalky, opaque spot in the enamel which gradually breaks down, involving the dentine in which the carious action is more rapid.

Q. What is the *Treatment of Dental Caries?*

A. Preventive; proper care of the teeth from the time of their eruption by the employment of a soft or medium brush on rising in the morning, after each meal, on retiring at night, and the use of a good dentifrice, with such adjuncts as floss silk or quill tooth-pick. An antiseptic, alkaline, or germicidal mouth-wash is also very serviceable.

The treatment of carious cavities consists in the removal of the carious matter when it is superficial, and properly preparing the surface by polishing, &c.; for deep cavities, the entire removal of the carious matter, and the insertion, after due form is given to the cavity, of a permanent filling material.

Q. What is *Hypersensitive Dentine* due to?

A. Irritation of the Fibrillæ of the Dentine by abrasion, the action of acids, and progress of dental caries.

Q. What is the *Treatment of Hypersensitive Dentine?*

A. Dryness of cavity, sharp cutting instruments when preparing a cavity; therapeutic agents which do not endanger the vitality of the pulp, such as prepared chalk, bicarbonate of soda, oil of cloves, eugenol, tannic acid, aconite, menthol, cocaine, vapocaine, chloretone; also electrical osmosis, chloral hydrate, etc.

Q. Before the application of obtunding agents, what may be used to neutralize the acidity of the carious cavity?

A. Solutions of ammonia, or carbonate of soda, or peroxide of sodium.

Q. What indications justify the *Extraction of Teeth?*

A. The presence of Deciduous Teeth obstructing the proper eruption of permanent teeth; the diseased condition of Deciduous Teeth; uncontrollable pain and incurable disease in Permanent Teeth; to prevent or correct Irregularity of other Permanent Teeth; and in preparing the mouth for an artificial denture, the loss of one or more remaining teeth may be beneficial. (See Oral Surgery.)

Q. What is the *Treatment of Hemorrhage* following extraction of teeth?

A. The application of a reliable styptic after properly cleansing the cavity of blood, such as tannic acid, gallic acid, solution of persulphate of iron, and powdered subsulphate of iron. (See Oral Surgery.)

Q. What two varieties of *Calculus* are found upon the teeth?

A. *Salivary* and *Sanguinary*.

Q. What is *Salivary Calculus* and its *Origin?*

A. It is composed of Phosphate and Carbonate of Lime, Magnesia, Fibrin or Cartilage, Mucus and fat,—75 per cent. of mineral, and 25 per cent. of animal matter, and the relative proportion of its constituents varies according to its density. It is deposited from the saliva upon all exposed surfaces of the teeth, and also upon artificial dentures, and is mixed with mucus.

Q. How is *Salivary Calculus* removed?

A. By instruments called Scalers passed well down beneath the edge of the deposit, and in such a manner that the tooth surface is not roughened by the instruments, and fine pumice or silex afterwards applied by small brushes and wood points, and the surface well polished.

Q. What are the effects of Salivary Calculus on the Teeth?

A. Irritation and inflammation of the gums and peridental membrane, thus destroying the connection of the teeth and rendering them loose.

Q. What is *Sanguinary or Serumal Calculus* and its *Origin?*

A. Composed principally of lime salts colored by hæmatin which accounts for its crystalline form. It is precipitated from the liquor sanguinis of the blood upon its disorganization, in the form of dark granules.

Q. What is its consistence?

A. It is much harder than salivary calculus, and adheres more firmly to the teeth, being a result of inflammatory action leading to suppuration.

Q. When is it most abundant?

A. When the Mucus is secreted in large quantities, and is in a very acid condition.

Q. What is its color?

A. It varies from a grayish-brown to a dark green.

Q. How is it best removed?

A. By what are known as Riggs' or other instruments of like character.

Q. What is the *Green Stain* common to the teeth of children?

A. A mucous deposit parasitic in character, which corrodes the enamel more or less rapidly, according to the time it remains and the quality of the teeth.

Q. How is it best removed?

A. By finely powdered pumice or silex and water, applied on wood points and small brushes rotated by the dental engine; when its effects are serious a corundum point is necessary, and the surface afterwards well polished.

Q. What is the Nature of *Saliva?*

A. A mixed fluid secreted by the different salivary glands and mucous follicles; in its normal state it is either neutral or alkaline; it may, however, become decidedly acid on account of decomposition occurring in the mouth.

Q. What are the different shades of color in dental caries indicative of?

A. The progress of the decay, and the nature of the structures of the affected tooth; the dark or black shade indicating slow progress in teeth of hard structures, the lighter shades indicating more rapid progress and weaker tooth structure.

Q. What causes *Discoloration of Teeth* containing a dead pulp?

A. The entrance into the tubuli of the coloring matter of the blood, and putrefactive matters from decomposed pulp.

Q. How may discoloration be avoided?

A. By removing the remains of a pulp immediately after its devitalization; or if this has not been done at such a time, the injection of peroxide of hydrogen, followed by pyrozone, or other bleaching agent.

Q. When a tooth filled with metal is particularly sensitive to heat, what does it indicate?

A. Thermal influences through the conducting property of the metal.

Q. How may such a condition be remedied?

A. By interposing between the metal and the sensitive area of the tooth-structure gutta percha or some other non-conducting substance; or the removal of the metal filling and the cavity refilled with a non-conducting substance, such as gutta percha, Hill's-stopping, etc., etc.

Chemistry.

Q. What is *Chemistry?*

A. The Science which investigates the composition of bodies and the changes which occur in them under various influences.

Q. How is the science of Chemistry divided?

A. Into *Inorganic*—non-metallic elements and metallic elements; and into *Organic*—compounds of carbon with hydrogen, oxygen, and nitrogen.

Q. What does *Inorganic Chemistry* include?

A. All the elements and their compounds, excepting certain compounds of carbon.

Q. What does the term *metallic* pertain to?

A. Those elements having the properties of a metal, viz., lustre, weight, good conductivity of heat and electricity, ductility, malleability, tenacity, opacity, and to such as are electro-positive.

Q. To what does the term *non-metallic* pertain?

A. It embraces the rest of the elements, viz., hydrogen, oxygen, nitrogen, chlorine, bromine, iodine, fluorine, sulphur, selenium, tellurium, carbon, phosphorus, arsenic, boron, and silicon.

Q. What does *Organic Chemistry* include?

A. The carbon compounds.

Q. What is *Matter?*

A. That which possesses weight or occupies space, or exists.

Q. How is matter divided?

A. Into *Mass*, *Molecule and Atom.*

Q. What is a *Mass?*

A. Any portion of matter which is perceived by the sense, or a quantity of matter composed of molecules.

Q. What is a *Molecule?*

A. The smallest quantity of matter which can exist by itself, or into which any substance can be divided without losing its identity of substance.

Q. What is an *Atom?*

A. An indivisible, indestructible portion of a chemical element. The smallest particle of matter entering into the composition of a molecule.

Q. Do Atoms exist alone?

A. No, but in groups called *molecules*.

Q. In an element what number atoms in the molecule?

A. Pairs of atoms of the same kind.

Q. Is the weight of an Atom known?

A. No; hence atomic weight is the weight of the atom as compared with the hydrogen atom.

Q. What is meant by the *Physical Properties of Matter?*

A. The various ways in which matter presents itself to the senses, and which may be shown without changing the identity of the molecule.

Q. What are *Chemical Properties?*

A. Such as result from the composition of the molecule with reference to its atoms, and apparent only when the molecule changes its identity.

Q. What are the forces which act upon matter?

A. Atomic attraction (chemism), which is the affinity of atoms for each other; and Molecular attraction, whose subdivisions are Cohesion, Adhesion, Polarity, Repulsion.

Q. What is *Cohesion?*

A. The force which unites or welds together adjacent molecules of the same nature.

Q. What is *Adhesion?*

A. The force by which different bodies stick together.

Q. What is *Polarity?*

A. The property in certain bodies by which they arrange themselves in certain directions, or point to given poles.

Q. What is *Repulsion?*

A. The act of driving back-repelling.

Q. What are the forces which act on matter?

A. Atomic attraction (chemism) which is the affinity of the atoms for each other; molecular attraction, subdivided into cohesion, adhesion, polarity, repulsion; and also into mass attraction; mass is an aggregate of two or more molecules, the forces of cohesion and adhesion and gravitation being applicable to the mass.

Q. What is *Gravitation?*

A. The force by which every particle of matter in the universe is attracted by every other particle.

Q. What are the general properties of matter?

A. Impenetrability; extension or magnitude; form or figure; indestructibility, and divisibility.

Q. What is *Porosity?*

A. The quality by virtue of which interstices or pores exist between the molecules of a body.

Q. What is *Elasticity?*

A. The property by virtue of which bodies resume their original form or volume when the force which altered ceases to act.

Q. What is *Inertia?*

A. The property that matter cannot of itself change its own state of motion or rest.

Q. What is a *Solid?*

A. A body whose molecules cannot be changed so far as their relative positions are concerned, without difficulty.

Q. What is a *Liquid?*

A. A body whose molecules readily glide past each other, but have a tendency to adhere together.

Q. What is a *Gas?*

A. An aeriform substance whose molecules are active, and constantly strive to occupy a greater volume.

Q. What is *Displacement?*

A. A body which sinks in water, and displaces exactly its own bulk of water, and loses a weight exactly equal to the weight of water displaced.

Q. What is *Specific Gravity?*

A. The relative weight of equal bulks of bodies according to an assumed standard. The standard for liquids and solids is distilled water at a temperature of 39.2° F.; for gases the standard is air or hydrogen. Example: If a body weighs 5 times as much as the same bulk of water, it is said to have a specific gravity of 5.

Q. What is *Density* in Chemical Phraseology?

A. The weight of a gas compared to hydrogen as a unit.

Q. What is the *Law of Fusion?*

A. Every solid begins to melt at a certain temperature governed by the fusing point of the given substance; when cooling the substance will solidify at the temperature of fusion. The temperature of the solid or liquid remains at the melting point from the moment that fusion or solidification begins until it is finished.

Q. What is meant by the *Boiling Point?*

A. The temperature at which a liquid gives off vapor rapidly.

Q. What is *Distillation?*

A. The conversion of a liquid into gas, and the recondensation of the gas into a liquid.

Q. What is *Sublimation?*

A. The conversion of such solids as do not melt when heated, directly into vapor.

Q. What is a *Solution?*

A. A soluble compound formed by chemical action between two substances, and which dissolves in the water present; also the adhesion of a liquid to a solid resulting in the destruction of the cohesion of the solid.

Q. What are *Solvents?*

A. All liquids are solvents, as water for metallic salts, alcohol for resins and mercury for metals.

Q. What is a *Saturated Solution?*

A. A solution formed when a liquid has dissolved all of a solid possible at a given temperature.

Q. What is *Deliquescence?*

A. The action by which bodies absorb water from the air and become liquid.

Q. What is *Efflorescence?*

A. The action by which substances on exposure to air lose water from their crystals.

Q. What is *Crystallization?*

A. The change of substances from a melted state or solution to the solid state, with the disposition towards geometrical form.

Q. What is *Electrolysis?*

A. The process of decomposing by electricity chemical compounds in solution.

Q. What is *Chemical Nomenclature?*

A. The naming of elementary bodies from some chemical or physical property they possess, and of compound bodies from their composition.

Q. What is a *Liquor?*

A. The watery solution of a fixed substance.

Q. What is an *Aqua?*

A. The watery solution of a volatile substance.

Q. When is one body said to dissolve in another?

A. When they coalesce and their particles intimately mingle; this is possible only in the liquid and gaseous states.

Q. What is *Water of Crystallization?*

A. A certain definite amount of water which most solid substances when separating from a solution take with them as a necessary part of the crystal.

Q. What is *Efflorescing?*

A. When a crystal loses its water of crystallization by heat or exposure and becomes an amorphous powder.

Q. How may Natural Waters be purified?

A. By boiling to kill living organisms, and filtered to remove suspended matters; but for chemical purposes, where great purity is desired they are distilled (*aqua destillata*).

Q. What is the process of *Distillation?*

A. A liquid rapidly vaporized, and the vapor, passing through a colder vessel, is recondensed.

Q. What is *Sublimation?*

A. When a solid is similarly treated.

Q. What is *Fractional Distillation?*

A. When a mixture of two or more liquids is heated, the one having the lowest boiling point distills first, leaving the others behind.

Q. How is *Hydrogen Dioxide*—Oxygenated Water (H_2O_2) prepared?

A. Prepared most easily diluted by passing CO_2 through water holding barium dioxide in suspension. $BaO_2+CO_2+H_2O=BaCO_2+H_2O_2$; the $BaCO_2$ may be allowed to subside and the clear solution poured off.

Q. What are its properties?

A. When concentrated it is a colorless, syrupy liquid, with a pungent odor and taste, prone to decompose into H_2O+O. Used to bleach hair and skin; as a disinfectant to ulcers, etc.

Q. What is *Fusion?*

A. The transition of a body from a solid to a liquid condition; substances that do not fuse (like carbon) are called *refractory*.

Q. What is *Solidification?*

A. When a liquid is cooled it contracts and finally assumes the solid state, under the law that a liquid begins to solidify at the same degree at which the solid begins to melt.

Q. What is the difference between a Mixture and a Chemical Compound?

A. Mixtures are joined together by adhesion and cohesion, and can be separated by such mechanical means as heat and filtration, and may be mixed in any proportion, as sugar and water. A Chemical Compound is one joined by chemical affinity or chemism.

Q. What is a *Chemical Symbol?*

A. The first letter of the name of an element; or when there are several elements whose names begin with the same letter, a distinguishing letter is added, and these represent elements.

Q. What are *Combining Weights?*

A. Quantities by weight in which one body combines with another.

Q. How are all substances chemically divided?

A. Into *Compound* and *Simple.*

Q. What is the difference between Compound and Simple Bodies?

A. Compound bodies are composed of a number of constituents and can be separated and their constituents shown; a Simple body cannot be thus separated.

Q. What are *Elements?*

A. Substances which have never been decomposed.

Q. How many elements are at present known?

A. Seventy; about one-half of these enter into the Materia Medica.

Q. What are *Binary Compounds?*

A. Chemical compounds which contain two elements.

Q. How are they usually named?

A. By joining the names of the elements present and attaching to one of them the termination *ide.* Example: Potassium iod*ide* can contain nothing but potassium and iodine.

Q. As elements may combine in several proportions forming several different compounds, what prefixes are used?

A. Those formed mostly from Greek or Latin numerals. Example: The bodies Cu_2O and CuO are called Copper oxides because they contain only copper and oxygen, but they are altogether different substances. The distinction is as follows:

Cu_2O Copper *sub*oxide.

CuO Copper *Mon*oxide. (Also *pro*toxide.)

The term *sub* is especially applied to compounds in which a member of the oxygen or chlorine group is deficient in amount. Example: $PbCl_2$, ZnI_2, Cu_2O are sub-compounds.

Q. When is the prefix *mon* used?

A. When the normal proportion of combination with some of the elements is two of the first to one of the second. Example:

K_2O Potassium *mon*oxide.

Ag_2O Silver *mon*oxide.

Q. What are the elements which show this exception?

A. Chlorine, Hydrogen, Lithium, Silver.
Bromine, Potassium,
Iodine, Sodium.

Q. What are *Sesqui*-compounds?

A. Elements in which the proportion is as 1 to $\frac{1}{2}$, but as fractions are not allowed in formulæ, the whole expression is multiplied by 2, which gives the proportion 2 to 3. Example: Fe O, $\frac{1}{2}$ becomes, therefore, $Fe_2\ O_3$ iron sesqui-oxide, *sesqui* meaning one and a half. Such are called *sesqui*-compounds.

Q. What higher proportions also occur?

A. Example: $K\ Cl\ O_4$=Hyperchlorate of Potassium. $H\ Cl\ O_4$= Hyperchloric Acid.

Q. What is an *Acid?*

A. An electro-negative compound neutralizing alkalies.

Q. What are *Salts?*

A. Substances formed by the action of acids upon certain elements or their oxides; any union of a base with an acid.

Q. What is a *Neutral or Normal Salt?*

A. One formed by the replacement of all the hydrogen-atoms of an acid by a base or radical.

Q. What is a *Basic Salt?*

A. One containing an excess of the basic element, and formed by the union of a neutral (normal) salt with a basic oxide or hydroxide.

Q. What does the term *Basic* imply?

A. Having properties of a base; i. e. capable of neutralizing acids.

Q. What is the difference between Physical force (action) and Chemical force (action)?

A. Physical causes merely a change of the *state* of matter, and not a change of identity; Chemical causes a change of the *identity* of the matter itself.

Q. What do the terms *univalent*, *trivalent*, *quadrivalent*, and *quinquivalent* mean when applied to elements?

A. The valence of a radical is its combining value or its value in exchange for other radicals (valence has nothing to do with the combining weight or chemical activity of an element however); hydrogen is taken as the standard; hence a radical that combines with or takes the place of one atom of hydrogen is said to be *univalent* (one valued); of 2 atoms, *bivalent;* 3, *trivalent;* 4, *quadrivalent;* 5, *quinquivalent.*

Q. What are the differences between an element, a chemical compound, and a mixture?

A. Compounds are substances that can be decomposed into two or more substances, distinct in their properties from the substance from which they were derived and from each other—whose molecules are composed of different kinds of atoms; elements are substances which have never been decomposed; two or more substances form a mixture when the particles of one are scattered throughout those of the other or others, without any change occurring in the chemical or specific properties of one or the other.

Q. What is *Specific Heat?*

A. The amount of heat required to raise the temperature of a substance one degree compared with that required to raise the temperature of the same weight of water one degree.

Q. When are substances said to be *Isomeric?*

A. When they are of identical chemical composition, with difference of properties, physical or chemical.

Q. From what are the *Symbols* of Elements derived?

A. Directly from their names or Latin equivalents; as the name nitrogen—symbol N. and Gold—Latin equivalent Aurum—Symbol—Au.

Q. How may the number of atoms of an Element in a Molecule be designated?

A. By numeral prefixes: as FeO, MONOXIDE of iron or iron MON oxide; MnO_2, DI oxide of manganese, or manganese DI oxide; SO_3, TRI oxide of sulphur, or sulphur TRI oxide; $Fe_2 O_3$, SESQUI oxide of iron, or iron SESQUI oxide; PCl_5, PENTA chloride of phosphorus or phosphorous PENTA chloride, etc.

Q. Can absolute rules be given for naming chemical compounds?

A. No; termination of acid names as follows: *—ic* acids produce *—ate* salts the salts from which the acids are derived, example: Carbonic acid, $H_2 CO_3$ when combined with potassium K. produces potassium carbonATE $K_2 CO_3$: *—ous* acids produce *—ite* salts; example: Sulphurous acid H. SO_3, combines with sodium Na, producing sodium sulphITE; the terms HYPO—and PER—mean respectively "*less than*" and "*more than*" referring to the oxygen contents of the compound. Thus we have the salts:

Na ClO_3, sodium chlorATE; $NaClO_2$ sodium chlorITE (less O than —"ate"); NaClO, sodium HYPO chlorITE (less O than—"ITE"); Na ClO_4, sodium PER chlorATE (more O than—"ATE").

Q. What does the termination—IC imply?

A. That there is only one salt of an element, as Na Cl. sodIC chloride; Ca SO_4, calcIC sulphate; or these salts may be written sodium chloride, calcium sulphate; or naming the acid first, chloride of sodium, or sulphate of calcium.

Q. What do the terminations —IC and —OUS, when applied to oxy-acids—acids containing oxygen, show?

A. That the combination with oxygen is twofold:—"OUS" indicating less oxygen than—IC. as SulphurOUS acid, H_2SO_3; SulphurIC acid H_2SO_4; in the same manner the terminations—IC and—OUS, when applied to oxy-salts, show a twofold combination; as, MercurIC chloride, H_gCl_2; MercurOUS chloride H_g 2 Cl_2; —OUS meaning more of metal than in the —IC combination. The termination —OUS is sometimes replaced by SUB; as cuprous oxide, Cu_2O, also suboxide of copper.

Q. What does the termination —IDE indicate?

A. The absence of oxygen; as hydrogen sulphIDE, H_2S; as potassium OXIDE, K_2O; hydrogen OXIDE H_2O.

Q. What does the termination —IUM or —UM indicate?

A. The element alone, as SodIUM Na; aurUM—Au.

Q. What does the termination —A indicate?

A. The oxide of the element; as sodA, Na_2O: silicA, SiO_2.

Q. What is *Valency?*

A. Called also "*quantivalence*" or "*atomicity*" (although the latter is applied to designate the number of atoms in a molecule) is the definite capacity which every elementary atom has for uniting with other atoms.

Q. What are *Monads?*

A. Elements having one bond of affinity—that is uniting with one atom of hydrogen to produce a saturated compound.

Q. What are *Dyads?*

A. Having two bonds uniting with 2 atoms of hydrogen.

Q. What are *Triads?*

A. Having three bonds uniting with 3 atoms of hydrogen.

Q. What are *Tetrads?*

A. Having four bonds uniting with 4 atoms of hydrogen.

Q. What are *Pentads* and *Hexads?*

A. Respectively having five and six bonds uniting with hydrogen.

Q. What is a *Radical?*

A. A stable molecule.

Q. What is a *Compound Radical?*

A. An unsaturated group of atoms acting like an element.

Q. What is Chemical Action or Force?

A. A change in composition; when iron, for example, undergoes chemical action a new substance is formed, which, though it contains iron, is entirely different from it in composition and properties.

Q. What are *Monobasic Acids?*

A. Prepared by the limited oxidation of glycols; and by treating the halogen fatty acids with silver oxide and water.

Q. What are *Dibasic Acids?*

A. Prepared by the further oxidation of monobasic acids.

Q. What is an *Anhydride?*

A. An anhydrous (not containing water) oxide.

Q. What is an *Aldehyde?*

A. Acetic aldehyde, C_2H_4O; alcohol deprived of two atoms of hydrogen, a colorless, limpid liquid; volatile, with a more or less pungent odor.

Q. What are the properties of aldehydes?

A. Oxidize in air up to the corresponding acids; precipitate metallic silver from ammoniacal solution of nitrate of silver.

Q. Distinguish between an acid and a salt?

A. An acid neutralizes alkalies; a salt is the union of a base with an acid.

Q. What compounds does Carbon form with Oxygen?

A. Carbon Monoxide and Carbon Dioxide.

Q. What are the properties of Carbon Monoxide?

A. Colorless, tasteless, odorless gas; burns with a pale-blue flame, very poisonous, combining with coloring matter of blood corpuscles, destroying their oxygen-carrying power.

Q. What are the properties of Carbon Dioxide?

A. Transparent, colorless gas, pungent odor, sour taste.

Q. What are *Hydroxides?*

A. Compounds of hydrogen and oxygen.

Q. What are the two compounds of hydrogen and oxygen?

A. Water, H_2O, or hydrogen monoxide; and dioxide of hydrogen, H_2O_2, used for bleaching purposes.

Q. How is the Specific Gravity of a Solid determined?

A. The weight a body loses when weighed in water, is the weight of its own volume of water and the standard with which the weight of that body must be compared.

Q. What do all hydrates contain?

A. Both oxygen and hydrogen; every acid contains hydrogen.

Q. What are *Carbohydrates?*

A. Compounds of carbon, hydrogen, and oxygen, in which the hydrogen and oxygen are in the proportion to form water.

Q. How do they occur?

A. Most of them in vegetable organisms, and a few in animal organisms. Dextrose, ready formed, in honey, and fruits—grapes especially, and in diabetic urine. Lævulose by treating cane sugar with dilute acids. Inosite in muscular flesh. Lactose in milk; others in plants.

Q. What are *Hydrocarbons?*

A. Various compounds of carbon and hydrogen; derived from methane or marsh-gas, CH_4.

Q. What are the 3 groups of *Carbohydrates?*

A. Amyloses which include cellulin, starch, dextrin, glycogen, gums, etc.:—Saccharoses, including cane sugar, milk, sugar, etc.; Glucoses, such as grape sugar (glucose), fruit sugar, etc.

Q. What is a *Reaction?*

A. The results of an experiment which gives the proportion in which bodies are used, and the proportion of the resulting substances.

Q. How are *Reactions* written?

A. By placing in proper proportion, connected by + signs, the formulæ of the bodies concerned, then writing the sign =, and following this by the formulæ of the resulting bodies. Example: $AgNO_3 + HCl = AgCl + HNO_3$ indicates that on bringing together nitrate of silver and hydrochloric acid a chemical change occurs by which silver chloride and nitric acid are produced.

Q. What are *Reagents?*

A. Certain compounds which are used for producing reaction.

Q. What does the term *Nascent* imply?

A. In connection with an element it expresses the fact that it has just been set free.

Q. What are *Formulæ?*

A. They are to molecules what symbols are to elements; they indicate the kind and number of atoms composing the molecule.

Q. Define an *Equation?*

A. A combination of formulæ and algebraic signs to indicate a chemical reaction and its results.

Q. To what is the term *Atomicity* applied?

A. To the definite capacity which every elementary atom has for uniting with other atoms; also to designate the number of atoms in a molecule.

Q. Into how many classes may *Salts* be divided?

A. Into 4, Normal, Mixed, Double and Conjugated.

Q. Define each class?

A. Normal Salts are those in which the hydrogen of the acid is replaced by a single element, combined according to its atomicities; Mixed Salts, those in which two or more elements have replaced the hydrogen, when some hydrogen remains, the body is termed an *acid* salt; Double Salts, those in which two complete salts unite to form a definite compound which is usually crystalline; Conjugated Salts, those in which a definite salt is united with a body not a salt; they are called *oxy-salts*, in which a basic oxide is united with the salt, and *anhydro-salts*, in which an anhydride is united with the salt.

Q. What are *Monobasic Salts*, *Dibasic Salts*, etc.?

A. Monobasic Salts are formed by one atom of a monad; Dibasic Salts are formed by two atoms of a monad; and so on according to the number of atoms of a monad.

Q. What may be regarded as a *Radicle?*

A. Any unsaturated molecule; radicles being the root or basis of the compounds into which they enter.

Q. What are the important *Chemical Groups?*

A. The Oxygen, Chlorine, Nitrogen, Carbon, Potassium, Calcium, Zinc, Iron, Copper and Platinum.

Q. What does the *Oxygen Group* include?

A. Oxygen, Sulphur, Selenium and Tellurium; they possess the power of forming, with many elements, basic or acid compounds according to the proportion in which they are combined, being electro-negative dyads.

Q. What does the *Chlorine Group* include?

A. Fluorine, Chlorine, Bromine and Iodine, and are the only elements which form salts without the aid of some member of the oxygen group; they are electro-negative monads.

Q. What does the *Nitrogen Group* include?

A. Nitrogen, Boron, Phosphorus, Arsenic, Antimony, and, according to some, Vanadium, Bismuth and Gold. They are generally triads or pentads, being of uneven atomicity, and neither strongly positive nor strongly negative. They form anhydrides, distinguished by the power of combining with water in two or more proportions, forming distinct acids. Several of them combine easily with hydrogen to form bodies somewhat similar to those of the potassium group.

Q. What does the *Carbon Group* include?

A. Carbon, Silicon, Titanium and Tin; they are tetrads, and, like the nitrogen group, their electrical relations are intermediate.

Q. What does the *Potassium Group* include?

A. Hydrogen, Potassium, Lithium, Sodium, Rubidium, Cæsium and Silver; they are electro-positive monads, and, with the exception of hydrogen and silver, have great affinity for the members of the oxygen and chlorine groups. With oxygen they produce powerful corrosive bases called the *alkalies*, and for this reason are sometimes termed the *alkali metals*.

Q. What does the *Calcium Group* include?

A. Calcium, Barium, Strontium and Lead; they are electro-positive dyads, and form oxides which are slightly soluble in water, but much less caustic or corrosive than the alkalies proper; they are often called *alkaline earths*.

Q. What does the *Zinc Group* include?

A. Zinc, Magnesium, Cadmium, and Beryllium; they are never found free, but are rather easily reduced; they are electro-positive dyads, and form a definite oxide, which is insoluble in water, but not caustic, and form definite salts.

Q. What does the *Iron Group* include?

A. Iron, Manganese, Aluminum, Nickel, Cobalt, Chromium; they are electro-positive, and are not found in the metallic state, except in small quantity. Most of them form two sets of compounds.

Q. What does the *Copper Group* include?

A. Copper and Mercury; they are electro-positive dyads, resembling each other in the power of forming two sets of compounds. In the normal condition they form chlorides insoluble in water and are thus partly related to silver.

Q. What does the *Platinum Group* include?

A. Platinum, Palladium, Iridium, Rhodium, Ruthenium and Osmium, usually called platinum metals, as the others are associated with platinum. They are not, however, connected by any striking relations.

Q. What is the action of acids on metals?

A. Metallic oxides and hydroxides (bases) unite with acids and form a class of neutral compounds called salts; the metals also have the power of replacing hydrogen in acids, the final products again being salts.

Q. How do the metals combine with the non-metallic elements?

A. With chlorine to form chlorides; with bromine to form bromides; with iodine to form iodides; with sulphur to form sulphides; with oxygen to form oxides; with hydrogen to form hydroxides.

Q. Into what two classes are metals affected by the magnet (possessing magnetic quality) divided?

A. Into *paramagnetic* those attracted, and *diamagnetic* those repelled by the magnet.

Q. What are the paramagnetic?

A. Iron, nickel, cobalt, manganese, and chromium—and are capable of receiving such a property.

Q. What are the diamagnetic metals?

A. Arsenic, gold, copper, silver, lead, mercury, cadmium, tin, zinc, antimony and bismuth.

Q. What metal retains magnetism permanently?

A. Steel, although it acquires it slowly; it forms the permanent magnet.

Q. What is a natural magnetic substance?

A. The ore of iron which is a magnetic oxide, Fe_3O_4 (lodestone).

Q. Describe *Galvanic Action?*

A. When two dissimilar metals in contact with each other are immersed in any conducting fluid or liquid which acts on either, a current of electricity is produced; thus when a zinc plate and a platinum plate are placed in sulphuric acid and then connected outside the acid, as by a copper wire, chemical action takes place, the result being that hydrogen is evolved at the platinum plate and that a current of electricity passes through the circuit; this is galvanic action, and the system thus arranged constitutes a galvanic or voltaic cell.

Q. What is Thermo-electricity?

A. Electricity induced by heat, as when two dissimilar metals are connected at two junctions and one of these junctions is heated a current of electricity results.

Q. Metals of what structure will produce the strongest current of electricity?

A. A decided crystalline structure; example—bismuth and antimony.

Q. What is the Symbol, Combining Weight and Specific Gravity of *Oxygen?*

A. S—O; C. W—16. S. G—1.1057.

Q. What is the *Source of Oxygen?*

A. Most abundant of the elements comprising parts of the air, water, crust of the earth, and organized bodies.

Q. How may *Oxygen be Prepared?*

A. Obtained from water (H_2O) by decomposing it by galvanic electricity; also from the following substances by heat: Mercuric oxide ($Hg\ O$); Manganese dioxide ($Mn\ O_2$); Tri-plumbic tetroxide ($Pb_3\ O_4$); Potassium nitrate ($K_2\ N_2\ O_6$) or ($K\ N\ O_3$); Potassium Chlorate ($K_2\ Cl_2\ O_6$) or $K\ Cl\ O_3$; also from Potassium acid chromate $K_2\ H_2\ 2\ Cr\ O_4$ with sulphuric acid ($H_2\ S\ O_4$).

The gas is generally prepared by heating a mixture of 4 parts by weight of potassium chlorate with one of manganese dioxide.

Q. What are the *Properties of Oxygen?*

A. Colorless, odorless and tasteless, a supporter of combustion and a stimulant. It bleaches when in the nascent state. It forms one-fifth of the atmosphere, eight-ninths of the water, and one-half of the earth. It is liquefiable at a great pressure at a low temperature; 1.10 times as heavy as air.

Q. What is the test of Oxygen?

A. A solution of pyrogallate of potassium will absorb oxygen and become black.

Q. What is *Combustion?*

A. Oxidation so rapid as to produce heat and light; if no light it is slow combustion.

Q. What are combustible substances?

A. Those which produce light and heat by their oxidation.

Q. What are non-combustible substances?

A. Those incapable of rapid oxidation.

Q. What is a supporter of combustion?

A. Oxygen, especially in its diluted form (air); when a combustible substance burns in a supporter of combustion the union is mutual, one being as much a party to the action as the other.

Q. What are oxidizing agents?

A. Compounds in which oxygen is held so feebly that it is readily given up to substances having a greater affinity for it.

Q. What is *Ozone?*

A. A modified form of oxygen having the structure O_3. It is obtained by the slow combustion of phosphorus in moist oxygen, or by passing electricity through the dry gas. It has a peculiar and oppressive smell, oxidizes metals, sets free iodine, chlorine, etc., and converts heat into the passive gas; possesses antiseptic properties; it is found in the air, especially after electric disturbances.

Q. What is the Symbol, Combining weight, and Specific Gravity of *Hydrogen?*

A. S.—H; C. W—1; S. G—.08961.

Q. How may *Hydrogen* be prepared?

A. By decomposing water (H_2O) by galvanic electricity; by the decomposition of steam with hot iron; from water by the action of the alkaline metals, potassium (K) or sodium (Na); also by the action of hydric chloride or dilute sulphuric acid, on zinc or iron.

Q. What are the *Properties of Hydrogen?*

A. Colorless, tasteless, odorless, non-poisonous, burns with a colorless flame, produces great heat and forms water; it is the lightest of all known substances. It exists in water and all vegetable substances.

Q. What are the *Tests of Hydrogen?*

A. Its inflammability and absorption of bromine.

Q. What is the composition of Water?

A. Water is the monoxide of hydrogen, H_2O; it always contains impurities either in solution, suspension, or in both.

Q. How may *Water* be formed?

A. When two volumes of hydrogen and one volume of oxygen are combined, complete condensation takes place and water is formed—H_2O.

Q. What are the *Properties of Water?*

A. Odorless, tasteless, and in large masses distinctly blue. Under ordinary pressure it freezes at 32° F. (0° C.) and boils at 212° F. (100° C.). It dissolves many substances, solid, liquid and gaseous, and is absorbed by many substances. Water is extensively distributed in nature; it is collected in large masses, exists in suspension in the atmosphere, in most minerals, and in all animal and vegetable tissues. Rain contains ammonium salts, and sea water is rich in mineral substances.

Q. How may Water be purified?

A. By filtration through porous materials, paper, charcoal, sand, etc., suspended impurities may be removed, but distillation is the only method of obtaining absolutely pure water.

Q. How may water be decomposed?

A. The two constituent gases of water may be obtained by passing an electric current through vessel of water and collecting the gases which form and escape from the two poles of the battery.

Q. How can water be prepared synthetically?

A. By passing an electric spark through a mixture of oxygen and hydrogen gas enclosed in an apparatus, the gases unite to form water.

Q. What is *Diffusion of Gases?*

A. Gases mingle more rapidly, liquids more slowly, to make a mixture of uniform density. When two gases of different densities are separated by a porous partition, they mingle, the lighter passing through more rapidly than the heavier, the rapidity being in inverse ratio to the square roots of their densities. The diffusion is more active in winter than in summer, because of the greater density of the warm air within the house and the cold air without.

Q. What is the Symbol, Combining Weight, and Specific Gravity of *Nitrogen?*

A. S.—N; C. W.—14; S. G.—0.972.

Q. How may *Nitrogen be Prepared?*

A. From the atmosphere by burning phosphorus (P) in a bell-jar containing air over water; by the action of nitric acid ($H\ N\ O_3$), on flesh; by treating Ammonia ($N\ H_3$) with Chlorine (Cl); from potassium nitrate ($K\ N\ O_3$), and ammonium chloride ($N\ H_4\ Cl$); by burning out the oxygen from a limited amount of air; by passing air over red-hot copper confined in a suitable vessel.

Q. Where does Nitrogen occur?

A. It exists free in the atmosphere; combined, it is found in all animal and plant life and in some of the products of their decomposition, such as coal, peat, and lignite; also in ammonia gas emanating from decaying matter.

Q. What are the *Tests of Nitrogen?*

A. By its forming ammonia and cyanogen (C N), by the use of the proper substances.

Q. What are the *Properties of Nitrogen Gas?*

A. Colorless, odorless and tasteless; it will not burn, nor support combustion and is non-poisonous. It is lighter than air, and can be liquefied only by intense cold and pressure; it is assimilated by plants in form of ammonia and as various nitrates and nitrites.

Q. What is the *Atmosphere?*

A. An intimate mixture of about four volumes of nitrogen with one volume of oxygen; it extends upward to a height estimated from 45 to 200 miles. The composition is not constant nor in exact proportions either by weight or volume, though it approaches very nearly the formula $N_4\ O$. Ordinary air contains small quantities of water, carbonic acid and ammonia besides nitrogen and oxygen. The capacity of air for holding moisture increases as the temperature rises, and the dryness or dampness of the atmosphere is due to the amount in proportion to what the air can take up. When the temperature falls the moisture separates to a greater or less degree, and there is fog, rain or dew, and if the temperature falls below freezing point, there is snow or frost.

Q. Is the atmosphere a mixture of gases or a chemical compound? Give reasons.

A. It is a mixture of gases; because its constituents are not in atomic proportions; because air can be made by mechanically mixing the gases; because solvents may remove one gas without affecting the others, each dissolving according to its own solubility.

Q. When does the air hold the most water?

A. The higher the temperature.

Q. Why is it necessary to supply water to the heated air of rooms in winter, especially in cases of bronchitis or catarrhal croup?

A. Because a cold, damp air when heated becomes capable of holding more water and appears dry; even in health a very dry air irritates the air passages, causes dryness of skin and *malaise;* while a very moist atmosphere retards evaporation from skin and lungs, raises the body temperature and becomes oppressive.

Q. What are the best disinfectants?

A. Free ventilation and consequent dilution; chlorine, bromine, iodine, and sulphur dioxide.

Q. What is the Symbol and Combining weight of *Carbon?*

A. S.—C; C. W.—12.

Q. In what two forms is Carbon found native?

A. The diamond, and as graphite; mineral coal, charcoal and lamp-black are also examples of carbon, but in different forms of purity.

Q. What are the *Properties of Carbon?*

A. The *Diamond* is a crystalline form of Carbon, of great hardness, and has been produced artificially in very minute form. *Graphite or Plumbago* is supposed to be an old form of coal and is not perfectly pure; it is largely used for making pencils and crucibles. All forms of carbon are insoluble in all liquids, and infusible and not acted upon by acids and alkalies, nor by the air at ordinary temperature. Heated strongly in air or oxygen they burn, forming $C\,O$ or $C\,O_2$.

Q. What are some of the common impure forms of Carbon?

A. Lamp-black, the deposit from smoky flame; wood charcoal, obtained by heating wood protected from air; animal charcoal, obtained by charring blood, bones and other animal tissues, and is in the form of a coarse black powder.

Q. What is *Coal* formed from?

A. From vegetable matter by a slow process of decay, mostly under water, by which the hydrogen and oxygen are mostly removed, and the carbon made compact by pressure.

Q. What are the *Tests for Carbon?*

A. Its burning forms carbonic anhydride (CO_2); also by producing carbonic acid.

Q. How is Coal Gas produced?

A. By heating bituminous coal in a closed vessel; it is contaminated with tar, ammonia, and sulphur compounds.

Q. How is *Carbonic Acid* formed?

A. By respiration of amimals; by ordinary combustion; by fermentation and decay; by decomposition of carbonate, either by heat or by acids.

Q. What are the *Properties of Carbonic Acid?*

A. Colorless gas with a sharp taste; soluble at ordinary pressure in its own bulk of water, and the solubility increases in proportion to the pressure; fifty per cent. heavier than air. It can be liquefied by a pressure of 800 lbs. to the inch, and freezes at 70° F. (—56° C.); it will not support animal life or ordinary combustion.

Q. What is its relation to plant-life?

A. Under the influence of light plants decompose it, the carbon being absorbed and the oxygen driven off.

Q. What are *Carbonates?*

A. A series of Salts formed by carbonic acid, most of which are insoluble in water.

Q. What are the *Tests for Carbonic Acid?*

A. It renders turbid a solution of calcium hydrate (lime water), or barium hydrate (baryta water); it turns litmus a wine-red, the blue color being restored on boiling.

Q. What is the Symbol, Combining Weight and Specific Gravity of *Chlorine?*

A. S.—Cl; C. W.—35.5; S. G.—2.45.

Q. What is the *Preparation of Chlorine?*

A. By the action of Sulphuric Acid (H_2SO_4) on Sodium Chloride ($NaCl$) and Manganese Dioxide (MnO_2); by heating a mixture of common salt, sulphuric acid and manganese dioxide.

Q. What are the *Properties of Chlorine?*

A. A greenish-yellow gas of a disagreeable and very irritating odor, irrespirable, disinfectant, and in the presence of water a bleaching agent. It can be liquefied at a pressure of four atmospheres. It combines with most of the metals, decomposes water, and bleaches and destroys many organic substances. Light increases its affinity for hydrogen. Chlorine will not bleach unless moist, a decomposition of the water occurring first, and the oxygen being set free as the active agent.

Q. What is the *Test for Chlorine?*

A. A soluble salt of Silver (Ag), as a nitrate ($Ag\,N\,O_3$), gives a white precipitate.

Q. What is the preparation of *Hydrochloric* (*Muriatic*) *Acid?*

A. Obtained by the action of Sulphuric Acid ($H_2\,S\,O_4$) on Sodium chloride (Na Cl). One ounce of common table salt is mixed with twice its weight of strong sulphuric acid in a flask and hydrochloric acid comes off freely.

Q. What are the Properties of *Hydrochloric Acid?*

A. Colorless gas of a strong pungent odor, and poisonous to plants and animals; it liquefies at a pressure of forty atmospheres; water readily absorbs it.

Q. What is the Test for *Hydrochloric Acid?*

A. Nitrate of Silver gives a white precipitate.

Q. What is the Symbol, Combining Weight, and Specific Gravity of *Bromine?*

A. S.—Br; C. W.—80; S. G.—2.976.

Q. What is the Preparation of *Bromine?*

A. It occurs in sea-water and sea-plants: prepared by the action of a mixture of sulphuric acid and manganese dioxide upon bromides.

Q. What are the Properties of *Bromine?*

A. A dark red liquid, which at ordinary temperatures evolves red vapors of an excessively irritating and disagreeable smell. It is three times as heavy as water and boils at 145° F. (63° C.) and freezes at 12° F. (25° C.). It is soluble in water, and its chemical properties are similar to chlorine, but not so energetic. It bleaches vegetable colors, and by decomposing water acts as an oxidizing agent. It is disinfectant and escharotic.

Q. What is the test for *Bromine?*

A. Free chlorine or a mixture of manganese dioxide and sulphuric acid will produce the red vapor of bromine.

Q. What is the Symbol, Combining Weight, and Specific Gravity of *Iodine?*

A. S.—I; C. W.—127; S. G.—4.948.

Q. What is the *Preparation of Iodine?*

A. It occurs with bromine and chlorine in sea-water and sea-plants, the ashes of which (Kelp) contain various iodides, and is obtained by passing chlorine gas through a saturated solution of these ashes, which frees the iodine.

Q. What are the *Properties of Iodine?*

A. Bluish-black crystalline masses, with a metallic lustre; slightly soluble in water, and freely in alcohol and alkaline solutions. It evaporates slowly at ordinary temperatures, melts at 225° F. (107° C.) and boils at 347° F. (175° C.). The vapor has a peculiar odor, somewhat like chlorine, but not so irritating, and a deep violet color; it possesses some bleaching and oxidizing powers; the iodides do not color.

Q. What are the *Tests for Iodine?*

A. The action of free chlorine, or a mixture of manganese dioxide and sulphuric acid produces a violet vapor; nitrate of silver, with soluble iodides a yellow precipitate, silver iodide insoluble in ammonia; free iodine is recognized by its action on starch.

Q. What is the Symbol, Combining Weight, and Specific Gravity of *Sulphur?*

A. S.—S; Combining W.—32; S. G.—1.98—2.04.

Q. What are the *Properties of Sulphur?*

A. Prepared from native sulphur by melting or distilling; when poured in moulds it is known as roll sulphur or brimstone; when sublimed, as flowers of sulphur. Sulphur is a yellow solid, crystalline brittle substance, insoluble in water and alcohol, but soluble in carbon disulphide, turpentine and fat oils. It melts at 232° F. and boils at 792° F.; it is a non-conductor of electricity, and becomes highly electrical by friction.

Q. What is the *Preparation of Sulphuric Acid* or *Oil of Vitriol?*

A. It occurs free in water of volcanic and mining regions, and in the saliva of certain animals. Sulphuric acid is obtained by first burning sulphur which produces anhydride sulphurous acid, the vapor of which is mixed with that of nitric acid, steam and air in a large room lined with lead, the floor of which is slightly inclined and covered by a few inches of water. The nitric acid changes some sulphurous acid to sulphuric, becoming itself converted into nitric oxide (N O), by this action; this nitric oxide takes oxygen from the air, and forms $N.O_2$ which oxidizes more sulphurous acid, and is thus again converted into N O. and again acted upon by the air.

Q. What are the *Properties of Sulphuric Acid?*

A. Colorless, oily liquid of a specific gravity of 1.848, boiling at 640° F. (338°C.); it is highly corrosive and poisonous; it absorbs water when exposed to the air; added to water it produces heat, often sufficient to make the water boil; its affinity for water is so great that it will decompose many organic substances, extracting the hydrogen and oxygen and leaving the carbon, the latter, so liberated, giving the acid a dark color.

Q. What are the *Tests for Sulphuric Acid?*

A. The addition of nitrate, chloride or acetate of barium, forms a white precipitate insoluble in water and dilute acids. The commercial sulphuric acid contains arsenic and lead.

Dental Materia Medica and Therapeutics.

Q. What does *Dental Materia Medica* teach?

A. The source or derivation, nature, form and appearance of all medicinal agents used in dental practice.

Q. What does *Therapeutics* teach?

A. The actions and uses of these drugs for the prevention, relief, or cure of disease.

Q. Upon what will the indications for treatment depend?

A. On the nature and seat of disease, on the symptoms present, the condition of vital organs, and also that of the part or organ affected.

Q. Name the Methods of treatment?

A. By means of remedial agents given internally; by the use of local and external applications, and electricity; by attention to diet and hygiene; by operations.

Q. By what routes do medicines enter the circulation?

A. By external application, and when administered internally.

Q. What are the external methods?

A. En-epidermic method, Epidermic, Endermic, Hypodermic, to serous cavities, to wounds and diseased surfaces, the Intra-venous method.

Q. What are the internal methods?

A. By inhalation, by the mouth, by the rectum.

Q. What does the En-epidermic method consist of?

A. The application of plasters, blisters, poultices, lotions, etc., to the skin.

Q. What the Epidermic, or method by inunction?

A. The application of remedies to the skin, aided by friction.

Q. What the Endermic method?

A. The application of a blister, opening the vesicle, and application of the remedy to the denuded surface.

Q. What is the Hypodermic method?

A. Injection, by hypodermic syringe, of drugs into the subcutaneous areolar tissue from which they are quickly absorbed by lymphatic and capillary vessels.

Q. What does it consist in?

A. The use of a graduated syringe. A fold of loose skin is caught between thumb and forefinger, and the point of the needle pushed through the skin till it works easily in the tissues beneath; or in case of the gums, the mucous surface dried, and kept dry. Then the injection is made slowly, on withdrawing the needle, pressure is made with the finger over the puncture for a minute to prevent escape of the fluid.

Q. What precautions should be observed?

A. The fluid or solution must be of small quantity and unirritating, and care must be taken that the needle does not enter a vein, and the entire dose carried *en masse* to vital centres; also that the solution used, and the needle, are sterilized, otherwise an abscess may be produced.

Q. Name some of the solutions in common use for hypodermic injection?

A. Cocaine hydrochlorate, Vapocaine, Chloretone, Sulph. Atropine, Sulphate of Morphine, etc., etc.

Q. Why are drugs applied to serous cavities?

A. For antiseptic purposes, and at times for an irritant action to set up adhesive inflammation.

Q. When to wounds and diseased surfaces?

A. As poultices, lotions, gargles, ointments, etc., for ulcers, inflamed surfaces, etc., etc.

Q. What is the Inhalation Method?

A. The breathing of the vapor of anæsthetic and other agents, which insures a greater state of purity.

Q. What by the mouth?

A. A useful and convenient method, with few disadvantages.

Q. When by the Rectum?

A. Employed when it is inadvisable or impossible to administer drugs by the mouth; given in the form of enemata.

Q. What three kinds of enemata are employed?

A. Purgative, absorptive, and nutritive.

Q. What is *Pharmacology?*

A. The art of preparing medicines for use and dispensing them on the order of the therapeutist. It includes a knowledge of Materia Medica, and acquaintance with the theories and manipulations of chemistry, and intimate practical knowledge of many special operations peculiar to itself.

Q. By what various routes may medicines be introduced into the circulation?

A. By the gastro-intestinal tract, the rectum, the respiratory tract, the veins and arteries, the subcutaneous cellular tissue, and the integument itself.

Q. What do all prescriptions begin with and what does it imply?

A. The sign ℞, an abbreviation of *recipe*, "take," followed by the drugs written in the genitive case.

Q. Of what four parts does a prescription consist?

A. The *superscription*—sign ℞, the *inscription*—names and doses of the drugs, the *subscription*—directions to the dispenser, and the *signature*—directions to patients.

Q. How are the constituents of the inscription arranged?

A. The *basis* or active ingredient, the *adjuvant* or auxiliary, the corrective—to limit or modify the action of the two former, and *vehicle* or excipient, to combine the whole into a convenient form of administration; also a flavoring agent for a mixture.

Q. What will obviate the difficulty in remembering the various doses of the medicines?

A. Keeping in mind the fact that infusions, decoctions, tinctures, pills, etc., are always administered in certain quantities, with a few exceptions.

Q. What care is required when ordering drop doses of a medicine?

A. That the size of drops differ according to the shape of the bottle and the density of the liquid.

Q. What does the rapidity with which medicines enter the circulation depend upon?

A. Their composition.

Q. Are the effects of medicines modified by their form?

A. Yes, some are far more active in solution than in solid form.

Q. How are poisons and other drugs which enter the circulation gotten rid of?

A. By the excretory organs which expel them from the system.

Q. Does pharmaceutical combination modify the action of medicines?

A. Yes, three or four drugs often act beneficially where one only would produce little or no effect.

Q. What other conditions modify the effects of medicines?

A. Age, Habit, Mind, Sex, Idiosyncrasy, Disease, Climate, Temperament. Small doses for children, long continuance renders some drugs inert, a patient of a cheerful disposition will recover sooner than one who is despondent or morose, the administration of drugs must be modified or avoided during menstruation, pregnancy and lactation, some patients have a peculiar susceptibility to action of certain drugs, different diseases influence the effects of medicines, narcotics act more energetically in hot climates, while calomel is the reverse. The nervous are more easily affected by medicines than the phlegmatic.

Q. What are Temperaments?

A. Individual peculiarities of physical organization.

Q. What are topical or local effects of medicines?

A. When their effects occur in, or are limited to, the parts to which they are applied.

Q. How do medicines operate through nervous agency?

A. By means of the sensory nerves the effects of medicines are carried to the brain, causing an excitement of a nerve centre, and a reflex action is transmitted along the efferent nerves resulting in the occurrence of certain phenomena.

Q. Have some medicines a specific action on certain tissues and organs?

A. Yes. For example, alcohol on the brain and strychnine on the spinal cord.

Q. Give the *Rule* for finding the amount of a drug in a given percentage of solution, with examples?

A. Find number of minims in stated quantity, and multiply this by the number indicating percentage, placing the decimal two points to the left.

Examples: 1. How many grains of drug in 2 fluid ounces of a 2 per cent. tincture (solution)? 2 fluid ounces = 960 (♏) × 2 (p. c.) = 19.20 grains. 2. How many grains of drug in 100 cc. of a 4 (p. c.) tincture (solution)? 100 cc. × 16.23=1623.00 (♏) × 4 (p. c.) = 64.92 grains.

Q. What are *Anodynes* or *Analgesics?*

A. Agents that relieve pain; called *general* when taken internally and acting by depressing the cerebral centres of perception and sensation; called *local* when applied so as to affect parts by obtunding the sensory nerve fibres, or by reducing the local circulation.

Q. What are *Narcotics?*

A. Medicines which stupefy or diminish the energy of the nervous system.

Q. What are *Hypnotics?*

A. Medicines which cause sleep without cerebral excitement.

Q. What are *Anæsthetics?*

A. Agents which produce insensibility to feeling, or to acute pain, and diminish muscular action. Divided into *General*—which affect the entire organism; *Local*—where their action is limited to the circumscribed parts to which they are applied.

Q. What are *Stimulants?*

A. Agents which excite the functions of an organ; increase organic activity.

Q. What are *Astringents?*

A. Agents which produce contraction and condensation of organic tissues, removing morbid affections, arresting hemorrhage and excessive secretions of mucous membrane.

Q. How are they divided?

A. Into Mineral and Vegetable.

Q. When is their use indicated?

A. To remove morbid affections, arrest hemorrhage, and excessive secretions of mucous membrane.

Q. What are the principal vegetable astringents?

A. Tannic acid, gallic acid.

Q. What are the principal mineral astringents?

A. Persalts of iron, alum, nitric acid, sulphuric acid.

Q. What are *Styptics?*

A. Agents which arrest hemorrhage by their local application. *Chemical*—coagulate the blood and stimulate the tissue to contraction; *Mechanical*—promote clot formations by retarding and detaining the blood in their meshes, or absorb it until it coagulates.

Q. What are the principal *Chemical Styptics?*

A. Tannic Acid, Alum, Persulphate of Iron, Powdered Subsulphate of Iron, Nitrate of Silver, etc.

Q. What are common *Mechanical Styptics?*

A. Spider's-web, Plaster of Paris, Sandarach Varnish, Matico Leaf.

Q. What are *Tonics?*

A. Medicines which promote nutrition and give tone to the system.

Q. What are *Irritants?*

A. Agents which produce irritation or inflammation; vascular excitement.

Q. What are *Sedatives?*

A. Agents that exert a soothing effect by lowering functional activity.

Q. What are *Emetics?*

A. Agents that excite vomiting.

Q. What is the difference between local and systemic emetics?

A. Local act on nerves of stomach; Systemic through the system.

Q. What are *Cathartics?*

A. Purgatives—agents which cause evacuations of bowels.

Q. What are hydragogue cathartics?

A. Purgatives that cause liquid alvine discharges.

Q. What are *Emollients?*

A. Agents which allay irritation, relax soft tissues, and protect sensitive surfaces.

Q. What are *Hæmostatics?*

A. Agents which arrest hemorrhage by internal administration.

Q. What are *Caustics* or *Escharotics?*

A. Agents which devitalize the tissue they act on, producing an eschar or slough.

Q. What are *Antiseptics?*

A. Agents which check the development of putrefaction but do not necessarily kill disease germs or micro-organisms.

Q. What are *Disinfectants?*

A. Agents which deodorize, neutralize, and sterilize the products of decomposition and putrefaction and prevent infection.

Q. What are *Deodorizers?*

A. Agents which destroy fetid effluvia, as odor or smell.

Q. What are *Germicides?*

A. Agents which destroy disease germs and micro-organisms concomitant with putrefaction.

Q. What is *Sulphuric Ether* obtained from?

A. The distillation of ethylic alcohol and sulphuric acid.

Q. What are the principal *Dangers of Anæsthetics?*

A. Fatty degeneration of heart; valvular lesions, kidney affections, respiratory obstructions from enlarged tonsils; tumors of brain; aneurism; chronic alcoholism.

Q. What is the dose of Sulphuric Ether?

A. As an anæsthetic: average quantity, ℥ v; for internal use in form of Hoffmann's anodyne ʒ ss to ʒ ij; of ether, ʒ ss to ʒ j.

Q. How is *Chloroform* obtained?

A. By distilling alcohol with chlorinated lime.

Q. What is the *Dose of Chloroform?*

A. For inhalation: ʒ j to ij; for internal administration: ♏ j to v. diluted.

Q. How is *Nitrous Oxide Gas* obtained?

A. By boiling the salt Nitrate of Ammonia in a glass retort, and washing the gas in pure water, sulphate of iron or caustic potash solutions.

Q. What is *Liquefied Nitrous Oxide?*

A. Nitrous Oxide Gas liquefied and solidified under intense cold and a pressure of 50 atmospheres or 750 lbs., and secured in strong iron cylinders; it is pure and free from deterioration.

Q. What are the *Properties and Action of Nitrous Oxide?*

A. Elastic and colorless, with an agreeable odor; it supports combustion almost as readily as oxygen, and is the safest general anæsthetic in use.

Q. What quantity of Nitrous Oxide is required to produce anæsthesia?

A. From 5 to 15 gallons.

Q. What is the *Source of Cocaine?*

A. The active crystalline alkaloid of the Peruvian Shrub *Erythroxylon Coca.*

Q. What are the principal *Salts of Cocaine?*

A. The Hydrochlorate, $C_{17}\ H_{21}\ NO_4$; the Oleate and the Hydrobromate.

Q. What are the *Medicinal Properties and Action?*

A. Locally an anæsthetic; internally a stimulant, improving digestion and stimulating the circulation and respiration.

Q. What are the *Dangerous Symptoms of Cocaine?*

A. Extremities cold and rigid; eyes staring and glassy; pulse weak; face pallid; heart feeble; respiration slow and weak; symptoms of collapse.

Q. What is the treatment of *Cocaine Poisoning?*

A. Fresh air, nitrite of amyl inhalations, brandy, whiskey, aromatic spirits of ammonia, strychnine, atropine, digitalis, and carbonate of ammonia by injection, chloroform or ether if convulsions.

Q. What is the *Derivation of Carbolic Acid?*

A. An alcoholic product of the distillation of coal tar.

Q. What are the *Properties and Action of Carbolic Acid?*

A. Colorless or pinkish acicular crystals, strong aromatic odor and taste like creosote; it changes to an oily fluid at 95° F.; if exposed to the air it liquefies by its crystals absorbing moisture; five per cent. of water liquefies it; it is freely soluble in alcohol, ether, chloroform, glycerine and the essential oils. It is escharotic, antiseptic, germicide, rubefacient and poisonous; internally sedative and carminative. It is more efficacious than creosote.

Q. What is the *Dose of Carbolic Acid?*

A. One-fourth of a grain diluted.

Q. What are the *Dental Uses of Carbolic Acid?*

A. As an escharotic, styptic, antiseptic and sedative.

Q. What is the Derivation of *Creosote?*

A. The product of the distillation of wood tar.

Q. What are the *Properties and Action of Creosote?*

A. Its physiological actions are identical with those of carbolic acid. It is an inflammable oily liquid, slightly soluble in cold water, but freely so in alcohol, ether and chloroform. It differs from phenol or carbolic acid by not coagulating collodion.

Q. What are the *Dental Uses of Creosote?*

A. The same as Carbolic Acid.

Q. What are the Properties of *Arsenic?*

A. A brittle, granular, steel-gray metal, very volatile and combustible, with an odor like that of garlic; a powerful poison, on account of the facility with which it absorbs oxygen. It is generally obtained from Cobalt ore. In small doses it is generally tonic; in large doses a corrosive poison.

Q. What is the Derivation of *Arsenious Acid?*

A. Obtained by roasting arsenical ores in a current of air.

Q. What are the *Properties of Arsenious Acid?*

A. White, solid, odorless, and tasteless; slightly soluble in cold water, and more so in hot water. Heated to 380° F., (193°C.), it vaporizes and condenses into brilliant, transparent crystals. It is exceedingly poisonous in all its forms, two or three grains being a fatal dose.

Q. What are the *Dental Uses of Arsenious Acid?*

A. Chiefly for devitalizing pulps of teeth; the following is Dr. Kirk's formula:

Arsenious Acid in fine powder	gr. xx;
Cocaine hydrochlorate	gr. xx;
Menthol, cryst.	gr. v.

Glycerine enough to make a stiff paste. ♏.

Q. To secure painless devitalization of pulp, what precautions?

A. Avoid pressure on pulp, and avoid contact of arsenic with gum tissue, and secure preparation in cavity by a thin concave disk of platinum or other metal, covered by a filling of soft gutta percha.

Q. What is the *Antidote to Arsenic?*

A. Hydrated Oxide of Iron.

Q. What are some of the *Tests for Arsenic?*

A. If solid, place suspected material on burning charcoal, when the arsenic, if present, will become deoxidized and emit a garlic odor. If in aqueous solution, it may be detected by adding sulphide of ammonium, which produces a yellow sulphide of arsenic; or the addition first of ammonia, and then a small quantity of nitrate of silver, will form a light yellow arsenite of silver. Also, Marsh's and Reinchs' Tests.

Q. What is the *Derivation of Tannic Acid?*

A. Obtained from nut galls; galls are oak excrescences.

Q. What are the *Properties and Action of Tannic Acid?*

A. In the form of thin, yellowish crystals; inodorous; soluble in water, but less so in alcohol and ether. A powerful astringent and styptic.

Q. What is the *Dose of Tannic Acid?*

A. Gr. j to xx, in pill form.

Q. What are the *Dental Uses of Tannic Acid?*

A. As a styptic for alveolar hemorrhage; affections of mucous membrane; ulceration of gums; hypertrophy of gums; mercurial salivation; spongy gums; sensitive dentine, etc.

Q. What is *Campho-Phenique?*

A. A limpid volatile fluid, hot aromatic taste, odor of camphor. Obtained from the chemical union of carbolic acid and camphor.

Q. What are the Dental Uses of *Campho-Phenique?*

A. Pulp canal dressing, local anæsthetic; obtunder of sensitive dentine; pain after extraction of abscessed teeth and separation of teeth, irritation of pulp, putrescent pulps, early stage of periodontitis; sterilization of instruments.

Q. What is *Phenol Sodique?*

A. A solution of Sodium Carbolate composed of pure melted carbolic acid, solution of caustic soda, and distilled water.

Q. What are its *Dental Uses?*

A. For hemorrhage after extraction of teeth, and removal of calculus, and as an antiseptic mouth-wash.

Q. What is *Vapocaine?*

A. An ethereal solution of 15 per cent. of Cocaine hydrochlorate.

Q. What are its Properties?

A. Local anæsthetic, great penetrating power when used as an obtundent, rapid action with a minimum amount of cocaine: neutral to litmus, and free from any substance injurious to the teeth; caustic alkalies decompose it and destroy its anæsthetic power.

Q. What is its dental use?

A. To obtund hypersensitive dentine.

Q. How is it used?

A. Apply rubber dam; dry cavity with hot air; place a piece of dry absorbent cotton in cavity, and drop the vapocaine on it until thoroughly saturated: allow it to remain from 2 to 5 minutes, keeping cotton saturated until ready for operation of excavating cavity; sharp burrs are necessary that the heat of friction does not penetrate beyond zone of anæsthesia.

Q. What is *Chloretone?*

A. A local anæsthetic and obtunder, non-toxic and antiseptic.

Q. What are its properties and action?

A. Has no toxic effect upon the heart, causes no sloughing or swelling of parts after its use; in water it forms a solution of one per cent. which is the anæsthetic equivalent of a 4 per cent. cocaine solution.

Q. What are the formulas for preparing chloretone solutions for dental operations?

A. For Extracting Teeth: dissolve 6 grains of chloretone crystals in 77 minims of 94 per cent. alcohol. Add this mixture to 403 minims of water at ordinary temperature, and shake vigorously until the crystals of chloretone are entirely dissolved. Inject slowly and wait about 5 minutes before proceeding to extract.

For Hypersensitive Dentine: Painful Gums, Exposed Pulps, etc., Chloretone, 100 grains, Sulphuric ether 1½ fl. drachms. Saturate pledgets of cotton with this solution and apply to painful area.

Q. What is *Trichloracetic Acid?*

A. Formed from acetic acid, three atoms of its hydrogen being replaced by chlorine.

Q. What are its properties and action?

A. Occurs in colorless deliquescent crystals; agreeable odor; readily soluble in water and alcohol; weak solutions—antiseptic, stronger—concentrated are powerful caustics and escharotics.

Q. What are its Therapeutic Uses?

A. Stimulant and antiseptic for putrid wounds, ulcers, etc.

Q. What are its Dental Uses?

A. As an escharotic in pyorrhœa alveolaris; as a solvent for calculi (10 per cent. solution): as a stimulant and astringent mouth-wash (one per cent.).

Q. What is *Pyrozone?*

A. An aqueous or ethereal solution containing an exact percentage of peroxide of hydrogen: prepared in three strengths—aqueous, ethereal and caustic, the aqueous being 3 per cent., ethereal 5 per cent. and the caustic 25 per cent.; the 3 per cent. is a mild antiseptic, with no toxic properties, the 5 per cent. is also antiseptic and non-irritating: the 25 per cent. is a bleaching agent and a powerful caustic.

Q. What are their Therapeutic Uses?

A. The 3 per cent. is employed externally and internally where a disinfectant is indicated; the 5 per cent. is also antiseptic, and a bleaching agent: the 25 per cent. is employed for ulcers, eczema, syphilitic patches, putrid wounds, etc.

Q. What are the Dental Uses of pyrozone solutions?

A. The 3 per cent. solution as a mouth-wash for inflamed surfaces: the 5 per cent. solution as a disinfectant and antiseptic for pus and mucous secretions and to render mouth aseptic; the 25 per cent. solution is employed as a bleaching agent: a caustic to diseased parts, causing resolution.

Q. What is *Eucaine?*

A. Hydrochlorate of Cocaine is obtained by the action of ammonia on acetone which forms triacetonamin, to which is added hydrocyanic acid.

Q. What are its Properties and Action?

A. White, neutral crystalline powder, soluble in 10 parts of cold water, and forms a stable solution which boiling does not deteriorate: unlike cocaine.

Q. What are its Dental Uses?

A. In from 2 to 5 per cent. solution it is employed hypodermically as a local anæsthetic in extraction of teeth: applied locally in lancing abscesses, removal of tumors, and necrosed bone; also cataphoretically for hypersensitive dentine, and removal of pulp, etc.: a 10 per cent. solution has given satisfactory results as a local anæsthetic.

Q. What is *Formaline?*

A. A 40 per cent. solution of pure formaldehyde in water.

Q. What is Formaldehyde?

A. A gaseous body formed by subjecting methyl-alcohol to oxidation.

Q. What are the Properties and Action of Formaline?

A. It is employed either in a gaseous or liquid form: non-toxic, with a penetrating odor; brought in contact with the animal skin, it causes a tanning effect, making it impermeable and finally causes necrosis; it destroys tissue with suppuration.

Q. What are its Therapeutic Uses?

A. It is germicide, disinfectant and antizymotic, and is used in aseptic and antiseptic surgery.

Q. What are its Dental Uses?

A. As a germicide, disinfectant, etc.: it is employed as an antiseptic and sterilizer in putrescent pulp-canals, and to devitalize pulps of teeth.

Q. Derivation of *Borax—Sodii Boracis*, $Na_2B_4O_7 + 10H_2O$?

A. A native salt; produced artificially by boiling together native boracic acid and carbonate of soda. Refrigerant, antacid, diuretic, detergent, emmenagogue.

Q. What are its Therapeutic Uses?

A. Internally for infantile diarrhœa, solvent for calculi, dropsy; externally for ulcerations, etc.

Q. Dental Uses?

A. Ulcerations of mouth, inflamed oral mucous membrane, fissured or cracked tongue, etc. Combined with honey—*mal boracis*, it is effective in apthæ, ulcers of mouth and inflamed surfaces, etc. It is used in the dental laboratory as a flux in melting and soldering metals, and to harden plaster models.

Operative Dentistry.

Q. What does the term Dental Technics imply?

A. A systematic series of manipulative procedures pertaining to practical dentistry for the beginner.

Q. Define *Operative Dentistry?*

A. That department of Dentistry which pertains to the surgical treatment of diseases of teeth and surrounding parts.

Q. What does an *Examination of the Mouth* comprise?

A. The number, arrangement, form and quality of the teeth, and the general condition of the gums and mucous membrane, and the appearance and reaction of the saliva.

Q. What does a special *Examination of the Teeth* comprise?

A. Their condition—the location and extent of caries and other defects if they exist.

Q. What instruments are required for such an examination?

A. Mouth mirror, and suitable explorers.

Q. What general instructions should be given to a patient in the hygienic care of the teeth?

A. The proper use of the tooth-brush on rising in the morning, directly after each meal, and immediately before retiring at night; the use of antacid, antiseptic, or germicidal dentifrices, or mouth-washes as each individual case may require.

Q. What does *Cleansing the Teeth* consist in?

A. The removal of Calculus, discolored marks or stains and all foreign matter.

Q. How is *Calculus* removed?

A. By sharp steel instruments called Scalers, and the surfaces polished with powdered pumice and polishing putty (Oxide of Tin), applied on wood points and soft rubber disks; the stain (especially green stain) is removed by the free application of iodine and the use of the polishing powders.

Q. What is the object of temporarily *Separating Teeth?*

A. To afford room for examination, and also for properly operating upon the approximal surfaces.

Q. What substances are used for *Separating Teeth?*

A. Wood, tape, cotton, silk or linen thread, wedge-forceps, or screw separators.

Q. Why should special care be taken in Wedging Superior Central Incisors?

A. These teeth being located at the junction of the two superior Maxillary bones on each side of the median or separating line, too rapid or forcible wedging may cause a permanent separation.

Q. How may Separating be done by the cutting away of tooth substance?

A. With Chisels or disks in such a manner as not to disfigure the external surfaces; removing the greater portion from the mesio-palatine and disto-palatine angles.

Q. What does the *Preparation of a Cavity for Filling* consist in?

A. Opening the cavity, removing the decay, and forming the cavity.

Q. How are Cavities classified?

A. Simple cavities, those on exposed surfaces; Compound cavities, those extending from one surface to another surface.

Q. What does the *Opening of a Cavity* consist of?

A. In enlarging the orifice of a cavity of decay so as to render accessible all parts of cavity.

Q. What Instruments are used for Opening Cavities?

A. Chisels, Burrs and Excavators.

Q. In removing Carious Dentine, in what direction should the cutting be done?

A. In a direction from the pulp to cause less pain.

Q. What are the general rules in *Forming Cavities?*

A. Remove all frail and overhanging walls; remove all unsupported enamel from the cervical wall, making this wall at right angles to the surface of the tooth; make a well defined undercut at cervical wall of incisor cavities and also at part next to cutting edge to retain filling; undercut or groove the lateral walls of proximal cavities in bicuspids and molars, and either slightly undercut the grinding surfaces, or, if it is thin, cut through it extending the grooves of the lateral walls through the opening on the grinding surface, thus presenting a dove-tailed outline. If cavity is of large size, the lateral walls should be cut away, so that the filling alone will come in contact with the adjoining tooth, leaving the margins free; all angles should be rounded and made smooth. For cohesive gold, "retaining pits" are made with a small, flat, square pointed drill, in the dentine near the enamel, and usually parallel with the long axis of the tooth; never drill towards the pulp; a depth of retaining pit equal to diameter of drill is sufficient; in bicuspids one retaining pit in middle portion of cervical wall is usually sufficient; no retaining pits are necessary for non-cohesive gold, but undercuts or grooves. In grinding surface cavities the walls should be nearly parallel with slight undercuts at opposite sides; the same rules apply to buccal, palatal, or lingual cavities.

Q. How are carious cavities which extend beneath the gum exposed?

A. By first dissecting away the gum between the teeth with a sharp bistoury and gently forcing gutta percha, or cotton rendered aseptic by aristol or other antiseptic, against it; if hypersensitiveness of gum is present, an application of cocaine solution may first be applied.

Q. How is moisture excluded from cavities during Filling?

A. By the use of napkins; bibulous paper, saliva pump, or rubber dam, the latter being the most perfect means.

Q. How is the *Rubber Dam prepared, and applied?*

A. By using a piece of medium thickness, about seven inches square, into which holes are punched about one and a half inches from the edge, and from one-eighth to one-fourth of an inch apart, and usually on a line parallel with edge of rubber; a holder is fastened to each upper corner of the dam and the elastic portion passed around head and tightened; the rubber is then stretched over the teeth which pass through the holes, and secured by a ligature wound twice around each tooth and drawn tight enough to turn the edge of the dam upward on the neck of the tooth and tied firmly with a square or surgeon's knot; a clamp may be used to hold the dam on the tooth, instead of a ligature; weights are also used for holding down the lower portion of the dam.

Q. What are Clamps?

A. Flexible steel instruments for securing the rubber dam from displacement.

Q. What are Dam-holders?

A. Elastic bands to draw aside the corners of the rubber dam and give ready access and admit light.

Q. What *Metals and Plastic Materials* are employed for Filling Teeth?

A. Gold, which occupies the first place, and Amalgam, which occupies the second place; also tin foil, gutta percha, and the different zinc cements.

Q. Describe the qualities that gold possesses to make it so desirable as a filling material?

A. Gold is the best material for filling teeth because it is so indestructible, because of its beauty, because it harmonizes with all complexions, and most shades of teeth, because it is free from the contaminating influences of the mouth, because of its capability of being made smooth, because it is durable and any tarnishing is superficial, because it does not dissolve in the oral fluids, nor change form under the pressure of mastication.

Q. In what two forms is Gold prepared?

A. In Foil, and Crystal or Sponge Gold.

Q. What are the two qualities of Foil Gold?

A. Non-cohesive and Cohesive.

Q. What is *Non-cohesive Gold?*

A. Foil so prepared that it will not cohere when the surfaces are brought in contact.

Q. What is *Cohesive Gold?*

A. Gold prepared by annealing so that the particles will cohere when the surfaces are brought in contact.

Q. On what principle is Non-cohesive or Soft Gold worked?

A. On that of *wedging.*

Q. On what principle is the Cohesive Gold worked?

A. On that of *welding.*

Q. How is Gold Foil numbered?

A. A sheet being four inches square is numbered according to its weight, a sheet of No. 4 weighing 4 grains.

Q. What is the weight of each Book of Foil?

A. One-eighth of an ounce.

Q. What numbers are used according to the thickness?

A. From No. 2 to No. 120 or thicker; all foil thinner than No. 20 is made by beating; all from No. 20 to 240 by rolling.

Q. What are the various forms in which Gold may be prepared for filling teeth?

A. The Rope, Tape or Ribbon, Mat, Cylinder, and Block.

Q. How is the Rope made?

A. By rolling the strip of foil in a napkin, or by first making a loose tape and twisting it.

Q. How is the Tape made?

A. By folding any portion of a sheet over and over again unti a desired width and thickness is obtained.

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Q. How is the Mat made?

A. By cutting the Tape transversely into small pieces.

Q. How is the Block made?

A. By folding a Tape on itself a number of times; a loose Block is made of Cohesive Gold by laying sheet upon sheet until a number of layers are so placed, when the mass is cut into squares with a very sharp knife.

Q. How is the Cylinder made?

A. By rolling a tape of non-cohesive gold on a fine broach, commencing at one end of the tape and continuing the movement until the required size is reached; loose cylinders are made by folding the tape, which is loosely folded, lightly around the broach.

Q. How is non-cohesive Gold packed?

A. By the wedging process, one end of the tape or rope being carried into the cavity and condensed against the distal wall, and the remainder introduced in the form of folds extending from the bottom of the cavity to, and some little distance above, the orifice; this is continued until no more folds can be introduced, every fold being pressed towards the side of the cavity; a wedge-shaped plugger is then passed into the filling and the gold pressed towards the sides of the cavity, additional gold is then added as at first, and the wedging process repeated until the cavity is full; the gold projecting above the orifice is then condensed with a large serrated plugger followed by others of smaller size until the surface is thoroughly condensed; the surplus gold and inequalities of surface are then ground or filed down and the uniform surface burnished and polished.

Q. How is Cohesive Gold introduced?

A. The filling is first started in the retaining pits which are solidly filled and united by building the gold, which is introduced in small masses, across the bottom of the cavity and condensed by hand pressure or by mallet force, the pluggers being finely serrated and rather broad; the gold is then built up higher against the walls of the cavity than in the centre until the surface is reached, when the centre is built up and a contour surface formed, which is burnished and polished.

Q. For what is Cohesive Gold especially adapted?

A. For starting fillings in shallow or irregular cavities, and for the surfaces of fillings.

Q. How are Cylinders introduced?

A. By first placing with the introducing plyers, loose rolled cylinders against the walls of the cavity and condensing them laterally;

hard rolled cylinders are then introduced and condensed in like manner, (each cylinder extending from the bottom of cavity to a little above the orifice), until the cavity is full; a wedge-shaped instrument is then pressed into the centre of the mass of gold and as large a cavity made as is possible, when smaller cylinders are introduced until no more gold can thus be added, when the surface gold is condensed, the excess ground or filed down, and the surface of the filling burnished and polished.

Q. How is Crystal Gold made?

A. By electrolysis.

Q. What is it useful for?

A. For starting fillings in cavities without retaining points, as it is free from any tendency to curl when condensed.

Q. How is it introduced?

A. In thin layers or masses, each being thoroughly condensed before another layer is added.

Q. Why is it necessary to anneal Cohesive Gold Foil?

A. Because exposure renders it non-cohesive, owing to a condensation of gases or moisture from the air upon the surface.

Q. How is the *annealing* done?

A. By holding the gold over, or passing it through the flame of an alcohol lamp, or on a plate of mica or platinum over the flame.

Q. What advantages has *Gold and Platinum Foil?*

A. Where great hardness of surface is desired, as on the cutting edges of teeth, and a color like that of the tooth.

Q. What is a *Dental Matrix?*

A. A plate or band of metal so applied to a tooth to be filled, as to supply a lost wall, and form a compound cavity into a simple one.

Q. What forms of mallets are used for condensing Gold?

A. Hand, Automatic, Electric and Engine.

Q. How may the Hand Mallet be used?

A. By the operator himself holding the plugger in one hand and striking the blow with the other, or the blows may be struck by an assistant.

Q. In the use of *Automatic Mallet* how is the blow struck?

A. By the expansion of a spiral spring.

Q. What is claimed for the Electric Mallet?

A. Quick action, and better solidity of impaction.

Q. How is the blow struck by the Engine Mallet?

A. By the action of a cam on a pulley which, as it revolves, strikes upon the end of the plugger.

Q. What should be the nature of Mallet force?

A. The blow should be rather light but sharp and quick, so that the force is expended upon the surface of the filling, as a slow, heavy blow spreads the mass of gold and may injure the tooth.

Q. How should the margins of a cavity be protected?

A. By having a considerable thickness of gold over margins, so that the blow may not fracture the enamel.

Q. What is the most satisfactory method of filling approximal surface cavities of bicuspids and molars?

A. To restore with the filling material the original outline of the tooth; restoration of contour.

Q. Are the different forms of gold ever combined in filling a single cavity?

A. Yes, the filling may be commenced with blocks or cylinders of semi-cohesive gold (non-cohesive annealed), and to this may be attached cohesive gold; or non-cohesive gold may be packed at the cervical wall and this followed by semi-cohesive gold, followed by a layer of cohesive; or again, the margins and body of the cavity may be filled with semi-cohesive gold and finished with cohesive; or the filling may be started with crystal gold.

Q. What advantages are claimed for Tin as a filling material?

A. Easy manipulation, and less conducting property.

Q. In what forms is Tin used for filling teeth?

A. In form of foil, shavings, and thin strips.

Q. What property renders Tin valuable?

A. It is a poorer thermal conductor than gold, and is valuable in deep cavities approaching near to pulp: it is also easily inserted and condensed.

Q. What objections to Tin?

A. Its color and softness.

Q. What metals are essential constituents of *Amalgam?*

A. Silver, Tin and Mercury.

Q. What other metals are frequently added?

A. Gold, Copper and Zinc, in proportions varying from 3 to 7 per cent.; also Platinum.

Q. How is an Amalgam Filling prepared?

A. A sufficient quantity of the filings of the ingot composed of all the constituents except mercury, is placed in a small mortar, or in the palm of the hand, mercury is added and the whole rubbed thoroughly together; the excess of mercury is squeezed out through chamois skin or pressed by flat-plyers; it may be washed in alcohol or solution of bicarbonate of soda (although some think washing injures it).

Q. How is Amalgam introduced?

A. By inserting small pieces and pressing them against all parts of the walls of cavity then rubbing and gently tapping with the plugger, and thus filling the cavity half-full; then covering the surface of the amalgam with a layer of bibulous paper or cotton, or tin foil, and pressing on this with the burnisher so as to absorb the surplus mercury; more amalgam is then added and the burnishing repeated until the cavity is filled, when the surface is finished smooth, and, at a subsequent sitting, cut down and polished.

Q. What is *Hill's Stopping* composed of?

A. Gutta percha, carbonate of lime and quartz.

Q. What is it used for as a Filling Material?

A. Temporary crown fillings, Root-canal fillings, cavities with frail walls, and as a non-conducting layer under metallic fillings, although pure gutta percha is generally employed for such a purpose.

Q. How is Hill's Stopping introduced?

A. By cutting into small pieces on a warm slab of porcelain and inserting one piece at a time until the cavity is filled; a coating of resin will cause the gutta percha to adhere firmly.

Q. How is Oxychloride of Zinc introduced as a filling material?

A. The liquid and powder are mixed on a glass slab to the consistency of thick paste and inserted into the cavity before its adhesive property is lost by hardening; used for temporary fillings and Root-canal fillings.

Q. What advantage has the *Oxyphosphate of Zinc* as a filling material over the oxychloride?

A. It is more durable for exposed fillings; but it has no antiseptic properties and in time becomes porous.

Q. What precautions are necessary in the use of the Zinc filling materials?

A. In mixing to work the powder in the liquid thoroughly, and a little at a time; to insert quickly as soon as it begins to set; perfect dryness of cavity; no hard burnishing to break up the crystallization; to keep filling dry for from 20 to 30 minutes, and cover surface after it is finished with melted wax, sandarach varnish or liquid gutta percha.

Q. What is the first requirement in preparing a cavity for the filling?

A. To remove every portion of tooth structure in the least degree affected or softened by the caries.

Q. How should the cavity to be filled be formed?

A. Of such a shape in the arrangement of its walls that the filling will not be displaced.

Q. How must the filling material be introduced into the cavity?

A. Placed solidly in contact with every part of the walls of cavity so as to make an absolutely water-tight joint at every part.

Q. How many acid-forming micro-organisms has a filling to contend with, comparatively?

A. Thousands so small that many of them are but one-half micron in diameter; there or 25 thousand microns in one inch, or 1,000 in a millimeter.

Q. What should be the form and finish of surface of a filling?

A. Such as will prevent any lodgments on its surface or about its margins; no overlapping margins or rough points; a smooth finish is a necessity not only for appearance, but as a curative and prophylactic agent.

Oral Surgery.

Q. What are the principal indications for the *Extraction of Teeth?*

A. Uncurable abscess, and periodontitis; hypercementosis; to prevent, and correct irregularity; to prevent deciduous teeth from injuring permanent teeth either by obstructing the eruption of the latter or to relieve inflammation; and to prepare the mouth for an artificial denture.

Q. Condense the indications for Extraction of Teeth?

A. When a tooth or part of tooth can be made of no further use, or when its retention cannot be accomplished with comfort to patient, or it prevents, by its presence the correction of more important teeth.

Q. When is Lancing the Gum necessary in the Extraction of Teeth?

A. In the case of roots of teeth, and to prevent laceration of gum in the case of a tooth standing alone; or very firmly articulated.

Q. For *Extracting Teeth* what Forceps are necessary?

A. Two Superior Molar (one for each side); One Inferior Molar (for either side); one for Superior Central and Lateral Incisors, Superior Cuspids, and Superior Bicuspids; one for roots of Teeth; one for Inferior Incisors; one for Inferior Cuspids and Bicuspids. Such a list as this gives the least number that will answer for the purpose.

Q. What 3 forces are applied in extraction of teeth?

A. Traction, Rotation and Pressure.

Q. Describe the operation of extracting the Six Anterior Teeth of Upper Jaw?

A. The operator stands at the right with the left hand pressed firmly against the patient's head, to hold it securely; with the forefinger of left hand raise the upper lip, and with the remaining fingers of same hand protect the lower lip; apply the edges of the beaks of forceps well under the free edge of gum, and grasp neck of tooth as high up as possible and with a firm hold to prevent the forceps from rotating; for the incisors apply the *rotary* motion, following every movement with the eyes; do not attempt to force tooth from its cavity until the connection with the jaw is broken; for the cuspids the outward and inward motions are given.

Q. Describe the operation for the Superior Bicuspids?

A. The operator occupies the same position as for the incisors; the forceps are carried as high up on the necks as is possible, and the outward and inward motions given.

Q. Describe the operation for the Superior 1st and 2d Molars?

A. The operator occupies the same position as for the anterior teeth; the cheek should be well distended by the fingers of the left hand; the forceps are so adjusted that the single pointed beak is pressed into the space between the two outer or buccal roots, and the concave beak encircles the single palatal root; the outward and inward motions are then given.

Q. Describe the operation for the Superior 3d Molars?

A. The operator occupying the same position as for the anterior teeth, a rotary motion is useful in connection with the outward and inward motions, especially if the roots of these teeth are so joined as to form one of a more or less conical form.

Q. Describe the operation for the Inferior Incisor Teeth?

A. The operator occupies a position somewhat higher and a little behind the patient on the right side, supporting the chin with the palm of the left hand, the fingers of same hand pressing away and protecting the lower lip; the inward and outward motions are then given, and care taken that the adjoining teeth are not injured.

Q. Describe the operation for the Inferior Cuspids and Bicuspids?

A. The operator occupies the same position as for the Incisors, and uses the inward and outward motions, and in the case of the bicuspids, which generally have a single root, the rotary, in connection with the inward and outward motions, is employed.

Q. Describe the operation for the *Inferior Molars?*

A. The operator occupies a higher position than for the Superior Molars, standing behind the patient, with the palm of the left hand against the side of the face, and supporting the lower jaw with the third and fourth fingers, while the first and second fingers raise the upper lip and press down the lower lip; the inward and outward motions are then made, and also the rotary in the case of the inferior third molars. Care must be taken that the forceps do not strike against the upper front teeth when the tooth suddenly leaves its cavity.

Q. Give general rules in regard to the application of the forces required for the *Extraction of Teeth?*

A. For *Superior Central* and *Lateral Incisors*—first, traction in direction of a line drawn through greatest axis of tooth; second, rotation, as there are single-rooted teeth; third, labial pressure.

For *Inferior Central and Lateral Incisors*—traction in the line of greatest axis of tooth, slight or no rotation, slight labial pressure.

For *Superior Cuspids*—traction to a considerable degree, slight rotation especially when the 1st bicuspid and lateral incisor are in position, labial pressure.

For *Inferior Cuspids*—traction, slight rotation, buccal pressure.

For *Superior Bicuspids*—traction principally, buccal pressure; other forces should be slight.

For *Inferior Bicuspids*—traction principally, in a direction which would move the tooth, if it suddenly loosens, towards the 1st Superior molar, or back of where it normally occludes, and slight rotation only.

For *Superior 1st and 2d Molars*—traction in direction of a line drawn from apex of palatine root to centre of occlusal surface: no rotation until the tooth is somewhat loose and a smaller diameter of roots meet with a larger diameter of root-cavities; the first traction in a buccal direction on account of these teeth having one buccal and two palatine roots; pressure steadily buccal until orifice of alveolar cavity is opened.

For *Inferior 1st and 2d Molars*—traction upward and backward, no rotation; pressure directly buccal.

For *Superior 3d Molars*—downward and buccal traction; rotation in a direction that would bring the back of the hand towards the median line: pressure outward and buccal, and at same time backward.

For *Inferior 3d Molars*—traction upward and backward; lingual pressure, or in the line of least resistance, but not too great pressure lingually.

Q. How are *Roots of Teeth Extracted?*

A. Briefly.—By using forceps with long, narrow sharp beaks, by elevator, etc., by cow-horn forceps, by alveolar forceps to cut through process to root, by elevator forceps using adjoining tooth as a fulcrum, by splitting forceps, etc., etc.

Q. How are *After-Pains of Teeth-Extraction* treated?

A. By introducing Orthoform powder into the alveolar cavity, or the careful inhalation of one or two minims of amyl nitrite; or one drop of a one per cent. solution of nitro-glycerine in half a glass of cold water.

Q. What antiseptic applications are serviceable after extraction?

A. Phenole Sodique, or the following combination: listerine and glycerine of each ℥j, Rose water ℥vij; use as a gargle, a wine-glassful several times a day.

Q. Name the *Casualties of Extraction*, or *Accidents* liable to occur?

A. Fracture of tooth, fracture of jaw, dislocation of jaw, accidental extraction of wrong tooth, extraction of two teeth instead of one, removal of capsule of developing permanent tooth in extracting its temporary predecessor, laceration of gum, wounds from slipping of instrument, especially the elevator, extracted tooth falling into air passages, or falling into pharynx and being swallowed, injuring inferior maxillary or other nerves, fracture of a tooth other than the one to be extracted, cutting lip in removing a jagged tooth, forcing tooth or root into antrum, wounding the tongue with forceps, bruising lower lip by pressure of forceps, pain after extraction, excessive hemorrhage.

Q. What characteristics are peculiar to teeth difficult to extract?

A. Short, thick crowns, incisors thick and strong which occlude with the inferior, small or constricted necks and long roots, with dense process, hypercementosed teeth, superior cuspids, also third molars partly erupted.

Q. What precautions must be taken when Extracting Teeth?

A. To avoid grasping the teeth too forcibly, as undue pressure is liable to fracture them; to avoid a rotating movement of the forceps on the necks of the teeth having a single root; to avoid inclosing the gum between the beaks of the forceps; to prevent the forceps from impinging upon teeth adjoining the one to be extracted.

Q. Why should dental instruments be sterilized?

A. To prevent infection.

Q. Describe a simple method for sterilizing instruments?

A. Immersing them from 3 to 5 minutes in an alkaline solution of boiling water and bicarbonate of soda, 2 per cent.; or in solutions of Lysol, Resorsin, Hydronaphthol, Carbolic Acid, Bichloride of Mercury—the latter, however, will rust instruments.

Q. What does *Hemorrhage* imply?

A. Flow of blood from the vessels.

Q. What is a *Hemorrhagic Diathesis?*

A. A habit or disposition of body peculiarly susceptible to a flow of blood, and is symptomatic of many diseases.

Q. Name some of the diseases such a diathesis may accompany?

A. Scurvy, Anemia, Dysentery, Typhus fever, and Purpura.

Q. What else may favor its induction?

A. Certain pernicious habits causing specific disorders, derangement of health, excessive smoking, drinking large quantities of water, certain poisons such as the alkalies, mercury, iodine, etc.

Q. Do all cases of hemorrhage depend upon such a diathesis?

A. No, for there are local causes, and in the majority of cases of hemorrhage following the extraction of teeth, it is due to a want of contractility in the vessel divided, and the inability of its coats to contract, although the condition of the blood is normal and no susceptibility, such as diathesis, exists.

Q. What may be the cause of this want of contractility?

A. Union between the external coat of the artery and bony wall surrounding it.

Q. Name the circumstances in which hemorrhage from the dental structures may occur?

A. By exudation through the thin structures when the blood is in a very fluid state; by the passage of blood through diseased or injured vessels; from divided vessels; from vessels having weak contractile power, and in cases where the contractile power cannot be exerted.

Q. Name the 3 distinct varieties of hemorrhage?

A. Arterial, Venous, and Capillary.

Q. What characterizes Arterial Hemorrhage?

A. Bright red color of the blood, by its flowing in jets, and by its arrest when pressure is applied above the wound upon the arterial trunk.

Q. What characterizes Venus Hemorrhage?

A. By the dark color of the blood, its steady flow, and its welling up from the bottom of the wound.

Q. What is Capillary Hemorrhage recognized by?

A. The oozing of the blood from the surfaces of the wound.

Q. What is Primary Hemorrhage?

A. The bleeding which occurs at the time of the injury.

Q. What is Secondary Hemorrhage?

A. The bleeding which takes place after the primary ceases, or after reaction is established, or later from the sloughing of ligated vessels and other tissues.

Q. What is Internal Hemorrhage?

A. The bleeding which occurs in the various internal cavities of the body.

Q. What is meant by Extravasation?

A. The escape of blood into the connective tissue.

Q. What constitutional effects are caused by severe hemorrhage?

A. A feeble, fluttering, rapid pulse, colorless lips, surface of body cold, blanched and clammy, respiration slow and sighing, faintness and nausea, great restlessness, roaring in ears, darkness of vision, and a fatal syncope may follow, or recovery may take place, which is generally followed by fever.

Q. Which is the most likely to prove fatal, sudden and severe hemorrhage, or one that is slow and continuous?

A. The sudden and severe.

Q. What is the case in regard to age?

A. Infants are more seriously affected by loss of blood than older patients.

Q. What are the various methods of arresting hemorrhage?

A. By ligation, torsion, pressure, cautery, heat, cold, position, acupressure, forcipressure, styptics, and constitutional treatment.

Q. What are *Styptics?*

A. They belong to the class of astringents, and are medicinal agents capable of arresting hemorrhage. They are divided into Chemical and Mechanical.

Q. What are Chemical Styptics?

A. Those which coagulate the blood and stimulate the tissues to contraction. Examples: tannic and gallic acids, preparations of iron, alum, nitrate of silver, sulphuric acid, actual cautery.

Q. What are Mechanical Styptics?

A. Agents which detain the blood in their substance, or absorb it until it coagulates. Examples: Spider-web, plaster of Paris, absorbent cotton, sandarach varnish on sponge, matico leaf.

Q. What is Styptic Cotton?

A. Cotton impregnated with some chemical styptic.

Q. What is *Styptic Colloid?*

A. Combination of Tannic acid, Collodion, and tincture of Benzoin.

Q. What is Elixir of Vitriol and Tannin?

A. A combination of the glassy salt of sulphuric acid and tannic acid.

Q. What is *Fletcher's Carbolized Resin?*

A. A solution of Carbolic acid and resin in chloroform.

Q. What are *Hæmostatics?*

A. Agents capable of arresting hemorrhage by internal administration.

Q. Name some Hæmostatics for Alveolar Hemorrhage?

A. Tannic acid 3 grains in 1/3 tumbler of water every five minutes, until 3 doses are taken after which the same quantity may be given 15 minutes apart; also ergot, antipyrine, acetate of lead, diluted mineral acids, etc., etc.

Q. Name some of the Styptics useful in Alveolar Hemorrhage?

A. Tannic Acid, Gallic Acid, Solution of Persulphate of Iron, Powdered Subsulphate of Iron, Nitrate of Silver, Sulphuric acid, Picric acid, etc.

Q. What is the Treatment of Hemorrhage following Tooth-Extraction?

A. Elevate the Head, cleanse cavity of clot with warm water, and apply the styptic on cotton to mouth of bleeding vessel, and firmly plug cavity over the styptic with cotton saturated with sandarach, and, if necessary, a compress made of cork, gutta percha, or modeling composition, and the jaws bandaged.

Q. What is a *Gutta Percha Styptic Plug?*

A. Disks of gutta percha saturated with a styptic, and applied by first softening in hot water and then carried with introducing plyers to apex of cavity and condensed firmly.

Q. How can *Hemorrhage from Gums* be controlled?

A. By rinsing the mouth freely with ice water and alum; if this fails, apply tannic acid.

Q. How diagnose between hemorrhage from stomach and hemorrhage from lungs?

A. Blood from stomach is usually of a dark brown color, and is vomited and not frothy, while blood from lungs is of a bright red color and frothy; it is coughed up, not vomited.

Q. What is the treatment for *Hemorrhage from Stomach?*

A. Rest in bed, patient kept from excitement, no stimulants, small pieces of ice swallowed, and teaspoonful doses of vinegar every 10 minutes, ice cold cloths over stomach.

Q. What is the treatment for *Hemorrhage from Lungs?*

A. Place patient in reclining position, but with head raised, a teaspoonful of salt water with same quantity of vinegar; this until internal remedies are resorted to, such as tannic acid solution, acetate of lead, etc., etc.; cloths wrung out in ice water may be applied to chest and neck if the patient is not too weak.

Q. How is *Hemorrhage from Nose* treated?

A. It is usually due to rupture of capillary vessels, or that of a small artery. Patient to sit upright and hold hands above head, a towel wrung out in ice water and small pieces of ice wrapped in it and the towel applied round the neck ; if bleeding continues, have patient snuff up from hand, or inject into nostrils ice water and alum—a teaspoonful of alum to half a glass of water; vinegar used in same manner is also useful ; plugging nostril with cotton saturated in alum water, is also useful.

Q. What precaution must be taken in extracting Deciduous Teeth ?

A. To avoid injuring the developing permanent teeth ; as some of the posterior ones are situated between the roots of the deciduous.

Prosthetic Dentistry.

Q. Define *Prosthetic Dentistry?*

A. The science and art of the replacement of natural teeth by artificial substitutes.

Q. What does the *Preparation of the Mouth for an Artificial Denture* consist in?

A. The restoration of the mucous membrane to a healthy condition, and the removal of all useless teeth and roots.

Q. Why should all diseased roots of teeth be removed?

A. On account of the irritation they cause, uncleanliness, and their effect upon the fit of the artificial denture and also the effect of their subsequent loss upon the adaptation of denture.

Q. What roots, if in good condition, may remain?

A. Roots of Superior Cuspid Teeth, and Roots to which Pivot and Cap Crowns and Bridge-Work can be attached.

Q. After the removal of teeth what anatomical changes occur?

A. The alveolar processes absorb to hard narrow ridges, free of cavities; vault of palate is reduced in depth; and (in case all teeth are removed) chin and nose approximate; muscles of cheeks contract, and expression of face is changed.

Q. What causes the *Absorption of Alveolar Processes?*

A. The loss of nutrition in parts which depend upon the presence of teeth for their vitality.

Q. Describe the change which occurs in the processes?

A. Removal of alveolar walls, and deposition of bone to fill up the deeper portions of cavities.

Q. How long a time does this process of absorption require when all of the teeth of upper jaw are removed at one time?

A. From 9 to 20 months, time varying according to age, diathesis and health.

Q. What effect upon this change of form of mouth has the wearing of a temporary denture?

A. The absorption proceeds more slowly, is less in degree and more irregular.

Q. What characteristics should the natural gums present when in a normal condition?

A. Dense fibrous, elastic, non-sensitive cushions covering the alveolar processes, and capable of sustaining considerable pressure without discomfort.

Q. What is a morbid condition of the gums, which results from hyperæmia of mouth, generally associated with?

A. Inflammation of pharynx, and certain forms of gastric disorders, such as dyspepsia, etc.

Q. What antiseptic and astringent mouth-washes are advisable in such cases?

A. Borine, listerine, borolyptol, etc.

Q. If there are symptoms of stomatitis present, what is an effective solution?

A. Chlorate of potassa, gr. xv to water ℥j.

Q. Name some other affections of the mouth which may contraindicate the insertion of artificial teeth until they are remedied?

A. Gingivitus, calcic inflammation, chronic inflammatory affections, alveolar pyorrhœa, scurvy, etc.

Q. What does the retention or removal of natural teeth depend upon when preparing mouths for artificial dentures?

A. Upon their condition, which may include their strength or frailty of crown and root; the existence or absence of diseased conditions, if the latter, whether they can be restored to health; whether they can be made useful, or whether their presence would interfere with the comfort, usefulness or natural appearance of the artificial set.

Q. What conditions should be determined on examining a mouth for an artificial denture?

A. The character of the denture required—in case of an edentulous mouth, the shape of the jaws whether long or short, hard or soft, deep or shallow; condition of alveolar ridge—firm and solid or soft and flexible; whether the relations of the upper and lower jaws are correct or not—that is, whether one or the other protrudes unnaturally. Also where natural teeth remain, to determine whether the denture is to be in the form of a plate or a bridge; if the former, the manner for its retention; if the latter, the form and anchorage.

Q. What is a general rule in regard to the retention of natural teeth?

A. To retain all healthy teeth and roots.

Q. How should a healthy root be treated when a bridge or plate is not desirable?

A. Retained and crowned if practicable.

Q. Why is the retention of isolated teeth often advisable?

A. Because such teeth will "stay the bite," and limit the degree of pressure on the artificial denture.

Q. On the other hand, what may be the disadvantages in such a case?

A. Isolated teeth will break the continuity of outline of the set, rendering it weaker; and the gum around such teeth is apt to recede at their necks and destroy the adaptation of the denture at such points.

Q. In the lower jaw, the retention of what isolated teeth is an advantage?

A. That of molars, especially if there is one on each side of the jaw, as they not only stay the denture, but also serve as clasp teeth for still further stability: the same may be said of isolated bicuspids.

Q. What isolated teeth is it justifiable to extract?

A. A single lateral incisor in upper jaw, or either a single central and lateral in the lower jaw.

Q. What is the nature of an edentulous mouth after all the teeth have been destroyed by alveolar pyorrhœa?

A. It affords the most unfavorable base upon which to insert artificial teeth, as a spongy thickened membrane remains after the absorption of the processes.

Q. Why is it desirable to retain the cuspid teeth?

A. Because they maintain a contour at the canine prominences owing to the size and location of their roots, which it is difficult to restore by an artificial denture.

Q. When artificial teeth are inserted immediately after the extraction of the natural teeth, how are the former to be arranged?

A. Plain teeth being preferable, their necks should be imbedded from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch into the open alveolar cavities of the extracted teeth.

Q. Why do not artificial dentures inserted over freshly wounded gums cause great irritation?

A. Because the pressure is mainly borne by the roof of mouth, and the plate serves as a cushion, and hastens the healing.

Q. Why are lower dentures more difficult to adapt than upper ones?

A. Because of the great degree of absorption of lower process; the interference of the muscles and ducts, and less area for atmospheric adhesion.

Q. Does an irregular alveolar ridge prevent a denture from fitting well?

A. No; although such an irregularity may interfere with a natural arrangement of plain artificial teeth.

Q. What is a frequent deformity met with?

A. Want of symmetry of alveolar ridge; usually a greater depression on left side than upon right side.

Q. Why is it that a more uniform and regular absorption of process occurs when no denture is worn?

A. Owing to the uniform pressure of food, and absence of the hard irregular surface of a denture pressing on the absorbing tissue.

Q. What advantages result from the wearing of a *Temporary Denture?*

A. Facility in using permanent one; preservation of facial expression; more perfect mastication; prevention of unnatural movements of tongue and muscles of jaws and their proper control.

Q. Should Temporary Dentures be as skilfully constructed as permanent ones?

A. Yes.

Q. How soon after extraction of teeth should temporary ones be inserted?

A. As soon as the inflammatory swelling which follows the operation has subsided.

Q. What is the effect of being without teeth for a long time?

A. Muscles relax; jaw may project unnaturally and assume an undue lateral movement, and tongue acquire erratic movements.

Q. How long after removal of all the teeth in one jaw is it usual for a patient to wait for a Permanent Set?

A. From 9 to 12 months; although the absorption of process may require from 6 months to 3 years after the removal of several or more teeth.

Q. What is the result of permitting teeth without antagonistic teeth to remain in mouth?

A. Their elongation, irritation and loss.

Q. What natural teeth are usually retained for *Clasps or Stays?*

A. First and Second Molar Teeth.

Q. What should be the condition of one or two natural teeth permitted to remain in mouth?

A. Free from caries and other diseases; in proper position; and not affected by recession of gum and absorption of process.

Q. Into what 2 classes may materials employed for obtaining impressions of the mouth be divided?

A. Those softened by heat, and those made into a paste with water.

Q. What *Materials are employed for Obtaining Impressions of the Mouth?*

A. Wax, Gutta Percha, Modeling Composition, Calcined Plaster of Paris.

Q. What are the requisites for an *Impression Material?*

A. Plasticity at ordinary temperatures so as to require moderate pressure and avoidance of displacing parts; sufficient hardness for retention and safe removal; hardening in a short time; and such properties of heat and moisture as will permit it to be tolerated in mouth; freedom from expansion or contraction to any great degree, and of pleasant taste and smell.

Q. Name a reliable test for a perfect impression?

A. The degree of resistance to its removal from mouth.

Q. If there is retching during time it is necessary for an impression to remain in mouth, what is the remedy?

A. Incline patient's head further forward, and direct him to keep tongue and throat quiet, to breathe entirely through nose, and resist tendency to vomit or swallow.

Q. What are the advantages of *Wax as an Impression Material?*

A. Facility with which it is softened and hardened; slight pressure required, and easy removal from mouth; its disadvantage—liability to change shape during its removal.

Q. What is the proper temperature of wax when taking an impression?

A. Between 120° F. and 130° F.

Q. What are the advantages and disadvantages of *Gutta Percha as an Impression Material?*

A. Plasticity so as to copy finest lines; elasticity until it hardens; disadvantages—shrinkage on cooling, and the high temperature necessary to render it sufficiently plastic.

Q. At what temperature is it fit for impressions?

A. 185° to 200° F., made plastic in hot water, and introduced into a warm cup.

Q. What are the advantages of *Modeling Composition?*

A. Sharpness of Impression; plasticity, facility of use, and cleanliness.

Q. How is it prepared for taking an Impression?

A. Softened in boiling water; wiped dry before it is placed in tray; and before removal from the mouth, allowed to partially harden.

Q. What process will cleanse impression trays from any modeling composition which may adhere to them?

A. Boiling the trays in sal soda water.

Q. What is *Plaster of Paris?*

A. Gypsum, composed of Lime 28 parts, Sulphuric acid 40 parts, Water 18 parts.

Q. What are the advantages and disadvantages of *Calcined Plaster of Paris* as an Impression Material?

A. It is the most reliable, as it copies the finest lines, and will fracture instead of change form; the only disadvantage is that it may not exert the pressure required on certain tissues in some particular cases.

Q. How may the quality of calcined plaster be determined by a simple test?

A. By squeezing a small quantity in the hand; if it adheres together in a mass it is of good setting quality; if it falls to powder like dry sand it is imperfect.

Q. What should be the consistence of the Plaster batter for an impression?

A. Just thick enough to run freely.

Q. What will hasten the Setting of Plaster?

A. Chloride of Sodium; Sulphate of Potash; Warm Water.

Q. What quantity of each?

A. Of Salt—1 grain to every ounce of water; of Sulphate of Potash—¼ grain to every ounce of water.

Q. How should the Plaster be added to the water in mixing?

A. By sprinkling the plaster in the water until it rises to the surface; stirring thoroughly until all air is expelled.

Q. Does Plaster expand on Setting?

A. Yes; coarse plaster more than fine; and the longer plaster is stirred the less it will expand.

Q. Does fine or coarse plaster make the hardest model?

A. Coarse plaster.

Q. Describe the preparation of surfaces of impressions of the different materials?

A. For wax, a slight coating of oil or soap-solution; for gutta percha, oil; for modeling composition, wet the surface; for plaster, shellac or sandarach varnish and oil or soap-solution, or soak in water.

Q. What are the important requisites for an *Impression Cup or Tray?*

A. It should be of a proper shape, and of a size to admit of easy introduction into mouth, and adaptation to the case on hand; large enough to cover ridge $\frac{1}{8}$ to $\frac{1}{4}$ of inch between outer rim of cup and gum; of a depth to give a uniform thickness of impression material of $\frac{1}{8}$ to $\frac{1}{6}$ of an inch, and not less at any point than $\frac{1}{2}$ of an inch, except where natural teeth come in contact with cup; and rigid enough to bear pressure on it.

Q. Why is more care necessary in selecting a full lower than an upper cup?

A. Owing to the divergence at posterior portions of lower jaw and narrowness of alveolar ridge, as a slight variation may cause a lower cup to cut into soft tissues and injure impression.

Q. What are *Impression Trays or Cups?*

A. Recepticles employed to contain impression materials and carry them into the mouth, retain them in position until they harden, and to insure the safe removal of impression, and retain the same during the making of the model or die.

Q. What are *Special Trays?*

A. Those differing from the ordinary forms and designed for special cases.

Q. Of what materials are they usually made?

A. Of gutta percha or sheet metal, such as lead, etc.

Q. What are the various forms of *Impression Trays* in use?

A. Full upper and full lower, partial upper and partial lower, which include cups with square bottoms for partial cases, and cups with concave bottoms for edentulous mouths; also partial trays, with modifications of each variety.

Q. How is the Model or Cast obtained?

A. By pouring Plaster batter into the Impression of the Mouth.

Q. What forms of *Plaster Models* are used?

A. Deep and Shallow; deep for sand-moulding to obtain metal dies, and shallow for plastic work such as vulcanite and celluloid; a definite form being given to the former in order that they be drawn from the sand mould without dragging.

Q. How may the plaster teeth, which represent the natural teeth on the model, be strengthened to prevent their fracture?

A. By inserting metal pins in the centre of each tooth cavity of the impression before pouring the plaster model.

Q. How are Impressions removed from Plaster Models?

A. From wax, gutta percha and modeling composition impressions by immersing in hot water; from plaster impressions by careful tapping to loosen impression, or in some cases of undercut by breaking the impression after separating the cup from it, into sections; in other cases by carefully cutting through the impression down to the surface of model at certain points and breaking off the sections.

Q. What varnishes are used for plaster impressions and deep sand-moulding models to coat their surfaces and render them hard and smooth?

A. Shellac and Sandarach.

Q. What is the composition of each?

A. Shellac five ounces to one quart of alcohol; Sandarach five ounces to one quart of alcohol.

Q. What is the composition of the *Soap Solution?*

A. Shavings of white castile soap one ounce, wax one ounce, water one pint; first dissolve the soap and wax in warm water.

Q. Are Plaster Models for plastic work, such as vulcanite and celluloid, varnished?

A. No, as the varnish would discolor the vulcanite and celluloid plates. (For *Selection* and *Arrangement* of artificial teeth see Part II.)

Q. What governs the choice of base for an artificial denture where such is admissible?

A. For full sets gold and continuous gum are considered to be the most desirable; it is claimed that metal is more congenial to tissues of mouth than a vegetable base; where weight is an advantage in the case of lower sets, continuous gum, or Weston or Watt metal bases are desirable; vulcanite answers best in mouths with a high vault of palate, and where the tissues are firm and healthy; for flat mouths with loose, spongy tissues, metal answers better than plastic materials; where vulcanite irritates the mouth, cast metal bases may be substituted with advantage. Bridge-work has almost entirely superseded clasp-plates where anchorage or abutment teeth are available.

Vulcanite.

Q. What is *India Rubber?*

A. Caoutchouc (Ko chŭck). A peculiar substance composed of carbon and hydrogen, found in suspension in the milky juice of the *Siphonia Elastica* or Rubber Tree.

Q. How is the juice obtained?

A. By tapping the trees.

Q. What does the juice resemble in color and consistence?

A. Cow's Milk.

Q. When freshly prepared what is the appearance of pure rubber?

A. Colorless and translucent; impurities render it dark in color.

Q. What does *Caoutchouc* consist of?

A. It is a hydrocarbon consisting of C_9H_7.

Q. What are its properties?

A. It is a bad conductor of heat, and a non-conductor of electricity; its texture is not fibrous, and will absorb from 18 to 26 per cent. of water; cold and long quiescence render it hard and stiff; when heated gradually it softens, and at 240° F., it begins to melt and remains semi-fluid after cooling; it begins to fume at 398°, and when exposed to a red heat will yield a rich gas which burns with a sooty flame. By boiling it swells to some extent and is more easily affected by solvents.

Q. What are *Solvents of Rubber?*

A. Ether free from alcohol; chloroform; oil of turpentine; oil of lavender; boiling linseed oil; bisulphide of carbon; cold tar; naptha; benzol.

Q. Will hot or cold water have any solvent action on Rubber?

A. No.

Q. What will prevent Rubber from deteriorating when exposed to oxygen in the light?

A. Keeping it close, and in the dark.

Q. What is *Dental Vulcanite?*

A. A mixture of pure rubber and sulphur.

Q. What is the composition of the strongest Vulcanite?

A. Rubber 48 parts, Sulphur 24 parts; no coloring matter.

Q. What is the composition of the Red Vulcanite?

A. Rubber 48 parts, Sulphur 24 parts, Vermillion 36 parts.

Q. What is the composition of Black Vulcanite?

A. Rubber 48, Sulphur 24, Ivory or Drop Black 36 parts.

Q. What is the effect of heating vulcanite to a temperature of about 235° F.?

A. The sulphur incorporated with it melts and the greater part of it combines with the hydrogen of the rubber to form hydrogen sulphide, the remaining full equivalent of carbon, and what is left of the hydrogen and sulphur under the effect of a higher temperature are converted into the substance known as hard vulcanite.

Q. What is the effect of raising the temperature, when vulcanizing, slowly?

A. All of the H_2S will escape, and the product will be uniformly compact and dense.

Q. What is the effect of raising the temperature rapidly?

A. The outer surface will become dense and hard from its loss of H_2S, and the escape of gas from inside be prevented, hence porosity.

Q. How may Vulcanite be bleached?

A. By immersion in alcohol and exposure to rays of sun; a glass tumbler being employed to contain the alcohol, which is covered with a flat piece of window-glass.

Q. Why does Vulcanite become porous when in thick masses?

A. Owing to the retention of sulphuretted hydrogen and other sulphur gases.

Q. How is the tendency to porosity overcome?

A. By gradually raising the temperature and consuming longer time in vulcanizing.

Q. What is the difference between the Soft Vulcanite of Rubber Goods and the Dental Vulcanite?

A. The former consists of rubber incorporated with less than one-fourth its weight of sulphur; the latter of rubber incorporated with more sulphur, requiring a longer time to vulcanize.

Q. What is *Pink Rubber?*

A. A lighter colored vulcanite obtained by adding 12 parts or more of oxide of zinc or white clay to the red vulcanite formula.

Q. What is *Weighted Rubber?*

A. Dental vulcanite incorporated with particles of pure metals such as tin and platinum to give weight to lower dentures.

Q. What are the Properties of Dental Vulcanite?

A. Extreme hardness and toughness when properly vulcanized; softness and elasticity for certain uses; extreme lightness; power of resistance to most chemical agents; facility with which it is manipulated; and closeness of adaptation.

Q. Why is it impossible to vulcanize rubber in contact with silver?

A. On account of the affinity existing between silver and the sulphur of the rubber.

Q. What preparation of mercury does the red vulcanite contain?

A. The sulphuret-vermillion.

Q. Is it possible to obtain any free mercury from the dental vulcanite after it is hardened by steam?

A. No.

Q. How may impure vermillion not in proper combination with the rubber cause deleterious effects?

A. By chemically decomposing and becoming converted into a poisonous salt of mercury by contact with the saliva.

Q. What style of teeth are mounted on the Vulcanite Base?

A. Teeth with convex headed pins projecting far enough from the inner surface to secure strong attachment to the vulcanite plate.

Q. Is it ever necessary to resort to teeth used on metal plates?

A. Yes, in cases where the bite is very short or the rubber teeth are too thick, the plate teeth being attached to gold or platinum backings which extend into the vulcanite base.

Q. How should the model-plate of wax, with teeth temporarily attached, be waxed up?

A. So perfectly and smoothly as to be a perfect *fac-simile* of the permanent rubber denture, and thus save time and labor in finishing; a few puffs of the mouth blowpipe will complete the smoothness of the wax forming the model-plate by flowing the wax. If plain teeth are used, the front of the model-plate should be curved to imitate the natural gum, and the rugæ defined on the palatal surface.

Q. Why should the Rugæ be represented on the permanent upper denture?

A. Because the rugæ assist the tongue to change the bolus of food to different parts of the mouth.

Q. What should be the thickness of the wax plate of the model set?

A. About No. 17 Am. Standard guage.

Q. Briefly describe the process of *Constructing a Vulcanite Denture?*

A. A shallow plaster model is obtained from the impression of mouth, on this model a base plate of wax, or gutta percha, or wax and paraffine, or of a combination known as the "ideal base-plate," or of modeling composition, or of sheet tin, No. 24, swaged between dies; upon this base-plate a rim of wax covering alveolar ridge of plate is moulded and the antagonism or "bite" thus secured; an antagonizing model is then made, by which the teeth are arranged in proper position and a *fac-simile* of the complete set is modeled by building up wax around the teeth; this wax-set, with the model on which it rests, is then placed in one of the sections of the vulcanizing flask and invested with plaster, the surface of which around the set of teeth is made uniform and smooth, varnished and oiled; the other section of the flask is then adjusted and filled with plaster batter over which the lid of flask is placed; after the investment has hardened, the two halves or sections of the flask are separated and the wax of the temporary plate entirely removed, the teeth being firmly held in place by the investing plaster, thus leaving a perfect mould of the base of the denture. Gates or grooves are then cut in the investment of the upper half of flask, and the sections of the flask are then placed in hot water, and the rubber is cut into pieces of suitable size and also warmed by being placed on the heated cover of the tin boiler which contains the sections of the flask, which are removed, and the mould filled by packing the warm and soft rubber into it until it is completely filled and there is a slight surplus of rubber; the sections of the flask are then adjusted and brought together by means of pressure carefully made by a screw clamp, or by loose screws of the flask; the flask is then placed in the boiler of the vulcanizer which is filled so full of hot water as to completely cover the flask; the top of the vulcanizer is then securely screwed down, and heat applied under the bottom of the vulcanizer until the mercury in the tube of the thermometer marks 320° F., on the scale; at this point it is kept from rising any higher by diminishing the heat, so that the temperature may continue at 320°, without rising or falling, for the space of 55 or 60 minutes; after the expiration of this time the heat is shut off, and the vulcanizer permitted to cool down; or it may be rapidly cooled by placing the boiler of the vulcanizer in cool water; when the mercury of the thermometer has fallen to 200°, the top of the boiler may be unscrewed and the flask removed, and when it is perfectly cold the flask can be separated, the investing plaster cut away, and the set of teeth cleansed of all adhering investment by means of stiff brushes and water; the palatine surface and rim of plate is then cut down by files and different forms of lathe-burrs and scrapers, smoothed by means of pumice stone and water on cork or felt wheels, and finally polished with oil and dry plaster applied with the thumb.

Q. What will determine the division between the two sections of the flask?

A. The height of the plaster surrounding the denture, which is regulated by the character of the teeth invested; when the teeth are to rest upon or are embedded in the wax of the base-plate, the set should be invested to a line just above the margin of gum, the teeth and wax rim being embedded in upper portion of flask; when the base of the artificial teeth are to rest on the natural gum, the investment should extend to the cutting edges of these teeth so as to retain them in the lower section of flask.

Q. Briefly describe the method of obtaining the "Bite" or Occlusion for a full upper Denture?

A. Place the base-plate with articulating ridge of wax attached to it in the mouth, and direct patient to close the lower teeth gently against it; bring the lips carefully over the wax and note the expression. Should the wax be too full, so as to protrude the lips, mark where the fulness exists, remove from mouth and cut away the wax enough to reduce the fulness; if, on the other hand, there is not fulness enough of the lips, add more wax. To determine the proper length of the teeth, the patient may be engaged in conversation, or be made to laugh or smile, so that the length of the articulating wax may be observed; then add or cut away from it until it is of the proper length; this determined, direct patient to bite slightly into the wax, so as to make a slight indentation of the lower teeth in it. Now mark the median line and remove the base-plate and place it on model. Soften some wax and take an impression of the lower teeth, and from this make a model; when hard and removed from the impression, put the teeth of this lower model into the indentations left in the articulating wax. Now attach the bite thus obtained to the metallic articulator.

Q. Describe the method of obtaining the "Bite" or Occlusion for entire artificial dentures?

A. First adjust to models temporary base-plates covering the entire ridge of lower model, and ridge and palatal portion of upper model, taking care not to thin the plastic plates by using too great pressure in adjusting them to the models; trim edges of base-plates to conform to outlines of future dentures, paying attention to attachments of muscles, etc.; then place a soft roll of wax on each alveolar portion of the two base-plates about one-half inch high and three-fourths inches wide, and press it down so that it will cover the inner and outer sides of ridge; these articulating ridges, or plates of wax, are then modeled into a uniform shape by trimming, and the temporary base-plates are hardened in cold water; the upper plate is then placed in the mouth and the length of the lip secured by marking on wax ridge; care should be taken to so trim the wax that the occluding edge will represent accurately the plane of the cutting edges of front teeth; the lower base-plate is then placed in mouth and trimmed to represent the desired length of the lower teeth; the two base-plates are then readjusted by placing them on the models to guard against any change of shape, warming them for such a purpose; they are then returned to mouth, and the patient directed to gently close the mouth while the operator secures with his fingers the plates in position; care must be taken to have the occluding surfaces of the wax ridges strike uniformly against each other, trimming the wax until this is secured, or adding more wax if necessary; when the ridges of wax strike solidly and evenly, then the bite is secured by making two or three parallel incisions in the two wax ridges while they are in the correct position, and also one incision to mark the central line. If the patient is directed to swallow and to close the jaws at the same time, such acts will involuntarily bring the lower jaw into correct occlusion with the upper; the two wax plates can then be removed from mouth adhering together, when they can be more securely attached by means of a hot spatula; when cooled they may again be returned to mouth to determine the accuracy of "bite," and also secure the proper contour of face by adding wax to the labial surface of upper base-plate, or by reducing the thickness of the original wax. What is called the "lip-lines," can also be secured by markings on the labial surfaces of the wax ridges at the same time; the highest lip-line is at the highest elevation of upper lip when in the act of laughing, and the lowest lip-line is the lowest point to which the lower lip can be depressed; the wax-plates thus marked are removed from the mouth, secured with melted wax on the models, and attached to the metallic articulator, or to one wholly of plaster.

Q. Of what materials may base-plates be made?

A. Of wax, gutta percha, paraffine, tin or vacuum metals.

Q. What may be substituted for the red rubber to imitate more nearly the color of natural gum?

A. Pink rubber, granular rubber and mottled rubber, at such points only, and not in contact with pins of teeth, as these rubbers are weak.

Q. How may much labor be saved in polishing rubber sets?

A. By burnishing thick tin foil (No. 60) over the wax before case is flasked; also by substituting a tin die for the plaster model on which to vulcanize.

Q. How may a tin model (die) for vulcanite work be made?

A. By using for the impression material a mixture of equal parts of plaster and Spanish whiting, thoroughly drying such an impression, and moulding around its edges potter's clay or sand to such a height as will give required depth to model (die); the molten tin is then poured into the impression.

Q. In repairing, how may a New Tooth be put on a set?

A. Pour plaster into the plate so as to secure a model, and select a tooth of same mould, grind and fit, which is better done by having an impression in wax or plaster of the space and also of a tooth on either side; a dovetail is cut in the plate back of the tooth, which latter is secured by means of adhesive wax, which also fills up the dovetail space, and this is properly smoothed. The case is then invested in the usual manner, the halves of the flask separated, the wax removed, and rubber packed against the tooth and into the dovetails, vulcanized and finished up.

Q. How may a Cracked Plate be repaired?

A. Put in its exact place, and secure it by dropping melted adhesive wax over the crack; then pour plaster over the opposite or palatal surface so as to form a model; remove set from model, and cut out the broken parts so that there is 1/8 of an inch or more between the edges when the parts are replaced on model; then cut dovetails with a fine saw along the edges on each side of the crack, wax up, flask, vulcanize and finish.

Q. How may a New Block be put on an old set?

A. Pour plaster into palatal surface and thus make a model; remove the broken blocks by passing the case to and fro through the flame of an alcohol lamp, so as to soften, but not burn the rubber, then cut down the projecting rubber which has held the old blocks, and also along the inside of rim; and drill one or two holes in plate—one near each bicuspid block, if the two front blocks are to be replaced; select proper blocks and neatly joint them; determine by trying in mouth, or by an articulator, the position of the new blocks, which are secured by adhesive wax; wax up the set, invest, flask, vulcanize and finish.

Q. How may a gold or platinum Clasp be attached to a Rubber Plate?

A. By forming a clasp with an addition to it extending into and imbedded in the plate, so as to give a firm support.

Q. When the gum is very full and will not admit of any substance being laid over it, what kind of teeth are best to prevent too much projection of lip?

A. A plain tooth ground to fit closely to the natural gum.

Q. In case of a "long bite," where the lower front teeth impinge so closely to the upper gum that rubber teeth and a thick rubber plate are inadmissible, what is the remedy?

A. Plate teeth backed with metal with extensions imbedded in plate.

Q. In flasking how is the plaster model with the teeth attached, placed in one section of the flask?

A. Soak the model in water while preparing the plaster batter; fill the section of flask with the plaster, and press the model into this until the plaster rises all round the wax rim and along the back of the wax plate; trim the plaster smooth when it has set, varnish and oil the surface; put on the upper half of flask and fill with plaster until it is full.

Q. How should plain teeth, or single gum teeth or blocks which are to rest directly upon the natural gum, to avoid unnatural fulness, be invested in the flask?

A. The division of the two parts of the plaster investment should be on a line with the cutting edges of the teeth; this refers more particularly to the front teeth, the investment being built up to the cutting edges of such teeth.

Q. How are the sections of flask separated?

A. When the investment has become hard, warm the flask sufficiently to slightly soften the wax, not melt it, and then separate the sections, when the wax and teeth will remain in the upper section, and the model in the lower section in the case of a full upper denture.

Q. What causes dark joints in the use of sectional block teeth?

A. Imperfect grinding or jointing, want of cleanliness, excess of rubber in packing, weak, soft plaster of investment, and not waiting long enough for investment to harden.

Q. How may dark joints between sections of block teeth be prevented?

A. By accurately grinding, and carefully filling joints with oxychloride of zinc mixed quite thin and allowed to harden; or dry plaster over such joints moistened with a drop of water; accurate jointing and careful packing will answer more effectively in excluding the rubber.

Q. How should sectional gum teeth be jointed?

A. By so grinding the joints that the proximal surfaces of the sections will come in perfect contact and not make V-shaped spaces.

Q. How should the wax plate be modeled?

A. To resemble the finished plate; and the greater care taken in this respect will correspondingly lessen the subsequent finishing process.

Q. How may the quantity of rubber for packing be determined?

A. By immersing all of the wax about the teeth and the wax of the base-plate in a glass of water, noting the rise in the water, then removing the wax, and supplying its place with the rubber cut into small pieces until the water rises to the same height as when the wax was in the glass.

Q. How may the heads of the pins of the teeth be thoroughly cleansed of wax?

A. By the application of alcohol on a pellet of cotton wound on the point of an excavator.

Q. Before packing the vulcanite how should the plaster model in investment be prepared?

A. By drying the mould and coating the surface of the model with liquid silex, or with soapstone powder and then thoroughly brushing it off with a soft brush, the object being to prevent the rubber from entering the pores of the plaster and adhering to its surface causing roughness; thin tin foil carefully applied will answer the same purpose.

Q. What is the next step in the process?

A. To heat the two sections in an oven or over a flame until they become quite warm, which will greatly aid the packing of the rubber, by its adhering to the warm surface.

Q. Describe the process of *Packing the Vulcanite?*

A. The mould, rubber and packing instruments, as well as the hands, should be perfectly clean; the rubber is cut into narrow strips about one inch in length, and also into small squares, with one larger piece to cover the palatal portion of model; all these pieces are then placed on a tin or zinc plate, and placed over a pan of hot water to soften them; the small pieces are then carefully packed around the pins with small curved and straight instruments, and the mould is filled by adding, one at a time, the small pieces and thoroughly uniting each one to the rubber already in the mould, using the oblong pieces to cover the small square ones, and to form the rim of the plate; the palatal portion, which is left free of rubber up to this stage of the process, is then covered with the largest piece of rubber, with a small square piece over its centre; the sections of the flask are then brought together, and if the rubber has been kept hot the margins of the flask-sections will almost come together and the softened rubber be pressed gradually towards the margin of mould; by such precautions fracture of both teeth and model may be prevented; the bolts of the flask are then slipped into place and the nuts screwed down just enough to keep the sections of flask together; the flask is then placed in a pan of boiling water for one or two minutes, and the nuts screwed down slowly and carefully until considerable resistance is offered, when the boiling process is repeated until the two sections are brought completely together, when the case is ready for the vulcanizer.

Q. What is the time and the temperature required to vulcanize?

A. A half hour is required to raise the temperature to the vulcanizing point, 320° F. or 75 pounds pressure per square inch; where, however, the rubber is unusually thick the time required is one hour longer, or in some cases one and a half hours, or more, according to the thickness.

Q. What is the result of raising the heat too rapidly?

A. The rubber becomes spongy or porous.

Q. When the vulcanizing point is reached how should the flame be regulated?

A. It should be slightly lowered so that temperature will remain uniform during the vulcanizing process.

Q. What is the time required to vulcanize from the time the heat reaches the vulcanizing point?

A. Usually one hour; when this time has expired the flame is cut off, and the vulcanizer allowed to cool to 200° F., when its cooling can be hastened by placing it in cold water.

Q. What is the effect of too rapid cooling?

A. Warping of rubber plate, or cracking of the gum blocks; hence several hours should elapse before the cooled flask is opened.

Q. How deep should the water cover the flask in the boiler of vulcanizer?

A. About an inch.

Q. How may the heat in vulcanizing be brought equally on all parts of the flask?

A. By letting flask rest on a piece of pumice stone placed on the bottom of the boiler at the centre.

Q. How is the cap of vulcanizer prevented from adhering too tightly?

A. By dusting on rubber packing powdered soapstone or whiting.

Q. How determine when the rubber has been properly vulcanized?

A. When shavings cut from it bend like horn.

Q. When deep undercuts are present on the model how may the projecting portion of alveolar ridge be protected from fracture on opening the flask or in the packing of the rubber?

A. The base of the model may be so cut away that the projecting portion of ridge may stand as nearly perpendicular as possible.

Q. How should the *outlet gates* for the escape of the surplus rubber be made?

A. By cutting a groove around the model in the investment between it and the margin of flask, the edges of the groove being beveled from its bottom towards the model to within $\frac{1}{16}$ of an inch of the border, the top of this partition being then slightly scraped; when this is carefully done the sharp edges and a uniform layer of the plaster from its entire surface are only trimmed away. The groove should not extend to the flask margin.

Q. What preparation of the surface of the plaster model is necessary before packing the rubber?

A. After thoroughly drying the case the surface of the model should be coated with liquid silex or covered with tin foil to prevent the rubber from penetrating the pores of the plaster and adhering to its surface, which will insure a smooth palatine surface.

Q. Describe the Chemistry of Vulcanization?

A. "The hardening of rubber (vulcanizing) is the changing of caoutchouc into a resin-resembling substance by the process of dry distillation, and, namely, by the removal of one equivalent of hydrogen. The addition of sulphur serves only as a base, which is indifferent towards carbon, but unites with hydrogen by virtue of a strong chemical affinity existing between hydrogen and sulphur, which forms a new compound, HS which escapes as a gas." (Boeck.)

Q. Describe the *Finishing Process*?

A. Carefully remove all adhering plaster by means of a stiff brush and water: reduce the rubber to the desired thickness and shape by files, scrapers, chisels and lathe-burrs: make surface smooth and uniform with fine sandpaper; then apply finely pulverized pumice-stone moistened with water on felt or cork wheels or cones on a lathe; then thoroughly wash surface of denture and give the final polish by prepared chalk or whiting in solution applied by a soft brush wheel; dry plaster is also used applied with the finger or chamois-skin.

Q. What change does dental vulcanite undergo when subjected to heat and pressure?

A. A molecular change known as "Vulcanization."

Q. What does this molecular change bring about?

A. Increase in hardness and specific gravity, and decrease in susceptibility to atmospheric influences.

Q. When does expansion and shrinkage occur during the vulcanizing of dental vulcanite?

A. As temperature rises the rubber expands; when vulcanizing heat is attained and temperature becomes stationary, the mass begins to solidify, and at such a stage gains in specific gravity and shrinks.

Q. What is the looseness of a tooth standing alone on a partial denture due to?

A. The shrinkage of the rubber.

Q. How may this shrinkage be prevented, and no spaces left under teeth for putrefying food?

A. By packing in enough rubber to perfectly fill mould, and retaining enough to ensure a full mould at end of vulcanizing process.

Q. How may enough rubber be retained to ensure a full mould?

A. By interposing pieces of heavy tin foil between the two halves of flask, so that it will not be fully closed; then, after the denture is about half vulcanized, remove flask, take out the pieces of tin foil and apply spring-pressure until the flask is completely closed; the second heating should immediately follow the first, to prevent the pressure from breaking down plaster model which soon disintegrates and softens.

Q. How thick should these tin foil pieces between sections of the flask be?

A. For upper dentures—No. 30; for very light cases—thinner; for heavy lower dentures—No. 24.

Q. How may sponginess or porosity be avoided in vulcanizing thick pieces of rubber?

A. By longer time to raise heat to vulcanizing point, and not raising it beyond a vulcanizing degree; also, by packing inside red rubber, pink rubber, weighted rubber, or pieces of old rubber plates, filed all over to secure clean surfaces; the more old rubber used the less will also be the shrinkage; the old should be completely covered by the new rubber to prevent difference of color.

Q. Is pure or adulterated rubber more liable to become porous ?

A. The pure rubber.

Q. What is warping of dentures due to when vulcanized a second time ?

A. Contraction of the rubber.

Q. How may this contraction be remedied ?

A. If a new denture, by warming the palatal edge enough to soften rubber, and bending it downwards to relieve the pressure on palatal surface at point causing irritation.

Q. If an old denture is so warped as to impair its fit, how may it be restored ?

A. Widen it at condyles, by first directing light puffs of blow pipe flame on part back of central incisors until rubber is softened through for a space size of a quarter of a dollar; then seize denture by condyles with both hands, and pull them forcibly apart, and at same time dip denture in cold water.

Q. What is cracking of sectional blocks due to ?

A. Either to excessive pressure in packing too much rubber; or attempting to close flask before enclosed rubber is well softened; or not allowing time for rubber to flow; or by contraction of rubber in cooling; or careless handling after removal from vulcanizer.

Q. Is rubber very sensitive to changes of temperature ?

A. It is the most sensitive of any solid body.

Q. What causes chipping of edges of blocks ?

A. If blocks are ground too much in rear so that only a narrow surface is left for contact at gum surface; or contraction, if rim of plate is thick and holds edges of gum.

Q. What will prevent this chipping ?

A. Grind to square edges so that rubber will not have hold upon them; if either corner of edge is ground sharp, it should be the front, not the rear one.

Q. How should the waxing-up be done ?

A. Wax should not overhang gums but be flush with gum, and surplus for finishing be secured by scraping off a little of the plaster after flasking and before packing.

Q. What should be the form of surface of denture immediately back of incisors ?

A. Convex instead of concave, by filling in behind incisors in waxing-up, so that surface of plate will form an easy "reversed curve" beginning with palatal surfaces of incisors, and extending backwards nearly or quite half an inch over plate before normal thickness of plate is reached.

Q. What defect will such a contour of surface correct?

A. The whistling or whirring S sound caused by incorrect contour.

Q. How are partial "spring plates" of vulcanite made?

A. By scraping away a little plaster from palatal portion of bicuspids and molars upon the model, and in waxing-up allow wax to extend half an inch from teeth all around, the plate being so narrow that centre of palate is uncovered: vulcanizing the rubber to the consistence of horn gives elasticity to plate.

Q. What is the objection to such plates?

A. Tendency to force teeth outward.

Q. How may the form of a Vulcanite denture be changed?

A. By heating in oven with teeth downwards, or in boiling water, then placed on a new model of mouth, forced into position with a cloth, and held until cold.

Q. How remove teeth from a vulcanite denture?

A. Either passed through a flame until hot; immersed in oil and boiled; or covering denture with hot, dry sand.

Q. How reset a tooth or block with Amalgam?

A. Form a globular-shaped undercut in plate, grind tooth or block into place, and retain it while packing in amalgam.

Q. How reset a tooth or block with Woods' Fusible Metal?

A. Enlarge socket within, cut a dovetail in plate for anchorage; mould metal into socket with a heated spatula; heat tooth so that it will melt the metal, and then press it into place; protect thumb with cloth or chamois, and smooth the surface.

Q. How may a hole in plate be filled up?

A. Countersink on both sides, and make oblong or angular.

Q. How is liquid rubber made?

A. By cutting vulcanite into small pieces and immersing them in benzine, turpentine, chloroform, ether, or bisulphide of carbon; useful in uniting old to new rubber in vulcanizing.

Q. How may a small hole in a plate be closed?

A. By mixing gum shellac and vulcanite filings, heating them and dropping into hole, and afterwards smoothing with a hot spatula.

Q. How strong should Vulcanizers be made?

A. Strong enough to withstand a pressure three or four times as great as is required for vulcanizing.

Q. What process gradually weakens and destroys Vulcanizers?

A. Corrosion, wholly upon sides of boiler, and at middle metal may waste away until scarcely thicker than paper.

Q. How can the weakness be determined?

A. Tapping boiler with a two ounce hammer; if metal is thick and strong, hammer will rebound from a light blow; if quite thin, the blow will sound dead as if made on lead and no rebound, and metal be dented and easily driven in.

Q. What is Corrosion the combined influence of?

A. Air and moisture.

Q. How may durability of vulcanizer be prolonged?

A. By expelling air before vulcanizing, and keeping boiler dry and clean when not in use.

Q. What powders are best for the packing to ensure easy separation of lid from boiler?

A. Black lead, soapstone; but a small quantity of either, otherwise it will become porous or scale off; oil will become gummy and dry and hold the lid tighter.

Q. Why should sufficient steam room always be left in boiler?

A. If filled with water and no room left for expansion, a pressure will be developed much greater than that due to production of steam.

Q. Is water elastic or inelastic?

A. Inelastic.

Q. What is the pressure per square inch in lbs. of steam at 320° F.?

A. 75 lbs.

Q. What at 350° F.?

A. 120 lbs.; and at 400° F., it is 234 lbs.; and at 500°, it is 663 lbs.

Q. What is the effect when water closely confined is heated?

A. Its expansion generates a force practically irresistible.

Q. If vulcanizer is filled with water, how great may be the pressure to the inch without heating water to boiling point?

A. 1,000 lbs.

Q. How are thermometers set to ensure durability?

A. In a mercury bath.

Q. Should soft vulcanized rubber turn color and become harsh, what will restore it?

A. Boiling it for five minutes in a solution of one ounce of common soda to pint of water, and afterwards washing in clean water.

Q. Why are vulcanite dentures sometimes lined with gold?

A. To prevent contact of rubber with mouth.

Q. How is the gold applied?

A. Either in one piece of heavy foil; or in a number of pieces, each overlapping the other, the rubber being first packed and gold applied to surface of model and closely adapted.

Q. How may *Black Rubber* be vulcanized?

A. By using pure black rubber, and dry process; no steam allowed to enter packing chamber of New-Mode Heater during process; the time required is five hours at 320° F.

Q. How may *Red Rubber* be vulcanized in New-Mode Heater?

A. The flask is heated and packed in oven, the apparatus closed; the screws covered with the caps to make them steam tight; the steam valve raised to admit steam to packing chamber: raise heat to 320° F., and allow case to remain in hot box at such temperature for one and a half hours.

Q. How may a silver plate be made with rubber attachment?

A. By interposing No. 60 tin foil between rubber and plate; or an electro-deposit of gold may answer.

Celluloid.

Q. What is the composition of *Dental Celluloid?*

A.

Pyroxylin (gun cotton) - - - -	100 parts.
Camphor - - - - -	40 "
Oxide of Zinc - - - - -	2 "
Vermillion - - - - -	0.6 "

Q. What kind of an admixture is Celluloid?

A. A purely mechanical one, the two most important constituents being camphor and gun cotton in their natural state.

Q. What is the strength of celluloid compared with that of Vulcanite?

A. Celluloid is stronger than Vulcanite.

Q. What is the Specific Gravity of pure celluloid?

A. About 1.4.

Q. What has been suggested to remove the camphor odor?

A. Placing set in solution of sulphuric acid, one part, water, two parts, for four or five hours.

Q. What are the advantages of celluloid over vulcanite?

A. A more natural gum color, and greater strength.

Q. What are the disadvantages of Celluloid?

A. If great care is not exercised in its moulding, change of shape; also discoloration and porosity, if the hard outer surface (such as the moulding between metallic surfaces gives) is removed in the finishing process.

Q. What is the principal solvent of celluloid?

A. Spirits of camphor.

Q. How is the celluloid prevented from adhering to plaster surface of model?

A. By coating such surface with liquid silex, collodion, or oil. The use of a block-tin or bronze metal cast, or tin foil over plaster surfaces, prevents adhesion and gives a harder outer surface to the celluloid plate.

Q. What is *Liquid Silex?*

A. Sodium silicate, Na_2SiO_3; as soon as it becomes thicker than thin syrup it should be discarded for dental use; the silex should be permitted to dry for 15 minutes.

Q. To secure the best practical results how should Celluloid be worked?

A. It should be moulded or pressed into form at the highest possible temperature that will not burn it; time given it to soften in screwing down flask, and the temperature of piece at once reduced when moulding is completed, and kept under pressure until cold.

Q. At what temperature does Celluloid become plastic?

A. From 250° to 300° F.

Q. What quality of Plaster of Paris should be used?

A. A good quality of builder's plaster, which has the requisite strength, not the fine and highly calcined.

Q. What are the three modes of moulding Celluloid?

A. With steam, glycerine or oil, and by dry heat; the latter being the best.

Q. The manipulations are similar to those of what other work, until flasking?

A. Vulcanite.

Q. How should the Plaster be mixed?

A. Not too thin, and free from air-bubbles, adding the plaster to the water and allowing it to absorb all it will take up, making it as thick as can be poured.

Q. Is it admissible to use salt, or sulphate of potash in the plaster?

A. No, they lessen the strength; if rapid setting is desirable, tepid water may be used without injury.

Q. What are Celluloid Blanks?

A. Prepared plates resembling the mouth in form and size, different series of which are made to select from—full upper and lower, and partial.

Q. How should the "flasking" for celluloid be done?

A. Place the model high in the shallow half of flask. Mix the plaster as thick as syrup, stir thoroughly and pour some into the flask (or impression when obtaining model), and shake down well; use a wooden tooth-pick to work the plaster in the crevices between the teeth. Then add more plaster to the batter remaining in bowl, until the mass is thick enough to build up; fill flask with this, and shake down thoroughly and solidly; so fill flask that it may be parted at the edge of the wax base-plate; separate flask surfaces with soap solution.

Q. What form of Blank should be selected for the case on hand?

A. One as near size of model as possible, not so wide as to permit of folding in from sides and thus form creases; just large enough to have an excess in every part.

Q. What is the base-plate composed of?

A. Thin paraffine, on which the vulcanite teeth are mounted in accordance with the articulation.

Q. What is the manipulation from this point according to the "Seabury Process"?

A. The fulness of gum, the festoons and undulations of the same are carried out as if the case were ready for flasking, when a plaster matrix is made over labial surface of gum and tooth, which matrix is divided at the centre and the two halves taken off. The paraffine is chilled in cold water, dried, and each tooth is warmed and carefully removed from base-plate. When all the teeth are taken off, the places they occupied are filled by dropping a small quantity of melted wax in each place so as to allow for a slight surplus. The case is then flasked without the teeth, and in separating sections of flask all the paraffine base-plate is preserved; a celluloid blank is moulded between the plaster sections; the paraffine base-plate is again returned to model (a metallic die is better than a plaster model), the teeth returned to their former places, and the case again waxed up as it was before. Thick tin foil (No. 60) is accurately burnished over gum surface and teeth, and stippled with a serrated plugger in imitation of gum; the edges of the tin foil beyond the edge of gum, are clipped with scissors and bent at right angles to gum surface; the case is flasked and ready for moulding.

Q. How may celluloid blanks be changed in form and made smaller before moulding?

A. By softening in boiling water and pressing into any shape, and trimming off excess with a sharp knife.

Q. After separating the sections of flask what is to be done?

A. Remove the base-plate of wax or paraffine by boiling water, and rub powdered soapstone over surface of model to prevent plaster from adhering to celluloid, or apply a thin coating of liquid silex.

Q. How is the excess of celluloid provided for?

A. By cutting a deep groove in the investment plaster of the upper section of flask all around the mould, and gradually tapering up to the margin of tin foil or plate.

Q. How is the excess better provided for in case gum teeth are used?

A. By trimming the plaster all around between model and edge of flask to about the thirty-second of an inch, and holes drilled in plaster opposite to each joint of the teeth of one-eighth inch in diameter, to relieve the blocks from as much pressure as possible.

Q. What length of time does the operation of closing the flask require?

A. From 5 to 20 minutes.

Q. How is Celluloid moulded by steam?

A. Fill boiler partly full of water, at least enough to cover ribs at bottom. Have screws well turned back, until plunger, when in position, will rest against top of boiler. Turn down cover securely; see that the gland is turned back and that screw works freely. Let the sense of feeling be best guide as to how hard to screw. After placing flasks in position, turn down screw very gently with thumb and finger until it is felt to touch flask. Fill cup with alcohol and light it, or light gas; the valve will now blow off steam at 225° F. Until this occurs nothing else is to be done. As soon as steam escapes at valve, with upper portion suspended, the blank will soften and the screw be felt to yield to light pressure with thumb and finger. The upper weight should now be dropped down; then turn screw very carefully, stopping when resistance is felt to increase; as soon as it yields, turn again, and follow up pressure as the heat rises and screw yields; then increase pressure allowing time between the turns of screw; at the close of process the pressure should be considerable, all that can be made by screw. If operation is properly timed, the steam will blow off at time moulding is completed, and alcohol in lamp consumed; if other heat is used, such as gas, the flame should be sufficient to complete process in thirty to forty minutes, not longer.

Q. How is Celluloid moulded in Glycerine?

A. Same method until flask is ready to be placed in tank; place blank in flask, put in screw-clamp and turn down screw until it touches flask lightly; put all into tank, and pour enough glycerine in tank until it comes up to top of flask; one and a half pounds of glycerine will suffice. Then apply heat, and as soon as blank softens the screw will yield to gentle pressure, (at 225° F.); turn screw very lightly at first, continuing as the celluloid is felt to yield, and increase to heavy pressure as the flask is closed. The heat should never rise much above 280° F. Lard or oil may be used instead of glycerine, but latter is more cleanly.

Q. How may a celluloid case be cooled?

A. As soon as screw is down, put out flame and blow off steam, and allow flask to become thoroughly cold before opening and removing set; the cooling of flask can be hastened by cold water without injury, but case must be kept in flask-clamp until cold.

Q. What precaution should be taken if celluloid is of extra thickness, or where shape of blank has been greatly changed?

A. The flask containing it should be placed over register or near stove for half a day or more at a temperature of not over 140° F.

Q. May Celluloid be moulded with safety in "New-Mode Heater" at a greater temperature than in any other apparatus?

A. Yes; as high as 310° or even 320° F., and to give better results against subsequent warping of plate.

Q. What is the dry-heat method in using the "New-Mode Heater"?

A. Dry the investment either by raising temperature to 320° F., keeping hot box dry, or by admitting steam to hot box; if steam is up, either method may be employed; then remove flask from chamber, adjust blank, replace flask in oven immediately under screws; open screw cap a turn or two to allow gas to escape from hot box; turn down large screw until it bears lightly on top of flask; close machine; and in five minutes moulding may be commenced. First turn screws with thumb and finger, and when blank is properly softened use the smaller key-wrench; close flask gradually, stopping whenever resistance is too great. If temperature is 300° F., flask can be closed in 10 minutes; if blank is very thick mould more slowly, about 30 minutes. As soon as flask is closed, put out flame, open door, and allow machine to cool; if a lock-flask is used, it may be removed and thoroughly cooled before opening machine, which is then ready for another set.

Q. How is a Celluloid set finished?

A. By use of sand paper, and scrapers; polished with pumice and water, finally using whiting or prepared chalk on a soft brush-wheel at high speed; or by rubbing with a soft cloth wet with camphor.

Q. What precaution may be taken to keep celluloid blank clean?

A. Clean hands, and wrapping flask in muslin cloth when moulding.

Q. What is the cause of porous celluloid plates?

A. Overheating, and want of pressure at proper time.

Q. What causes the dark lines on celluloid plates?

A. Using a blank too wide, or one too thin in centre, causing celluloid to press inward as well as outward and fold upon itself; or beginning the pressure too soon which tears blank.

Q. How may the natural gum be imitated?

A. By using tin foil (50 or 60) over palatal and outer gum surfaces and "stippling" it, which is done by dotting the surface with a dull pointed instrument or serrated plugger, or engine-plugger which gives a reacting blow.

Q. How are cases of deep undercuts managed so as to avoid breaking plaster model?

A. By so investing model in flask that the pressure in moulding is brought to bear upon the mass of plaster supporting projection; in other words by elevating front surface of model where projection is located.

Q. How may we add to or repair a broken celluloid plate?

A. By perfectly cleaning surfaces to be united, forming dovetails on each side of crack or space in old plate, and moistening the edges with liquid celluloid or spirits of camphor, and moulding a piece of celluloid into crack or space.

Q. How may a broken tooth be replaced?

A. By removing all the broken tooth without disturbing outline of socket, heat a large burnisher in boiling water and enlarge the hole; insert the new tooth; pour plaster over face of tooth to secure it, and cover bulge made in celluloid by enlarging the hole for new tooth, with heavy tin foil. Heat an instrument in hot water and force the celluloid firmly about pins of tooth; drop cold water on it while holding the hot instrument against it. Another method is to proceed as just described up to point of using hot instrument, then fasten tooth with adhesive wax and invest in flask; after separating the sections, remove wax and place a small piece of celluloid over inner surface of tooth, and mould in heater.

Q. How may a tooth be removed from a celluloid set?

A. Hold outside surface of tooth in flame of an alcohol lamp until heat softens celluloid around pins of tooth.

Q. How may a continuous gum of celluloid be attached to a vulcanite plate?

A. Use continuous gum teeth (or those with long necks), set them up in wax in usual manner, leaving outside of roots exposed; place a softened thin strip of wax to portion of wax plate representing gum; finish palatal surface, and invest in flask; remove wax, pack with rubber and vulcanize; remove from flask when rubber plate will present a vacancy to be filled with celluloid at portion representing outer surface of gum; fill this vacancy or space with paraffine and wax by melting and dropping it in, and carve it into desired form of gum; then invest in one section of flask with teeth upward and raised in such a manner that the upper section of flask may be removed without dragging; imbed in plaster to rim, pouring it over palatal surface, covering crowns and filling interstices between necks of teeth, but leaving their outer surfaces exposed; then after it has set, pour more plaster around inner edge of flask section forming a ridge, leaving a groove between it and plate; finish investing, and remove wax away from groove and teeth with boiling water. Select a proper blank, and saw off its outer rim, which is softened in boiling water, and with a cloth pressed closely about teeth and held in place until it has hardened; join the two sections of flask and place in oven of "New-Mode Heater," and when temperature of 280° F. is reached the flask is closed.

Q. What advantages have metal casts or models over plaster models?

A. Better results are obtained by moulding either vulcanite or celluloid upon metal, no danger of fracture, and palatal surface of plate comes out with a hard polish.

Q. How is this metal model or cast obtained?

A. The same as a zinc die for swaging; composed of block tin or fusible metal.

Q. How may it be formed so as to render its removal from hardened celluloid plate easy?

A. By pouring metal into a sand model, and allowing it to remain only long enough to cool on outside; then, turning it over, letting all the metal remaining molten run out, and thus obtaining a thin shell which is cut all round ridge with a fine saw leaving only enough connection to hold parts together; plaster is poured into this hollow shell and the model completed. To remove it from hardened plate, the edges are crushed in between a vise. Another method is to form a plaster core of cross shape, and sinking this into the molten metal of the cast before it has cooled, thus dividing the cast into four sections which may be crushed together in a vise. (Genese.)

Q. How are metallic clasps and backings attached to vulcanite and celluloid plates?

A. By having the ends, or, in case of clasps, the additions, extend into the wax base-plate, supported by the plaster, after these ends are bent at more or less of a right angle to surface of cast or model; the vulcanite (or celluloid) is packed under and over these extensions.

Q. How is liquid celluloid made?

A. By dissolving pieces of celluloid in spirits of camphor.

Q. What may cause the warping of celluloid plates?

A. Moulding under high pressure and at a low temperature; also the heating of the plate by friction in polishing, as it will in the case of vulcanite plates, especially partial ones.

Q. What may be the cause of small holes over surface of plate after moulding?

A. Celluloid being cellular in structure, when it is heated and expands, its cells absorb moisture or other liquids, such as oil or glycerine, as a sponge absorbs water, and the moisture throughout the interior of the substance softens the walls of the cells, and they crumble away; if oil, or glycerine, is used the cells are filled with it, and the subsequent pressure closes their orifices without expelling the liquid; if steam is used, when the plate cools the vapor is condensed and its expansive force becomes almost nothing, and in addition to the softening effects of the moisture the walls of the cells are required to sustain the pressure of the atmosphere and of cohesion without any internal support. The celluloid ought, it would seem, to crumble even more rapidly. When on the other hand, the plate is moulded in contact with dry air, while the cells still imbibe the surrounding medium, it is a medium without moisture, and of at least considerable expansive force, even when cooled. The plate therefore remains smooth and compact. (W. W. Evans.)

END OF PART I.

Part II.

Anatomy.

QUESTION. What are the nutritive fluids of the body?

ANSWER. Lymph, chyle, and blood.

Q. What is the nature of the *Blood?*

A. A thick opaque fluid; of a bright red color from the arteries, and dark red or purple from the veins; saltish to the taste, viscid and of a peculiar faint odor and an alkaline reaction.

Q. When allowed to stand after being drawn what is its appearance?

A. Soon solidifies into a jelly-like mass, after which drops of a transparent yellowish fluid ooze from the surface and collect around it.

Q. What occurs to this mass in about 24 hours?

A. It separates into two parts—clot or coagulum and serum.

Q. What is *Clot?*

A. It consists of a solid, colorless material, known as *fibrin*, and many minute cells or corpuscles, known as *blood-corpuscles.*

Q. When is the *Fibrin* formed?

A. During the act of solidification.

Q. What are the *Blood-Corpuscles* enclosed in?

A. In the fibrin, and thus the clot is formed.

Q. What is seen in a drop of blood by means of the microscope?

A. A number of minute bodies or corpuscles floating in a clear fluid.

Q. What two varieties of *corpuscles* does the blood hold in suspension?

A. The *red or colored* and the *white or colorless.*

Q. What is the clear fluid in which these corpuscles float called?

A. The *liquor sanguinis* or *plasma.*

Q. How does the liquor sanguinis differ from the serum?

A. It contains one at least of the elements from which fibrin is formed.

Q. Describe the *Red or Colored Corpuscles?*

A. Circular disks with a slight central concave depression having a raised border, of a faint reddish-yellow in arterial blood, and a greenish-yellow in venous blood; highly elastic.

Q. Describe the *White* or *Colorless Corpuscles* (Leucocytes)?

A. In human blood, larger than the red, rounder or spheroidal; they are a type of a true animal cell, and consist of a mass of transparent albuminous substance called *protoplasm*, containing one or more nuclei, and bright granules of a fatty nature; the white corpuscles are similar to those of lymph and chyle.

Q. What are *Blood-plaques* or *Blood-plates?*

A. A third corpuscle in the blood sometimes called hæmatoblasts; colorless protoplasmic disks in the ratio of one to 18 or 20 red corpuscles, finely granular and without a nucleus.

Q. What do they bear an important relation to?

A. Coagulation of the blood, especially in the formation of thrombi.

Q. What is the *Liquor Sanguinis* or *Plasma?*

A. The fluid part of the blood composed of serum and fibrin elements which unite when out of the body and form the fibrin in connection with a fibrin ferment.

Q. What are the two *Fibrin Elements?*

A. *Fibrinogen* and *Fibrino-plastin* or *Paraglobulin.*

Q. What is the appearance of *Fibrin* when fresh blood is filtered?

A. A white or buff-colored substance of a stringy appearance.

Q. What is *Serum?*

A. The fluid liquor sanguinis after the fibrin elements have separated from it; straw-colored, with an alkaline reaction; it contains salts, fatty matters, sugar, and gases.

Q. What are *Blood Crystals?*

A. Hæmoglobin separated from the blood undergoing crystallization called *hæmoglobin crystals;* elongated prisms.

Q. What is *Lymph?*

A. A transparent, colorless, or slightly yellow watery fluid, conveyed by a system of vessels, called *lymphatics*, into the blood.

Q. What is *Chyle?*

A. An opaque, milky white fluid, absorbed by the villi of the small intestines from the food and carried by vessels called *lacteals* to the beginning of the thoracic duct, where it mixes with the lymph and is carried into the circulation by the same channels.

Q. What are *Connective Tissues?*

A. Tissues which support and connect the principal tissues of the body.

Q. Into what three groups are Connective Tissues divided?

A. Into *Fibrous Connective Tissues*, *Cartilage*, and *Bone*.

Q. What three forms of Fibrous Connective Tissue?

A. White, Yellow Elastic, and Areolar.

Q. What is *White Fibrous Tissue?*

A. It binds bones together in form of *Ligaments;* it connects muscles to bones or other structures in form of *Tendons;* and invests or protects various organs in form of *Membranes.*

Q. What is the nature of *Yellow Elastic Tissue?*

A. Elastic to such a degree that the white fibrous element is excluded; found in the vocal cords, trachea and bronchi, coats of blood vessels, and in certain ligaments.

Q. What is *Areolar Tissue?*

A. Tissue in which the meshes are easily distended, and thus separated into areolæ or spaces, which communicate freely and are easily permeated by fluid, or inflated by air.

Q. What is *Adipose Tissue?*

A. Areolar Tissue whose areolæ or spaces are occupied by fat-cells.

Q. What is *Cartilage?*

A. A non-vascular structure found in joints, thorax, air-passages, nostrils, ears, etc.

Q. What is cartilage which is afterwards replaced by bone, called?

A. Temporary Cartilage, which in the fœtus, forms the greater part of the skeleton.

Q. What is the nature of Cartilage?

A. A gristly mass of firm consistence, elastic, and of a pearly-bluish color.

Q. What is the Color of *Bone* in its fresh state?

A. Pinkish-white externally and deep red within.

Q. Of what two kinds of tissue is Bone composed?

A. Dense and compact on exterior of the bone, and cancellous on the interior.

Q. What is the nature of the *Compact Tissue?*

A. Like ivory, but extremely porous.

Q. What is the nature of the *Cancellous Tissue?*

A. Consists of slender fibres and lamellæ which unite to form a reticular structure, which resembles lattice-work.

Q. What is the difference in structure between the Compact and Cancellous Tissues?

A. The different amount of solid matter and the size and number of spaces in each.

Q. How do the nutrient vessels reach bone tissue?

A. By means of the fibrous membrane in which bone is enclosed called the periosteum.

Q. What occupies the interior of the bones of the limbs?

A. The *Marrow*, of a yellow color, consisting of fat, fluid, areolar tissue and vessels.

Q. What lines the interior of the cylindrical cavities of bone?

A. Medullary membrane, or Internal Periosteum.

Q. What is the relation of the periosteum to bone?

A. Adheres to surface of the bones in nearly every part, except at their cartilaginous extremities; it forms part of the strong ligaments or tendons attached to the bone.

Q. What is the *Periosteum?*

A. Nutritive membrane surrounding bone.

Q. Describe the *Periosteum?*

A. Consists of two layers closely joined, the outer formed of connective tissue with a few fat cells; the inner of elastic fibres, forming dense membranous networks; in the young it is very vascular and thick; in the old, thinner and less vascular.

Q. What is the source of the blood vessels of the compact tissue of bone?

A. From the periosteum, the vessels passing into the minute orifices of this tissue and running through the Haversian Canals.

Q. How is the Cancellous Tissue supplied with blood vessels?

A. In a like manner, but by a less number; the medullary canal is supplied by one large artery which enters at the nutrient foramen.

Q. What are the *Haversian Canals?*

A. Tubes which run parallel with the longitudinal axis of the bone for a short distance, and then branch and communicate.

Q. What is their diameter?

A. Average 1-500; some as large as 1-200 of an inch.

Q. What are *Lamellæ?*

A. Thin plates of bone tissue encircling the central canal.

Q. What are *Lacunæ?*

A. They appear like dark, oblong, opaque spots; but are cells filled during life with a nucleated cell, the processes from which pass down the canaliculi; and by means of these cells the nutritive fluids are brought into contact with the ultimate tissue of bone.

Q. What are *Canaliculi?*

A. Very minute canals which cross the lamellæ and connect the lacunæ with the adjoining lacunæ and the Haversian Canal.

Compare the Analyses of Bone, Dentine, Enamel and Cementum.

	Bone.	*Dentine.*	*Enamel.*	*Cementum.*
Calcium carbonate - -	7.05	3.36	4.37	8.02
Calcium phosphate - -	58.39	66.72	89.82	60.73
Calcium fluoride - -	2.25			
Magnesium phosphate -	2.08	1.18	1.34	1.00
Organic Matter - -	30.23	28.01	3.59	29.42
Salts - - - - - - - - - -				83

Q. The Organic and Inorganic constituents of Bone form what per cent.?

A. Organic—one third, or 33.3 per cent.
Inorganic—two thirds, or 66.7 per cent.

Q. What is the difference in proportion between the two constituents at different periods of life?

A. In the young the animal matter is in excess; in the old the bones contain more earthy and less animal matter.

Q. What is *Muscle?*

A. Organic contractile tissue, the means of animal motion.

Q. What are the *Muscles* formed of?

A. Bundles of reddish fibres called *fasciculi* endowed with the property of contractility, the bundles are enclosed in a delicate web called the *internal perimysium*, while the sheath which invests the entire muscle is called the *external perimysium.*

Q. What is the *Sarcolemma?*

A. The tubular sheath of the muscular fibre; transparent, elastic, homogeneous membrane, very tough.

Q. What is the form and size of the *Muscular Fibres?*

A. Cylindrical or prismatic, not very long—1 ½ inches, their average breadth being 1-400 of an inch.

Q. What is a Nerve?

A. Fibrillar cord conveying stimuli to and from nerve centres.

Q. What is the function of *Gray or Vesicular Nervous Structure or Substance?*

A. To originate nervous impressions and impulses.

Q. What is the function of *White or Fibrous Nervous Structure?*

A. To conduct nervous impressions and impulses.

Q. How is the Gray Structure distinguished?

A. By its dark reddish-gray color and soft consistence.

Q. What is it composed of?

A. Of vesicles or corpuscles—nerve or ganglion corpuscles, containing nuclei and nucleoli.

Q. What is the *White* or Fibrous Structure composed of?

A. Two kinds of fibres—the medullated or white, and the non-medullated or gray fibres.

Q. Where is the Gray or Vesicular Structure found?

A. Brain, Spinal cord, various ganglion, in some of the nerves of special sense, and in gangli form enlargements in the course of certain cerebro-spinal nerves.

Q. Where is the White or Fibrous Structure found?

A. In the nervous cords, a great part of the brain, and spinal cord.

Q. What do the Medullated or Dark-bordered fibres form?

A. The white part of brain and spinal cord, and greater part of the cerebro-spinal nerves, and give to these structures their opaque white appearance.

Q. What do they present when examined?

A. Two parts; the central portion is called the *Axis-Cylinder*, and around this is a sheath of fatty matter called the *White Substance of Schwann*, the whole being enclosed in a delicate membrane called the *Neurilemma or Primitive Sheath.*

Q. How much of the nerve-tube does the axis-cylinder constitute?

A. One-half or one-third.

Q. What is the function of the Medullary Sheath or White Substance of Schwann?

A. Fatty matter in a fluid state which insulates and protects the essential part of the nerve—the axis-cylinder.

Q. What is the size of the nerve-fibres of the White Substance?

A. 1-1200 to 1-2000 of an inch.

Q. What are *Nerve-Cells?*

A. Irregular nucleated cells in nerve matter: nerve-corpuscles are the same.

Q. What is the *Brain or Eucephalon?*

A. That part of the cerebro-spinal system which is contained in the cavity of the skull.

Q. Into what parts is it divided?

A. Medulla oblongata, pons. cerebellum, and cerebrum.

Q. What is the *Neuroglia?*

A. A network of fine connective tissue which supports the brain and spinal cord.

Q. What are the nerves connected with ?

A. At one end with the cerebro-spinal centre or with the ganglia, and distributed at the other end to the different textures of the body.

Q. What is a *Nerve Plexus ?*

A. The communications which take place between two or more nerves.

Q. What is the course of Nerves ?

A. They subdivide into branches, and these frequently communicate with branches of a neighboring nerve.

Q. How are the *Sympathetic Nerves* constructed and of what do they consist ?

A. Like the cerebro-spinal nerves, and consist mainly of non-medullated fibres collected into funiculi and enclosed in a sheath of connective tissue.

Q. What do the *Sensory* or *Afferent Nerves* transmit ?

A. Impressions made upon the peripheral extremities to the nerves.

Q. What do the *Motor* or *Efferent Nerves* transmit ?

A. Impressions from the nervous centres to the parts where the nerves are distributed.

Q. What is a Ganglion ?

A. A collection of gray and white nerve substance usually oval in outline, frequently found in the course of a nerve trunk.

Q. How may the *Ganglia* be regarded ?

A. As separate and independent nervous centres, smaller than the brain, and of less complex structure, connected with each other, with the cerebro-spinal axis, and with the nerves in different situations.

Q. What do *Ganglia* consist of ?

A. Vesicular nervous matter traversed by tubular and gelatinous nerve-fibres.

Q. What are the *Vaso-Motor Nerves ?*

A. Nerve fibres found sometimes in sympathetic and sometimes in cerebro-spinal nerves; the division of one of these nerves causes a dilatation of the minute arteries in, and consequently an increased supply of blood to, a corresponding vascular area.

Q. What does the *Vascular System* comprise ?

A. The Heart, Arteries, Veins, Capillaries and Lymphatics.

Q. What is an *Artery ?*

A. Vessel carrying blood from heart.

Q. How many coats has an artery ?

A. Three.

Q. What is the structure of the *Inner* or *Endothelial* coat of an Artery ?

A. Consists of a layer of pavement epithelium, a subepithelial layer of delicate connective tissue with branched cells in the inter-spaces, and an elastic layer consisting of an elastic membrane with a network of elastic fibres which forms the chief thickness of the inner coat.

Q. What distinguishes the *Middle* coat of an Artery from the Inner Coat?

A. Its color, and the transverse (circular) arrangement of its fibres.

Q. What does the Middle Coat consist of?

A. Two elements, elastic and muscular, the elastic being in excess in the larger arteries.

Q. How is a continuous blood-current kept up?

A. The arteries are distended with blood forced into them by the systole of the heart, and by their gradual contraction during the diastole, keep up a continuous current.

Q. What is the function of the muscular element of the Middle coat?

A. By its contraction and relaxation, it regulates the quantity of blood sent to any part.

Q. What does the *External* coat of an Artery consist of?

A. Mainly of connective tissue and elastic fibres; in large arteries it is thin, but in small it is as thick as the middle coat.

Q. Are arteries supplied with vessels and nerves?

A. Yes, the vessels being called *vasa vasorum*—vessels of vessels; the nerves are chiefly from the sympathetic, and partly from the cerebro-spinal system.

Q. What is a *Capillary?*

A. A minute blood vessel.

Q. What is the usual size of the Capillaries?

A. 1-3000 of an inch in diameter; in skin and marrow 1-1200.

Q. Where are the Capillaries located?

A. Between the smallest branches of the arteries and the commencing veins.

Q. What is a Vein?

A. Vessel returning blood to the heart.

Q. Are the Veins constructed like the arteries?

A. Yes, they have three coats analogous to those of the arteries.

Q. What is the principal difference between the coats of the veins and arteries?

A. The weakness of the middle coat of the veins, which allows them to collapse when divided and not stand open like the arteries.

Q. What purpose do the valves of the veins serve?

A. Prevent the reflux of the blood.

Q. Are the veins supplied with nutrient vessels and nerves like the arteries?

A. Yes, but the nerves are less in number.

Q. What is the structure of the *Lymphatics and Lacteals?*

A. Composed of three coats—internal or elastic, external or fibro—areolar and the middle, or muscular.

Q. What is the function of the *Lymphatics?*

A. To carry off most of the waste products, and to act as absorbents.

Q. What is the function of the *Lacteals?*

A. To take up the chyle.

Q. What is the nature of *Mucous Membranes?*

A. Soft, velvety, very vascular, surface coated with a tenacious secretion called *mucus*, which protects such membranes from foreign substances.

Q. What is the *Mucous Membrane of Mouth?*

A. Consists of three parts,—the epithelium, tunica propria or basement membrane, and beneath this the submucosa or corium which forms the deeper part.

Q. What is the epithelial layer of Mucous Membrane supported by?

A. The Corium, analogous to the derma of the skin.

Q. What is the nature of the Epithelium?

A. Thick, stratified, squamous (scaly), with cells culumnar in form.

Q. What is the nature of the *Corium?*

A. Very vascular, with a dense network of capillaries which lie immediately beneath the epithelium and are derived from small arteries of the submucous tissue; consists of a bundle of fibrous connective tissue, few elastic fibres, and somewhat loose in texture.

Q. What are found imbedded in Mucous Membrane?

A. Numerous glands.

Q. What project from its surface?

A. Villi and papillæ, processes analogous to the papillæ of the skin.

Q. What two tracts does Mucous Membrane cover?

A. The Gastro-pulmonary and the Genito-urinary.

Q. Describe the extent of the *Oral Mucous Membrane?*

A. For upper jaw, it begins at upper lip and is reflected to upper jaw and at the central incisors it forms frænum of upper lip; then passes over alveolar ridge to roof of mouth which it covers, and extends as far back as posterior edge of palate bones; it is then reflected downwards covering the soft palate; then it passes upwards lining the nares and downwards lining pharynx, æsophagus, stomach and intestines; after entering nostrils and lining floor, roof and septum of nose, and turbinated bones, it enters the maxillary sinus or antrum and lines that cavity. In lower jaw, it lines posterior surface of lower lip; thence reflected on anterior face of lower jaw where it forms the frænum of lower lip; then over alveolar ridge covering it in front and passes over its posterior surface where it enters mouth proper; then reflected to under surface of tongue where it forms its frænum; then spreads over dorsum and sides of tongue to its root; then reflected to epiglottis forming another fold; then enters glottis, and lines larynx, trachea, etc.

Q. Where are the *Temporal Bones* situated?

A. At side and base of the skull.

Q. Of what three parts does each Temporal Bone consist?

A. Squamous, mastoid and petrous.

Q. What is the *Squamous* portion?

A. The upper and anterior part of the bone.

Q. What is its form, etc.?

A. Scale-like, thin, translucent, outer surface smooth, convex, and grooved at back part for deep temporal muscles.

Q. What muscle does it afford attachment for?

A. Temporal Muscle.

Q. What fossa does this Squamous portion form a part of?

A. Temporal fossa.

Q. What fascia does the curved temporal ridge at its back part give attachment to?

A. Temporal fascia.

Q. What more does this temporal ridge do?

A. Limits origin of temporal muscle, and marks line between the Squamous and Mastoid portions.

Q. What is the Zygoma or Zygomatic Process?

A. A long arched process projecting from lower part of squamous portion.

Q. How is the Zygoma connected to the Temporal Bone?

A. By anterior, middle, and posterior roots.

Q. What does the anterior root terminate in?

A. A rounded eminence called Eminentia Articularis.

Q. What does the Eminentia Articularis form?

A. The front boundary of the Glenoid Cavity.

Q. What does the Middle Root form?

A. Outer margin of Glenoid Cavity.

Q. Where does it end?

A. At Gasserian Fissure.

Q. Where is the Tubercle for the attachment of the External Lateral Ligament of Lower Jaw?

A. At the junction of anterior root with Zygoma.

Q. Where is the oval depression forming a part of glenoid fossa for condyle of lower jaw?

A. Between anterior and middle roots.

Q. What is the nature of internal surface of Squamous Portion?

A. Concave, with many eminences and depressions for the cerebrum.

Q. How is the Glenoid Fossa bounded?

A. In front by eminentia articularis; behind by vaginal process; externally by auditory process, and middle root of Zygoma.

Q. What is the Gasserian Fissure?

A. A narrow slit which divides the Glenoid fossa into two parts.

Q. What forms the posterior part of this fossa?

A. The Tympanic Plate, a lamina of bone which forms anterior wall of tympanum and external auditory meatus.

Q. What does the Tympanic plate form at its lower part?

A. A sharp edge called the Vaginal Process.

Q. A part of what gland does the Tympanic Plate lodge?

A. Parotid Gland.

Q. Where is the *Mastoid Portion* of Temporal Bone situated?

A. At posterior part of bone.

Q. What is the nature of its outer surface?

A. Rough, and perforated by numerous foramina.

Q. Where is one of these of large size called the Mastoid Foramen?

A. At posterior border of bone, and transmits vein to lateral sinus, and artery to dura mater.

Q. What is the Mastoid Process?

A. A conical projection of the Mastoid portion downward.

Q. What is the *Digastric Fossa?*

A. A deep groove on inner side of Mastoid process for attachment of digastric muscle.

Q. Where is the *Occipital Groove?*

A. Parallel (but more internal) with the digastric fossa.

Q. What does it lodge?

A. Occipital artery.

Q. Where is the *Fossa Sigmoidea?*

A. A deep curved groove on internal surface of Mastoid Process, for part of lateral sinus.

Q. What are the *Mastoid* cells?

A. A number of cellular spaces hollowed out in Mastoid Process.

Q. Where is the Petrous Portion of Temporal Bone situated?

A. Wedged in at base of skull between sphenoid and occipital bones.

Q. What is its form, and direction?

A. Pyramidal; direction from without being inward, forward and slightly downward.

Q. What parts compose it?

A. Base, apex, three surfaces, and three borders.

Q. What does the Petrous Portion contain in its interior?

A. The essential parts of the ear.

Q. What is the *Meatus Auditorius Externus?*

A. A canal leading into the tympanum of ear.

Q. Where is this canal situated?

A. In front of the mastoid process and between the posterior and middle roots of Zygoma.

Q. What is the *Auditory Process?*

A. A curved plate which surrounds part of circumference of Auditory canal.

Q. What is the nature of *Apex* of Petrous Portion?

A. Rough and uneven.

Q. What is it received into?

A. The angular interval between posterior border of greater wing of sphenoid bone and basilar process of occipital.

Q. What does the anterior surface of Petrous Portion form?

A. Posterior part of middle fossa of skull.

Q. What does the Posterior surface form?

A. Front part of posterior fossa of skull.

Q. What does the Inferior or Basilar surface form?

A. Part of base of skull.

Q. What are the *Borders* of the Petrous Portion?

A. Superior, Posterior, and Anterior.

Q. What deep excavation is in the outer half of Posterior Border?

A. Jugular fossa.

Q. Where is the *Sphenoid Bone* situated?

A. At the Anterior part of base of skull.

Q. With what bones of cranium does it articulate?

A. All of the other bones of the cranium which it binds together.

Q. How is it divided?

A. Into a central portion or body, two greater and two lesser wings, and two processes below—pterygoid.

Q. What is the Body of this bone?

A. Large, cuboid in form, hollowed out inside, forming a mere shell.

Q. Describe the Body?

A. Consists of four surfaces—superior, inferior, anterior, and posterior.

Q. What is the Ethmoidal Spine?

A. A prominent point in front of superior surface for articulation with ethmoid bone.

Q. What is the Optic Groove?

A. A narrow transverse groove on Superior surface for the optic commissure.

Q. What is the Optic Foramen?

A. Termination of Optic Groove, for passage of optic nerve and ophthalmic artery.

Q. What is the Olivary Process?

A. A small eminence, of olive shape, behind optic groove.

Q. What is the Pituitary Fossa or Sella Turcica?

A. A deep depression posterior to optic groove for the pituitary body.

Q. What are the Middle Clinoid Processes?

A. Two small eminences which bound the Pituitary Fossa in front.

Q. What is the Carotid or Cavernous Groove?

A. A broad groove on either side of the body which lodges the internal carotid artery.

Q. Describe the Posterior Surface?

A. Quadrilateral in form, and joined to the basilar process of occipital bone.

Q. What is the Ethmoidal Crest?

A. A vertical lamella in the middle line of anterior surface, which articulates in front with ethmoid bone, and forms part of septum of nose.

Q. What are the Sphenoidal Cells or Sinuses?

A. Two large irregular cavities hollowed out of interior of body of the Sphenoid bone, partly closed in front by the Sphenoidal turbinated bones, having a round opening by which they communicate with the nose.

Q. What is the Rostrum?

A. A triangular spine in middle line of inferior surface, which is received into a deep fissure between the alæ of the vomer.

Q. What is the Pterygo-palatine canal?

A. A canal close to the root of pterygoid process, for the pterygo-palatine vessels and pharyngeal nerve.

Q. What are the Greater Wings?

A. Two strong processes arising from sides of body of bone, curved upward, outward and backward, prolonged behind into a sharp-pointed extremity called the Spinous Process, each has three surfaces and a circumference.

Q. What does the Superior or Cerebral Surface form?

A. Part of the middle fossa of skull.

Q. Where is the Foramen Rotundum?

A. At the anterior and internal part of the Superior Surface; it transmits the second division of 5th Pair of Nerves.

Q. Where is the Foramen Ovale?

A. Behind and external to the foramen rotundum for transmission of 3d division of 5th Pair of Nerves.

Q. Where is the Foramen Vesalii?

A. At inner side of foramen ovale, opposite root of pterygoid process, transmits a small vein.

Q. Where is the Foramen Spinosum?

A. In posterior angle near spine of sphenoid; it transmits middle meningeal artery.

Q. What does the Pterygoid Ridge divide?

A. The convex External Surface of the greater wing into two portions.

Q. Where is the External Pterygoid muscle attached?

A. To the inferior portion of the external surface.

Q. Where is the Temporal Muscle attached?

A. To the superior portion of the external surface.

Q. Where is the Spinous Process of Greater Wing?

A. At posterior part of inferior portion External Surface.

Q. What are connected to Spinous Process?

A. Internal lateral ligament of lower jaw and tensor palati muscle.

Q. What does the smooth quadrilateral Anterior Orbital Surface of Greater Wing form?

A. Outer wall of orbit of the eye.

Q. With what does the outer half of the margin of the serrated circumference of the Greater Wing articulate?

A. Petrous portion of Temporal Bone.

Q. What does the inner half form?

A. Anterior boundary of foramen lacerum medium, and presents posterior aperture of Vidian canal.

Q. Where does the circumference of Greater Wing articulate with Squamous portion of Temporal Bone?

A. At the serrated edge in front of Spine.

Q. Where does the Greater Wing articulate with Parietal Bone?

A. At tip, in a triangular portion.

Q. Where with the Frontal Bone?

A. At a broad serrated surface internal to the triangular portion.

Q. What are the *Lesser Wings?*

A. Two thin triangular plates of bone arising from upper and lateral parts of body of Sphenoid; they project outward terminating in a sharp point.

Q. What does the smooth, flat superior surface of each support?

A. The anterior lobe of brain.

Q. What does the inferior surface form?

A. The back part of roof of orbit of eye, and foramen lacerum anterius.

Q. Where does this triangular fissure lead?

A. From cavity of cranium into orbit.

Q. Converted into a foramen by articulation with frontal, what does this fissure transmit?

A. The 3d, 4th, 1st division of 5th and 6th nerves, filaments of cavernous plexus of sympathetic, orbital branch of middle meningeal artery, a branch of lachrymal artery to dura mater, and opthalmic vein.

Q. What does anterior border of Lesser Wing articulate with?

A. Frontal Bone.

Q. Into what is the Posterior Border received?

A. Into Fissure of Silvius of brain.

Q. What does the inner extremity of Posterior Border form?

A. Anterior Clinoid Process.

Q. Where is the Optic Foramen?

A. Between the two roots for transmission of optic nerve and ophthalmic artery.

Q. Where are the Pterygoid Processes of Sphenoid Bone?

A. One on each side which descend from point where body and greater wing unite.

Q. What does each of these Processes consist of?

A. An External and Internal Plate.

Q. What separates the plates behind?

A. An intervening notch known as the Pterygoid Fossa.

Q. What does the broad, thin External Pterygoid Plate form?

A. Part of inner wall of Zygomatic fossa.

Q. What does it give attachment to by its outer surface?

A. External Pterygoid Muscle.

Q. What is the Hamular Process?

A. The hook-like extremity of the long and narrow Internal Pterygoid Plate.

Q. Where is the Scaphoid Fossa?

A. At base of Internal Pterygoid Plate.

Q. What does the anterior wall of Pterygoid Process form?

A. Posterior wall of Spheno-Maxillary Fossa; it supports Meckel's Ganglion.

Q. What are the *Sphenoidal Turbinated* or *Spongy Bones?*

A. Two thin curved plates of bone which are separate until puberty and sometimes are never joined to Sphenoid bone.

Q. What does each one articulate with?

A. In front with Ethmoid; externally with Palate bones.

Q. With what bones does the Sphenoid articulate?

A. With all of the cranium, five of face—2 malar, 2 palate, and vomer; it also sometimes articulates with Superior Maxilla.

Q. What is the nature of the *Ethmoid Bone?*

A. Very light and spongy, cubical in form.

Q. Where is it situated?

A. At anterior part of base of cranium, between the two orbits at root of nose, helping to form each of these cavities.

Q. Of how many parts does it consist?

A. Three, a horizontal plate forming part of base of cranium; a perpendicular plate, forming part of septum of nose; and two lateral masses of cells.

Q. Where is the thick, smooth triangular process called *Crista Galli?*

A. It projects upward from the middle line of the horizontal or cribriform plate.

Q. What does the cribriform plate on each side of crista galli support?

A. Bulb of olfactory nerve.

Q. What does the Perpendicular Plate assist in forming?

A. Septum of nose.

Q. What does the anterior border of this Plate articulate with?

A. Nasal spine of frontal and crest of nasal bones.

Q. What is its posterior border divided into two parts, connected with?

A. By its upper half with Sphenoid, and its lower half with Vomer.

Q. What is attached to its Inferior border?

A. Triangular Cartilage of nose.

Q. What are the *Lateral Masses of Ethmoid Bone?*

A. The Ethmoidal Cells, a number of thin walled cavities, placed between two vertical plates, the outer forming part of orbit, the inner one part of nasal fossa of same side.

Q. What are the *Ethmoidal Foramina?*

A. Anterior and Posterior openings into orbit.

Q. What is the Os Planum?

A. A thin smooth square plate of bone which forms the outer surface of each lateral mass.

Q. What is the Unciform Process?

A. An irregular lamina which projects from inferior part of each lateral mass, immediately beneath the os planum.

Q. What does it serve to close?

A. The upper part of orifice of antrum.

Q. What does the inner surface of each lateral mass form?

A. Part of outer wall of nasal fossa of same side.

Q. What does the inner surface terminate in as it descends from under surface of cribriform plate?

A. The Middle Turbinated Bone.

Q. What is the Superior Turbinated Bone?

A. A thin curved plate which bounds above the superior meatus of nose.

Q. Where is the Middle Turbinated Bone?

A. Below and in front of Superior Meatus, extending whole length of inner surface of each lateral mass.

Q. What is the Infundibulum?

A. A funnel-shaped canal by means of which the anterior ethmoidal cells, and through them the frontal sinuses communicate with the nose.

Q. With what 15 bones does the Ethmoid articulate?

A. Sphenoid, 2 sphenoidal turbinated, frontal, 2 nasal, 2 superior maxillary, 2 lachrymal, 2 palate, 2 inferior turbinated, and vomer.

Q. What are the *Nasal Bones?*

A. Two small oblong bones placed side by side at middle and upper part of face.

Q. What do they form by their function?

A. The Bridge of Nose.

Q. Describe the Nasal Bones?

A. Each has two surfaces, outer and inner, and four borders; the outer surface is concave from above downward, convex from side to side, the inner surface is concave from side to side, convex from above downward; the superior border is thick and articulates with frontal; the inferior border is broad, thin and sharp, directed obliquely outward, downward, and backward, to which is attached the lateral cartilage of nose.

Q. What is the Nasal Angle?

A. The border prolonged at its inner extremity into a sharp spine.

Q. What does the external border of Nasal bone articulate with?

A. Nasal process of Superior Maxillary.

Q. What does the internal border articulate with and form?

A. Its fellow of opposite side, and forms part of septum of nose, being prolonged behind into a vertical crest.

Q. What does this crest articulate with?

A. Nasal spine of frontal bone, and ethmoid bone.

Q. With what does each Nasal bone articulate?

A. With four, 2 of cranium—frontal and ethmoid, and two of face —the opposite nasal and superior maxillary.

Q. Where are the *Palate Bones* situated?

A. At back part of Nasal Fossa, wedged between the Superior Maxillary and pterygoid process of sphenoid.

Q. What cavities does each bone assist in forming?

A. Floor and outer wall of nose, roof of mouth and floor of orbit.

Q. What Fossa and Fissure does each bone assist in forming?

A. Spheno-maxillary and Pterygoid fossa, and Spheno-maxillary fissure.

Q. What does each Palate bone resemble in form?

A. The letter L.

Q. Into what parts is the Palate bone divided?

A. Inferior or horizontal and superior or vertical plate.

Q. What is the nature of Horizontal Plate?

A. Quadrilateral, thick, and presents 2 surfaces and 4 borders.

Q. What does the Superior Surface form?

A. Being concave from side to side, it forms back part of floor of nostril.

Q. What does the Inferior Surface form?

A. Back part of hard palate.

Q. Where is Posterior Palatine canal?

A. At outer extremity of a transverse ridge at posterior part of inferior surface.

Q. Where are the orifices of the two accessory palatine canals?

A. Near the deep groove at the outer extremity of the transverse ridge.

Q. What is the nature of the anterior border of Palate bone?

A. Serrated and bevelled, and articulates with palate process of Superior Maxillary bone.

Q. What is the nature of the posterior border?

A. Concave and free, and serves for attachment of Soft Palate.

Q. What is the Posterior Nasal Spine?

A. The inner extremity of the posterior border which is sharp and pointed when united with the opposite bone, and gives attachment to the Azygos Uvula muscle.

Q. What is the external border united with?

A. Lower part of perpendicular plate.

Q. What is the nature of the internal border?

A. The thickest, and serrated for articulation with its fellow of opposite side.

Q. What does the superior ridge of both bones form?

A. A crest into which the vomer is received.

Q. What is the nature of the vertical Plate?

A. Thin and oblong, directed upward and a little inward.

Q. Where is the Inferior Turbinated Crest?

A. Immediately above the shallow depression which forms part of interior meatus of nose.

Q. What does this Crest articulate with?

A. The Inferior Turbinated Bone.

Q. Where is the Superior Turbinated Crest?

A. Above the Inferior, and forms part of middle meatus.

Q. What is the nature of the external surface of Vertical Plate?

A. Rough and irregular to articulate with inner surface of superior maxillary.

Q. Where is the Posterior Palatine canal?

A. Towards the back of external surface, which canal is first a groove, until articulation with superior maxillary bone forms a canal.

Q. Where is the Maxillary Process?

A. On the anterior border of external surface opposite Inferior Turbinated Crest.

Q. Where is the Pterygoid Process, or Tuberosity of palate?

A. At the lower part of this anterior border.

Q. What is the Orbital Process?

A. A well marked process of the superior border of Vertical Plate; the fellow process which is smaller being called the Sphenoidal Process.

Q. Where are the *Malar Bones* situated?

A. At upper and outer part of face, and form prominence of cheek.

Q. What is their nature?

A. Two in number, they are quadrangular in form, and each presents external, internal surfaces and frontal, orbital, maxillary and zygomatic processes and four borders.

Q. What is the nature of External Surface?

A. Smooth and convex, and having near centre the malar foramina.

Q. What does the External Surface give attachment to?

A. Zygomaticus major and minor muscles.

Q. What is the nature of Internal Surface?

A. Concave, directed backward and inward, and presents internally a rough triangular surface for articulation with Superior Maxillary; externally a smooth concave surface which forms part of Zygomatic fossa, and affords attachment to part of Temporal muscle above, and Masseter muscle below.

Q. What is the nature of the Orbital Process?

A. A thick and strong plate which projects backward from orbital margin of bone; its upper surface, by uniting with greater wing of sphenoid, forms outer wall of orbit; its under surface, smooth and convex, forms part of temporal fossa; its anterior margin forms part of circumference of orbit; its superior margin articulates with frontal bone; its posterior margin with sphenoid; internally it articulates with orbital surface of superior maxillary; on upper surface are orifices of one or two temporo-malar canals for filaments of orbital branch of superior maxillary nerve.

Q. What is the nature of the Maxillary Process?

A. Rough and triangular; articulates with Superior Maxillary.

Q. What is the Nature of Zygomatic Process?

A. Long, narrow and serrated; articulates with Zygomatic process of temporal bone.

Q. What is the nature of the four Borders?

A. The orbital is smooth, arched and forms part of circumference of orbit; the maxillary is rough and bevelled to articulate with superior maxillary, and affords attachment to levator labii superioris proprius muscle; the temporal border is like italic letter *f*, in shape, and gives attachment to temporal fascia; the zygomatic border is continuous with lower border of zygomatic arch, and gives attachment to edge of masseter muscle.

Q. With what bones does the malar articulate?

A. Frontal, Sphenoid, Temporal, and Superior Maxillary.

Q. Where are the *Inferior Turbinated Bones* situated?

A. One on each side of outer wall of nasal fossa.

Q. What does each consist of?

A. A layer of thin spongy bone turned over upon itself like a scroll, extending horizontally along outer wall of nasal fossa.

Q. What is the nature of Internal Surface?

A. Convex, perforated by many apertures and traversed by grooves and canals.

Q. What is the nature of External Surface?

A. It forms part of inferior meatus; upper border is thin and irregular, and joined to bones along outer wall of nose.

Q. What is the Lachrymal Process?

A. The anterior process of the middle portion of superior border of external surface.

Q. Where is the Ethmoidal Process?

A. At junction of the two middle fourths of the bone, and joins the ethmoid.

Q. What is the Maxillary Process?

A. A thin lamina of bone curving downward and outward, and hooking over lower edge of orifice of antrum.

Q. What is the form of both extremities?

A. More or less narrow and pointed.

Q. With what bones do the Inferior Turbinated articulate?

A. The ethmoid, superior maxillary, lachrymal and palate.

Q. Where is the *Vomer* situated?

A. A single bone at back part of nasal fossæ, forming part of septum of nose.

Q. What is its nature?

A. Thin, like a ploughshare in form, and has two surfaces—lateral, and four borders.

Q. What is the nature of the Lateral Surfaces?

A. Smooth, and marked by small furrows for vessels, and by a groove on each side, sometimes a canal, called naso-palatine which transmits naso-palatine nerve.

Q. What is the nature of the Borders?

A. The superior is thickest, with a deep groove on each side of which is a horizontal wing; the groove receives the rostrum of the sphenoid; the inferior border is longest, broad and uneven in front where it articulates with superior maxillary bones; thin and sharp behind where it unites with palate bones; the upper half of anterior border consists of two laminæ of bone between which is received the perpendicular plate of ethmoid; the lower half is united to triangular cartilage of nose; the posterior border is free, concave and separates nasal fossæ behind; thick bifid above, thin below.

Q. With what bones does the Vomer articulate?

A. Sphenoid, Ethmoid, 2 Superior Maxillary, 2 Palate, and with cartilage of septum of nose.

Q. How is the *Nervous System* divided?

A. Into the Cerebro-spinal, or nervous system of animal life; and the Sympathetic, or nervous system of organic life.

Q. What is the structure of Nervous Tissue?

A. Of two substances, the White or fibrous, and the Gray or vesicular matter, both of which contain phosphorized fat, albumen and water.

Q. What is the White Nerve matter composed of?

A. A number of tubes each consisting of a central *axis* cylinder, surrounded by the *White Substance of Schwann*, and this enclosed in the membrane, or *Nerve Sheath*.

Q. How do nerves terminate?

A. Sensory Nerves end peripherally as plexuses in their end-organs in the tissues. Motor Nerves end peripherally in muscles, as plates or plexuses; their central termination is not known or understood.

Q. What is the Neurilemma, or Perineurium?

A. The covering of a bundle of the tubes, and when so invested the bundle of tubes is called a *Nerve*.

Q. How is a Nerve nourished?

A. By a minute capillary system of blood vessels.

Q. Of what does the *Cerebro-spinal System* consist?

A. Of the brain, spinal cord, the ganglia, and the cranial and spinal nerves.

Q. What is the *Brain?*

A. The contents of the cranium, especially the cerebrum.

Q. What are the *Membranes of the Brain?*

A. The Dura Mater, the Arachnoid, and the Pia Mater.

Q. Describe the *Dura Mater?*

A. A dense, inelastic fibrous membrane lining interior of skull, forming the internal periosteum of cranial bones, continuous with dura of spinal cord, and connected with large portion of base of skull; it contains numerous blood vessels, and its inner surface is covered with a layer of endothelial cells.

Q. Describe the *Arachnoid?*

A. A serous sac which forms the middle membrane, and which contains a serous fluid small in quantity; it is thin and delicate like spider web, hence its name.

Q. Describe the *Pia Mater?*

A. A vascular connective tissue membrane supplied by branches of internal carotid and vertebral arteries, covers surface of brain dipping into all the sulci, and forming the velum interpositum and choroid plexus of 4th ventricle; and contains lymphatics and nerves. It consists of a minute plexus of blood vessels held together by very fine areolar tissue.

Q. How is the Brain divided?

A. Into Medulla Oblongata, Pons Varolii and Cerebellum, the Mid-brain, Inter-brain, and two Hemispheres.

Q. What is the average weight of the male and female adult brains?

A. Male—49½ ozs.: female 44 ozs., of which the cerebrum is about ⅞.

Q. Give the number of lobes and fissures of each lateral half of the cerebrum or hemisphere?

A. Five lobes and 8 fissures, besides many less important ones.

Q. What are the *Convolutions of Brain?*

A. The folding upon itself of the organ with intervening furrows, both being formed of gray matter; the convolutions are not uniform.

Q. What *Ganglia comprise the Brain?*

A. Besides the gray matter of the cerebral hemispheres, of the cerebellum, and medulla oblongata, the following: Olfactory Bulbs, Corpora Striata, Optic Thalami, Tubercula Quadridgemina and Tuber Annulare.

Q. What are the *Commissures of the Brain?*

A. Nineteen connecting bands, 10 being longitudinal and 9 transverse in direction.

Q. What are the *Ventricles of the Brain?*

A. Five small belly-like cavities.

Q. What is the Meso-cephalon?

A. The parts which connect the cerebrum with the cerebellum and medulla oblongata.

Q. What is the *Cerebrum?*

A. The chief portion of the brain.

Q. What is the *Cerebellum?*

A. The inferor part of the brain, situated beneath the posterior lobes of cerebrum.

Q. Of what is the Brain composed?

A. Of Gray and White Matter, the gray matter being connected together by nerve fibres from the white matter.

Q. Do the membranes of the brain invest the Spinal Cord?

A. Yes.

Q. Describe the *Spinal Cord?*

A. The cylindrical, elongated part of the cerebro-spinal axis, which is contained in the vertebral canal. Length usually 17 or 18 inches; weight (divested of nerves and membrane) about 1½ ounces. Consists of white and gray nervous substance, the white situated externally and constituting the greater part of the organ; issuing from the spinal cord are 31 pairs of nerves, each of which are composed of an anterior motor, and a posterior sensory root the latter being the larger; the anterior root arises between the anterior and lateral white columns, the posterior root between the posterior and lateral columns; on each posterior nerve root immediately beyond its point is a ganglion.

Q. What is the structure of the White matter?

A. Medullated nerve fibres, which form the anterior and posterior nerve roots.

Q. What is the structure of the gray matter?

A. Contains multipolar cells of different sizes and shapes, with axis-cylinders and branching processes.

Q. Name *Cranial Nerves*, and functions of the 12 Pairs?

A. 1st Pair	Olfactory,	Special sense of smell.
2d "	Optic,	" " sight.

3d Pair	Motor Oculi,	Motion to 5 orbital muscles.
4th "	Pathetic,	Motion to one orbital muscle.
5th "	Trifacial,	Sensation and motion, possibly special sense of taste.
6th "	Abducens,	Motion to one orbital muscle.
7th "	Facial,	Motion to muscles of face.
8th "	Auditory,	Special sense of hearing.
9th "	Glosso-Pharyngeal,	Sensation, motion and special sense of taste.
10th "	Pneumogastric,	Sensation and motion.
11th "	Spinal accessory,	Motion.
12th "	Hypoglossal,	Motion to muscles of tongue.

Q. How many origins has a Cranial Nerve?

A. Two, superficial and deep.

Q. How do cranial nerves pass out of cranium?

A. Through base of skull.

Q. What is reflected over them as they pass out?

A. A prolongation of dura mater as a sheath.

Q. What are nerves of special sense?

A. Convey the impression made upon their peripheral ends to a particular cell of Brain.

Q. What is the *Pons Varolii?*

A. Eminence at upper part of Medulla Oblongata, formed by the union of the crura cerebri and crura cerebelli.

Q. What is the *Medulla Oblongata?*

A. Upper enlarged portion of Spinal Cord, resting on basilar process of occipital bone.

Q. What is the *Foramen Ovale?*

A. An opening in Sphenoid bone for transmission of Inferior Maxillary branch of 5th Nerve.

Q. What is the *Foramen Rotundum?*

A. Opening in Greater Wing of Sphenoid bone for transmission of Superior Maxillary branch of 5th Nerve.

Q. Describe the origin and course of 5th Pair of Nerves?

A. The pons varolii and medulla oblongata, by a large sensory or posterior root, and a small motor or anterior root. The deep origin is widely separated from the superficial origin. Backwards from anterior surface of pons varolii, the nerve passes directly through pons to medulla oblongata without any connection with its fibres, on reaching the medulla it forms 3 main divisions, one anterior and two posterior.

From the superficial origin the two roots extend obliquely upward and forward across summit of petrous portion of temporal bone, and through an oval opening in dura mater into middle fossa of cranium.

Q. Where does the larger Posterior Sensory Root terminate?

A In *Gasserian Ganglion.*

Q. Where is this Ganglion situated?

A. In depression on anterior surface near apex of petrous portion of temporal bone.

Q. What is the form of this Ganglion?

A. Broad, flattened somewhat semilunar or crescent-shaped; its convexity is forward and slightly upward.

Q. What 3 large divisions arise from anterior or concave margin of the Ganglion?

A. Ophthalmic, Superior Maxillary and Inferior Maxillary.

Q. Which is the largest?

A. The Inferior Maxillary.

Q. What does the Ophthalmic supply?

A. Eyeball, lachrymal gland, mucous membrane of eye and nasal fossæ, integument and muscles of eyebrow, forehead and nose.

Q. Name the terminal branches of *Ophthalmic?*

A. Lachrymal, Frontal and Nasal.

Q. Name the terminal branches of the *Superior Maxillary?*

A. Orbital Spheno-palatine, Posterior Dental, Middle Dental, Anterior Dental; and on the face—Palpebral, Nasal and Labial.

Q. Name the terminal branches of the *Inferior Maxillary?*

A. Masseteric, Deep Temporal, Buccal, and 2 Pterygoid, comprise the anterior and smaller division; while the Auriculo-temporal, Gustatory or Lingual, and Inferior Dental, comprise the posterior and larger division.

Q. Describe *Ophthalmic*, or 1st Division of 5th Nerve?

A. Smallest; arises from upper part of Gasserian Ganglion; one inch long; sensory; enters orbit through sphenoidal fissure, when it divides into the three terminal branches.

Q. Describe *Superior Maxillary*, or 2d Division of 5th Nerve?

A. Sensory; arises from middle of Gasserian Ganglion and passes through foramen rotundum, crosses spheno-maxillary fissure and through infra-orbital canal at which foramen it emerges on face, giving off in spheno-maxillary fossa the orbital, spheno-palatine, and Posterior Dental branches; in the infra-orbital canal it gives off anterior dental branch; on face, the palpebral, nasal and labial branches.

Q. Describe the *Inferior Maxillary*, or 3d Division of 5th Nerve?

A. Largest; compound nerve, large or *sensory* root arises from inferior angle of Gasserian Ganglion; the smaller or *motor* root passes beneath this ganglion and joins sensory root just after its exit through foramen ovale; immediately beneath base of skull divides into anterior and posterior branches; the anterior is smallest and receives nearly all of the motor root giving branches to muscles of mastication; the posterior branch is largest, and for most part sensory receiving a few filaments from motor root. Supplies teeth and gums of lower jaw, temple and external ear, lower face and lip, and muscles of mastication.

Q. Describe *Inferior Dental Branch?*

A. Largest, passes downward with artery of same name, first beneath external pterygoid muscle, and then between internal lateral ligament of lower jaw, and ramus of jaw to inferior dental foramen, and then through inferior dental canal to mental foramen where it divides into incisor and mental branches.

Q. Describe course of branches of *Ophthalmic Nerve?*

A. *Frontal;* largest, enters orbit through sphenoidal fissure; passes forward between Levator palpebræ muscle and periosteum; midway between apex and base of orbit it divides into two branches—supratrochlear and supraorbital; the former goes to corrugator supercillii and occipito-frontalis muscles, and the latter supplies same muscles and also the orbicularis palpebrarum. *Nasal;* enters orbit between the two heads of external rectus muscle, and passes inward to the orbit, where it enters anterior ethmoidal foramen; then enters cranium and into nose, where it divides into internal and external branches, the former supplying mucous membrane near anterior part of septum of nose, the latter supplying wing and tip of nose, and then joining with facial nerve. *Lachrymal;* smallest, passes into orbit through sphenoidal fissure to lachrymal gland supplying this gland and conjunctiva, and terminates in upper eyelid, finally joining facial nerves.

Q. Describe the course of Branches of *Superior Maxillary Nerve?*

A. *Orbital;* arises in spheno-maxillary fossa, and enters orbit by spheno-maxillary fissure, and then divides into temporal and malar; the first runs in a groove along outer wall of orbit in malar bone, and is joined by a branch of the lachrymal, and enters temporal fossa, ascends and pierces temporal muscle, and fascia and is distributed to integument of temple and side of forehead, and then joins facial and auriculo-temporal; the latter (malar), passes along external inferior angle of orbit and emerges on face in a foramen of the malar bone, perforating orbicularis palpebrarum muscle, and supplies prominence of cheek; it also joins facial *Spheno-palatine*, two in number, which descend to spheno-palatine ganglion. *Posterior Dental:* Two in number, arise from trunk as it is about to enter infra-orbital canal, divide and pass downward on tuberosity of superior maxillary bone; one of them enters a canal in this bone, passes from behind forward, and joins the anterior dental nerve opposite canine fossa. Numerous filaments form a plexus in outer wall of superior maxillary bone just above the alveoli; from this plexus filaments are given off for the pulps of the molar teeth, the lining of antrum, portion of gums; the other branch passing to the gums and mucous membrane of cheek. *Anterior Dental:* Large, is given off from superior maxillary nerve just before it emerges from infra-orbital foramen; it enters a special canal in front wall of antrum, and joins the posterior dental. In its course through the canal it gives off the *middle dental*, which supplies the bicuspid teeth. Sometimes this branch is given off directly from superior maxillary nerve in back part of infra-orbital canal, and passes in a special canal to the bicuspid teeth. Other filaments of the anterior dental nerve pass to the canine and incisor teeth, and it forms a communication with a nasal branch from Meckel's ganglion. *Palpebral:* Pass upward beneath orbicularis palpebrarum, which they supply, and also integument and conjunctiva of lower eyelid with sensation, joining facial and malar nerves at outer angle of orbit. *Nasal:* These branches pass inward and supply integument of side of nose and join nasal branch of ophthalmic. *Labial:* Largest and most numerous, descend beneath Levator labii superioris to integument and muscles of upper lip, mucous membrane of mouth, and labial glands; the infra-orbital plexus is formed by filaments from facial which join these branches just beneath orbit.

Q. Describe *Spheno-palatine or Meckel's Ganglion?*

A. Largest of cranial ganglia, placed in spheno-maxillary fossa, close to spheno-palatine foramen; triangular; reddish-gray color, situated just below superior maxillary nerve as it crosses the fossa.

Q. Describe course of anterior Branches of *Inferior Maxillary Nerve?*

A. *Masseteric:* Outward course above External pterygoid muscle in front of temporo-maxillary articulation; crosses sigmoid notch to masseter muscle as far as anterior border.

Deep Temporal: Two in number, anterior and posterior; supply deep surface of temporal muscle; posterior branch small, and situated back of temporal fossa; anterior branch reflected upward at pterygoid ridge of sphenoid bone, to front of temporal fossa; generally given off from buccal nerve.

Buccal: Pierces external pterygoid and passes down beneath coronoid process of lower jaw, or through temporal muscle, to buccinator where it divides into superior and inferior branches, and gives a branch to external pterygoid and a few filaments to temporal muscles; the superior branch supplies integument and part of buccinator muscle and joins with facial; inferior branch passes to angle of mouth and supplies same parts as superior, and also joins facial nerve. *Pterygoid:* Two in number, one supplying each pterygoid muscle; the branch to internal pterygoid passes inward to deep surface; connected at its origin with otic ganglion; frequently derived from buccal.

Q. Describe the Posterior Branches of *Inferior Maxillary?*

A. The larger division and mostly sensory, but receives a few filaments from motor root.

Q. Into how many branches does it divide?

A. Three—Auriculo-temporal, Gustatory, and Inferior Dental.

Q. Describe these Branches?

A. *Auriculo-temporal:* Arises by two roots and runs backward beneath external pterygoid muscle to inner side of neck of lower jaw; then upward between external ear and condyle of jaw under parotid gland, and ascends over zygoma, and divides into two temporal branches, the *posterior* being the smaller, and distributed to pinna of ear and adjoining tissues; the *anterior* passes to vertex of skull, and supplies integument of temple, joining with facial and orbital of superior maxillary; the auriculo-temporal communicates with otic ganglion.

Lingual or Gustatory: Supplies papillæ and mucous membrane of tongue; passes between internal pterygoid muscle and inner side of ramus of jaw, and crosses to tongue across Wharton's duct, along side of tongue to apex, immediately beneath mucous membrane, its branches supply mucous membrane of mouth, gums, sublingual gland, papillæ and mucous membrane of tongue, anastomosing with hypoglossal nerve at tip of tongue.

Inferior Dental: Largest of the three branches of Inferior Maxillary; passes downward with inferior dental artery beneath external pterygoid muscle and then between internal lateral ligament and ramus of jaw to dental foramen, which it enters, and then passes through dental canal of inferior maxillary bone, beneath the teeth as far as the mental foramen, where it divides into two terminal branches—*incisor* and *mental.* While in the dental canal it sends filaments to the molar and bicuspid teeth; the *incisor branch* continues forward within the bone to median line, supplying the canine and incisor teeth; the *mental branch* emerges at mental foramen, and its two or three branches supply skin and mucous membrane of lower lip. *Mylo-hyoid:* Leaves inferior dental nerve as the latter is about to enter dental foramen; it descends in a groove on inner surface of ramus, and sends filaments to mylo-hyoid and digastric muscles, and to submaxillary gland.

Q. What two small ganglia are connected with the inferior maxillary nerve?

A. Otic and Submaxillary.

Q. Describe *Otic Ganglion?*

A. Small, oval, flattened; reddish gray color, situated immediately below foramen ovale on inner surface of inferior maxillary nerve, it is in relation with the latter nerve at a point where a motor root joins the sensory portion, being thus connected by two or three filaments, and also with the auriculo-temporal nerve; this connection with the auriculo-temporal accounts for earache during dentition.

Q. Describe the *Heart?*

A. A hollow muscular organ situated in the thorax, between the lungs and within the pericardial sac; its rests on the diaphragm somewhat to the left of the median line of body; it is conical in form, and is suspended by the great vessels in such a manner that the apex points to the left and downward; its size is about that of the closed fist, and its average weight is ten ounces. It is divided by a septum into two cavities not connected, and each of these into two, the auricle and ventricle. The auricles receive the blood from the veins and pour it into the ventricles; the capacity of the auricles is about four ounces; of the ventricles, about six ounces.

Q. Name the Valves of the Heart?

A. Mitral valve, semilunar valves (3), tricuspid valve, aortic valve.

Q. How are the ventricles of the heart filled with blood?

A. From the pulmonary veins through the open mitral valve into the left ventricle; from the right auricle past the tricuspid valve into the right ventricle.

Q. What are the principal Arteries supplying the Head?

A. Two Vertebral and two common Carotid.

Q. Describe *Common Carotid Arteries?*

A. Right and Left; about ⅓ inch in calibre and are similar in position and course through the neck on either side; the Right is the shorter, and is more superficial than the Left; it is one of the terminal branches of the innominate artery, which arises from arch of aorta on right side, the other branch being the Subclavian.

Q. Describe *Left Common Carotid?*

A. Arises from left of arch of aorta, passes upward and a little outward to left of sterno-clavicular articulation, and then pursues same course as right common carotid; it is situated just behind upper portion of sternum.

Q. Where do the Common Carotids terminate?

A. Opposite upper border of thyroid cartilage, without giving off any branches up to that point.

Q. What are the two branches of each common carotid?

A. External and Internal Carotids.

Q. Describe *External Carotid?*

A. One-fourth of an inch in calibre; arises from common carotid in the carotid triangle, opposite upper border of thyroid cartilage; passes up neck to a point opposite neck of lower jaw where it divides into two terminal branches—Internal Maxillary and Superficial Temporal.

Q. What are the Branches of External Carotid?

A. Eight—Superior Thyroid, Lingual, Facial, Occipital, Posterior Auricular, Ascending-pharyngeal, Temporal and Internal Maxillary.

Q. Describe the *Superior Thyroid Artery?*

A. The first branch of External Carotid; 1-7 inch in calibre; arises close to bifurcation of common carotid; passes upward, forward and downward to thyroid cartilage, and thence to thyroid gland.

Q. Describe the *Lingual Artery?*

A. Arises opposite the hyoid bone; passes upward, downward, upward again, to under surface of tongue to its tip, where it ends in the Ranine artery, which is very superficial; 1-7 inch in calibre.

Q. Describe *Facial Artery?*

A. Arises a little above lingual; passes upward, forward, inward, again forward within Submaxillary Gland, extending parallel with base of lower jaw; leaving gland, it makes a sharp turn upward over edge of body of jaw, curving through a notch in front of masseter muscle; quite superficial over body of jaw, and flow of blood can be controlled by pressing artery against edge of bone; it then passes obliquely upward and forward towards inner canthus of eye where it ends as the *angular* artery; from body of jaw it passes near angle of mouth and ends in Levator labii superioris alæque nasi muscle.

Q. How are the Branches of Facial divided?

A. Into Cervical and Facial.

Q. What are the Cervical and Facial Branches?

A. *Cervical Inferior or Ascending Palatine*—supplies stylo-glossus and stylo-pharyngeus muscles, soft palate and palatine glands; *Tonsillar*—supplies tonsil and root of tongue; *Submaxillary*—supplies submaxillary gland, lymphatic glands, neighboring muscles and integuments; *Submental*—largest, supplies muscles attached to jaw, a superficial branch supplying depressor labii inferioris muscle and integument, and a deep branch supplying lower lip; the muscular branches supply internal pterygoid and stylo-hyoid, masseter and buccinator muscles. Facial Branches: *Inferior labial* supplies muscles and integument of lower lip; *inferior coronary* supplies labial glands, mucous membranes, and muscles of lower lip; *superior coronary* supplies upper lip and nose; *lateralis nasi* supplies wing and dorsum of nose; *angular* supplies cheek, lachrymal sac, and orbicularis muscle.

Q. Describe *Occipital Artery?*

A. Arises from posterior part of external carotid opposite the facial, covered by part of parotid gland, and higher up passes across internal carotid artery, internal jugular vein, and pneumogastric and spinal accessory nerves; ascends, passes backward in a groove of temporal bone, and vertically upwards over occiput where it divides into numerous branches.

Q. Describe *Posterior Auricular Artery?*

A. Small, arises opposite apex of styloid process, ascends covered by parotid gland to groove between cartilage of ear and mastoid process where it divides into *interior* branch, which supplies back of auricle and *posterior* branch supplies scalp above and behind ear. The posterior auricular also supplies digastric, stylo-hyoid, and sterno-mastoid muscles, and parotid gland, and divides into stylo-mastoid and auricular branches.

Q. Describe *Ascending Pharyngeal Artery?*

A. Smallest of external carotid branches; deep in neck; arises from back part near beginning of carotid; ascends vertically to under surface of base of skull; supplies muscles and nerves of neck; and a pharyngeal branch goes to tympanum; and a meningeal branch to dura mater.

Q. Describe *Temporal Artery?*

A. Smaller of the two terminal branches of external carotid; begins in parotid gland between neck of condyle of lower jaw and external meatus, crosses root of zygoma just beneath integument, and two inches above zygomatic arch divides into *anterior* and *posterior* branches; the anterior passes over forehead and supplies muscles, etc., of that region and can be felt when used to note the pulse; the posterior temporal is larger, and curves upward and backward along side of head and joins its fellow of opposite side.

Q. What are the Branches of *Temporal artery?*

A. Besides some small branches to parotid gland, temporo-maxillary articulation, and masseter muscle, its branches are the *transverse facial*, given off in parotid gland, passes across face between Steno's duct and lower border of zygoma, and divides on side of face into numerous branches which supply parotid gland, masseter muscle, and integument; it rests on masseter muscle; *middle temporal* arises just above zygomatic arch, and supplies temporal muscle, and a branch goes to orbicularis palpebrarum; *anterior auricular* branches go to external ear.

Q. Describe *Internal Maxillary Artery?*

A. Larger of the two terminal branches of external carotid; passes inward, at right angles to carotid, to inner side of condyle of lower jaw, to supply deep structures of face; at its origin is imbedded in parotid gland; situated on level with lower end of lobe of ear; it passes forward and inward between ramus of jaw and internal lateral ligament; crosses inferior dental nerve and lies beneath external pterygoid muscle; in 2d part of its course, it passes obliquely forward and upward, back of ramus of jaw and lower part of temporal muscle; in 3d part of its course, it approaches superior maxillary bone; enters spheno-maxillary fossa, and lies in relation to Meckel's ganglion.

Q. What are the Branches of Maxillary Portion of Internal Maxillary?

A. *Tympanic* to tympanum; *Middle Meningeal* to dura mater; *Small Meningeal* to Gasserian ganglion, and dura mater; and *Inferior dental.*

Q. Describe *Inferior Dental Artery?*

A. Descends with dental nerve to foramen on inner side of ramus of lower jaw; passes along dental canal in body of lower jaw giving off branches to molar and bicuspid teeth; opposite 1st bicuspid it divides into two branches—*incisor* and *mental;* incisor branch continues forward in bone beneath incisor teeth and gives off branches which supply inferior canines and incisors, as far as symphysis, where it anastomoses with same artery on opposite side; mental branch emerges with nerve at mental foramen and supplies chin, and anastomoses with submental, inferior labial, and inferior coronary arteries.

Q. Where is *Mylo-hyoid* branch of Interior dental given off?

A. As the inferior dental enters dental foramen; it runs in mylo-hyoid groove and ramifies under surface of mylo-hyoid muscle.

Q. What are the Branches of the Pterygoid Portion of Internal Maxillary?

A. *Deep Temporal*, two in number which supply temporal muscle; *Pterygoid*, which supply pterygoid muscles; *Masseteric*, which passes above sigmoid notch to supply masseteric muscle; *Buccal*, a small branch which runs forward to supply buccinator muscle.

Q. What are the Branches of the Spheno-maxillary Portion of Internal Maxillary?

A. *Alveolar or Posterior Dental*, which is given off by a common branch with the infra-orbital just as the trunk is passing into spheno-maxillary fossa; it descends upon tuberosity of superior maxillary bone and divides into numerous branches, some entering the posterior dental canals to supply molar and bicuspid teeth and lining of antrum; others continue forward on alveolar process to supply the gums; *infra-orbital*, a continuation of internal maxillary; arises by a common trunk with posterior dental, and passes along infra-orbital canal with superior maxillary nerve, emerging on face at infra-orbital foramen. In the canal it gives off branches to orbit, lachrymal gland and muscles of the eye; other branches called *anterior dental* descend through canals in bone to supply mucous membrane of antrum and the upper front teeth; on face it supplies lachrymal sac, inner angle of orbit, and anastomoses with facial, and nasal of ophthalmic; *descending palatine* passes down along posterior palatine canal; emerges from posterior palatine foramen, runs forward on inner side of alveolar border of hard palate to anterior palatine canal; its branches go to the gums, mucous membrane of hard palate, and palatine glands, while in palatine canal, branches leave it to supply soft palate and tonsils; *vidian*, passes along vidian canal to pharynx, Eustachian tube and tympanum; *pterygo-palatine*, passes through pterygo-palatine canal to pharynx and Eustachian tube; *nasal or spheno-palatine* passes through foramen of same name into cavity of nose, and its branches supply nose, antrum and ethmoid and sphenoid cells.

Q. Describe *Internal Carotid Artery?*

A. Commences at bifurcation of common carotid, opposite upper border of thyroid cartilage; runs upward to carotid foramen in petrous portion of temporal bone; then forward and inward through carotid canal into skull; then ascends to posterior clinoid process, forward through cavernous sinus; then upward, pierces dura mater and divides into terminal branches; it supplies anterior part of brain, eye and appendages, forehead and nose.

Q. What does the term "anastomoses" imply?

A. The union or inosculation of one blood vessel with another.

Q. Name, with the origin, insertion and action of each of the muscles concerned in the movements of Lower Jaw?

ANSWER:	*Origin.*	*Insertion.*	*Action.*
Temporal.	Temporal fossa and fascia.	Coronoid process.	To bring incisor teeth together.
Masseter.	From anterior ⅔ and inner surface of Zygoma and malar process of superior maxillary.	Angle, ramus and coronoid process of lower jaw.	Raise back part of lower jaw; muscle of mastication.
External Pterygoid.	Upper head from pterygoid ridge, great wing of Sphenoid, Lower head from External pterygoid plate and tuberosities of palate and superior maxillary bones.	Depression in front of condyle of lower jaw and inter-articular fibro-cartilage.	To draw jaw forward.
Internal Pterygoid.	Pterygoid fossa of sphenoid, and tuberosity of palate.	Angle and inner surface of ramus as high as dental foramen.	Raise and draw forward lower jaw.
Digastric.	By two bellies:—posterior from mastoid process of temporal bone; anterior from fossa on inferior maxillary near symphysis.	Into central tendon, perforating stylo-hyoid muscle; bound down to hyoid bone by aponeurotic loop.	To raise hyoid bone and tongue and draw down lower jaw.
Omo-hyoid.	Upper border of Scapula.	Hyoid Bone.	To depress and draw backward hyoid bone and depress lower jaw.
Mylo-hyoid.	Mylo-hyoid ridge.	Hyoid bone.	To elevate and draw forward hyoid bone and depress lower jaw.
Genio-hyoid.	Inferior genial tubercle of inferior maxillary.	Hyoid bone.	Elevates and draws forward hyoid bone, and depresses jaw.
Platysma Myoides.	Cellular tissue and integuments below clavicle.	Chin and fascia of lower jaw.	To depress mouth and wrinkle skin.

Q. Name principal *Muscles of Expression*, with origin, insertion and action?

ANSWER:	*Origin.*	*Insertion.*	*Action.*
Orbicularis Oris.	Nasal septum and inferior and superior maxillary borders.	Buccinator and adjacent muscles.	To close mouth.
Levator labii superioris alæque nasi.	Nasal process of Superior Maxillary.	Cartilage of wing of nose and upper lip.	To elevate upper lip and dilate nostril.
Levator labii superioris.	Lower margin of orbit.	Upper lip.	To elevate the lip.
Levator anguli oris.	Canine fossa of Superior maxillary.	Angle of mouth.	To elevate angle of mouth.
Zygomaticus Major.	Malar bone.	Angle of mouth.	To raise lip outward.
Zygomaticus Minor.	Malar bone.	Angle of mouth.	To raise lip outward.
Levator Labii Inferioris.	Incisive fossa of Inferior Maxillary.	Integument of lower lip.	To elevate lower lip.
Depressor Labii Inferioris.	External oblique line of Inferior Maxillary.	Lower lip.	To depress lower lip.
Depressor anguli oris.	External oblique line of inferior maxillary.	Angle of mouth.	To depress angle of mouth.
Buccinator.	Posterior alveolar process of both jaws.	Orbicularis oris.	To compress cheeks.
Risorius.	Fascia over masseter muscle.	Angle of mouth.	The laughing muscle.

Q. Describe the *Stomach*, and the part it takes in digestion?

A. It resembles in structure the rest of intestinal tract, hollow, with a peritoneal covering and a mucous membrane lining, in the latter is the special function, as there lie glands which secrete the gastric juice; its active peristaltic motion churns the food about after deglutition, and exposes it to the action of the digestive organs; the function of the stomach is the digestion of proteids.

Q. What are the *Glands of Stomach?*

A. The peptic and pyloric.

Q. Name the time required for stomach digestion?

A. From one to five or six hours, the time varying according to kind and amount of food ; rest of the stomach favors digestion, also an even mind, or its gentle exercise, undisturbed mental condition, and a healthy body. Little or no absorption takes place from stomach.

Q. What is the capacity of the stomach ?

A. About a quart in the adult, but its muscular walls admit of its contraction so as to adapt itself to contents much or little.

Q. What nerves supply the stomach ?

A. The pneumogastric and sympathetic ; also numerous ganglia are found in the stomach-walls ; irritation of pneumogastric causes contraction ; its division cessation of peristalsis ; the vagus to some degree controls secretion.

Q. What is the *Duodenum?*

A. The first part of the small intestine.

Q. What is the *Jejunum?*

A. The upper $\frac{2}{5}$ of small intestine.

Q. Describe the *Kidneys?*

A. Two glandular organs somewhat of the form of a bean, somewhat more than 4 inches in length and 2 inches in breadth, and 1 inch thick, and weigh from 4 to 6 ounces ; invested by a thin but tough capsule, which on removal leaves a smooth even surface of a deep-red color ; a central cavity is known as the sinus, within which are the apices of 10 pyramidal projections ; a cut section shows that the outer (cortical) portion differs in appearance from the more central (medullary) portion. The blood-supply is from the renal artery, and the nerve-supply from the sympathetic system through the solar plexus.

Q. Describe the circulation of blood in the Kidney ?

A. The renal artery on entering the kidney divides into several branches which pass into the tissue of the organ ; branches from these arteries terminate in the cortex, and into the pyramids ; those which pass into the cortex divide to become the afferent vessels to the Malpighian bodies, and after passing through the capillary tuft, the blood is recollected and goes out by an efferent vessel ; this efferent vessel divides into a minute capillary plexus which surrounds the uriniferous tubules in the cortex of the kidney, and these capillaries unite to form the venous return circulation ; numerous minute branches are given off which pass into the pyramids, surround the portion of the uriniferous tubule which passes into the medullary region of kidney, and return to join the branches from the cortex and form the venæ propriæ.

Q. What are the *Ureters?*

A. The ducts of the kidneys, which, after the urine is collected in the tubules and passes into the pelvis, carries it in irregular quantities to the urinary bladder.

Q. What are *Malpighian Corpuscles?*

A. Small bodies in cortex of kidney.

Q. What are *Malpighian Bodies?*

A. Minute tufts of capillaries which are surrounded by a capsule lined by epithelial cells—glomeruli of the kidneys.

Q. What is the condition of Fibres of *Peridental Membrane* next to the bone?

A. So thick as to represent bundles.

Q. What is the nature of Peridental Membrane on surface in contact with the cementum?

A. A fine network of interlacing bands closely connected with surface of cementum.

Q. How do the thicker fibres of its outer surface pass into the fine network of inner surface?

A. Insensibly where inner surface is more richly cellular.

Q. What are found on inner surface?

A. Large, soft nucleated plasma masses—cementoblasts.

Q. What is the office of the Peridental Membrane?

A. *Functional*, so far as it is the membrane in which osteoblasts that form alveolar walls, and cementoblasts that form cementum, are developed; *Physical*, so far as the function of securing tooth in cavity; *Sensory*, so far as it is the organ of touch of the tooth, on account of its abundance of nerves.

Q. What other cells besides osteoblasts and cementoblasts are found in the Peridental Membrane?

A. Fibroblasts for renewal of fibrous tissues; Osteoclasts for removal of alveolar walls, for change in position of teeth, or for change of form of root through the cementum-absorption.

Q. When are Osteoclasts developed?

A. As occasion requires; but are generally present somewhere within alveolus.

Q. Does the Peridental Membrane contain Lymphatics?

A. Yes, peculiar to itself, and many in contact with cementum.

Q. Into how many parts is it divided?

A. Three—*Gingival*, portion about neck of tooth and below margin of alveolar cavity; *Apical*, portion occupying apical space; *Body*, portion from margin of alveolar wall to apical space.

Q. How are the arteries distributed over Peridental Membrane?

A. Larger ones enter root canal to supply pulp, while the others, four, six or eight in number, pass along sides of root to this membrane; passing along membrane they divide into many branches, a number of which enter Haversian canals of alveolar walls, or receive branches from such a source.

Q. Describe nerve supply of Peridental Membrane?

A. Nerves are received by it in same manner as the arteries; a rich plexus is formed at gingival border.

Q. What function do the nerves give to this membrane?

A. They render it the organ of touch, as the enamel has not such a sense.

Q. When normal is it very susceptible to irritation?

A. No, but is very painful when inflamed.

Q. Are the nerves supplied to this membrane through the alveolar walls sufficient to maintain its sensory function?

A. Yes, Example: Large acute abscess in apical space destroying the nerves entering at such space (see Dental Histology).

Q. What is the exposed surface of *Gums* covered with?

A. A dense, squamous epithelium to withstand severe abrading by the food, etc.

Q. What does the exposed surface of gums rest upon?

A. On a layer of softer epithelial cells which cover a series of papillæ rising from fibrous tissue beneath; and all rest on upper edge of alveolar process, and the dense epithelial covering is drawn tightly around necks of teeth forming a strong resistant, but flexible, cushion to the tissues it protects.

Q. What has been called the Dental Ligament?

A. The radiating bundles of fibrous tissue which form the strong attachment of gum to necks of teeth.

Q. How far does this attachment to tooth extend from extreme edge?

A. One-eighth to three-eighths of an inch, varying in different persons and about different teeth.

Q. In what respects does the inner surface of free margin of gums differ from other parts?

A. It is covered with a soft polygonal gland-like epithelium, but it has no gland structure.

Q. What is it called?

A. The Gingival organ.

Q. What does it secrete?

A. A profusion of Mucous Corpuscles.

Q. When they accumulate and are mixed with micro-organisms what is formed under free margins of gums?

A. A soft, cheesy mass like pus, and often mistaken for it.

Q. Describe structure of *Salivary Glands?*

A. Consist of numerous lobes made up of smaller lobules connected by loose areolar tissue, vessels, and ducts.

Q. What does each lobule consist of?

A. Numerous closed vesicles which open into a common duct.

Q. What arteries and nerves pass through and lie close to Parotid Gland?

A. External Carotid, Internal Carotid arteries, Internal Jugular vein; and Facial nerve.

Q. What artery lies in a groove in Submaxillary Gland?

A. Facial artery.

Q. Describe the *Lungs?*

A. Two essential organs of respiration in the cavity of thorax covered by the pleura, characterized by lightness (sp. gr. 0.345 to 0.746), sponginess, elasticity, and crepitation when pressed. They together weigh about 42 ozs., the right lung heavier than left by 2 ozs., also the largest having 3 lobes, while the left has 2 lobes.

Q. How is each Lung divided?

A. Into Apex, Base, External and Internal surfaces and Root.

Q. What is the Structure of the Lung?

A. A serous coat—pleura, sub serous elastic areolar tissue investing the entire organ, and parenchyma, or true lung tissue composed of lobules and alveoli, or air cells.

Q. What are the blood vessels and nerves of the Lungs?

A. Vessels—bronchial and pulmonary arteries; bronchial and pulmonary veins, lymphatics; and nerves—branches of pneumogastric and sympathetic.

Q. What are the *Pleuræ?*

A. Two delicate serous sacs, one surrounding each lung and reflected over the pericardium, the diaphragm, and inner surface of thorax.

Q. What are the *Kidneys?*

A. The organs secreting urine.

Q. Where are they situated?

A. Posteriorly in the abdomen, one on each side of the spinal column, behind peritoneum; the right is lower than the left; each one is 4 inches by 2 by 1, and weighs from 4 to 6 ozs.

Q. What is the Ureter?

A. The excretory duct of each kidney in the form of a musculo-membranous tube 16 to 18 inches long and of calibre of a small goose quill.

Q. What is the Bladder?

A. The reservoir of the urine.

Q. Describe the *Bladder?*

A. A musculo-membranous sac, situated in anterior position of pelvis, behind pubes.

Q. What is the Structure of Bladder?

A. It has a partial peritoneal investment, and its walls have 3 coats —Muscular, Cellular, and Mucous coats.

Q. What nerves supply the bladder?

A. Branches from the hypogastric and sacral plexuses.

Q. Describe the *Liver?*

A. The largest gland in the body, weighing from 3 to 4 pounds, and measuring transversely about 12 inches, antero-posteriorly 6 inches, greatest thickness 3 inches; situated in right hypochondriac, epigastric, and part of the left hypochondriac regions, with 5 hepatic fissures and 5 hepatic lobes.

Q. What is the Structure of the Liver?

A. Composed of numerous lobules, each consisting of hepatic cells.

Q. What is the Gall-bladder?

A. A pear-shaped bag 3 by 4 inches long, an inch in greatest diameter, holding 8 to 10 fl. drachms.

Q. What is the *Pancreas?*

A. A racemose gland, 7 inches long, of a grayish-white color, situated behind the stomach; resembles the salivary glands in structure, its pancreatic duct extending the whole length of the gland.

Q. What is the *Spleen?*

A. A soft, spongy, vascular organ, about 5 by 3 by 2 inches, weighing 6 to 10 ozs., and situated deeply in the left hypochondrium, embracing the cardiac end of stomach to which it is connected.

Q. What is the *Stomach?*

A. The principal organ of digestion, pyriform in shape, musculo-membranous in structure, about 12 inches long by 4 inches in average diameter; the fundus connected to spleen, and pylorus (or lesser end) in contact with anterior wall of abdomen.

Q. What is the structure of Stomach?

A. Has 3 coats—mucous, cellular, and muscular.

Q. Name the vessels and nerves of Stomach?

A. Branches of Hepatic artery and branches of Splenic artery; Nerves—terminal branches of right and left pneumogastrics, semilunar ganglion of sympathetic, forming gastric plexus.

Q. What is the *Small Intestine?*

A. A convoluted, tubular digestive organ, about 20 ft. in length; the duodenum is the first part of small intestine and is 10 inches in length, the jejunum is the second part, and the ileum is the third part.

Q. What are the coats of the small intestine?

A. A mucous, submucous or cellular, and muscular coat.

Q. Describe the *Duodenum?*

A. It begins at the sulcus pyloricus and ends at the duodeno-jejunal angle or flexure where it becomes the Jejunum; its axial length is 10–12 inches (12 fingers); it is supplied with blood by the right and left gastro epiploic arteries; it has no meseul and is partially covered with peritoneum, and surrounds the head of the pancreas; into its descending portion open the ductus communis choledochus, and the pancreatic duct; 3 coats—mucous, submucous or cellular and muscular.

Q. What is the *Jejunum?*

A. It comprises the $\frac{2}{5}$ of small intestine, its coil lying around the umbilical region; it is empty after death, hence its name; the Ileum comprises the rest of small intestine and terminates at the ileo-caecal valve.

Q. What are the Glands of *Small Intestine?*

A. Crypts of Lieberkühn, Brunner's Glands, Solitary Glands, and Peyer's Patches.

Q. How long is the *Large Intestine?*

A. About 5 feet, of large calibre, and has same coats as small intestine, but no villi.

Q. What is the *Œsophagus?*

A. A muscular membranous tube, about 9 inches long; it is situated in neck between the trachea and vertebral column; it has three coats—mucous, cellular, and muscular.

Q. What is the *Larynx?*

A. A musculo-membranous cartilaginous box placed between trachea and base of tongue, and constituting the essential organ of the voice.

Q. What are the *Cartilages of the Larynx?*

A. Thyroid, cricoid, epiglottis, arytenoid, cuneiform, cornicula.

Q. What is the *Trachea?*

A. A membranous-cartilaginous cylindrical tube, about 4½ inches long and ¼ to 1 inch diameter, beginning at lower border of larynx and ending by its bifurcation into the two bronchi; composed of a fibro-elastic membrane, containing 16 to 20 imperfect cartilaginous rings connected by muscular fibres.

Q. What are the *Bronchi?*

A. Two tubes similar in formation to trachea, extending from its bifurcation into the lungs, where they divide and subdivide into bronchial tubes losing their rings at the 2d or 3d subdivisions, whence plates of cartilage extend to their minuter ramifications. The two divisions are Right and Left Bronchi.

Q. Describe the *Shoulder Joint?*

A. A ball and socket joint; the bones of its formation being large globular head of humerus which is received into the shallow glenoid cavity of the scapula; above the joint is protected by an arched vault, formed by the under surface of coracoid and acromion processes, and the coraco-acromial ligament; the ligaments are the capsular, glenoid, coraco-humeral and transverse humeral; synovial membrane; the supraspinous muscle above, and long head of triceps below; externally, the infra-spinatus, and teres minor; internally, the subscapularis muscle; within the long tendon of the biceps; the deltoid is placed most externally, and covers the articulation on its outer side, and in front and behind; the arteries are branches of anterior and posterior circumflex, and suprascapular; the nerves are from the circumflex and suprascapular.

Q. Describe the *Elbow Joint?*

A. A hinge joint; bones of its formation are trochlear surface of humerus, which is received into greater sigmoid cavity of ulna; the radial head of humerus articulates with cup-shaped depression on head of radius; circumference of head of radius articulates with lesser sigmoid cavity of ulna; articular surfaces are covered with thin layer of cartilage and joined together by a capsular ligament of unequal thickness; the ligaments are: anterior, posterior, internal lateral, external lateral; also the orbicular ligament of upper radio-ulnar articulation; the synovial membrane is very extensive, and covers margin of articular surface of humerus; three masses of fat are between capsular ligament and synovial membrane; muscles in relation to joint are, in front, brachialis anticus; behind, triceps and anconeus; externally, the supinator brevis and common tendon of origin of the extensor muscles;

internally, the common tendon of origin of the flexor muscles, and flexor carpi ulnaris, with ulnar nerve; the arteries are from the communicating branches between superior profunda, inferior profunda, and anastomotica magna, branches of the brachial, with anterior, posterior, and interosseous recurrent branches of ulnar, and recurrent branch of radial artery; the nerves are derived from the ulnar and the olecranon, a filament from the musculo-cutaneous, and two from the median.

Physiology.

Q. In the chemical basis of the body, what is the proportion of oxygen, carbon, hydrogen, and nitrogen taken together?

A. About ninety-seven per cent.

Q. What other elements are present in small quantities?

A. Sulphur, chlorine, phosphorus, silica, fluorine, sodium, potassium, calcium, magnesium, and iron.

Q. What two important groups of substances form the body?

A. Nitrogenous and non-nitrogenous.

Q. Which of these perform the most important functions, and all the active portions of the organism?

A. The Nitrogenous.

Q. What are Proteids?

A. The albumins and albuminoid constituents of the organism.

Q. What are they precipitated from?

A. From solutions by alcohol and different metallic salts, coagulated by heat and mineral acids.

Q. What do the Carbo-Hydrates include?

A. Starches and sugars.

Q. Are Fats widely distributed in plants and animals?

A. Yes; they contain little oxygen.

Q. What is the function of the *Blood?*

A. It distributes nutritious materials to all parts of the system, and collects substances no longer needed on account of change going on in the tissues, and carries them to organs which discharge them from the body.

Q. What is the color of Blood in different parts of the system?

A. In systemic arteries of a bright scarlet-red; in corresponding veins of a dark bluish color; in pulmonary artery a dark blue; in pulmonary veins scarlet.

Q. What is the variation in color due to?

A. From combination of hæmoglobin with oxygen (oxy-hæmoglobin) for arterial blood; and from deoxidation of the oxy-hæmoglobin for venous blood.

Q. What is the Specific Gravity of the Blood?

A. At 60° F. it has a specific gravity 1055 (1045–1062).

Q. What is the reaction of the blood?

A. Alkaline, due to presence of sodium carbonate and disodic phosphate.

Q. What does the odor of blood depend upon?

A. Presence of volatile fatty acids, and is characteristic and peculiar to the animal from which it is obtained.

Q. What is the taste of blood?

A. Saline, due to the salts it contains.

Q. What is the temperature of the blood?

A. Varies from 98.5° F., at surface of body to 107° in hepatic vein.

Q. How does blood differ in character?

A. Arterial blood has more oxygen and less carbon dioxide, and is more coagulable; blood of portal vein varies with stages of digestion when it contains more water, albuminous matters, and sugars, and less corpuscles; in hepatic vein there is more sugar, but less albumen and fibrin.

Q. What gives the dark color to Venous Blood?

A. As it issues from the right ventricle, the oxygen present is insufficient to satisfy the whole of the hæmoglobin of the red corpuscles; much reduced hæmoglobin is present, hence the purple color of venous blood.

Q. What is the *Specific Gravity of Blood?*

A. At 60° F. (15° C.) 1055, a faintly alkaline reaction; at a temperature of 100° F. (37.8° C.) it has a salty taste and an odor peculiar to the animal.

Q. What are *White Blood Corpuscles, or Leucocytes?*

A. Small protoplasmic cells, occurring in large quantities in the lymph; of a finely granular structure, and nuclei; they have an amœboid movement and migrate through blood-vessel wall and the tissues; larger than the red disks, and have no cell wall.

Q. What are *Red Blood Corpuscles?*

A. They give red color to blood; soft, elastic, and alter shape when passing through small vessels, and then resume normal shape, as soon as pressure is removed; no nuclei; many in number.

Q. What is the size of red blood corpuscles of man?

A. About 1-3200 inch in diameter, and 1-12000 inch thick.

Q. What is the size of White corpuscles?

A. About 1-2500 inch in diameter.

Q. What is the nature of White corpuscles?

A. Flattened bi-or tri-nucleated cells; possess a contractile power and closely resemble amœbæ; most numerous in venous blood; contain several nuclei.

Q. What is the function of Red Blood Corpuscles?

A. To absorb oxygen and carry it to the tissues, all the vital functions becoming more active.

Q. What is the difference in movement between the white and red corpuscles?

A. The white in the interior of vessels adhere to inner surface, while the red move through the centre of stream.

Q. What is the peculiar power of the white corpuscles?

A. An amœboid movement by which they are able to pass through walls of capillaries into surrounding tissues.

Q. What is *Hæmoglobin?*

A. The substance that gives red color to red corpuscles, and by their aid carries oxygen to the tissues; a crystalline matter; fills the spaces of the stroma and gives the yellowish green color.

Q. What is *Hæmatin?*

A. Red coloring matter of the blood. An amorphous principle of the blood, with steel-black metallic lustre; not to be confounded with "hematin," a synonym of hæmatoxylin. Hæmatin is the result of decomposition of hæmoglobin.

Q. Name the *Gases* of the blood?

A. Chiefly oxygen, carbonic oxide and nitrogen.

Q. What is the proportion of these gases in the blood?

A. About one-half the volume; of these carbonic oxide is greatly in excess in both arterial and venous blood; the proportion is: in 100 volumes of arterial blood, $CO_2 39, O_2 20, N 1+$; in 100 volumes of venous blood, $CO_2 46$, $O_2 10$, $N 1+$.

Q. Quantity of blood in body?

A. Equal to one-twelfth to one-thirteenth part of weight of body.

Q. How is this quantity distributed?

A. About one-fourth in heart, lungs and large vessels.

" " " in liver.

" " " in muscles.

" " " in other organs.

Q. When taken from the body what is its tendency?

A. To form a clot or coagulum—crassamentum.

Q. What is coagulation or clotting of Blood due to?

A. Presence of *fibrin*.

Q. How is the Clot made up?

A. Fibrin is developed and forms in fibrils which entangle blood corpuscles, as in a web.

Q. What may prevent or delay coagulation?

A. Alkalies or their neutral salts; egg-albumen, syrup, glycerine, water, oil, or cold at freezing point.

Q. What may hasten coagulation?

A. Contact with any foreign body, heating from 39° to 55° C., or constant agitation.

Q. What is *Fibrin?*

A. A nitrogenous proteid coagulating in exposed blood.

Q. What is the source of fibrin?

A. Largely, if not entirely, from the plasma.

Q. What is *Plasma?*

A. Fluid part of the blood.

Q. What is *Serum?*

A. The pale fluid constituent of the blood.

Q. Describe the formation of a Clot or Coagulum?

A. If blood is drawn and exposed to the air in a shallow vessel, it will become semi-solid—jelly-like—then drops of the pale fluid-serum—begin to appear on the surface, and these unite to form, in the course of an hour a sufficient amount of the fluid to float the clot, which, in the meantime, is contracting from the sides of the vessel. The serum continues to exude and the clot to contract for 24 to 36 hours, the color of the clot remaining red, while the serum has a pale straw color.

Q. Why does not blood clot in living vessels?

A. It is supposed that the living blood-vessels exert a restraining influence upon the formation of the fibrin ferment.

Q. What is the chemical basis of blood?

A. Water is the principal constituent, and in it are dissolved salts and proteid matters, and suspended in it are the corpuscles—water, inorganic salts (chiefly sodium chloride and potassium phosphate), organic matter (Hæmoglobin), proteids and fats.

Q. What is the proportion of the white to the red corpuscles of the blood?

A. The usual proportion is 1 to 500, but this relation is varied by conditions of health and disease, by age, etc. Some give the proportion 1 to 350 red. The white are larger than the red corpuscles.

Q. What is the function of the white blood corpuscles?

A. They are a source of reserve active protoplasm for the repair of destructive processes in both health and disease; they assist in the absorption of solid and fatty matters, and a certain part—phagocytes—acts against foreign substances, or obnoxious microbes.

Q. What are the constituent parts of the red corpuscles?

A. The stroma and hæmoglobin.

Q. What is the *Stroma?*

A. A transparent, colorless, homogeneous and plastic substance, very extensible and pliable.

Q. What is the function of the Heart?

A. To propel blood through body—to give the initiative and chief impulse to the circulation of the blood.

Q. How does the right side differ from left side of Heart?

A. The right side takes venous blood from vena cava and propels it through lungs to left side.

Q. What is circulation of right side called?

A. Pulmonic circulation.

Q. What is the function of auricle of heart?

A. To force blood through auriculo-ventricular opening and to supply ventricles.

Q. What is the function of Valves of Heart?

A. To allow the blood to pass in one direction only through the heart. They prevent regurgitation of blood.

Q. How does the Blood circulate through the heart?

A. It enters right auricle from cavæ, and passes from right auriculo-ventricular opening into right ventricle, then through pulmonary artery into lungs; from lungs through pulmonary veins to left auricle, and through left auriculo-ventricular orifice to left ventricle; from the ventricles through aorta and thus through arterial system.

Q. What are the movements of the heart?

A. Contraction, or systole; expansion, or diastole.

Q. What is the rate of heart beats?

A. Before birth, per minute, 140-150; at birth, 130; during 1st year, 125-135; 3d year, 95-100; 8th, 9th, to 14th year, 85-90; adult, about 75; old age, 65.

Q. What is meant by *Circulation of Blood?*

A. The course which the blood follows in taking food and air to the tissues, and bringing away useless material for excretion, and returning when freshly charged with oxygen and food.

Q. What comprises the Circulatory Apparatus?

A. The Heart, which propels the blood; Arteries, which convey it from heart to different parts of body; Capillaries, which bring the blood into intimate contact with the tissues; Veins, which collect the blood from capillaries and return it to heart.

Q. What is the difference between arterial and venous blood?

A. Arterial blood is bright red from combination of hæmoglobin with oxygen. Venous blood is purplish or blue, from deoxidation of the oxy-hæmoglobin. Arterial blood contains more oxygen and less carbon dioxide than venous.

Q. What are *Microcytes?*

A. Corpuscles smaller than the red or white; probably immature corpuscles.

Q. What are the *Heart-Sounds?*

A. The first sound, over apex of heart, is dull, prolonged, booming; the second, immediately after the first, is sharp, quick, almost clicking, and heard best over base of heart.

Q. What is the Cause of heart-sounds?

A. Of the first, muscular action and vibration of auriculo-ventricular valves, and chordæ tendinæ; of second, caused by the closure of the semilunar valves.

Q. What is meant by *Systole?*

A. The contraction of heart and arteries.

Q. What force does the heart exert in systole?

A. The left ventricle exerts more than twice as much power as the right.

Q. What are the influences of nervous system upon heart's action?

A. Not clearly known. The mechanism of rhythmical contraction is contained within the heart itself; and it is possible that nerve-ganglia exist in the human heart, as they do in the frog's heart, and these ganglia are connected with fibres from pneumogastric (vagus) nerve and with the sympathetic system.

Q. What is the effect of Pneumogastric nerve upon heart?

A. An inhibitory or slowing effect.

Q. What is the relation of the heart to Sympathetic nervous system?

A. If the fibres are left after all other nerve-connections of heart are cut away, stimulation of spinal cord causes the heart's action to become rapid. These are called accelerator nerves.

Q. In what sex is the Pulse most rapid?

A. Female.

Q. What effect has posture on pulse?

A. Erect causes a more rapid pulse than the prostrate; respiratory changes, small repeated swallows of water, etc., influence its rate.

Q. What is meant by blood-pressure?

A. That under which the stream is kept up by the action of heart and walls of blood vessels.

Q. What are the nerves which influence blood-pressure called?

A. Vaso-motor.

Q. What effect has galvanism on blood-pressure?

A. It raises it.

Q. What is Asphyxia?

A. Condition caused by non-oxygenation of blood.

Q. What effect has asphyxia on blood-pressure?

A. It increases it by stimulation of vaso-motor centre in medulla.

Q. What assists flow of blood in Capillaries?

A. Capillary attraction and pressure due to the muscular movements of body; the action of the heart and coats of the arteries.

Q. What causes the pulse?

A. A wave of force which passes along column of blood in artery due to a single contraction of heart, so that each pulse represents a heart beat, but not the blood thrown out at that beat.

Q. What force does the heart exert in Systole?

A. The left ventricle exerts more than twice as much power as the right; the intra-auricular pressure is very much less than the intra-ventricular and there is a negative pressure during diastole in the auricles.

Q. What is the estimated work of the heart in Systole?

A. Each ventricular contraction represents 3½ to 4½ foot-pounds, in 24 hours this is estimated to equal more than 120 foot tons.

Q. What influence has the nervous system upon the heart's action?

A. Somewhat undecided; the mechanism of rhythmical contraction, however, is contained within the heart itself; it is probable that nerve-ganglia exist in the heart, and these ganglia are connected with the pneumogastric (vagus) nerve and with the sympathetic system.

Q. What is the effect of the pneumogastric nerve upon heart?

A. An inhibitory or slowing effect.

Q. How is the heart related to the sympathetic Nervous System?

A. By the accelerator nerves, fibres of sympathetic from the cervical and upper dorsal spinal cord which pass to the heart.

Q. How is the heart nourished?

A. By the coronary arteries; they do not receive blood during systole, but during diastole from pressure of blood in the elastic arteries; the blood is returned to right auricle through coronary vein.

Q. What is the action of the auricles?

A. During rest the heart-blood flows freely from veins to ventricles, the auriculo-ventricular valves offering no resistance; but the influx is so strong that by the time the heart begins to contract the auricle is quite filled and the ventricle partially; the contraction of auricle is sudden and very quick, commencing at great veins and extending towards the ventricular opening; both auricles contract simultaneously.

Q. Why do not the auricles throw blood back into veins?

A. The power of auricular contraction is not great enough to cause a reflux; the muscular coat of great veins near heart contracts; the weight of incoming blood opposes.

Q. What is the action of the ventricles?

A. The ventricles are distended during their rest by flow of blood from the veins and by auricular contraction, and their contraction is continuous with that of auricles; the ventricular contraction is slower and probably empties the cavities; the ventricles contract simultaneously, and their shape is changed; they shorten and twist to the right and the form is conical; as the organs relax they turn back and resume their former positions and have a cone shape with elliptical base. The shortening of ventricles in systole is denied by some.

Q. What are the four principal valves of the heart?

A. Two auriculo-ventricular, and two in great arteries, the aorta and pulmonary artery.

Q. What is the Tricuspid valve?

A. The right auriculo-ventricular valve of the heart.

Q. What is its action?

A. In some cases it does not entirely close, but allows a certain amount of regurgitation of blood—in disease or violent exertion in which the lung capillaries are overcharged with blood.

Q. What is the "period of repose"?

A. The perceptible pause between the contractions of the heart-muscle.

Q. How is the Heat of Body lost?

A. The blood at surface of body is cooled by colder air, or by evaporation of sweat; this is regulated by vaso-motor nerves, as upon exposure to a colder atmosphere there is sudden contraction of superficial capillaries; also loss of heat by lungs.

Q. What products result from combustion in the body?

A. Carbonic oxide and water.

Q. What causes unite to compel the return of blood through the veins?

A. The pressure remaining from the force of the left ventricle systole and arterial elasticity; muscular action in pressing upon veins which have valves; suction power of heart; aspiration power (suction) of chest in respiration; the slight rhythmical contraction of the veins.

Q. What is *Arterial Tension?*

A. The walls of arteries being elastic and blood forced into them at considerable pressure, permits them to keep the blood under elastic compression within the arteries, so that when an artery is cut the blood spurts from it in a jet; the capillaries on account of the friction they offer to the blood current maintain a less degree of tension.

Q. What causes modify arterial tension?

A. The rate of heart-beats; vaso-motor changes; the amount of blood in system; motion of thoracic walls in breathing.

Q. What controls vital capillary force?

A. The vaso-motor sympathetic plexus of each capillary.

Q. At what speed does the blood circulate?

A. Thirty-five feet per second.

Q. What is Respiration?

A. The process by which oxygen is introduced to system and by which carbonic acid is excreted.

Q. What is the object of *Respiration?*

A. To bring oxygen of air in close relationship with the hæmoglobin in blood, and to permit of elimination of carbonic acid gas, and other effete products from body.

Q. What do the movements of chest represent?

A. Enlargement represents inspiration, and contraction expiration.

Q. What is the function of the pulmonary artery?

A. Supplies blood for aeration—oxidation.

Q. What is the function of bronchial artery?

A. Supplies blood for nourishment of lung tissue.

Q. How is blood brought to vesicles and exposed to the air?

A. The smaller branches of pulmonary artery divide more and more and do not anastomose with each other; the minute capillaries pass between the air vesicles, the thin wall of vessel and vesicle permitting a free interchange of gases to take place.

Q. What are the pathological conditions of blood?

A. Plethora—increase in volume or quantity; Anæmia—deficiency of red globules and increase in water; Leucocythemia—increase of white and diminution of red corpuscles; Glycohæmia—excess of sugar; Uræmia—increase of urea; Cholesteræmia—excess of cholesterine; Thrombosis and Embolism—clotting of blood in vessels and coagula; Lipæmia—excess of fat; Melanæmia—pigment in blood.

Q. Describe *Inspiration?*

A. The side walls and front of chest move upward and outward and a vacuum is thus made, and air rushes in to equalize the internal and external atmospheric pressure; the antero-posterior diameter of chest is increased by raising of anterior part of ribs, the posterior ends being fast in spinal column; the increase in lateral diameter is due to outward movement of ribs; the increase in vertical diameter by descent of diaphragm, its convex surface becoming less arched; the diaphragm is the most important respiratory muscle.

Q. Describe *Expiration?*

A. These movements occur passively by the weight of chest, which sinks down, displacing the air, aided by the elastic tissue of lungs; when it is forced, the abdominal muscles pull down the chest.

Q. What is the effect of sex on Respiration?

A. In males it is largely abdominal; in females chiefly costal or thoracic.

Q. What sounds issue from chest?

A. Respiratory murmurs, caused by passage of air in and out of respiratory apparatus.

Q. In what organs is the function of Respiration performed?

A. The Lungs, and the transfer is effected through the agency of the blood.

Q. Describe the course of the air entering the lungs?

A. Through nose or mouth, through pharynx to larynx, entering rima glottidis, passes through larynx to trachea and bronchi.

Q. What is the mechanism of Respiration?

A. Inspiration—the drawing of air into lungs; Expiration—the act of breathing forth.

Q. Describe the rhythm of respiration?

A. Inspiration is slightly more rapid than expiration, a slight pause occurring after expiration before a fresh breath is drawn.

Q. What is the temperature of expired air?

A. That of the body.

Q. How much carbonic acid does exhaled air contain?

A. About 43 parts per 1,000 of CO_2.

Q. How much oxygen is taken from the air in respiration?

A. Roughly estimated at 5 per cent.

Q. How much water in expired air?

A. Varies with atmospheric conditions; ordinarily in a day 10 ounces in form of vapor in excess of that normally present.

Q. What is the use of nitrogen in respired air?

A. A diluent of the oxygen.

Q. How is the blood changed by respiration?

A. Venous becomes arterial blood, the blood gains in oxygen, loses carbonic acid, becomes cooler, coagulates more readily.

Q. What symptoms from want of oxygen in blood?

A. Oxygen becomes less causing dyspnœa, respiratory actions violent, asphyxia, face blue, eyes starting, face anxious, convulsive condition over whole body, exhaustion, respiration slow and very feeble, death.

Q. What effect has respiration upon the Circulation?

A. Each inspiration produces a partial vacuum in thoracic cavity, hence, it draws the blood to the heart from the great veins; increases arterial tension by facilitating the venous return.

Q. What is the *Respiratory Murmur?*

A. Sound produced by the air entering and escaping from lungs during respiration.

Q. Name the *Respiratory Nerves?*

A. The external one is the posterior thoracic; the internal one is the phrenic.

Q. What is *Tidal Air?*

A. That which is habitually changed in an ordinary act of breathing.

Q. What is *Complemental Air?*

A. The excess of air in forced inspiration.

Q. What is *Reserve Air?*

A. The air left in the lung after ordinary expiration.

Q. What is *Residual Air?*

A. A certain amount of air which always remains after forced expiration.

Q. What muscles are used in ordinary inspiration?

A. The external intercostals, the levatores costarum and the scaleni.

Q. What serves to keep dust, etc., out of air-passages?

A. The ciliated epithelium which lines trachea and bronchi.

Q. What is the composition of the atmosphere?

A. Oxygen 79 parts, Nitrogen 21, Carbonic acid .04, Ammonia and of impurities a trace.

Q. What is the vital capacity of the lungs?

A. The total amount of air which can be given out by the most forcible expiration following upon a most forcible inspiration—that is, the sum of the complemental, tidal and reserve airs.

Q. What does expired air contain?

A. Carbonic acid and various impurities; ammonia has also been found; when expired air is condensed, the aqueous product is found to contain certain organic matter and rapidly to putrefy, and the organic substances thus present are the cause of bad breath.

Q. Name the three native albumens?

A. Egg-albumin, serum-albumin, and acid-albumen.

Q. How is the atmosphere changed in respiration?

A. In passing in and out of the lungs it is robbed of a portion of its oxygen, and loaded with a certain quantity of carbonic acid; the blood also as it passes along the pulmonary capillaries undergoes important correlative changes.

Q. What changes occur in the quantity of carbonic acid produced and oxygen consumed in man and female according to age?

A. In man from birth to 30 years there is an increase and after that diminishes; in female, the quantity always less than that of man, increases up to puberty, remains during menstruation at a standstill, and after the climacteric declines.

Q. Give the percentage of gases in inspired and expired air?

A. Expired air contains about 4 or 5 per cent. less oxygen and about 4 per cent. more carbonic acid than the inspired air, the quantity of nitrogen suffering but little change.

Q. Does age affect the amount of CO_2 exhaled?

A. Yes, it increases from eight to thirty-two years, remains almost stationary from thirty-five to fifty; after fifty it constantly diminishes, and at eighty years is no more than in a child of ten years.

Q. What effect has the quickening of respiration on amount of CO_2?

A. The quicker, the less amount in each respiration, but aggregate amount is increased.

Q. How much Oxygen is abstracted from every volume of air?

A. About four and a half per cent.

Q. What arteries supply the lungs?

A. Bronchial for nutrition, and pulmonary for oxidation.

Q. What is the normal rapidity of respiration?

A. In healthy adult 14 to 18 per minute; in infants and invalids more rapid.

Q. What does *Eupnœa* signify?

A. A normal breathing.

Q. What does *Apnœa* signify?

A. Too much oxygen absorbed by the blood.

Q. What does *Dyspnœa* signify?

A. Labored or difficult breathing.

Q. What is *Hiccough?*

A. A sudden inspiration due to descent of diaphragm.

Q. What are the various forms of *Digestion?*

A. Salivary, Gastric, Pancreatic, Biliary, and Intestinal—succus entericus.

Q. What is the function of Salivary Digestion?

A. To convert starch into sugar.

Q. On what does Gastric Digestion act?

A. Proteids, converting them into peptones.

Q. What is Intestinal Digestion?

A. The preparation for assimilation of fats, and conversion of proteids into peptones.

Q. What is the function of the *Pancreas?*

A. To secrete a limpid, colorless fluid for the digestion of the proteids, fat and carbohydrates.

Q. What are the pancreatic ferments?

A. Trypsin, Amylopsin, Strypsin.

Q. What changes do the proteids undergo in digestion?

A. Decomposition: the gastric juice dissolves them and converts them into peptone.

Q. What change does fat undergo in digestion?

A. The gastric juice is powerless on fats; and when they are eaten they undergo no change except slight emulsion; the pancreatic fluid emulsifies them and splits them up into their respective acids and glycerine.

Q. What change does starch undergo in digestion?

A. It is converted into grape sugar by the pancreatic juice.

Q. What are the characteristics of Saliva?

A. A mixture of secretions of the Parotid, Submaxillary and Sublingual Glands; tasteless, slightly turbid, distinctly alkaline reaction; specific gravity 1.004 to 1.008; contains five-tenths per cent. of solids, the most of which are organic, as mucin which causes viscidity, traces of albumen and globulin, and a peculiar ferment—ptyalin; the inorganic are salts, the principal one being sulphocyanate of potash; together with salivary corpuscles, epithelial cells, and micro-organisms.

Q. What is the quantity of Saliva secreted in 24 hours?

A. From 7 to 70 ounces.

Q. What is the nature of *Parotid Saliva?*

A. It contains ptyaline, urea, traces of a volatile acid, and such inorganic constituents as salts of soda and potash; containing more of the ptyalin and less of urea than that of the other glands; it is also much thinner.

Q. What is the nature of *Submaxillary Saliva?*

A. Decidedly alkaline and tenacious or viscid; contains mucin, but less ptyalin than the parotid.

Q. What is the nature of *Sublingual Saliva?*

A. More viscid and cohesive than the others; contains much mucin, salivary corpuscles and sulphocyanate of potash.

Q. What is the composition of the *Oral Fluid* composed of all the secretions mingled together?

A.	Water, - - - - - - -	994.10
	Solid Constituents, - - - -	5.90
	Epithelium and mucus, - - - -	2.13
	Fat, - - - - - - - - -	0.70
	Mucin, ptyalin, and traces of alcoholic extracts,	1.41
	Sulpho-cyanide of potassium, - - -	0.10
	Alkalies, earths, and oxide of iron, - -	2.19

Also small quantities of nitrogen, more oxygen, and yet more of carbonic acid gas.

Q. What is the effect of stimulation?

A. Increased flow, and glandular vascularity.

Q. What effect has mastication on the flow of Saliva?

A. Increases it.

Q. What other condition may increase the flow of Saliva?

A. Nausea by a reflex through vagus nerve.

Q. What is the Physiological action of Saliva?

A. The transformation of starch into dextrin, and of dextrin into sugar.

Q. Upon what does the power of saliva to convert starch into sugar (diastaltic) depend?

A. Upon ptyalin.

Q. What is Ptyalin?

A. A peculiar ferment in Saliva.

Q. What is the action of Nervous System upon Salivary Glands?

A. A more abundant secretion of saliva upon applications of a stimulus—increased by reflex nerve-force; stimuli may be mechanical or chemical, or mental; the flow is increased by taking food into mouth, or by irritating mouth, or by smelling or thinking about food. In the submaxillary gland the chorda tympani nerve increases vascularity of gland by one portion of its fibres, and excites the secreting function by another set of fibres, the sympathetic nerves of the gland acting as vaso-constrictors. In the parotid gland the vaso-dilator impulse comes from the facial nerve through fifth nerve by communication of the lesser petrosal nerve. The vaso-constrictor impulse comes from the sympathetic; a medullary centre controls this function.

Q. What is *Maltose?*

A. Sugar formed by action of saliva on starch.

Q. What are the mechanical uses of Saliva?

A. Keeps mouth moist; facilitates speech; renders mastication easy, and also movements of tongue; dissolves substances, and assists taste, and also assists deglutition.

Q. What muscles are concerned in *Mastication?*

A. The combined action of temporal, masseter, and internal pterygoids elevate the jaws; the digastrics, mylo-hyoids, genio-hyoids, and platysmas depress the jaw; the displacement of the articular surfaces backward or forward is produced, when forward by external pterygoids, which pull jaw down and forward; one external pterygoid acting, the jaw is pulled sideways, causing a grinding motion; when backward the digastric and hyoid act.

Q. What is the influence of Tongue in mastication?

A. To keep food between teeth, and it is assisted by muscles of lips and buccinators.

Q. Describe process of *Deglutition?*

A. Opening of mouth is closed by orbicularis oris; the muscles of mastication press jaws together; the tongue is pressed against hard palate, first its tip, then middle and root, forcing food backwards; at same time levator palati draws soft palate upward and backward, completely closing the posterior openings of nasal cavities, and muscles of larynx firmly close rima glottidis; after anterior arch is passed, the food is prevented from returning to mouth by palato-glossi muscles; and the constrictors of the pharynx urge it on to œsophagus; and it is further propelled by the muscular fibres of œsophagus which contract peristaltically when there is forced deglutition, as ordinarily the food is projected into œsophagus by the voluntary muscles.

Q. What nerves govern deglutition?

A. The efferent nerves.

Q. What govern the movements of the œsophagus?

A. The vagus and trifacial.

Q. What is the nature of Gastric Juice?

A. Rather clear, colorless (or straw-colored), of acid reaction, sour taste, peculiar odor.

Q. What is the quantity secreted in twenty-four hours?

A. From eight to fourteen pounds.

Q. What does it contain?

A. Pepsin, hydrochloric acid, the chief acid, and a little lactic acid.

Q. What is the function of the Pepsin and Lactic Acid?

A. Pepsin dissolves proteids; while lactic acid digests them like hydrochloric acid.

Q. What is *Chyme?*

A. Mixture of food and gastric juice.

Q. What is the effect of gastric juice upon proteids?

A. Changes them into acid albumen, or syntonin, which is at once changed into propeptone or hemi-albuminose; the latter being converted into peptone which is absorbed into the blood from small intestine, and changed back into proteids and so deposited in the tissues.

Q. What other special ferment is in stomach?

A. Milk-curdling ferment.

Q. *What is Digestion?*

A. The process by which food is introduced to the body and prepared in such a way that it becomes suitable for absorption and tissue-nutrition.

Q. What processes are necessary?

A. Mastication, insalivation, deglutition, stomach digestion, intestinal digestion and defacation.

Q. Name the digestive fluids and state their function?

A. Saliva, gastric juice, bile, pancreatic juice, succus entericus, intestinal juice.

Saliva moistens food and assists in mastication and digestion; converts starch into sugar.

Gastric juice exerts a solvent action due to the presence in it of a ferment body—trypsin.

Bile has a solvent action on fats, it is an emulsive agent and prepares the way for the action of the pancreatic juice.

Pancreatic juice exercises a solvent action on proteids (albuminoid constituents), converting them into peptone; its digestive powers, like those of the gastric juice, depending upon the ferment trypsin.

Q. What is the use of Saliva?

A. It keeps mouth in moist condition, lubricates the tongue, dissolves soluble portions of the food, mixes with the food and forms a soft and slippery bolus suitable for swallowing; it has a special digestive function by the action of its ferment ptyalin.

Q. What is the action of Ptyalin?

A. It acts upon starch changing it to sugar—grape sugar or glucose, maltose being found in the ferment's action.

Q. What is the action of the nervous system upon the salivary glands?

A. Saliva is increased by reflex nerve-force.

Q. How long does gastric digestion continue?

A. Only during the presence of food.

Q. What is the time required for stomach digestion?

A. It varies with the kind and amount of the food, from one to five or six hours.

Q. Does absorption occur in the stomach?

A. No, except in a very slight degree.

Q. What is the daily secretion of Gastric Juice?

A. From 10 to 20 pints.

Q. What is the source of the hydrochloric acid?

A. Secreted by the cubical parietal cells of the peptic glands.

Q. What other acids are found in the Stomach?

A. Lactic, Acetic, Butyric and some fatty acids.

Q. What is their origin?

A. They are products of digestion or of abnormal processes due to decomposition of food.

Q. What is the source of Pepsin?

A. The globular cells of the peptic glands.

Q. What are Peptones?

A. Albuminoids produced by the action of pepsin.

Q. How are non-nitrogenous bodies affected by gastric juice?

A. Starches are not affected. Sugar is dissolved, and cane sugar is changed to grape sugar. Fats are unaffected.

Q. How does the stomach empty itself?

A. The pyloric opening permits the escape of Chyme, aided by strong peristaltic efforts on the part of stomach at its pyloric end. At the completion of digestion the pylorus permits the escape of undigested and digested matter.

Q. What is the Function of the Stomach?

A. The digestion of the proteids.

Q. What is Vomiting?

A. The regurgitation of food through the cardiac orifice and thence through mouth, a reflex act the pressure of abdominal muscles opposing the fixed diaphragm, aiding the contraction of the stomach; the stimuli which excite the reflex act are either local in the stomach or peripheral; violent irritation of the gastric mucous membrane will excite it, also mental impulses, swinging motion, irritation of kidneys, testes, ovaries, etc. The reflex act is controlled by a centre in the medulla oblongata acting through the pneumogastric nerve.

Q. What is Intestinal Digestion?

A. After passing pylorus, food comes in contact with the alkaline secretions of the small intestine and of liver and pancreas. In the small intestine the food is further prepared for absorption, and from this part, the digested food is taken up for nutrition of body.

Q. Describe small intestine digestion?

A. By peristaltic action of the intestine the food is carried through the length of the organ, but its progress is impeded by the valvulæ conniventes, which retard the too rapid advance of food, and thus cause it to be thoroughly exposed to the action of the digestive fluids.

Q. What system of nerves regulates the peristaltic action?

A. The Sympathetic.

Q. What are the glands peculiar to small intestine?

A. Lieberkühn's, Brunner's, and Peyers.

Q. What is the function of the Intestinal Glands?

A. Secretion of intestinal juice (succus entericus).

Q. How is the flow of Bile excited?

A. The secretion of the liver is stored in the gall-bladder until its flow is excited by the acid discharge of the stomach-contents into the duodenum. Inspiration and expiration cause alternate pressure upon gall-bladder, and aid in emptying it.

Q. Where does Absorption occur in the small intestine?

A. Probably throughout its length; in stomach and large intestine the absorption is much less.

Q. What becomes of the food absorbed by the Lacteals?

A. It is collected from all the lymph-spaces in the villi and about glandular structure of intestines, and is taken thence into larger lacteals whence it passes through the mesenteric lymphatic glands into the chyle receptacle of the thoracic duct; hence into the blood vessels.

Q. What becomes of the food absorbed by the blood vessels?

A. It is taken by the portal vein to liver, and there further elaborated for tissue-nutrition.

Q. How are the processes of Secretion and Excretion performed?

A. By activity of the cells, which are grouped into glands.

Q. How is Secretion effected by the Glands?

A. By Physical and Chemical processes.

Q. What conditions affect glandular activity?

A. Increased amount of blood passing through gland increases the vascularity; increase in material upon which gland acts stimulates the activity of the gland, and increases its secretion; reflex nervous action, and often active through vaso-motor nerves, also increases the secretion; trophic influence of nervous system affects the secreting power of a gland.

Q. What are the *Valvulæ Conniventes?*

A. Transverse or oblique folds of the mucous membrane of small intestine extending partially around the tube; also found in the duodenum and jejunum. They serve to increase the area of mucous membrane, to retard the too rapid advance of food, and cause it to be thoroughly exposed to the action of the digestive fluids, and are covered with villi; the function of the secretion of mucous membrane (mucus) is to lubricate and moisten the soft and delicate cells of the membrane; the villi are small cylindrical elevations projecting into the tube from the mucous surface and bathed in the secretions.

Q. What is now considered to be the seat of both digestion and absorption?

A. The Small Intestines. Prof. Miles (Univ. of Md.) says that a comparatively small amount of food is digested in the stomach, and a less amount is absorbed from this organ; he claims that the stomach is little more than a pouch in which food may be stored and preserved by the antiseptic and germicidal properties of normal stomachic secretions until such time as nature demands its ejection into the duodenum; the peculiar duplications and reduplications of lining membrane of small intestines making what are known as the *valvulæ conniventes*, which are to be found in large numbers and encroach upon the lumen of canal, and which serve to check the flow of chyme in its passage through the intestines, thus affording an excellent opportunity for the pancreatic juice and bile to exert their digestive influences upon the contents. A further function of these valves and their attendant villi may be found in the greatly increased absorbing surface in contact with substances rendered assimulative by the previous action of certain juices. In the minute millions of villi spread out over the whole surface of membrane are found plexuses of capillary blood vessels and nerves ramifying wonderfully over the surface, an arrangement which renders possible the direct absorption of certain substances into the blood; while other matters are taken by the *lacteals*, whose origin can be traced to the villi also, and carried into the blood by the lymphatic channels.

Q. What is the nature of the Pancreatic juice?

A. Thick, transparent, odorless, saltish taste, alkaline reaction and viscid consistency.

Q. What is its action?

A. Powerfully digestive.

Q. What is the importance of Pancreatic Juice?

A. Containing four hydrolytic ferments, it is a very important digestive fluid.

Q. What is its action on fats?

A. Forms them into a fine emulsion and at last into fatty acids.

Q. When is the pancreatic juice poured out?

A. When the food enters small intestine from stomach.

Q. What are the *Functions* of the *Liver?*

A. The secretion of bile; the formation of animal starch; the production of blood corpuscles at a certain period of development; the destruction of blood corpuscles; the formation of urea; the retention and destruction of certain poisonous substances absorbed from the intestinal tract.

Q. What is *Bile?*

A. A yellowish brown or dark green transparent fluid with neutral reaction and bitter taste; it is the juice secreted by the liver.

Q. What does it contain?

A. Mucus from gall-bladder; bile acids, glyco-cholic, and tauro-cholic acid the most abundant in man.

Q. What is *Cholestrin?*

A. An univalent alcohol found in solution in bile.

Q. What quantity of bile is secreted per day?

A. About seventeen ounces.

Q. What are the functions of bile?

A. Emulsification of fats, lubrication of walls of intestine and to facilitate absorption of fats; prevents decomposition and stimulates peristaltic action.

Q. What is the function of large intestine?

A. It absorbs liquids from fecal matter of small intestine.

Q. What is *Absorption?*

A. The digested food is taken from the intestines and carried into the blood, whence it is taken to nourish the cells. This term is also applied to the removal of worn-out material from the tissues.

Q. By what channels is the food absorbed from intestines?

A. By blood vessels and lymphatics.

Q. What condition must chyle be in to render it fit for absorption?

A. Must have property of passing through animal membranes; all the products of digestion, such as proteids, starches, fats, which were not dialyzable, become peptones, sugars, and emulsified fat, capable of dialysis, and ready for absorption.

Q. What is *Dialysis?*

A. The property of fluids which enables them to pass through animal membrane—*osmosis.*

Q. What becomes of the food (pabulum) absorbed by the blood vessels?

A. It is taken by the portal vein to the liver and there further elaborated for tissue-nutrition.

Q. What becomes of the food absorbed by the lacteals?

A. It is collected from all the lymph-spaces in the villi and about the glandular structure of the intestines, and is taken thence into the large lacteals, whence it passes through the mesenteric lymphatic glands and into the receptaculum chyli of thoracic duct; hence it passes on into the blood—vascular system, which it joins at root of neck at the union of the left jugular and subclavian veins.

Q. Describe the condition food must be in that it may be absorbed by the blood vessels and lacteals?

A. It must be in a fluid state, and the more dilute the solution the more ready is the absorption; insoluble substances and dense solutions are not readily absorbed. The rapid removal of the absorbed matter and renewal of fresh blood in capillaries are of great importance: thus if the portal circulation is obstructed, so that the blood circulates slowly, or capillaries are tense from intravascular pressure, the absorption will be slow.

Q. Describe the properties of *Living Protoplasm?*

A. Living protoplasm possesses the chemical property of being able to assimilate and convert into its own substance non-living proteid material.

Q. Describe the power of motion of Living Protoplasm?

A. The protoplasm of some cells, especially that of white blood cells, shows changes of form, which is called *amœboid motion*, and is accomplished by a budding out of the protoplasm in one or more places; these protrusions may be withdrawn, or mass of protoplasm may flow along one particular elongation, and so transfer its bulk to that particular spot.

Q. How does *Absorption* occur?

A. In two ways: By means of blood-capillaries and the lacteals.

Q. What are absorbed by capillaries and by lacteals?

A. The first absorb sugars and proteids, and the latter the fats.

Q. Where is the greatest amount of absorption carried on?

A. In the upper half of the small intestine.

Q. What three forces are in action in absorption of digested food?

A. Endosmosis, diffusion, and filtration.

Q. What is *Endosmosis?*

A. The change which occurs between two fluids capable of forming an intimate mixture with each other through an animal membrane.

Q. What is *Diffusion?*

A. Mixing of two liquids, one over the other, in a vessel without presence of a septum.

Q. What are the Special Functions of the *Spleen?*

A. The elaboration of nitrogenous foods; a prominent source of origin of red and white blood corpuscles; the organ in which many of the red blood corpuscles undergo fatty degeneration when their usefulness is impaired.

Q. What is the *Normal Temperature* of *the Body?*

A. 98.5° F.

Q. What difference in temperature between various parts of the body?

A. Surfaces of hands and feet cooler than any other portion, liver as high at times as 105° F.

Q. What is the *Source of Animal heat?*

A. The potential energy taken into body with food, and with oxygen during respiration; the amount depending upon that of kinetic energy liberated.

Q. What are the direct sources of heat?

A. The blood is charged with more carbon, hydrogen and oxygen than is required for repair of tissues, and these gases uniting with the sulphates develop heat by chemical means, while the rest of heat of body is developed by a slower combustion. The blood of all animals contains certain substances which are oxidized through some type of breathing apparatus, the heat of combustion generally serving to elevate the temperature of the body; in this manner the oxygen necessary for animal life is converted into carbon dioxide, CO_2, which is requisite for plant existence.

Q. What keeps temperature of body uniform?

A. Circulation of blood, which distributes heat evenly.

Q. What effect has perspiration on heat of body?

A. By its evaporation it tends greatly to dissipate heat formed too rapidly.

Q. What is the difference between *Sweat* and *Perspiration?*

A. Sweat is the secretion of the sudoriferous glands; perspiration is the secretion of the sweat glands which forms in drops upon the skin.

Q. What is *Asphyxia* due to?

A. Failure of respiration.

Q. What effect have acids and alkalies upon the secreting glands?

A. Acids have a stimulating effect; alkalies check the secretions, and have a depressing influence.

Q. What is *Secretion?*

A. The separation from the blood of some product, either directly or indirectly, by the vital process peculiar to a gland or membrane; the kidney is an example of an excreting gland; the pancreas or mammary gland, an example of a secreting gland.

Q. What are *Excretions?*

A. Materials separated from the blood by cell-activity and discharged from the body, being useless and harmful—urine, sweat.

Q. What is the function of the *Kidneys?*

A. The secretion of urine—the elimination and secretion of water and nitrogenous matter.

Q. How do the Kidneys secrete urine?

A. By filtration, by real functional action.

Q. Describe the course of the Urine?

A. The urine collected in the tubules of kidney passes into pelvis and is carried to urinary bladder in irregular quantities by ureters which act as ducts; the action of the two kidneys is irregular.

Q. What prevents regurgitation from bladder?

A. By the oblique course of ureter through muscular wall of bladder.

Q. What are the physical characteristics of normal urine?

A. A clear, amber-colored fluid of slightly acid reaction, a characteristic odor and salty-bitter taste; normal specific gravity 1010 to 1030.

Q. What is acidity of urine due to?

A. The presence of acid sodium phosphate.

Q. What is its chemical composition?

A. A solution of urea and urates with a little organic salts.

Q. What conditions increase urinary secretion?

A. Increased force of the heart, effect of nervous system by reflex vaso-motor impulses, anæmia producing a greater determination of blood to kidneys.

Q. What will decrease the secretion of urine?

A. Diminished force or frequency of heart-beats, dilatation of capillary areas outside of kidney, division of spinal column below the medulla, also stimulation of cord below the medullar constriction of venal artery.

Q. What two methods of elimination in kidneys?

A. The process of filtration and secretion.

Q. What is the daily quantity of urine secreted?

A. One to two quarts, varying in health with amount of fluid taken, of food consumed, activity of skin evaporation, character of food, condition of blood, excess of fluids requiring more functional activity of kidneys.

Q. What is the Chemical Composition of *Urine?*

A. Water 976; solids, crystallizable nitrogenous bodies; urea 14; uric acid, free (trace), uric acid in form of alkaline urates, hippuric acid and hippurates, pigments, extractives, and mucus 11; salts: Inorganic—chlorides of potassium and sodium, sulphates and phosphates of sodium and potassium, phosphates of magnesium and calcium, silicates (trace), organic—lactates, acetates, and formates (occasionally). Sugar occasionally (trace), gases, nitrogen and carbonic acid.

Q. What abnormal matters are sometimes found in urine?

A. Serum albumin, globulin, ferments, peptone, blood, sugar, bile acids and pigments, casts, fats, micro-organisms, etc.

Q. What is the Specific Gravity of Urine?

A. 1020; may vary under conditions of health from 1010 to 1030 or more.

Q. What is a *Urate?*

A. A combination of uric or lithic acid with a base; urates are present in normal urine.

Q. What is the Murexid-test for uric acid?

A. Nitric acid and ammonia, a beautiful red color; made by covering substance or residue on evaporating with nitric acid; evaporate to dryness on water bath, and add ammonia.

Q. What is the principal solid of the *Urine?*

A. Urea, the substance by which the nitrogen of decomposed tissue is given off. A highly nitrogenous waste material.

Q. What condition occurs when urea is not freely eliminated?

A. Uræmia.

Q. What is the origin of *Urea*, CH_4N_2O?

A. It is formed in the liver from kreatine, kreatinin, and other proteid waste which are formed all over the body, principally in the muscles by the metabolism of the cells of the muscles, brain, etc. It is secreted in the convoluted tubules of the kidney.

Q. What is *Uric acid*, $C_5H_4N_4O_3$?

A. A waste nitrogenous crystalline substance. It is formed all over the body by the metabolism of the working parts, muscles, brain, etc., and is secreted in the convoluted tubules of the kidneys.

Q. What is the amount of Urea excreted?

A. Amount varies—the urinary solids about one-half the solid constituents of the urine—averages 4 per cent. of urinary solids, and urea in healthy urine may exceed 2½ per cent.

Q. How is the blood of the renal artery distributed to the kidney?

A. To the cortex and pyramids, and capillaries and veins.

Q. How is the water of the urine secreted?

A. By filtration.

Q. How much of the body is made up of water?

A. 58.5 per cent., continually taken in and given off.

Q. *What is Nutrition?*

A. The process of assimilation (act of absorbing) of food.

Q. In the daily expenditures of the body, what are the most important excretory channels?

A. The lungs, skin, kidneys, and intestines.

Q. What are the sources of income?

A. Food, drink and oxygen.

Q. What is the result of the expenditure?

A. The growth of the body and the secretion of its necessary materials, the maintenance of the tissues, the continuance of physical conditions suitable to life, and nervous energy.

Q. What is the effect of starvation upon the body?

A. Loss of weight, especially of the fat; sense of hunger giving way to sense of pain; excessive thirst; absence of sleep; progressive weakness and emaciation; fetid exhalations of skin and lungs; diarrhœa with convulsions or delirium, and death, if absolute deprivation, in from 6 to 10 days.

Q. What is the effect on the human body of an exclusive diet?

A. Breaking down of tissue and general malnutrition.

Q. What is the effect of over-feeding?

A. Excess of nitrogenous food, if digested, increases the metabolic work of the glandular organs, especially of liver and kidneys, and induces disease of such organs, and the food is apt to pass undigested and undergo putrefactive changes with resulting gaseous distension, especially the carbohydrates produce such effects.

Q. What are the requirements of a normal diet?

A. Well cooked food, containing the amount of carbon and nitrogen which is excreted—about two pounds of solid food and two quarts of fluid.

Q. What is the importance of Saline matters (chloride of sodium, for example) in food?

A. Such matters are essential to health; certain of the proteid qualities are dependent on the presence of salts, and when they are not present in proper proportions, nutrition is affected, as shown by certain forms of scurvy.

Q. What supplies the potential energy of the body?

A. The food, which the metabolism of the body converts into the energy of heat and mechanical labor.

Q. What will increase the production of carbonic acid in the body?

A. Muscular exercise.

Q. What are the main sources of the heat of the body?

A. The muscles and the glandular organs.

Q. Through what channels is the heat of the body lost?

A. By the skin, lungs, urine and fæces through intestines.

Q. What are the daily expenditures of the body?

A. From the *lungs* there are exhaled every 24 hours—of carbonic acid 30 ounces; of water 10 ounces, with traces of organic matter; from the *skin*—of water 23 ounces, of solid and gaseous matter 1 ounce; from the kidneys—of water 50 ounces, organic matter 1½ ounces, of minerals and salines ½ ounce; from the *intestines*—of water 4 ounces, various organic and mineral substances 2 ounces; in all 122 ounces.

Q. What are the quantities of the sources of income?

A. The chief factors are food, drink and oxygen, and for 24 hours the income of food chemically dry is 16 ounces; water (drink) 80 ounces; oxygen, absorbed by lungs, 26 ounces; in all 122 ounces.

Q. What are the variations of temperature in different parts of the body?

A. In the mouth (by the clinical thermometer) it is higher than in the axilla, and in the rectum it is higher than in the mouth; the temperature of infants and children is slightly higher and more susceptible of variation than that of adults, and after 40 years of age it is lower than before that age.

Q. What is one of the most marked phenomena of starvation?

A. The fall of temperature, which is very rapid during the last days of life; the low temperature of body is a powerful factor in causing death.

Q. What is one value of fats and carbohydrates in food?

A. They are sources of energy, more than three-fourths of the normal income of potential energy coming from them; they are ultimate sources of muscular energy as well as of heat, and they can be retained and stored up in the body with comparative ease; more than is the case with proteid food.

Q. For what purposes can a diet be chosen?

A. For the simple maintenance of health, for the sake of muscular energy, or for fattening purposes.

Q. Why are the several saline matters, including the extractives of animal and vegetable food no less essential elements of a diet, than proteids, fats, or carbohydrates?

A. Because they are necessary to life, and disease if not death would follow their absence.

Q. What are the three great classes of Foods?

A. Proteids, fats, and carbohydrates.

Materia Medica and Therapeutics.

Q. What precautions should be observed in the administration of Ether, Chloroform, etc.?

A. Assured that patient is not affected with any serious disease of heart, lungs, or brain; loosen clothing about neck and chest; remove artificial teeth, if any are worn.

Q. What inhaling apparatus is necessary?

A. Sponge, napkin, or handkerchief, placed inside a cone made of stiff paper or formed of a towel, with a small opening at apex for admission of air; or a wad of lint can be held in palm of hand, and anæsthetic poured on these.

Q. How should the inhalation be conducted?

A. Commence cautiously, patient directed to breathe naturally and to banish all fears, and obey such instructions as raising the hand or opening eyelids when desired; the napkin or sponge held three or four inches from face, gradually bringing it closer to prevent irritation of air passages, and patient directed to make full inspirations.

Q. What are the stages of anæsthesia?

A. First, slight relaxation; second, tetanic or convulsive; and third, complete relaxation and unconsciousness.

Q. During a favorable administration what is condition of patient when fully anæstheticised?

A. Face cool; profuse perspiration; eyes closed; insensibility to touch; somewhat contracted pupils; pulse somewhat slower than normal.

Q. What is the order in which the nerve centres are affected by the anæsthetic?

A. Cerebrum, cerebellum, spinal cord, medulla oblongata.

Q. What is the time required for complete anæsthesia?

A. For ether—four to twenty-four minutes, average time eight minutes. For chloroform — two and one-half to fifteen minutes, average time seven minutes.

Q. What are the conditions rendering anæsthesia dangerous?

A. Affections of heart, such as fatty degeneration, valvular lesions; disease of kidneys; tumors of brain; respiratory obstructions, thoracic tumors; hypertrophied tonsils; aneurism of vessels; and chronic alcoholism.

Q. What conditions are to be avoided when giving anæsthetics?

A. Full stomach; empty stomach from long fasting; excitement.

Q. What general instructions should be given patients to prepare for the administration of anæsthetics, especially Ether?

A. To partake of no food for 12 hours preceding administration, except a little milk or tea 1 or 2 hours before, in order to avoid vomiting.

Q. What is the treatment of Dangerous Symptoms?

A. When heart's action is suspended stop administration, place body in a reclining position, if necessary invert body, and admit air freely; the failure of respiration indicates the drawing forward of tongue, and for serious cases the inhalation, with great care, of two or three drops of nitrate of amyl, also the inhalation of ammonia. Galvanism (the positive pole to nostril and negative pole over diaphragm), and artificial respiration and warmth, with brisk friction upward of extremities.

Fire or light in a room filled with ether vapor, which is heavier than air and very explosive, is dangerous.

Q. What is the value of *Nitrous Oxide* as a general anæsthetic?

A. Pleasant and safe, transient nature of its effects, no unpleasant after-effects.

Q. What is its disadvantage?

A. The shortness of its anæsthesia.

Q. How is Nitrous Oxide Gas administered?

A. Same care should be observed as with ether or chloroform. Seat patient in a horizontal position in an operating chair with back lowered, dress about throat and waist loose, and no food for two hours before the inhalation; a rubber mouth-prop placed between teeth to prevent closure of jaws. The patient is then directed to take full, natural and deep inspirations of gas, the nose being held or covered to prevent entrance of air.

Q. What are its effects?

A. Strong, involuntary respirations, with snoring, more or less livid appearance of lips, cheeks and finger nails, and loss of sense of touch.

Q. What is a reliable test for complete anæsthesia?

A. Loss of sensibility to touch in conjunctiva.

Q. What quantity of N. O. Gas is required?

A. Five to fifteen or more gallons.

Q. What are the different stages under N. O. Gas?

A. First stage, muscular activity; second stage, muscular rigidity; it is considered dangerous on account of asphyxia, to carry it to muscular relaxation, hence the necessity for use of mouth-prop.

Q. What is *Bromide of Ethyl, or Hydrobromic Ether?*

A. A colorless, volatile fluid with an agreeable odor, somewhat like ether, and pungent taste; not inflammable or irritant; obtained by distilling bromide of potassium and sulphuric ether with chloride of lime.

Q. What are its Dental uses?

A. Anæsthetic: Its administration is somewhat dangerous having a poisonous action on centres of respiration; it decreases the heart force.

Q. How is *Bromide of Ethyl* administered?

A. The same as Ether and Chloroform, one drachm being used at the commencement of the inhalation, and deep, full inspirations taken.

Q. How are the Salts of Cocaine used as local anæsthetics?

A. For extraction of teeth and other dental operations, by hypodermic injection, or by application to gum on either side of the tooth; two or three applications being made at intervals of two minutes. For devitalizing pulps, the arsenious acid is combined with cocaine; it is also applied to hypersensitive dentine.

Q. What is *Alcohol?*

A. A colorless, inflammable fluid, with pungent odor, and burning taste, soluble in water and ether, and vaporizable by heat, obtained by repeated distillations from fermented grain or starchy substances.

Q. What are its Dental uses?

A. Stimulant in acute inflammations, acute neuralgias, etc.; in chloroform narcosis whiskey will sustain heart and prolong anæsthesia, also wine in nitrous oxide gas administrations; acts as a styptic by coagulating blood and contracting mouth of vessel; as an antiseptic for suppurating wounds, and as a canal dressing; for softened and sensitive dentine; for drying cavities before filling, absolute alcohol is employed.

Q. What is *Nitrite of Amyl?*

A. A clear, yellowish, oily liquid, with ethereal odor, very volatile and inflammable; insoluble in water; but soluble in alcohol, ether, and chloroform; derived from action of nitric or nitrous acid upon amylic alcohol.

Q. What are its Therapeutical and Dental uses?

A. Employed in syncope, chloroform narcosis, epileptic attacks, and other convulsive and spasmodic diseases.

Q. What is the Dose of Nitrite of Amyl?

A. From ij to iij minims.

Q. What is *Myrrh?*

A. A resinous exudation from a small tree of Arabia and Africa; in small masses of a reddish-yellow color, brittle and translucent, with aromatic taste and peculiar fragrant odor; very astringent.

Q. What are its Dental uses?

A. In form of tincture, diluted, as a gargle and mouth-wash; stimulates spongy and inflamed gums; in alveolar pyorrhœa, in full strength.

Q. What is *Capsicum?*

A. Cayenne Pepper, fruit of a tropical plant; pungent odor, hot taste; contains an acrid volatile principle called capsicine.

Q. What are its Dental uses?

A. In form of tincture or plaster in periodontitis; as a stimulating gargle.

Q. What is *Oil of Cloves?*

A. A clear, colorless oil from flowers of an evergreen myrtle of the Indies; pungent, spicy taste, fragrant odor.

Q. What are its Dental uses?

A. To relieve odontalgia by its stimulating effect; also as an antiseptic.

Q. What is *Eugenol?*

A. An active principle of oil of cloves, sometimes called an acid; a clear, colorless oil, with taste and smell of oil of cloves.

Q. What are its Dental uses?

A. An antiseptic in treatment of putrescent pulps, etc.

Q. What is *Cinchona?*

A. The bark of South American trees of same name, the medicinal properties of which depend upon the alkaloids they contain, at least two per cent. of which is *Quinine.*

Q. What are the Dental uses of Cinchona and Quinine?

A. As a tonic for neuralgia from malaria, facial neuralgia, periodontitis, cancrum-oris, etc.; as an antiseptic and germicide; and as an ingredient of dentifrices for its tonic and antiseptic properties.

Q. What is *Eucalyptus* derived from?

A. The leaves of an Australian tree, but now found in other countries, *Eucalyptus globulus*.

Q. What are its Dental uses?

A. As an antiseptic, either alone or combined with iodoform, for putrescent pulps, and alveolar abscess, necrosis and caries of maxillary bones.

Q. What is the derivation of *Iodine?*

A. Principally from Marine Plants.

Q. What are the Dental uses of Iodine?

A. In form of tincture for periodontitis, affections of gums, fungous growths, putrescent pulps, alveolar abscess; for periodontitis it is combined with aconite, and for ulcerations with carbolic acid; mixed with carbolic acid it is rendered colorless.

Q. What is the derivation of *Iodoform?*

A. From the action of chlorinated lime upon iodide of potassium; in the form of small yellow crystals of a soft touch, sweetish taste, and unpleasant odor; insoluble in water, but soluble in alcohol, ether, chloroform, and essential oils.

Q. What are its Dental uses?

A. Antiseptic for alveolar abscess, putrescent pulps, pyorrhœa alveolaris, etc., often combined with oil of cloves, and eucalyptus.

Q. Name two substitutes for Iodoform?

A. Iodol and Aristol.

Q. What is the derivation of *Iodol?*

A. From action of iodine on certain constituents of animal oil; in the form of a grayish-white powder; odorless; slight taste; soluble in alcohol ether, chloroform, carbolic acid, etc.

Q. What are its Dental uses?

A. Same as those of Iodoform.

Q. What is *Aristol* derived from?

A. By adding a solution of iodine in iodide of potassium to a solution of hydrate of sodium containing thymol; a red-brown non-crystallizable powder; insoluble in water and glycerine, but soluble in alcohol, and readily so in chloroform, ether, and essential oils; slight odor of thymol.

Q. What are its Dental uses?

A. As an antiseptic for gangrenous pulps, root-canals, etc., alveolar pyorrhœa, combined with oil of cassia, acute pulpitis; combined with collodion as a pulp-capping material.

Q. In what form is *Iron* used medicinally?

A. In form of Salts.

Q. What are the Dental uses of Tincture of Chloride of Iron?

A. Styptic in hemorrhage from tooth extraction, gums and mucous membrane.

Q. How is *Peroxide of Hydrogen* obtained?

A. By combining an extra molecule of oxygen with hydrogen monoxide.

Q. What are its Dental uses?

A. As an antiseptic, etc., in alveolar abscess, inflammation and ulceration of mucous membrane, alveolar pyorrhœa, fungous growths, etc.

Q. What is *Peroxide of Sodium?*

A. Obtained by adding peroxide of hydrogen to an excess of caustic soda solution.

Q. What are its Dental uses?

A. A sterilizer and bleacher of discolored teeth; a solvent of shreds of pulp-tissue, and organic matter; putrescent pulp-canals, etc.

Q. How is *Permanganate of Potash* prepared?

A. By fusing black oxide of manganese with chlorate of potassium and caustic potassa; in form of dark purple crystals, soluble in water; sweetish taste.

Q. What are its Dental uses?

A. For abscesses, diseases of antrum, ulcers of mouth with offensive breath, and fetid discharge, necrosis and caries of maxillary bones.

Q. What is the source of *Aconite?*

A. From root of *Aconitum Napellus*, the active principle being an alkaloid—aconitine.

Q. What are its Dental uses?

A. Internally in chronic cases of neuralgia; locally for alveolar abscess, periodontitis (equal parts of tincture aconite and tincture iodine).

Q. Treatment of Aconite Poisoning?

A. Evacuate stomach; administer stimulants, apply warmth to extremities and maintain recumbent position.

Q. What is the source of *Opium?*

A. Concrete, milky, exudation of capsules of Papaver Somniferum.

Q. In what form does it occur?

A. In brownish masses of a narcotic, earthy odor, and bitter taste.

Q. What is *Morphine?*

A. One of the seventeen alkaloids of opium; in form of colorless, flat prisms, odorless, and with a very bitter taste.

Q. What are the Dental uses of Morphine?

A. Anodyne: for pulpitis, ingredient of nerve-paste, for sensitive dentine, neuralgia, etc.

Q. What are the dental uses of *Opium?*

A. In convulsions of teething; mercurial salivation, periodontitis, inflamed gums and mucous membrane, injections in alveolar abscess; generally used in form of the wine or tincture.

Q. What is *Sulphate of Atropine?*

A. Atropine is one of the two alkaloids of belladonna; obtained by adding mixture of sulphuric acid to etheral solution of atropine; narcotic, anodyne, stimulant, and antispasmodic—same properties and action as belladonna.

Q. What are its Dental uses?

A. Pain of pulpitis and periodontitis; ingredient of a nerve paste.

Q. What is *Sulphate of Zinc?*

A. A specific emetic acting with little depression.

Q. What is *Chloride of Zinc?*

A. A powerful escharotic; also a deodorized and disinfectant; it promotes healthy granulations applied to indolent ulcers, destroys diseased tissue and promotes healthy action in adjacent parts.

Q. What are its Dental uses?

A. Obtunding sensitive dentine, styptic for superficial hemorrhage from gums and mucous membrane, injection for chronic alveolar abscess, and diseases of antrum; also to arrest recession of gum and absorption of alveolar process; in solution it is one of the ingredients of oxychloride of zinc filling material. Internally for convulsions of dentition in doses one-half to five grains; locally as one of the ingredients of zinc filling materials, it is combined with chloride of zinc solution, and with glacial phosphoric acid—the latter known as oxyphosphate of zinc; combined with carbolic acid for capping pulps.

Q. What is *Iodide of Zinc?*

A. A local stimulant and escharotic; internally tonic, astringent, and antispasmodic in doses of one to five grains, in form of syrup.

Q. What are its Dental uses?

A. Locally for alveolar pyorrhœa in connection with peroxide of hydrogen, also in tumors of mouth, enlargement of tonsils, chronic abscesses.

Q. What is *Nitric Acid?*

A. Aqua fortis—sulphuric acid acting upon nitrate of potash or soda; a powerful caustic and escharotic; colorless when pure, emitting acrid, corrosive fumes. Diluted form, ten per cent. absolute alcohol, is used internally as a tonic and refrigerant. Dose of diluted acid two to fifteen drops in water.

Q. What are the Dental uses of Nitric Acid?

A. As a caustic for devitalizing pulps of teeth, malignant ulcers of mouth, cancrum oris.

Q. What is *Bichloride of Mercury*, *Mercuric Chloride?*

A. Corrosive Sublimate—one of the products of the distillation of a sodium chloride and mercuric sulphate (the other product being sodium sulphate) in the form of colorless crystalline masses, inodorous, acrid, styptic taste, fusible, soluble in sixteen parts of water, seven parts of alcohol and ether.

Q. What are the antidotes?

A. Albumen, wheat-flour, milk.

Q. What are its Dental uses?

A. For alveolar abscess, disinfecting root canals, putrescent pulps, diseases of antrum, etc.

Q. In what strength is it safe to use its solutions?

A. One to five thousand of water, to one to two thousand, one to one thousand, the latter with care.

Q. What is the difference in properties between Calomel and Corrosive sublimate?

A. Calomel is mild chloride of mercury an alterative and purgative; Corrosive Sublimate is a germicide, antiseptic, and corrosive poison.

Q. What is *Nitrate of Silver?*

A. Lunar caustic—obtained by dissolving silver in nitric acid; in form of colorless shining crystals, soluble in water, and of a metallic styptic taste.

Q. What is the antidote?

A. Common salt—chloride of sodium.

Q. What are its antagonists?

A. Tannic acid and vegetable extracts.

Q. What are its Dental uses?

A. Styptic, although the clot from it is soluble in albumen; obtunder of hypersensitive dentine (applied in stick form, or by dipping end of silver wire in nitric acid), especially when it is due to abrasion; ulcerated mucous membrane, etc.

Q. What is *Hydrochloric Acid?*

A. Muriatic acid—colorless when pure, yellow on exposure; caustic taste; volatile, with a dense white, suffocating vapor.

Q. What are its Dental uses?

A. For inflamed and ulcerated mucous membrane and gums; in Laboratory as a flux in soldering.

Q. What is *Pepsin?*

A. An organic ferment which forms digestive principle of gastric juice; usually obtained from mucous membrane of pig's stomach, or from calf and sheep.

Q. What are its Dental uses?

A. To digest putrid pulps; and combined with hydrochloric acid for devitalizing pulps.

Q. What is *Thymol* obtained from?

A. From volatile oils of Thymus vulgaris; in form of large prismatic white crystals; odor of thyme; pungent aromatic flavor.

Q. What are its Dental uses?

A. Combined with glycerine in form of *Glycorole of Thymol*, it is a valuable antiseptic for putrescent pulps, ulcers of mouth, wounds, etc., also to arrest putrefactive process in chronic pulpitis, alveolar abscesses, also in stomatitis.

Q. What is *Menthol?*

A. Peppermint Camphor, obtained by cooling the oil distilled from the herb of *mentha arvensis* and *mentha piperita;* in colorless crystals with taste and smell of peppermint, soluble in alcohol and ether.

Q. What are its Dental uses?

A. Facial neuralgia, odontalgia, sensitive dentine, decomposing pulps, necrosed teeth, root-canals, etc.—used externally.

Q. What is *Chloro-Phenique?*

A. A nearly saturated aqueous solution of chloro-phenic acid combined with antiseptic essential oils.

Q. What are its Dental uses?

A. For catarrhal inflammation of mouth, alveolar pyorrhœa, menstruum in devitalizing paste, pulp canals for putrescent pulps, early stages of periodontitis, etc.

Q. How do the *Volatile* or *Essential Oils* differ from Fixed Oils?

A. The essential oils are composed of carbon and hydrogen; the fixed oils are compounds of carbon, hydrogen and oxygen.

Q. Name some of the Essential Oils which are obtunders of sensitive dentine and antiseptics ?

A. Oils of peppermint, cloves, caraway, cajeput, mustard turpentine, cassia, cinnamon, thyme, eugenol, eucalyptol, peppermint, caraway, mustard, wintergreen.

Q. What is Dr. Black's antiseptic mixture for putrid pulp-canals and abscesses ?

A. Oil of cassia, 2 parts; oil of wintergreen, 3 parts; mix and add carbolic acid (melted crystals), 1 part; known as 1, 2, 3 mixture.

Q. What other combination is used for same affections ?

A. Eugenol, or oil of cloves, and iodoform.

Chemistry.

Q. What does chemistry investigate?

A. Composition of substances around us, changes in them, and laws that govern these changes.

Q. Into what are all substances chemically divided?

A. Into compound substances and simple elements.

Q. Describe each?

A. Compound: Those which can be broken up into simpler substances, a H_2O into H and O; Simple: Substances which cannot be broken up into anything more simple, as H. O. N. C. S., etc.

Q. What are the three laws of *Chemical Combinations?*

A. 1.—The law of Definite or Constant proportions. A definite compound always contains the same elements and the same proportions of those elements—by weight or by volume.

2.—The law of Multiple Proportions. When two elements unite in more than one proportion by weight or by volume, they do so in simple multiple of that proportion forming different compounds, each of which, as regards definiteness of composition, of course obeys the first law.

3.—The law of Reciprocal Proportions or Equivalents. The proportions in which two elements unite with a third are the proportions in which they unite with each other.

Q. What properties has an *Acid?*

A. Acrid or sour taste when dissolved in H_2O; changes color of organic substances, as litmus from blue to red; contains H, which can be replaced by metals a salt being formed.

Q. What properties has an *Alkali?*

A. Directly opposite those of an acid, taste of lye, changes red litmus to blue; acted on by acids from salts.

Q. What is an *Alkaloid?*

A. A vegetable alkali; the active principle of drugs, and on it the activity depends.

Q. What is *Dialysis?*

A. The power certain substances have of dialyzing or passing through moist membrane.

Q. What are *Colloids?*

A. Substances that will not pass through moist membrane.

Q. What are *Crystalloids?*

A. Substances that dialyze rapidly, and assume shape of crystals.

Q. What is an *Anhydride?*

A. A substance which forms an acid when dissolved in H_2O, as $CO_2 + H_2O = H_2CO_3$ carbonic acid.

Q. What is the *Analytical Method?*

A. The resolution of a body into its elements.

Q. What is the *Synthetical Method?*

A. The formation, artificially, of a compound by combining its proximate parts.

Q. What is meant by a *Chemical Equation?*

A. A collection of formulæ, signs, and symbols, and implies that a chemical action is to take place, or has taken place.

Q. Examine following equations and if any errors correct them?

$CaCO_3 = CaO + CO_2$.

$NaOH + HCl = NaCl + H_2O$.

$Fe + 2HCl = FeCl_2 + H_2$.

$2NaCl + H_2SO_4 = Na_2SO_4 +_2 HCl$.

A. All are correct.

Q. Difference between a *Chemical Element* and a *Compound?*

A. First, is a substance which cannot be reduced any lower, a simple substance; second, is one which can be reduced into its compound parts—made up of two or more substances.

Q. What is Atomic Weight?

A. The weight of an atom or substance as compared to the weight of some atom taken as a standard. The atom of H is lightest and is used as a standard.

Q. What is a *Molecular Weight?*

A. The sum of the addition of weights of all the atoms of the several elements which have united to form a compound body.

Q. What is meant by calling chlorine a monad, oxygen a dyad, nitrogen a triad, and carbon a tetrad?

A. Elements combine in different proportions; this is called quantivalence or valence or atonicity; it is the power of attraction which atoms of elements have of attracting and holding in combination 1, 2, 3 or 4 atoms of some other element; H is used as the standard, and combining power of atoms compared with combining power of atoms of H, gives the valence of the element. Those having combining power of one, as Cl, as compared with atoms of H, are called Monads; those having combining power of two, as O, are called dyads; those of three, as N, triads; those of four, as C, tetrads.

Q. Explain difference between atomic and molecular formulæ, with examples?

A. Atomic is the number of atoms in an element; this collection is written at the right and a little below as H_2, being 2 atoms of H. Molecular is the number of molecules in an element or compound, and is written just in front, as $4\ H_2\ O$, being 4 molecules of $H_2\ O$.

INORGANIC CHEMISTRY.

OXYGEN AND HYDROGEN.

Q. Describe the leading properties of Oxygen?

A. An inodorless, tasteless gas, only sparingly soluble in $H_2\ O$, has great affinity for nearly all other elements, and combines directly with nearly all substances; it does not combine with fluorine; the union of substances with O forms oxides.

Q. What influence has Oxygen on oxidation and combustion?

A. Both are carried on very energetically in atmospheric air; sulphur and phosphorus burn with intense light, and heated iron or steel wire will burn with sufficient heat to melt the wire.

Q. What is the action produced by animals and by plants on the air?

A. Animals breathe in O and give off $C\ O_2$ to the air. Plants give off O and take in C breaking up $C\ O_2$ liberating the O.

Q. What is the composition of Atmosphere?

A. Oxygen 20.60; Nitrogen 77.95; Carbon dioxide .04; Moisture 1.40; Nitric acid and Ammonia, traces. The oxygen supports animal life; nitrogen dilutes the oxygen.

Q. Why is it necessary that the oxygen should be diluted?

A. To prevent too rapid vital or life functions which would soon exhaust and destroy animals.

Q. How is Plant Life sustained?

A. The plant absorbs carbon dioxide, $C\ O_2$, through its pores, and by action of sunlight and chlorophyll (the green coloring matter of plants) the $C\ O_2$ is decomposed into carbon and oxygen, the carbon being assimilated by the plant structure and the oxygen returned to the atmosphere.

Q. How does Ozone differ from Oxygen?

A. Ozone is a modified form of oxygen, made when non-luminous electric discharges pass through air or oxygen; when phosphorus partially covered with H_2O is exposed to air; also during a number of chemical decompositions. It differs from ordinary oxygen in having a peculiar odor, like wet-matches, by being a stronger oxidizing agent; liberates iodine from potassii iodide; ozone contains three atoms to the molecule; oxygen but two; the three molecules of oxygen are reduced to two when it is changed into ozone, $3\ O_2$ oxygen $= 2\ O_3$ ozone.

Q. What are Barometers?

A. Instruments to measure pressure of atmosphere.

Q. What is the degree of atmospheric pressure in a glass tube containing fifteen lbs. of mercury, one inch square at base?

A. Fifteen lbs. to the square inch.

Q. What is the principle of the barometer?

A. A glass tube three feet long, closed at one end, is filled partly full of mercury, and inserted in a vessel of mercury, and the mercury column is maintained by the pressure of the atmosphere upon surface of mercury.

Q. What are the properties of Hydrogen?

A. Colorless, inodorless, tasteless gas, lightest of all known substances, having specific gravity of 0.0692 as compared with atmospheric air, burns readily in air, or in pure oxygen, with a non-luminous, colorless or slightly bluish flame.

Q. What is formed when hydrogen is burned in air?

A. Water, as it takes one atom of oxygen from the atmosphere.

CHEMICAL CALCULATIONS.

Q. Describe briefly the Metric System?

A. It combines weight, capacity, and distance. The metre is the unit of length and starting place for whole system. It is one ten-millionth of the distance of equator to the pole; it is 39.1 inches long. This is a decimal system. Less than the metre, the Latin prefixes are used; above the metre, Greek prefixes.

1-10 metre	= 1 decimetre.	10 metres	= 1 decometre.
1-100 "	= 1 centimetre.	100 "	= 1 hectometre.
1-1000 "	= 1 millimetre.	1000 "	= 1 kilometre.

This applies to distance only. A cube 1 decimetre is unit of capacity and is called Litre; it is about one quart.

Latin prefixes below the litre, Greek above.

1-10 litre = 1 decalitre.	10 litres = 1 decolitre.
1-100 " = 1 centilitre.	100 " = 1 heclolitre.
1-1000 " = 1 millitre.	1000 " = 1 kilolitre.

One cube one centimetre of distilled water at its greatest density 4° centigrade, is the unit of weight, and called a gramme.

Below the gramme Latin, and above Greek prefixes.

1-10 gramme = 1 decagramme.	10 grammes = 1 decogramme.
1-100 " = 1 centigramme.	100 " = 1 hectogramme.
1-1000 " = 1 milligramme.	1000 " = 1 killogramme.

The gramme weighs about fifteen and one-half grains.

Q. How is a Thermometer graduated?

A. The bulb end is heated, so that a portion of air is expanded and forced out, and then placed in a jar of mercury; the air cooling will contract, and a portion of mercury is drawn in; the bulb is again heated, when vapor of mercury will fill tube and force out nearly all the air; the bulb being shaken a drop of mercury will fall into tube, and another heating will fill both tube and bulb with vapor of mercury, and while hot the open end of tube is sealed up, leaving a vacuum. To graduate, it is placed in melting ice, and the point at which mercury stands is marked; this gives freezing point; it is then placed in escaping steam, and mercury point marked, which gives boiling point; having these two points the scale is made between them by marking at equal distances points called degrees.

Q. Describe the three thermometric scales in use?

A. Fahrenheit, Centigrade, and Reaumur's. Fahrenheit Zero is obtained from intense cold of ice and salt mixture, freezing point falling 32°, boiling point 212°. Centigrade has freezing point for zero, boiling point falls at 100°. Reaumur's freezing point at zero and boiling point at 80°.

Q. What are the laws of *Gaseous Diffusion?*

A. The volume of a gas is inversely as the pressure; density and elastic force directly as the pressure, and inversely as the volume; a gas is a vacuum for every other gas; the gaseous state is the one which differs the most; all gases expand or contract when temperature is raised or lowered an equal number of degrees.

WATER.

Q. What is meant by latent heat of water?

A. Heat not indicated by thermometer; latent heat is necessary to convert solids into liquids, and liquids into gases, and is not indicated by thermometer.

Q. Describe changes in bulk which water undergoes when heated from 0° to 100°?

A. Water is at its greatest density at 38° F. 4° C. above and below that it expands.

Q. When does water boil?

A. At 212° F.; 100° C.; 80° Reaumur.

Q. How is pure water obtained?

A. Pure H_2O is obtained by distillation which is conversion of water into gas, and it then boils into a liquid. Rain water is the purest natural water, and the purest form of it is that collected after a rain of several days duration.

Q. What is composition and chief properties of hydrogen dioxide or peroxide?

A. Thick, colorless, oily liquid, odor like diluted Cl. and metallic, astringent taste. It is compound of two atoms of H to two atoms of O H_2O_2.

NITROGEN.

Q. Describe the preparation of Nitrogen Gas?

A. By burning phosphorus in a closed space over water; by passing air over red hot copper, the oxygen of air unites with the copper and forms oxides of copper, nitrogen being set free; by passing chlorine gas through ammonia.

Q. What are the properties of Nitrogen?

A. A colorless, tasteless, inodorless gas, not inflammable, will not support life or light, but is harmless and inert, lighter than air, a little lighter than oxygen; intense cold and great pressure will reduce it to a clear, colorless liquid. Nitrogen occurs in the atmosphere as a gaseous element, nearly $\frac{4}{5}$ of which consists of nitrogen, the remaining $\frac{1}{5}$ being almost entirely oxygen. Nitrogen is slightly soluble in water, and is 14 times heavier than hydrogen.

Q. Why does Nitrogen often produce explosive compounds?

A. Because its compounds once formed are prone to decomposition, either with violent decomposition, or gradual putrefaction. Example: Iodide of nitrogen if put on paper, when it becomes dry will explode on slightest touch; Nitrogen has little tendency to combine with other elements.

Q. Give composition of four oxides of nitrogen?

A. N_2 O. Nitrous oxide; N_2 O_2, or N. O. nitric oxide; N_2 O_3, nitrogen tetroxide; N_2 O_5, nitrogen pentoxide.

Q. Write out in symbols, decomposition occurring in preparation of nitric acid, and meaning of the symbols?

A. The salt Nitrate of Sodium is acted on by sulphuric acid, one or two molecules of the nitrate can be used, as Na N O_3 + H_2 S O_4 = H N O_3 + Na H S O_4; or 2 Na N O_3 + H_2 S O_4 = 2 H N O_3 + Na 2 S O_4. The first gives one molecule H N O_3 and Sodium Bisulphate, the latter two molecules of H N O_3 and sulphate of sodium Na_2 S O_4.

Q. Give tests for Nitric acid?

A. When heated with copper fillings and sulphuric acid, evolves red fumes of nitrogen tetroxide; a solution of indigo is decolorized by nitric acid.

Q. Name chief properties of *Nitrous Oxide gas?*

A. Colorless, little odor, sweet taste, supports combustion almost as well as oxygen; inhaled, it causes exhilaration, intoxication, anæsthesia; used in dentistry as an anæsthetic.

Q. How is Nitrous Oxide prepared?

A. By heating ammonium nitrate and collecting the gas.

Q. What is relation between nitrogen pentoxide and nitric trioxide and nitrites?

A. The first contains N_2 O_5, two atoms of N. to five of O; the trioxide contains two atoms of N to three of O. N_2 O_3; the tetroxide N_2 O_4, two atoms of N. to four of O; nitrogen dioxide N_2 O_2 or N. O. contains equal volumes of N. and O; nitrogen monoxide, or nitrous oxide, N_2 O. contains two atoms of N to one of O, nitrites formed by deoxidizing nitrates.

Q. How is Nitrous Dioxide (nitric oxide) prepared?

A. By extracting nitrogen from same substances as nitric acid which contains it. 3 Cu + 8 H N O_3 = Cu N O_3 + 4 H_2 O + 2 N O.

Q. What is the difference between nitrous oxide and nitric oxide?

A. Nitrous oxide contains one atom less of oxygen, N_2 O_2—Nitric oxide; N_2 O—Nitrous oxide.

Q. By what two methods can ammonia be prepared?

A. First, by passing an electric discharge for many hours through mixture of one volume of nitrogen to three of hydrogen (difficult). Second, by treating ammonia from gas works (a sulphide), with calcium hydroxide.

Q. What are the properties of ammoniacal gas?

A. Colorless, very pungent odor, alkaline taste, strong alkaline reaction; burns in pure oxygen forming water and free oxygen.

Q. How may ammonia be frozen?

A. By mere application of seven atmospheres, or by intense cold can be converted into a liquid, which at 80° C. or 112° F. forms a solid crystalline mass.

Q. How is Liquid Nitrous Oxide prepared?

A. By treating the gas under a pressure of fifty atmospheres, when it is converted into a colorless liquid.

CARBON.

Q. Name the three distinct forms in which carbon exists?

A. Diamond, graphite, and amorphous, as coal, lamp-black, bone-black and charcoal.

Q. State their peculiarities?

A. Diamond is purest form of carbon, very hard and very valuable; graphite is a somewhat rare, dark-gray mineral; amorphous is of soft, black consistency.

Q. Carbon combining with oxygen, hydrogen, and nitrogen, forms what compounds which constitute a separate branch of chemistry?

A. Carbon combining with O. N. and H. forms hydro-carbons, which form Organic Chemistry.

Q. Describe the nature of the diamond?

A. Crystallizes in regular octahedrons, cubes; or in some figure intimately connected with these; hardest known substance; infusible, but burns when heated intensely, forming $C\,O_2$.

Q. Describe nature of graphite?

A. Graphite, plumbago, or black-lead, is carbon crystallized in short six sided prisms, somewhat rare, of a dark-gray color, used principally for lead pencils, solder supports, etc.

Q. What changes occur in passage of wood into charcoal?

A. Charcoal is obtained by heating or burning wood out of contact with air; it contains hydrogen and mineral substances of wood, and has lost carbon by burning.

Q. Describe source and nature of coal?

A. Formed from vegetable matter by a slow process of decay, mostly under water, in which hydrogen and oxygen are in great part removed, and the carbon by pressure made compact, the decay being partly a fermentation and partly a decay, and chiefly slow destructive distillation; of hard, brittle consistence, black color; it is an impure form of carbon.

Q. How many compounds does carbon form with oxygen, and what are they?

A. Two, carbon dioxide $C\ O_2$, and carbon monoxide C. O.

Q. How may carbonic acid gas (carbon dioxide), be generated?

A. By burning carbonate of lime $Ca\ C\ O_3$ (limestone); $Ca\ C\ O_3$ acted on by H Cl will give carbon dioxide.

Q. What are its properties?

A. $C\ O_2$ is a colorless, odorless gas, with faintly acid taste; is not a poison in itself, but will cause death by arresting respiration.

Q. What law regulates absorption of this gas in water?

A. Cold water absorbs about its own volume, and under great pressure a large amount is absorbed in the water.

Q. How can carbonic acid be obtained in liquid and solid states?

A. By pressure of thirty-eight atmospheres at temperature of 32° F. or 0° C. it is converted into a colorless liquid, which, by intense cold, becomes a solid, crystalline, snow-like substance.

Q. How is carbon monoxide, or carbonic oxide gas formed?

A. When carbon is burned in an insufficient supply of oxygen; by passing $C\ O_2$ over red hot carbon one atom of oxygen will be removed, $C\ O_2 + C = 2\ C\ O$; or carbonate of calcium $Ca\ C\ O_3$, heated with some form of C. $Ca\ Co_3 + C = Ca\ O + 2\ C\ O$.

Q. In what forms are compounds of carbon with hydrogen known?

A. Hydrocarbons, very numerous.

Q. What are marsh gas (methane $C\ H_4$), and Fire-damp, Ethene $C_2\ H_4$?

A. Hydrocarbons.

Q. How is *Acetylene*, $C_2\ H_2$, formed?

A. When electric sparks pass between electrodes of carbon in an atmosphere of hydrogen.

Q. How is Ethene (heavy carburetted hydrogen, or olefiant gas) formed?

A. By destructive distillation of organic substances.

Q. What are its properties?

A. A colorless, almost odorless gas.

Q. Describe the structure of a Flame?

A. Consists of three parts or cones the inner or central being unburnt gas; the second, partially burnt and burning gas; the outer cone, showing highest temperature, but scarcely any light, is where complete combustion takes place.

Q. Describe principle of a Bunsen Burner?

A. One in which enough air is admitted to flame to produce complete combustion; no light, but intense heat is produced.

Q. What is Cyanogen Compound?

A. Does not occur itself in nature, but compounds of it are found when organic matter containing nitrogen are heated with an alkali, especially in presence of iron.

Q. What is most important compound formed by cyanogen with hydrogen?

A. Hydrocyanic acid.

Q. How is cyanogen gas formed?

A. By heating cyanide of mercury $Hg(Cn)_2 = Hg + Cn_2$.

Q. What are its properties?

A. A colorless, transparent gas, with peculiar odor, very soluble in H_2O., heavier than air, can be collected by displacement, acts as chlorine.

CHLORINE.

Q. How is Chlorine prepared?

A. By acting on sodium chloride with sulphuric acid, and treating the hydrochloric acid formed with manganese dioxide.

Q. What are the properties of chlorine?

A. A greenish-yellow gas, very disagreeable odor irritating to fauces, two and one-half times heavier than air; under pressure of 45.50 lbs. to square inch, and cooled by salt and ice mixture, it can be reduced to a greenish-yellow liquid.

Q. Combining with hydrogen, chlorine forms what acid?

A. Hydrochloric, $H\,Cl$.

Q. Upon what does the bleaching power of chlorine depend?

A. The presence of moisture; the chlorine liberates the oxygen from the moisture, and it is the liberated oxygen that bleaches.

Q. Does dry chlorine gas bleach?

A. No.

Q. What is composition of bleaching powder?

A. For convenience chlorine is passed through slaked lime; called chloride of lime or calcium hypochlorite $Ca(Cl\,O)_2$.

Q. Give formulæ of oxides of chlorine and corresponding acids?

A. Hypochlorous oxide, $Cl_2 O + H_2 O = 2 H Cl O$.

Chlorous oxide, $Cl_2 O_3 + H_2 O = 2 H Cl O_2$.

Chlorous tetroxide, $Cl_2 O_4$, does not contain water to form an acid.

Chloric oxide, $Cl_2 O_5 + H_2 O = 2 H Cl O_3$. Not known in separate state but combined with water.

Per chloric oxide, $Cl_2 O_7 + H_2 O = 2 H Cl O_4$.

H Cl., Hydrochloric acid.

H Cl O., Hypochlorous acid.

$H Cl O_2$., Chlorous acid.

$H Cl O_3$., Chloric acid.

$H Cl O_4$., Perchloric acid.

Q. Give preparation of Nitro-Hydrochloric acid (Aqua Regia)?

A. Obtained by mixing four parts nitric with fifteen parts hydrochloric acid; the two act chemically on each other.

Q. What are the properties of Aqua Regia?

A. Noted for its dissolving power on gold and platinum, which depends on action of free chlorine, and chlorinous gas, which parts easily with its chlorine.

Q. How do chlorine and oxygen unite?

A. Not directly, but may be made to unite indirectly.

BROMINE.

Q. How is Bromine obtained?

A. Found in sea water as magnesium bromide, which yields bromine when treated with chlorine, $Mg Br_2 + Cl_2 = Mg Cl_2 + 2 Br$.

Q. What are its properties?

A. At common temperature, a dark reddish-brown liquid giving off brown fumes of exceedingly suffocating and irritating odor; very volatile, and sparingly soluble in $H_2 O$; strong disinfectant, and its aqueous solution is a bleaching agent.

Q. What is composition of Bromic and Hydrobromic acids?

A. Bromic acid—$H Br O_3$; Hydrobromic—H Br.

Q. What are the oxides and oxy-acids of bromine analogous to?

A. To those of chlorine.

Q. What are the acids of Bromine?

A. Hydrobromic, H Br., Hypobromic, H Br O., and Bromic acid; $H Br O_3$.

Q. How is *Iodine* obtained?

A. In nature in combination with sodium and potassium, in some spring waters, and from sea water; chiefly derived from vitrified ashes of seaweed, known as kelp; washing, evaporating, and crystallizing and treating with manganese dioxide, and hydrochloric or sulphuric acid.

Q. What are its properties?

A. Heavy, bluish-black, crystalline substance, sharp, and acrid metallic taste and lustre, neutral reaction, sparingly soluble in water, stains skin brown, and internally is an irritant poison.

Q. Give equation of the decomposition occurring in its manufacture from potassium iodide?

A. $K\,I + Cl = K\,Cl + I$. This occurs when Chlorine acts in potassium iodide. Sulphuric acid may also be used with manganese dioxide. $2\,K\,I + Mn\,O_2 + 2\,H_2\,S\,O_4 = K_2\,S\,O_4 + Mn\,S\,O_4 + 2\,H_2\,O + 2\,I$.

Q. How is hydriodic acid gas obtained and what are its properties?

A. By action of hydro-sulphuric acid used upon iodine in presence of water $H_2\,S + 2\,I = 2\,H\,I + S$. Its salts are used in medicine; a colorless gas, very soluble in water.

Q. Give source of *Fluorine?*

A. Found in nature as fluorspar, calcium fluoride, traces of it in many minerals, some waters, enamel of teeth and bones of mammals.

Q. What are its properties?

A. A colorless gas, highly irritating and suffocating odor, with affinities stronger than any other element, combines with every element except oxygen, has great affinity for vessels in which it is made.

Q. What general relations do the four elements chlorine, bromine, iodine and fluorine exhibit among themselves?

A. A natural growth of elements, known as haloids or halogens; all combine with hydrogen forming $H\,F$; $H\,Cl$; $H\,Br$; and $H\,I$; combine directly with most metals forming fluorides, chlorides, bromides and iodides; with exception of fluorine, they have a distinct color in gaseous state, a disagreeable odor, and disinfecting properties; relative combining energy lessens as atomic weight increases; fluorine with lowest has greatest volume, and with highest atomic weight the smallest affinity for other elements.

Q. How is Hydrofluoric acid obtained?

A. By action of sulphuric acid on fluorspar; used in gaseous state or in solution in water, for etching glass.

Q. How is *Sulphur* obtained?

A. Found in uncombined state in volcanic districts; in combination with other elements in form of sulphates (gypsum $Ca\,S\,O_4$; $2\,H_2\,O$), and frequently as sulphides (in pyrites $Fe S_2$; galena $Pb S$; cinnabar $Hg S$. etc.). Sulphur also enters into organic compounds during decomposition of which sulphur is evolved as sulphuretted hydrogen, which gas is also a constituent of some waters; also crude sulphur. Sublimed sulphur (flower of sulphur) by heating sulphur to boiling point, and depositing vapor in form of a powder of small crystals; washed sulphur, sulphur totum, is washed with very dilute ammonia water, and then with pure water, to free the sulphur from all sulphuric and sulphurous acids; precipitated sulphur (milk of sulphur) made by boiling hydrate of calcium with sulphur and water, filtering, and adding hydrochloric acid, washing and drying the precipitated sulphur.

Q. Give names and symbols of compounds of sulphur, oxygen and hydrogen?

A. Sulphurous acid $H_3 S O_3$, and sulphuric acid $H_2 S O_4$.

Q. How is sulphur dioxide prepared?

A. By action of strong sulphuric acid on many metals (Cu. Hg. Ag. etc.), $2 H_2 S O_4 + Cu = Cu S O_4 + 2 H_2 O + S O_2$, always formed when sulphur is burned in air.

Q. What are its properties?

A. Colorless gas, suffocating, disagreeable odor, very soluble in water, forming sulphurous acid; a strong deoxodizing, bleaching, and disinfecting agent; poisonous when inhaled in a pure state; diluted with air it irritates air passages and causes coughing.

Q. Sulphurous acid is the hydrogen salt of what compounds?

A. Sulphates.

Q. How does bleaching action of sulphurous acid differ from that of chlorine?

A. Chlorine bleaches only in presence of moisture and destroys colors entirely; sulphurous acid bleaches of itself, but colors return by adding weak solution of ammonia.

Q. In what respect are sulphurous and carbonic acids similar?

A. Both extinguish flame of candle.

Q. How may true sulphurous acid be formed from sulphur dioxide?

A. By treating it with water, as in $H_2 O + S O_2 = H_2 S O_3$.

Q. What are salts called sulphites?

A. Those formed by action of sulphurous acid on substances.

Q. How is sulphuric acid prepared?

A. By passing into large chambers simultaneously vapors of sulphur dioxide, nitric acid and steam, with atmospheric air; oxygen of nitric acid oxidizes the sulphur dioxide, which at same time takes up water S

$O_2 + O + H_2 O = H_2 S O_4$; as formed by action of nitric acid on sulphurous acid, $3 H_2 S O_3 + 2 H N O_3 = 3 H_2 S O_4 + H_2 O + 2 N O$.

Q. What are the properties of Sulphuric acid?

A. Colorless, oily liquid, tending to combine with $H_2 O$, absorbing it rapidly from atmosphere; when $H_2 O$ is mixed with $H_2 S O_4$, heat is generated; acts energetically on organic matter removing the H and O. combining them into $H_2 O$, with which it unites, leaving both so rich in carbon that the black color predominates; so strong an acid as to displace most other acids.

Q. How may presence of sulphuric acid be detected?

A. By its changing and blackening again organic substances; sodium sulphate may be used $Na_2 S O_4$; barium chloride produces a white precipitate of barium sulphate, insoluble in acids, $Na_2 S O_4 + Ba Cl_2 = Ba S O_4 + 2 Na Cl$.

Q. How may *Thiosulphuric acid* be obtained?

A. Not known in separate state, as it decomposes into sulphuric and sulphurous acids when attempts are made to liberate it from its salts, some of which are used, as sodium thiosulphate $No_2 S_2 O_3$. This is the sodium hyposulphite of the W. S. P.

Q. How is *Hyposulphurous acid* formed?

A. $H_2 S O_2$ by action of sulphurous acid on zinc, $H_2 S O_3 + Ƶ n = Ƶ n O + H_2 S O_2$.

Q. What are the principal compounds of sulphur, hydrogen, and oxygen?

A. Hyposulphurous acid, $H_2 S O_2$; fuming sulphuric acid $H_2 S_2 O_7$; sulphurous acid $H_2 S O_3$; sulphuric acid $H_2 S O_4$; dithionic acid, $H_2 S_2 O_6$; thiosulphuric acid, $H_2 S_2 O_3$; tetrathionic acid, $H_2 S_4 O_6$; pentathionic acid $H_2 S_5 O_6$.

Q. How is *Sulphuretted hydrogen* formed?

A. By action of sulphuric acid on ferrous sulphide Fe S. $Fe S + H_2 S O_4 = Fe S O_4 + H_2 S$; it is liberated by decomposition of organic matter (putrefaction), and as a constituent of some spring waters; also formed by destructive distillation of organic matter containing sulphur.

Q. What are its properties?

A. A colorless gas, very offensive odor, disgusting taste, very soluble in water, highly combustible in air, burning with a blue flame, poisonous when inhaled.

Q. How may this gas be used for separation of metals into groups?

A. Dissolved in water, used as a reagent for precipitating and recognizing metals, a use which depends on the property of the sulphur to combine with many metals to form insoluble compounds. $Cu\ S\ O_4 + H_2\ S = Cu + H_2\ S\ O_4$.

Q. Where is *Selenium* obtained?

A. Found native, also in combination, forming selenides; rare; has several allotropic forms; its power of conducting electricity is affected by light; resembles sulphur in its properties.

Q. Where is *Tellurium* found?

A. Native, and also in union with bismuth, gold, etc., rare; has a metallic lustre, purplish color, fuses below red-heat, and boils at a somewhat higher temperature; resembles sulphur in its properties.

Q. Where is *Silicon* found?

A. In nature, very abundant as silicon dioxide or silicon, $Si\ O_2$ (rock crystal, quartz, agate, sand), and in form of silicates, which are granite, porphyry, basalt, feldspar, mica, etc., or a mixture of them; very much resembles carbon; insoluble, infusible in all common solvents.

Q. Where is *Boron* found?

A. In but few places, either as boric or boracic acid, or borate of sodium (borax); in nature combined with sodium, and oxygen as borax, $Na_2\ B_4\ O_7 + 10\ H_2\ O$.

Q. How is crystallized boron prepared, and what are its properties?

A. By action of aluminum; in boric anhydride $B_2\ O_3$, if pure in brilliant crystals closely resembling the diamond, and next to it in hardness.

Q. Where does *Boric* or *Boracic acid* occur, and how obtained from borax?

A. $H_3\ B\ O_3$ exists in steam jets discharged in some volcanic regions, and some of its salts occur as minerals; prepared by dissolving borax in warm dilute sulphuric acid and allowing solution to cool.

Q. With what is *Phosphorus* found in combination?

A. Chiefly in nature in form of phosphates of calcium, iron, and aluminum; in small quantities in all soils on which plants will grow.

Q. How is it prepared from bone ash?

A. Bones deprived of animal matter, the bone ash is treated with sulphuric acid, the liquid concentrated, mixed with charcoal and sand, and heated; calcium is then formed, the charcoal takes the oxygen and the phosphorus distils over. $Ca_3\ (P\ O_4)_2 + 2\ H_2\ S\ O_4 = 2\ Ca\ S\ O_4 + Ca\ H_4\ (P\ O_4)_2$. calcium acid phosphate, $Ca\ H_4\ (P\ O_4)_2 + Si\ O_2 + C_5 = Ca\ Si\ O_3 + 2\ H_2\ O + 5\ C\ O + P_2$.

Q. What are the properties of Phosphorus?

A. When recent, a colorless, nearly transparent solid, soft as wax; exposed to light, it becomes brownish, opaque, and harder, takes fire easily, usually kept under water, burns with bright flame, causing white clouds of phosphoric anhydride; extremely poisonous, less than $\frac{1}{4}$ grain has caused death; used as a medicinal substance, and on matches.

Q. Whence do animals ultimately get the phosphorus they need?

A. It is an essential constituent of all plants, and through the plants it is taken in as food.

Q. Give the different modifications of phosphorus?

A. Several allotrophic forms, of which the red is the most important, it is obtained by exposing phosphorus in an atmosphere of carbon dioxide; it is not poisonous, nor luminous, not combustible under 28° F. over this it is converted into common phosphorus.

Q. How is Phosphoric Acid prepared?

A. Phosphoric acid is capable of combining chemically with 1, 2, or 3 molecules of water forming 3 different acids:—

$P_2 O_5 + H_2 O = H_2 P_2 O_6 = 2 H P O_3$, Metaphosphoric acid.

$P_2 O_5 + 2 H_2 O = H_4 P_2 O_7$, Pyrophosphoric acid.

$P_2 O_5 + 2 H_2 O = H_6 P_2 O_8 = 2 H_3 P O_4$, Chlorophosphoric acid.

Phosphoric acid may be made by burning phosphorus, dissolving the phosphoric oxide in water, and boiling to convert metal into orthophosphoric acid.

Q. Give formula of sodium phosphate?

A. $Na_3 P O_4$.

Q. What two chlorides of phosphorus are known?

A. $P Cl_3$, and $P Cl_5$, used in researches in organic chemistry.

Q. What is *Hypophosphorous Acid?*

A. Prepared by adding sulphuric acid to barium hypophosphite.

Q. Name the oxides of phosphorus?

A. Phosphorus anhydride $P_2 O_3$, and phosphoric anhydride $P_2 O_5$; the first is produced by slow oxidation of phosphorus in air, water is absorbed and phosphorous acid is formed; the second is produced by active combustion of phosphorus; it is a white snow-like solid, with high affinity for water, and forms three different bodies by uniting with water in three proportions.

ARSENIC.

Q. Where is Arsenic obtained?

A. At times in native state, but generally as a sulphide or arsenide.

Q. What does it closely resemble in its chemical properties, and in its compounds?

A. Antimony.

Q. How is arsenic separated from its ores?

A. By washing, As_2O_3 being formed, vapors of arsenic oxide allowed to pass over red hot charcoal, $As_2O_3 + 3C = 3CO + 2As$.

Q. What are the properties of arsenic?

A. The vapor when thus prepared, condenses into a steel-gray metallic mass; odorless, tasteless, very brittle, volatilizes unchanged and without melting when heated to 1800 C. without access to air; heated in air it burns with a bluish-white light, forming arsenious oxide.

Q. What are the peculiar characteristics of arsenites and arsenates?

A. Poisonous and give off garlic-odor fumes.

Q. What are the tests for presence of arsenic?

A. Heat and dry arsenious compound, mix with charcoal and dry potassium carbonate in glass tube with small bulb on end, when the compound is decomposed and metallic arsenic deposited as a metallic ring in upper part of tube. Reinch's Test:—A thin piece of copper with a bright surface, is placed in a slightly acidulated solution of arsenic, and it will, when solution is heated, become coated with film of metallic arsenic; the latter may be sublimed from the copper by placing it in a dry, narrow test tube, and heating; most of the arsenic being converted into arsenious oxide, which forms deposit of small octohedral crystals.

Q. How does ferric oxide act as an antidote in arsenical poisoning?

A. By forming with the arsenic insoluble ferric arsenite or arseniate, which is not poisonous.

Q. What is the preparation and composition of *Arseniuretted Hydrogen?*

A. Always formed when either arsenious or arsenic oxides or acids, or any of its salts, are brought in contact with nascent hydrogen, as zinc and diluted sulphuric acid which evolve hydrogen.

$As_2Cl_3 + 6H = AsH_3 + 3HCl.$

$As_2O_5 + 16H = 2AsH_3 + 5H_2O.$

$As_3O + 12H = 2AsH_3 + 3H_2O.$

Q. Describe modes in which *Metals* generally occur?

A. In form of ores, from which they are obtained by roasting.

Q. What are *Metallic Oxides?*

A. Substances formed by action of oxygen on metals.

Q. What are *Metallic Salts?*

A. Substances formed by action of acids on metals.

POTASSIUM.

Q. How does Potassium occur?

A. Only in compounds.

Q. How is Potassium prepared?

A. By heating the carbonate $K_2 C O_3$, one of its oxygen compounds, with charcoal in an iron retort.

Q. What are its properties?

A. Occurs in many rocks and soils; a quite soft metal, freshly cut surface presents a silver lustre, but quickly tarnishes in air; burns with a purple flame, and decomposes water; soft as wax, lighter than water.

Q. Give sources of potassium compounds?

A. Silicate of potassium which by gradual disintegration of granite rocks, has entered into the soil, whence it is taken up by plants as one of the necessary constituents of their food, which is the source of the Potassium compounds.

Q. How is *Caustic Potash*, Potassium Hydrate, K H O, obtained?

A. By action of potassium on water; also by boiling dilute solution of potassium carbonate, or bicarbonate and calcium hydroxide. $K_2 C O_3 + Ca\ 2 H O = 2 K O H + Ca C O_3$.

Q. What are its properties?

A. Very alkaline and a powerful cautery.

Q. How is *Potassium Carbonate*, Salts of Tartar, $K_2 C O_3$, prepared?

A. By heating the bicarbonate which is decomposed $2 K H C O_3 = K_2 CO_3 + H_2 O + C O_2$.

Q. What are its properties?

A. Very deliquescent, soluble in equal weight of water, with strong basic and alkaline properties.

Q. How is *Potassium Nitrate*, $K N O_3$ Nitre, Saltpetre, prepared?

A. By mixing animal refuse matter with earth and lime, and preventing lixiviation by placing in heaps; by decomposition of the animal matter, ammonia is formed, which, by oxidation, is converted into nitric acid, and this combining with the calcium, forms calcium nitrate; this is dissolved by water, and potassium carbonate, or chloride, is added when potassium nitrate is obtained. $Ca\ 2 N O_3 + K_2 C O_3 = 2 K N O_3 + Ca C O_3$.

Q. What are its properties?

A. Saline, astringent, cooling to taste, and with a neutral reaction; great oxidizing agent, used in making gunpowder.

Q. What is gunpowder?

A. Mixture of 75 parts of nitre, 15 parts of charcoal, and 10 parts of sulphur.

Q. What occurs when it explodes?

A. The nitrogen, carbon dioxide and carbon monoxide occupy at moment of explosion, about 1200 times the bulk of the powder, and the explosive action is due to this sudden expansion in volume.

Q. How is *Potassium Bitartrate*, K H T, Cream of Tartar, prepared?

A. By adding tartaric acid to a solution of the normal tartrate; it exists naturally in grape juice, on sides of wine casks whenever there is vinous fermentation.

Q. What are its properties?

A. Refrigerant.

Q. How is *Potassium Chlorate*, $K\,Cl\,O_3$. prepared?

A. By passing chlorine gas through potassium hydrate.

Q. What are its properties?

A. In form of white, anhydrous crystals, with a taste like nitre; they deflagrate violently with combustible matter, and explode by friction or blows; used for inflammations, etc., of mucous membranes.

Q. How is *Potassium Iodide*, K I. prepared?

A. By adding iodine to caustic potash; occurs in sea water and is taken up by the seaweeds; it is used medicinally; in form of white cubic crystals, soluble in water.

Q. How is *Potassium Permanganate*, $K_2\,Nn_2\,O_8$. obtained?

A. By decomposition of potassium manganate in water; commercially from manganese dioxide, potassium chlorate, and potassium hydroxide; in dark purple crystals, soluble in water, and decomposed in contact with organic matter; a disinfectant, the green and red disinfectants known as *Condy's fluids* are alkaline manganates and permanganates; used as a reagent for determining iron in laboratory work.

SODIUM.

Q. What are the sources of sodium compounds?

A. Found in small quantities in all soils; occurs in large quantities in combination with chlorine as rock salt; to a large extent in the ocean.

Q. What is the salt-cake process?

A. That by which sodium carbonate is made.

LITHIUM.

Q. What is the source of Lithium?

A. In nature in combination with silicic acid in a few rare minerals, or as a chloride in some spring waters; these compounds color flame a beautiful crimson or carmine.

Q. What are the compounds of lithium?

A. Hydroxide, carbonate, and phosphate.

SAL-AMMONIAC.

Q. How is Ammonium chloride obtained?

A. By saturating ammoniacal liquor of the gas works with hydrochloric acid, evaporating to dryness and purifying by sublimation; in form of white crystalline powder, or long fibrous crystals; cooling saline taste.

CALX.

Q. How is Lime obtained?

A. By burning limestone, calcium carbonate $Ca\,C\,O_3 = Ca\,O + C\,O_2$.

Q. What is Lime Water?

A. A saturated solution of calcium hydroxide in water, colorless, odorless caustic taste, and alkaline reaction.

Q. Give composition and properties of Glass?

A. All varieties are mixtures of fusible, insoluble silicates, made by fusing silicic acid (white sand) with different metallic oxides or carbonates, the silicic acid combining chemically with the metals.

Q. How are colors imparted to glass?

A. By addition of certain metallic oxides, as manganese—violet, cobalt—blue, chromium—green, etc.

Q. What are the tests for presence of zinc, cadmium and manganese?

A. For Zinc: add to solution of a zinc salt ammonium sulphide, a white precipitate of zinc sulphide is produced. For Cadmium: it forms a yellow sulphide with hydrosulphuric acid, soluble in dilute acids. For Manganese: such compounds fused with borax give a violet color to the color bead; or heated on platinum foil with mixture of sodium carbonate and nitrate form a green solution in water, which an acid turns red.

BISMUTH.

Q. How does Bismuth occur?

A. Native and as Sulphide.

Q. What is *Bismuth Nitrate*, $Bi_3 N O_3$?

A. Formed by treating bismuth with nitric acid.

Q. What is Bismuth Subnitrate, $Bi O N O_3$?

A. Water added to bismuth nitrate to decompose it, the precipitate being bismuth subnitrate.

Q. What are its form and uses?

A. As a medicine and cosmetic (pearl powder); in the form of a white tasteless powder.

Q. What is *Bismuth Subcarbonate*, $(Bi O)_2 C O_3$.—similar to bismuth subnitrate in constitution, properties and uses?

A. Made by adding a solution of ammonium carbonate to a solution of bismuth nitrate.

ANTIMONY.

Q. How does Antimony occur?

A. Native and as a sulphide.

Q. When is the gas Antimonious Hydride, $S B H_3$, formed?

A. Whenever hydrogen is generated (nascent) in the presence of a reducible antimony compound.

Q. What is *Antimonious Chloride*, $Sb Cl_2$?

A. A yellow semi-solid called *butter of antimony*.

Q. What is Oxychloride of Antimony, $Sb O. Cl$?

A. A white powder formed by decomposing and precipitating antimonious chloride.

Q. What is *Antimony and Potassium Tartrate*, $(Sb O K S)$?

A. *Tartar Emetic*; prepared by treating antimonious oxide with the bitartrate of potassium; it has a sweetish metallic taste soluble in water, and slightly in alcohol.

Q. What is *Antimonious Oxide*, $Sb_2 O_3$?

A. Prepared by treating the oxychloride with sodium carbonate to remove the chlorine; a whitish, insoluble, volatilizable powder.

Q. How may the presence of antimony be detected?

A. By orange precipitate with $H_2 S$; also by Marsh's test.

Q. What is *Marsh's test?*

A. Nascent hydrogen test for arsenious acid.

LEAD.

Q. What is *Lead Oxide-Litharge*, $Pb O$?

A. A native yellow substance, also made artificially by heating lead in air; it forms with oil lead plaster.

Q. What is *Lead Acetate*, $Pb\ Ac_2$?

A. *Sugar of Lead:* made: $Pb + 2\ H.\ Ac = Pb\ Ac_2 + H_2\ O.$ used in medicine more than any other lead salt, its solution will dissolve considerable quantities of Pb O. forming the *Solution of the Subacetate of lead.* Goulard's extract: it is astringent and sedative; diluted it is called *lead water*, and is used in skin and mucous affections, etc., etc.

Q. What is *Lead Carbonate*, $Pb\ C\ O_3$?

A. *White Lead:* $Pb\ Ac_2 + Na_2\ C\ O_3 + 2\ Na\ Ac.$

All the lead compounds are poisonous.

MAGNESIUM.

Q. What is *Magnesium*, Mg?

A. Occurs in many silicates as *talc*, *serpentine*, and in magnesian limestone, asbestos, meerschaum, etc.; silvery-white metal, burns with a brilliant white light, and is rich in chemical rays.

Q. What is Magnesium Sulphate, $Mg\ S\ O_4$?

A. *Epsom Salts:* made artificially from native carbonate; occurs in waters of various springs; a white, crystalline salt, of a nauseous bitter taste, used as a purgative.

Q. What is *Magnesium Citrate?*

A. Prepared by adding a solution of citric acid to $Mg\ C\ O_3$, and bottling immediately to retain the $C\ O_2$: *liquor magnesii citratis*, a pleasant saline purgative.

Q. What is *Magnesium Oxide*, Mg O?

A. *Magnesia:* made by heating the carbonate, like Ca O; insoluble and tasteless; antidote for acids.

Q. What is Magnesium Hydrate, $Mg\ (H\ O)_2$?

A. Made by precipitating a magnesium solution with potassium or sodium hydrate. Suspended in water it is called *Milk of Magnesia.*

ZINC.

Q. What effect has air upon zinc?

A. It tarnishes quickly in air or water; becomes quickly coated with a film of oxide that protects it from further corrosion.

Q. What is the effect of acids on commercial zinc?

A. Acids rapidly attack it.

Q. What is *Zinc Sulphate*, $Zn\ S\ O_4$?

A. *White Vitriol:* made by heating zinc with water and sulphuric acid; $Zn + H_2SO_4 = ZnSO_4 + H_2$; a white soluble salt resembling $MgSO_4$ in appearance; astringent and emetic.

Q. What is *Zinc Chloride*, $ZnCl_2$?

A. Made: $Zn + 2HCl = ZnCl_2 + H_2$; a white, deliquescent salt, strongly astringent; caustic.

Q. What is *Zinc Carbonate*, $ZnCO_3$; made by precipitation; $ZnSO_4 + Na_2CO_3 = Na_2SO_4 + ZnCO_3$?

A. Used as zinc white in place of lead carbonate as it is not discolored by H_2S; as a topical remedy for excoriations, etc., and in form of ointment.

Q. What is *Zinc Oxide*, ZnO?

A. Prepared either by burning metallic zinc, or heating the carbonate, $ZnCO_3 = ZnO + CO_2$; a yellowish-white powder used externally in ointment form, and as an ingredient of zinc cement for filling teeth; internally as a tonic and astringent.

CADMIUM.

Q. What is *Cadmium*?

A. Resembles zinc in properties and some uses, but is more volatile; the sulphide is yellow, and insoluble in acid solutions; bluish-white.

Q. How does Cadmium occur?

A. A rare metal accompanying ores of zinc; also as the mineral greenokite—the sulphide; it tarnishes but little in air, and burns when strongly heated; melts at 320° F.; malleable.

ALUMINIUM.

Q. What is the nature of *Aluminium*?

A. Never found free, but in abundance, and in the distribution of its compounds it is next to oxygen and silicon; 3d among elements and 1st among metals; isolated with difficulty; enters into the composition (as a silicate) of all primitive rocks, of feldspar, slates and clays; of the minerals garnet, emerald, topaz; an oxide, Al_2O_3, is the mineral *corundum*, which in various degrees of coloring and purity is the ruby, sapphire, topaz, amethyst, and emerald; an impure variety is called *emery*.

Q. How is it prepared?

A. By decomposing aluminium chloride by metallic potassium; or more recently, by the electrolytic reduction of corundum, Al_2O_3, with copper producing an alloy of copper and aluminium; or by the electrolytic reduction of oxide of aluminium having a cover of fused cryolite, producing metallic aluminium.

Q. What is *Aluminium Chloride*, $Al_2\ Cl_6$?

A. Prepared by aluminium hydrate in solution of hydrochloric acid.

Q. What is *Aluminium Sulphate*, $Al_2\ 3\ S\ O_4$?

A. Made by treating white clay with $H_2 S\ O_4$; has properties similar to the chloride.

MANGANESE.

Q. What does *Manganese* resemble in its properties ?

A. Iron: manganese is used to alloy iron in the preparation of certain kinds of steel.

Q. What is its most abundant ore ?

A. Manganese Dioxide.

Q. What is *Manganese Dioxide ?*

A. Black Oxide of Manganese, an insoluble steel-gray powder that readily gives up its extra atom of oxygen; used in the preparation of chlorine and oxygen.

Q. What is *Manganous Sulphate*, $Mn\ S\ O_4$?

A. Made by heating manganese dioxide with sulphuric acid: $Ma\ O_2 + H_2 S\ O_4 = Mn\ S\ O_4 + H_2 O + O$; a soluble rose-colored salt.

Q. What is *Manganous Sulphide*, $Mn\ S$?

A. It is precipitated whenever a salt of manganese is treated with $N\ H_4\ H\ S$; its formation.

Q. What is *Potassium Permanganate*, $K_2\ Mn\ O_4$?

A. The heating together of a mixture of $K\ H\ O.\ K\ Cl\ O$ from which results a green mass of potassium manganese; if this be dissolved in water it forms a green solution which on boiling or standing awhile becomes purple, to the formation of $K_2\ Mn\ O_4$. It gives up its oxygen so readily to organic matter at the same time losing its purple color, that it is used as a test for organic impurity in water, and as a disinfectant.

MERCURY.

Q. What Properties has *Mercury ?*

A. Only metal liquid at ordinary temperatures; resembles silver in appearance—hence name "hydrargyrum" (water silver), and quicksilver (fluid silver); so heavy (specific gravity 13.56) that iron and stone float upon it as corks on water; it does not tarnish in air; dissolves all metals except iron, to form amalgams.

Q. What is *Mercurous Iodide*, HgI ?

A. Proto-iodide, Green iodide, Hydrargyri Iodidum Viride; made by rubbing together chemical equivalents of mercury (200) and iodine (127) until they combine and form a green substance.

Q. What is *Mercuric Iodide*, HgI_2?

A. Binodide Red iodide: made like HgI, except that 2 equivalents of iodine are used; in precipitating it is first yellow, but rapidly becomes red; warming the red powder changes it back to yellow, but on shaking or rubbing the red is restored, the changes in color being due to changes in crystalline structure.

Q. What is *Mercurous Nitrate*, $Hg\,N\,O_3$?

A. Formed when mercury is treated with cold dilute nitric acid.

Q. What is *Mercuric Nitrate*, $Hg_2\,N\,O_3$?

A. Acid Nitrate of Mercury: formed if mercury is boiled with strong nitric acid.

Q. What is *Mercurous Sulphate*, $Hg_2\,S\,O_4$?

A. Made by digesting sulphuric acid with excess of mercury.

Q. What is *Mercuric Sulphate*, $Hg\,S\,O_4$?

A. Made by heating mercury with excess of sulphuric acid; white, crystalline salt, used in some galvanic batteries.

Q. What is Mercurous Chloride, Hg Cl?

A. *Calomel*, *mild Chloride*, *Hydrargyrum Chloridum Mite:* made by heating mercurous sulphate with Sodium Chloride ($Hg_2\,S\,O_4 + 2\,Na\,Cl = Na_2\,S\,O_4 + 2\,Hg\,Cl$), when the mercurous chloride sublimes and is condensed in a cool receiver; a white, insoluble powder; exposed to light it slowly decomposes; with aqua regia, and more slowly with other soluble chlorides, it is converted into mercuric chloride; although calomel may pass through stomach unaltered, it is converted into the mercurous oxide by the alkaline fluids in the small intestine.

Q. What is *Mercuric Chloride*, $Hg\,Cl_2$?

A. *Bichloride of Mercury*, *Corrosive Sublimate:* prepared by sublimation from a mixture of mercuric sulphate and sodium chloride—$Hg\,S\,O_4 + 2\,Na\,Cl = Na_2\,S\,O_4 + Hg\,Cl_2$; crystalline and soluble; disagreeable styptic taste; very poisonous; used as an antiseptic and germicide.

Q. What is *Mercuric Ammonium Chloride?*

A. Ammoniated Mercury, White Precipitate; formed by adding ammonia to a solution of mercuric chloride; used in ointment.

Q. What is *Mercurous Oxide*, $Hg_2\,O$?

A. Black oxide of Mercury: made by heating a mercurous salt with a soluble hydrate; seldom used in medicine.

Q. What is *Mercuric Oxide*, Hg O?

A. Red or Yellow Oxide: made by decomposing mercuric nitrate by heat; crystalline; red color; but when made by precipitating a mercuric solution with a hydrate it is an amorphous yellow powder.

Q. How is *Oleate of Mercury* made?

A. By warming mercuric oxide with oleic acid; liquid or semi-solid; it is rapidly absorbed when applied to skin.

COPPER.

Q. How is *Copper* found?

A. Usually combined with sulphur, but often in metallic state; a red, malleable metal; an excellent conductor of electricity.

Q. What is *Cupric Sulphate*, $Cu\,S\,O_4$?

A. Blue Vitriol, Blue Stone: made by heating copper with strong $H_2\,S\,O_4$; also obtained incidentally as a product from copper mines, silver refineries, etc.; in beautiful crystals of blue color; soluble in water, insoluble in alcohol; a prompt emetic, astringent; coagulates albumen; not so much used as an emetic as is Sulphate of zinc, as gastro-enteritis may be induced if the copper is not all ejected from stomach.

Q. What is *Cupric Hydrate*, Cu 2 H O?

A. Formed as a bluish white precipitate whenever a soluble copper salt is treated with a soluble hydrate. When heated even under water, it decomposes.

Q. What is *Cupric Oxide*, Cu O?

A. Black Oxide: made by heating copper turnings in air; it gives up oxygen freely.

Q. What is *Cuprous Oxide*, $Cu_2\,O$?

A. Suboxide: made by boiling the black oxide with an oxidizable substance as glucose; the precipitate is first yellow (hydrate), but soon becomes bright red (oxide).

Q. What is *Cupric Subacetate* or *Oxyacetate?*

A. Verdigris: made by exposing plates of copper to acetic fumes of grape husks, etc.; liable to be formed whenever fruits containing acetic acid are placed in copper vessels.

Q. What is a *Test* for Copper?

A. Dip into suspected solution a more electro-positive metal, as iron, and a plating of metallic copper will be deposited on the iron, an equivalent proportion of which takes the place of the copper in the solution.

PLATINUM.

Q. How does *Platinum* occur?

A. Free, associated with the allied metals palladium, rhodium, ruthinium, and iridium; owing to its scarcity it is almost as costly as gold; like silver in appearance; melted with difficulty; few substances corrode it; platinum vessels are useful for a high heat, or to contain corrosive chemicals; platinum wire is used in flame testing, for stirring molten metals, etc.

Q. In what acids does it readily dissolve?

A. Nitro-muriatic, forming *platinic chloride*, $Pt\ Cl_4$; a valuable reagent for potassium, ammonium, and the alkaloids.

IRON.

Q. How does *Iron* occur?

A. Abundantly as oxide, carbonate and sulphide; occasionally free.

Q. How is it prepared?

A. The Carbonate or Sulphide is first roasted until converted into oxide; the oxide is heated in a blast furnace with coal and fluxes—limestone and silicates; the carbon of the coal removes the oxygen from iron, which then melts and sinks beneath the melted fluxes, and the fused iron is drawn off and poured into sand moulds in the form of pigs; this is *cast iron* containing 4 or 5 per cent. of carbon; *wrought iron* contains little carbon, and *steel* an intermediate quantity.

Q. How is *Wrought Iron* made?

A. From cast iron by "puddling," which burns out the carbon by oxidation; blowing air through molten iron.

Q. What is the color of iron, and what effect has moist air upon it?

A. Bluish-gray, Sp. gr. 7.5; it rusts (oxidizes) when exposed to moist air, or water containing air.

Q. What is *Reduced Iron?*

A. Made by heating ferric oxide nearly to redness in a tube through which hydrogen is passed; a very fine dark-gray powder which will ignite on contact with a flame and burn with a red glow.

Q. What is *Ferrous Chloride*, $Fe\ Cl_2$?

A. Made by adding iron to hydrochloric acid until effervescence ceases; it is green, and prone to oxidize, with formation of ferric compounds.

Q. What is *Ferric Chloride*, $Fe_2\ Cl_6$?

A. Made by adding nitric and hydrochloric acids to ferrous chloride; the nascent chloride evolved by the acids in combination converts the ferrous into ferric chloride. The aqueous solution—*liq. ferri chloridi* diluted with alcohol forms the *tinct. ferri chloridi*; if citrate of potassium or sodium be added to this tincture, the solution loses its styptic taste, and does not affect the teeth; it is not incompatible with solutions containing tannin.

Q. What is *Ferrous* Sulphate, $Fe\ S\ O_4$?

A. Copperas, Green Vitriol: made by placing iron in a solution of sulphuric acid: $Fe + H_2\ S\ O_4 = Fe\ S\ O_4 + H_2$; a disinfectant destroying organic matters by abstracting their oxygen.

Q. What is *Ferric Sulphate*, $Fe_2\ 3\ S\ O_4$?

A. Tersulphate: made by adding nitro-sulphuric acid to solution of the ferrous sulphate.

Q. What is its solution?

A. *Liq.* ferri tersulphatis, Liq. ferri subsulphatis—*Mousel's Solution*, prepared like the above, but using only half quantity of sulphuric acid; styptic.

Q. What is *Ferrous Hydrate*, $Fe\ 2\ H\ O$?

A. It is precipitated on mixing solutions of a hydrate and a ferrous salt; a green precipitate which soon oxidizes and becomes brown.

Q. What is *Ferric Hydrate*, $Fe_2\ 6\ H\ O$?

A. A brownish-red, gelatinous mass, precipitated by soluble hydrates from ferric solutions; a favorite antidote for arsenic, if freshly prepared and in large doses. Ferric hydrate dissolves freely in a solution of ferric chloride, forming a dark red liquid of a styptic taste.

Q. What is *Dialysed Iron?*

A. If the dark-red liquid just mentioned be put in a vessel with a bottom of parchment or animal membrane (Dialyser) and suspended in water, the chloride passes out through membrane into the water; when barely enough ferric chloride remains in the dialyser to hold the ferric hydrate in solution and styptic taste has disappeared, the liquid (dialysed iron) is removed.

Q. What is *Ferrous Iodide*, $Fe\ I_2$?

A. Prepared by placing in water and adding iron filings: $Fe + I_2 = Fe\ I_2$.

Q. What is *Ferrous Carbonate*, $Fe\ C\ O_3$?

A. Made by adding a soluble (alkaline) carbonate to a ferrous salt; insoluble in pure water, but slightly soluble in water containing carbonic acid.

COBALT.

Q. What are the chemical characteristics of *Cobalt?*

A. Nearly silver white metal, salts generally of a red color; solution gives a blue color.

Q. What of *Nickel*, N?

A. Very similar to cobalt, nearly silver-white metal, salts give a green color.

Q. Where is *Titanium*, Ti, found?

A. Exists as titanic anhydride, $Ti\ O_2$, also in iron ores.

Q. What of *Chromium*, Ch?

A. A metal of very beautiful color in its compounds; resembles aluminum and iron, also sulphur; forms two basic oxides and an acid.

Q. What of *Molybdenum*, Mo?

A. Occurs chiefly as a sulphide, and as lead molybdate, both rare.

Q. What of *Tungsten*, W?

A. Rare metal, exists as a manganese-iron tungstate, called wolfram and tungstate (scheelite).

Q. What of *Uranium*, U?

A. Rare metal, grayish, not oxidized by air or water, but dissolves in acids.

Q. What of *Vandium*, V?

A. Rare metal, found with iron and lead; has been used to make indelible ink.

Q. What of *Thalium*, Tl?

A. Acts as a monad and triad, resembles lead, but compounds are like potassium and somewhat like those of silver.

Q. How are *Tin* compounds distinguished?

A. Tin is bivalent in some compounds, quadrivalent in others.

Q. How can compounds of tin be detected?

A. By adding muriatic acid to solution of stannous salt, when brown stannous sulphate is precipitated; also by adding hydrosulphuric acid to solution of a stannic salt, when yellow stannic sulphide is precipitated.

Q. Give formulæ for *Potassium Chromates*?

A. Potassii dichromas $K_2\ Cr_2\ O_7$. Potassium chromate $K_2\ Cr\ O_4$.

Q. Of oxides of arsenic and antimony?

A. Arsenious oxide—acidum arseniosum, $As_2\ O_3$.

Antimonious oxide—antimonii oxidum $Sb_2\ O_3$.

Antimonic oxide, $Sb_2\ O_5$.

Arsenic oxide, $As_2\ O_5$.

Q. What decomposition takes place in melting lead?

A. $2\ Pb\ S + 3\ O_2 = 2\ Pb\ O + 2\ S\ O_2$.

Q. How is White Lead—carbonate of lead, $Pb\ C\ O_3$, formed?

A. By action of air, carbon dioxide, and vapors of acetic acid simultaneously on lead.

Q. In what do organic substances differ from inorganic?

A. Organic are formed in the living organism, and those compounds formed by their decomposition. Inorganic, those that are not living, and never have been, nor never will be.

Q. Give examples of an organized structure?

A. The different cells which make up the human body; cells of growing plants, etc.

Q. Can organic substances be formed artificially?

A. Many substances once thought to be exclusively produced in the living organism, can be formed artificially from inorganic matter, or by direct combination of the elements.

Q. Can *Hydrocyanic Acid* be prepared from inorganic sources?

A. Yes, and by action of ammonia on chloroform.

$C\ H\ Cl_3 + N.\ H_3 = H\ C\ N + 3\ H\ Cl$; by heating ammonium formate to 392° F.—$N\ H_4\ C\ H\ O_2 = H\ C\ N + 2\ H_2\ O$.

Q. What is the formula of Acetone?

A. $C_2\ H_6\ O$.

Q. Of Aldehyde?

A. $C_2\ H_4\ O$.

Q. Acetanilide or Antifebrin?

A. $C_6\ H_5\ C_2\ H_3\ O.\ N\ H$.

Q. Of Methyl alcohol?

A. $C\ H_3\ H\ O$.

Q. What is the source of Methyl Alcohol?

A. One of the many products obtained by destructive distillation of wood, it is a thin, colorless liquid, in smell and taste similar to ethyl alcohol.

Q. What is Ethyl Alcohol, $C_2\ H_5\ H\ O$?

A. An alcohol obtained from ethene by addition of elements of water, by agitation of ethene with strong sulphuric acid, when ethyl sulphuric acid is formed. $C_2\ H_4 + H_2\ S\ O_4 = C_2\ H_5\ H\ S\ O_4 =$ ethyl sulphuric acid.

Dental Pathology.

Q. What is *General Pathology?*

A. That branch of medical science that treats of nature of diseases in general.

Q. What is *Special Pathology?*

A. That which treats of the nature of individual diseases.

Q. Define *Disease?*

A. A condition of body characterized by abnormal action of one or more of the various organs owing to an unnatural state or structural change.

Q. How may diseases be classed?

A. As functional and structural.

Q. What characterizes functional diseases?

A. Disturbance of the functions of a part.

Q. What characterizes structural diseases?

A. Alteration in the structure of a part.

Q. Into what two varieties may disease be divided according to the nature of the symptoms?

A. Acute and Chronic.

Q. What characterize *Acute Diseases?*

A. Rapid onset and rapid course.

Q. What *Chronic Diseases?*

A. Slow in their course, and milder symptoms.

Q. What *Constitutional Diseases?*

A. Where the system of organs, or the whole body is involved.

Q. What *Idiopathic Diseases?*

A. Where one exists by itself without any connection with another disease.

Q. What *Specific Diseases?*

A. Such as arise from the introduction of a specific virus or poison within the body.

Q. What *Septic Diseases?*

A. Those arising from putrefactive fermentation of some foreign substance within the body.

Q. What *Zymotic Diseases?*

A. Germ diseases, or those due to introduction and multiplication of some living germ within the body.

Q. Give the *Predisposing Causes* of *Disease?*

A. Debilitating influences, previous and present disease, excitement, hereditary influences, temperament, age, sex, occupation, etc.

Q. Name the normal pulse beats per minute from birth to old age?

A. At birth—140; 1st year—110; 2d year—100; 5th year—90; 10th year—85; Puberty—80; Adult—75; Old age—80.

Q. What is the normal Temperature of the body?

A. 98.5° F.

Q. What is generally considered to be a dangerous temperature?

A. 105° F.: while 107° F. is usually fatal.

Q. How is the temperature in fevers?

A. Highest in the evening and lowest in the morning.

Q. What is the case in the fever of Difficult Dentition?

A. The reverse—the temperature being highest in the morning and lowest in the evening.

Q. What does *Anemia* imply?

A. Deficiency of red corpuscles in blood; deficiency of blood.

Q. What does *Hyperemia* imply?

A. An abundance of red corpuscles; a condition of plethora.

Q. What does *Spanemia* imply?

A. A poor quality of blood; poverty of the blood.

Q. What does *Plethora* imply?

A. A fulness of blood vessels.

Q. What changes occur in the white and red corpuscles in inflammation?

A. The white increase in number and adhere to walls of vessels and obstruct capillaries, and thus arrest progress of the red disks; some make their way through walls of vessels, and are known as exudation corpuscles; losing vitality they become pus corpuscles.

Q. What does Exudation imply?

A. Morbid oozing out of fluids.

Q. What is *Gangrene?*

A. Incipient mortification, or death of a part from failure in nutrition.

Q. What is *Mortification?*

A. Putrefactive fermentation, or death of a part from want of nutrition.

Q. What is *Necrosis of Bone?*

A. Mortification or death of bone, corresponding to gangrene of soft parts.

Q. What is *Caries of Bone?*

A. Ulceration of bone, chronic inflammation of bone.

Q. What is *Exfoliation?*

A. The separation of bone or other tissue from the living structure; throwing off of dead bone.

Q. What is a *Sequestrum?*

A. A detached or dead piece of bone within a cavity, abscess, or wound.

Q. What is an *Ulcer?*

A. An open wound or sore that is difficult to heal.

Q. What does ulceration imply?

A. The process of formation of an ulcer.

Q. Diagnose between an Ulcer and the Fistula of an Alveolar Abscess?

A. An ulcer is an open sore; a fistula is an abnormal tube-like passage giving vent to pus.

Q. What are the symptoms of *Suppuration?*

A. The symptoms of inflammation, such as heat, pain, and vascular excitement, diminish, the swelling becomes softened, there is fluctuation, and the redness changes to a yellowish or mottled color.

Q. What is meant by the "pointing" of an *Abscess?*

A. The formation of a conical part, caused by tendency of pus to come to the surface, where softening and fluctuation occur.

Q. What effects may arise from extensive Suppuration?

A. A frequent, weak pulse, less fever, chills and sweats with flushes of heat debility, exhaustion, and even death.

Q. What does the term "adynamic" or "adynamia," imply?

A. Deficiency or loss of vital or muscular power.

Q. What is the *Etiology of Dental Caries?*

A. A gradual softening and disintegration of the tooth structures, appearing first as a chalky, opaque spot in the enamel, changing to a darker hue, and progressing from the periphery towards the pulp, and breaking down the tooth structure gradually but effectively.

Q. Into what two classes may the causes of this disease be divided?

A. *Predisposing* and *Exciting*.

Q. What are the *Predisposing Causes?*

A. The character of the tooth structure in regard to faulty development; the influence of constitutional or systemic disturbances; the position of the teeth in relation to each other—irregularity favoring the lodgment of fermentable substances; impaired nerve and blood supplies; the effects of illness; heredity; and influence of sex.

Q. What is the *Exciting Cause* of Dental Caries?

A. Certain micro-organisms which attach themselves to the surface of the tooth by forming a gelatinous film or plaque, and in their growth form an acid (*lactic*) which dissolves the lime salts of the tooth.

Q. How do the micro-organisms gain entrance to the tooth structure?

A. An opening is effected by the solution of the enamel, and the organisms enter and progressively decompose the structure.

Q. What is the Micro-organism instrumental in causing dental caries?

A. The *Streptococcus Media* (alpha fungus of Miller); Dr. Black claims to have found two other varieties of this streptococcus—the streptococcus magnus, and streptococcus minor, but that these two latter are inconstant in the saliva, although similar in characters to the Streptococcus Media.

Q. What is the size of the Streptococcus media?

A. Averaging about five-tenths microns in diameter, a micron being the 1-1000 of a millimeter.

Q. What is the most constant of the micro-organisms in the saliva?

A. The *Caries Fungus*, which is found in the saliva of every mouth; in every part of the human mouth, and is commingled with masses of other micro-organisms.

Q. In what condition is the human saliva generally found?

A. Acid in reaction, the degree of acidity being greater at different times and under different conditions.

Q. Describe the changes in the Saliva at different times during the day?

A. On waking in morning the acid reaction is energetic; after breakfast the saliva is generally neutral or but feebly acid; after this during the day the acidity increases, but after another meal it is again less acid, increasing however in acidity until the next meal.

Q. How may these changes be accounted for?

A. During eating the contents of the oral cavity is changed frequently, and fresh fluids enter it so rapidly from the salivary glands that the condition of the saliva becomes neutral or nearly so; when the fluids remain at rest during the inactivity of the glands, the acidity of the saliva increases until it is again weakened by the glands resuming their activity; this acid reaction of the saliva is not due to the caries fungus alone for several other varieties are concerned in it.

Q. What is necessary in order that caries be produced?

A. That the caries fungus grows in contact with the surface of the tooth, and that the acid generated by it be applied directly to the enamel under conditions in which it will not be dissolved and dissipated in the saliva, but act upon the tooth (Black).

Q. How is the covering or film which attaches itself to the surface of the tooth formed?

A. Produced by the formation of gelatine by the fungus.

Q. May such a film or covering be produced artificially?

A. Yes; from badly performed operations such as adapting gold crowns, retaining appliances, etc., as they may supply the necessary covering to protect the micro-organisms.

Q. Can pits and fissures form sufficient coverings for these micro-organisms to act upon tooth structure?

A. Yes, for such a plaque or film as described by Dr. Williams and which is a necessary factor, would remain undisturbed in such a locality.

Q. In what respect does the action of *Caries* upon the Enamel differ from its action upon the Dentine?

A. The lime salts are first dissolved away by the acid which action upon the enamel first softens and then removes it entire in the area involved, for the reason that the organic material in enamel is insufficient to retain its form after the lime salts are removed. Upon dentine the action is different for the reason that after the solution of the lime salts by the acid, its organic material is sufficient to retain the integrity of its physical and histological forms. Therefore while caries in enamel may be simply the solution of its lime salts, caries in dentine involves both the solution of the lime salts and the destruction of the organic matrix (Black).

Q. Which precedes the other, the solution of the lime salts or the decomposition of the organic matrix?

A. The solution of the lime salts in the dentine.

Q. How does caries of teeth differ from caries of bone?

A. In caries of teeth there is no inflammation nor ulceration, while in caries of bone there is both an inflammatory and an ulcerative process.

Q. Where does caries of teeth always begin?

A. On the surface, never within the substance of the tooth.

Q. What is meant by *Areas* of Liability to Caries?

A. The points of beginning, which include only the area of surface in which caries makes it first beginning upon surface of tooth.

Q. What is the order of frequency of these areas of liability?

A. 1st. In pits, grooves and fissures in occlusal surfaces of molars and bicuspids, in pits in buccal surfaces of molars, and pits in lingual surfaces of lateral incisors. 2d. In proximate surfaces of the teeth near the contact points close to gum. 3d. Buccal and labial surface cavities in gingival third, or near gum margin.

Q. What is the order of frequency in regard to forms of carious cavities as to age?

A. Pits and fissure cavities occur earliest in life, next proximate cavities, buccal and labial cavities later.

Q. What appearance does caries present when it first attacks a smooth surface of tooth?

A. That of a whitish spot, the smoothness, lustre and translucency of the enamel changing to slight roughness, and surface becoming lustreless and opaque.

Q. Under what conditions only are micro-organisms found in decaying enamel?

A. Only where the enamel rods have fallen out, making space for them to enter, as they have no power to create openings except as the substance of the tissue is dissolved by the acid they generate.

Q. How does this acid act upon the tooth structure?

A. It is absorbed into its substance to a considerable depth, and causes a progressive dissolution, and this can occur before any of the enamel rods have fallen away, or any break appears on the enamel surface.

Q. Upon what substance is the principal effect in such cases manifested?

A. Upon the cement substance between the enamel rods (Dr. Williams).

Q. What grades of color does decayed enamel present?

A. All grades, from whitish or grayish to intense black.

Q. What is the cause of the dark or black color of a carious area?

A. The filling in of the interstices with the dark sulphurets.

Q. When a carious area of enamel changes to a very dark or black color, what does this change indicate?

A. That the decay has ceased to progress.

Q. What is the prognosis when the superficial portions of decayed areas in teeth show a dark color?

A. That new beginnings of decay are not taking place in that mouth, or if so, only in the most unfavorable localities (Dr. Black).

Q. What is the *Secondary decay* of Dr. Miller, and the *Backward decay* of Dr. Williams?

A. When enamel has been penetrated, and the decay in the dentine has progressed in the interior and undermined the enamel, then the decay of the enamel will progress from within outward, or backward.

Q. In the dentine what always precedes the invasion of the micro-organisms?

A. The solution of the lime salts.

Q. By what process does the acid always reach the dentine before the micro-organisms?

A. By percolation, or process of filtration.

Q. Why do not the micro-organisms, when the decay has reached the dentine invade the tubules before the solution of lime salts occur?

A. Because if they are growing in contact with the dentine, the acid they are forming will continually spread into the tissue before them and effect the solution, in advance of the growth, either partial or complete (Black).

Q. What is the usual form of a carious cavity in the dentine?

A. That of a cone, the base at the orifice of cavity and the apex towards the pulp.

Q. What may change this form of cavity?

A. The decay meeting in its progress interglobular spaces, granular areas, or abnormally arranged tubules, which rapidly fill up with micro-organisms and change the form and direction of the carious action.

Q. How do the micro-organisms when they have reached the tubules of the dentine, invade them?

A. Only by growth, and without other movement.

Q. What will retard the carious process on the surface of the enamel, or cause it to cease altogether?

A. Any change in the conditions of the fluids of the mouth which will prevent the reforming of the gelatinous film or plaque when once torn away, or any change which causes its too frequent removal.

Q. How does the prevalence of dental caries compare with that of other diseases?

A. It is the most prevalent of all diseases to which the human race is subject; almost universal.

Q. To what period of life is it most prevalent?

A. In the young more than in middle life or old age; the most destructive effects are seen in early adult life or about 20 to 30 years.

Q. Does the general saliva ever become sufficiently acid to act upon the teeth?

A. No. Dr. Black states that if it did the teeth would decay all over instead of at selected points, for all their surfaces are practically equally exposed to it; but the beginning of caries is strictly localized.

Q. Is dental caries entirely independent of the vitality of the teeth?

A. Yes, as teeth that have lost their pulps decay as readily as teeth with living pulps; an example in human teeth placed in mouths of those susceptible to caries, or as crowns on natural roots, and teeth of animals placed in mouths will also decay, although such teeth while in mouths of animals do not decay.

Q. Where is the greatest sensitiveness of caries found on excavating, independent of the pulp?

A. In shallow cavities, and along the line of union of the enamel and dentine.

Q. What new formation of tissue may result from the irritation of caries?

A. That of secondary dentine in pulp chambers in slowly progressing caries.

Q. Is heredity a strong factor in the predisposition to dental caries?

A. Yes, but a change from one country to another may change such a tendency.

Q. How may the coming of immunity to dental caries be hastened?

A. By effective treatment of decayed areas which appear early in life.

Q. How may the coming of immunity to caries be prevented?

A. When such conditions as painful mastication, the result of caries, leads to disuse of teeth, and neglect in correcting such causes which grow worse and include a greater number of teeth.

Q. Is there ever a relapse from immunity to susceptibility to caries?

A. Yes, even after immunity continuing for five or ten years; but if decayed areas have been successfully filled, immunity may continue.

Q. Why are females during pregnancy more susceptible to caries?

A. At such a period a large quantity of lime phosphates are required for the growth of the fœtus, and this supply is directed from the teeth of the mother (fractures of bones during this period join less readily from the same cause); the reactions of the oral fluids during pregnancy are often decidedly acid; acid eructations as a result of reflex disturbances of digestion must also be considered.

Q. When the 1st permanent molar is found with decay on the occlusal surface at 8 yrs., when is the 2d molar apt to be decayed on same surface?

A. At 14 yrs., or two years after it erupts.

Q. At what four points are 1st permanent molars liable to decay?

A. 1st: Central pit of occlusal surface; 2d on mesial surface; 3d, Distal surface; 4th on buccal surface.

Q. What acids are injurious to tooth structure?

A. Nitric, sulphuric, hydrochloric and lactic.

Q. What acids are most commonly found in the mouth?

A. Hydrochloric and Lactic.

Q. What form of dental caries is caused by nitric acid?

A. White and extremely sensitive, the organic as well as the inorganic structures being destroyed.

Q. What form by Sulphuric Acid?

A. Black, less sensitive and slow in progress.

Q. What form by Hydrochloric Acid?

A. Brown, the inorganic matter being destroyed, and the organic remaining.

Q. What from Lactic Acid?

A. A light form, less sensitive than that caused by nitric acid.

Q. What Teeth are most prone to attacks of caries?

A. First Molars, the inferior more than superior; then Second Molars, Second Bicuspids, Third Molars, First Bicuspids, Lateral Incisors, Central Incisors, and Cuspids.

Q. What are the different shades of color in dental caries indicative of?

A. The progress of the decay, and nature of structure of affected tooth—the dark or black shade indicating slow progress in dense teeth, the lighter shades indicating more rapid progress and weaker tooth structure.

Q. What effect has illness upon susceptibility to caries?

A. When severe, the conditions influencing attacks of caries are, want of proper nutrition, acid secretions, and free fermentation on account of uncleanliness, and increased activity of micro-organisms.

Q. What effect has sex on susceptibility to dental caries?

A. Teeth of females more prone than those of males.

Q. What is the *Preventive Treatment of Caries?*

A. Cleanliness from period of eruption of deciduous teeth; use of a proper tooth-brush daily after each meal, and the use of a proper dentifrice upon rising, and just before retiring, assisted by floss-silk and a quill tooth-pick to cleanse proximal surfaces.

Q. What mouth washes are often useful as an adjunct?

A. Alkaline—such as lime water, borax, or bicarbonate of soda, to neutralize any acidity of oral fluid; antiseptic and germicidal to destroy micro-organisms.

Q. Give formula for a *Dentifrice?*

A. ℞. Cretæ preparatæ, ℥viij; Pulv. radicis iridis; ℥iv; Pulv. ossis sepiæ, ℥j; Pulv. sacchari albi, ℥j; Saponis castil, ℥j; Sodæ bicarb, ℥ss; Pulv. cinchonæ flava, ℥j; cochineal, ℥j; olei rosæ, gtt. 20. Mix and reduce to an impalpable powder.

Q. What is the source of Mucous Deposit on Teeth of Children?

A. Brown or green stain—not from same sources as salivary or sanguinary calculus, but a deposit from the mucous when the latter is in a very acid condition, in the form of fungi.

Q. How is it safely removed?

A. By finely powdered pumice on wood points or small brushes rotated by dental engine, and the surface burnished or polished.

Q. What is the effect of the Mucous Deposit?

A. It erodes enamel and facilitates attacks of caries.

Q. What is the analysis of Salivary Calculus?

A. Phosphate of Lime, 62.00; Carbonate of Lime, 12.00; Animal matter and mucus, 15.00; Water and loss 11.00 = 100.00.

Q. Does *Salivary Calculus* injure tooth structure?

A. Indirectly by exposing necks of teeth to deleterious agents; its irritating effects are manifested on gums, causing recession, inflammation, and absorption of alveolar process.

Q. Where does salivary calculus collect in greatest quantities?

A. On lingual surfaces of lower front teeth, and buccal surfaces of upper molars; more on side least used in mastication.

Q. How does it differ in color?

A. From a light cream to a dark yellow, brown and black; soft when first deposited, but soon becomes hard and brittle.

Q. What is the nature of *Sanguinary or Serumal Calculus?*

A. In the form of irregular crystalline granules at different points on surface of root of tooth, even to apex, or encircling root just below free margin of gum; harder and more firmly attached than salivary calculus.

Q. What is Sanguinary Calculus chiefly composed of?

A. Lime salts colored with hæmatin of blood, to which its crystalline form is due.

Q. With what form of inflammation is it in connection?

A. Suppurative process, at which stage the liquor sanguinis is transuded, degenerates during the formation of pus, and its lime salts are liberated and deposited within the area of suppuration; it is a result of ulceration; salivary calculus is a cause of ulceration.

Q. What is *Periodontitis* or *Pericementitis?*

A. Inflammation of the Peridental Membrane.

Q. What is the nature of this membrane?

A. Very vascular, very susceptible to irritation and inflammation, and highly sensitive when inflamed.

Q. What may cause its inflammation?

A. The death of the pulp, and the infiltration of septic matter through apical foramen; also mechanical violence—as a blow or the biting of hard substances.

Q. When a filled tooth is particularly sensitive to heat, what does it indicate?

A. Thermal influence through conducting property of the metal.

Q. What serves to retain the perfect adaptation of metallic fillings under any possible temperature expansions or contractions?

A. The elasticity of the enamel within safe limits of perfect resilience, or return to its former form is 2 per cent. of its length, or about 40 times as great, while that of dentine is greater, and this amply retains the adaptation of the filling material (Black).

Q. Where does *Periodontitis* or *Pericementitis* commonly commence?

A. In the apical space at end of root.

Q. What is the condition of Peridental membrane in apical space?

A. It is usually thicker than along root of tooth.

Q. What accounts for the intense pain of Periodontitis?

A. The membrane is confined in a bony cavity and being very profusely supplied with nerves and blood vessels, there is not space for the expansion of these when they are engorged and conjested.

Q. What are the two forms of this affection as to duration and severity?

A. Acute and chronic.

Q. Describe symptoms of *Acute Periodontitis?*

A. First, uneasiness in tooth affected; a desire to press upon it; a feeling of fulness; relief as long as pressure is maintained; then pain of a dull heavy character, elongation of tooth, owing to the thickening of its investing membrane; pressure no longer relieves but is painful; the gums assume a deep red color, instead of the normal pale rose hue; and become congested and swollen.

Q. How may Periodontitis be diagnosed?

A. By pressure or slight blows on affected tooth—percussion.

Q. How does Periodontitis differ from Pulpitis?

A In that it is not generally affected by thermal changes, and pressure on tooth crown apart from pulp will cause pain in periodontitis.

Q. What distinguishes *Chronic Periodontitis?*

A. It is a modified form of the Acute, and may be limited to soreness of the tooth only, and slight annoyance, or it may be attended with considerable congestion and sensitiveness when tooth is pressed upon, subsiding and reappearing.

Q. Name the causes of Periodontitis?

A. Inflammation of pulp resulting in its death; salivary calculus; improper use of arsenious acid; action of mercurial remedies, mechanical violence; too close proximity of a metallic filling to pulp; loss of antagonizing teeth; overhanging portions of metallic filling in proximal cavities; constitutional causes such as malaria, syphilis, rheumatism, scrofula, etc.

Q. What is the common cause of Periodontitis?

A. Entrance of pyogenic organisms from pulp-canals into the tissues of apical space, and into the lymphatics.

Q. Into what 3 classes may it be divided according to location?

A. Gingival, commencing at gum margin; apical commencing at apex in apical space; and the form beginning at some point between gum margin and apical space—alveolar or lateral.

Q. What causes the gingival form?

A. Calculi; local effects of medicinal agents being eliminated at gum margin, such as mercury, iodide of potassium, etc.

Q. What causes the apical form?

A. The entrance of septic matter from canals of pulpless teeth.

Q. What causes lateral variety, or that at a point between gingival margin and apical space?

A. Gouty periodontitis, and inflammation due to injury from operations, such as malleting, severe wedging, and undue occlusion of teeth.

Q. What is the treatment of Periodontitis?

A. Remove all irritating matter from pulp canals, apply counter-irritants to gum over root, such as a combination of tinctures of aconite and iodine cannabis indica and comp. tinct. of benzoin; local blood-letting by lancet or leeches; syringe pulp canals with warm water; disinfect pulp canals with peroxide of hydrogen, or 3 or 5 per cent. of pyrozone, or peroxide of sodium; the affected tooth to be mechanically protected; and after use of the agents referred to, the pulp canals injected with Black's 1, 2, 3 mixture. Cantharidal collodion may also be used as a counter-irritant; saline cathartics to relieve congestion, morphia to relieve intense pain.

Q. How may it be determined that a dead-pulp in an apparently sound tooth is the cause of periodontitis?

A. By increasing opacity of crown, or loss of translucency; looseness of tooth, and the injection of gum over root.

Q. What is the treatment in such cases?

A. Mouth perfectly sterilized, also all instruments to be used, with powerful antiseptics, access gained to pulp chamber, and injections made of strong solutions of peroxide of sodium.

Q. What are the symptoms of Chronic Apical Periodontitis?

A. Tooth tender to pressure, slightly loose, and elongated, and more or less congestion of overlying gum.

Q. What is the treatment of Chronic Periodontitis?

A. Remove cause, protect tooth from pressure, cleanse root canals after sterilizing carious cavity with antiseptics, remove contents of chamber and canals, a drop of sulphuric acid (50 per cent.), is pumped into canals with a broach and cotton until they are freely opened, which will also sterilize.

Q. Why is an abscess connected with a tooth called *Alveolar Abscess?*

A. Because the collection of pus is within the alveolar cavity in the form of a sac adhering to root of tooth.

Q. Is the seat of an abscess invariably at the apex of the root of a tooth?

A. No, besides being in apical space, it is sometimes at the side of the root, or, in the case of molars, in the bifurcation of roots.

Q. Describe manner in which an *Alveolar Abscess* is formed?

A. The Peridental membrane being the seat of the abscess, plastic lymph is effused, which is condensed into a sac, and the accumulation of pus within the sac causes it to distend, which exerts pressure on the bone surrounding it, bringing about absorption to accommodate the increasing quantity of pus, which finally makes its way to the surface, usually by a fistulous opening through bone and soft tissues.

Q. Does Alveolar Abscess ever result in necrosis of bone?

A. Yes; when the pus burrows between the periosteum and bone and separates the two, the septic matter thus brought into contact with the bone causes necrosis.

Q. What other results may occur?

A. The pus may invade the duct of a salivary gland and cause salivary fistula; or cause inflammation of tonsils when the abscess affects an inferior third molar; or, invading the muscles of cheek and neck, cause trismus.

Q. Describe progress of Acute *Alveolar Abscess* from its inception to full development?

A. Begins in the apical space, usually by the infiltration of irritant or septic matter, through apical foramen of tooth, affecting peridental membrane, the poison existing in the form of gases or septic material generated by decomposition of pulp of tooth after its devitalization; the first symptom is acute inflammation of the investing membrane about the apical foramen, beginning with a sense of uneasiness, pressure and slight pain, succeeded by elongation of tooth from thickening of inflamed peridental membrane, pain on pressure, the inflammatory condition manifesting itself in the gum over affected tooth; violent throbbing pain, with increased redness, heat, tension, and swelling follow, lasting until the escape of the pus.

Q. What are the constitutional symptoms?

A. Fever, hot dry skin, coated tongue, prostration, constipation, and violent pain in face and neck.

Q. How distinguish between *Periodontitis* and *Acute Alveolar Abscess?*

A. Pericementitis (or periodontitis) is indicated by uneasy sensation, sense of fulness which pressure at first relieves, but afterwards aggravates, a dull annoying pain, protrusion of tooth, looseness, at first a red line or ring on or near margin of gum, which redness becomes general over root, febrile symptoms, temperature at times 104° or 105° F. if severe, intense headache. Alveolar abscess is distinguished, after symptoms similar to periodontitis, by a swelling over root of tooth, which becomes defined and prominent, the formation of pus, pointing of swelling, discharge of pus about neck of tooth, or through fistulous opening in gum, or on surface of face or neck, foul tongue, offensive breath, hot skin, thirst, headache, fever and rigor.

Q. How diagnose *Alveolar Abscess without Fistulous Opening?*

A. Pulp-chamber is filled with a decomposing mass and communicates with carious cavity, gum over root conjested, tooth more or less loose, and any sealing up of carious cavity causes inflammatory symptoms; prognosis is generally favorable, except a large part of peridental membrane is destroyed.

Q. What are the complications of Alveolar Abscess?

A. With suppuration of Antrum; necrosis of Jaws and Palate bones; glossitis; penetration to inferior dental vessels and nerves, etc.

Q. What symptoms characterize *Chronic Alveolar Abscess?*

A. May result from long continuance of acute form, or commence with less active symptoms; pain less severe, but more enervating, more diffused discoloration, more extended œdema, infiltration of pus into adjoining tissues, gradual subsidence of such symptoms upon the establishment of a fistulous opening.

Q. What effect has the pus of an abscess upon bone of alveolar cavity?

A. The bone is absorbed for the enlargement of the abscess.

Q. Name Points of escape of pus of an Abscess?

A. Through alveolar wall, apical foramen, root canal, and crown cavity, along side of root to free edge of gum, through process into antrum or nose, and facially or cervically.

Q. What teeth present unfavorable prognosis in abscess?

A. Superior laterals, inferior bicuspids and third molars.

Q. How may a fistulous opening be established?

A. By closing canals or crown cavity, and hastening suppuration; by making an opening through tissues opposite sac of abscess, and by lancing soft tissue.

Q. How may alveolar abscess at bifurcation of roots of teeth be diagnosed?

A. Pain of acute periodontitis due to a putrescent pulp, followed in a day or two by a discharge of pus about neck of tooth, the gum-attachment previous to the appearance of pus remaining unbroken, and the open pulp-canals not giving vent to any secretion.

Q. What is the treatment?

A. The introduction into pulp-chamber and canals of peroxide of sodium, and the abscess cavity syringed with pyrozone.

Q. By what treatment may an alveolar abscess of a lower molar be prevented opening on face or neck?

A. By lancing freely to evacuate pus through gum; by supporting externally with bandage or compress to change direction of pus; by stimulating internally until an internal fistula is established; by extracting tooth.

Q. What is the result of an abscess discharging on face?

A. An unsightly scar.

Q. What is the Surgical Treatment of Alveolar Abscess?

A. Make an incision in the gum externally to apex of root and walls of abscess cavity or sac; into this opening introduce a burr attached to dental engine, cut through alveolar wall and break up sac, and also cut off end of root of tooth as smoothly as possible; if there is any necrosed bone present remove it also; then syringe cavity with peroxide of hydrogen, or this combined with bichloride of mercury; also aromatic sulphuric acid.

Q. What is the Therapeutical Treatment of Alveolar Abscess?

A. Gain free access to diseased parts, remove cause by destroying the sac of abscess, open up entrances to canals freely, sterilize thoroughly with peroxide of hydrogen and injections of warm water, destroying the micro-organisms and evacuating contents of abscess, remove all septic matter for fistulous opening, if any exists, inject pyrozone through tract, (25 per cent.), or peroxide of sodium (25 per cent.), subsequently Black's 1, 2, 3 mixture, or campho-phenique, on cotton introduced into canals, and crown-cavity temporarily filled; case should be examined every few days.

Q. What is the Treatment of the Chronic Form of Alveolar Abscess?

A. For simple cases, consists in removal of septic matter from pulp-chamber and canals, and affording free vent for the pus through the tooth, and allowing parts to rest and recover from the soreness, then, the use of some disinfectant placed in pulp canal on a pledget of cotton, tight enough to exclude saliva; the cavity may be opened from time to time for discharge of pus, if necessary; if pain returns open canal and treat as before. Where external lamina of bone has been penetrated by the pus, and a tumor is present, it should be opened and the pus discharged; if in this case the tooth is very sore, the opening of the pulp chamber may be delayed, and cotton saturated with a 95 per cent. solution of carbolic acid be introduced into the incision in gum to keep it open; after the extreme soreness has passed, the canals should be opened, all septic matter removed, and the canals thoroughly disinfected, and the opening in gum allowed to heal.

Q. What is the *Constitutional Treatment for Acute Alveolar Abscess?*

A. In addition to local blood-letting, leeches to gum, hot water held in mouth, dry cups, quinine sulph. gr. viii, to which is added morphia sulph. gr. 1/8; gtts. x. of tr. aconiterad in ʒj of water if pulse is full and bounding; Davis powder gr. x. in hot lemonade; next morning tablespoonful of magnesia sulph. in glass of water. Constitutional treatment is often necessary in severe cases, such as an active saline cathartic, followed by a stimulant tonic, such as ten to fifteen grains of quinine. (See Constitutional Treat. of Acute Alveolar Abscess.)

Q. What is *Phagedenic Pericementitis?*

A. A specific inflammation, infectious in character, which begins in the gingival borders and results in destruction of peridental membrane and alveolar walls; of the fungoid type.

Q. What is the treatment?

A. With a curved bistoury cut into margin of gum within limit of healthy tissue, then through alveolar process and dissect up the tumefied line, scrape margins of cavity and cauterize several times with carbolic or chromic acid; internally mild stimulants and tonics.

Q. What does the tissue of the *Dental Pulp* consist of?

A. Connective tissue group, supplied with many blood vessels and nerves. (See Dental Histology.)

Q. What are the processes of the odontoblasts or dentine forming cells?

A. Dentinal fibrillæ.

Q. What is in close connection with each odontoblast?

A. A nerve branch.

Q. How is the impression made on the protoplasm of the odontoblasts through injury of the fibrillæ, communicated to the sensorium?

A. By means of the fine nerve filaments found everywhere in the periphery of the pulp; and sensation follows lines of pathological changes.

Q. Why has the dentine no need of nerves?

A. Owing to the peculiar arrangement of the odontoblasts and their processes the dentinal fibrillæ; the cells being in physiological relation to the sensory nerve endings, the conditions for the translation of injury to protoplasm into the sensation of pain are complete.

Q. Do such considerations account for hyperæsthesia of dentine and injury to dental pulp by irritation of the fibrillæ?

A. Yes.

Q. What is required to make up the sum of the sensory functions of a tooth?

A. The pulp and peridental membrane.

Q. What does the sense of touch wholly reside in?

A. The Peridental Membrane, which receives the impression of even the slightest touch upon any part of surface of tooth.

Q. From what does the dentine derive it sensory function?

A. Directly from pulp through dentinal fibrillæ, and the pulp responds to injury by a sense of pain, not of touch.

Q. Does the dental pulp manifest decided sensibility to thermal changes?

A. Yes, but it does not determine degrees of temperature, or distinguish heat from cold; and it must be aided by nerves of lips, gums, and peridental membrane to so discriminate.

Q. Where does *Sensitive Dentine* generally manifest itself?

A. On abraded masticating surfaces, and in carious cavities.

Q. From what causes?

A. Exposure and injury or irritation of dentinal fibrillæ.

Q. What is the cause of pain when dentine is cut into?

A. The fibrillæ are injured, and these communicating with the pulp, establish the circuit of sensibility to the pulp and through it to the brain.

Q. What provision is established by nature to preserve the dental pulp from exposure on gradual loss of covering?

A. The formation of Secondary Dentine; the pulp shrinking in size, the space thus left is occupied by this secondary formation.

Q. What are the safest obtunders of Sensitive Dentine?

A. Those that confine their action to the superficial layer.

Q. With what materials should very sensitive teeth be filled?

A. With a reliable non-conducting material; or if gold is used, with a preparatory layer of gutta percha, asbestos, tin foil, zinc cement, etc.

Q. In the treatment of sensitive dentine what simple measures are sometimes of service?

A. Use of very sharp burrs and excavators, in a direction away from pulp; application of a burnisher to sensitive surface.

Q. What agents are used as obtunders of Sensitive Dentine?

A. Tannic acid, chloride of zinc, carbolic acid, chloroform, aconite, nitrate of silver, carvacrol, oil of cloves, eugenol, campho-phenique, oil of eucalyptus, cocaine, chloral, thymol, menthol, sesquichloride of chromium, carbonate of potash, ethylate of sodium, crystallized carbolic acid and caustic potash equal parts, dehydration by warm air, rhigolene spray, chloretone, cataphoresis, and dento-electric cautery.

Q. What is the *Dental Pulp?*

A. The soft tissue that occupies the central cavity of each tooth.

Q. How is it divided?

A. Into coronal portion or bulb, and canal or root portion.

Q. What does the form of Dental Pulp correspond to?

A. The general form of the tooth in which it is located.

Q. What is the appearance of Dental Pulp when in a healthy condition?

A. Of a grayish-white color.

Q. What is its appearance when in a state of active inflammation?

A. Of a bright red color, the capillaries being visible.

Q. What is the mass of pulp-tissue composed of?

A. A semi-gelatinous matrix, thickly studded with cells a little apart from each other.

Q. What other tissues form parts of the dental pulp?

A. Blood vessels and nerves.

Q. What are the functions of the dental pulp?

A. The formation of the dentine, and maintenance of vitality of the teeth.

Q. Describe the arrangement of Blood vessels of Pulp?

A. Very numerous before roots are formed, afterwards when apical foramen is completed, less numerous until they consist of two or three branches only, which divide into many capillaries and thus form a complete network of vessels within substance of pulp.

Q. What is the difference in size of the arteries and veins of Pulp?

A. The veins are slightly larger than the arteries, and freely anastomose with each other.

Q. In what manner do the nerves enter the pulp?

A. Through apical foramen by a single bundle, and divide in the canal, and subdivide in the coronal portion, sending off filaments to the periphery.

Q. Does the pulp show any decided sensibility to thermal changes?

A. Yes; there appears to be a certain association in this respect between it and the peridental membrane.

Q. What do these manifestations show?

A. That it is necessary to protect an irritant pulp from thermal changes.

Q. What is a test for diseased condition of pulp?

A. When any pain in region of face or ear is decidedly increased by filling mouth with cold or warm water.

Q. By what means can periodontitis and pulpitis be diagnosed?

A. If periodontitis is present, the tooth is sensitive to touch, and not sensitive to moderate thermal changes; in pulpitis the tooth is not sensitive to touch, but very sensitive to changes of temperature; in reflected pain from pulpitis the tooth is not sore to touch, while radiating pains are absent in periodontitis without pressure of a tooth that is sensitive to touch.

Q. Do we have swelling of soft parts about tooth in pulpitis?

A. No; such swelling is indicative of periodontitis, and alveolar abscess.

Q. What does *Hyperemia* of Dental Pulp imply?

A. That its blood vessels are congested or too full of blood.

Q. What renders pulp of a tooth susceptible to morbid impressions?

A. Peculiarities of temperament, habit of body, condition of health, condition of the tooth structures.

Q. What does *Hyperæsthesia* imply?

A. An excessive state of irritability.

Q. Does such a condition depend upon any organic change in the tissues of a tooth?

A. It may exist independent of any organic change, either in the pulp, dentine, or enamel.

Q. What is the most common cause of hyperæsthesia of pulp?

A. Caries, even before it has penetrated to the pulp.

Q. What constitutional causes?

A. Impaired digestion, and disordered bodily functions.

Q. What local causes of irritability of pulp?

A. Impressions of heat and cold, acids, etc.

Q. What is the *Treatment of Irritability of Pulp?*

A. Remove cause; if from acids—the use of alkaline washes such as bicarbonate of soda, lime water, etc., if from impressions of cold or heat through a metallic filling—such fillings should be removed and either replaced by non-conducting filling material, or the metallic filling renewed with a preparatory layer of gutta percha or other non-conductor, covering the sensitive surface.

Q. When must such treatment be instituted?

A. Before inflammation of pulp has commenced.

Q. What is the treatment in cases of excessive sensibility of dentine owing to abrasion and which would result in irritation of pulp?

A. The application of nitrate of silver; also capping.

Q. Why is an *Inflamed Pulp* (pulpitis) so excessively painful?

A. Because pulp is enclosed in a cavity with unyielding walls, where its expansion is impossible, and as its vessels become distended with blood, there is undue pressure upon its nerve filaments.

Q. Is Pulpitis confined to carious teeth only ?

A. No; teeth free from caries may be affected as well as decayed ones.

Q. What determines the severity of the pain ?

A. The structure and condition of the affected tooth, and state of health.

Q. Besides irritation of fibrillæ, what other causes of Pulpitis ?

A. Contact of irritating matters (carious for example), mechanical violence, sudden thermal changes (heat and cold conveyed through tooth structure, or through a metallic filling), pressure of a filling on thin lamina of dentine, use of improper filling materials, improper use of the teeth, etc.

Q. What constitutional symptoms may attend Pulpitis ?

A. Headache, earache, constipation, full, quick pulse, dry skin, furred tongue; due perhaps to impaired health.

Q. Is an inflamed pulp amenable to treatment ?

A. Yes, in the earlier stage of inflammation, when other conditions of system are favorable, as an inflamed pulp will recover if placed in good hygienic condition.

Q. What is the Treatment of Pulpitis caused by an exposed pulp ?

A. Cleanse cavity of all extraneous and irritating matter, syringe with tepid water made alkaline by a little bicarbonate of soda, dry cavity, and make application of tincture of aconite; or cocaine, carbolic acid, glycerine and water; or carbolic acid and chloroform; or a paste of oxide of zinc and carbolic acid; or 10 per cent. solution of carbolic acid, oil of cloves, oil of cajeput, iodoform, iodol, iodoform and carbolic acid, carefully applied, and lightly confined in cavity; if the cause is from pressure of a filling, this should be removed and the pulp treated as described; for constitutional symptoms when present, saline cathartics, blood-letting, leeches, etc. If inflammation has not advanced too far, the final treatment is capping pulps with oxychloride of zinc over oxide of zinc and carbolic acid.

Q. What are the premonitory symptoms of the inflammation extending from pulp to peridental membrane ?

A. Uneasiness about root of tooth, a disposition to press on tooth which gives relief, a gnawing sensation, and gradually increasing discomfort and pain.

Q. When the inflammation of pulp results in suppuration how long does it take to run its course?

A. The time varies, generally from three to ten days.

Q. When pus has formed what measure may give relief?

A. Drilling a vent-opening through crown, or neck, or through the root, for escape of pus.

Q. May Pulpitis result in suppuration without the formation of an alveolar abscess?

A. Yes, abscesses may form in the substance of the pulp, beginning at its surface near point of exposure, progress until the entire pulp becomes a mass of pus full of micro-organisms.

Q. Does a dead pulp allowed to remain in a tooth invariably cause trouble?

A. As a general rule it does sooner or later, although such a tooth may remain quiet for weeks, months, or even years, and the effects, in the form of suppuration and pain, be manifested as a result of thermal changes, exposure to draughts, or wet feet, etc.

Q. Should a pulp be devitalized only to relieve pain?

A. No, devitalization should only be resorted to after all other means to relieve the irritation or congestion have failed.

Q. Why is the normal living pulp so necessary to the tooth?

A. Because it is the nutrient organ of the tooth, and with the peridental membrane makes up the sensory functions of the tooth.

Q. In a case of extreme agony from an irritable pulp what is the treatment?

A. First palliative remedies; remove all extraneous matters from cavity; syringe with tepid water made slightly alkaline with carbonate of soda; then apply aconite and chloroform combined; if a careful examination shows the pain not to be due to actual exposure of pulp, apply either carbolic acid combined with iodoform, or acetate of morphia with oil of cloves, and afterwards a capping of lacto-phosphate of lime in form of paste, or iodoform, carbolic acid and oxide of zinc in same form, and over the capping a temporary filling of gutta percha, or oxychloride of zinc.

Q. If the loss of the pulp is inevitable, how may it be devitalized?

A. Either by the application of a devitalizing agent, such as arsenious acid; by immediate extirpation; or by the application of the actual cautery.

Q. When arsenious acid is used how long is it necessary to keep it in contact with pulp?

A. From twelve to twenty-four or forty-eight hours, according to strength of devitalizing combination, the presencc of pain on its application, and the nature of the tooth structures.

Q. How does arsenious acid act on the Pulp?

A. By first exciting the sensory nerves, then paralyzing them, exciting a degree of inflammation in proportion to the quantity of arsenic employed; the excitement passing away, the arsenic is gradually absorbed.

Q. Does death of the pulp immediately follow?

A. No, if an excessive quantity is applied, the inflammation suddenly excited will resist the absorption of the arsenic; hence in many cases it is better to reduce the inflammation before applying the arsenic.

Q. When properly applied after the inflammation has been reduced, what quantity of arsenious acid will devitalize the pulp?

A. About one-hundredth part of a grain.

Q. What is the quantity of arsenic usually employed for devitalizing pulps?

A. From 1-100 to 1-25 part of a grain, depending on position and character of exposure, and allowed to remain twenty-four hours.

Q. After devitalization what should then be done with the pulp?

A. Entirely removed with a steel, temper-drawn, barbed broach; or by means of an instrument made of steel wire filed down to proper size, flattened at extremity, and bent in the form of a delicate hook, and tempered at hook portion only.

Q. How is such an instrument manipulated?

A. By carefully passing it up side of canal as far as possible, then rotating it to cut off connection of pulp; the barbed broach is passed through body of pulp and rotated.

Q. What is the proper method of applying and confining the arsenical preparation in the tooth?

A. Wash out cavity with a strong antiseptic and remove débris of decay and foreign matter, as these may prevent action of arsenic on pulp tissue, and if pain is present apply warm electrozone, followed by thymol and oil of cinnamon, and make direct application of agent to pulp surface; cover this with a lead cap, and fill balance of cavity with gutta percha; no pressure should be made upon pulp.

Q. Describe another method of application?

A. Place the portion of devitalizing paste on a small disk of paper or pledget of cotton and lay it carefully on point of exposure, and flow over it oxyphosphate of zinc.

Q. What is the result from carelessness in permitting arsenic to come in contact with soft tissues, such as the gum and peridental membrane?

A. Extensive sloughings and necrosis of process. (See Oral Surgery.)

Q. Is the arsenic readily absorbed by organic matter?

A. Yes, hence the greatest care must be observed in its use.

Q. How long a time should elapse after the arsenic has acted, before the attempt is made to remove the dead pulp?

A. Some prefer waiting for several days or even a week or more, until partial sloughing of pulp occurs, when it may be removed painlessly.

Q. How may the pulp be devitalized and removed with a minimum amount of pain?

A. By the use of local anæsthetics, or obtunders, and the galvano-cautery.

Q. Why is it necessary to remove the pulp from the teeth?

A. To prevent the putrefaction which would ensue from its presence and subsequent periodontitis and alveolar abscess.

Q. When is the proper time for filling the roots after the removal of the pulp?

A. The safest method is to apply an antiseptic dressing to root canals, such as oil of eucalyptus, eugenol, or eugenol and iodoform, or oil of cloves, or aristol, and let case rest for a week, so as to overcome any putrefaction which may occur from a collection of fluid and lymph in canal.

Q. After removal of coronal portion of pulp, how may inaccessible root portions be mummified?

A. By alum, tannin, or glycerol, followed by thymol.

Q. What is the method of destroying pulps of single root teeth by means of a blow on a piece of wood introduced in a root canal?

A. A piece of hickory or orange wood is filed down and smoothed by emory paper to a fine attenuated point of such a size as will enter pulp canal. The end of this is moistened in carbolic acid, and being introduced as far into the canal as can be done without causing pain, a sudden well directed blow with a hand mallet drives the point of the wood into the pulp, an operation which is either painless according to the experience of some patients, or causes pain of very short duration.

Operative Dentistry.

Q. Into what two processes may the Filling of Teeth be divided?

A. Into Surgical and Mechanical.

Q. What does the Surgical comprise?

A. Separation of teeth, relief of sensitiveness, removal of carious portion, the formation of the cavity to retain the filling.

Q. What does the Mechanical comprise?

A. Preparation of filling material, insertion and finishing of filling.

Q. What is the period of life when caries is most active?

A. From eighth to thirtieth year.

Q. Is the occurrence of caries in deciduous teeth an indication that it will also occur in permanent teeth?

A. Yes; hence constant care and frequent inspection are necessary.

Q. What may be determined by special examinations of the teeth?

A. Number, position, and extent of carious cavities.

Q. Where should the examination of the teeth be commenced?

A. At the median line, and each tooth on the right and left sides carefully inspected.

Q. What is the preliminary step to the treatment of caries in the proximate surfaces of teeth?

A. The securement of space by temporary separations.

Q. How are teeth thus separated?

A. By the swelling of cotton or tape, the resilience of strips of india rubber, and immediate wedging.

Q. Where is immediate wedging most applicable?

A. To the front teeth when but little space is required for examination, and in the treatment of small cavities.

Q. How is immediate separation made?

A. By wedges of wood, and metallic separators acting on the wedge principle.

Q. How is superficial caries treated?

A. By removing the soft carious part, and cutting away so much of the adjacent solid structure with chisels, as to make a plane surface;

then polishing the cut surface by corundum flour, pumice, and oxide of tin.

Q. How should the cutting be done on proximal surfaces?

A. In such a manner that while the teeth touch at a small point near cutting edge, they are apart near gum, and the inner portion of space is made larger than the outer portion; the form of surface should appear slightly rounded; this gives a self-cleansing space.

Q. Is such cutting away of the front teeth of children which have a tendency to overlap, objectionable?

A. Yes, it would only enhance the irregularity.

Q. Why is such cutting away of proximate surfaces of bicuspids and molars, except in space between inferior bicuspids, objectionable?

A. Because so much would have to be cut away as to disfigure the teeth, and the artificial space thus made to prevent proximal closure, would permit the food to be forced against the gum and result in discomfort and injury, and perhaps loss of teeth.

Q. In what part of the tooth is the manifestation of dentinal sensibility greatest, when excavating?

A. Near line of junction of enamel and dentine, and on the direct radiant line from the coruna of pulp to the periphery of the dentine.

Q. In what direction should the movements of the cutting instruments be made?

A. Away from the pulp.

Q. How is the application of heated air made for relief of sensitive dentine?

A. Dry cavity thoroughly, and use a hot air syringe, the first blasts made at intervals of a few seconds; as pain diminishes by the moisture of cavity being removed, the force of the blasts of hot air is increased, and the intermissions shorter and less frequent, until the pain ceases, when the operation can be gone through with.

Q. What is Dr. Bogue's method of using veratria combined with carbolic acid?

A. Protect tooth by rubber dam, apply the following combination, wait a time, cleanse with alcohol and air—dry the cavity: veratria, gr. vj; pure carbolic acid, gr. vj; absolute alcohol minims, vj; glycerine, gtt. v.

Q. For what cases is nitrate of silver serviceable?

A. To relieve the sensibility of dentine after removal of superficial caries, and that occurring about necks of teeth; but only for posterior teeth. (See Nitrate of Silver for Dental Caries.)

Q. What may be resorted to in cases of extreme sensibility of dentine when other remedies fail?

A. Local Anæsthesia or General Anæsthesia as far as second stage of cerebral excitement, by means of sulphuric ether.

Q. What temporary filling materials may afford relief in sensitive dentine caused by slight thermal irritation, which excites calcification of the fibrillæ?

A. Gutta percha, oxyphosphate and oxychloride of zinc.

Q. Of these which is the most effective?

A. Oxychloride of zinc, although it may be more irritating at first.

Q. Why is it dangerous to use arsenious acid for sensibility of dentine?

A. Because of its tendency to devitalize the pulp, as it is readily absorbed.

Q. How should slight defects in sulci of molars and bicuspids be treated before decay intervenes?

A. By widening and so shaping such sulci and afterwards polishing cut surfaces as to render them self-cleansing.

Q. In preparing a cavity for filling, to what extent should it be opened?

A. So as to render all parts accessible, or easy access to every portion.

Q. What is the general rule in opening cavities?

A. To remove all carious portion from about orifice, and also all overhanging portions of enamel liable to be broken down in the process of filling, or afterwards by the force of mastication, or, although strong, will not admit of gold being properly inserted, etc.

Q. What are the general rules in regard to the formation of cavities for retaining the filling?

A. The sides for a certain distance within orifice should be nearly transverse to the plane of the general face of the proposed filling, and should have an inward divergent direction; such sides may be grooved or undercut to secure retention of filling, such undercuts or grooves extending to all parts of the boundary, which may be done except in cases where, owing to loss of structure, a contour filling is required, when retaining pits may be resorted to, or gold screws; the borders or margins of cavity should be countersunk to protect them from injury during introduction of filling, and to facilitate the perfect adaptation of the gold to such margins, and to permit the gold to be carried to the outer limits of the surfaces of certain teeth as a protection against force of mastication as in the case of proximal fillings; the countersinking will also enable the margins of a cavity to be well defined in the finishing and polishing process, and the degree of countersinking will vary from the removal of the acute edge to a depth corresponding to the thickness of the enamel; deeper for cohesive than for non-cohesive gold.

Q. What is meant by a Simple Cavity?

A. One permitting easy and direct approach to all parts of it, and bounded by strong walls, such as are confined to grinding, buccal, labial and palatine surfaces.

Q. What may be termed an Ordinary Cavity?

A. One with an indirect approach, where the instruments cannot be applied at any desired angle, such as proximal surface cavities.

Q. What is meant by a Compound Cavity?

A. Cavities left by the union of two which began on different surfaces, coalescence occurring by the extension of the decay from each.

Q. What is the method of opening and forming simple cavities?

A. First cut down enamel at central part until orifice is nearly as large as interior; if sulci are present, these should be opened out to their extremities, although they need not be made so deep as the larger part of cavity; no more need be cut away from larger part or from sulci than will leave perpendicular walls, and a concave bottom; or a slight groove or undercut may be made around the larger part of the cavity, within the margin of the enamel.

Q. How may Labial surface Cavities be prepared?

A. Procure a regular outline by small chisel or wheel-burr in the healthy enamel; a retaining point in each lateral wall if cavity is shallow; if broad, a slight groove around but within the margin; the floor be made flat vertically but correspond to general outline of tooth horizontally; slight countersunk margins to well define outline.

Q. How may Buccal surface Cavities be prepared?

A. The walls or sides should be made transverse to a flat floor; and on account of more difficult approach by interference of cheek, the sides should be undercut to make the introduction of the filling easier, and facilitate the retention of the first-pieces of gold.

Q. How may Palatal and Lingual Surface Cavities be prepared?

A. Opened by directing drill nearly parallel to axis of tooth, and finish removal of caries with small round-ended excavators; when on lingual surfaces of inferior molars operation is more difficult owing to inward inclination of these teeth, interference of tongue, and the pulp being close to this surface; a wheel drill is best for removing caries and forming cavity; amalgam is preferred by many for such cavities.

Q. How prepare Proximate surface Cavities?

A. *For Small Proximate Cavities of Front Teeth:* Separate sufficiently, define margins with thin enamel chisels; and it is admissible to remove a small part of palatal surface to facilitate approach; then with small rose-drills or excavators, remove caries and form cavity from palatine surface; square cervical wall, slightly groove palatal wall with small-wheel burr, or a bent hoe-shaped excavator, slightly countersink and smooth surface of enamel.

For Large Proximate Cavities in Front Teeth; Labial Wall Perfect: Make required separation; operate from palatine surface; cut down at middle part of palatal enamel wall nearly to bottom of cavity to secure easy access; cut away thin palatal wall with a chisel, until a greater thickness is reached, and remove caries with a thin spoon-shaped excavator; as cavity extends from neck to near cutting edge and is usually nearer palatal than labial surface, the latter having a concave border on inner surface, it need not be undercut or grooved; allow normal dentine to remain at base of labial margin, leaving a concave instead of flat bottom; make a retaining pit in the base of palatal wall near cervical wall which is generally thick enough, and a small groove from this pit to channel of approach; cut the cervical wall up to cementum, so that no thin line of enamel is left at that point; make cervical wall transverse to axis of tooth, and a retaining pit may be made in the wall.

For Large Proximate Cavities in Front Teeth; Labial Wall Imperfect: No support can be had from remaining part of labial wall, hence all must be made in tuberosity or thick part of base of this wall near the cervical, upon the inner plate of enamel, and by a retaining pit in cervical wall; separate sufficiently; open cavity by cutting away labial wall until a smooth strong border is obtained, with a regular curve; allow greater part of palatal wall, if perfect, to remain, or remove as little as is necessary for safety, and to bring gold a little over edge of this wall if lower teeth are abrading it; cut down cervical wall squarely and extend cavity at cervical wall to cementum, if otherwise, a thin line of enamel only would remain; make retaining pit and groove in outer part of cervical wall, and a slight undercut along base of labial and palatal wall.

For Proximate Cavities in Front Teeth extending to Cutting Edge: The Labial wall being usually frail, and pulp alive, all support is to be obtained by cutting into stronger and thicker parts at base of cavity; such cavities require contour fillings, and it is often necessary to remove angle of crown at cutting edge and restore it with gold; where caries of this nature occurs on teeth worn to thick cutting edges, a dovetail form of cavity on cutting edge, may afford retention.

Q. How prepare *Cavities on Mesial Surfaces of Bicuspids and Molars?*

A. For small simple cavities wide separations are necessary if the grinding surface is not cut into in order to approach such cavities; if so, then a slight separation is required; but location of small cavities on such surfaces will determine this point; if cavity can be approached without cutting away grinding surface, the case is simple; if near grinding surface, the overhanging enamel should be cut away and a compound cavity made; the greatest objection to forming small simple cavities of this kind on such surfaces, is the probability of the teeth coming together, and failure from caries. When cavity is confined to mesial surface, the formation is done with rose-drills and the cavity extended towards gum; some prefer to extend slightly below gum if tooth is of poor structure; some also prefer to open cavity by cutting away buccal margin and permit gold to appear slightly in front; a groove is made in both outer and inner walls; a shallow retaining pit in cervical walls, and a pit towards or under each cusp. Larger cavities in this surface necessitate the removal of more of the grinding surface leaving a dovetailed or triangular space, which serves to anchor the filling; the filling having to be built on cervical wall, if lateral walls are frail, hence its surface should be made transverse to axis of tooth, and its outline should meet that of outer and inner walls by an easy curve, not by an angular one; fissure drills and chisels may be used for forming margins of walls, so as to form a double dovetail, one on mesial and the other on grinding surface.

Q. Why is it dangerous to make retaining points or pits at apex of proximal surface cavities?

A. Because such weaken the plates of enamel that come together at that point.

Q. How prepare *Distal Surface Cavities of Bicuspids and Molars?*

A. The grinding surface wall is generally removed to afford easy approach; cut away grinding surface wall at central part to bottom of cavity, if lateral walls are strong; cut grooves in lateral walls and extend them, if admissible, into sulci of grinding surface.

Q. How may *Grinding Surface Cavities of Bicuspids and Molars* be prepared?

A. Determine extent of sulci caries; open with fissure drills and gouge-shaped chisels; in cutting out sulci, extend opening until it includes entire fissure; make extremities round, not angular, for better adaptation of gold; when fissures are large, use small curved chisels, or fissure drills; begin at central part, and make parallel walls or sides to the grooves; in bicuspids the caries usually commence in two pits in sulci joined by a slight line, which should be cut through so as to unite the pits which are to be opened out; in case one of the sulci of grinding surface of an upper molar is connected with sulci of palatine surface, they should be connected in opening them out; and the same should be done in case of lower molars where sulci of grinding surfaces joins sulci on buccal surfaces.

Q. How prepare *Deep Grinding Surface Cavities?*

A. Cut down with chisels the overhanging enamel at central part, until orifice is as large, or nearly so, as interior, and open out any sulci which may extend from central part; but depth of opened out sulci need not be as great as central cavity, and their width need not be greatly increased; the floor of cavity can be left irregular, and not be flat; better to make it concave; the perpendicular part of cavity need not be deeper than thickness of enamel, if caries has not penetrated further; the margins should be countersunk by bud-shaped burrs or corundum points.

Q. In order to *Finish* a filling of gold or other metal what are the requisites?

A. A sufficient quantity of the filling material to allow of cutting down to such lines as will represent the original contour of the tooth surface; a fine polish which only solidity by perfect condensing can furnish.

Q. Describe the process of *Finishing Fillings?*

A. After all the gold has been introduced, thoroughly burnish the surface of filling to render it as compact as possible, and also to force the gold into close contact with the margins of cavity; for fillings in occlusal surfaces of molars and bicuspids, small finishing burrs are employed to cut away the overlapping gold and define the margin of the cavity, due attention being paid to the occlusion with the tooth in the opposite jaw; when a uniform surface has been secured, a wood-point charged with a solution of fine pumice powder is used to smooth the gold surface, after which a round-headed burnisher is applied to secure a polished surface; corundum points may be substituted for the burrs in cutting down the excess of gold. Fillings on labial and buccal surfaces may be dressed down with corundum points followed by Hindostan stones; pumice with glycerine to form a paste is also very efficient, applied with a wood point; the dead finish left by the pumice is preferable to a high polish in the case of conspicuous fillings; a final finish is given with chalk, oxide of tin, or flour of pumice applied on wheels of felt, or flexible rubber, or the flexible rubber polishing cup. For finishing fillings in approximal surfaces, fine files and gold trimmers are employed for cutting down the excess of gold, after which sandpaper disks, also emery and corundum and buckhorn tape charged with fine pumice, or a flexible rubber wheel; pointed finishing files are also serviceable for cutting away overlapping gold at cervical margins; the final polish is given with chalk, oxide of tin, or rouge.

Q. When under certain conditions is *Nitrate of Silver* useful in arresting dental caries?

A. Principally in deciduous teeth, occasionally in permanent teeth.

Q. What precautions should be observed in its use, its effect being to discolor the teeth?

A. It must not be used in deep cavities, or those that approach near the pulp, or intense pain difficult to alleviate will ensue.

Q. What are the most applicable cases?

A. Broad, shallow cavities, or such that can be made so by leveling the margins; in permanent teeth to shallow and very sensitive cavities on buccal surfaces.

Q. What is Dr. Black's method of using Nitrate of Silver?

A. Cut away enamel margin of broad shallow cavities in deciduous teeth, to expose decayed area, and remove the outer portion of the carious material only: one object is to expose the decayed area to washings by the saliva; apply rubber dam, dry decayed area with absorbent cotton, and lay upon area some pulverized nitrate of silver, with just enough water to dissolve it, and insure saturation of the softened dentine; allow this to remain for 5 to 15 minutes; remove surplus, and the cavity flooded with water to wash away the nitrate. Every care must be taken to protect soft tissues and the clothing. The carious area thus treated, should assume a deep black color within 2 or 3 days, and if this does not occur repeat the application.

Q. To what structures is the discoloration confined?

A. To the dentine and enamel that has been affected by the caries; sound enamel is never discolored; it should never be used on the labial surfaces of permanent teeth.

Q. For what other purpose is Nitrate of Silver effective ?

A. For sensitive points on necks of permanent teeth, where the discoloration will be out of sight.

Q. When is *Cavity Lining* necessary ?

A. When caries has progressed so far as to nearly reach the pulp, also to prevent discoloration from amalgam.

Q. What substances are employed to avoid thermal conduction ?

A. Copal varnish, solution of Canada balsam in chloroform, or a solution of Nitro-cellulose in methyl alcohol (Kristaline or Cavitine); also rubber in alcohol.

Q. What metal Cervical Wall Linings are sometimes used ?

A. Tin, a combination of tin and gold, and amalgam.

Q. What advantage in folding a layer of tin within gold foil ?

A. Prevents waste by electrolysis, which may occur when tin alone is used, and the combination permits of a more easy adaptation to walls of cavity in localities difficult to approach.

Q. How may Lateral Walls of cavities be lined ?

A. By oxyphosphate of zinc, but it should be placed within the margin of the cavity, so that the metal filling overlaps it.

Prosthetic Dentistry.

Q. What preliminary measures are necessary for obtaining Impressions of Mouth?

A. Note condition of oral secretions and mucous membrane; if oral secretions are thick and viscid, rinse with warm water, or solutions of salt and alum; if mucous membrane is very soft and spongy, use for some time dilute phenol sodique or other astringent mouth-wash.

Q. By what treatment can gagging and retching be prevented when an irritable throat is present?

A. By temporarily benumbing the parts so that the contact of impression material will be tolerated.

Q. How may this be accomplished?

A. By the use of a gargle of camphor-water, or one of bromide of potassium (gr. xx–℥j), or by spraying soft palate and pharynx with a 1 per cent. solution of cocaine.

Q. What is the method of obtaining a Full Upper Impression in Plastic Materials such as Wax, Gutta Percha, or Modeling Composition?

A. Operator stands to right and a little back of patient, who occupies a common chair; direct patient to open mouth but not too wide as this lessens size of orifice laterally; press away right side of mouth with corner of cup, and distend left side of mouth with one or two fingers of left hand, pass cup and contents into the mouth, adjust it to ridge, then press up evenly and firmly until all parts are imbedded in material; direct patient to draw down upper lip, and with finger over it, the operator presses all around the rim, at the same time keeping the cup in position by a firm pressure over its concave surface with middle finger of left hand, while the thumb and forefinger retain hold of handle of cup.

Q. How may such an Impression be safely removed from mouth?

A. In case of plastic materials it is best done by directing patient to give a cough, or expel air forcibly from lungs, or attempt to swallow, and thus overcome the atmospheric pressure.

Q. How can such substances be hardened before removal from mouth?

A. By ice water applied on a small napkin, or a piece of ice in napkin.

Q. What general form of cup is necessary in Full Lower Impressions?

A. One which conforms to height and thickness of ridge, with sides of sufficient depth and width.

Q. What is the method of obtaining a Full Lower Impression in same materials?

A. The patient is seated in an operating chair, the head against head-rest, and operator to the right and more to the front; the cup introduced in same manner as for full upper impression and no downward pressure made until it is well adjusted to ridge, the cheeks pressed away to prevent including folds of membrane between cup and ridge; the patient directed to raise and protrude tongue so as to free inner side of ridge of fold of membrane to its full depth, the tongue is then drawn back into mouth, after cup is in position over ridge, and downward pressure is made on cup over region of bicuspids on each side with two fingers of each hand, while the thumbs on each side are under jaw. In removing impression, one angle of cup should pass out of orifice of mouth first after the entire impression is raised clear of ridge.

Q. What is the method of obtaining Full Upper and Lower Impressions in Wax and Plaster combined?

A. First obtain the impression in wax; then remove about one line of thickness of wax surface after hardening it; mix a thin batter of plaster, and cover with it the surface of wax impression. Return whole to mouth, adjust it to ridge and make pressure upwards, hold firmly in position until it hardens; remove and prepare surface for pouring model.

Q. What precautions are necessary in the use of Modeling Composition?

A. Place tissue or other paper in the bottom of a shallow pan to prevent material from adhering, use boiling water to soften it, dry on a cloth after removal from water; pass impression cup over a flame, or immerse it in the hot water, then dry its surface to prevent the material from leaving cup on withdrawing it from mouth; build it into cup to approximate form of arch, leaving a surface free of folds; then proceed as with wax, pressing it well around outside of ridge, and with index finger press upward and forward the part overhanging back of cup.

Allow it to cool for about a minute retaining it firmly in position, and then carefully remove it from mouth, so that its sides are not compressed by corners of mouth; plunge it into cold water until hard; and remove from water only when ready to pour model.

Q. How may a Partial Impression be obtained with wax and plaster combined?

A. By first taking an impression with wax, and when hard, removing a line in depth of entire wax surface, and enlarging impressions of the natural teeth; then score the entire wax surface with point of knife to enable plaster to adhere to it; then pour thin batter of plaster over wax surface, filling also impressions of teeth and return to mouth; if on removal any portion of plaster should break away from wax surface, it can be accurately restored.

Q. How may a Full Upper Impression in Plaster be obtained?

A. Select cup a little larger than mouth; if palatine portion of mouth is high, wax may be built up on cup to raise it in centre. To prevent plaster batter from running from back of cup a slight rim of wax may be built across; fill cup with plaster batter just thick enough to run in a stream; insert cup as for wax impression and press up gently with rear slightly in advance of the front; retain in mouth until the surplus plaster in bowl breaks with a sharp fracture; then remove impression by first wetting finger and with it raise lips and cheeks, and carefully make pressure on handle of cup; if this does not loosen it, direct patient to give a slight cough, or attempt to swallow, which will admit air and break up the atmospheric pressure; where there is a deep undercut, draw impression forward and downward at same time.

Q. How obtain a Full Lower Impression in Plaster?

A. At times it may be necessary to deepen rim of cup with wax, at other times to cut it away; mix plaster batter just thick enough to be retained in cup when it is inverted, and place enough in cup so that it may extend well down on inside of ridge at the back; before introducing cup press out cheeks with finger or handle of mouth glass, so that membrane does not fold over ridge; or have patient raise tongue above cup as soon as cup is placed in mouth, and before pressing it down over ridge; after pressing cup down, have patient lower tongue to force plaster close to ridge; slightly press cheeks against plaster, and allow it to harden, after which raise lips and cheeks away from cup, and raise up with handle, and remove from mouth.

Q. How may Partial Impressions in Plaster be obtained?

A. By making impromptu cups of sheet gutta percha, shaped over a model made from wax impressions of mouth, and cup so flexible as to allow it to be bent outwards at points opposite undercuts or dovetailed spaces between teeth, and thus fracture the thin plaster covering surface of such a cup, the parts being afterwards restored to proper positions.

The surface of gutta percha cup is roughened with point of a warm blade of knife, to assure adhesion of plaster to it; or another method may be resorted to for upper partial impressions; place enough plaster against palatal surface to fill mouth even with grinding surfaces of teeth; if it is desired to obtain impression of buccal and labial surfaces place a little plaster inside of rim of cup, then insert cup in mouth so that it passes beyond the plaster, using same precautions as for a full impression.

Q. For securing a Partial Lower Impression in Plaster when teeth are irregular, or stand in different directions, what is the method?

A. First obtain an impression in wax, and from it a plaster model; then fit wax caps over entire crowns of plaster teeth, but not the necks; remove wax caps from model and place them on natural teeth; then take the impression in the usual manner and remove it same as a full impression; replace wax caps and any plaster that may break around necks of teeth in impression.

Q. When should a *Partial Plaster Impression* be removed from mouth?

A. Where there are no undercuts or dovetails, as soon as it hardens enough to break with a sharp fracture; otherwise allow plaster to become very hard, so that tray may be detached and the plaster cut into and removed in sections which are afterwards replaced.

Q. When a plaster impression, on account of undercuts, breaks on removing it from the mouth, or where it is necessary to cut it into sections after detaching the tray, how may it be restored?

A. The pieces should be carefully preserved, the largest of them first restored to its proper position in the tray, and the smaller fragments fitted into their proper places about it; the entire surface should then be varnished, and the plaster batter poured over it and the model built up; adhesive wax will assist in securing the fragments, especially if they are numerous, until the plaster is poured over them.

Q. When may modeling composition or wax answer better than plaster for an impression?

A. When certain areas of the roof of the mouth are found to be hard, and others soft so that a plate would exert uneven pressure upon the parts on which it rests; then the harder impression materials will press away the soft parts, and the plate will have a uniform bearing.

Q. How may the *Articulation* be obtained?

A. For metal work the metallic plate is used; for vulcanite or celluloid a base plate of wax, gutta percha, paraffine and wax, or modeling composition, is necessary, such base plate being softened and shaped over plaster model; a rim of wax is built upon the plate over alveolar ridge, of the form of the arch; tried in mouth and trimmed or added to as required, and so placed as to restore contour; to prevent too close a bite a small block of soft wood is inserted in the wax rim at a point opposite occluding front teeth, the grain of the wood running parallel with ridge so that small portions may be easily split off until the proper length of teeth is obtained, which is determined by lower natural teeth coming in contact with block of wood, and thus preventing patient from biting too far into wax rim. (See *Obtaining "Bite"* under Vulcanite.)

Q. When in mouth, and lips at rest in natural position, what should be the size of the wax rim?

A. About one-sixteenth of an inch for upper bite, and one-sixteenth shorter than lip for lower bite.

Q. Should patients ever be requested to "bite" naturally?

A. No, as they are certain to do just the opposite.

Q. How is Articulating Model made?

A. For full upper or lower case the wax articulation is placed upon model in case of plastic work (or plaster is run into palatal surface of plate in metal work), and fastened by passing a heated spatula around edges. If a metal articulator is used, the model with articulation is secured to this with plaster; the cavities made in wax by teeth are then filled with thin plaster batter, and by jarring, each plaster tooth is made perfect; enough of plaster somewhat stiffer is built upon this to bring it even with top or bottom of articulator, this is smoothed and allowed to harden, when it is separated, and wax removed; the base plate is then fastened to the model, and teeth arranged on it; if the case is of metal, pouring the plaster into concave surface of metal plate, and building it up to top or bottom of articulator, forms the half part, and the teeth are arranged on the metal plate. Another method is to obtain a wax impression of opposite jaw and a plaster model from this; the plaster teeth of this model are inserted into depressions made in wax articulation by the natural teeth, and fastened by means of melted wax; all parts are then attached to metal articulator as before described.

Q. Describe how outline of a full upper denture may be marked on plaster model ?

A. Begin at heel of model, do not encroach on soft palate, hence, curve the plate-line to avoid doing so; extend line so as to cover condyles or maxillary tuberosities; extend it as high as possible on outside of ridge without interfering with muscles and reflected portions of membrane of cheeks and lips, and as outline is drawn forward allow room for fræna on either side and front of mouth; carry outline as high on outside of ridge as plate can be borne with comfort, the highest points over canines, and a lower line back of such points.

Q. What should the Vacuum Cavity conform to in shape ?

A. Somewhat to general contour of palatal arch; if this is broad, make cavity broad; if long and narrow, make cavity long and narrow.

Q. What is the general rule in regard to size of Vacuum Cavity ?

A. About one-quarter the area of space enclosed by a line drawn around centre of ridge and back edge of plate.

Q. How mark outline of vacuum cavity ?

A. Do not extend it over rugæ, if possible, and let it be at least one-eighth of inch inside of back edge of plate. (See Atmospheric Pressure.)

Q. How mark outline for a Full Lower Denture ?

A. Carry line on model as far over ridge on outside as the integument will allow, and give room for fræna; on inside let outline be drawn so that plate will rest in depression extending along inner surface of ridge; the back of plate should just cover curve of gum so that edge will not interfere with tongue; the plate must not be too wide, nor extend too far back; if integuments greatly overlap ridge, mark outline so that plate is quite narrow.

Q. How mark outline for Partial Upper Dentures ?

A. So that it may fit accurately around remaining natural teeth, but not rest on them.

Q. How *Outline Partial Lower Dentures* containing *Bicuspids and Molars ?*

A. Let plate extend in front up over lingual surfaces of six anterior natural teeth, (not cut out to extend around such teeth), that plate may not press painfully on gums, and also for the reason that a thinner plate can be made to extend back of anterior natural teeth, which although thin will be stiff and unyielding owing to its peculiar shape, all of which is secured by allowing plate to extend just above rounded portion of natural teeth and rest on the broad, flat surfaces approaching their cutting edges.

Q. How far down should outline of such a plate extend on front part, inside?

A. So far down behind six front teeth that tip of tongue will not be liable to get under it.

Q. When lower teeth anterior to 2d or 3d molars are to be inserted, how *Form the Plate?*

A. A tip or tongue of metal may be attached to back part of plate over ridge, so as to extend up the mesial surface of natural molar on each side of mouth, and slightly over crown on grinding surface; such tongue of metal will assist in holding denture in position by hooking over molar, and transfer pressure of mastication from gum to molar on each side.

Q. How determine when jaws close properly in securing the "Bite" or antagonism?

A. By arresting the movement of jaw in act of speaking; or by having patient place tip of tongue against roof of mouth on opening mouth, and retaining it in that position on closing mouth, or biting into wax rim; or by depressing chin on breast, and then causing the mouth to be closed.

Q. How may proper *Length of "Bite"* be determined?

A. By the general expression—the lips should rest easily together, without effort, stretching or pouting.

Q. At what points is considerable fulness of gum usually required to give expression and reduce wrinkles from angle of nose to corners of mouth?

A. Over canine teeth.

Q. Where should fulness of gum be avoided?

A. Under nose.

Q. What determines *Selection of Plain or Gum Teeth for a Denture?*

A. Degree of absorption of process; presence of roots of teeth; unusual projection necessary; or irregular arrangement required.

Q. In *Selecting Artificial Teeth* what points have to be considered?

A. Size, shape, color, character, peculiarities, and, for partial cases, teeth to match remaining natural ones.

Q. As regards *Size?*

A. The width and length generally, and especially the relative width and length of central and lateral incisors and canines.

Q. As regards *Shape?*

A. Whether teeth are to be perfectly straight or wedge-shaped, larger in diameter across cutting edges than across necks.

Q. As regards *Character?*

A. Whether teeth are to be flat or curved (convex) on labial surfaces, curved transversely or from gum to cutting edge; whether thin, translucent, and of delicate form, or thick, dense, and massive.

Q. As to *Peculiarities?*

A. The presence or absence of grooves, ridges or lines transversely or longitudinally over crowns; shape of cutting edges according to age, or some peculiar form, straight or rounded; whether uniformity in shape is desirable or more of curvature on posterior than anterior edge.

Q. As regards *Shade?*

A. Should match natural teeth if any remain, except when latter are greatly discolored, then the color of artificial should be the least noticeable; rather a little too dark than too light.

Q. As regards any *Difference in Size?*

A. No difference if possible; if any is necessary, larger teeth can be ground down so as not to mar them—grind from sides or cutting edges, not from labial surfaces; better select teeth a little too large than too small.

Q. As regards *Position of Pins?*

A. Cross pins will often interfere with natural teeth of opposite jaw, and such pins weaken teeth more than longitudinal pins. Cross pins afford more leverage, become stretched, and are liable to be broken off, and not suitable for close bites; but if the other pins will not answer, the backings should extend to cutting edge. For bridge-work, cross pins render teeth more liable to fracture in soldering.

Q. How is *Width of artificial incisor teeth* to be determined?

A. By position of natural canines; also by space or not it is desired to make between incisors.

Q. What position should the six anterior teeth of upper jaw occupy?

A. Full width of jaw so as to partially conceal posterior teeth.

Q. How should posterior artificial teeth be placed as regards proximity?

A. Close together to prevent lodgment of food.

Q. When are thin anterior teeth required?

A. In close bites owing to occlusion of lower front teeth; also when jaws are small and tongue large.

Q. As regards *Strength?*

A. Select teeth that will not require so much grinding away as to endanger stability of their pins.

Q. In arranging artificial teeth should the curve be outward or inward?

A. Outward curve.

Q. In arranging an entire set of upper and lower teeth, how should the bicuspids and molars be placed?

A. First upper bicuspids should articulate between 1st and 2d lower bicuspids, so that each tooth meets two opposing teeth. Upper first bicuspids should be partly hidden by canines, and upper bicuspids and molars should slightly project over corresponding lower teeth; inner or palatal cusps should meet as well as outer cusps. The lower teeth should be placed well on alveolar ridge and not incline too much outward, and enough space be given to tongue.

Q. What teeth of an entire denture should be the longest?

A. The lower to ensure greater stability.

Q. In grinding an entire denture, what teeth should be first arranged?

A. Lower incisors.

Q. The curves of arch in both jaws should be made by what teeth?

A. By six anterior teeth.

Q. The greatest pressure in masticating should be on what teeth?

A. Second bicuspids and first molars; hence second molars should be somewhat shorter.

Q. Should the lower teeth occupy an oblique or perpendicular position?

A. Perpendicular, as it is seldom necessary to incline them outward or inward; even when lower jaw projects somewhat, lower teeth should be perpendicular and upper teeth project outwards to meet them.

Q. What is the advantage of trying teeth in mouth after they are ground and temporarily arranged?

A. To determine articulation and expression; and to make any necessary changes.

END OF PART II.

PART III.

General Histology.

Q. What is the *Blastoderm?*

A. A membrane made up of a large number of cells.

Q. Of what two portions is it composed?

A. The *Archiblast* consisting of three layers, the outer layer known as the *Epiblast*, the middle layer as the *Mesoblast*, and the inner layer as the *Hypoblast*.

Q. What is the remaining portion of the Blastoderm called, and what does it fill up?

A. The *Parablast*, which fills up the interstices of the Mesoblast.

Q. Name the elementary tissues composing the human body?

A. The Epithelial, Connective, Muscular and Nervous tissues.

Q. From what layers of the blastoderm are these tissues produced?

A. The epiblast gives origin to epithelium of skin and adnexa, to the epithelium of terminal portions of alimentary canal, to the neuroglia and nervous system.

The mesoblast provides material for genito-urinary organs, and voluntary and involuntary muscles.

The hypoblast, the epithelium of the respiratory, genito-urinary, and digestive systems, and glands and passages in connection with them.

The parablast provides material for the formation of the connective tissue, including bone, cartilage and fat, lymphatic vessels and tissues, blood cells and blood vessels and the true endothelial cells.

Q. What is the general structure of *Epithelial Tissues?*

A. Composed entirely of cells with a small amount of intercellular substance, and is in the form of a membrane covering free surfaces.

Q. What are the important surfaces covered with epithelial tissue?

A. Surface of skin and mucous membranes, surface lining ventricles of brain and spinal canal, free surfaces of serous membranes and organs of special sense.

Q. Name the elements which compose *Connective Tissue?*

A. Fibres cells, intercellular substances, vessels and nerves.

Q. Name the varieties of connective tissues?

A. Fibrous, Adipose, Embryonal, Mucous or Mucoid, Reticular Lymphoid, Cartilage, Bone, Elements of blood and lymph.

Q. What are the subdivisions of fibrous connective tissue?

A. Areolar, White Fibrous and Yellow elastic tissue.

Q. What physical characteristics does white fibrous tissue possess?

A. White color with shiny lustre, toughness, but pliancy.

Q. What structures are almost entirely composed of white fibrous tissue?

A. Tendons, ligaments, periosteum of bone, fascia, and all tissues in which great strength is required without extensibility.

Q. What is *Areolar Tissue?*

A. Connective or cellular tissue.

Q. Where is it found?

A. The most widely distributed tissue; commencing under the skin, it is traced under mucous and serous membranes, along blood vessels and nerves, around and between muscle-fibres and bundles, and gives support to all organs of the body.

Q. Where is *Yellow Elastic Tissue* found most abundantly?

A. In hyoid ligaments, vocal cords, ligamenta subflava and walls of blood vessels.

Q. What is the structure of Embryonal Connective Tissue?

A. Composed of small round cells, having no definite arrangement, lying in a homogeneous intercellular substance, in which are numerous fine fibres or fibrillæ.

Q. What is *Adipose Tissue?*

A. Made up of numerous small vesicles filled with fatty or oily substance, well supplied with blood vessels, but no nerves terminate in it.

Q. What is *Reticular Tissue?*

A. Composed of fine network or reticulum like that in white fibrous connective tissue, in the spaces between its fibres.

Q. What is *Lymphoid Tissue?*

A. Reticular tissue with its interstices filled with lymphoid cells, found in lymphatic glands, tonsils and follicles in small intestine.

Q. What is *Cartilage?*

A. A non-vascular elastic tissue softer than bone-gristle.

Q. What is the appearance of *Cartilage?*

A. Pearly white or yellowish color, firm and dense, and yields to pressure or torsion resuming its original shape when such is removed.

Q. What are the varieties?

A. White fibro-cartilage, hyaline, yellow elastic.

Q. What are the two varieties of Hyaline Cartilage?

A. Temporary, of which the skeleton of the embryo is made up in great part, and which later ossifies into true bone; and Permanent, some of which are the costal cartilage, articular cartilage and the tracheal cartilages.

Q. Are there any vessels or nerves in Cartilage?

A. No nerves; and no blood vessels in articular cartilage.

Q. Describe a *Muscle?*

A. Consists of fibres arranged in bundles. Muscles form the flesh of animals, and produce the active movements of the body.

Q. Into what two general classes are Muscle-fibres divided?

A. Non-striated, smooth or vegetative muscle, independent of the will, and known as involuntary; and striated, striped or animal muscle, subject to the will and called voluntary.

Q. What are the structural elements?

A. Fibres which are cells greatly elongated.

Q. What is the functional characteristic of muscle?

A. Contractility.

Q. What is the *Sheath of a Muscle?*

A. The delicate homogeneous structure which invests the contractile substance of the fibre.

Q. Where is the *Nucleus* located?

A. It lies near centre of cell, and is rod-shaped.

Q. Where do the non-striated muscles occur?

A. In all involuntary organs except the heart.

Q. What is the shape of the *Non-Striated Muscle cell?*

A. Spindle-shaped cylindrical or slightly flattened.

Q. Describe the *Striated Muscle?*

A. Developed from the original embryonic cell, and composed of long, irregularly cylindrical fibres.

Q. What are the component parts of a Muscle?

A. The Sarcolemma, the Nucleus, the Muscle Substance.

Q. Describe the *Sarcolemma?*

A. A clear, elastic sheath which invests each fibre and generally is closely attached to the enclosed substance of the muscle.

Q. What is the shape and position of the Nucleus?

A. Oval or fusiform, and located directly beneath the sarcolemma, and usually parallel to the long axis of the fibre.

Q. How are muscles joined to the bones?

A. By special connective tissue formations, tendons, faciæ, bursæ, and tendon sheaths.

Q. What composes a *Striated Muscle?*

A. Muscle fibres (striped) placed lengthwise in parallel bundles, surrounded by a connective tissue sheath—the *perimysium*—which carries the nerves and lymph vessels.

Q. What is the Endomysium?

A. The connective tissue sheath surrounding each fibre, and carrying blood vessels and nerve terminals.

Q. What are *Tendons?*

A. Bundles of fibrous tissue in which the fibres have a parallel course.

Q. Describe the manner in which the muscles and tendons are united?

A. By the extension of the endomysium of the muscle fibre and the blending of the tissues.

Q. What are *Fasciæ?*

A. Very similar to tendons, but very rich in elastic fibres.

Q. What are *Tendons*, *Sheaths* and *Bursæ* composed of?

A. Connective tissue in varying thickness, and lined on their inner side with endothelial cells.

Q. What is the appearance of Muscular Fibres?

A. Usually cylindrical, sometimes prismatic, usually not more than 1½ inches long.

Q. Describe the Heart Muscle: What is its peculiarity?

A. Its fibres are striated transversely, but it is an involuntary muscle.

Q. Describe the *Cells* of Heart Muscle?

A. Quadrangular in shape, often branched at one end, joined end to end, forming the fibres of the muscle: they appear to have no sarcolemma or investing membrane.

Q. What are the structural elements of *Nerve Tissue?*

A. Nerve fibres and nerve cells.

Q. How many kinds of nerve fibres?

A. Two—medullated and non-medullated.

Q. To what two nerve systems do they belong?

A. The medullated fibres to cerebro-spinal, and the non-medullated to the sympathetic.

Q. Name the elements which compose a medullated nerve fibre?

A. *Axis cylinder*, *medullary sheath*, and *neurilemma* or sheath of Schwann.

Q. Describe the *Axis Cylinder?*

A. A cylindrical structure, which passes through the axis of the nerve fibre, and is surrounded by the sheath of Schwann.

Q. What is the *Medullary Sheath?*

A. A sheath enveloping the axis cylinder, and made up of a semi-fluid translucent substance called *Myelin*.

Q. Describe the *Neurilemma?*

A. A thin, structureless tube enclosing the medullary sheath. It is divided into segments with an oval nucleus in each.

Q. What are bundles of nerve fibre called?

A. *Fasciculi* or *Funiculi*.

Q. How is connective tissue of nerves divided, and what is the name of each division?

A. The fasciculi are bound together by connective tissue called the *epineurium* or *peri*-fascicular connective tissue; each fasciculus is surrounded by several concentric lamellæ called the *perineurium* or *lamellar sheath;* prolongations of the tissue pass between the nerve fibres called endoneurium or intra-fascicular connective tissue.

Q. How do nerve fibres terminate in nerve centres?

A. The axis cylinder with no medullary or primitive sheath joins a process of the nerve cell; or the axis cylinders break up into their primitive fibrils before entering the nerve cells.

Q. How do *nerve fibres* terminate at their point of distribution?

A. They may terminate in distinctly nucleated flattened structures called *end plates*, as in voluntary muscles; or break up into fine fibrils as in involuntary muscles; in the finger ends they end in peculiar oval bodies, made up of concentric lamellæ and called *Pacinian* bodies.

Q. Describe the non-*medullated Nerve Fibre?*

A. Naked fibres having neither medullary sheath nor neurilemma; they have in their surfaces flattened, elongated nuclei at frequent intervals, and their distribution is not clear.

Q. *What are Nerve Cells?*

A. Cells having a large, well defined nucleus, and usually a large, shining nucleolus; they branch and have one or more processes, and are called *unipolar* or *multipolar ganglion cells*—according to number of processes. Some continue as nerve fibres, while others break up into fine fibrils; these cells vary considerably as to size and shape.

Q. What is peculiar in ganglionic cells of sympathetic nervous system?

A. They are surrounded by a distinct capsule of connective tissue lined with flattened cells; through this capsule one or more cell processes pass to become non-medullated nerve fibres.

Q. What constitutes a *Neuron?*

A. The nerve cell and axis cylinder.

Q. Name the important forms of special sensory nerve endings?

A. Tactile cells, tactile corpuscles and end bulbs.

Q. What are *tactile nerve cells?*

A. Oval nucleated elements resembling ganglion cells.

Q. What are *tactile corpuscles?*

A. Of oval shape, about 1.300 inch long by 1.800 inch thick, and composed of one, two or more medullated nerve fibres invested with a sheath of single connective tissue—Henle.

Q. What are *End Bulbs?*

A. Composed of 3 parts—the capsule, inner bulb, and nerve fibre, and cylindrical in form.

Q. How does the axis cylinder frequently end?

A. In a slightly expanded terminal bulb.

Q. What is *Reflex Action?*

A. Action which results from a centripetal nerve-impulse passing to a nerve-centre in a ganglion, and there transforming to a centrifugal impulse passing to a muscle; may be simple and involve a single muscle, or complex and involve many; all reflex actions are involuntary, but many of them may be checked or prevented by a voluntary effort.

Q. What is the course of a motor impulse from the brain to the muscles?

A. Through the central nervous system from the central nervous cells.

Q. Where do the sensitive fibres have their origin?

A. From the peripheral sense organs.

Dental Histology.

Q. Define Histology?

A. A study of the intimate structure of tissues and organs.

Q. Define Dental Histology?

A. The study of the microscopic structures of the teeth and tissues of the mouth.

Q. Name the Dental Tissues?

A. Enamel, Dentine, Cementum, and Tooth-pulp.

Q. With what structures of animals are the human teeth analogous?

A. With the dermal scales of the sharks and rays.

Q. What is the analogy between the teeth and the hair?

A. Both are developed from papillæ of connective tissue, the one covered by, and the other supported on it, both of epithelial structure.

Q. To what structures of the body are the teeth allied?

A. To the nails and hair.

Q. What compose the Epithelial Tissues?

A. Epithelial cells, which are definite in outline, and consist of the cell-substance, protoplasm, and a nucleus.

Q. What two forms are most frequently met with?

A. The flattened or squamous (scaly), and the columnar or prismatic.

Q. What is the form of the nucleus of each variety?

A. The nucleus of the columnar cells is round, while the nucleus of the squamous cells is flattened.

Q. What variety of outline in the columnar cells?

A. Conic, club-shaped, spindle-shaped, and either short or long.

Q. What form is the nucleus inclined to?

A. That of the form of the cell-substance; usually oval or oblong.

Q. How is the character of the epithelium established?

A. By the arrangement of the cells; from a single layer of cells—a single-layered epithelium; from several layers of cells—a stratified epithelium.

Q. What causes variations in the outline of the cells?

A. The pressure of neighboring cells.

Q. With what are the cells cemented together?

A. By a very thin layer of albuminous cement substance.

Q. What are ciliated cells?

A. A third class of epithelial columnar cells, whose free surfaces are covered with minute processes which are constantly vibrating.

Q. What are continuous masses of epithelial cells called, and where are they found?

A. Epithelia, and are found covering the surface of the skin, lining internal canals and organs, such as the mucous membrane of the mouth (on which they are abundant) as well as lining the numerous ducts leading into the oral cavity.

Q. What is glandular epithelium?

A. That composing the numerous glands and ducts.

Q. What variety of epithelium is principally found in the mouth?

A. The stratified squamous variety.

Q. Describe the Connective Tissues?

A. Generally, all those tissues which support and join together other tissues and having less cells than epithelial tissues; the intercellular substance predominates and is characteristic of this group of tissues.

Q. What are the three classifications of connective tissue?

A. Fibrous connective tissue, cartilage and osseous tissue, including dentine.

Q. Where is fibrous connective tissue found?

A. In skin and mucous membrane, intermuscular tissues, tendons, fascia and aponeuroses.

Q. What is its nature?

A. Composed of a meshwork of fine fibres of two kinds—fine, white, structureless fibres arranged closely in bundles and bands, crossing and intersecting; the other, yellow, elastic fibre, not arranged in bundles, but intermingling with the white fibres, and called elementary connective tissue fibres.

Q. What are trabeculæ?

A. Fibrous connective tissue, the minute bundles of which are collected into groups called trabeculæ, which form an unbroken mass.

Q. What is the Areolar Tissue?

A. The connective tissue fibres loosely arranged, and crossing and intermingling, with large intervening spaces, forming a loose, flabby tissue.

Q. What are the 3 varieties of fibrous connective tissue?

A. Mucous, Fibrillar, and Reticular.

Q. What is Mucous Connective Tissue?

A. An abundance of intercellular substance in which are a few bundles of fine fibrils and a number of round or oval cells.

Q. What is Fibrillar Connective Tissue?

A. Areolar tissue.

Q. What is Reticular Connective Tissue?

A. A network of slender bundles of connective tissue associated with nucleated cells.

Q. What is the form of fibrous connective-tissue cells in mucous membrane?

A. Oblong and somewhat flattened, and with many processes which unite with like processes from neighboring cells, and thus form a network.

Q. What are Plasma-cells?

A. Those large, oval or round, which are granular in appearance, and rich in protoplasm.

Q. What are Pigment Cells?

A. Where the body of the cell besides containing a nucleus, also contains pigment granules.

Q. What are Fat-Cells?

A. Where fat-globules of considerable size unite and form a round cell.

Q. What is the Basement Membrane or Membrana Propria?

A. Fibrous connective tissue, which, on account of its being immediately contiguous to epithelium, becomes somewhat modified, forming a new membrane.

Q. What is Fat?

A. Adipose Tissue—numerous fat-cells uniting, and well supplied with blood vessels and nerves.

Q. What does the Basement Membrane form in the Salivary Glands, and in other glands and ducts?

A. The proper walls of the tubes.

Q. What are Gland-Cells?

A. The cells generated in the tubes and ducts of glands, and which correspond to the epithelial cells of coarser mucous membrane.

Q. What is Cartilage?

A. A semi-opaque, non-vascular tissue, of a white color, composed of a somewhat elastic, dense matrix containing nucleated cells.

Q. What is the variation in character of Cartilage due to?

A. To the difference in the character of the matrix; the principal variation being in the size of the cells.

Q. Where are the cells of Cartilage situated?

A. In the spaces of the matrix, which they completely fill.

Q. What is the Perichondrium of Cartilage?

A. A thin, tough, firm membrane, well supplied with blood vessels and nerves, and essential to the growth and maintenance of the tissue.

Q. What are the 3 varieties of Cartilage?

A. Hyaline, elastic, and fibro-cartilage.

Q. What is Hyaline Cartilage?

A. Cartilage of a faint pearly blue color, slightly transparent, and investing the articular ends of bones, forming costal and nasal cartilages, trachea and bronchi, and part of larynx; it has a granular matrix.

Q. What is Elastic Cartilage?

A. Cartilage of a dull-yellow color—yellow cartilage—like hyaline except that it has a network of elastic fibres which penetrate the matrix. Yellow cartilage has round or oval cells containing nuclei and nucleoli.

Q. What is Fibro-cartilage?

A. Cartilage yellowish or milky white, composed of cells and a matrix made up of fibrous connective tissue arranged in bundles; numerous nucleated cells oval and more or less flattened, and each in a delicate capsule; it belongs to temporo-mandibular articulation, and is more common throughout body than the elastic.

Q. What two other divisions of Cartilage are recognized?

A. *Temporary*—the kind in fetus and youth destined to be converted into bone. Example: Meckel's Cartilage; and *Permanent*—including all that are generated as cartilage. Temporary cartilage resembles the hyaline except that the cells are not grouped together, and its cells are not so uniformly distributed throughout the matrix.

Q. What is *Bone* mainly composed of?

A. Tricalcium phosphate and cartilage.

Q. What does the joining together of organic and inorganic substance result in?

A. Hardness, solidity, and elasticity.

Q. What is the nature of such a combination of the organic and inorganic in bone?

A. Either part may be removed without destroying the other.

Q. What is the matrix of bone composed of?

A. Salts of lime (principally the phosphate), and slender fibrils joined together by a cement substance.

Q. What is the Cement Substance?

A. Chiefly of insoluble lime-salts.

Q. What two kinds of structure are to be found in the same bone?

A. Dense or compact, and spongy or cancellated. Example: Maxillary Bones.

Q. What shape are the *Lacunæ?*

A. Spindle-shaped spaces, numerous and of small size.

Q. What minute canals branch out from the lacunæ?

A. *Canaliculi* which anastomose with similar ones from neighboring lacunæ.

Q. What is the outline of the *Haversian Canals?*

A. Circular, and are in the centre of a small area bounded by concentric layers, like lacunæ and canaliculi.

Q. What is the general direction of the Haversian Canals?

A. Longitudinal with long axis of long bones, and in flat bones they ramify in various directions.

Q. In the matrix of bone what kind of cells does each lacunæ contain?

A. Nucleated, protoplasmic cells.

Q. What are *Sharpey's Fibres?*

A. Numerous delicate processes or rods, passing through the concentric laminæ to weld them together.

Q. What is *Bone-Marrow?*

A. The soft mass which fills the interstices of spongy bone and the cavities of long bones.

Q. What is the nature of Periosteum?

A. A compact connective-tissue of two layers—an outer or fibrous layer, rich in blood vessels; and an inner or osteogenetic layer with few blood vessels, of loose texture, rich in elastic fibres and spheric connective-tissue cells with oval nuclei, which are the osteoblasts.

Q. How do *Nerves* enter the substance of Bone?

A. First entering the Haversian Canals, and thus communicate with blood vessels of the marrow and periosteum.

Q. What are the two varieties of Marrow?

A. Red and Yellow; red in flat bones, including maxillæ, vertebræ, and ribs; the yellow in long bones of the extremities.

Q. Of what does the *Non-striated*, *Smooth*, *or Involuntary Muscular Tissue* consist?

A. Of contractile fibre-cells, elongated, spindle-shaped and cylindrical, and very elongated extremities, which become shorter and thicker by contraction; variable in length—$\frac{1}{10}$ to $\frac{1}{450}$ of an inch and composed of a pale, homogeneous-looking protoplasm, each inclosing an elongated, or rod-shaped nucleus.

Q. What binds the muscular fibres together?

A. A cement-substance forming fasciculi, and then strata or membranes.

Q. What do the connective-tissue septa provide a way for?

A. For the larger blood vessels, and the capillaries penetrate the fasciculi.

Q. Where only is Involuntary Muscular Tissue found in the mouth?

A. Only in the ducts of the salivary glands.

Q. What is *Striated or Voluntary Muscular Tissue?*

A. Composed of long, cylindrical fibres, regularly striated transversely, with their extremities usually attached to bones by means of tendons. Example: the muscles of cheeks and lips.

Q. What is the formation of *Fasciculi?*

A. The grouping together of the fibres of connective tissue into various sized bundles.

Q. What is the *Perimysium?*

A. A layer of connective tissue surrounding the fasciculi and forming a sheath for the individual bundles.

Q. What is the *Endomysium?*

A. A delicate connective tissue which passes from the perimysium into the substance of the bundle, and separates the individual fibre.

Q. What is the *Sarcolemma?*

A. A structureless, elastic sheath of striped muscular fibre.

Q. What is the *Sarcoplasm?*

A. A faintly granular substance like protoplasm, but not identical with it, which serves as a matrix for the fibrillæ.

Q. How are the *Fibrillæ* arranged?

A. Parallel to one another, and supported by the sarcoplasm.

Q. What does each fibre of a Voluntary Muscle comprise?

A. The Sarcolemma, muscle-nuclei, fibrillæ, and sarcoplasm.

Q. What does *Nervous Tissue* consist of?

A. Of an infinite number of definite morphologic units, which have a common origin and like structure, but different functions in different parts of the body.

Q. What does the Neurologic Unit, called the *Neuron* consist of?

A. The nerve cell or *Neurocyte*, the nerve-process, or *axon*, and the end-tufts or *terminal branches*.

Q. Describe the *Nerve-cell or Neurocyte?*

A. Smooth at first, devoid of processes and of a variety of shapes and sizes according to functions—spheroid, pyramidal, spindle-shaped, stellate, etc.

Q. What are *Dendrons or Dendrites?*

A. One or more protoplasmic processes arising from the neurocyte.

Q. What is the *Axon or Nerve-process?*

A. The first outgrowth of the protoplasm of the neuroblast: it arises from a cone-shaped projection of the cell-body and is short, of regular outline and hyaline appearance.

Q. What are *End-Tufts or Arborizations?*

A. The many branches into which an axon breaks up as it approaches its final termination.

Q. What are the two great systems of Nerves?

A. The *Cerebro-spinal* and the *Sympathetic*.

Q. How are the nerve fibres or conducting media of the cerebro-spinal nerves arranged?

A. In parallel or interlacing bundles, grouped into nerve-branches or nerve-trunks.

Q. What is the *Endoneurium?*

A. The fibrous connective tissue which holds the nerve fibres together in the bundles.

Q. What is the *Perineurium?*

A. The connective-tissue sheath which invests each fasciculus.

Q. Into what two classes are Nerve fibres divided?

A. The White or Medullated, and the Non-Medullated or Gray.

Q. What is the *Medullary Sheath?*

A. The White Substance of Schwann—a bright, fatty substance (Myelin) surrounding the axon or axis-cylinder, the conducting or central part of the nerve fibre.

Q. What are *Non-Medullated Nerve Fibres?*

A. Without a neurilemma, and composed of an axis-cylinder only; they are cylindrical or band-like, transparent with faint longitudinal striations. Non-medullated fibres with a neurilemma, are composed of an axis-cylinder surrounded by a neurilemma and throughout their extent are homogeneous.

Q. What are the *Nerve Cells or Ganglia Cells?*

A. Found in ganglia and also along course of nerves: composed of granular or faintly striated protoplasm, with a nucleus inclosing a nucleolus: differ in size and shape, the most common forms being spherical, spindle-shaped, and stellate.

Q. What are the two processes?

A. If one process, the cell is called *unipolar;* if two, *bipolar;* if a number exist, *multipolar;* the two processes are the axis-cylinder and the branched, protoplasmic process.

Q. What characterizes the *axis-cylinder process?*

A. Its hyaline appearance and unbroken outline.

Q. What the *protoplasmic process?*

A. It is thicker, granular and striated.

Q. Of how many parts does the *Oral Mucous Membrane* consist?

A. The *Epithelium*, *Corium*, and between these the Basement *Membrane* or Membrana Propria.

Q. Describe the *Epithelium?*

A. A thick, stratified, squamous membrane, the superficial cells being like scales or horn; the deeper cells are columnar in form and contain very little pigment. This membrane is composed of epithelial tissue, and the columnar cells are elongated and placed perpendicular to the surface of the corium with which they are in contact.

Q. Describe the *Corium?*

A. It is composed of dense connective tissue bundles interpersed with elastic fibres, and it passes into the submucous tissue or submucosa so gradually that there is no apparent line of demarkation.

Q. What is the *Basement Membrane?*

A. A structureless membrane interposed between the epithelium and corium.

Q. What is the *Submucous Tissue* or *Submucosa?*

A. It consists of a bundle of fibrous connective tissue with few elastic fibres; it is loose in texture, and loosely connected with the underlying periosteum, and over the greater portion of the gums and the entire hard palate, the submucous tissue is attached to the bones of the mouth by their periosteal covering. The glands of the mucous membrane are situated in the submucous tissue.

Q. Describe the *Glands of the Mucous Membrane?*

A. They are branched, tubular, mucous glands.

Q. What variety of muscular tissue is present in the submucous tissue?

A. Striped muscular tissue, in addition to adipose tissue in the form of groups of fat cells.

Q. How is the blood supply of the oral mucous membrane distributed?

A. The larger vessels to the submucous tissue and the capillaries to the corium, and numerous veins ramify through the superficial part of the corium, and the lymphatics form two networks.

Q. Describe the nerve supply of the Oral Mucous Membrane?

A. In the submucous tissue the medullated nerve fibres form a loose reticulum, from which numerous fibrillæ pass to the corium, where they terminate or continue as non-medullated nerve fibres, and enter the papillæ of the epithelium forming networks.

Q. In what parts of the mouth does the submucous tissue form a conspicuous portion?

A. In the orbicularis oris muscle, soft palate, uvula, and pillars of the fauces.

Q. Into what 3 parts may the labial covering of the lips, including the integument be divided?

A. Cutaneous, transitory, and muco-membranous portion.

Q. What covers the cutaneous portion?

A. A thin membrane consisting of a double layer of flattened epithelium; subjacent to this are fasciculi of fibres, intersecting each other and closely joined together, and composed of connective tissue intermingled with elastic tissue. Numerous small vascular papillæ are seen on the surface of the corium, cylindrical or conical in form; at various depths of the corium are numerous hair and sebaceous follicles.

Q. What characterizes the transitory portion?

A. The portion in sight when the lips are closed. At its beginning it is quite thin but increases in thickness in passing towards the muco-membranous portion. The superficial cells are flattened, joined together closely, and without nuclei; the cells of the middle and deeper layers are oblong or spherical; the fibrous tissues increase in thickness as the muco-membranous portion is approached, and numerous thin and somewhat elongated papillæ are distributed over the surface of the transitory portion.

Q. What characterizes the muco-membranous portion?

A. This includes all that portion covering the labial folds within the mouth. The epithelium is much thicker and is the stratified squamous variety; superficially the cells are flattened and tubular with nuclei; in the middle layer the cells are flat and oblong, and in the deeper layer there are irregular nucleated cells. Different fibres compose the structure—some fine and united into fasciculi, intermingled with elastic fibres; others coarse, and strongly looped; the mucous membrane forming the labial frena is covered by an epithelial layer much thinner than that distributed to other parts of the lips.

Q. What arteries pass through the lips near the union of the transitory and muco-membranous portion of the mucous membrane?

A. The coronary, and their accompanying veins.

Q. What are the characteristics of the *Mucous Membrane of the Cheeks?*

A. But little variation in the structure from that of the muco-membranous portion of the labial mucous membrane; the cells of the middle layer are more numerous, more closely joined, and more irregular.

Q. What characterizes the *Mucous Membrane of the Gums?*

A. It is very dense, on account of the numerous fasciculi present, also tough, more so than elsewhere in the mouth, especially about the gingival margins, and over the greater portion of the alveolar walls, and closely bound down to the bone by prolongations of the tendinous fasciculi of the periosteum which penetrate the membrane.

Q. What is the epithelium of mucous membrane of gums composed of?

A. Of lamina of tesselated and ribbed cells; the superficial ones are flattened cells of pavement epithelium; under this they are thicker and more ribbed, while the deepest ones are conical and cylindrical with conical extremities.

Q. What is the tissue of the corium composed of?

A. Of flattened fasciculi of connective tissue, the fibres running parallel with one another.

Q. What 3 sets of fibres of the mucous membrane of gums?

A. Those running vertically, those passing in a horizontal direction, and those which radiate fan-like; the first extending from above downward, the second pass from right to left parallel with the surface, the third reflected from the peridental membrane, and distributed in fasciculi about the alveolar margins.

Q. What characterizes the *Mucous Membrane of the Hard Palate?*

A. It is, like that of the gums, dense and tough; the papillæ of the corium which enter the epithelium are not so numerous as those of the gums; more numerous in the posterior third, than in the anterior third; there are fewer papillæ in the median line (raphe) and over the rugæ; the epithelium is of the pavement variety, thinner in front than back, the cells being more numerous at some points than at others; the mucous membrane is also thicker posteriorly than anteriorly; and the fibres radiate from the alveolar borders towards the centre of the palate, the anterior fibres passing obliquely backward, while those of the lateral walls run parallel with one another to the median line.

Q. Of what form are these fibres?

A. Broad usually, and form a plexus between the epithelium and submucous tissue.

Q. How is the submucous tissue distributed over hard palate?

A. Sparingly over central portion; it contains a few fat-cells laterally.

Q. What characterizes the *Mucous Membrane of Soft Palate?*

A. Its substance is made up of fasciculi of connective tissue intermingled with a plexus of elastic fibres, distributed from side to side, or horizontally, longitudinally, and obliquely; many conical papillæ enter the epithelium as projections from the corium, which are larger and more numerous than on the uvula. The corium is variable in thickness on account of the presence of the glands, and is thinnest along margin of hard palate, gradually growing thicker to the free border.

Q. What is the *Blood-supply of the Oral Mucous Membrane?*

A. Superior and inferior coronary, buccal, lingual, transverse facial, palatine and alveolar—branches of external carotid artery.

Q. How are these arteries distributed?

A. The minute terminal branches enter the submucous tissue, and are distributed parallel to the surface, and anastomosing form plexuses from which minute branches supply the papillæ of corium; after passing through papillæ, the blood is carried into a venous plexus and passes from the parts.

Q. How are the *Nerves of the Oral Mucous Membrane* supplied?

A. Medullated fibres are first distributed to the submucous tissue forming an open reticulum from which fibres pass to the corium, terminating in end-bulbs, or after loosing their medullary sheath, are distributed to epithelium, their free extremities lying between the epithelial cells.

Q. What does the *Peridental Membrane* invest and line?

A. The roots of the teeth, lines the walls of the alveolar cavities, and is reflected from the periosteum covering the external surfaces of the alveolar process, entering the alveolar cavities as a single membrane.

Q. What other names have been ascribed to it ?

A. Alveolo-dental periosteum, Pericementum, Peridonteum.

Q. What does it nourish ?

A. The bony walls of alveolar cavities, and the cementum of the teeth.

Q. What is its origin ?

A. According to Broomel, the walls of the follicles of the teeth in their development, are made up of two layers, the outer layer being dense and firm and finally becoming the *peridental membrane*, while the inner layer, being thin, frail and delicate, and in the recent state somewhat transparent, assists in forming cementum.

Q. What is the mass of the Peridental membrane made up of ?

A. White fibrous tissue, rich in nerves and blood vessels.

Q. Into what classes is this tissue divided ?

A. Into two classes : the principal fibres which spring from the cementum of root of tooth and are attached to the bone of the alveolus thus holding the tooth in its cavity ; and the indifferent or inter-fibrous tissue, made up of fibres and cells which fill the spaces between the principal fibres, surrounding and accompanying the blood vessels and nerves.

Q. How are the three offices of the peridental membrane accomplished ?

A. The functional office is accomplished through its cellular elements—the osteoblasts and cementoblasts ; the physical office is performed by the fibrous elements through which the tooth is held in its cavity, and the sensory office through the abundance of nerves which are richly distributed to all parts of the membrane.

Q. Of what then does this membrane consist ?

A. Connective tissue, cells, fibres, blood vessels and nerves.

Q. Where are the *Osteoblasts* of the membrane found ?

A. Lying against the bone between the principal fibres, and are instrumental in forming the alveolar walls.

Q. How are they distributed ?

A. Unequally, being numerous and crowded in some parts, and almost wanting in other parts ; more plentiful in the young and seldom present in old persons ; also, the membrane is thickest in youth, and as the formation of the bone progresses it becomes reduced in thickness.

Q. What is the nature of the osteoblasts ?

A. Polygonal or cuboidal cells ; oval in form and varying in size.

Q. What occurs to these cells as age advances ?

A. Instead of being crowded together as in youth, the cells separate into groups.

Q. Where are the cementoblasts found?

A. On the opposite side of the peridental membrane, in contact with the root of the tooth, and between the fibres of the membrane.

Q. How do the cementoblasts differ in form from osteoblasts?

A. Instead of being polygonal or cuboidal, they are more or less flattened with irregular outlines; and extending from the body of cell are a number of irregular processes which penetrate the neighboring fibres or interfibrous substance; also unlike the osteoblasts, the cementoblasts are evenly distributed over entire surface of the cementum.

Q. What other cells besides the Osteoblasts and Cementoblasts does the membrane contain?

A. Fibroblasts and Osteoclasts; also Glands exist in it.

Q. What is the function of the *Fibroblasts?*

A. To increase or renew the fibrous tissue.

Q. What are the *Osteoclasts* or *Cementoclasts*, and their function?

A. Giant cells varying in size, round or oblong with a number of nucleoli; no processes and seldom branched; larger than osteoblasts. Their function is to remove part of alveolar walls, as in moving irregularly placed teeth, and to act likewise on the cementum of root; they have the power of dissolving calcified tissue.

Q. What are the principal fibres of this membrane called which pass directly into the hard structures of the alveolus and cementum?

A. Sharpey's fibres.

Q. What gives the strong attachment of the membrane to bone and cementum?

A. The connective tissue fibres.

Q. What is the arrangement of the principal fibres in the apical portion of membrane?

A. They are large and divide or change into fan-shaped fasciculi which spread out in all directions to be attached to the bone. The large spaces between the fibres, are, in the young, chiefly occupied by embryonal tissue, and the amount of the indifferent fibrous tissue increases as age advances. In young subjects, the tissue in the apical portion resembles that of the pulp or dentinal papilla; hence, the theory that the peridental membrane and pulp have the same origin.

Q. What is the arrangement of the principal fibres with reference to the attachment of the tooth to its alveolar cavity?

A. At the alveolar margin the fibres are inclined towards the apex of root holding tooth in the alveolus; just below the margin of alveolus the fibres are specially large and pass out at right angles to axis of tooth, supporting it against the lateral force of mastication; farther down in alveolar portion of membrane the fibres are so arranged as to support the tooth in its cavity against the force of occlusion.

Q. Describe the arrangement of the principal fibres in the alveolar portion of the peridental membrane?

A. They pass from cementum to alveolar cavity wall, and near the gingival border the fibres are large and do not change into smaller fibres in passing across to the bony wall as in other parts of the membrane; an individual fibre may be traced from the cementum to the bone without losing its identity. At the border of the lower portion of the alveolar division, the fibres pass obliquely from cementum to the bone, being inclined towards the apex of root; beyond the border and for a short distance along the root, the fibres pass directly from the cementum at right angles to axis of tooth, where the single fibres are larger and more frequently pass from cementum to bone without dividing; farther towards apex the fibres again become oblique and incline more in the opposite direction; in passing from cementum to bone, the fibres have a course towards the margin of alveolus, away from apex of root; many of the fibres proceeding from cementum near apex are large and as they pass out across the membrane break up into fan-shaped fasciculi to be attached to wall of alveolus.

Q. Describe the arrangement of the fibres in the gingival portion of the peridental membrane?

A. On labial and lingual sides of the root the fibres arrive from cementum in large bundles, and pass out dividing into smaller fibres and are lost in their attachment to the fibrous mat of the gum; towards mesial and distal sides, the fibres bend around laterally and pass directly from tooth to tooth; they arise from the cementum of one tooth in the form of large fibres, change into smaller ones which are deflected from their direct course to pass around fibres which are parallel with the axis of the tooth, and finally reunite into large fibres attached to the cementum of the adjoining tooth.

Q. Where are the Glands of the Peridental Membrane situated?

A. Between the fibres close to the cementum.

Q. Describe their arrangement?

A. They form a network around the root, extending to near apex; it is very close to gingival portion and becomes more open towards the apex.

Q. How many Glands have been found in a cross section of central incisor through gingival portion of membrane ?

A. As many as two hundred.

Q. What is the nature of the cells of the glands ?

A. Epithelial with granular protoplasm each having a large nucleus; arranged in threads, like tubular glands, the threads winding in and out between the fibres; no ducts have been found to these glands.

Q. What is the Interfibrous Tissue of the Peridental Membrane ?

A. Principally made up of fibroblasts belonging to the principal fibres, and other fibroblasts accompanied by delicate fibres; it pervades the entire membrane wherever there is space for it, and is more in amount than the principal fibre. It forms an investment for the blood vessels and nerves, and tissues of their walls.

Q. Describe the course of the Blood vessels supplying Peridental Membrane ?

A. Four or five blood vessels enter the membrane at apical space and supply it with a rich capillary plexus; as they pass through the membrane they receive lateral branches from the Haversian Canals which open on sides of alveolus; these lateral branches are enough to maintain size of vessels, notwithstanding they supply capillary plexus; at the gingival border they also receive branches which enter the membrane over margin of alveolus, all affording a triple source of blood supply.

Q. Of what importance is this triple supply of vessels ?

A. When the vessels entering at apical space are destroyed by suppuration at that point, the gingival and alveolar portions of the membrane are still supplied with blood by the vessels of the Haversian Canals in sides of alveolus, and also those which enter membrane at gingival margin over the margin of alveolus.

Q. Describe the Nerve-supply of Peridental Membrane ?

A. It is distributed similar to the blood-supply—from the branch entering apical space, through canals of walls of alveolus, and at gingival margin over margin of alveolus.

Q. What changes occur in this membrane with advancing age ?

A. Its thickness decreases, by deposition of bone within alveolus, and that of cementum on surface of root; the number of its cellular elements decreases, and also the glands; the blood vessels, which in young membrane are in centre of tissue and form there a vascular area, in the old membrane lie close to the bony wall of alveolus, frequently in grooves in the walls.

Q. Describe the process of Absorptions in Cementum?

A. When they occur, the fibres of peridental membrane are first cut off at that point by osteoclasts, and these giant cells then attack cementum scooping out a hollow in which they lie close against surface attacked, which is found to be smooth and polished; the osteoclasts must be in absolute contact with the surface undergoing this process.

Q. What is probably the cause of an Absorption of this nature?

A. May be due to many causes, some of which are very obscure; as they are almost always found at the time tooth arrives at complete occlusion, they may be caused by movements necessary to bring cusps in proper occlusion with opposing tooth.

Q. How is the Contour of tooth-root restored?

A. After absorption has ceased, the next layer of cementum to be formed dips down into the cavity excavated, and after the formation of a few layers the contour of root is restored.

Q. How are Natural and Forced Movements of Teeth accomplished?

A. Such as are necessary in correction of irregular positions of teeth are owing to the combined action of osteoblasts and osteoclasts, as the process is one of destruction and repair—the osteoclasts cut off the attachments of certain of the fibres and dissolve the bone of alveolar wall in direction of the pressure exerted on the tooth; then the osteoblasts deposit new bone, forming a new alveolus, or a portion thereof, and reattaching the fibres, and thus rendering the tooth again firm in its cavity.

Q. What is the nature of *Enamel?*

A. A vitreous, hyaline substance containing little or no organic matter not more than 5 per cent.; Dr. Williams asserts that there is no organic matter.

Q. What is the difference between the action of acid on enamel, and on dentine and bone?

A. Acid dissolves the inorganic salts out of bone and dentine, and leaves the organic matter which retains the form of structure; when enamel is treated with acid, no trace of form of structure remains.

Q. What influences the thickness of enamel on crown of tooth?

A. The function of its different parts as it is thickest over cutting-edges, and in the cuspid teeth the thickest enamel is found on the occlusal surface, and on bicuspids and molars on occlusal surface also.

Q. What is Enamel composed of?

A. Salts of lime, the calcium phosphate being in excess, while the calcium carbonate and calcium fluoride are in smaller quantities.

Q. What effect has the calcium phosphate?

A. Being in excess, it increases the hardness of enamel.

Q. What effect would an excess of calcium carbonate have?

A. It would decrease the hardness of enamel.

Q. The teeth of what sex contain the greatest amount of calcium phosphate?

A. Those of males, while those of females contain more of calcium carbonate than do the teeth of males.

Q. Of what structural elements is the enamel composed?

A. Hexagonal prisms, or rods or fibres, and interprismatic or cement substance, which is also calcified.

Q. What is the given diameter of an enamel prism?

A. From 3.4 to 4.5 microns (a micron is equivalent of 1–25400 of an inch, or the one millionth of a meter).

Q. What compose the layers of enamel at the time the tooth erupts?

A. Enamel prisms, narceous layer of Sudduth and Nasmyth's Membrane.

Q. What is the general direction of enamel prisms?

A. Nearly at right angles to body of tooth, but they do not pursue a straight course in passing from dentinal surface to that of crown, but run in a tortuous or wave-like manner.

Q. How are the prisms placed on dentinal surface?

A. On end; minute depressions in the dentine receiving the pointed ends of the enamel prisms.

Q. Does the direction of enamel prisms also vary according to the part of crown they compose?

A. Yes; at the cutting edge and occlusal surface they are more or less vertical, while on lateral surface they are horizontal.

Q. Describe the Enamel Rods or Prisms?

A. Long, five or six-sided, pointed at both ends, some extending from the surface to dentine, others shorter, filling in the interprismatic spaces, and ending in points between the converging rods or prisms, often irregular in outline with expansions and contractions more marked in some than in others, according to some histologists, but according to others, no increase of diameter of the rods exist.

Q. How are they arranged?

A. Parallel with each other; the supplemental or peripheral rods which extend but a short distance from surface filling in the spaces between the longer prisms.

Q. What is the appearance of a section of enamel cut across the rods ?

A. That of a tile pavement, in areas five or six-sided, separated by the cement substance.

Q. What appearance does the striation of Enamel present ?

A. That of alternate light and dark bands, like the striation of voluntary muscle.

Q. What causes the striation ?

A. Varicosities, or variations in size of rods ; or, according to some, caused by a deposit of pigment with the lime salts in that part, and mark the intermittent formation of enamel.

Q. What is the Interprismatic Matrix ?

A. Not an organic structure, but a transparent, inorganic substance.

Q. What is the brown striæ of Retzius ?

A. Markings of a brownish color, which run nearly parallel with the surface of the dentine or enamel.

Q. What are the lines of Schregar ?

A. Markings due to the various directions assumed by the neighboring groups of enamel rods.

Q. How do enamel and dentine calcify ?

A. In opposite directions; the outer wall of dentine being completed before enamel calcification begins.

Q. What is the Stellate Reticulum ?

A. The transformation of the centre cells of the enamel organ which at first are polygonal, into a radiating network.

Q. What is the Stratum Intermedium ?

A. A layer of unaltered cells between the surface, columnar cells, enamel cells and stellate reticulum.

Q. How is Amelification, or calcification of enamel performed ?

A. One theory—the ameloblasts (enamel cells) become directly converted into enamel ; another theory is that the ameloblasts are simply considered as controling agents by secreting or depositing the calcium salts which form the enamel prisms—that the enamel is secreted from the extremities of the ameloblasts, thus being productive of enamel fibres corresponding in size and position to the secreting cells.

Q. What is the general process of enamel calcification ?

A. An organic matrix is first developed into which the first formed layer of enamel is deposited, and the matrix gradually disappears, leaving behind the inorganic elements.

Q. How is the *Transparent Cement-Substance*, which is between the enamel rods, formed?

A. According to Dr. Williams, it is formed by the distribution of a translucent liquid substance about the previously formed pattern for enamel rods; this pattern generated through the activity of the enamel cells, is composed of a translucent material somewhat more solid than the structure which surrounds it; these two substances calcify together, the latter forming the enamel prisms, while the former makes the cement or interprismatic substance.

Q. What is Nasmyth's Membrane, or *Enamel Cuticle?*

A. Called also persistent dentinal capsule, is a very thin and indestructible structure found covering the enamel when the tooth is erupted; it is the remains of inner tunic of enamel organ, the columnar cells of which have become flattened and horny, and is soon worn away after tooth is erupted.

Q. What is the Narceous Layer of Sudduth?

A. The granular layer which covers the outer ends of the enamel rods, giving a smooth, polished surface to the outer surface of the tooth.

Q. What is its origin and nature?

A. Some assert that it is continuous with, and similar in structure to cementum, being an extension of that structure; others that it is a product of the epithelium; others that it is the result of a change in form and character of enamel cells occurring before or after calcification of the underlying tooth tissues. As to nature, some describe it as a layer of horny scales; others that it is similar to structure lining the dentinal tubules, the lacunæ, etc.

Q. From what organ is the *Dentine* generated?

A. From the dental pulp.

Q. What are its characteristics?

A. White or slightly yellowish in color, somewhat elastic and harder than bone, but less so than enamel, and more so than cementum.

Q. What proportions of organic and inorganic matters in dentine?

A. Twenty-eight per cent. of organic, and seventy-two per cent. of inorganic.

Q. What two kinds of organic matter in the general structure of dentine?

A. Organic matrix into which the salts are deposited, and the dentinal fibrils.

Q. What is the nature of the matrix?

A. Composed of organic and inorganic substances which are variable in different teeth—the organic being in larger quantity during youth.

Q. What are the *Dentinal Fibrils?*

Q. Soft, elastic fibres occupying the tubules of dentine, which are elongated processes of the odontoblasts of the pulp. Williams claims that they originate from contracted cells lying between the odontoblasts.

Q. What are the functions of the fibrillæ?

A. To nourish and render sensitive the dentine.

Q. Has it ever been fully demonstrated that true nerve fibres enter the dentine along with the fibrils?

A. No; but Broomel and others believe that the sensitiveness of the dentine is produced by the presence of organized tissue in the tubuli, in the substance of which ramify minute nerve-terminals.

Q. Describe the *Dentinal Tubules?*

A. From the walls of the pulp-cavity they permeate the dentine in all directions, generally in a direction perpendicular to the surface, and in different parts of the tooth radiating in various directions; from the surface of the pulp-cavity they run in a more or less spiral manner towards the surface, becoming smaller as they approach surface of dentine, on account of the numerous branches they give off; their size varies in diameter from 1.1 to 2.3 microns; in their first course they present few or no branches but in their outer course the branches become very numerous, given off at an acute angle, and anastomosing freely with each other; immediately under the enamel and cementum they terminate in enlargements.

Q. Do they enter the enamel between the prisms?

A. There is reason to believe that they do not.

Q. Describe the *Dentinal Sheaths—Neumann's Sheaths?*

A. The walls of the tubes—not formed by matrix of dentine, but by an indestructible substance, the exact nature of which is in doubt; some however, think the walls are calcified. Sudduth denies a wall to the tubes. The dentinal sheaths are the most indestructible part of the dentine, resisting action of acids and strong alkalies; their exact nature is in dispute.

Q. What is the *Granular Layer of Tomes?*

A. The layer of dentine immediately beneath enamel and cementum; granular in appearance, with round or irregular spaces; caused by the enlarged ends of tubules filled with living protoplasm and presenting a granular appearance at the part named.

Q. What two forms of curves have the dentinal tubules?

A. In their course a double curve in direction of tubule which at its opening into pulp-chamber is perpendicular to inner surface of dentine, and at its outer end is perpendicular to line of junction between enamel and dentine; also besides this curve in its general direction the tubule presents many wavy curves throughout its course, as many sometimes, it is said, as 200 in the length of a single tubule.

Q. What are the *Interglobular Spaces of Dentine?*

A. Spaces due to portions of dentine where matrix has not been calcified, leaving irregular cavities filled with organic matter—points of imperfect development; the tubuli pass through them.

Q. What are the *Incremental Lines of Salter?*

A. Lines appearing in sections of dried teeth and running parallel with line between enamel and dentine; caused, it is supposed, by shrinkage of tooth in drying.

Q. When does Calcification of Dentine begin?

A. Not until the dentinal papilla has developed to the size and form of the dentine of the future crown of tooth.

Q. After first layer of dentine is formed on surface of papilla all additions take place from what direction?

A. From within; the reverse being true of enamel—from without.

Q. Where does Calcification of Dentine begin?

A. On cutting edges of incisors and cuspids, tops of cusps of cuspidate teeth, coronal extremities of crowns.

Q. What are the characteristics of *Secondary Dentine?*

A. The structure is less perfect; the tubuli are crooked and irregular, and differ from those of original dentine.

Q. When dentine of the root is absorbed is new dentine formed?

A. No, the loss is repaired by formation of cementum.

Q. What are the characteristics of *Cementum?*

A. Generally it is confined to the root of tooth, but its thin margin at the neck may slightly overlap the enamel; it gradually increases from the thin margin at the neck to the apex where its greatest thickness exists; at this point it forms the extremity of root.

Q. In what respects does it resemble bone?

A. It contains lacunæ and canaliculi, and is similar in structure so far as that it consists of a gelatinous basal substance combined with salts of lime.

Q. What is the nature of its Matrix?

A. Almost identical with that of bone; its organic and inorganic substance blending together give it hardness, solidity, and elasticity.

Q. What is its Matrix composed of?

A. Calcium salts, and cartilaginous fibrils, united by a small quantity of cement-substance in fine and coarse bundles.

Q. How is cementum formed in regard to structural development?

A. In regular layers like the lamellæ of bone, between which are the small spaces—lacunæ in which the cement corpuscles are found.

Q. Where are the lacunæ most abundant?

A. Around apex of root, and bifurcation of roots of molars; in the thin portion near neck of tooth, both lacunæ and canaliculi are very few in number or entirely absent.

Q. What is the relation of the fibres of the peridental membrane to the cementum?

A. The cementum is built up around them, and they are calcified with the matrix of the cement.

Q. What are *Cement Corpuscles?*

A. The cementoblasts of the peridental membrane which become encapsuled within developing cementum, and persist as irregularly shaped spaces filled with a protoplasmic mass; they are oval or oblong.

Q. How do they differ from lacunæ of bone?

A. By being variable in size, form, and in number, and direction of their processes.

Q. What are Cement Fibres?

A. The fibres of the peridental membrane which become encapsuled in the developing cementum, and are more or less imperfectly calcified; they are delicate, thread-like structures like Sharpey's fibres.

Q. Describe the formation of *Cementum* or *Cementification?*

A. The contents of the dental follicle—enamel organ and dentinal germ, are confined in a closed sac, which sac is not directly instrumental in the calcification of dentine or enamel. When the tooth is erupted a part only of the root is calcified, and as it grows, the follicular or sac-wall enclosing the enamel organ and dentinal papilla becomes closely adherent to the root as it is formed; upon the inner surface of the sac-wall a layer of cementoblasts are generated, and calcification taking place, the cementum is thus formed; so that the process of cementification is a modified form of subperiosteal bone formation, which was the old theory in regard to development of cementum.

Q. What is the function and form of the *Dental Pulp?*

A. The formation of dentine; its form corresponds to outline of pulp cavity.

Q. Describe the Dental Pulp?

A. A mucous-like protoplasmic matrix, principally composed of embryonal connective tissue, containing delicate fibres and numerous nucleated cells, and is richly supplied with blood vessels and nerves.

Q. Where are the Cells of Pulp very numerous?

A. On the periphery—that part in close relation to the dentine.

Q. How are the Cells located?

A. Widely scattered in gelatinous intercellular substance, or mucoid matrix.

Q. What three kinds of cells are found in the pulp?

A. Spindle, Spherical and Odontoblasts; generally the cells are elongated or spindle-shaped, with hair-like processes passing out from each extremity.

Q. What is the outline of the cells in the Pulp-Chamber?

A. They vary, in some cases being spherical, and in others like slender filaments similar to cell processes; in one class three or more filaments are given off.

Q. How are the pulp-cells distributed and arranged?

A. In coronal portion of pulp there is no regular arrangement in the cells beneath the odontoblasts; in the root portion of pulp the cells are arranged parallel with the length of the root; they are fewer cells in the interior of pulp, but they become more numerous towards periphery.

Q. What kind of cells are the *Odontoblasts?*

A. Large, elongated, multi-polar, nucleated cells; before dentification they are spheroid or pyriform, during this process their extremities become somewhat flattened and square, and in old age they return to their spherical form.

Q. How are they arranged on the surface of pulp next to dentine?

A. Closely, forming a continuous layer.

Q. What is the *Membrana Eboris?*

A. An old name given to the layer of odontoblasts on periphery of pulp.

Q. How are processes of the Odontoblasts classified?

A. Into Central or Basal; Peripheral or Dentinal; Median or Intercellular.

Q. Describe the blood-supply of the Dental Pulp?

A. One or sometimes two or three arteries enter the pulp through the apical foramen, and pass into the centre of the organ giving off lateral branches which pass to the periphery, and finally terminate in a capillary plexus beneath the odontoblastic layer; the veins of pulp are somewhat larger than the arteries, form numerous anastomoses and pursue the same course as the arteries; the blood vessels form networks extending in a direction parallel to long axis of tooth; the vessels have delicate walls of thin muscular fibre.

Q. Is the pulp destitute of Lymphatics?

A. Yes. None have been found in its substance.

Q. Describe the nerve-supply of the Dental Pulp?

A. One large or two minute medullated trunks enter the pulp at apical foramen and pursue a parallel course, giving off a few fibres in root portion, but branching into numerous subdivisions, distributed in every direction in the coronal portion of pulp, and terminating in a rich plexus immediately beneath the odontoblastic layer; when the periphery is reached the fibres become non-medullated; the final distribution of the non-medullated fibres is still doubtful.

Q. What degenerative changes may occur in Pulp?

A. Calcification and Mummification.

Dental Pathology.

DISEASES OF DENTAL PULP.

Q. In the treatment of pathological conditions of dental pulp, what is it necessary to understand?

A. Its structure, functions, susceptibilities, life endowments, resisting and recuperative power, and its pathological conditions.

Q. Into what two portions is the pulp divided?

A. Coronal, and root portion.

Q. What are the horns of the pulp?

A. The projections under the cusps of crowns.

Q. To what group does the tissue of pulp belong?

A. Connective tissue group.

Q. What portion of pulp do the odontoblasts form?

A. The periphery.

Q. What is the arrangement of blood vessels of pulp?

A. The two or three trunks which enter the apical foramen, divide into a number of branches, until the entire tissue is permeated by a rich plexus or network of capillaries immediately beneath membrana eboris.

Q. How are the veins distributed?

A. They are somewhat larger than the arteries and anastomose freely with each other.

Q. How are the nerves of pulp arranged?

A. Enter foramen with arteries, and form a bundle throughout the root portion of pulp; but in coronal portion they subdivide in every direction, and send filaments to periphery; immediately beneath membrana eboris a very delicate nerve plexus exists.

Q. Are any lymphatics found in pulp?

A. No.

Q. Name pathological conditions of dental pulp.

A. Simple exposure; irritation, which includes hyperæmia; inflammation—pulpitis—either acute or chronic; suppuration; gangrene; fungous growth, or polypus; calcification of its tissues, including nodular deposits, and secondary dentine.

Q. How are all exposed dentinal surfaces connected with the pulp?

A. Through the fibrillæ.

Q. May irritation of pulp occur without its exposure?

A. Yes, from pathological conditions of fibrillæ.

Q. Name causes of irritation of pulp?

A. Exposure of dentine to thermal changes, to extraneous agents, mechanical violence; from constitutional causes, such as malaria, rheumatism, gout, dyspepsia, syphilis, etc.

Q. How may a metallic filling near pulp cause irritation?

A. By conducting property of metal.

Q. Is pulp ever affected by impressions through enamel?

A. No, not permanently.

Q. When dentine is exposed by caries, what results?

A. Fibrillæ kept in constant state of irritation, which may extend to pulp and, if continuous, cause pulpitis.

Q. Does extent and rapidity of irritation of pulp depend upon density of tooth?

A. Yes, in caries in teeth of soft structures, chemical action exposes a greater area of organic matter to irritating effects of acids, and micro-organisms, and there is a more rapid disintegration of structure.

Q. Why is the irritation of fibrillæ in very dense teeth not so prone to extend to pulp?

A. Because tubuli have small calibre, and the slow progress of caries in such teeth.

Q. Is young and also imperfectly developed dentine more liable to such impressions?

A. Yes.

Q. How may impressions of heat and cold, if long continued, reach dentine, independent of caries?

A. By fluids or currents of air penetrating fissures in enamel, or affecting an abraded surface.

Q. What is direct and most positive cause of *Irritation of pulp?*

A. The action of caries.

Q. The formation of what structure affords a good example of effect of gradual but continuous irritation of pulp?

A. That of secondary or osteo-dentine.

Q. What affection of teeth?

A. Hypercementosis.

Q. What is effect of long continued friction on a surface of dentine?

A. Tubular consolidation—deposit of secondary dentine in the tubes.

Q. Is it often unwise to fill teeth of young patients with metal without interposition of some non-conducting material?

A. Yes, for in exact ratio to sensitiveness of tissue will be the danger of thermal action.

Q. Does long continued over-stimulation of a thin layer of dentine ever cause death of pulp?

A. Yes, and action of obtunders should be restricted to a superficial layer of dentine.

Q. What do many consider to be best fillings for children between twelve and fifteen years to lessen danger of thermal action?

A. Non-conducting materials.

Q. How demonstrate that pulp manifests decided sensibility to thermal changes?

A. By throwing on a normal tooth a jet of ice water and one of warm water when patient experiences a sharp twinge of pain from each jet.

Q. If rubber dam is so applied that all parts of crown are protected what will be result?

A. No sensation of heat or cold, but one of pain.

Q. What furnishes a good example?

A. Excavating a superficial cavity with burr on engine.

Q. What is the prognosis in regard to any pain in region of face or ear that is increased by filling mouth with cold or warm water?

A. That it has its origin in disease of pulp.

Q. What are exceptions to such a rule?

A. Some rarer types of neuralgia of branches of fifth pair; also in the earlier stages of apical pericementitis, caused by expansion of gas of decomposition by warm water.

Q. In what teeth is thermal sensitiveness most frequently found?

A. In the Superior Incisors.

Q. How may thermal changes be prevented in teeth sensitive from caries?

A. By filling with gutta gercha—Hill's Stopping.

Q. Where a metallic filling gives rise to irritation what is the remedy?

A. Removal of such filling and insertion of one which is non-conducting; or sensitive portion of cavity so filled, and remaining portion with a durable filling.

Q. When decay has nearly reached pulp, and dentine over it is very sensitive to touch of instrument?

A. Bathe freely with wood creasote or carbolic acid, and after absorbing surplus with cotton or bibulous paper, cover sensitive surface with prepared chalk, and over this solution of gutta percha in chloroform, asbestos, or oxyphosphate of zinc.

Q. When cause of pulp-irritation is due to malaria, rheumatism, etc.?

A. Systemic treatment for such affections.

Q. What is *Hyperæmia of Pulp?*

A. The overfilling of its vessels with blood, and no injury results when it does not exceed a reasonable degree; apparent by an uneasy sensation.

Q. But if frequently repeated with inordinate thermal change?

A. Vessels of pulp fail to contract, and remain distended, and irritation and inflammation result.

Q. Does hyperæmia of pulp depend upon lesion of tooth?

A. No, it may occur in a perfectly sound tooth.

Q. What is meant by a *Partially Exposed Pulp?*

A. Where overlying dentine is partially decalcified and usually more or less discolored.

Q. What are the symptoms?

A. Differ from those of irritated pulp only in degree, and are recognized by extent of decay and touch of instrument.

Q. What is the treatment of partially exposed pulps?

A. Do not expose pulp, and treat as for irritated or sensitive pulp.

Q. Symptoms of an *Exposed Pulp?*

A. If simple, no pain except when irritated by foreign matters, and pulp appears as a small, grayish-white, or red object in dentine.

Q. What is Treatment of an Exposed Pulp?

A. Cap with solution of gutta percha in chloroform; introduce oxysulphate or oxyphosphate of zinc, and when hard a permanent filling; no pressure on pulp. Some cap pulp with paste of carbolic acid and oxide of zinc, and over this oxyphosphate of zinc; or pure wood creosote and oxide of zinc in form of paste of consistence of cream, with an oxychloride of zinc covering; or lacto-phosphate of lime paste, or a paste of creosote (or carbolic acid), oxide of zinc and iodoform.

Q. What changes does an inflamed pulp present?

A. The normal pinkish-gray color disappears, and a bright red ensues, followed by dark red and purple.

Q. What change occurs as to character of pain?

A. From an unpleasant sensation indicative of hyperæmia, the pain becomes sharp, and paroxysmal; then more constant and severe, until it throbs with every pulsation of heart.

Q. What may give some relief at this stage—pulpitis?

A. A slight exudation from distended vessels, or application of cold.

Q. What may occur when inflammation reaches its height?

A. Suppuration and death, followed by periodontitis and alveolar abscess.

Q. What indicates chronic inflammation of pulp?

A. Where acute symptoms abate, and pulp becomes less sensitive, a condition of ulceration.

Q. What occurs when red blood corpuscles break up, or great extravasation results?

A. Coloring matter is absorbed into fibrillæ, at times to such a degree as to impart a red tinge to the dentine.

Q. How may a tooth thus become darkly *discolored?*

A. The coloring matter is thus set free in solution, and enters tubuli, and the formation of dark sulphurets give tooth a dark appearance.

Q. How may such discoloration be prevented?

A. By removing remains of dead pulp as soon as it is devitalized, and sterilizing the pulp-cavity and canals; or if this has not been done, to remove the contents thoroughly and inject peroxide of hydrogen followed by pyrozone (25 per cent.) or peroxide of sodium (50 per cent.) as *bleaching agents.*

Q. When pulpitis assumes chronic form, what is it due to?

A. To a great degree of vitality in system, giving a resisting power to progress of disease.

Q. May the pulp recover from inflammatory conditions?

A. Yes, where moderate extravasations of blood are absorbed, and where inflammatory lymph is not only tolerated, but the tissues are capable of disposing of it.

Q. Why is pain of pulpitis greater at night?

A. Owing to difference in the blood-pressure.

Q. What is the treatment of pulpitis?

A. Syringe cavity with solution of carbonate of soda and water to relieve pain; avoid removing any cap of decalcified dentine present; local depletion is sometimes resorted to if pulp is exposed; application of an antiseptic and germicide to destroy micro-organisms; capping with paste of iodoform, oxide of zinc, and carbolic acid; then a temporary filling introduced without pressure.

Q. What is the treatment of a wounded pulp?

A. First bathe surface of pulp with calendula or glycerin, and then cap as in other cases of exposure.

Q. Is treatment of inflamed pulps universally successful?

A. No, and such systemic affections as anæmia, malaria, scrofula, syphilis, etc., militate against a successful prognosis.

Q. What is to be done if a pulp cannot be made healthy or if inflammation recurs?

A. Devitalize and remove it. (See Part II.)

Q. What causes formation of small abscesses in substance of pulp?

A. Suppurative inflammation in cells of membrana eboris; deeper in pulp tissue they form, by an aggregation of inflammatory products, into masses close to each other, and which coalesce.

Q. In what respect does pain of abscess in pulp differ from pain of hyperæmia?

A. Onset of attack is not sudden, but begins with a slight gnawing pain, persistently increasing, until it becomes agonizing, and ceases when strangulation occurs; in from 6 to 24 hours periodontitis usually occurs.

Q. When a pulp degenerates in structure—mummifies, or dry gangrene ensues what is it due to?

A. Long continued chronic inflammation, or development of secondary dentine, and consequent stagnation of circulation.

Q. Does any decomposition attend a degenerated pulp?

A. No, and tooth retains its color.

Q. What artificial measures may be resorted to for digesting or mummifying portions of pulps in inaccessible parts of root canals?

A. The introduction of a paste composed of equal parts of tannic acid and thymol and glycerine, introduced with wood or ivory instruments; or Söderberg's paste, composed of Dried Alum, Thymol, Glycerol, all in equal parts to which are added oxide of zinc to make a stiff paste and a little cocaine to prevent any pain from the alum.

Q. What is the treatment of chronic pulpitis?

A. The conservation of pulp is rarely successful; hence devitalization is usually resorted to.

Q. What is the treatment of Putrescent Pulps?

A. Peroxide of hydrogen, alternating with iodide of zinc (xxiv grs. or more to ounce of water); also pepsin paste, eucalyptol, crystals of carbonate of sodium, peroxide of sodium, pyrozone, formaline, sulphuric acid.

Q. What gases are employed as *Sterilizing Agents?*

A. Oxygen and Chlorine.

Q. What gas is liberated from such sterilizing agents as Peroxide of Hydrogen and Peroxide of Sodium?

A. Oxygen.

Q. What is the value of Aristol as a Sterilizing agent?

A. It contains double the quantity of iodine that iodol and iodoform do, and has for its base thymol, a powerful antiseptic.

Q. What is the value of Formaline as an antiseptic?

A. It converts albumin and gelatine into a thick and tough coagulum.

Q. What is the value of the Essential Oils as antiseptics?

A. They act without causing coagulation; the most efficient being the oil of thyme and oil of cinnamon.

Q. What is the value of such alkalies as potassium and sodium (kalium-natrium), carbonate of soda, peroxide of hydrogen, and peroxide of sodium as sterilizing agents?

A. They saponify the fatty matters, and dissolve albuminous substances; their liberated oxygen acting as an oxidizer.

Q. Name some of the essential oils used as antiseptics in root-canal and dentine sterilization?

A. Cassia, cinnamon, thymol, eucalyptus, and myrtle.

Q. If pulps of deciduous teeth become devitalized what is the treatment?

A. Cleanse cavity of decay, remove dead pulp, and fill pulp-chamber with pyrozone (25 per cent.) or peroxide of sodium (25 per cent.); if root portions of pulp are still sensitive, sulphuric acid (50 per cent.) or formalin (10 per cent.), chloro-percha of consistence of cream, is then pumped in by means of a little cotton on a broach; then fill crown cavity with Hill's stopping; other materials for root-filling are aristol wax, paraffin, etc. After such treatment the filling of the root canals either with chloro-percha or aristol wax is generally satisfactory.

Q. How render pulp-canals and dentine aseptic?

A. By a solution of peroxide of sodium pumped into canals and permitted to remain for several minutes; when immediate root-filling is resorted to, the usual method is to fill with oxysulphate of zinc.

Q. When immediate root-filling is not deemed advisable?

A. Then fill with aristol and permit it, duly protected by a temporary filling, to remain for a week.

Q. After the non-septic removal of pulp, what is the treatment usually pursued?

A. Wash out canals with pyrozone (3 per cent.), pump alcohol in canal and evaporate to dryness, then introduce a small amount of oil of eucalyptus, or other antiseptic, and fill canals with gutta percha points introduced with warm instruments.

Q. After removal of body of pulp from chamber and canals, should any filaments remain, how may they be treated?

A. Either sulphuric acid (50 per cent.), or trichloracetic acid, may be pumped into the canal by broaches armed with cotton, until such filaments are destroyed.

Q. What forms do the orifices of the pulp-canals of the different teeth usually present?

A. The upper centrals and laterals and cuspids a circular orifice; the upper 1st bicuspids—round orifices; upper 2d bicuspids a dumb-bell shaped orifice; upper molars—palatal a large round orifice, anterior buccal root, round or triangular and small, the disto-buccal root very small orifice; same in second molar; in third upper molar the orifices vary, may be one large orifice or 3, 4, or even 5 very small ones. The orifices of canals of lower incisors, cuspids and bicuspids are usually oval; that of posterior root of lower molars, large and round, while that of the anterior root is small and of a dumb-bell shape.

Q. How may the orifices of the pulp-canals, when obscure, be made apparent?

A. By the application of sulphuric acid (50 per cent.) to the pulp-chamber.

Q. How are deciduous teeth without fistulous openings to be treated?

A. Same as permanent teeth with blind abscesses (which see).

Q. How are pulpless teeth treated where pulp has been recently devitalized?

A. Freely open pulp-chamber and bathe it with pyrozone, or combinations of carbolic acid, oil of cassia and wintergreen, or oil of cassia and guiacol; then using a smooth broach with a fine hook on end, remove all portions of pulp; then disinfect canals with alcohol pumped in by a broach, followed by pyrozone or peroxide of sodium, bichloride of mercury 1-1000, and apply iodoform or iodol, or by oil of cloves and eucalyptol (equal parts); then permanently fill root-canals with gutta percha cones, or chloro-percha, or zinc cements, preferably the oxysulphate, or oxyphosphate.

Q. How are pulpless teeth treated where pulps have been dead for some time?

A. Same as in preceding case, except that greater care is necessary in cleansing canals of dead pulp, that no septic matter shall be forced through ends of roots, and they should be disinfected for a longer time.

Q. How treat pulpless teeth affected with "blind abscesses"?

A. Open pulp-chamber thoroughly, and syringe with tepid water; dry canals carefully and inject peroxide of hydrogen until all bubbling ceases; then dry canals again, and bathe them with eugenol, or oil of cassia, carbolic acid and wintergreen combined, or with oil of cassia and guiacol, or oil of cassia and iodoform or iodol, or a five per cent. solution of carbolic acid and oil of cassia, and pack crown cavity loosely with cotton for three days, or until discharge ceases, if not every fourth day until it has ceased; then tightly pack root canals with one of the disinfecting solutions before named, and fill crown-cavity with Hill's stopping for four or five days; if no soreness of tooth on pressure, or evidence of moisture when canals are wiped out with dry cotton, fill canals permanently with gutta percha or other material; then fill the crown cavity.

Q. How treat pulpless teeth with fistulous openings, when apex of root has become roughened by action of pus?

A. Pass a fine smooth broach through fistula to determine if any roughness about ends of roots; if so they should be smoothed by enlarging fistula by compressed sponge tents, renewed daily, and parts bathed with a four per cent. solution of muriate of cocaine, when a fine cut burr of proper size can be used on engine to smooth rough portion of roots, and remove any dead bone if present; then use peroxide of hydrogen in canals, and see that they are open freely at ends, and flood cavity with one of the disinfectant solutions, such as peroxide of sodium, etc., and pump it through each canal, if possible, with fibres of cotton around a fine broach as a piston, until it appears at fistulous opening; or make pressure on a piece of rubber dam placed over a pellet of cotton in crown cavity saturated with the antiseptic; then pack canals tightly with cotton saturated with same, and fill crown cavity with gutta percha. After a week or ten days if continued discharge from fistula, repeat treatment; if no discharge treat as for case of blind abscess and fill canals and crown cavity permanently. In all cases apply rubber dam, and open freely the pulp-chamber.

Q. How may Pulps be rapidly digested?

A. Paint surface slightly with 1-200 of sodium fluosilicate, or a solution of borate of soda, 1-200; carbonate of magnesia may also be used, but not in excess; then apply a paste composed of 1 gram of papain made into a thick paste with glycerol and a drop of hydrochloric acid solution, 1-300; the operation should be done under antiseptic precautions.

Q. What precedes *Hypertrophy* or *Fungus growth of pulp?*

A. Chronic inflammation.

Q. What is the nature of such a polypus?

A. Not so painful as an acutely inflamed pulp, as the nerves do not increase in growth.

Q. What is the treatment?

A. Extirpation, application of nitric acid applied on wooden toothpick, and removal of remains, and filling; the prognosis is not favorable, however.

Q. What are *Pulp Nodules?*

A. The formation of small nodules of secondary dentine within pulp cavity usually in body of pulp, at times in root portion; pain neuralgic in character, or infra-orbital neuralgia, with paroxysms in one or more teeth.

Q. How may their presence be diagnosed?

A. Where evidence exists of no other affection, cold water and percussion may locate the tooth affected.

Q. What is the treatment?

A. Drill into pulp chamber and devitalize and remove pulp, and fill canals.

Q. Describe *Reflex Odontalgia?*

A. The symptoms of pain transmitted from one diseased tooth to others in which the exciting disease has not previously existed.

Q. What is *Secondary Dentine?*

A. Dentine formed in pulp-chamber and root-canals after tooth is fully developed.

Q. In what does it differ from true dentine?

A. The tubuli very irregular, no centre of radiation as in normal dentine, and more like canaliculi of bone; formed as a continuation of primary dentine, sometimes to such a degree as to entirely obliterate pulp; in other cases as nodules in substance of pulp; in former case it is protective.

Q. What is the cause of its formation?

A. Irritation of pulp from the abrasion of mastication, force of occlusion, or a blow.

DISEASES OF MUCOUS MEMBRANE AND GUMS.

Q. What is *Stomatitis?*

A. Inflammation of oral mucous membrane.

Q. What are the symptoms and causes?

A. Reddened, elevated patches sometimes over whole mouth; when it is superficial with little swelling, it is called *erythematous*, in which there is redness and heat, and considerable tenderness; acute pain when deep in tissue; portions of epithelium become opaque with appearance of whiteness in streaks or patches; superficial ulcerations sometimes occur; copious flow of saliva, impaired taste, difficult mastication; whitish fur on tongue. Causes—irritation of any local character, constitutional causes, such as fever, teething, etc.

Q. Describe *Catarrhal Stomatitis?*

A. May be acute or chronic; in children connected with dentition; in adults from mechanical irritants, acid reaction of saliva; extremes of heat and cold; due to exanthema; improper hygienic conditions; poor food; effects of mercury. Symptoms: redness, heat, pain and swelling; pain burning and smarting; some fever; anorexia; diarrhœa with flatulence; impaired taste; may extend to fauces; difficult swallowing; ptyalism; excoriation of corners of mouth; sordes; furred tongue.

Q. What characterizes chronic form?

A. The stroma is involved and structural changes occur; connective tissue of stroma infiltrated with exudations from vessels; mucous membrane indurated and thickened; mucous glands encysted and granular; papillæ of tongue swollen, disagreeable oral secretions; sordes on teeth.

Q. What is the Treatment of Stomatitis?

A. For simple stomatitis of children, emollient washes, such as slippery elm, or pith of sassafras in cold water; when severe, solution of acetate of lead (three grains to ounce of water); bromide of potassium to relieve nervous excitement and fretfulness; borax and honey, or borax and glycerine, or weak solution of alum. For catarrhal stomatitis: remove cause of irritation; alkaline washes, or dilute solution of chloride of zinc (one grain to ounce of water), or of nitrate of silver (same strength). Phenate of soda as a wash or spray; or carbolic acid, one drachm, oil of gaultheriæ, two drachms, peppermint oil three drachms, as a spray.

Q. What is *Aphthous Stomatitis?*

A. Appears first as small whitish vesicle-shaped elevations on inner surface of lower lip, near frænum of tongue, or inside of cheeks, or at times on tongue; the vesicles are surrounded by an inflamed ring at base, and when they break leave a gray surface which heals slowly; the ulcers are shallow and very painful, but cause little or no constitutional symptoms. Common to adults, and women during pregnancy and lactation.

Q. What is treatment of Aphthous Stomatitis?

A. Small doses of rhubarb, or citrate of magnesia, and tonics; locally, nitrate of silver, or nitric acid on sharp end of a wood tooth-pick, chlorate of potassium solution, alum, borax.

Q. What is *Thrush*, or *Parasitic Stomatitis?*

A. The inflamed spots soon become coated with small whitish points, which coalesce forming patches, which vary in color, but generally remain moist and clear; the exudation is at first closely adherent and then peels off to be replaced by fresh exudation; vegetable fungi exist, the parasites developing in acid secretions, and hence thrush occurs where oral secretions are vitiated and only by addition of vegetable parasites; common to emaciated children, and in adults follows typhus and malarial fevers, and in last stages of consumption; there is also decided gastric intestinal disturbance.

Q. What is the treatment of Thrush?

A. Neutralize acid conditions to destroy fungi; regulate bowels with rhubarb, and bicarbonate of potash; a grain of quinine every three hours, iron with quinine, as a tonic; locally, apply wash of permanganate of potash one grain to water one ounce.

Q. What is *Ulcerous Stomatitis*, or *Noma?*

A. Begins in gums, and extends to cheeks; gums congested, and have bluish swollen appearance; surfaces coated with exudation of pus, fibrin, epithelial scales, and micro-organisms; the grayish-white exudation gives way and also underlying tissue, and mucous membrane loses its vitality, and sloughs off; teeth loosen and drop out, and bone becomes affected in extreme cases; common to children of from one to ten years, who are exposed to bad hygienic conditions.

Q. What is the treatment of *Ulcerous Stomatitis?*

A. Constitutional—cod liver oil and syrup of lacto-phosphate of lime, tinct. of chloride of iron and quinine. Locally—nitrate of silver, chloride of zinc, or carbolic acid washes, fresh air, nourishing diet.

Q. What is *Gangrenous Stomatitis, or Cancrum Oris, or Gangrænopsis?*

A. A serious disease affecting unhealthy children, constitutional in character; cellular tissue of cheeks infiltrated with pus and fibrin, to such a degree as to become thickened and indurated on inside, and skin externally tense, and glistening, followed by ulceration and gangrene; mucous membrane of cheek presents a dark appearance surrounded by red inflammatory border, the dark portion soon sloughing, and forming an ulcer with ragged, uneven border, and covered with a dark-brown deposit; soft parts and bone become involved, and decomposition leads to formation of sulphuretted hydrogen which gives breath a fetid odor. It is very often fatal, pyæmia occurring followed by hemorrhage, exhaustion and death.

Q. What is the treatment of Gangrenous Stomatitis?

A. Prompt and energetic; internally give chlorate of potassium, five to ten grain doses every four hours, and tonics to keep up strength; parts sprayed with chlorinated soda, or carbolized water; the chief hope is to prevent ulcer from assuming phagedenic character, and it should be destroyed with strong nitric acid, nitrate of silver, acid nitrate of mercury, bromine, or concentrated hydrochlorid acid.

Q. What is *Mercurial Stomatitis?*

A. A form due to the effects of mercury (salivation); soreness, inflammation and sponginess of gums about necks of teeth (usually inferior incisors are first affected); ulceration; fetid breath; increased salivary secretion; swelling of salivary glands; slight fever; muscular pains; loss of flesh; coppery taste, ulceration, stiffness of jaws, extension of effects on gum to mucous membrane of mouth and palate, sore throat, ulceration marked about necks of teeth, teeth become loose, often hemorrhage; sloughing may occur and bone of jaw be laid bare; and, in extreme cases, death from exhaustion.

Q. What is the Treatment of Mercurial Stomatitis?

A. Dilute sulphuric acid with bitter tonics; or 5 drop doses of tincture of belladonna three or four times a day, or iodide of potassium, locally: strong solution of bichlorate of potassium, tannic acid, borax; etc.

Q. Describe *Syphilitic Ulceration of Mouth?*

A. Generally results from constitutional syphilis; initial sore is generally superficial, not often irritating, with discharge of but little pus; at times sore is phagedenic, glands of neck swollen and enlarged ulcer located on tip or side of tongue or on tonsil.

Q. Into what two classes may secondary syphilitic ulcers of mouth be divided?

A. Into such as result from abrasion or injury; and those that first make their appearance on dorsum of tongue, tonsils, or pharynx.

Q. What is the difference between syphilitic ulcers and epithelioma?

A. A syphilitic ulcer is more readily amenable to specific medication, and some evidence of secondary syphilis will be present on other parts.

Q. What is the treatment of Syphilitic Ulceration of Mouth?

A. All rough edges of teeth removed, and if this does not answer, then apply with camel's-hair brush three times a day, solution of ten grains of chromic acid to ounce of water, or if such fails, a mercurial course, and abstinence from use of tobacco, and alcoholic drinks.

DISEASES OF PERIDENTAL MEMBRANE AND TEETH.

Q. What is *Hypercementosis?*

A. *Hypertrophy* of *Cementum* of tooth.

Q. What are its effects?

A. Great enlargement of roots, and may, if large, cause neuralgic pains, and interfere with extraction of teeth.

Q. Where is the enlarged portion generally located?

A. Near apex of root, but may be on any part of cementum, and of different forms.

Q. What is the cause?

A. Local, or, as some contend, constitutional irritation of peridental membrane, also from effects on that membrane of occlusion; syphilis is also supposed to induce the affection.

Q. What is the treatment?

A. Iodide of potassium is recommended in earlier stages, but extraction is generally resorted to.

Q. What is *Erosion of Teeth?*

A. A characteristic disease of the hard tissues of the teeth in which there is a loss of substance without apparent cause, most commonly on labial surfaces of front teeth, and buccal surfaces of posterior teeth, characterized by irregular or cup-shaped excavations, or facets, in enamel, which present a smooth, polished appearance.

Q. How does it progress?

A. The facet increases in area and depth slowly, and passing through the enamel enters the dentine, retaining its hardness of surface and polish, with color unchanged.

Q. What is the cause?

A. Unknown; thought by some to be from acid secretions of mucous follicles; like small facets caused by the wear of a hard substance, or by grinding with a very fine stone which would leave a smoothly polished surface; the eroded surface retains its hardness and color; by others, that it is an absorptive process from congested condition of lip which gives rise to an acid secretion which erodes tooth structures, assisted by motions of lip; electrolysis is also ascribed as the cause; also hereditary syphilis; also to wear by tooth-brush.

Q. Does it ever occur on the palatal lingual and proximate surfaces?

A. Yes, occasionally; on the proximate surfaces of the teeth in the form of a round groove as if made with a round file.

Q. What objections arise to the theories advanced as to the cause of erosion?

A. Some of the worst cases have occurred where the tooth-brush has never been used; and also in cases where the lips, owing to injuries and surgical operations, have not been in contact with the eroded surfaces and hence no acid secretions from such sources. Some positive objection arises to every proposed cause.

Q. What is the duration of erosion?

A. It may cease to progress at any time, or it may continue until the affected teeth are destroyed. It may destroy the teeth within 3 or 4 years, or require 10 or more years.

Q. Can the area of erosion be limited by a filling?

A. No, a filling can only limit the depth of the erosion.

Q. During its progress when does sensitiveness occur?

A. Only when the dentine is reached.

Q. Why does it rarely happen that the pulp of the tooth is exposed by erosion?

A. Owing to its slow progress the slight irritation, long continued, of the dentinal fibrillæ causes the formation of secondary dentine before the erosion has advanced so deeply as the pulp.

Q. What is the treatment?

A. When far advanced, removal of eroded area, forming a cavity, and filling.

Q. What is *Abrasion of Teeth?*

A. A gradual loss of substance from mechanical causes, such as friction.

Q. What is the treatment?

A. Filling, also the covering of tooth with a gold cap.

Q. What is the condition of abraded dentine?

A. Extremely sensitive, which may lead to irritation of pulp.

Q. What are the remedies used for such sensitiveness?

A. Obtunders of sensitive dentine, such as phosphoric acid, cocaine, creosote, tannic acid, carbolic acid, chloroform, ether spray, chloride of zinc, caustic potash and carbolic acid, or bicarbonate of soda in solution, nitrate of silver, use of hot-air syringe, galvano cautery, or cocaine (alkaloid) ten grains, with sulphuric ether one and one-half drachms. If so abraded as to inflame pulp, devitalize the latter, and fill root canals.

Q. What is *Necrosis of Teeth?*

A. Death of entire organ, both pulp and peridental membrane.

Q. What are common causes?

A. Death of pulp, mechanical violence, mercury, debilitating diseases, impaired nutrition rendering tooth loose, loss of vascular supply, and great discoloration.

Q. What is the remedy for a virtually necrosed tooth?

A. Extraction.

Q. Name the causes of *Discoloration of Teeth?*

A. From increase of density; change of color on or in the enamel; depositions on the surface; the action of caries, and from devitalization of pulp.

Q. What are the most common of these causes?

A. Putrefaction processes which follow the death of the pulp, the pigmentary products of decomposition being organic in character.

Q. How do substances known as bleaching agents act?

A. By virtue of their property to evolve oxygen, and are known as oxidizing agents; those which act by virtue of their strong affinity for oxygen, removing the oxygen atom from the color molecule to form by-products the nature of which depends on the character of the bleaching agent.

Q. Name some of the oxidizing agents?

A. Chlorine, iodine, bromine, peroxide of hydrogen, pyrozone, sulphurous oxide.

Q. What is essential after the use of the bleaching agent?

A. To wash the cavity with hot distilled water before filling with oxychloride of zinc cement.

Q. How may discolored teeth be *Bleached?*

A. Remove all discolored dentine, and apply to cavity either chlorinated lime saturated with acetic acid one part, and water eight parts; or wash out cavity repeatedly with peroxide of hydrogen, and dry with hot air; or place a little aluminum chloride in cavity and saturate it with peroxide of hydrogen; or bathe cavity with solution of permanganate of potash, and then use alternately a four per cent. solution of sulphuric acid and Labarraque's solution of chlorinated soda, and repeat for short time; or one hundred grains of sodium sulphite and seventy grains of boracic acid, dry, and grind together in a mortar, place some in cavity and add a drop of water; or sodium sulphite one hundred grains, and boric oxide fifty-five grains, mix and use as above. Pyrozone (25 per cent. solution), and Peroxide of Sodium (50 per cent.) are efficient bleaching agents; also the cataphoric method (see Cataphoresis).

Q. What is meant by *Cataphoresis* (or Electrical Osmosis, or Electrical Diffusion)?

A. The introduction of drugs into the system through the skin by means of ointments or solutions applied by the electrode of a battery.

Q. Define the term *Cataphoric?*

A. Passing, or causing passage, from the anode to the cathode, through a diaphragm or septum.

Q. What is an *anode?*

A. The positive pole of a galvanic battery.

Q. What is a *Cathode?*

A. The negative electrode or pole of an electric circuit.

Q. Describe the principle of *Cataphoresis?*

A. Being a flow of fluids from the positive to the negative pole, if these fluids contain medicines which make them medicinal solutions, these medicines must flow from the positive to the negative pole conveyed by the current, and if application is made to the one tissue by the positive and to any remote tissue by the negative pole, and the solution has a tendency to flow with the current, then such medicines will travel in that direction.

Q. What battery appears to be the one best suited for the cataphoric method?

A. The Chloride of Silver Dry Cell Battery.

Q. Of what does the mechanism of the apparatus for applying the cataphoric method consist?

A. The *voltage* which represents the pressure of the current as indicated by the numbered attachments; the *milliampere dial*, which records the flow of the current through the tissue; the *current controller*, which furnishes in smaller quantities the further pressure upon the tissue as may be required; a large voltage is not necessary, as a low one will insure more comfort to the patient; there must be uniform and continuous pressure; to use this method on living teeth a *rheostat* is necessary to enable the operator to have perfect control of the current.

Q. What are the dental uses of cataphoresis?

A. For bleaching discolored teeth; for obtunding the sensitiveness of dentine; for extirpation of pulps; for aborting abscesses; for sterilization of roots; for abraded teeth; for preparation of teeth for crown and bridge adjustment, etc.

Q. What is essential for the medicinal solutions employed in the cataphoric method?

A. They must be conductors of electricity.

Q. What solutions are employed?

A. Cocaine, cocaine and guiacol, cocaine and chloride of sodium; oil of cassia and soda sulphate, cocaine and boric acid, eucaine, vapocaine, pyrozone, etc.

Q. Describe the operation of Bleaching a Tooth by the cataphoric method?

A. Apply the rubber dam, remove carious portion, and well expose the central division of the tubuli, seal the apical foramen, pack crown cavity with absorbent cotton, saturated with a 25 per cent. solution of pyrozone to which is added a solution of chloride of sodium; the anode of the positive pole, after the negative pole is attached by means of a band to the wrist of the patient, is applied to the cotton in the cavity and the current turned on; the current strength required is about 25 milliamperes, and the time required in the case of sensitive dentine is from 6 to 8 minutes, in some cases 15 minutes; when bleaching, from 2 to 5 minutes. The solutions must in all cases be aqueous, not ethereal or alcoholic; the wrist to which the negative pole is attached, should be protected against injury, by cotton saturated with the salt solution.

Q. What is *Alveolar Pyorrhœa?*

A. A disease characterized by destruction of peridental membrane, loss of walls of alveolar cavity, inflammation of surrounding tissues, deposit of either salivary or sanguinary calculi on roots of teeth, or of both varieties, formation of pus about roots of teeth, and a general calcic diathesis.

Q. What are the 2 general divisions?

A. Those of local origin, and those of constitutional derangement (Peirce).

Q. What are the three forms according to location and character?

A. Gingival, Cachectic or Phagedenic, and Gouty.

Q. What diathesis, according to Prof. Peirce, does this disease accompany when it is owing to constitutional degeneration?

A. The gouty diathesis.

Q. What are the predisposing and exciting causes of the gingival form?

A. Predisposing—catarrhal inflammation of gums, due to constitutional and local causes; the direct local cause is a sub-acute inflammation of margins of gums.

Q. What are the symptoms of this form?

A. Gum margins swollen and detached from their connection with the teeth; a probe passed into the space reveals the presence of calculus attached to the neck of the tooth, with absorption of margins of process, next to the deposit; if disease progresses, or if disease is slow in its progress, the periosteum of the bone is the seat of the affection, the mucous follicles at gum margin show degeneration, and the secretion becomes irritating and corrosive; the gums assume a purple color and become turgid and somewhat everted; opposite seat of calculus there occurs absorption of alveolar process; pyrogenic micro-organisms invade the pockets in gums and a degeneration of peridental membrane occurs, and at last this membrane is wholly destroyed, except at the apex of tooth, which is retained by a small attachment of fibrous tissue.

Q. What are local causes of this form?

A. Mal-occlusion, non-occlusion, irregular positions of teeth such as overcrowding; want of cleanliness is a prolific source of this affection.

Q. What is the source of the calcic deposits?

A. An altered secretion from irritated glands of inflamed gums coagulated by the acid of lactic fermentation of food, the lime salts from saliva are retained in the coagulum, the form of the calculus being determined by pressure of overlying gum (Burchard); the calculi act as irritants, causing inflammation, and when the organisms enter a suppurative degeneration of the peridental membrane ensues; coincident with this degeneration is the solution of the alveolar walls.

Q. What is the effect upon the tooth at an early stage?

A. Becomes loose and changes position, the looseness becoming progressive, and pus issues from gum-margins.

Q. How diagnose between alveolar pyorrhœa and alveolar abscess?

A. Alveolar abscess is usually preceded by acute apical periodontitis, and a probe may be passed to end of root without meeting with obstructions; in pyorrhœa such symptoms as characterize periodontitis in the incipiency, and a probe will meet with resistance from the still attached peridental membrane and calcic deposits are detected even if small in size.

Q. What is the treatment?

A. First remove all causes of irritation: when of local origin, local treatment is indicated, such as the removal of the sanguinary calculus with scaling instruments after first sterilizing mouth with a 3 per cent. solution of pyrozone; after use of scalers, loose teeth must be secured by ligature, or, with what is better, mechanical appliances; the pus-pockets are syringed with the same pyrozone solution, or with peroxide of hydrogen, after which antiseptic and stimulating applications are made, such as tincture of myrrh, etc. Sulphuric acid, (aromatic or officinal), also the use of peroxide of hydrogen alternately with iodide of zinc, two or three times a week, are employed with advantage. Black's 1, 2, 3 mixture is an excellent antiseptic.

Q. What characterizes the *Phagedenic form of Alveolar Pyorrhœa?*

A. A molecular disintegration of the peridental membrane, beginning between the gingival and apical portions of membrane, but nearer the latter, progressing rapidly towards gingival portion. In its incipiency no calcic deposits, and pus, although usually present, is sometimes wanting; the pain is obscure and difficult to locate definitely; the gum loosens from neck of tooth, and an instrument may be passed for a considerable distance towards apex of root; the pulp is still alive, as may be determined by applications of cold; the absorption of the alveolar walls is, it is claimed, a secondary factor in the history of this form, as these walls are more slowly destroyed than the peridental membrane; the degeneration of a portion of the peridental membrane and also the absorption of a portion of the alveolar wall may occur before the gingival margin is affected. Trichloracetic acid is a solvent of calculi.

Q. What is the treatment of the phagedenic form?

A. The removal of all dead and irritating matters, and the use of antiseptic and sterilizing injections, followed by such agents as will induce tissue regeneration in the form of healthy granulations; weak solutions of chloride of zinc are beneficial. The gum margins should, if possible, be preserved to prevent recession, and access to seat of disease, if attended to early, be gained by an incision forming a flap, the edges of which can afterwards be united by stitches. Prognosis is unfavorable.

Q. What characterizes the *Gouty form of Alveolar Pyorrhœa?*

A. It usually accompanies the gouty diathesis, which is regarded as a predisposing cause; any conditions which tend to weaken the vitality of the peridental membrane may also be regarded as predisposing causes; although the deposit of sanguinary calculus in contact with the peridental membrane may be regarded as an exciting cause, yet this form of pyorrhœa may occur without the presence of such a deposit being apparent; tests with cold water show the pulp to be still alive, and the pus generated may either perforate the gum, or burrow along the peridental membrane and find an exit at the neck of the tooth; the tooth progressively loosens, and an incision through the gum will show the destruction of a portion of the alveolar wall; no local cause is apparent to account for the disease. The prognosis is unfavorable.

Q. What is the *Treatment of Gouty Alveolar Pyorrhœa?*

A. Local treatment consists in securing loose teeth by ligatures, or mechanical appliances; correct faulty occlusion; remove thoroughly all calcic deposits, a solvent of caculi, such as trichloracetic acid may be required; pyrozone (25 per cent.) is effective, followed by antiseptic and astringent washes: Chloride or iodide of zinc gr. iij to water ℥j, are useful applications.

The constitutional treatment consists in the administration of such agents as will eliminate waste products through the bowels and kidneys; colchicum in acute form; in chronic form iodide of potassium; lithium water or bitartrate of lithium are good eliminants and increase alkalinity of the blood; alcoholic agents are to be avoided, and an anti-gout regimen prescribed.

Q. What is *Calcic Inflammation?*

A. Inflammation of gums or peridental Membrane caused by deposits of calculi.

Q. What are the causes?

A. Salivary and Serumal calculi.

Q. What is the treatment?

A. Removal of calculi with large and small scales, and the application of astringent and antiseptic lotions and injections.

Oral Surgery.

Q. To what Jaw is *Necrosis* most common?

A. The lower jaw, as the recuperative powers of this bone are less than those of the upper jaw.

Q. What are the causes?

A. The same as those of periostitis, such as accidents, inflammation of the periosteum, the pus of alveolar abscess burrowing between bone and periosteum, mercurial and phosphorous poisoning, local arsenical poisoning, gangræna oris, ulcerations of soft tissues of mouth, eruptive fevers, scorbutus, syphilis.

Q. What are the symptoms?

A. In the early stage like those of periostitis. The pus when upper jaw is affected, finds exit by side of loosened teeth, or through gums, the gums loosen from the teeth and bone, and pus oozes from between them. When the lower jaw is affected, the pus burrows through the tissues covering body of bone, and finds exit upon under surface of jaw, or on the neck, fetid odor, and if swallowed causes nausea and vomiting; often general emaciation and septicemia.

Q. What is the treatment?

A. No interference except opening subperiosteal abscesses and disinfection, until separation of sequestrum has occurred, when it should be removed, free openings made for discharge of pus, frequent irrigation with solutions of permanganate of potash and cinnamon water, which will correct the fetid odor, also with peroxide of hydrogen or pyrozone—3 per cent. Constitutional treatment: nutritious diet, milk, concentrated liquid foods, such tonics as iron, quinine, cod-liver oil, etc.

Q. How may *Caries of Bone* be distinguished from Necrosis?

A. Caries of Bone owing to the difference in density, gives a dull sound on percussion with a probe, while necrosis on percussion gives a sharp sound owing to its hardness, and resists penetration of the instrument.

Q. What are the Causes of Caries of Bone?

A. It is a chronic inflammatory condition caused in most cases by tubercular or syphilitic infection, and most frequently occurs in the lower jaw.

Q. What is the treatment?

A. Solutions of pyrozone, peroxide of hydrogen, aromatic sulphuric acid.

Q. Define *Septicemia*?

A. A disease characterized by the absorption of septic products; a form of blood poisoning.

Q. What are the Causes?

A. A product of putrefaction in the form of ptomaines absorbed by the system in the introduction of micro-organisms into the tissues; its prognosis is very unfavorable.

Q. What are its symptoms?

A. Serious constitutional disturbance, such as a high temperature—101° to 103°, great prostration, disorders of nervous system and internal organs, typhoid symptoms, and tendency to heart-failure, delirium, cold, clammy skin, and coma in fatal cases.

Q. What is the treatment?

A. Free drainage, irrigation with bichloride of mercury—$\frac{1}{1000}$, or carbolic acid—$\frac{1}{20}$, or peroxide of hydrogen in moderate quantity. Sometimes surface of wound is curretted to enable disinfectants to reach parts and expel micro-organisms.

Constitutional treatment: Saline purgatives, tonics, nourishing food, alcoholic stimulants, strychnia, digitalis, antipyretics.

Q. What is *Cleft Palate*?

A. A fissure existing in upper jaw at birth; often associated with a corresponding fissure involving the lips, the lateral halves of which fail to unite at median line.

Q. What is it due to?

A. Failure of the intermaxillary bones to develop.

Q. What may the fissure involve?

A. The lips, alveolar border of jaw, hard and soft palates, making a common opening of mouth, nose and pharynx.

Q. In extreme cases, where may the cleft extend to?

A. To base of skull.

Q. What characterizes single cleft palate?

A. Fissure occurring to one side of median line and confined to one intermaxillary bone.

Q. What characterizes double cleft palate?

A. Fissure occupying median line, the two intermaxillary bones being involved.

Q. What is the effect on certain teeth?

A. The premaxillary bones are joined in an irregular mass, attached to vomer or nasal septum projecting greatly, and as a consequence the incisors assume a malposition.

Q. What effect does such a deformity have upon speech and deglutition?

A. It impairs both.

Q. What is the best period for treatment of cleft palate?

A. Between ages of ten and sixteen.

Q. What must precede the cleft palate operation?

A. Repair of hare-lip, to lessen breadth of palatal cleft.

Q. What is operation for closure of cleft in hard palate called?

A. Uranoplasty.

Q. What does it consist in?

A. Freshen mucous edges of fissure; make incision down to bone and close to alveolar process, from immediately outside posterior palatine foramen as far forward as is necessary; raise soft parts between these incisions from hard palate, bring them together in median line, and secure by a suture; control the hemorrhage by pressure; then close fissure in soft palate by sutures, keep sutures undisturbed for five or six days, according to the tension of flaps; the halves of upper jaw may be pressed together by strong clamps and edges united by sutures, thus closing the fissure.

Q. What is *Staphylorraphy?*

A. The operation of closing a cleft in the soft palate.

Q. What does it consist in?

A. Paring or denuding the edges of cleft, to bring them in apposition; passing the silk sutures through the vellum; dividing the muscles of soft palate to prevent their separating the two halves, and thus have vellum at rest, and then tying the silk sutures, which are one-fourth or three-sixteenths of an inch apart, and are not tied so tightly as to strangulate the tissue.

Q. What is *Hare-lip?*

A. The failure of lateral portions of upper lip to unite, and is single or double as the fissure corresponds with position of one or both intermaxillary bones, as in cleft palate with which hare-lip is often associated.

Q. What is the treatment of hare-lip?

A. Should be closed as soon as possible after birth, not more than a few months, when parts are more amenable to treatment. The mucous borders are removed, and the raw surfaces united by suture, removing as little tissue as possible, to prevent making lip already short, any more so; and it is necessary to dissect lip and cheek from upper jaw to bring sides of fissure together and keep them so without tension. Professor Tiffany passes through each cheek the end of a wire suture, catching it to a flat button, to take all strain from line of union, the button resting on thick adhesive plaster to prevent injury to skin.

Q. What is a *Cyst?*

A. A sac containing fluid; a hollow tumor filled with fluid or semi-solid contents.

Q. What are *Dentigerous Cysts?*

A. Cysts in connection with teeth, and common to either jaw.

Q. When in upper jaw what are they liable to be mistaken for?

A. Antral cysts.

Q. Describe progress of dentigerous cysts?

A. Painless, and of slow growth, bone surrounding them is gradually expanded, and owing to absorption becomes very thin or may disappear, adjacent structures may be displaced until deformity results; sometimes a firm shell of bone surrounds the increasing cyst, but usually fluctuation can be felt.

Q. What does the contents of such a cyst consist of?

A. Clear fluid, more or less brown in color, and an unerupted tooth.

Q. What is the treatment?

A. Open cyst freely, remove, if necessary, a portion of the wall, and bring about granulation and contraction. If the cyst is due to an unerupted tooth, make free incision and remove the tooth, when cavity will heal by granulation.

Q. What is the best means for diagnosing a dentigerous cyst?

A. Make an incision; the non-appearance of a tooth, and the peculiar form of the tumor may also assist in diagnosing.

Q. What is a frequent cause of cystic formations?

A. Displacement of a tooth.

Q. What effect may a misplaced tooth have upon bone?

A. May cause excessive growth, and be the nucleus of a tumor.

Q. Define the term *Fracture?*

A. A solution in the continuity of a bone.

Q. Name and define the varieties of Fracture?

A. *Partial* or incomplete—where some of the bone fibres have given way while the rest have yielded, bending but not breaking as in young bones; *Complete*—where the bone is broken through; *Simple*—in which there are two fragments, or a break in bone without external communicating wound; *Compound*—in which the ends of fragments have penetrated skin, or an external wound leads down to fracture; *Comminuted*—where bone is broken into a number of pieces; *Compound Comminuted*—where in connection with a comminuted fracture, there is an external wound; *Complicated*—where a serious injury of the part accompanies the fracture; *Impacted*—where one fragment is driven into and fixed in the other; *Intra-periosteal*—one unaccompanied by laceration of the periosteum.

Q. How are fractures classified according to direction of the separation?

A. Into oblique, transverse, longitudinal; also called intra-articular; spontaneous.

Q. What is the Cause of Fractures?

A. Violence.

Q. The Fracture of what jaw is the most frequent?

A. That of the lower jaw.

Q. What is the common cause of *fracture of upper jaw?*

A. Direct violence, or a blow upon malar prominence.

Q. What is the treatment for Fracture of Upper Jaw?

A. In many cases no splint is necessary as infiltration from inflammation and stiffening of periosteum will keep edges of fracture in apposition. In cases of very extensive fracture, no pieces of bone or teeth should be removed, but all replaced, and retained by interdental splint, the mouth kept clean; and as the pieces unite they should be placed in their proper position.

Q. What is *Fracture of Lower Jaw* commonly due to?

A. Direct or indirect violence, and generally through body of bone.

Q. What other parts of lower jaw besides body may be fractured?

A. Ramus, neck of condyle, coronoid process, rarely symphysis.

Q. What is nature of fracture of ramus?

A. If between masseter and internal pterygoid muscles, there will be no displacement of fractured end; but a fracture just in front of masseter muscle is difficult to retain in position. Often it is accompanied with one of body of bone.

Q. What is nature of fracture of neck of condyle?

A. The condyle is drawn forward by external pterygoid muscle; the zygoma so protects neck of condyle, that its fracture generally results from a blow on the chin.

Q. What is the nature of fracture of coronoid process?

A. Very rare, and could only be due to action of temporal muscle, and is difficult to diagnose; the fractured parts can only be brought together by wiring.

Q. What is the nature of fracture of Body of bone?

A. Depends upon force of the injury and direction of line of fracture. It is generally easy to bring parts in apposition in cases of single fracture; in double fracture, with considerable drawing of parts downward, the middle portion must be secured by wiring it at each end.

Q. What is the nature of fracture of body in front of angle of jaw?

A. The masseter muscle raises the posterior part of bone.

Q. What fracture of the lower jaw is the most difficult to diagnose?

A. Where condyle is broken from rest of bone.

Q. What are the symptoms of fracture of lower jaw?

A. History of injury, pain, crepitation, loss of power or function, irregularity of the arch of teeth, undue mobility, and excessive flow of saliva.

Q. What is the treatment of Fracture of Lower jaw?

A. Four-tailed bandage with or without pasteboard cap for chin, is the most simple and often an effective appliance; an emergency appliance may be made in form of interdental splint with modeling composition held in partial cups of block tin like impression cups without handles, or metal caps fitted over fractured jaw, or wire splints with ligatures, Kingsley's splint of rubber and wires with free ends, or the interdental rubber splint.

Q. Define *Dislocation?*

A. The complete or partial separation of the articular surface of one bone from that of another.

Q. How does Dislocation of Lower Jaw occur?

A. Either as a unilateral or a bilateral accident, the bilateral being the most frequent.

Q. How can displacement of condyle from glenoid cavity occur?

A. Only forward; never backward or upward or outward without fracture of bone, such as margins of glenoid cavity.

Q. Name and define the varieties of Dislocations?

A. *Traumatic*—the result of external violence, or of muscular action; *Pathological*—from destruction of a part by disease; *Congenital*—those in which some part of a joint has never developed.

Q. What is a Simple Dislocation?

A. Where there is displacement without injury to any other tissue.

Q. What is a Compound Dislocation?

A. One in which there is a wound which exposes some part of the articulation.

Q. What is a Complicated Dislocation?

A. One in which important nerves, blood vessels or other tissues are involved.

Q. What are the causes of dislocation?

A. Violence, spasm of external pterygoid muscle, relaxation of structures composing temporo-maxillary articulation, tooth-extraction, vomiting, yawning, shouting, violence, such as a blow.

Q. What are the symptoms of Dislocation of Jaw?

A. Deformity. Mouth remains open, speech and deglutition impaired, rigidity, profuse salivation, temporal muscle is stretched and tense above zygoma and, in some cases, the coronoid process can be felt from inside of mouth, a depression in front of ear, great pain, and in unilateral, the symphysis is more on non-dislocated side; the severe pain is of a dull, sickening character.

Q. Having occurred once, is it prone to happen again?

A. Yes, on account of membranous joint structures remaining relaxed.

Q. What is the method of reduction?

A. Seat patient in operating chair, head supported by rest, thumbs of operator wrapped in a napkin to prevent bruising, and having them bitten; operator stands in front of patient and passes thumbs into mouth until they rest on the right and left posterior molar teeth; then he makes downward and backward pressure, and at same time let fingers rest easily on skin over angles of jaw; the condyles are thus made to glide backward over articular eminence; then close jaws tightly and bandage them. When the dislocation is bilateral and of long duration, it may be necessary to reduce one condyle at a time.

Q. What is the structure of solid non-malignant *Tumors* of upper jaw?

A. Fibrous, Cartilaginous, and Osseous.

Q. What is a *Tumor?*

A. A more or less circumscribed mass of tissue, the cells of whose structure are of the same kind as those of the tissue in which it is found or derived.

Q. What are *Malignant Tumors?*

A. Those of rapid growth with infiltration of surrounding tissues, tendency to recur after removal, metastasis, involvement of neighboring or lymphatic glands; general cachexia.

Q. What are *Benign Tumors?*

A. Effects simply local, system does not suffer, clinical characters just the opposite of Malignant tumors.

Q. Mention the different kinds of tumors of the mouth and jaws?

A. Epulis, Epithelioma, or Carcinoma, Sarcoma, Fibroma, Osteoma, Papilloma, Chondroma, Neuroma.

Q. What is the nature of *Fibrous Tumors of Jaw?*

A. Firm, elastic, at times lobulated, within white, and presenting a structure of interlacing bundles of fibres.

Q. Where are they generally situated?

A. Periosteum of alveolar ridge, peridental membrane and antrum.

Q. What is the usual cause?

A. Irritation, a blow, diseased tooth, etc.

Q. What is their progress?

A. Of slow growth, and inducing more or less deformity and functional interference according to situation.

Q. What is their effect on antrum?

A. When large, expansion of upper jaw and absorption of bone, projection towards nose, mouth, or pharynx, or downward may fill the mouth and cover the teeth, displace the eye, cause epistaxis, and by pressure displace adjoining organs and tissues.

Q. What is sometimes observed in such growths?

A. Calcareous degeneration of a portion.

Q. What is the nature of *Enchondroma* of upper jaw?

A. A tumor on outer surface of the bone, beginning early in life, of slow growth, no pain, but great deformity on account of displacement of neighboring organs by pressure. Enchondroma is harder, of slower growth and less irregular on surface than fibroma.

Q. What is the treatment of Enchondroma?

A. Extirpation of the tumor, and also of subjacent bone.

Q. What is *Osteoma?*

A. A bony tumor from anterior surface of jaw, antral wall, or, rarely, from palate.

Q. What is its nature?

A. Slow growth, extreme hardness, deformity of adjacent tissues, sometimes invades both antrum and orbit, and becomes quite large, extremely hard, ivory-like, sometimes called *ivory exostosis.*

Q. What is the treatment?

A. Free excision, and removal of portion of subjacent bone.

Q. Where is endostial fibroma most common on lower jaw?

A. Between symphysis and angle, may occupy dental canal and involve inferior dental nerve.

Q. What is the direction of its growth?

A. Downward and outward.

Q. Where is Ivory Exostosis generally found?

A. Near angle of lower jaw.

Q. What is *Hypertrophy of Gums?*

A. An excessive growth of normal tissue as a result of chronic inflammation.

Q. What oral tissues are prone to hypertrophy?

A. Gums and mucous membrane.

Q. What is the pathology of Hypertrophy?

A. An excess of blood which is devoted to the development of extra growths, such as excessive fibrous stroma.

Q. Describe Hypertrophy of Gums?

A. The extra growths of the points of gum between teeth and thickened margins of gum around necks of teeth, in the form of smooth, pink or warty masses.

Q. What is *Hygroma?*

A. A serous bursa or cyst caused by growths of cartilage and sarcomatous tissue, and common to joints such as that of the wrist, etc., etc.

Q. What is the treatment?

A. In some cases rest of part, moderate pressure and counter-irritants; but generally, it is necessary to incise the sac, evacuate the contents, currett out the interior, and irrigate with 1.1000 solution of bichloride mercury.

Q. What change often occurs in the alveolar border of bone of jaw?

A. Decided expansion; but no new glandular or epithelial elements in the gums.

Q. What is the localized form of *Hypertrophy of Gums* caused by?

A. Irritation, lack of cleanliness, presence of salivary calculus.

Q. What is the treatment of Hypertrophy of Gums?

A. Attention to proper hygiene of mouth; excision of hypertrophied gum; use of stimulants and astringents such as tannic acid, or the acid may be combined with wood creosote; also strong tincture of myrrh; sometimes excision of edge of alveolus is necessary; hemorrhage can be controled by tannic acid, or powdered subsulphate of iron.

Q. What is *Epulis?*

A. A tumor of any kind growing from, or in connection with gum.

Q. Describe a *Fibrous Tumor of Gum?*

A. Generally sessile; originates from periosteum of alveolar border, within the socket; slow in growth, painless, may interfere with neighboring structures; smooth, rounded or lobulated, somewhat elastic, of natural color, benign.

Q. What is the treatment?

A. Excision; if periosteum and adjacent bone are involved they should be removed.

Q. To what class do malignant growths of Jaws generally belong?

A. Class of *Sarcoma* being the most rapidly fatal.

Q. Describe growth and progress of Malignant Tumor of Jaws?

A. May arise either from alveolus, or from body of bone, from surface or centre; if from periosteum, a shell of bone generally partially encloses it; its first increase is slow, and for months the bone may slowly expand, or natural cavities be entered; at length absorption by pressure of the obstructing bone occurs, when growth becomes rapid, and tumor loathsome; outgrowths, protrusion, sloughing, and hemorrhage follow; early but little or no pain, later very severe, especially when trunk of nerve is invaded.

Q. How may benign and malignant tumors be distinguished?

A. By such diagnostic points as cause, rapidity of growth, incorporation of neighboring parts, action on mucous surface (pedunculated), secondary growths, either glandular or otherwise.

Q. What is *Epithelioma* or *Carcinoma?*

A. The only form of cancer affecting the jaws; may occur in the comparatively young; first appears in the gums and spreads to the bone. It rapidly infiltrates the surrounding tissues, and is distinguished from the non-malignant tumors by its rapid infiltration; the skin becomes adherent, and of a brawny-red appearance. First appears as an indurated plane, somewhat elevated, with eroded or ulcerated surface about centre; base and edges of a pink color; generally on gum over lower jaw; painful; extends along the jaw, composed of epithelial cells;

lymphatics early involved. Generally due to irritation from carious tooth, or ill-fitting denture.

Q. What is the treatment?

A. Removal of affected gum and adjacent bone by free excision, and application of chloride of zinc paste. Unless early removed the case is hopeless.

Q. What is *Ankylosis?*

A. Stiff joint from union of bones.

Q. What may cause *Ankylosis of Jaw?*

A. Tumors of parotid gland, pharynx, or soft palate and by their size, may prevent free motion of lower jaw, mumps cause stiffness; reflex spasm of muscles of mastication from eruption of wisdom teeth, and extraction gives relief; diseases of temporo-maxillary articulation; adhesions and cicatrices, from salivation cancrum oris, wounds, results of scarlet and other fevers, etc.

Q. What is the treatment of ankylosis from adhesions and cicatrices?

A. Gradual stretching of cicatricial bands, with many small incisions into such bands; stretching by Goodwillie's gag, teeth should be protected by plates over them; rubber wedges have also been used; the excision of a condyle is sometimes necessary.

Q. What is the treatment of *Mucous Cysts of Lips?*

A. Evacuate contents with a seton, and the inflammation will cause their walls to adhere; if this fails, a free incision and application of strong tincture of iodine.

Q. What is the treatment of *Ulcers of Lip* due to herpes or to cracks from cold?

A. Oxide of zinc-salve, with occasional application of sweet spts. of nitre.

Q. What is the nature of a *Cicatricial Adhesion* between the mucous membrane of cheek and alveolar ridge?

A. It may be in the form of a cord-like attachment which interferes with the proper outlining of a denture, or with its stability, especially if it is located on a level with the top of the alveolar ridge.

Q. Describe its action when so located?

A. The movements of the cheek transmitted through the cord-like attachment will tend to displace an artificial denture.

Q. What may cause such an adhesion?

A. It may result from the healing of the fistulous opening from an alveolar abscess; from wounds of the mouth caused by incisions, or mutilation of soft tissues in extracting teeth; from caustic agents; from ulcerations resulting from diseased conditions of the oral mucous membrane, such as poisoning by mercury (salivation); also as a sequela of scarlet and other eruptive fevers, etc.

Q. Describe the *Treatment of a Cicatricial Adhesion?*

A. Sterilize the mouth with an antiseptic solution of borine, listerine or boric acid, etc.; paint the part with a 10 per cent. solution of cocaine, or with vapocaine or chloretone; draw the cicatricial tissue tense, by drawing or forcing the cheek from the alveolar wall and with a sharp bistoury divide the attachment, the incision to be made in the middle of the cord-like attachment; apply a styptic such as tannic acid, alum or powdered subsulphate of iron, or the spray of peroxide of hydrogen; dry the cut surfaces with lint or absorbent cotton, and paint them with styptic collodion, or with antiseptic varnish such as steresole; direct patient to use as an antiseptic mouth-wash several times a day, either borine, listerine, or borolyptol, etc., in proper solutions. If unhealthy granulations appear, apply to such a surface a solution of nitrate of silver (gr. iv to ℥ j of water), keeping the surfaces separated with lint.

Q. Name the *Diseases to which the Maxillary Sinus is liable?*

A. Suppurative inflammation or Abscess; traumatic injuries; catarrh; mucous engorgement; syphilitic ulceration; necrosis of walls; mucous cysts; tumors.

Q. What causes *Suppuration of Antrum—Abscess of Antrum?*

A. Disease about roots of superior first and second molar teeth, as the ends of their roots often project into floor of antrum, or are close beneath it, traumatic injuries, catarrhal affections.

Q. What lesions of teeth?

A. Alveolar abscesses, dead pulps and malplaced teeth.

Q. What are the symptoms?

A. The beginning of affection is usually insidious, unless opening into nose is closed; a dull, deep-seated pain over face and forehead, which later grows more intense, and is reflected to ear, assuming a sharp, penetrating character; cheek swollen and tender; thinning of walls by dissolving action of the pus; crepitus or pressure; formation of pus indicated by rigor, followed by rise of temperature and constitutional disturbances; there is a feeling of distension and heaviness in upper jaw, which the discharge of pus will relieve, and which will run out into nose or throat on lying down on one side; bad taste and smell; nausea from pus being swallowed; if the pus cannot escape into nose, there is pain, fever, rapid pulse, distension of walls of antrum and absorption of the walls, perforation, and sudden flow of pus, with relief of symptoms; in extreme cases the eye may protude and inflammation extend to membranes of brain; both antra may be thus diseased; it is often a catarrhal inflammation.

Q. What is the escape of the pus due to?

A. The absorption of the walls, and the penetration of the soft tissues.

Q. What are the locations at which the rupture of the walls occurs?

A. At points which offer least resistance, such as the nasal wall, palate process, infra-orbital plate, or roof of antrum; sometimes the buccal wall gives way, or the pus may follow the root of a tooth which penetrates the antrum, and discharge in mouth; rarely it may take a backward course, after penetrating orbit of eye, and reach the brain through the sphenoidal fissure, or optic foramen.

Q. When the escape of pus is through nose, what causes the offensive odor?

A. The presence of hydrogen sulphide gas, liberated by decomposition of albuminates in the discharges.

Q. What is the condition of teeth of affected side?

A. The teeth are often painful to percussion when they do give rise to the affection; when due to lesions of the teeth, the diseased ones are more painful to percussion, and sensitive than the adjoining ones; but in some cases the teeth are not affected in such a manner.

Q. What are the diagnostic signs?

A. Location and character of pain, discharge from one nostril, except where both antra are affected, swelling of face, bulging out of side of face, tenderness of affected side, crepitation, soreness of teeth to percussion, protrusion of eyeball, fetor of breath.

Q. What diseases of antrum may be confounded with its suppuration?

A. Tumors, especially osseous ones, which may be diagnosed by the electric mouth-lamp, or stomatoscope.

Q. What is the treatment?

A. The removal of diseased tooth, if it is the cause; if not from a tooth, the second molar should be extracted, and antrum in all cases freely opened (usually ¼ inch opening) through the alveolar cavity, and kept clean by frequent syringing with antiseptic solutions; some prefer opening on outer wall of alveolus between first and second molars.

Q. How can opening from alveolar cavity into antrum be made?

A. By antral trephine, or spear-pointed drill operated by the dental engine; and it should be prevented from closing by a small silver canula, or a small metal plate fitting portion of ridge about opening, with a small tube attached to fill aperture, and facilitate flow of pus and syringing.

Q. What solutions are used for syringing or irrigating antrum?

A. First with mild injections, afterwards with gently stimulating ones. Weak solutions of sulphate of zinc and rose water; permanganate of potash (two grains to ounce of water); listerine; warm solution of salt and water, followed by permanganate of potash; carbolic acid one part, oil of sweet almonds fifteen parts on cotton, to be retained for some time in antrum; Thiersch solution; or boric acid solution.

Q. What is the treatment of *Mucous Engorgement of Antrum*, resulting from acute coryza, or *la grippe?*

A. The same as for suppuration of antrum; it is recommended, however, to obtain entrance by passing probes or sounds of different diameter into antrum by natural opening into nose, thus expanding it to secure drainage; if this is not possible, then making an opening through alveolar process between the first and second molars.

Q. When may the Antrum become involved in *Syphilitic Ulceration?*

A. When the roof of mouth is the seat of destructive syphilitic process; it is a manifestation of the tertiary form of syphilis; it rarely if ever originates in the antral cavity; quite common in the nasal cavity.

Q. How diagnose this affection?

A. No characteristic symptoms, except swelling at angle of nose and cheek, that distinguish it from those of the nose; it is like syphilis of nose, often diagnosed as ozena, fetid catarrh, etc.

Q. What is the treatment?

A. That of tertiary syphilis; no mercury, but iodide of potassium, beginning with 10 to 15 grains, three times a day, gradually increasing the dose; as a disinfectant and deodorizer boric acid and cinnamon water equal parts.

Q. What may cause *Necrosis of Walls of Antrum?*

A. Diseased teeth which induce periostitis, such as are affected with periodontitis and alveolar abscess; also local arsenical poisoning by the careless application of arsenious acid to devitalize pulp, injuries, pus in antrum, syphilis, mercurial and phosphorus poisoning, etc.

Q. What are the symptoms?

A. Those of Necrosis of jaw.

Q. What is the treatment?

A. The same as for necrosis of jaws, etc.

Q. What are *Mucous Cysts of Antrum?*

A. Cysts arising from the mucous follicles of its lining membrane, and at times of such a size as to fill the antrum, and causing disfigurement by the distension of its walls.

Q. What is the treatment?

A. After opening the antrum, the walls of cyst are cut away and the inner surface of cavity is curetted at the point from which the cyst has formed, and a free drainage is established and antiseptic washes (boric acid) employed.

Q. What is *Polypus of Antrum?*

A. A small pedunculated tumor growing from its mucous surface, and similar in structure to nasal polypus; the symptoms resemble those of mucous cysts, their size only leading to their diagnosis.

Q. What is the treatment?

A. Thorough extirpation; irrigation of cavity with antiseptic solutions.

Q. Define *Periostitis of the Jaws?*

A. Inflammation of the periosteal covering of the jaws.

Q. In what forms may the acute variety appear?

A. Either as a simple local inflammation, which may become suppurative, resulting in subperiosteal abscesses; or it may be diffuse and infective, depending upon the cause or severity, and diathesis present.

Q. How may it terminate?

A. In resolution, suppuration, or necrosis.

Q. What are the causes?

A. Difficult eruption of teeth, irritation of diseased teeth, or devitalized teeth, injuries, eruptive fevers, typhoid conditions, syphilis, scorbutus, exposure to cold, chemical poisons, as mercury, and vapor of phosphorus.

Q. What diatheses are predisposing causes?

A. Scrofulous, tubercular, and syphilitic.

Q. What are the symptoms?

A. Elevation of temperature, general constitutional disturbance, swelling and conjestion of gum and affected side of face, severe, bursting pains, loose teeth elevated in their cavities, excruciating pain on pressure or percussion on teeth. Swelling extending down neck, pus pointing beneath jaw, or burrowing between muscles, even as low down as clavicle, spasmodic closure of jaws.

Q. What is the treatment of Acute form?

A. Extraction of offending teeth, local depletion by free scarification of gum, cold application, or, if painful, hot fomentations, or hot water held in mouth opiates to relieve pain; for suppurative stage, free incisions to bone within mouth as soon as pus has formed, evacuate pus, and irrigation with antiseptic solutions of boric acid, etc. Constitutional treatment—good food, tonics, such as iron and cod-liver oil, and stimulants.

Q. What is the *Chronic* form usually the result of?

A. Syphilis.

Q. What is the treatment of Chronic form?

A. Iodide of potassium (20 grs. in divided doses 3 times a day), comp. syrup of sarsaparilla increased to drachm doses.

Q. What is the treatment of Mercurial Periostitis?

A. Eliminating the mercury by iodide of potassium (5 to 10 grs.) in solution, saline cathartics; local treatment—scarifying gums, painting them with equal parts of tinct. of aconite and iodine, or tinct. of iodine and glycerine, equal parts; as a mouth-wash chlorate of potassium 1 drachm to ounce of water; for fetor of breath, permanganate of potassium, 2 to 10 grs.; solutions of listerine or boric acid as antiseptic washes.

Q. What is *Arsenical Necrosis?*

A. Necrosis of alveolar process due to careless application of arsenious acid for devitalization of tooth-pulp; or from the penetration of arsenic beyond apical foramen, and causing the death and sloughing of soft tissues and also of process.

Q. What is the treatment?

A. The same as that of necrosis of Jaws from other causes (which see). The application of hydrated oxide of iron (sesquioxide) to the injured tissues as an antidote for the arsenic remaining in them.

Q. What is *Phosphorous Necrosis?*

A. Maxillary necrosis from poisonous fumes of phosphorus gaining access to the periosteum.

Q. What are the symptoms?

A. Like that of toothache at first, then excruciating pain in jaw, great swelling, often over side of face and head; abscesses opening upon external surfaces, deterioration of health, constitutional disturbance, death at times from exhaustion.

Q. What is a characteristic feature?

A. A pumice-like deposit upon sequestrum.

Q. What is the treatment?

A. Local treatment is that of ordinary necrosis of jaw, and constitutional that of sustaining the vital powers by tonics, stimulants, and concentrated liquid food.

Q. What does *Syphilitic Necrosis* of a severe form always precede?

A. Death of the bone in region of mouth and nose.

Q. How does the *Reproduction of Bone or Repair*, after necrosis, differ in the upper jaw from that in the lower jaw?

A. True bone is rarely reproduced in upper jaw, but instead there is developed a hard, fibrous tissue; in lower jaw reproduction of true bone is the usual result.

Q. What causes a *Mucous Patch?*

A. The transformation of a syphilitic papule, under the combined influence of warmth, moisture, and friction, as on a muco-cutaneous surface, especially at such a junction as the corners of the mouth.

Q. What is the character of a mucous patch?

A. On the transformation of the papule (which is of a copper color) the mucous patch assumes a gray color, or becomes opalescent on a mucous surface, while on a cutaneous surface it is red, smooth, and polished; it is also moist with a free secretion; often offensive, and always highly contagious; treatment is that of syphilis.

Q. What is a *Gumma?*

A. A gummy tumor from peculiar caseation of tertiary syphilitic inflammatory deposit.

Q. What are gummata of tongue an important manifestation of?

A. Of tertiary syphilis, and they may be either submucous, or muscular in their origin; the submucous are of the size of a pea or cherry stone; single or multiple; commence to soften after their appearance, and discharge through a small orifice in top of tumor; muscular gummata are larger and commence as small hard tumors, and reach the size of a hazelnut; they open by a small, narrow channel which enlarges and extends along the muscular fibres.

Q. What may gummata of tongue be mistaken for?

A. Only for tubercular ulcers, or for epithelioma.

Q. What do gummata of soft palate sometimes result in?

A. Perforation of palate bones.

Q. What are the symptoms when on the soft palate?

A. The soft palate becomes red and thickened at one point, or over its entire surface, and the induration and thickening can be felt with the finger; the immobility of the palate is a prominent symptom, and with the induration and thickening, is a valuable diagnostic sign; they are slow and insidious, and cause no pain or discomfort.

Q. What is the treatment?

A. Mercurial; local—such as the application of sulphate of copper or nitrate of silver; later, iodide of potassium internally.

Q. Where are *Muciparous Cysts* of the Oral Mucous Membrane found?

A. Upon lips, cheeks, palate and tongue.

Q. Describe them?

A. Small in size, varying from pin-head points to that of an almond; their walls are very delicate, the mucous membrane covering them very thin, at times almost transparent, and easily ruptured; contain a viscid fluid, or, if of long standing, serous in character; on rupturing spontaneously, they leave a deep circular ulcer, slow to heal.

Q. What is the most common seat of these cysts?

A. The lips; the lower especially.

Q. Where are muciparous cysts of soft palate usually found?

A. Near tonsils, and of frequent occurrence; their form is usually globular or ovoid; on the tongue they are usually on dorsum or borders, especially on posterior portion; fluctuation can be detected in the larger ones.

Q. What are the causes?

A. Obstruction of mucous glands, or over-secretion of fluid by gland.

Q. What is the treatment?

A. Excision of cyst and destruction of its walls in cases of small cysts; puncture or incision and evacuation of contents in cases of large cysts, and walls destroyed with nitrate of silver (stick form); may be packed with antiseptic gauze to promote granulation.

Q. What is the treatment of *Cracked or Chapped Lips?*

A. By constant application of simple or rose water ointment, and a strip of court-plaster; if fissure persists, cauterize with nitrate of silver, first using cocaine.

Q. How treat Herpes of lips—Cold Sores or Fever Blisters?

A. Apply a little nitrate of mercury ointment.

Q. How are cysts of lips, due to obstruction of mucous follicles, treated?

A. Freely laid open, dried out with lint, and inside painted with strong nitric acid.

Q. What is *Salivary Fistula* due to?

A. Usually in line of Steno's duct, from injury, operation, or abscess following obstruction; if duct is opened externally, saliva escapes and a fistula is the result.

Q. What is the treatment?

A. Establish opening in the mouth, by passing a probe into fistula and cutting down on it from within, and passing probe daily; then close fistula by touching it with a thermo- or electro-cautery; or a seton may be passed through fistula into mouth, brought out, and the two ends tied; if fistulous opening is small, use fine point of an electric cautery.

Q. How may *Hemorrhage from wounds of Tongue* be arrested?

A. By hot water, ice, exposure to air, or tying ranine artery if it is profuse; then treat wound with weak washes of Condy's fluid, or a paint of iodoform and alcohol.

Q. What does *Plastic Surgery* comprise?

A. All reparative measures whether applied to skin, tendons, nerves or the skeleton; now restricted to reparation of defects of skin and mucous membranes adjoining natural openings.

Q. What does it consist of?

A. Transplantation and Skin grafting.

Q. What are its divisions?

A. *Autoplasty*, when a defect is covered by living tissue taken from body of patient; *Heteroplasty*, wherein living tissues foreign to body of patient are employed.

Q. Describe *Inflammation of Parotid Gland?*

A. Commonly known as Mumps, also as Parotitis, an infectious disease which may affect one or both glands; usually occurs in males at an early age.

Q. What are its symptoms?

A. Begins with rigor, nausea, rise of temperature, and general lassitude followed by dull pain in back of jaw, considerable swelling, and interference with mastication and deglutition; mild cases may consist in slight stiffness of jaw and pain when masticating, the constitutional symptoms slight. The disease may manifest itself first on one side of face, then upon the other; one attack secures immunity from any subsequent one.

Q. What is the principal danger?

A. Metastasis of testes, mammæ, and ovaries: due to effects of a cold.

Q. What is the duration of disease?

A. Usually from 8 to 12 days, when it usually terminates in resolution, rarely in suppuration.

Q. What diseases may it be a sequel of?

A. Typhoid fever, scarlet fever, puerperal fevers, erysipelas, variola, or be associated with pyemia.

Q. What is the treatment?

A. In mild form protection against taking cold; in a more severe form, rest, protection from sudden change of temperature, dry heat to face, hot brick in flannel, hot water rubber bag, will relieve the pain; liquid food; saline cathartic, tonics, and anodynes in severe cases.

Q. How may *Salivary Calculi* cause inflammation?

A. By its deposit in the ducts, or in substance of the Salivary Glands; usually in the ducts of the glands.

Q. In what glands are these deposits usually found?

A. In ducts of submaxillary and sublingual glands; rarely within the duct of parotid gland.

Q. To what period is a deposit of Salivary Calculus most common?

A. Between ages of 20 and 40 years; although cases are recorded as early as 12th year.

Q. What are the symptoms of calcic inflammation?

A. Acute inflammation with extensive swelling in floor of mouth about tongue, fulness of submaxillary triangle, often severe pain, with rise of temperature, nausea, dizziness, and a feeling of prostration; at times the calculus forms a hard mass within the duct, of an oblong form, sometimes spindle-shaped.

Q. What are the causes?

A. Generally some foreign substance which has lodged in duct, or the micro-organism *leptothrix buccalis*.

Q. What is the treatment?

A. The removal of the calculus by an incision within mouth over the calculus, and its excision by forceps, and use of antiseptic lotions.

Q. What is *Neuralgia?*

A. Severe paroxysmal pain in a nerve.

Q. What is its nature and causes?

A. It may be the result of neuritis, or it may occur without any apparent structural change in the nerve-tissue; the causes may either be predisposing or exciting.

Q. What are the predisposing causes?

A. Hereditary tendency, such diseases as gout, anæmia, rheumatism, nephritis, syphilis, malaria, mercurial poisoning, also the effects of lead, arsenic, antimony, phthisis, diabetes, influences associated with sex, pyemia, indigestion, etc., etc.

Q. What are the exciting causes?

A. Irritation of nerves, injuries, atmospheric changes, local action of heat and cold, and febrile diseases.

Q. At what age is the predisposition to nervous diseases most common?

A. In middle life; also in cold and damp seasons.

Q. What is *Trifacial Neuralgia?*

A. Neuralgia of the trifacial nerve; commonly called tic douloureux.

Q. In what two forms does it appear?

A. Acute and chronic—acute, usually associated with, or dependent upon inflammatory conditions of teeth and alveolar processes, etc., and usually disappears on removal of the cause; chronic, which is persistent, and usually due to structural changes in the nerve, or blood vessels connected with it.

Q. Although neuralgia may exist in any nerve from neuritis, in what nerves does it most commonly occur?

A. In the trifacial and sciatic nerves.

Q. When affecting the superior maxillary division of the 5th pair, where is the pain usually located?

A. In superior teeth, gums, and maxillary bone.

Q. When affecting the inferior division of 5th pair, where is the pain most frequently located?

A. Inferior teeth, gums, and integument of lower lip and chin.

Q. What are the symptoms of neuralgia of 5th pair?

A. Excruciating pain; in trifacial neuralgia the pain is sudden, acute, in distinct paroxysms, with longer or shorter intervals, sharp, stinging (like the sting of a wasp), and may last for an hour or two or for many hours; it may be excited at any time by eating, laughing, talking, etc., or by mental impression.

Q. What is the treatment of Trifacial Neuralgia?

A. Either therapeutic or surgical; the therapeutic consisting in the administration of such drugs as quinine, arsenic, iron, gelsemium, cannabis indica, belladonna, phosphorus, electricity, etc., etc.; as local applications, chloroform, menthol, oil of peppermint give temporary relief in many cases; morphine or cocaine hypodermically will often relieve severe paroxysms.

Q. What is the Surgical Treatment of Facial Neuralgia?

A. Subcutaneous division of the nerve-trunk ; resection of the nerve-trunk ; nerve stretching ; evulsion and the ligature of arteries leading to nerve-trunk and nerve-centres.

Q. What is *Ranula ?*

A. Large cystic tumor under tongue on side of frænum linguæ ; semi-translucent, soft, and over it large dilated veins, painless, containing clear, glairy fluid ; due to dilation of ducts of salivary glands, and to obstruction of ducts of sublingual glands.

Q. What is the treatment ?

A. Destroy lining membrane of cyst by caustics, after excising a portion of cyst-wall ; injection of tincture of iodine ten parts, water ten parts, and iodide of potassium one part ; stick of nitrate of silver to interior of sac.

Q. What are *Sublingual Cysts ?*

A. Situated between tongue and lower gum, may be mistaken for ranula, grow slowly, painless, contain a thick, putty-like material, sometimes purulent and offensive.

Q. What is the treatment ?

A. Excision.

Operative Dentistry.

Q. What is the recognized principle in preparing cavities for *gold fillings?*

A. To make free ingress; flush walls with antagonizing bearings; retaining grooves or undercuts and pits; cavity-shape slightly larger at orifice than at base; countersunk margins; no acute angles; the object being that packing may be accomplished with no interstices between gold and cavity walls—no leakage.

Q. What in preparing cavities for *amalgam fillings?*

A. Form cavity without angles, no flush walls, few, if any, pits; cavity-shape considerably larger inside than at orifice; broad concave undercuts, and overhanging edges if strong not objectionable, because of spheroidal tendency and proneness of amalgam to draw away from straight walls.

Q. How is Copper Amalgam prepared for insertion?

A. The hard pellets or bars are put into an iron spoon and heated over a flame until mercury begins to ooze out, when it is rubbed up with a pestle in a small glass or porcelain mortar, to make it plastic, and excess of mercury pressed out.

Q. How is non-cohesive gold packed?

A. By wedging.

Q. What shape of Pluggers?

A. Generally smooth more or less of a right-angle and wedge-shaped for introducing; and serrated points for condensing, either for hand pressure with large handles, or for mallet force.

Q. How is non-cohesive gold introduced and condensed?

A. The gold, either in form of strip, rope, tape, fold, cylinder, or mat, is arranged in parallel layers, of sufficient length to extend from bottom to a little beyond margin of cavity, each piece as it is introduced being condensed against wall until a sufficient number fills the cavity tightly; a wedge-shaped instrument is then passed into the filling, and the gold pressed laterally towards the sides of cavity, and additional pieces or folds added, until no more can be introduced by wedging, using smaller instruments and smaller pieces of gold during the process; the protruding gold is then condensed with a large serrated plugger, followed by smaller ones until surface is thoroughly hardened; the inequalities of surface are ground down, and surface is burnished and polished, care being taken that no gold overlaps margin of cavity, and that margin is well defined.

Q. How is cohesive gold introduced and condensed?

A. Gold in form of tape, rope, pellet or mat, or parts of the two former, is packed by hand pressure or mallet force, the points of pluggers being finely serrated and rather broad; the gold being annealed, the filling is started in retaining pits, or by placing crystal gold or blocks or cylinders annealed in bottom of cavity, enough in quantity to extend across, and be held in position against walls, the gold being carried to cavity by pliers and not touched by fingers; pieces of gold of convenient length are added to gold in cavity each one cohering to gold against which one end is first brought in contact, and the entire piece then condensed with plugger, by either folding upon itself, or extending along cavity; this process is repeated with piece after piece, the gold being built somewhat higher against walls than in centre of filling until surface is reached, when it is either contoured or made level with margin as case may require.

Q. How is Amalgam introduced and condensed?

A. Cavity dry, and protected from moisture, small pieces inserted by plyers, and brought in contact with all of inner surface of cavity by pressing, rubbing, and gently tapping with the plugger, the point of which should be no larger than the part of cavity into which amalgam is being introduced; by using a mat of bibulous paper or cotton on surface of amalgam after cavity is half-filled, and during subsequent introduction, and rotating the point of plugger on such a mat, the excess of mercury is brought to surface, and the amalgam densely packed, when cavity is thus filled, the cervical wall and undercuts receiving careful manipulation, the surplus is removed, surface burnished towards edges until amalgam begins to harden, and, at a subsequent sitting, cut down and polished.

Q. How is *Gutta Percha*, or Hill's Stopping used?

A. Cut in small pieces, which are placed on a porcelain slab and softened, one piece being inserted with a smooth-faced plugger at a time, until cavity is filled, care being taken that the material is only softened to a degree of adhesiveness, and not burned. Resin is sometimes used as a coating for walls of cavity to cause the material to adhere firmly. The surface may be finished with a warm burnisher, or by using on burnisher chloroform or oil of cajeput to soften the gutta percha.

Q. How are the *Zinc Cements Oxychloride and Oxyphosphate* used?

A. Mix liquid and powder thoroughly with a small spatula, on glass or porcelain slab, to the consistence of soft putty, working a little of the powder at a time into the liquid; insert quickly into a dry and well protected cavity, so that the material is brought into direct contact and adheres to walls; remove surplus with a sharp-edged instrument, and refrain from hard burnishing after it begins to harden, so that crystallization may not be interfered with; keep dry for twenty to thirty minutes, which may be better done by coating surface with solution of gutta percha in chloroform, or soft wax.

Q. Why are *Gold* and *Platinum* beaten together, sometimes used for filling teeth?

A. To insure greater hardness than pure gold, to make a lighter colored filling; worked like cohesive foil, but with more difficulty.

Q. Why are Gold and Tin combined by laying together a sheet of each and rolling into ropes, or folding into tapes?

A. Claimed that it preserves teeth better than gold alone, and is more easily packed; used as non-cohesive foil, especially at cervical margins of approximal cavities.

Q. Is *Amalgam* ever used as a foundation for gold in filling?

A. Yes; it should be allowed to harden first.

Q. Where are *Gutta Percha Fillings* indicated as doing best?

A. In soft, highly organized teeth in proximal surface cavities, buccal surface cavities of molars, in labio-cervical cavities of front teeth, and as a non-conducting base for fillings of metals, and for pulp canals.

Q. Where are Amalgam fillings indicated as doing best?

A. In all grinding surface cavities of molars and bicuspids, when walls are strong and economy an object, in large cavities on proximal surfaces of molars, especially the posterior; and some use it for filling pulp canals.

Q. Where are *Oxyphosphate* of *Zinc Fillings* indicated?

A. For temporary fillings, especially when an acid diathesis is present; and for such cavities as indicate a near exposure of pulp, and as a foundation for gold or amalgam, for pulp canals, and for large, badly decayed cavities in molars and bicuspids where little dentine remains.

Q. What is *Oxysulphate of Zinc?*

A. Zinc oxychloride containing some zinc sulphate, which quickly sets to the consistence of plaster of Paris.

Q. What are its properties as a filling material ?

A. It is principally used for capping pulps, as it is unirritating, and a non-conductor, the oxyphosphate of zinc paste being introduced over it.

Q. Where are *Tin Fillings* indicated as doing best ?

A. On proximate surfaces of bicuspids and molars, on grinding surfaces, and as a material possessing less conducting property than gold; it is, however, softer than gold and wears from friction more rapidly.

Q. How does non-cohesive gold act as a filling material ?

A. It has stood the test successfully for many years; the use of it in simple cavities saves time; it is frequently used at cervical margins of large proximate cavities, and cohesive built on it; it is readily adapted to margins of cavities.

Q. What is the greatest value of *Cohesive Gold* as a filling material ?

A. For the restoration of contours in all cases, on account of its welding properties, and filling cavities in fissures or sulci of grinding, palatal, and buccal surfaces.

Q. What is the value of *Crystal Gold* in filling ?

A. This gold being precipitated in small granules, renders it excellent for bottom of deep cavities, on account of its ready adaptation and rapidity of insertion; it builds up faster than ordinary gold, and remains in place better during manipulation.

Q. When built into a contour, how does Crystal Gold compare with ordinary foil ?

A. It is granular and lacks tenacity of fibre present in beaten foil.

Q. What distinguishes *Cohesive* from *Non-cohesive Gold?*

A. When two pieces of cohesive gold are brought into contact they will weld cold, while non-cohesive will not, but the particles slide over each other without cohering.

Q. How is *Gold Foil* graded ?

A. When gold has been beaten by ten-pound hammer till pieces are four times their original size, they are again cut into four equal squares and beaten with a seven-pound hammer to thinness required for filling. Sheets usually cut three and one-half inches square, packed between leaves of books, which are marked according to number of grains in each sheet; number four contains four grains to sheet, number three, three grains; number four will be as much thicker than number three, as one grain of gold will make it. The numbers run from two to two hundred and forty.

Q. In Simple approximal cavities of superior incisors what are necessary?

A. Sufficient room, and such a preparation of cavity as will leave strong walls with little undercut.

Q. When a cavity in proximate surface joins a labial cavity near neck of tooth what is the method?

A. Fill labial cavity first, then proximal, and join the two in one operation.

Q. When *Non-cohesive Gold* is to be used on cervical wall as a foundation for filling, how should such wall be prepared?

A. Made smooth with no pits or grooves.

Q. Give some general rules for the formation of cavities?

A. Remove all frail overhanging walls; if it is best to save such, strengthen with zinc cement; remove all unsupported enamel at cervical wall, and make this wall at right angles to surface of tooth; make walls of cavities in front teeth according to conditions present, and make undercut at cervical wall, and also at cutting edge wall to retain filling; undercut or groove lateral walls of proximal cavities in bicuspids and molars, and, if grinding surface is left intact, make a slight undercut in wall under it; if cut through, extend cavity on grinding surface towards centre or farther, with a dovetailed outline; if cavity is large, lateral walls may be cut away so that gold may come in contact with adjoining teeth, leaving margins free; round and smooth all angles; for cohesive gold make retaining pits, with a small, flat, square-pointed drill, near enamel, but in dentine, and usually parallel with long axis of tooth; do not drill towards the pulp; make depth of retaining pit, equal to diameter of drill; one retaining pit at middle portion of cervical wall of a proximal cavity in bicuspids, is sufficient; for non-cohesive gold no retaining pits; in grinding surface cavities make walls nearly parallel, and slight undercuts at opposite points; same with cavities on palatal, buccal and lingual surfaces.

Q. How is the gold packed in *Proximal Surface Cavities* of Bicuspids and molars?

A. After first pieces of non-cohesive gold are secured in place against cervical wall, by hand-force or pressure, the mallet is used and they are made to overlap border of cavity, the next layer of pieces is packed in same manner, the layer in each case being commenced by packing a piece of gold at either side and securing the two by a larger one in the middle, which slightly overlaps the first pieces; when the second layer is completed, cohesive gold is incorporated, but this should be done before the complete consolidation of the pieces of second layer of non-cohesive; the cohesive gold is then packed in such a manner that too much fulness at lower portion of filling is avoided, by the maintenance of a slight concavity of the surface as the filling is built up; the gold should be built up slightly fuller than edge of cavity and be condensed somewhat over the margin.

Q. How prepare and fill approximal surface cavity of an incisor where both labial and palatal surfaces are to be removed?

A. Make labio- and palato-angle extensions of cavity along cervical wall, with grooves or undercuts, a slight concavity in cutting edge wall, and a groove or undercut along palatal border, with a slight groove also in dentine along labial border—the grooves being continuous around borders of entire cavity, but those at angles of cervical wall deeper than along palatal, labial, and cutting edge. After filling in and connecting the gold occupying the grooves in cervical wall, the lost palatal wall should be restored, and there is then left a more simple cavity to complete the filling of; then build over floor of cavity and into groove of cutting edge.

Q. How prepare and fill a cavity where the *Palatal*, *Labial and Cutting edge* walls are removed?

A. Prepare cervical wall as in preceding case with grooves along border but extending deeper into labio- and palato-angles; the presence of a live pulp prevents much interference with remaining surfaces and but slight grooves can be made, if any, along labial, palatal, and cutting edge borders; resort must be had to a gold screw to retain such a filling, as there is a loss of tooth structure to almost the plane of the pulp-chamber. First pack the gold solidly into the retaining grooves of cervical wall connecting them along cervical border from palato- to labio-angles; then drill through the gold thus placed and into the dentine beyond, tap the drill-hole and insert screw tightly into place, and cut it off just short enough not to reach to line of cutting edge, after which complete the filling with small pieces of gold, taking care to pack gold properly around screw and to contour.

Q. How prepare and fill a cavity where so much of incisor crown is removed as to leave but one angle at cutting edge; generally the result of fracture of half the crown of tooth?

A. The cervical portion of cavity is prepared as in preceding case where undercuts or grooves in palato- and labio-approximal angles are united by one less deep along cervical border; a retaining extension is made on the other side of pulp in surface under remaining angle at cutting edge; a gold screw is inserted through gold packed in grooves of cervical wall, and into the dentine beyond the gold, and the remaining gold packed in same manner as in preceding case, the lost portion of crown being thus restored; in all such cases where the pulp is dead the root canals are first filled and a portion of pulp-chamber utilized for retention of crown cavity filling.

Q. Where both angles of crown at cutting edge and palatal and labial walls are removed, with a prolongation of remaining part of crown in centre?

A. A cavity of this nature needs no retaining screws, as the cervical walls on both sides of crown are prepared in same manner as preceding cases, and the slight portion of cutting edge being shortened the gold is built across from one approximal cavity to the other, forming a gold cutting edge of a depth sufficient to give strength, and also support to the two approximal fillings which are thus joined together, and crown contoured.

Q. Where caries extends from Approximal to Grinding surface—a compound cavity of bicuspid or molar?

A. By a fissure drill or chisel the portion of cavity on grinding surface is opened by cutting down overhanging edges, dovetailing and countersinking margins, following decay and sulcus to its opposite extremity, and making wall more or less parallel; the approximal portion of cavity is extended into the cementum; if decay has advanced near margin of enamel; the cervical wall is made parallel with grinding surface; grooves are cut in palatal and buccal walls extending up under cusps of grinding surface taking care not to weaken the palato- and bucco-approximal angles, where approximal portion of cavity joins the grinding surface portion. The cervical wall is first covered by a large mat or pellet of non-cohesive gold, slightly overlapping the margin, and partly condensed against wall by hand-pressure, using a foot plugger; this is covered with another mat of same gold, and malleted down, so that whole surface and border are well covered, the under layer of gold serving as a soft cushion which adapts itself to irregularities of surface; some use number sixty foil for second layer; the approximal portion of cavity is then packed with gold, especial care taken to carry gold well into grooves in palatal and buccal walls, and against sides of cavity, and build up towards grinding surface and under cusps, then over angle of tooth into grinding surface portion, the first layer of gold extending over the whole of this surface and condensed against the bottom, and then built up against the side and end walls until all portions of the cavity are filled.

A band matrix is almost indispensable in introducing large fillings which restore parts of crowns of molars and bicuspids.

Q. How is cavity formed in cutting edge of an incisor owing to abrasion or erosion?

A. Make labial edge smooth with a corundum wheel or stone, dress down palatal edge freely for strength of filling against opposing teeth; with a rose burr cut a groove in dentine around margin of cavity, not touching enamel, drill retaining pit at each end of groove; commence filling with the pits and carry gold across bottom of cavity from one pit to another and build up against walls higher than centre until margin of cavity is reached, when the gold should overlap border all around, and the contour cutting edge completed. Gold retaining screws are sometimes used in such cavities when proximity of pulp interferes with the proper shaping.

Q. How are *labial surface cavities of incisor and cuspid teeth* prepared and filled?

A. Give a circular or oval shape to orifice by rose drill, smooth and countersink margins, drill a small retaining pit in each end with a slight undercut in dentine joining the two pits, but touching edge of enamel; fill retaining pits first, then carry gold over bottom of cavity and against walls, and when margin is reached continue the packing until the margin is slightly overfilled, and then reduce surface of gold in conformity to shape of labial surface of tooth.

Q. Where labial surface cavities extend under gum?

A. A clamp may be necessary to hold dam in position after the latter is secured by a ligature above cervical margin. The cervical margin of cavity should be undercut, and a piece of non-cohesive gold placed against cervical wall, and its inner border carried into undercut, the opposite or margin towards cutting edge is covered in same manner, and when both are secured, cohesive gold is used for filling in and building up to and a little outside of margin for surface finishing.

Q. How are gold angles of cutting edges built on incisors?

A. A cavity of this kind includes both proximal surface and cutting edge to a greater or less degree; where length of crowns will admit, they may be shortened to some degree and thus lessen the amount of gold visible; if this is not possible, then cervical wall of approximal portion of cavity is undercut and the groove continued from that wall around labial and palatal borders in the dentine within the enamel edge and the enamel margin made uniform and smooth and slightly beveled; gold is then packed against cervical wall and condensed, and a hole drilled through it into the dentine for a retaining screw, which should be of a length to just reach within line of angle at cutting edge; the gold in small pieces is then built securely around screw and made to overlap border of surfaces and cutting edge, and contouring completed in conformity with all the surfaces and cutting edge.

Q. How is a cavity on approximal surface of incisor extending to cutting edge prepared and filled?

A. Enter cavity from palatal surface; cut away unsupported enamel from labial surface; leave as much labial wall as quality of tooth will admit of; remove carious part, smooth walls and bevel them outward; make cervical wall at right angle to cavity and leave it solid, not undercut, as the finished gold filling following outward bevel of enamel edge of this wall gives strength at such a weak point; make such an undercut in labio-cervical portion as will not weaken the cervical wall; do not approach pulp by an undercut in cervical wall; have main undercut formed well up under cervical portion of labial wall, make a groove to extend towards, but not to cutting edge, in dentine, and following labial wall; at safe distance from pulp, this groove may cross cavity; or by use of a retaining pit which extends in direction of pulp rather than towards cutting edge, it connects with a groove which follows the palatal to the cervical wall where it ends in a retaining point or larger undercut at junction of palatal and cervical walls; often a groove cannot be made between basilar ridge and pit between pulp and cutting edge, but a well defined one can be formed over basilar ridge; begin packing the gold in labio-cervical undercut.

Q. What are *Porcelain Disk or Inlay Fillings?*

A. Disks of porcelain of a size to fit cavity to avoid a show of metal; may be ground from an English tooth; or carved and baked specially for case; after cavity has been prepared, a piece of tin foil (No. 20) is placed over the orifice and pressure made on it with a piece of thick rubber or cork; the pattern is then cut out, and glued to the surface of an artificial tooth of proper shade which is ground down until a disk is obtained of the size desired.

Q. How are they introduced?

A. Walls of cavity made perpendicular, or a little undercut, outline of cavity circular or oval, no angles; after fitting inlay to cavity (loose, if gold foil is to be filled in around it; close fitting, if it is to be secured with zinc cement or gutta percha), it is ground to conform to surface of tooth, and then polished. Inlays are also made by securing the form of the prepared cavity with very thin platinum, and the mould filled with easily fused porcelain body and baked in a gas furnace, the inlay is then ground on its face and secured in cavity with zinc cement.

Q. How is the Pulp removed from Canal?

A. By immediate extirpation with a barbed-broach, or drawn-temper broach with point bent to form small hook; the instrument is passed along side of pulp, after it is obtunded by atropine, cocaine, carbolic acid, or chloroform, then rotated and withdrawn; general anæsthesia by nitrous oxide may be resorted to.

Q. How are Roots prepared for Filling?

A. After complete removal of pulp, if canals are of normal form, they need not be enlarged; if otherwise, they may be enlarged one-fourth or one-third of their length; the diameter of foramen may be determined by a fine hook broach; and a drill a little larger be used; the length of canal may be determined by measuring the distance on the broach when its hook passing through foramen catches on end of root.

Q. What is urged against, and what for, enlarging or reaming out root-canals?

A. Against: danger of perforating side of canal; breaking of delicate canal-cleansers used to scrape such canals; the difficulty in removing débris or forcing it through apical foramen of root. For: The gaining of easy access to the canals, and the facility with which the filling-material can be introduced.

Q. How may free entrance be obtained to root-canals when the orifices are obscure or difficult to locate from crown cavity?

A. By the application of a 50 per cent. solution of sulphuric acid by the method suggested by Dr. J. R. Callahan, which is to place a small pellet of cotton saturated with the acid over the probable locations and allow it to remain in the sealed cavity for 12 hours, when a black dot will indicate the entrance to the canal.

Q. How may a broken broach be removed from a root canal?

A. By arming a barbed broach with a few fibres of cotton, and passing it on one side of broken piece; or, if possible, grasping it with canal pliers; if piece cannot be thus removed, fill canal with tincture of iodine and close crown cavity with gum sandarach on cotton; the iodine in a few days will reduce the iron to an oxide which is readily removed by a drill.

Q. What materials are used for filling root canals?

A. Gold, tin, amalgam, gutta percha and oxychloride or oxyphosphate of zinc; gold and tin foils are rolled into cylinders or points about size and length of canal; gutta percha is used in form of solution in chloroform, or in form of small cones; oxychloride and oxyphosphate of zinc are used in form of a thin paste; also a resinous substance called "balsamo del deserto" which has antiseptic properties; also floss silk saturated with chloro-percha and dried.

Q. What are the objections to oxyphosphate of zinc for filling root-canals?

A. It has no antiseptic properties, and being porous, becomes in time very offensive; hence it is inferior to the oxychloride for such a purpose.

Q. How are these materials introduced?

A. Gold and tin are carried to place by a fine canal-plugger, and gently condensed; gutta percha solution and zinc cements are introduced by means of cotton wound on a fine broach, or cotton thread may be saturated with these cements; gutta percha in form of cones with square ends, which are dipped in chloroform and pressed into place with canal-plugger; amalgam may also be introduced with a canal-plugger; some prefer filling upper third of canal with gold or tin and remaining portion with gutta percha, or oxychloride of zinc cement.

Q. Describe Sponge-Grafting for Perforated or Incomplete Roots?

A. Make examination with a Donaldson broach or bristle, with a small hook on end; register length of root or location of perforation by having a small disk of rubber to slide on broach, which will give length of instrument necessary; then use the finest Turkey sponge freed from sand, washed, and sterilized in phenate of soda, or other sterilizing agent, a piece of which is carried to place by the smooth broach, and a filling of gutta percha inserted into root canal; the part of the canal beyond the perforation should be filled with a softened gutta percha cone and that above this with chloro-percha.

Q. How are teeth prepared for Replantation and Transplantation?

A. Extract with care, wash in tepid water, remove any unhealthy membrane from root, cut off a small portion of end of root, enlarge foramen in end, remove pulp, fill root canal, first preparing and filling crown cavity if any exists.

Q. How are teeth *Replanted and Transplanted?*

A. Clean alveolar cavity of all blood, syringe with warm salt water, bathe tooth in solution of bichloride of mercury, 1.2000; press firmly into cavity; have patient to close jaws to secure proper occlusion; secure tooth with ligatures to adjoining teeth.

Q. How are teeth *Implanted?*

A. By cutting a hole in gum, and forming a cavity of proper size in the alveolar process with drill and burrs, and the tooth (recent or dried) inserted and secured in the made alveolar cavity by ligatures to adjoining teeth.

Irregular Arrangement of Teeth.

Orthodontia.

Q. With what set of teeth should the prevention of malposition begin?

A. With the deciduous.

Q. What knowledge is necessary?

A. That of periods of eruption of both sets of teeth, and of the indications of nature.

Q. Can definite rules for correction of irregularity be closely adhered to?

A. No, as every case almost presents its own peculiarities.

Q. In what direction have the teeth, if unobstructed, a tendency to move?

A. Forward to median line.

Q. What must govern treatment of irregularity?

A. Age, condition of teeth, constitution of patient, character and degree of irregularity.

Q. At what age is the moving of teeth comparatively easy?

A. Eleven or twelve years; at eighteen or nineteen slower; more difficult as age advances.

Q. What may result from irregularly arranged teeth?

A. Irritation of gums, lips, or cheeks, difficulty in cleansing, defective mastication, sometimes speech, disposition to dental caries, deformity more or less conspicuous according to nature and degree of deviation.

Q. Are deciduous teeth prone to irregularity?

A. No, unless associated with some characteristic deformity.

Q. For a regular and well developed set of teeth what is necessary?

A. Ample and coincident development of maxillæ.

Q. What may give a different result?

A. A trifling accident, as a fall, may result in inversion of an incisor and later impair entire occlusion.

Q. What effect has inherited or transmitted peculiarities?

A. Many forms of irregularity owe their origin to such causes, and it is the result of the same law of nature which gives form and features of progenitors to the offspring.

Q. Can such a tendency, even when transmitted for generations, ever be stamped out?

A. Yes, many think so.

Q. What may be the effect of the unabsorbed portion of a deciduous root, or a mere spicula?

A. It may cause a permanent tooth to deviate and, eventually, be the cause of impaired occlusion of all the teeth.

Q. Into what two classes are causes of irregularity divided?

A. Congenital and acquired.

Q. What are congenital causes?

A. Want of proportion between teeth and jaws. Excessive vaulting of palate due to arrest of development of sphenoid bone, or defective growth of vomer, defect in conformation of jaw, such as elongated lower jaw, failure of permanent teeth to erupt, retarded eruption of teeth, asymmetry in body of bone of lower jaw, excessive growth of maxillary bones, hereditary transmission.

Q. What are acquired causes?

A. Premature extraction of deciduous teeth, retention of obstinate deciduous teeth, thumb-sucking, sleeping with mouth open, injudicious extraction of permanent teeth.

Q. At what period is the correction of irregularity attended with the most satisfactory results?

A. Previous to sixteenth or eighteenth year.

Q. How may a permanent central incisor accommodate itself when aperture left by deciduous central is not as wide as the crown of erupting tooth?

A. By pressure on crown of loose deciduous lateral.

Q. What may cause protrusion of superior permanent canines?

A. A contracted arch, or premature extraction of deciduous canines; canines are prone to malposition on account of late eruption.

Q. Why are bicuspids not prone to irregularity?

A. Owing to situation between roots of deciduous molars.

Q. What is a general rule in regard to extraction of a permanent tooth to make room for a permanent canine?

A. If space between lateral incisor and first bicuspid is less than a space equal to width of crown of canine, then the extraction of first bicuspid is justifiable; if space is as wide as crown of canine, then extract second bicuspid provided both bicuspids are sound; if sixth year molar is decayed to such a degree that it cannot be permanently preserved, then its removal is justifiable, and not one of the bicuspids.

Q. By what operation may the extraction of any of the permanent teeth be unnecessary?

A. Expanding the arch to such a degree as to give the space necessary for the misplaced teeth.

Q. What may cause deviation of bicuspids?

A. Lateness of eruption; the cuspids meeting no resistance fall into natural position while bicuspids erupt inside of arch, forming an angle.

Q. Can the jaw at times be expanded so as to render unnecessary the removal of a permanent tooth?

A. Yes.

Q. In extracting a permanent tooth to make room for another, what must also be considered?

A. The articulation or occlusion of the teeth in question.

Q. Why are bicuspids superior to the sixth year molar?

A. Owing to location and durability.

Q. In what respect is a sixth year molar superior to at least one of the bicuspids?

A. In mastication; and the two bicuspids resembling each other, the loss of one is not so noticeable if the molar occupies its position.

Q. At what period may a sixth year molar be extracted with expectation of twelfth year molar occupying its place?

A. Between tenth and eleventh years, or just before eruption of twelfth year molar.

Q. If sixth year molar remains perfect until twelfth year, what is the probability?

A. That it may be as valuable as the twelfth year molar.

Q. Should it ever become necessary to decide between removal of a lateral incisor or canine, what is the rule?

A. If a lateral incisor is decayed or loose, or shuts within lower teeth, then it may be removed; and it is a very rare case which would justify the removal of a canine, if in a perfect condition, and only if lateral incisor was perfect in structure and position, and there were good reasons for retention of both bicuspids and sixth year molar, and there was no space for both lateral and canine.

Q. What is Kingsley's rule in regard to the extraction of permanent teeth for correction of irregularity?

A. That a pair of any of the teeth may be removed, except the canines of both jaws, and the superior central incisors; that the upper lateral incisors and any pair of lower incisors may be removed without serious detriment to mouth.

Q. To what may the undue prominence of superior incisors be due?

A. To both congenital and acquired causes—congenital, when it results from a contracted or malformed arch; acquired, when from thumb- or nipple-sucking.

Q. To what may obliquity of an incisor be due?

A. To a retained deciduous tooth, or contracted arch.

Q. Will the premature and delayed extraction of a sixth year molar, which it is impossible to preserve, cause irregularity of adjoining teeth?

A. Yes, may result in the tipping over of crown of second molar, and second bicuspid by force of occlusion, or obliquity of second bicuspid.

Q. With what condition of organism and tissues is the V shaped arch often associated?

A. Delicate organism, enlarged tonsils, spongy gums and offensive breath.

Q. May it be regarded as both inherited and acquired?

A. Yes, as it is apt to affect near relatives of same generation, and is also caused by thumb- and nipple-sucking.

Q. Describe a V shaped arch?

A. Incisors project unduly, and assume an oblique position resting on or protruding over lower lip; bicuspids and molars approach each other from opposite sides, so that vault of palate is greatly constricted.

Q. What may cause superior front teeth to shut within inferior?

A. An unusually small upper maxilla: unnatural length of lower maxilla from excessive development; retarded eruption or inverted position of upper teeth; or the unnecessary extraction of superior canine teeth.

Q. What other form of irregularity differing only in degree, but due to same causes, may result?

A. Teeth of both jaws meeting edge to edge.

Q. What is the form characterized by imperfect occlusion, the posterior molars alone antagonizing, due to?

A. A peculiar conformation of one or both jaws, as excessive development of posterior portion of alveolar ridge; or, according to Tomes, enlarged tonsils causing mouth to be kept open.

Q. How should appliances for correcting irregularity be constructed?

A. As simple as possible, to save time and labor; as light and delicate as is consistent with strength and the force they are to exert; capable of exerting traction in proper or required direction, and productive of the least irritation possible.

Q. Describe a saddle-shaped arch?

A. Maxillary bone too narrow at anterior extremity for teeth suited to a more expanded jaw; vault high and narrow; molars pushed forward leaving only space for one bicuspid, which teeth are turned inward towards palate; may include one or both arches.

Q. What should be the first operation in correcting irregularity?

A. After careful examination, obtain plaster models of both jaws and study them carefully to determine the degree and direction of force to be applied, point of anchorage which must afford greater resistance than teeth to be moved.

Q. How may the resistance of deviating teeth be lessened?

A. By first loosening them by wedging with rubber, wood, cotton, etc.

Q. How should the force be applied to the tooth to be moved?

A. Either at right angles to long axis of root, or at an angle of forty-five degrees; the greatest pressure being required in direction of greatest resistance.

Q. How great should be the force exerted in moving a tooth?

A. Enough to cause absorption of bone without producing inflammation to any great degree; in some cases slight inflammation is desired.

Q. At what age is too rapid movement of teeth objectionable?

A. Over twenty years of age.

Q. Describe the processes which occur in the movement of a tooth from its original to a new position?

A. There is first a compression of the peridental membrane and pressure on the alveolar wall in the direction of the force applied, and a distension of the peridental membrane in the opposite direction, the hard structure in front is then acted upon by the osteoclasts, and the bone behind is built up by the osteoblasts.

Q. What occurs when a tooth is rotated in its socket?

A. A stretching of the fibres of the peridental membrane.

Q. What may occur from too much force used in spreading the arch?

A. Separation of the superior maxilla at the symphysis.

Q. What other accidents may happen from the exercise of too great force?

A. Death of pulp by strangulation, by rupture of its vessels at apical foramen, by rupture of peridental membrane, injury to the tooth-crown, permanent enlargement of the alveoli.

Q. Is the practice of drilling holes in teeth for anchorage advisable?

A. No, as a band or a cap can be secured to a tooth with oxyphosphate of zinc, in which holes may be drilled, or loops or hooks soldered on at any point desired.

Q. Name some of appliances in use for correcting irregular positions of teeth?

A. Ligatures of waxed floss silk or thread; sections of rubber tubing, such as bands; adjustable metal bands; jack-screws; elastic wires, such as piano wire; springs of piano wire, elastic, but soft enough to be easily bent; swaged caps in connection with hooks, bars, tubes and levers; metallic tubing; spring plates; crib or skeleton plates of wire; compressed wooden wedges, inclined plane, etc., etc.

Q. How may teeth within arch be brought out?

A. By appliance acting on the principle of the lever, such as a wedge, a bent band acting as a double lever, a straight bar.

Q. How may a tooth be rotated?

A. On principle of wheel and axis, such as a gold band around tooth with an arm bent at right angles extending from it to deviating tooth, and a rubber band attached to end of arm, the latter being bent as tooth rotates.

Q. What is the principle of the inclined plane?

A. A plane surface inclined at any angle, and fitted to lower teeth as a fulcrum when upper teeth are to be moved outward.

Q. What is the principle of the screw?

A. It works in a hollow cylinder with a corresponding thread cut inside; it is very effective in spreading arch and forcing obstinate teeth to new positions, and free end should act against a band of metal encircling crown of tooth to be moved; jack-screws, such as the McCullom and Lee and Bennett are used.

Q. How is elastic force obtained?

A. By rubber, and spring of metals; rubber bands cut from tubing.

Q. What are ligatures?

A. Cords, strings or wires for binding teeth while regulating, for attachment of other appliances to teeth, or for holding them in place after they have been moved; of silk, linen, etc., care being taken in tying the knots to prevent slipping, etc.

Q. What is the Patrick method based on?

A. Elasticity or spring of a platinized gold band or wire, anchored to strong teeth by bands, the force of the bow-spring being applied to the teeth by wedges, hooks, T bars, and catches slipping along spring.

Q. What is the Positive or Farrar System?

A. Consists in bringing to bear upon teeth to be moved a continuous force by means generally of the screw for a positive and definite result; that a tooth should be moved a certain distance as far as it is safe or proper, at one operation, and then retained immovable until another operation, so as to compress tissues in front of advancing tooth to such a degree that there is absorption without inflammation, thus making place for the moving tooth, while at same time a deposition of bone takes place behind the tooth which tends to retain it.

Q. What is Byrnes method?

A. Taking advantage as a motive power, of the spring or elastic force of thin gold bands.

Q. What is the Coffin method?

A. The adaptation of a vulcanite plate to hard palate, and over posterior teeth, the plate being split in half after vulcanizing; the halves are connected by a piece of piano-wire bent into shape of letter W, the ends flattened and imbedded in the rubber plate; after plate has been worn for a few days the two halves are separated by being stretched apart, and the wire is thus converted into a spring of considerable power and constant tension, by which the arch is expanded laterally. The same principle is applied to lower jaw and two curved wires lie along the lingual aspect, the plate being divided at median line.

Q. What is the Talbot method?

A. Increasing the elasticity of the wire by coiling it from one to three times around a mandril, the coil working like the mainspring of an Am. watch; the ends of the two arms fit into holes in rubber plate, or in bands of metal attached to teeth with zinc cement. The same appliances modified as to form, are effective in regulating individual teeth, as well as expanding arch.

Q. What appliances are used for rotating teeth?

A. The screw-wrench of Farrar, the small appliance of Guilford consisting of two bent pieces of gold plate soldered together in centre, the free ends acting as springs, and the short ends forming a T to retain appliance in connection with the spring ends acting upon opposite sides of teeth; and the Talbot appliance consisting of a band of platinum around crown of tooth, with a tube soldered lengthwise with band, which is secured by zinc cement; a piece of piano-wire is passed into tube and allowed to extend to an adjoining tooth and acts as a spring, being bent daily.

Q. For what other purposes are appliances constructed?

A. To move both crowns and roots, to compel the full eruption of crowns, to correct protruding jaws and teeth, to shorten length of teeth by pressure, and for retaining teeth in new positions.

Q. What do retaining appliances consist of?

A. Rubber plates, same with metallic attachments, metal bands in connection with bars, skeleton or crib plates, etc.

Q. What are Skeleton Plates and their Uses?

A. Appliances made of platinum wire formed on a metallic die of such a form as to cover the crowns of the loose teeth, and such others as are necessary to support the appliance. For retaining moved teeth, and teeth loose from disease.

Metallurgy.

Q. What kind of bodies are the metals?

A. Elementary Bodies.

Q. How many elements are now known?

A. Seventy-four, and are divided into metallic and non-metallic.

Q. How many of them are metals?

A. Fifty-seven.

Q. How many are employed in true metallic condition?

A. Fourteen—Antimony, Aluminum, Bismuth, Copper, Gold, Iron, Lead, Magnesium, Mercury, Nickel, Platinum, Silver, Tin, Zinc.

Q. How many are used in medicine, for coloring pigments, and for alloys?

A. Twelve—Arsenic, Barium, Cadmium, Calcium, Chromium, Cobalt, Lithium, Manganese, Potassium, Sodium, Titanium, Uranium.

Q. What metals contribute to the maintenance of animal and vegetable life?

A. Aluminum, Calcium, Iron, Magnesium, Manganese, Potassium, Sodium.

Q. Into what two classes are metals divided?

A. Into Noble and Base.

Q. What are Noble Metals?

A. Those capable of being separated from combinations with oxygen by only heating to redness.

Q. What are Base Metals?

A. Those whose compounds with oxygen are not decomposable by heat alone.

Q. How many Noble Metals?

A. Ten—Mercury, Gold, Silver, Platinum, Palladium, Ruthenium, Rhodium, Iridium, Osmium, Davyum.

Q. What is a metal?

A. An element generally solid at ordinary temperatures (mercury is an exception), fusible by heat, insoluble in water, with a metallic lustre, and properties of conducting heat and electricity.

Q. What general properties distinguish metals from non-metals?

A. Metals (except mercury) are solid at ordinary temperature, have metallic lustre, are opaque, good conductors of heat and electricity; non-metals have no such properties.

Q. How do the colors of metals differ?

A. From white, to yellow, red, gray and bluish.

Q. What is the lustre of metals due to?

A. Perfect opacity, by which rays of light are reflected from surface.

Q. Do metals have odor and taste?

A. Yes, arsenic has odor of garlic; iron, copper and zinc give forth odors when heated; odor and taste depend upon voltaic action.

Q. Are all metals fusible?

A. Yes, but the temperature at which they melt differs greatly.

Q. What does the specific heat of metals consist in?

A. The amount of heat required to raise equal weights of different metals from same to another given temperature.

Q. Do metals expand or contract when heated?

A. Expand, but not uniformly, and within certain limits of temperature, the degree of expansion is proportionate to amount of heat to which they are subjected.

Q. Have metals great heat conducting property?

A. Yes, they are the best of all solid bodies.

Q. Taking Silver at the standard of 100, what is the order of the following metals used in dentistry?

A. Copper, 73.6; Gold, 53.2; Tin, 14.5; Iron, 11.9; Steel, 11.6; Lead, 8.5; Platinum, 8.4; German Silver, 6.3; Bismuth, 1.8; Fusible metal, 2.8.

Q. What is the power of metals to conduct electricity?

A. Nearly in ratio of their capacity of transmitting heat, and in the following order: Silver, copper, gold, zinc, iron, tin, lead, antimony, bismuth.

Q. What is meant by Malleability?

A. The property of a metal to be extended in all directions by hammering or rolling.

Q. Which is the most malleable of all metals?

A. Gold, then in the following order—silver, tin, copper, cadmium, platinum, lead, zinc, iron, nickel, palladium, potassium, sodium, mercury.

Q. What is meant by Ductility?

A. That property by which a metal can be drawn into a rod or wire.

Q. What is the order as to ductility?

A. Gold, silver, platinum, iron, copper, zinc, tin, lead, nickel, palladium, cadmium.

Q. What is meant by Tenacity?

A. The power of a metal to sustain weight and resist rupture when a rod or bar is subjected to tension.

Q. What is the order as to tenacity?

A. Iron, copper, platinum, silver, gold, zinc, tin, lead.

Q. Will all metals assume a crystalline form?

A. Yes, under favorable circumstances.

Q. What metals are *attracted by the Magnet?*

A. Iron, nickel, cobalt, manganese, chromium; called *paramagnetic.*

Q. What metals are *repelled by the Magnet?*

A. Arsenic, Gold, Copper, Lead, Tin, Zinc, Mercury, Antimony, Bismuth and Cadmium—called *diamagnetic.*

Q. How may elasticity and sonorousness be conferred on metals?

A. By alloying.

Q. Are all metals volatile?

A. More or less, but only a certain number are capable of being easily converted into a state of vapor at the highest temperatures.

Q. What agents are capable of volatizing a metal?

A. Voltaic current, oxyhydrogen blow-pipe flame, and concentration of solar rays in focus of lens.

Q. What are Alloys?

A. Compounds composed of metals capable of uniting with one another; alloys partake of the nature of a solution of one metal in another, and are not true chemical compounds because they do not unite in true chemical proportions.

Q. What is the nature of alloys?

A. Usually harder and more fusible than the metals of which they are composed.

Q. What may an alloy consist of?

A. A solidified solution of one metal in another; a chemical combination; a mechanical mixture; a solidified solution or mechanical mixture of two or all of the above.

Q. What is the tendency in a simple mechanical mixture?

A. To separate; some metals form mixtures so mechanical that if allowed to stand after fusing they will separate. Example: Lead and zinc, the lead having highest specific gravity settles to the bottom.

Q. Is the density of an alloy always the mean of its constituents?

A. No, as resulting number is sometimes equal to, or greater or less than the theoretical mean.

Q. What effect does alloying have upon the color?

A. It is always changed.

Q. Does alloying have any effect upon malleability, ductility, and tenacity?

A. Yes very much. Examples: Gold and platinum alloy is much harder and elastic; a very little lead will destroy the ductility of gold.

Q. What effect has alloying upon tenacity?

A. It increases it; and also increases the hardness.

Q. What effect has alloying upon fusibility?

A. The fusing point of an alloy is less than that of the least fusible metal forming one of the constituents.

Q. Why is this the case?

A. Because the attraction existing between the particles of a mixture will be sooner overcome by repulsion, than will the attraction in the case of a homogeneous body.

Q. What is the effect on Gold to alloy it with Tin, Lead, Bismuth, or Silver?

A. Tin renders gold hard and brittle, and the alloy contracts greatly on cooling. Lead impairs the ductility of gold and renders it brittle. Bismuth renders gold very brittle, and greatly affects its color. Silver increases the hardness of gold, but does not materially affect its malleability.

Q. What are the advantages and disadvantages of an alloy of platinum and gold for filling teeth?

A. It gives a whiter color to the filling; but even when the platinum and gold are in less than equal parts, it imparts elasticity and renders it more difficult to manipulate.

Q. What is the composition of Gold Coin?

A. Gold 90, copper 10.

Q. What of Silver Coin?

A. Silver 90, copper 10.

Q. What of Brass?

A. Copper 67 to 72, zinc 28 to 33.

Q. What of German Silver?

A. Copper 50, zinc 25, nickel 25.

Q. What of Type Metal?

A. Lead 80, antimony 20.

Q. What of Pewter?

A. Tin 92, lead 8.

Q. What of Plumbers' Solder?

A. Tin 67, lead 33.

Q. When an alloy contains a volatile metal what is the effect of heat upon it?

A. It decomposes it.

Q. What is meant by Liquation?

A. The separation of metals, such as tin, lead, zinc, etc., by melting.

Q. What is the action of an acid on an alloy?

A. More energetic than upon a simple metal.

Q. What is the combined effect of action of heat and air on alloys composed of two metals, one readily oxidizable and the other having less affinity for oxygen?

A. Are readily decomposed, the first being rapidly converted into an oxide.

Q. When a noble and a base metal are to form an alloy, what is the method?

A. The noble metal should be fused first, the base metal then added and the whole covered with powdered charcoal to prevent oxidation, and then thoroughly mixed by stirring.

Q. When adding brass, etc., to gold or silver in making solders, what is the method?

A. Fuse the gold or silver first with sufficient quantity of borax, then the brass in form of wire quickly added, and the borax covering the liquid mass will prevent oxidation.

Q. What is an *Amalgam?*

A. An alloy of mercury with one or more other metals; an alloy in the nature of solution, in which one of the metals is mercury.

Q. What qualities should a dental amalgam possess?

A. Strength and sharpness of edge, maintenance of color, retention of shape, no undue expansion or contraction, and exercise no injurious influence on the mouth by the formation of soluble salts.

Q. What is the discoloration of amalgam largely due to?

A. To the formation of sulphides, owing to presence of sulphur in fluids of mouth.

Q. What properties have Amalgams of Silver-tin alloys which contain less than 50 per cent. of Silver?

A. They shrink at first and then expand.

Q. What those which contain over 75 per cent. of Silver?

A. They expand only.

Q. What those which contain 65 per cent. of silver and 35 per cent. of tin?

A. Such Amalgams show least expansion and contraction when freshly cut.

Q. What is the influence of Tin on amalgam?

A. It facilitates amalgamation, and gives plasticity.

Q. What is the influence of Silver on amalgam?

A. It facilitates amalgamation and setting, gives sharpness of edge, rapid hardening, and lessens tendency to assume spheroidal form.

Q. What is the influence of Gold?

A. Sharpness of edge and rapid hardening.

Q. What is the influence of Platinum?

A. Greater hardness, and more rapid setting.

Q. What is the influence of Copper?

A. Controls shrinkage but increases tendency to discoloration; it is also supposed by some to exert a preservative influence on tooth structure.

Q. What is the effect of Gold and Copper on an amalgam?

A. Will decrease the tendency to contract or shrink, and hasten setting.

Q. The tendency of some or many amalgams to assume a globular form, has what effect upon tooth?

A. It leaves edges of cavity unprotected.

Q. Do some amalgams (as one with an excess of silver, or of mercury and silver) ever unduly expand?

A. Yes, sometimes enough to split tooth, or reach one-fortieth of the diameter of filling.

Q. What is the effect of zinc on an amalgam according to Dr. Black?

A. It will induce an expansion which will continue for an indefinite time.

Q. What is the effect of aluminum on an amalgam?

A. The formation of an aluminum amalgam is characterized by an exhibition of the affinity of aluminum for oxygen, and its setting is attended by the evolution of great heat, expansion, oxidation of the instruments used, a crackling of gas disengagement (Dr. Black).

Q. What is meant by "Flow of Amalgam"?

A. According to Dr. Black, change of mass form from molecular motion under stress; he also claims that "spheroiding" of an amalgam is a misnomer, as the phenomenon ascribed heretofore to a spheroidal tendency is due to expansion.

Q. What cause has Mr. Fletcher assigned for expansion?

A. That it occurs only in amalgams that shrink, the filling being raised, or forced out, by decomposition of tooth-substance and formation of gas under loosened filling; the forcing in and accumulation of food under filling, etc.

Q. What are the effects of dryness and moisture when mixing amalgams?

A. If mixed in a perfectly dry mortar, comparatively little expansion takes place; but if a drop of water is added, the mass almost instantly increases 3 or 4 times its original volume.

Q. To what may failure of an amalgam filling sometimes be attributed?

A. Not only to shrinkage, but to the action of sulphur on the silver of an amalgam.

Q. What is the presence of sulphur in mouth due to?

A. Uncleanliness resulting in decomposition of particles of food about teeth, which contaminates oral fluids, the sulphur being in combination with hydrogen as hydric-sulphide (H_2S).

Q. What will keep bright almost any amalgam filling?

A. Attrition, either by mastication or use of tooth brush.

Q. Does every amalgam filling that retains its brightness protect the tooth?

A. No, but conversely one that is greatly discolored may protect the tooth.

Q. What should the basal proportions of a good dental amalgam consist of?

A. Sixty silver, forty tin, modified by additions of gold and zinc; some add copper, or antimony, or platinum, to this list.

Q. What does nearly every amalgam now made contain?

A. Fifty per cent. of tin, and more than forty of silver, while remaining per cent.—2 to 7 are gold and platinum.

Q. What is Prof. James H. Harris' formula?

A. To every one hundred grains of silver and tin add two per cent. of gold and platinum, and from two to four per cent. of zinc.

Q. What is the composition of Arrington's Amalgam?

A. Tin 57.5, silver 42.5.

Q. What of Blackwood's?

A. Tin 56.85, silver 42, gold 0.50, platinum 15, zinc 0.50.

Q. What of Dawson's white alloy?

A. Tin 49.27, silver 48.24, gold 0.05, zinc 2.44, with a trace of palladium.

Q. What of Dibble's?

A. Tin 49.65, silver 49.75, gold 0.20, zinc 0.40.

Q. What of Flagg's Contour?

A. Tin 37, silver 58, gold 5.

Q. What of Globe?

A. Tin 53.36, silver, 47.74, gold 1.50, platinum 0.40.

Q. What of Hardman's?

A. Tin 44.57, silver 50.12, copper 5.31.

Q. What of Johnson and Lund's Extra?

A. Tin 61.55, silver 36.75, gold 0.15, platinum 0.50, cadmium 1.45.

Q. What of Justi's?

A. Tin 59.10, silver 35.20, gold 0.32, platinum 0.08, copper 3.50, zinc 1.80.

Q. What of King's occidental?

A. Tin 54.75, silver 42.75, zinc 2.50.

Q. What of Lawrence's (new)?

A. Tin 50.43, silver 44.06, copper 5.51.

Q. What of Standard?

A. Tin 55.40, silver 44.60.

Q. What of Townsend's (improved)?

A. Tin 54.50, silver 44.50, gold 1.

Q. What of Welch's (new)?

A. Tin 51.90, silver 46.00, gold 1.70, platinum 0.40.

Q. What of Dr. Ambler Tees?

A. Tin 40 dwts, silver 24 dwts, gold 1 dwt, platinum 1 dwt.

Q. How should dental amalgams be prepared?

A. Gold, silver, and platinum to be melted first with borax, and kept fused for five minutes; tin melted in a separate crucible, and the molten gold, silver, and platinum poured into the fused tin, and the mass quickly poured into an ingot-mould and reduced to filings.

Q. What is the action of mercury in dental amalgam?

A. As soon as incorporated, its molecules begin to act on the silver particles, chemically combining with them to form a hard filling.

Q. What is the effect of too much tin?

A. The molecules of silver will be so far apart, or meet in such small quantities, that the mass is very plastic and wants hardness; hence tin is but the medium or vehicle in which the silver molecules are interspersed for amalgam purposes.

Q. Is there a great difference of opinion in regard to the effect of gold on a dental amalgam?

A. Yes, while some contend that it diminishes shrinkage, increases rapidity of setting, imparts fine-grained plasticity, and edge strength, and controls maintenance of color, others think that it reduces color standard, and has no effect on shrinkage or expansion; still others consider its presence of no use, and rather an injury.

Q. Is there a difference of opinion in regard to the quantity of zinc?

A. Yes, while some think but four per cent. will facilitate setting, control shrinkage and prevent discoloration; others contend that quantities over two per cent. will not accomplish such results.

Q. When is platinum thought to be of service in an amalgam?

A. Only when it is combined with tin and silver and proper quantity of mercury, does it confer quick-setting, and great hardness; but all alloys containing platinum amalgamate less readily than those in which it is absent.

Q. What objections have been urged against platinum?

A. That it is of no use in dental amalgams because it renders them more brittle and liable to crumble in proportion to quantity used.

Q. What is claimed for copper in dental amalgams by Flagg, Miller and others?

A. That it has a marked compatibility with tooth-bone, and that dental pulps show a decided toleration for amalgams containing copper; that they exert marked anti-bacterial influences upon walls of cavities, and have same effect as if antiseptics were incorporated.

Q. What is the usual quantity of copper incorporated in a dental amalgam?

A. About five per cent.; ranging from one to ten per cent.

Q. Why does copper discolor an amalgam?

A. Owing to its ready affinity for the sulphur of sulphuretted hydrogen gas, and with the silver forms black sulphide of silver.

Q. What is Copper Amalgam?

A. Pure copper and mercury only; must not be confounded with amalgams containing copper, silver, tin, and other metals.

Q. How is Copper Amalgam prepared?

A. Pure copper is obtained by precipitating copper from its solution by electricity in the form of impalpable powder, the amalgamation being accomplished by trituration with pestle in a mortar; the surplus mercury is squeezed out through chamois skin, repeating the heating, squeezing, and triturating until crystallization occurs and the required density is obtained.

Q. How is it prepared for filling cavities?

A. Softened by heat, and triturated to render it plastic, until a smooth, gray mass is made.

Q. What is the effect of annealing Alloys for dental Amalgams?

A. Annealed alloys take up much less mercury, and yield a greater quantity of "dirt" upon mixing, the black oxide being a lower oxide of tin.

Q. How is such an alloy annealed?

A. By placing the filings in a test tube or flask, and the vessel put in boiling water for at least 15 minutes.

Q. Why is Antimony sometimes used in dental amalgams?

A. To control shrinkage and give fine-grained plasticity.

Q. What are the objections to its use?

A. It causes discoloration and makes a dirty amalgam.

Q. Why is Palladium used in an amalgam?

A. To control shrinkage and render it quick-setting.

Q. What are the objections to its use?

A. It imparts brittleness and discoloration, and difficult manipulation.

Q. Why was Cadmium used in amalgam?

A. To retain color, and give rapid setting.

Q. What objections to its use?

A. Injury to tooth-structure and pulp.

Q. Is mercury a cause of discoloration of amalgam?

A. No, mercury retards the black discoloration.

Q. What quality of mercury should be used?

A. Chemically pure, and free from tin, lead, zinc, bismuth, etc.

Q. What is the process of rectifying mercury by nitric acid?

A. Digest one or two pounds of mercury in dilute nitric acid (1 f. ℥. to 8 of water) for three or four hours in a glass bottle at temperature of 130° to 140° F., shake bottle every half hour, then pour off the diluted acid and its impurities, and wash mercury in water.

Q. What is the object of *washing* amalgams before expressing the mercury?

A. To remove the oxide which coats the alloy; according to Dr.

Flagg, washing increases the shrinkage; but washed amalgams retain their color better; hence some prefer washing in chloroform, alcohol, etc.

Q. How may the excess of mercury be removed from the surface of an amalgam filling?

A. By pressing on such surface tin-foil or bibulous paper.

Q. How may gold-foil and amalgam be combined?

A. By filling the cavity with plastic amalgam and rubbing pieces of gold until no more gold is amalgamated (Dr. Rhein).

Q. What appliances are used in dental laboratory for melting metals?

A. Safety-lamp with mouth or automatic blow-pipe, Burgess, Knapp's, Fletcher's and other blow-pipes and melting furnaces.

Q. What are crucibles in which metals are melted composed of?

A. Clay mixed with silica, burnt clay, graphite or plumbago and other infusible materials; and for melting platinum crucibles, of lime.

Q. Before using a Hessian crucible how should it be prepared?

A. Powdered borax should be rubbed on inside to glaze surface, facilitate pouring and prevent loss of metal by adhering to sides.

Q. What are Ingot-moulds for reception of molten metal made of?

A. Cast iron, soapstone, charcoal; and of lime for platinum.

Q. How should Ingot-mould be prepared for the metal?

A. Heated and oiled, if of iron.

Q. How is rolling Ingot into Plate accomplished?

A. By passing it between cylindrical steel rollers, gradually brought together by screws, the metal being frequently annealed.

Q. How is wire made?

A. By a draw-plate, through the holes of which the metal of a cylindrical shape is drawn.

Q. What is meant by soldering?

A. The union of pieces of metal by the fusion of an alloy that is called solder, and which melts at a lower temperature than the pieces of metal to be united.

Q. What are the requisites for successful soldering?

A. Contact of the pieces of metal to be joined together; a metallic surface free from oxidation, and other impurities over which the solder is to flow; a fusible, free flowing solder; proper degree of and distribution of heat; and in the case of artificial dentures, complete drying and heating up of investment.

Q. What will prevent or remove oxidation and give bright clean surfaces in soldering?

A. Borax employed as a flux, by dissolving the oxide and protecting surface from further oxidation by excluding air; also a weak solution of sulphuric acid and water.

Q. What should be the requisites of a dental solder?

A. Free flowing, correspond in color as nearly as possible to metals to be united, and of as high a grade as is possible, to resist action of fluids of mouth.

Q. How should the heat be managed in soldering?

A. Raised gradually to prevent displacement of pieces of solder, or the fracture of teeth; both teeth and plate brought to same temperature; equal distribution of heat until parts are heated nearly to fusing point of solder, when a pointed blue flame is directly brought to bear on the solder.

Q. What are Solder-supports made of?

A. Well-burned charcoal of light woods, pumice stone, graphite or plumbago, coke, asbestos and plaster, charcoal and plaster, etc., or the sheet-iron funnel-shaped hand furnace filled with ignited charcoal, which serves to heat up case, as well as for a support.

ZINC.

Q. What is the Symbol of *Zinc?*

A. Zn.

Q. What is the Atomic Weight?

A. 65.2.

Q. Is metallic zinc ever met with in nature?

A. No.

Q. What are the principal ores of zinc?

A. Red oxide—Sulphide (blende), native carbonate (calamine).

Q. What is the most valuable?

A. Carbonate, and from it metallic zinc is extracted.

Q. How is metallic zinc obtained from the carbonate?

A. First roasted or calcined to expel water and part of the carbonic acid, and make it friable, then reduced to powder, and mixed with coal dust and distilled at a red heat; carbon monoxide escapes, while the reduced metal volatilizes and is condensed.

Q. What is the nature of zinc?

A. Brittle, crystalline, of a bluish-white color, and recent fracture shows a brilliant crystalline surface.

Q. What is its density?

A. 6. 8 to 7. 2.

Q. Between what degrees of temperature does it become quite malleable and ductile?

A. 248° to 302° F.

Q. What is remarkable about its malleability?

A. It retains it when cold.

Q. What is the effect of heating to 410° F.?

A. It becomes so brittle that it may be powdered in a mortar.

Q. What is the fusing point of zinc?

A. Below red heat—773° F.

Q. What is the effect of a bright-red heat?

A. Boils, volatilizes, and in air burns with a whitish-blue light generating oxide of zinc.

Q. How is chloride of zinc prepared?

A. Dissolving zinc in hydrochloric acid.

Q. What is the effect when zinc is heated to a low red heat?

A. It burns with a bluish flame, forming oxide of zinc, $Zn\,O$.

Q. What do the oxide and chloride form the chief ingredients of?

A. Oxychloride of zinc filling material.

Q. What the oxide and glacial phosphoric acid?

A. Oxyphosphate of zinc filling material.

Q. What other minerals in the oxychloride?

A. Borax and silex.

Q. What other minerals in the oxyphosphate?

A. Borax, silex, and ground glass.

Q. How much zinc is usually added to dental amalgams?

A. Two to four per cent.

Q. What is the effect of melting zinc and lead together?

A. Lead goes to bottom as the heavier, both being alloyed, the zinc with one to two per cent. of lead, and the lead with one to six of zinc.

Q. Does zinc unite with tin?

A. Yes, in all proportions.

Q. Are dies for swaging plates ever made of zinc and tin?

A. Yes, zinc four parts, tin one part, for sharpness; also zinc two parts, tin one part (Fletcher).

Q. What is zinc alloyed with to form Brass?

A. With copper—28 to 33 zinc; 67 to 72 copper.

Q. Does zinc expand greatly when heated?

A. Yes, and contracts on cooling.

Q. Is a zinc die very brittle and easily trimmed when hot?

A. Yes; a hot zinc die may fracture by falling on a hard surface.

Q. Will zinc affect melting ladle?

A. Yes, may penetrate it; but may be prevented by coating inside with whiting.

Q. What is the effect of melting zinc a number of times?

A. It becomes very brittle, owing to presence of dissolved zinc oxide, or to contamination with iron of the melting ladle.

Q. When in such a condition how may it be purified?

A. By melting and throwing on its surface some dry ammonium chloride.

Q. Does zinc dissolve in all common acids?

A. Yes, forming zinc chloride, $Zn\ Cl_2$; zinc sulphate, $Zn\ SO_4$; zinc nitrate, $Zn\ (N\ O_3)_2$.

Q. Does zinc dissolve in alkali solutions?

A. Yes, for example, in potassium hydroxide, forming $K_2\ Zn\ O_2$.

Q. Is zinc often associated with arsenic?

A. Yes; commercial zinc and zinc oxide are seldom found free from it.

Q. Is the contraction of zinc in making a die for metal work immaterial?

A. The expansion of plaster model in setting counteracts the contraction of the zinc die.

Q. What is the best form of zinc for dies?

A. Bertha zinc (Essig).

LEAD.

Q. What is the Symbol of *Lead?*

A. Pb. (Plumbum).

Q. What is the Atomic Weight?

A. 206.5.

Q. What is the source of Metallic Lead?

A. Native sulphide or galena, Pb S.

Q. By what process is lead obtained?

A. Reduced by roasting the ore until considerable lead oxide and sulphate are formed, and the mixture heated, air being excluded; or a simple method is heating the ore with iron.

Q. What is the nature of lead?

A. Soft, bluish, little tenacity, very malleable and ductile.

Q. What is the fusing point of Lead?

A. 617° F.

Q. What is the effect of white heat on lead?

A. Boils and volatilizes.

Q. What is the effect of dilute acids on lead?

A. Slow action.

Q. Does lead readily unite with tin?

A. Yes, in all proportions.

Q. Does lead unite readily with mercury?

A. Yes, condensation results from the union.

Q. What is the effect of alloying lead with much silver?

A. It will remain fluid at a lower temperature; separation of ores of lead and silver are thus effected.

Q. What is the effect of lead on gold?

A. The one nineteen hundred and twentieth part of lead will impair ductility of gold.

Q. Have lead and platinum great affinity?

A. Yes, and the alloy usually can be fused at a low temperature.

Q. What are the most valuable alloys of lead?

A. Those it forms with tin, antimony, and bismuth.

Q. What is Type Metal?

A. Lead 4 parts, antimony 1, tin 1.

Q. What are the dental uses of lead?

A. For counter-dies and an ingredient of fusible metals.

Q. What alloys of lead are used for counter-dies?

A. Lead 8, antimony 1; lead 1, tin 2.

Q. What compose some of the Fusible Metals?

A. Lead 1, tin 1, bismuth 1—fuses at 250° F.
Lead 5, tin 3, bismuth 8— " 200° F.
Lead 2, tin 1, bismuth 3— " 200° F.

Q. What is *Spence's Metal?*

A. A solution of the sulphides of metals, as lead, iron antimony, zinc, etc., in melted sulphur; not strictly an alloy; for dental uses, the compound is made by melting iron sulphide in sulphur; it fuses at 160° C, and expands on cooling, and gives a good die (Hall).

Q. What is *Rose's Fusible Metal?*

A. Bismuth 2 parts, lead one part, and tin one part; melts at 200° F.

Q. Give the formula for *Soft Solder?*

A. Lead 2 parts, tin one part.

Q. What is Wood's metal, for repairing vulcanite sets, composed of?

A. Lead 6, bismuth 7, cadmium 1; fuses at 180° F. (See process under Bismuth.)

TIN.

Q. What is the symbol of *Tin?*

A. Sn (Stannum).

Q. What is the Atomic Weight?

A. 118.

Q. In what form is it found?

A. Chiefly as an oxide; the chief ore is tin stone, $Sn\ O_2$.

Q. How is metallic tin obtained?

A. Ore is first stamped, then roasted to free it from sulphur and arsenic, then subjected to high temperature with charcoal which sets free the metal.

Q. What is its nature?

A. Soft, malleable, brilliant white, faint lead tint when compared with silver.

Q. What is the Fusing Point of Tin?

A. 442° F. or 440° F. according to some, with a density of 7.3.

Q. What is cause of peculiar crackling sound a bar of tin emits when it is bent?

A. By sliding of crystalline plates over each other; it is called "the cry of tin."

Q. When heated much above its fusing point: also when exposed to air, what is the effect?

A. It oxidizes freely, and is converted into oxide of tin, or "polishing putty," in form of a yellowish-white powder: it does not readily tarnish in the air, but does so quickly in hydrogen sulphide gas, stannous Sulphide being formed, Sn S.

Q. What is effect of nitric acid on tin?

A. Converts into hydrated dioxide, a white, insoluble powder, metastannic acid, $H_{10}\ Sn_5\ O_{15}$.

Q. What is the effect of hydrochloric acid?

A. When aided by heat, forms stannous chloride.

Q. What is the effect of nitro-hydrochloric acid?

A. Forms stannic chloride.

Q. Does Tin alloy with many metals?

A. Yes and renders them more brittle.

Q. What is Dr. G. F. Reese's base for artificial dentures?

A. Tin 20, silver 2, gold 1.

Q. What is Cheoplastic metal?

A. Tin, silver, bismuth, antimony, and cadmium.

Q. What is Fletcher's Platinum and Gold Amalgam?

A. Tin 50.35, silver 43.35, gold 3.35, platinum 1.30, copper 1.65.

Q. What is Dr. Bean's base for lower sets?

A. Tin alloyed with a small percentage of silver.

Q. What is Bell-metal?

A. Tin 2, copper 78.

Q. What is common Babbitt metal?

A. Tin 12, antimony 3, copper 2.

Q. What is Bronze?

A. Alloy of tin and copper, and sometimes zinc.

Q. How may pure tin be obtained?

A. By dissolving commercial tin in hydrochloric acid; filter, evaporate solution to small bulk, treat with nitric acid, wash thoroughly, expose to red heat in crucible with charcoal, and pure tin in form of button is found at bottom of crucible.

Q. What are the impurities of commercial tin?

A. Arsenic, lead, iron, copper antimony, bismuth.

Q. What is the object of using tin and gold foils combined, against cervical walls of cavities?

A. Galvanic action is confined to the two metals, and tooth-structure is protected.

Q. What are its dental uses?

A. Tin is used both for dies and counter-dies, in form of foil for filling teeth, and in thicker foil for base-plates, for to cover plaster models of vulcanite and celluloid work, and as a metallic model on which to mould celluloid, as a constituent of fusible alloys, and amalgams, etc.

Q. Has tin any affinity for cast iron?

A. No, but adheres to surface of wrought iron; if cast iron is decarbonized it will adhere to it.

Q. What is Mosaic Gold?

A. White oxide of tin combined with sulphur.

BISMUTH.

Q. What is the Symbol of *Bismuth?*

A. Bi.

Q. What is its Atomic Weight?

A. 207.5.

Q. What is its Fusing Point?

A. 510° F.

Q. What is its nature?

A. Very brittle, slightly reddish-yellow in color, of crystalline structure-like antimony in this respect, unchanged in air, at a red heat it burns with a blue flame, the oxide $Bi_2\ O_2$, being formed, in moisture hydrogen sulphide forms bismuth sulphide, $Bi_2\ S_3$.

Q. What is the most important compound?

A. Bismuth subnitrate $Bi\ (O\ H)_2\ N, O_3$, used in medicine.

Q. What effects have nitric, sulphuric and hydrochloric acids on bismuth?

A. Soluble in nitric; slightly soluble in sulphuric and insoluble in hydrochloric acid.

Q. What is its source?

A. Occurs native, also as bismuth glauce, $Bi_2\ S_3$, and bismuth ochre, $Bi_2\ O_3$.

Q. How is it reduced from the oxide?

A. By fusing with carbon.

Q. How is native metallic bismuth separated from the ore?

A. By heating in inclined iron retorts, when it runs from a small opening in lower end.

Q. How distinguish bismuth from lead?

A. By fusing bismuth on charcoal when it gives a brittle bead.

Q. What are its alloys chiefly used for?

A. To make fusible alloys, such as Newton's, Watt's, Weston's, Wood's, Essig's, Kingsley's, Mellott's, Richmond's, etc.

Q. What is the effect of bismuth when alloyed with other metals?

A. It increases the fusibility of other metals, forming alloys, some of which melt in boiling water.

Q. What is the effect of alloying tin with bismuth?

A. 1 part of bismuth with 24 of tin forms a malleable alloy; but more of bismuth added to the tin will render the alloy brittle.

Q. What is the formula for Richmond's fusible alloy for crown- and bridge-work?

A. By weight tin 20 parts, lead 19, cadmium 13, and bismuth 48; fuses at 150° F. as hard as zinc, and can be poured into a plaster impression.

Q. What is the formula for Mellott's fusible metal?

A. Tin 5 parts by weight, lead 3, bismuth 8; employed with "moldine" as an impression material—potter's-clay and glycerine.

Q. Give the proportions of some other fusible alloys?

A. Tin 4, lead 4, bismuth 7, cadmium 1, melts at 180° F.

Tin 2, lead 4, bismuth 7, cadmium 1, melts at 158° F.

Tin 3, lead 2, bismuth 5, melts at 212° F.

Q. What is the formula for Wood's metal?

A. Bismuth 7 parts, lead 6, cadmium 1, melts at 180° F; used for replacing teeth on vulcanite sets.

Q. What is the process?

A. A dovetail space is cut in plate with a saw, tooth fitted, and the alloy is packed in with a small soldering-iron or spatula heated in an alcohol lamp.

Q. Give an alloy that will fuse as low as 145° F.?

A. Bismuth 15 parts, lead 8, tin 4, cadmium 3.

ANTIMONY.

Q. What is the Symbol?

A. Sb (Stibium).

Q. What is its Atomic Weight?

A. 120.

Q. What is the fusing point?

A. 840° F.

Q. What is its source?

A. Chief ore is Stibnite, $Sb_2 S_3$; reduced by first roasting and then heating with carbon.

Q. What is its nature?

A. Bluish-white in color, very brittle, easily pulverized, crystalline structure, and in appearance resembles bismuth; does not change in dry air; when heated to red heat it yields antimonious oxide, $Sb_2 O_3$; hydrogen sulphide tarnishes it slightly.

Q. Are there any compounds of much importance?

A. No, but it is extensively used in alloys.

Q. What does it resemble in its chemical properties?

A. Arsenic.

Q. What are the effects of acids?

A. Insoluble in hydrochloric and sulphuric acids, except the latter is concentrated and boiling; it is oxidized by nitric acid forming antimonic acid, $H_3 Sb O_4$; aqua regia dissolves it forming antimony chloride, $Sb Cl_3$; it is soluble in tartaric acid, but alkalies have no such effect.

Q. What is the effect of antimony on alloys?

A. Hardens them, and causes them to expand on cooling; it forms an amalgam which decomposes in air and water.

Q. What is its odor when heated?

A. Similar to garlic.

Q. What are its chief uses in alloys?

A. For making type metal, britannia metal, Babbitt metal, stereotype metal; also as an ingredient of fusible alloys; sometimes used as a die on account of its slight shrinkage.

Q. What is the formula for best type-metal?

A. Lead 75, tin 5, and antimony 20 parts (Essig).

Q. What is Haskell's formula for Babbitt metal?

A. Tin 72.72, copper 9.09, antimony 18.18, used for dies on account of non-shrinkage; or copper 1 part, antimony 2, tin 8.

Q. What is the formula of a counter-die for a Babbitt Metal die?

A. Lead 7 parts, and tin one part.

Q. What is Fletcher's formula for dies and counter-dies?

A. Copper 4 lbs., banca tin 96 lbs., antimony 8 lbs.; nearly as hard as zinc with little shrinkage.

Q. What other alloys does antimony assist in forming?

A. Bell metal, gun metal, speculum metal.

GOLD.

Q. What is the Symbol of *Gold?*

A. Au (Aurum).

Q. What is its Atomic Weight?

A. 197.

Q. How early was gold used in dentistry?

A. 300 B. C., by the Romans to secure artificial teeth in mouth.

Q. What is the native rock or bed of gold?

A. Quartz.

Q. Is gold always found in metallic state?

A. Yes, it is rarely found in crystals; form of octahedrons.

Q. What is the invariable alloy of native gold?

A. Silver; California gold 10 per cent., Australian 5 per cent.

Q. What other metals are often found with gold?

A. Iron, copper, platinum, iridium, palladium, rhodium, tellurium.

Q. What is the effect when iridium exists in gold?

A. The small and very hard fine grains injure rolling mill.

Q. What glittering particles are often mistaken for gold?

A. Iron and copper pyrites and yellow mica.

Q. What are the tests for such minerals?

A. For iron pyrites—magnet attracts them, very brittle, one quarter as heavy, and nitric acid acts violently on them; for copper pyrites—

they lose metallic lustre under blowpipe, and fuse into black globules; and if carbonate of soda and borax are added, a button of copper is obtained; for yellow mica—its specific gravity is only three, that of gold nineteen, and microscope shows it to be without metallic lustre and dark-gray in color.

Q. What ore is invariably gold-bearing?

A. Lead.

Q. Has a native gold amalgam ever been found?

A. Yes, in California.

Q. What other metals sometimes contain gold?

A. Arsenic, antimony and platinum.

Q. What is the color and softness of pure gold?

A. Rich yellow, nearly as soft as lead.

Q. What properties distinguish gold?

A. Extreme malleability, ductility, and tenacity; most malleable of all metals; one grain may be beaten into leaves covering fifty-six square inches, and one three hundred thousandth of an inch thick.

Q. How many times heavier than water?

A. $19\frac{1}{2}$.

Q. Is it a very tenacious metal?

A. No, but if covered by silver, one grain may be drawn into a wire five hundred feet long.

Q. How thin can gold be hammered into foil, and drawn into wire?

A. Into $\frac{1}{300000}$ of an inch in thickness; drawn into wire so fine that one mile of it will weigh less than a grain.

Q. How is Gold Foil prepared?

A. Perfectly pure gold is rolled into ribbon about $\frac{1}{800}$ of an inch in thickness, cut into pieces an inch square, hammered between sheets of tough paper or vellum, and finally animal membrane—gold-beater's skin until $\frac{1}{200000}$ of an inch in thickness; sheets of gold cut and made into books.

Q. What is the Fusing Point of gold?

A. 2016° F.

Q. Is it capable of being welded while cold?

A. Yes.

Q. How can gold be volatilized?

A. Only by passing a powerful charge of electricity through a thin leaf.

Q. How is gold obtained from quartz rock?

A. By stamping and amalgamation.

Q. By what other process is gold sometimes reduced from the ore?

A. Exposing roasted ore to chlorine gas, which converts it into a soluble chloride, which is removed by washing, and the gold precipitated by sulphate of iron.

Q. What will dissolve gold?

A. Aqua Regia—hydrochloric acid two parts, nitric acid one part.

Q. How may gold be refined?

A. By concentrated hot sulphuric acid converting the silver and copper into soluble sulphates, without action on gold; also by nitric acid, but latter does not yield as fine a gold.

Q. What is an accurate method of separating silver from gold?

A. Refining by chlorine gas.

Q. Give a method of reducing alloyed gold to pure gold?

A. Dissolve in aqua regia (3 parts of hydrochloric acid to 1 part of nitric acid), wash and precipitate with the protosulphate of iron (green copperas) dissolved in clear rain water; filter the solution, and allow the gold, which is in the form of a brown powder, to settle to the bottom of the vessel; after pouring off the solution, wash the brown powder, and then melt the gold with carbonate of potash; if minute traces of iron remain, digest the gold in dilute sulphuric acid.

Q. What will precipitate gold in solution?

A. Oxalic acid, sulphurous acid, and sulphate of iron.

Q. How may brittle gold be treated?

A. Exposing it in a fused state to a stream of chlorine gas, which converts contaminating substances into volatile chlorides.

Q. What will also restore the toughness of gold?

A. By throwing a little corrosive sublimate on surface of molten metal.

Q. How may scrap gold of dental laboratory be refined?

A. By melting it with mixture of nitrate of potash and borax; or ten per cent. of black oxide of copper.

Q. How may iridium be separated from gold?

A. By melting gold with three times its weight of silver and granulating it; then treat alloy with nitric acid to dissolve the silver, and then add aqua regia to act upon gold, and precipitate gold from solution by oxalic or sulphurous acid.

Q. How may Laboratory gold scrap be freed of iron, lead, tin and copper?

A. Boil scrap in form of filings in pure nitric or hydrochloric acid, then wash in water, and melt, using carbonate of potash, or borax as a flux.

Q. How refine gold scrap containing solder and platinum ?

A. Melt for one-half to one hour, adding nitrate of potash and borax frequently, stirring with rod; cool, break crucible and separate gold from dross with hammer, melt gold again and pour into ingot mould, roll or hammer ingot into thin ribbon, and dissolve in aqua regia, evaporate solution to dryness and again melt.

Q. From what form of gold is plate of artificial denture made ?

A. From gold coin.

Q. What is fineness of gold coin ?

A. Am. coin—21.6; English—22.

Q. What of pure gold ?

A. 24.

Q. From what form of gold should solder be made ?

A. Pure gold, so as to determine its carat or fineness.

Q. Give formulæ for Gold Plate from pure gold ?

A. 18 carat plate—pure gold 18 dwts; pure copper 4 dwts; pure silver 2 dwts. 20 carat plate—pure gold 20 dwts; pure copper 2 dwts; pure silver 2 dwts. 22 carat plate (crown-and bridge-work)—pure gold 22 dwts; fine copper 1 dwt; silver 18 grs.; platinum 6 grs.

Q. Give formulæ for gold plate from coin ?

A. 18 carat plate—gold coin 20 dwts; pure copper 2 dwts; pure silver 2 dwts. 20 carat plate—gold coin 20 dwts; pure copper 18 grs., pure silver 20+grs. 21 carat plate—gold coin 20 dwts; pure silver 13+grs.

Q. Formula for 21 carat plate ?

A. Gold coin 20 dwts; pure copper 6 grs.; pure platinum 7 5–7 grains; or 10 grs. of platinum to 20 dwts of gold coin.

Q. Give formula for gold solders ?

A. 14 carat solder—Am. gold coin $10; pure silver 4 dwts; pure copper 2 dwts. 18 carat gold solder—gold coin 30 parts; pure silver 4 parts; pure copper 1 part; brass 1 part. 20 carat solder for crown- and bridge-work—Am. gold coin $10, (258 grs.); spelter solder (equal parts of copper and zinc) 20.64 grs.

Q. What is a formula for gold clasps, etc. ?

A. Coin gold 20 dwts; pure silver 10 grs.; pure copper 8 grs.; platinum 20 grs.

Q. How may an easy flowing solder be made of a $1 gold coin ?

A. By adding to it silver 8 grs., copper 5 grs., zinc 5 grs.

Q. Formula for Gold-Aluminum Solder?

A. Gold 5 parts, copper 1 part, silver 1 part, aluminum 2 parts.

Q. How is the fineness of gold usually expressed?

A. In carats: pure gold is 24 carats, or 1,000 fine; 22 carat gold contains 22 parts of pure gold and two of other metal, and is 916.6 fine.

Q. How ascertain carat of any given alloy?

A. Multiply 2 by weight of gold in alloyed mass, and divide product by weight of mass, the quotient is the carat sought.

Q. How reduce gold to a required carat?

A. Multiply weight of gold used by 24, and divide the product by required carat; the quotient is the weight of mass when reduced, from which subtract weight of gold used, and remainder is weight of alloy to be added.

Q. How raise gold from lower to higher carat?

A. Multiply weight of alloyed gold used, by number representing proportion of alloy in given carat; divide product by figures representing quantity of alloy in required carat; quotient is weight of mass when reduced to required carat by adding fine gold.

Q. Does alloying gold with silver affect its malleability?

A. No, but increases its hardness; same with pure copper.

Q. What effect has equal weight of platinum on gold?

A. Alloy of good malleability, but dulness of color.

Q. What is nature of alloy of gold and tin?

A. Hard and brittle.

Q. How does gold combine with mercury?

A. At all temperatures; union facilitated by heating.

Q. How with silver?

A. In all proportions.

Q. How much gold must a gold-silver, or gold-copper alloy contain to prevent disintegration by nitric acid?

A. At least 25 per cent.

Q. How does gold combine with zinc?

A. Has strong affinity, but alloy is brittle.

Q. What is Purple of Cassius?

A. Gold, tin and oxygen, stannous and stannic chlorides added to gold chloride; gives gum color to artificial teeth.

Q. What quality of gold is used for filling teeth?

A. Pure and nearly pure.

Q. What two varieties of gold foil?

A. Cohesive and Non-cohesive.

Q. What is Cohesive Gold?

A. Pure gold.

Q. How is quality of non-cohesiveness obtained?

A. Either by slightly alloying, or by depositing carbon on surface, or by some mechanical process during lamination, or action of some gaseous substance.

Q. Does union take place between particles of non-cohesive gold introduced into a cavity?

A. No, they are made to adhere mechanically by wedging one piece against another.

Q. How is it with cohesive gold?

A. Union or welding occurs whenever two pieces are brought in contact.

Q. What does a comparison between cohesive and non-cohesive sheets of gold show?

A. Cohesive of closer texture; and more disposition to separation of particles of non-cohesive.

Q. What is the important property of cohesive gold as a filling material?

A. Welding by pressure after recent annealing to a dull red heat.

Q. What impairs cohesive property of gold?

A. Exposure to air, moisture, certain gases, exhalations of skin, blood, etc.

Q. What will restore gold impaired by many such causes?

A. Annealing.

Q. What gases are particularly injurious to cohesive property of gold?

A. Sulphurous acid gas from matches, and decay of animal and vegetable matter; sulphuretted hydrogen from same cause, such as blood left in spittoon; carbonic acid gas; chlorine gas.

Q. Does annealing gold harden or soften it?

A. Softens it.

Q. What form of gold is more readily affected by deleterious agents?

A. Cohesive.

Q. For grinding surface and other simple cavities the use of what form of gold is a saving of time?

A. Non-cohesive.

Q. What is the best method of annealing gold foil?

A. On a sheet of mica over an alcohol flame; not by passing pieces through the flame.

Q. What is Plastic Gold?

A. Gold for filling teeth which is of such a granular quality (lack of fibre) as to prevent it from curling up when pressure is made upon any part of a portion of it, condensing only under the point of the instrument, or pressure, with no drawing up of the surrounding portions; valuable for starting fillings.

Q. What is Tin-Gold?

A. A combination of tin and gold, formed by laying a sheet of tin-foil and one of gold foil together, and either rolling, folding, or crimping them, and then using in the same manner as non-cohesive foils.

Q. How is corrugated gold prepared?

A. By placing sheets of foil between leaves of unsized paper, and tightly packing in iron boxes, which are exposed to a temperature high enough to carbonize the paper, making gold soft and non-cohesive.

Q. Describe some of the qualities that gold possesses to make it so desirable a filling material?

A. Its indestructibility, its beauty, its resistance to action of acids, its non-contaminating influence, its durability, etc.

SILVER.

Q. What is the Symbol of Silver?

A. Ag (Argentum).

Q. What is its atomic weight?

A. 108.

Q. What are the most common ores of silver?

A. Those resulting from combination with sulphur as sulphides—argentite Ag_2 S, and galena.

Q. How is silver extracted from its ores?

A. Ore is roasted with common salt, by which silver chloride is formed; the mixture is placed in casks and treated with iron and water; then mercury is added which is then volatilized.

Q. In what form is silver found?

A. As native silver, occasionally in flat masses, sometimes crystalline.

Q. What does it contain traces of?

A. Gold, antimony, etc., but free from any considerable admixture; also as chloride, bromide and iodide.

Q. What is chloride of silver?

A. Native horn-silver—silver, 75.3, chlorine, 24.7.

Q. With what metals is silver associated in this country?

A. Copper, also with lead ore—galena, and antimony.

Q. How is metallic silver obtained from the ore?

A. By uniting it with lead and separating by cupillation; by converting it into a chloride and reducing by iron and sulphuric acid; by amalgamation.

Q. How is native silver usually separated from its accompanying rock?

A. By stamping to powder and amalgamating.

Q. What is the nature of the Colorado and Idaho Silver ores?

A. Silver 60 parts, antimony 20, sulphur 14, oxygen 10.

Q. What are the properties of silver?

A. A brilliant whiteness, hardness between gold and copper, very ductile and malleable, but not as much so as gold, in tenacity it exceed gold; best conductor of heat; not changed by air or water, but readily tarnished by sulphur, or its compounds, silver sulphide being formed.

Q. What metals form alloys with Silver?

A. Gold, copper, platinum, iridium, steel, mercury, and manganese.

Q. What is the Specific Gravity of Silver?

A. 10.53.

Q. What is the fusing point of silver?

A. 1873° F.

Q. Name a few of silver compounds of importance?

A. Nitrate, $Ag\ N\ O_3$; Chloride, Ag Cl; bromide, Ag Br; Iodide, Ag I.

Q. Describe process of obtaining Pure Silver?

A. Dissolve metal in pure nitric acid slightly diluted with water, assisted by a moderate heat; precipitate with a solution of common salt; pour off solution, wash chloride; place it in water acidulated with hydrochloric acid; then add pieces of clean iron, when an evolution of hydrogen takes place, liberating the silver in a spongy mass, which is washed and melted; gives silver of 999.7 fineness, the 0.3 impurity being iron.

Q. How obtain pure silver from coin?

A. For 1 oz.: dissolve 520 grains of coin silver in 1 oz. of pure nitric acid diluted with ¼ water, and apply heat until all is dissolved; dilute solution with 2 or 3 times its bulk of rain-water, into which put a strip of bright copper; wash and melt the precipitated silver.

Q. How may pure silver be obtained from Chloride of Silver?

A. By fusing with carbonate of soda.

Q. How may pure silver be obtained from Nitrate of Silver?

A. By dipping a sheet of copper in a solution of the nitrate; 1½ ounces of nitrate will contain rather more than 1 oz. of pure silver.

Q. How is Granulated Silver obtained?

A. By pouring pure silver from a height of several feet into water.

Q. How is Nitrate of Silver (Lunar Caustic) prepared?

A. By dissolving silver in nitric acid with a gentle heat.

Q. How may silver chloride and other compounds of silver be reduced to metallic silver?

A. By fusing on charcoal with sodium carbonate.

Q. What is effect of alloying silver with copper?

A. Adds greatly to the hardness; maximum hardness from 1 part of copper to five parts of silver.

Q. What will give a durable plate for dentures?

A. 3 to 10 grains of platinum to each pennyweight of silver.

Q. Give formula for Silver solders?

A. For good solder; pure silver 6 parts, copper 3, zinc 1; or pure silver 5½ dwts, brass wire 40 grains. Easy flowing—Pure silver 20 parts, copper 3, brass 5; or silver 6 parts, copper 2, brass 1.

Q. Describe process of making Silver Solder?

A. Put silver in crucible and cover with powdered borax, and melt thoroughly; then add copper and brass, hold crucible with tongs, and mix by shaking; pour into ingot mould, and roll to thickness No. 27.

Q. How give a frosted surface to Silver?

A. Heat nearly to redness, plunge into water acidulated with nitric or sulphuric acid.

Q. Give standard fineness of Am. and French coin?

A. 90 parts pure silver, 10 parts pure copper.

Q. English Coin?

A. 111 parts silver, 9 parts copper.

Q. How many volumes of oxygen does silver absorb when it is melted?

A. Twenty, and contracts on cooling, evolving the included oxygen.

Q. What causes silver to "spit" or "sprout?"

A. Sudden cooling causing the oxygen to escape.

Q. How may silver be deposited on another metal?

A. By connecting the article with zinc negative pole of galvanic battery, and immersing in solution made by dissolving cyanide of silver in a solution of cyanide of potassium.

Q. What effect does tin, zinc, antimony, lead, and arsenic have on silver?

A. They render it brittle.

MERCURY.

Q. What is the Symbol of Mercury?

A. Hg (Hydrargyrum). Quicksilver.

Q. What is the Atomic Weight?

A. 200.

Q. At what temperature does it become solid, or fuse?

A. At 40° F; the only metal liquid at ordinary temperatures, below 40° it may be hammered and welded.

Q. At what temperature does it volatilize readily?

A. At 60° F. and somewhat at ordinary temperatures; boils at 66° F.

Q. What are its properties?

A. Silver—white color, high lustre; boils at 660° F. very soluble in strong nitric acid; is dissolved in sulphuric acid only by heat; hydrochloric acid has no effect on it.

Q. Where is it found of singular purity?

A. California, Australia, and British Columbia.

Q. What are its sources?

A. Cinnabar, or mercuric sulphide—the ore from which the metal is obtained, also horn quicksilver, native amalgam of silver and mercury.

Q. How is it obtained from the sulphide?

A. Sulphide is heated in iron retort, or roasted in furnace, and mercury is condensed from the vapor.

Q. How is it adulterated?

A. With tin and lead.

Q. How detect presence of such metals?

A. By scattering a little on clean glass plate, when it "tails" or leaves a track; or by foul surface when shaken in a bottle containing air; or by allowing a large globule to roll over surface of white paper, and, if impure, it will leave a streak of dross in its track, which absolutely pure mercury will not.

Q. How may lead be removed?

A. By nitric acid diluted with two parts of water, which should cover its surface for several days, with occasional stirring.

Q. How is it distilled and redistilled to make it pure?

A. Place it in a glass or iron retort and add to its surface clean iron filings or coarse powdered cinnabar and heat on sand bath; if cinnabar is used, its sulphur converts foreign metals into sulphides, and the pure mercury is set free.

Q. What is a simple method of redistilling it?

A. Place mercury in a bottle and add fine ground loaf sugar, shake thoroughly, open bottle and blow in air by a bellows, repeat several times, and filter through pin holes of paper cone, the oxides of foreign metals adhere to the sugar; pure mercury can also be obtained by decomposing pure vermilion, red oxide, or corrosive sublimate, by heat.

Q. How may pure mercury be obtained for dental amalgams?

A. By putting the impure mercury in a little mercurous nitrate dissolved in water which decomposes the salt, and oxidizes the metals; also by digesting in a solution of nitric acid one part and water eight parts for several hours at temperature of 130° F.

Q. With what metals does mercury amalgamate readily?

A. Gold, silver, tin, lead, zinc, bismuth, potassium, and cadmium; with potassium with violence; not so readily with platinum, copper and palladium.

Q. What two oxides does mercury form?

A. Mercurous oxide, $Hg_2 O$, and Mercuric oxide, $Hg O$—red precipitate.

Q. What others, particularly as chlorides?

A. Calomel, $Hg_2 Cl_2$, corrosive sublimate, $Hg Cl_2$, a powerful disinfectant and corrosive poison.

Q. What effect has hydrochloric and sulphuric acids on mercury?

A. Insoluble in both.

Q. Being soluble in aqua regia and in nitric acid, what are formed?

A. In aqua regia it forms mercuric chloride, and in nitric acid it forms mercurous and mercuric nitrates.

Q. What is Vermilion?

A. Mercuric sulphide ($Hg S$); used to color vulcanite and celluloid.

Q. How is it obtained?

A. By stirring mixture of one part of sulphur with seven parts of mercury in an iron pot, chemical union takes place, and result is a black powder, and small quantities are put in subliming pots and heated to redness for 36 hours, levigated and dried.

Q. What is nature of pure vermilion?

A. Inert and harmless.

Q. What may it be adulterated with?

A. Red lead, disulphide of arsenic, ferric oxide, brick dust.

Q. What effect have acids and alkalies upon it?

A. No effect.

Q. What will convert vermilion into corrosive sublimate?

A. Aqua regia.

Q. What is vermilion employed for?

A. To color vulcanite and celluloid.

Q. What do the best amalgams contain?

A. Tin, silver, gold, platinum and zinc.

Q. How are dental amalgams made?

A. By melting platinum, gold and silver first, and surface of molten alloy covered with charcoal; then add the tin, and stir with a porcelain rod, and pour into ingot mould; ingot cut or filed into shavings or filings.

Q. What kind of mercury should be employed in the preparation of amalgams?

A. Only the chemically pure.

PLATINUM.

Q. What is the Symbol of Platinum?

A. Pt.

Q. What is the Atomic Weight?

A. 197.6.

Q. What is source of largest supply?

A. Ural Mountains of Russia; it is not an abundant metal.

Q. How is the ore treated to obtain the metal?

A. Heated with nitric and hydrochloric acids to dissolve foreign metals present, then with diluted nitro-hydrochloric acid to prevent iridium from being dissolved, then with ammonic chloride to precipitate yellow crystalline ammonio-platinic chloride, which is decomposed by heat, giving platinum in finely divided state, which is subjected to great pressure, and column of platinum heated by charcoal to dry and cleanse it, again heated and hammered on ends to weld particles; and traces of iron removed by coating it with mixture of borax and carbonate of potash when it is again heated to white heat, and spongy mass forged into a solid mass.

Q. What property has it similar to iron?

A. Like iron capable of being hammered while red hot, and welded under intense heat; gold welds cold, silver not at all.

Q. At what temperature does it fuse?

A. 3999° F. by oxyhydrogen blowpipe; with six or eight jets to melt masses.

Q. What is specific gravity?

A. 21.5; heaviest metal.

Q. What are the properties of platinum?

A. Pure is very malleable, exceeds in tenacity all metals except copper, in ductility ranks next to silver, whiter than iron, softer than gold or silver, harder than copper; no single acid will affect it, nor air, nor moisture at any temperature, fusible metals readily alloy with it, and their oxides act on it, aqua regia dissolves it more slowly than gold, alkaline carbonates have no effect on it, but caustic alkalies attack it at red heat; resists oxidation as well as pure gold, expands less under heat than any other metal, and is thus suitable for pins of teeth. It is not affected by air, moisture or hydrogen sulphide.

Q. What are its dental uses?

A. As a base for continuous gum, plate 28 or 30, and, in swaging, annealed at a strong white heat for 8 or 10 minutes; for dowels in crown-and bridge-work, pins for porcelain teeth, for backings, and as a coloring material for porcelain teeth.

Q. What are the platenoid metals (native contaminations) used in dentistry?

A. Palladium and iridium.

Q. What is Platinum-Aluminum Solder?

A. Gold 3 parts, Platinum 0.1, Silver 2, Aluminum 10; said to resist the action of corrosive substances.

Q. What will destroy its malleability?

A. Heated in contact with arsenic, phosphorus, and silica.

Q. What are its chief uses in dentistry?

A. Pins for artificial teeth, base for continuous gum work. (If pins expanded much, teeth would be cracked; and if plate did so, the gum and body would crack.)

Q. What is proper solder for platinum?

A. Pure gold.

Q. What two states of fine division does platinum exhibit?

A. Spongy platinum, and platinum-black, either of which can be used to give grayish tint to porcelain.

Q. What is nature of Platinum Alloys?

A. Unite with gold in all proportions; equal parts of platinum and gold make a malleable alloy; one part to eleven of gold is grayish-white, elastic, and answers for irregularity appliances; two parts to one of gold, is a brittle alloy; silver and platinum, is less white but harder than silver and less malleable, one-thousandth part of platinum hardens steel and iron, and one per cent. will prevent ordinary nitric acid from acting on iron; antimony, bismuth, tin, lead and zinc readily unite with platinum when it is heated to redness; arsenic forms with it a brittle alloy, fusible, and has been used as a solder.

Q. What effect has iridium when alloyed with it?

A. Increases its hardness, melting point and resistance to reagents.

Q. In what respect is platinum like iron?

A. It can be welded at white heat; and by oxyhydrogen blowpipe can be soldered with itself.

Q. With what other metal does it compare in malleability?

A. With tin; more tenacious than silver, and the most ductile except gold and silver; platinum wire can be drawn to $\frac{1}{1200}$ of an inch in diameter.

Q. What causes its "spitting"?

A. Where in a fused state it absorbs oxygen, like silver, which in being expelled causes spitting.

Q. What peculiar property does finely divided or spongy platinum possess?

A. Condensing gases upon its surface.

Q. Of what gases can it absorb many times its own volume of oxygen?

A. Hydrogen and other gases.

Q. What is Spongy Platinum?

A. Made by igniting ammonium platinic chloride.

Q. What is Platinum Black and its use in dentistry?

A. A finely divided platinum, made by dissolving platinum in aqua regia, evaporating the excess of acid, diluting with water and adding this solution to a boiling solution of glycerine and potassium hydroxide; it is used for coloring enamel of artificial teeth.

Q. Dissolving more slowly than gold in aqua regia, what does it form?

A. Platinic chloride, $Pt\,Cl_4$.

Q. With what metals is platinum in metallic form found?

A. Alloyed with palladium, rhodium, iridium, osmium, etc.

Q. What is the process for obtaining pure platinum?

A. Ore is first treated with nitric acid to dissolve any iron or copper present, then with dilute aqua regia, when it is dissolved and precipitated from this solution as ammonium platinic chloride by ammonium chloride; upon being heated it is decomposed, and the finely divided platinum resulting is converted in compact variety by mixing with water and moulding under high pressure and then welding at a high heat.

PALLADIUM.

Q. What is the Symbol of Palladium?

A. Pd.

Q. What is the Atomic Weight?

A. 106.5.

Q. To what group does it belong?

A. Same as iridium, rhodium, osmium, ruthenium and davyum.

Q. What is its Source?

A. Occasionally found native, but chiefly obtained from crude platinum after precipitation by ammonic chloride, when it is neutralized by carbonate of soda, and mixed with sol. of cyanide of mercury, palladium cyanide resulting, which when washed, dried, and melted gives metallic palladium.

Q. What are the properties of palladium?

A. When reduced to metal, it is a spongy mass, which may be welded into a solid mass like platinum; appears like an alloy of gold and platinum where latter is in excess; slightly darker than platinum, malleable, and ductile, but its density is only 11.8; like platinum in hardness, and the two alloyed are harder than either.

Q. What is its fusing point?

A. 2786° F. same as cast iron.

Q. What are its dental uses?

A. For plates, and amalgam; for plates either pure or alloyed with silver, but is not better than gold and platinum.

Q. What are the properties as an amalgam?

A. Added to gold, silver and tin, it blackens alloy, but not the tooth, and has same effect as platinum; sets rapidly, and mixed in large quantity, it evolves heat, and explodes with emission of light; should be used in small pellets and introduced rapidly; unites readily with mercury when in fine powder, there being a chemical affinity between them; unites with silver in all proportions, giving a very brilliant surface; as it cools it hardens and expands; very expensive.

Q. How may palladium be distinguished from platinum?

A. By dropping a small quantity of tincture of iodine on palladium and evaporating over a flame, when a dark spot will remain, which does not occur with platinum.

IRIDIUM.

Q. What is Symbol of Iridium?

A. Ir.

Q. What is the Atomic Weight?

A. 198.

Q. What is its source?

A. Several forms of platinum ore or crude platinum; associated with California gold in hard small grains; also found in scales.

Q. What will liberate iridium?

A. Dissolving crude platinum in aqua regia, in form of gray, metallic scales, which resist action of acid.

Q. What is the most interesting form?

A. Native alloy of iridium and osmium-osmo-iridium.

Q. What are its properties?

A. Very hard and brittle, nearly white, and only fusible under oxyhydrogen blowpipe, when it is like polished steel, same density as platinum, and at white heat may be compressed into compact masses, and only again dissolved by igniting it with a mixture of chlorate of potassium and sodium in a current of chlorine.

Q. What are its dental uses?

A. Alloyed with platinum for posts of crowns, and backings of teeth for greater strength; also for plates, but is hard to swage, requiring die and counter-die of zinc; also for clasps.

Q. What is the best solder for it?

A. Pure gold.

Q. What is its fusing point?

A. 3999°, same as platinum.

ALUMINUM—ALUMINIUM.

Q. What is Symbol of Aluminium?

A. Al.

Q. What is its Atomic Weight?

A. 27.

Q. What is its source?

A. Main constituent of earth alumina, the oxide of the metal aluminium, and is in greatest profusion in whole composition of the globe; no other metal is so abundant; alumina is an ingredient of common clay.

Q. What does its combination with oxygen and silicum form?

A. Essential part of granite.

Q. How is it obtained ?

A. By heating to redness a mixture of double chloride (or fluoride) of aluminum and sodium (cryolite) with metal sodium, by which chloride of sodium is formed and metal aluminum separated; it may be separated by electrolysis.

Q. What are its properties ?

A. Extreme lightness, color of new zinc, very malleable and ductile, may be rolled into thin sheets or drawn into fine wire, very sonorous, conducts heat and electricity same as silver; does not oxidize in air; when pure it is as hard as silver and rivals steel in strength.

Q. What is its specific gravity ?

A. 2.6; only 2½ times heavier than water, 4 times lighter than silver.

Q. What effects have acids upon it ?

A. Strong nitric acid does not affect it, insoluble in dilute sulphuric, but is readily dissolved in dilute or strong hydrochloric acid; also in solutions of caustic potash or soda; it resists oxidation from influence of air.

Q. How does it compare in tenacity with silver and copper ?

A. Superior to silver; less than that of copper.

Q. What is the effect of organic substances upon aluminum ?

A. Withstands their action as fully as silver—as now manufactured.

Q. What is the natural solvent for alumina ?

A. Hydrochloric acid.

Q. What other acid will dissolve it ?

A. Concentrated sulphuric; strong nitric has little effect upon it.

Q. When casting aluminum what is the proper temperature ?

A. Not heated much above fusing point and not kept melted for any length of time.

Q. How should it be annealed ?

A. Surface of plate coated with oil, and then passed over flame of alcohol lamp, or Bunsen burner, until all oil is burned off, and plate becomes white, but no longer; it should be allowed to cool slowly.

Q. What forms of moulds are used in casting aluminum plates ?

A. Either iron, sand and plaster, or plaster and marble dust; metal poured as cold as possible.

Q. How should an aluminum plate be polished ?

A. By use of rouge or tripoli; or by a polish consisting of stearic acid 1 part, fullers' earth 1 part, and rotten stone 6 parts, ground fine and well mixed.

Q. What is nature of its alloys?

A. It forms alloys with nearly all metals; with copper it resembles gold; with tin and zinc a brittle alloy, with silver a hard alloy, but it does not amalgamate with mercury, although an aluminum dental amalgam is sold; it forms the base of all the silicates; the only oxide is alumina $Al_2 O_2$.

Q. Does aluminum unite with mercury?

A. No, but it forms a number of alloys with other metals; it unites readily with zinc, and also alloys with nickel and copper, both giving hardness to each other.

Q. What is its fusing point?

A. 1160° F.

Q. What are the dental uses of Aluminum?

A. As a base for artificial teeth, either swaged or cast, plain teeth answer best for the cast base.

Q. How are teeth attached to a swaged plate of aluminum?

A. By perforating plate with a number of countersunk holes for attachment with vulcanite or celluloid.

Q. Have any solders been discovered that are satisfactory for attaching artificial teeth?

A. No.

Q. What solder is used for articles of ornamentation?

A. Aluminum 6 parts, copper 4 parts, zinc 90 parts, no borax can be used as a flux.

Q. What is the Frismuth solder with vaseline as a flux?

A. Soft solder—pure block tin 90 to 99 parts; bismuth 1 to 10 parts. Hard solder—pure block tin 90 to 98 parts, bismuth 1 to 5, and aluminum 1 to 5; a mixture of copaiba balsam 3 parts, and Venetian turpentine 1 part with a few drops of lemon juice, is also as a flux, the soldering iron being dipped into it, as such instruments are necessary to make friction at the point of fusion, to insure adhesion.

COPPER.

Q. What is the Symbol of Copper?

A. Cu (Cuprum).

Q. What is its Atomic Weight?

A. 63.2.

Q. Source of copper?

A. Commonly from copper pyrites, a combination of sulphide of copper and iron; it is also found as a native metal with silver; the ore is heated in a furnace to convert the iron sulphides into oxide and process repeated with silicious sand, to get rid of the iron; the resulting oxide is reduced by aid of carbonaceous matter and high heat.

Q. What is its nature?

A. Of a brownish-red color, slightly tinged with yellow, faint, nauseous taste, and when exposed to friction, emits an odor similar to its taste.

Q. How may pure copper be obtained?

A. By decomposing a solution of pure sulphate of copper in a galvanic current; or by boiling a concentrated solution of the sulphate in pure zinc.

Q. What are the properties of copper?

A. Great malleability, only exceeded by gold and silver; in tenacity it is next to iron; and for conducting electricity it is equal to silver, and transmits heat only less than silver and gold; soluble in nitric acid, but only with aid of heat in sulphuric acid; hydrochloric acid has slow action on it; its specific gravity is 8.93.

Q. What is the nature of its alloys?

A. It unites readily with all other metals, it is added to gold and silver to impart hardness as in coins and plate; an alloy of copper and platinum equal parts, has a gold color, and same specific gravity as gold.

Q. What is Aluminum Bronze?

A. Pure copper alloyed with 2.5 to 10 per cent. of aluminum, quite malleable and of a fine golden color.

Q. What is the effect of copper in an amalgam?

A. Makes it quick-setting, and lessens its contractibility.

Q. How may copper be detected in a dental amalgam?

A. The alloy is first acted on by nitric acid, and any silver present is recovered in form of chloride, the copper is then precipitated by caustic potash from remaining solution either as oxide, sulphide, or in metallic state.

Q. What composes a Copper Amalgam?

A. Pure copper and pure mercury.

Q. What composes German Silver?

A. Copper 46, nickel 34, and zinc 20.

Q. What is the fusing point of copper?

A. 2000° F.

Q. Does copper readily unite with mercury?

A. No, unless aided by heat.

IRON.

Q. What is the Symbol of Iron?

A. Fe (Ferrum).

Q. What is the Atomic Weight?

A. 56.

Q. From what ores is iron chiefly obtained?

A. Carbonates and oxides.

Q. How is it obtained?

A. By heating the ores in contact with carbonaceous compounds, by which the metal is liberated.

Q. What are the properties of iron?

A. White color, soft and tough, nearly twice as strong as any other metal, it is one of the lightest, heat makes it ductile, but at ordinary temperatures it is the least yielding and the most rigid; it has a specific gravity of 7.8; soluble in nitric, dilute sulphuric, and hydrochloric acids; strong sulphuric has little action on it; chlorine and bromine act on it readily; but if kept in contact with a platinum wire, it will remain in strong nitric acid for many weeks without being affected; its strength and value depend greatly on its fibrous texture.

Q. How does steel differ from iron?

A. In becoming very hard and brittle, if, when heated to bright redness, it is suddenly cooled by being plunged in water.

Q. What is Steel?

A. Iron chemically combined with the requisite amount of carbon to endow it with the property of hardness and brittleness when heated to bright redness and suddenly plunged in water.

Q. How is steel made?

A. Imbedding bars of iron in charcoal powder in a furnace for several hours under heat; this makes "blistered steel," cutting such bars into short pieces and heating bundles of them to welding point, and consolidating each bundle into a solid mass under a tilt-hammer, makes "Shear steel," fusing blistered steel in plumbago crucible, and protecting surface from oxidation by melting glass on it, and casting the fluid steel into ingots, makes "cast steel," the best and most homogeneous variety.

Q. What is Bessemer Steel?

A. Steel made by forcing atmospheric air into melted cast iron.

Q. How is hardening of steel done?

A. By subjecting it to extremes of temperature, first coating its surface with soap to prevent scaling and oxidation, and answers best in re-tempering dental intruments; the metal is then heated to full redness and plunged into cold water, oil or mercury, or, in the case of small instruments, placed on a large surface of cold metal.

Q. What is the effect of heating hardened steel to redness and allowing it to cool slowly?

A. It becomes soft, and may be proportionately reduced by heating to short of redness, the proper point of which is indicated by certain colors which appear on the brightened surface of a steel instrument when held over a flame. To obtain a certain temper, it is necessary to plunge the instrument into cold water, or bring it in contact with a cold surface, the moment the desired degree of hardness (temper) is reached, as a certain color shows.

Q. What causes the different shades of discoloration?

A. The formation of a thin film of oxide, which becomes thicker and darker and steel softer, as the temperature rises.

Q. What is the proper temper for dental instruments?

A. Enamel chisels, a light yellow at 430° to 450° F.; Excavators, medium yellow at 470°; Pluggers, a brown yellow at 490°; Saws, a brown purple at 520° F., when elasticity is required, blue at 530° to 570°.

Q. What should be appearance of fractured surface of fine steel?

A. A silky appearance.

Q. What effect does overheating have on steel?

A. It impairs its quality by depriving it of carbon, and a fractured surface shows a coarse granular condition.

Q. What is case-hardening?

A. Giving to external surface of iron the hardness of steel, by heating it in a substance rich in carbon (such as bone-dust, and cyanide of potassium), and afterwards chilling in water.

Q. How may a steel instrument be distinguished from one of iron?

A. A drop of nitric acid on steel will cause a dark stain by separation of the carbon.

Q. How may instruments be sharpened?

A. By small disks of emery paper; place on mandrel of engine a disk cut from thin metal of same size as emery disk and on this place the emery paper disk; hold the instrument always at same angle against disk, and the disk away from cutting edge; as soon as featheredge appears use a finer grade of emery paper until it disappears; the emery paper used is from 0-00-000-0000 according to fineness of edge desired.

Q. How may large tools be sharpened?

A. By using a machine like a lapidary's wheel running a large disk horizontally.

Q. How may burrs be sharpened?

A. Use hard rubber corundum disks (grinding edge of disk thin against emery paper) in the engine, holding burr in the hand; the edge of disk is run through grooves of burr.

Prosthetic Dentistry.

METAL WORK.

Q. After obtaining impression of mouth what is the next step?

A. To obtain a Model in Plaster of Paris.

Q. What must be determined either when taking impression or before varnishing the model?

A. The form and position of Vacuum Cavity, if such is used. (See Atmospheric Pressure.)

Q. Describe the different methods of forming such a cavity?

A. It can be formed in mouth by attaching a disk of wax covered with absorbent linen to mucous membrane of palate, before the impression plaster is introduced; or it may be cut in impression; or formed on plaster model with a soft piece of metal; or a considerable area of surface of impression may be scraped away.

Q. What parting fluid is used between impression and model?

A. Shellac varnish which stains plaster surface, or sandarach which leaves a glossy surface; many prefer soap solution, made by dissolving an ounce of white soap in a pint of hot water. If any undercuts use either shellac or sandarach varnish and when dry, a slight film of oil.

Q. What will determine size and shape of model?

A. The kind of work; for swaged metal plates, model must be of a size and thickness as to enable die to withstand heavy blows of hammer, or other force, and of a shape that will permit of its easy withdrawal from the sand in moulding for the die; or a mould from a shallow model may be deepened by surrounding it with an iron ring with sloping sides.

Q. What will give the required shape and thickness to model?

A. Surrounding impression with a flaring rim of tin, or sheet wax two and a half inches wide.

Q. What should be the condition of surface of plaster impression?

A. It should be wet, as plaster batter flows more freely over such a surface.

Q. How should the plaster for models be mixed and poured?

A. Mixed quickly and as thin as is consistent with hardness in setting, and poured promptly; in partial and lower cases the impression may be held in hand and the cup tapped lightly against the table, or handle of cup rapped on, to ensure plaster settling thoroughly, and to drive out air-bubbles.

Q. How may the expansion and warpage of plaster impressions and models be prevented?

A. Mix three or four ounces of potash alum to gallon of water for mixing plaster; potash alum is sulphide of alumina and potash.

Q. How may the impression be separated from model?

A. If impression is of plastic material it must be thoroughly softened, not melted, and rim turned down first; if of plaster, its easy removal will depend on shape of mouth in full upper or lower cases, and can be done by tapping on cup, or on base of plaster impressions; if form of mouth is not favorable, the plaster impression must be cut into and removed in sections.

Q. How may removal be facilitated in taking impression?

A. By placing small, thin wax cut-offs inside rim of cup, and extending above it so as to cause plaster rim to fracture in sections.

Q. What mineral varnish is used to coat models?

A. Silicate of Soda—Liquid Silex.

Q. How may a lower cup be prepared to render its removal from plaster impression easy?

A. By coating its surface with wax, which is readily softened.

Q. If metal to form a die is poured into an impression, what kind of tray is necessary?

A. One that does not melt at a low temperature, such as brass, German silver, etc.

Q. Describe a method by which a die may be cast in an impression?

A. Use an impression material consisting of equal parts of plaster and Spanish whiting, remove impression from tray (which is easily done if the surface of tray is previously coated with a film of wax), thoroughly dry and heat the impression and surround it with moulding sand, so built up around and above edges of impression as to form base of model of required depth.

Q. How may the plaster teeth on a model be strengthened?

A. By common pins inserted in impressions of teeth in the impression before pouring model.

Q. How should plaster teeth be prepared on a model for sand moulding?

A. Cut off within a sixteenth or at most an eighth of an inch from their base.

Q. How may Plaster Models be hardened?

A. By boiling in a strong solution of alum, or by immersing a warm and dry model in a strong solution of carbonate of soda, which converts surface into carbonate of lime.

Q. How is the die for swaging obtained?

A. By moulding the model in sand, and pouring into the mould melted zinc.

Q. What is the best sand for moulding?

A. A mixture of new and old Brass Moulders' sand.

Q. What other moulding materials are employed?

A. Marble-dust, tripoli, and whiting.

Q. What properties should such a material possess?

A. Be fine enough to copy closely and smoothly, yet coarse enough to permit escape of vapor; contain clay enough to give coherence, without packing too compactly.

Q. How should sand be moistened?

A. With enough water only to prevent its crumbling; too much water will cause sand to cling to model, and cause "blowing" of the metal.

Q. How should the sand be manipulated?

A. Packed so as to give an even, firm surface, but not so compactly that vapor cannot escape when molten metal is poured into mould.

Q. What is the effect of the vapor not escaping through the sand?

A. It passes through body of molten metal and renders face of die imperfect.

Q. What may occur if metal chills on contact with surface next to the sand, and remains molten in interior of die?

A. The thin shell forming surface of die will press upward, and make a defective die, without any sign of a flaw on its surface.

Q. What will prevent this, and also the blowing of the metal?

A. By using sand not too rich in clay, nor too fine, nor too damp, and not packed too firmly; also by drying mould; or mixing sand with oil or glycerine.

Q. When may fine sand firmly packed be used?

A. When mould is dried and heated to a temperature of 250°.

Q. When mould is damp, at what temperature should the metal be poured?

A. At the lowest consistent with proper fluidity.

Q. What is the proportion of oil or glycerine to be used in sand?

A. One quart of oil to one peck of sand; one part of glycerine to two of water for mixing sand.

Q. What are the objections to oil-mixed sand?

A. Soiling hands, and disagreeable odor.

Q. What is used to dust over surface of mould before moulding?

A. Soapstone, rotten stone or charcoal powder.

Q. How may undercut models be prepared for sand moulding to prevent dragging?

A. By use of false plaster cores to fill up the undercuts; or by use of Hawe's sectional moulding flask.

Q. How are false cores prepared?

A. By first varnishing and oiling surface of undercut, and building over it plaster batter giving to outside surfaces of core the required flare to correspond with that of model; then thoroughly drying the core and moulding it with model in the sand; after model is removed from sand, the core is returned to its proper place in mould, and metal of die poured.

Q. How is sand mould for die made?

A. The model is placed on flat surface of moulding bench with face up and heel towards operator; over it the moulding flask is placed; a small quantity of sand is first sifted over face of model, and the flask filled around and full of unsifted sand that it may not pack too tightly; when flask is full, and the sand sufficiently packed, it is leveled off and turned over exposing base of model, and a pointed instrument passed around the base to make a slight bevel in the sand; the sand is then lightly condensed with fingers and all loose particles brushed away; the model is either tapped with the wooden handle of an instrument, or a gimlet is screwed into a small piece of wood inserted in the plaster in centre of base when pouring model, for the purpose of loosening it in the sand preparatory to throwing it out on inverting flask, with a quick movement, or drawing it from sand by means of the gimlet; having a bed of sand on which the model will fall, prevents injury to it, when it is thrown from mould.

Q. What are moulding flasks?

A. Wooden box six or eight inches square with top and bottom boards for die, and a stout iron ring four by two and one-half for the counter-die; or the form known as Bailey's moulding flasks.

Q. How should the plaster model be placed in the sand?

A. So that the centre of plate to be swaged on it, shall come directly under the metallic cone which is placed on base of die, in order to distribute the force from blows of hammer equally.

Q. How is the plaster model protected in ramming the sand over and around it?

A. By having sand at least an inch deep over its face and around its sides, compressed by the fingers.

Q. What is the next step in obtaining the die?

A. To pour metal into the sand mould for the die.

Q. What metals are used for dies?

A. Zinc, and Babbitt metal; also fusible metal, but the latter principally for partial counter-dies, and in crown-and bridge-work.

Q. What metal is generally used for counter-dies?

A. Lead; or, as a counter-die for Babbitt metal die, an alloy of lead and tin.

Q. At what temperature should the metal of the counter-die be poured?

A. As soon as it all melts; the metal of a Babbitt metal die should be poured while a small portion of it remains unmelted.

Q. How may molten lead be tested before pouring it on face of a zinc die?

A. By thrusting into it a roll of paper which it should only brown and not ignite or carbonize.

Q. What is the heat required for melting zinc?

A. 773° F., but it should not be overheated.

Q. How should the zinc be melted?

A. In an iron ladle which should be removed from furnace before the zinc has entirely fused, the melting being completed by agitating the fluid metal before pouring it into sand mould.

Q. When zinc is used how many dies and counter-dies are necessary?

A. Two dies with a counter-die to each one, the last being used for finishing.

Q. What is the contraction of a zinc die two inches wide, and two and one-half deep?

A. Between two and three one-hundredths of an inch. Dr. Buckingham says one forty-fifth of an inch across and one thirty-sixth of an inch in length, and there is expansion in plaster model of one-fourth of this amount. Zinc contracts four times as much as plaster expands.

Q. How is the counter-die obtained?

A. By placing die in centre of flask, and building up sand around it until the swaging surface or face only is left exposed; over this an iron ring from one-half to three-fourths larger than exposed face of die, is placed, and the edge slightly imbedded in the sand; the lead or alloy composing the counter-die is then melted and poured at the lowest possible temperature over the face of the die, and the flask filled as far as it is desired to give a certain depth to counter-die.

Q. What is the composition of Haskell's Babbitt metal?

A. Copper one pound, antimony two pounds, tin eight pounds. The copper is first melted, then the antimony, when it is removed from fire and the tin added.

Q. What is the composition of the counter-die for a Babbitt metal die?

A. Lead seven parts, tin one part.

Q. What is claimed for the Babbitt metal die?

A. Non-shrinkage.

Q. What preparation of surface of a Babbitt metal die is necessary before the metal of the counter-die is poured upon it?

A. The surface of die should be coated with lamp-black to prevent adhesion of the metals.

Q. What advantage has a block-tin counter-die with a zinc die?

A. Sharpness of impression and greater hardness, but should only be used as a finishing counter-die after the use of a lead one.

Q. What properties commend zinc as a die?

A. Hardness, little shrinkage, easy fusibility.

Q. What commend lead as a counter-die?

A. Softness, and low fusing property.

Q. What are the disadvantages of steel, iron, copper, brass, and bronze for dies?

A. Too great shrinkage, and high fusing property.

Q. If great shrinkage in the metal of a die, what is the effect on the swaged plate?

A. It will not be deep enough in arch of palate, nor wide enough between condyles of ridge, and if mouth is unyielding, the plate will bind on each side of alveolus.

Q. If die is too soft and becomes much battered in swaging, what is the effect on plate?

A. It will bear too hard on palate and rock.

Q. What may correct this?

A. The use of a number of dies; but the same will not correct the effect of great shrinkage in metal of die.

Q. What will correct this latter defect?

A. The use of a die of softer non-shrinkage metal (Babbitt metal) following one of the harder shrinkage metals.

Q. Should the swaged plate fit the plaster model or the die?

A. The metal die.

Q. Suppose the model is correct, and although the plate may fit the die yet it will not fit the mouth?

A. Either the process of making die was imperfect; or too few dies have been used; or a metal not suitable; or it is a case which no swaged plate can be made to fit.

Q. Is the moderate shrinkage of a zinc die ever of advantage?

A. Yes, where it counteracts the expansion of the plaster model.

Q. How may a counter-die be made without a sand mould?

A. By dipping the plaster model into the molten metal of a counter-die, within an iron ring, and then carefully pouring into impression of counter-die the metal of die.

Q. How may a die be made without a plaster model?

A. By surrounding impression with an iron ring imbedded in potters' clay, and pouring metal of die into the impression.

Q. Of what should such an impression be composed?

A. Of plaster and marble dust or silex, or plaster and fine white sand, or plaster and fine coal ashes, or plaster and Spanish whiting, first heating it to same temperature as the metal to be poured into it.

Q. Can a zinc counter-die be made on a zinc die?

A. Yes, by pouring the metal for the counter-die at a low temperature, or by coating surface of die with a solution of whiting and alcohol, or lamp-black.

Q. What are such dies and counter-dies used for?

A. The swaging of alloyed elastic metal plates, such as gold alloyed with platinum.

Q. What is the effect of overheating the zinc for a die?

A. Injures the zinc, burns the mould, and causes the sand to adhere to face of die, making a rough surface.

Q. How should zinc be poured into a sand mould?

A. The molten metal should first come in contact with the most prominent parts of mould, which should be filled up steadily, but not too slowly.

Q. Is the depression in the base of all zinc dies any evidence of inaccuracy of face of die?

A. No, but it may be prevented by inserting the heated end of an iron rod in the molten metal as soon as the mould is filled, and thus delay the cooling.

Q. Does zinc deteriorate by repeated melting?

A. Yes; it presents the appearance of hair-like fissures.

Q. How may such zinc be restored?

A. By keeping it in a molten state on fire for ten or fifteen minutes, and covering surface with powdered charcoal.

Q. Should separate ladles be used for melting zinc and lead?

A. Yes, a smaller ladle for zinc to distinguish one from the other.

Q. What is the effect on die of mixing zinc with lead?

A. The lead will sink to bottom of mould and form the face of the die, rendering it too soft.

Q. How may zinc be freed from impurities?

A. By melting in a deep crucible with equal parts of lead, stirred thoroughly and kept melted for one or two hours covered with powdered charcoal, when lead will settle to bottom carrying with it other impurities; when the mass has cooled to about 650° F. the crucible is inverted and the solid zinc separated from the still fluid lead.

Q. What should be condition of die before pouring metal of counter-die on its face?

A. Cool, dry, and face free of particles of sand.

Q. How much of face of die should counter-die cover?

A. So much as is determined by outline of plate marked on plaster model; more will cause plate to be firmly retained in counter-die after swaging, and be liable to injury on attempt to prize it out.

Q. How is plate loosened from a properly made counter-die?

A. By tapping on base of counter-die.

Q. What is a partial counter-die?

A. One covering but a part of face of die, generally employed for adapting plate to palatine portion of die.

Q. What alloys are used for partial counter-dies?

A. Fusible metals, lead with five to ten per cent. of antimony or one eighth part of tin.

Q. What is a common Fusible metal alloy?

A. Equal parts of Bismuth, Tin and Lead, which melts at 250° F.

Q. How is a partial counter-die made?

A. By building up potters' clay on surface of die to height equal to depth of die desired, and leaving so much of face of die to be covered by counter-die exposed, as is necessary for size of counter-die.

Q. What are the Spence and Darcet metals composed of?

A. Compounds of sulphur, bismuth, antimony, etc., the first melting at 239°, and the second at 201.2° F. (See Lead).

Q. What is their nature?

A. Hard but very brittle.

Q. How are they used as dies and counter-dies?

A. Encased in strong malleable cast-iron box, and the plate swaged between them by screwing or by hydraulic pressure.

Q. What Metals are employed as bases for artificial teeth?

A. Gold, platinum, aluminum, silver, and alloys.

Q. How should size of metal plate (gold, etc.), to be swaged between die and counter-die, be determined?

A. By outline drawn on plaster model; make a pattern of soft paper or thin sheet tin, No. 24, on model, conforming to outline; then flatten it out without stretching, and cut form out of gold plate, a little larger than pattern; the pattern should be secured from the die, not from plaster model, to avoid injury to latter.

Q. What should be the minimum fineness of gold plate?

A. Not less than 18 carats; more than 20 is too soft.

Q. How does gold plate compare in thickness to silver plate?

A. Gold plate being stronger and stiffer, is usually several numbers thinner than silver.

Q. What should be difference between a plate for a shallow mouth and one for a deep mouth?

A. That for shallow mouth should be heavier than one for deep mouth.

Q. How should partial plates be made?

A. Strengthened at all weak points by extra pieces either of plate or half-round wire soldered on.

Q. What is average thickness of full gold plates?

A. Nos. 24, 25, 26, and 27; No. 26 for upper, and 24 for lower plates according to Am. Standard Wire Gauge; lower plates are often made of two sheets of metal No. 29.

Q. What for Silver plates?

A. For upper full plates No. 24; for lower No. 22.

Q. What is Silver often alloyed with to make a more rigid plate?

A. Platinum (pure silver being too soft) and it decreases the tendency of the silver to tarnish.

Q. Describe process of Swaging a full upper plate?

A. Place die on bench, with plaster model near, on which is marked outline of plate; anneal the metal by placing it on a support of plumbago or charcoal, and by means of blowpipe heat (if gold) to a cherry red (less if silver), and plunge it in cold water to cool it; then place the annealed plate in proper position over face of die; hold it firmly with one hand, and with a wooden or horn mallet, first form the centre of plate over hard palate, until this part is well driven down and adapted to surface of die; repeated annealings of plate may be necessary to accomplish this, but before each annealing the plate should be subjected to the acid bath (sulphuric acid 2 parts, water 1 part) to remove any particles of zinc, and, after swaging, any particles of lead that may adhere to plate; then bend down with mallet the outer edges of plate over the ridge, far enough to meet outline drawn on plaster model; when plate is well adapted to face of die and especially central portion, it is again annealed and carefully placed between die and counter-die; if the outer-edges of plate are carefully and slowly, with repeated annealings, worked by mallet over ridge, there need not be any folds or creases; some prefer placing several thicknesses of soft paper between die and plate; then place them, with the die down, on an anvil, holding the die with the left hand, and strike the die a light blow with a hammer, of three lbs. weight, with handle one foot long; separate the dies, loosen plate from counter-die, and examine to see that it has not moved out of position; if not, anneal, return plate to dies, and strike several moderately heavy blows, repeat annealing and return plate, and strike heavy, fair, sharp evenly distributed blows.

Q. How may the force of the heavy blows be evenly distributed, and the base of die be uninjured?

A. By using a cone of zinc or iron, with a base nearly equal to that of die and several inches long, with a flat apex, on which to strike with hammer.

Q. How may the noise and vibration of "hammer swaging" be obviated?

A. By interposing between the floor and the swaging block a thick sheet of rubber (1 ½ to 2 inches thick), with the addition of a loose bottom for the block in which are inserted 4 pieces of solid rubber 2 inches long on which the block rests.

Q. Describe the *Parker Process of Shot Swaging?*

A. The apparatus consists of a heavy cast iron cylinder with a thick bottom and a plunger with a concave face, and which fits closely in the cylinder; the plunger has also a cylindrical head on which to strike the blows with a hammer. The plate to be swaged is first approximately adapted to a zinc die and lead counter-die by the usual "hammer swaging" process, after which the *plaster model*, with the plate on it, is placed on the bottom of the cylinder which is 4 inches in diameter—the plaster model corresponding in size, and fine bird shot poured in until the model and plate are covered to the depth of an inch or more above the alveolar face of model; the plunger is then placed in position, and its cylindrical head struck several times with a heavy hammer; the force of the blows upon the shot evenly distributes the pressure over the entire plate area, and the plate is thus driven into accurate acquisition with the plaster model, which latter serves as a die, and the shot as a counter-die.

Q. Describe the *Gartrell Method of Swaging?*

A. The method differs from the Parker method only in the nature of the pressure applied, which is by means of a powerful screw press somewhat similar in form to the vulcanite press; hardened brass or steel shot as well as the ordinary lead shot are employed. This method is also useful for swaging the platinum plates for continuous gum work at any stage of their construction; also for remedying badly fitting vulcanite plates; to swage tin linings and coverings for coating plaster surfaces of impressions and models in vulcanite and celluloid work; to swage trial base plates of tin for securing the bite and mounting the teeth; it is also useful for swaging on a fusible metal die.

Q. What is the *Palmer Process of Swaging?*

A. Similar in some respects to the Gartrell method, the principle being that of a screw forced against what is called a "waxy plaster," the model or die used being of plaster or fusible metal.

Q. What is the *Igel Method* for Swaging Seamless Gold Crowns and Plates?

A. The use of a mixture of lead and plumbago in small particles instead of shot in an apparatus peculiar to this process.

Q. How should the Gilbert Vacuum Cavity be formed in plate when swaging?

A. By defining the form when central portion of plate is adapted to die, and afterwards, during swaging, using chasers made of hard wood, bone or ivory, carefully thinning and rounding edge of each, and frequently renewing the edge, which is one-quarter inch wide; place the edge of the wooden chaser in the imprint of the vacuum cavity, and, holding it at right angles, strike light, rapid blows on the end with a mallet, repeated by passing around the chamber or cavity with the instrument until outline of cavity is sharply defined and the metal not indented or bruised; a chaser made of soft rose-copper answers well as a finisher if carefully used.

Q. How is the Cleveland Vacuum Cavity formed in plate?

A. First make copper model of size and shape of cavity, and as thick as depth of cavity desired; form over this copper model a cap of gold, with a flange, by swaging it between dies, when temporarily attached to die by wax, with copper model under it resting on die at location of vacuum cavity; make edges smooth and slightly bevelled, the edges of cap extending in form of a flange, one-sixteenth of an inch wide, beyond copper model; an opening is cut in plate at location of vacuum cavity, as large as the copper model, and the cap soldered over it by means of the flange which overlaps the opening in plate.

Q. What is claimed for the Cleveland Vacuum Cavity?

A. That the edges can be made to fit roof of mouth accurately; that even in soft mouths the mucous membrane never fills up the cavity, as there is always a space left around the chamber; that no irritation of membrane occurs if all edges are rounded and not left sharp. (See Atmospheric Pressure for Vacuum Cavities.)

Q. Is it ever necessary to cut out V shaped piece of plate and afterwards solder edges, in swaging outer rim over ridge?

A. No, if the plate is slowly and carefully worked over ridge.

Q. What is the annealing temperature for gold, silver, platinum and aluminum?

A. For gold to a dull red heat; for silver below red heat; for platinum, a high heat; for aluminum a low temperature to prevent brittleness and cracking.

Q. What is object of annealing and reannealing during swaging?

A. To overcome the inelasticity the plate acquires under manipulation.

Q. How should the plate be protected from contamination from particles of the die and counter-die which may become attached during swaging process?

A. By subjecting it after each swaging and before annealing to an acid bath composed of boiling sulphuric acid 1 to water 10 parts.

Q. How should the swaged plate be finished?

A. Trim edges according to outline; bevel and burnish edges, and place plate in acid bath to remove marks of fire.

Q. How may an accurate adaptation to die be determined?

A. Pressure on front of ridge and on back edge of plate, and around top of ridge with the fingers, should not cause any motion of plate on die.

Q. How may slight inaccuracies of fit be remedied?

A. Locate point in fault, and place several thicknesses of soft paper over point where plate binds and again swage by light solid blows.

Q. How is a double plate for lower jaw constructed?

A. Use No. 29 for gold and 26 for silver; make each plate separately, both swaged to fit die, allowing the lower one to be a little larger around edges so that the two may be soldered together; place both between die and counter-die and swage; then secure them with binding wire and solder; one binding wire clamp in front and one either side near condyles, and twist ends over top of plate; support plate at all points on solder support; then file edges according to outline on plaster model; use little solder, and do not apply flame direct on binding-wire clamps.

Q. How may a lower plate in the swaging process be first adapted to a sharp prominent-ridge?

A. By first grooving it with lower plate bending-pliers.

Q. What is the objection to a swaged rim on lower plates?

A. Cannot reduce plate in depth without cutting through rim.

Q. How construct partial upper plates?

A. Have plate cut a little too large, to allow for slipping, and carefully adapt with mallet, frequently annealing, and in swaging have die and counter-die brought carefully together with plate between; or burrs may be cut in the lead and turned over edge of plate to keep it in position; then swage lightly until it is securely fixed in proper place on die; and excess left around impress of teeth on die can be accurately cut out after plate is well swaged; extensions of plate between natural teeth should be strengthened by additions of plate when teeth are soldered.

Q. How should ends of prolongations of plate into interdental spaces be finished?

A. Beveled, or filed to a sharp edge; and for single gum tooth should extend high enough on inner surface of a thin gum to protect it.

Q. How may a lower partial plate be strengthened where the teeth are scattered?

A. By allowing plate to pass over natural teeth for some distance and made to fit closely to them, it also assists a sharp ridge to bear the pressure of mastication.

Q. How is a partial lower plate made, where the artificial teeth are incisors and canines, or even first biscuspids ?

A. Cut teeth from either the model before moulding or from zinc die nearly down to line of plate on lingual surface, inclining on buccal surface so as to form sharp angle; remove edge of front tooth on each side that it may not penetrate the plate ; such a form of die will permit the plate to hook over the teeth and hold plate in place during swaging ; when soldering on the teeth, a thick piece of plate is added back of the position of natural teeth.

Q. How is a partial lower plate made, where artificial teeth are bicuspids and molars ?

A. Cut teeth from plaster model before moulding, or from zinc die, as in the preceding case but not down to line of plate, so that the plate may extend up over lingual surfaces of natural teeth, and its lower inside edge be carried under the rounded or protruding portion of ridge ; this prevents the pressure of mastication on ridge under artificial teeth, and also on gum in front on lingual side, and prevents edge interfering with tongue, and also strengthens such a plate; although an additional thickness of plate may be soldered on inside of natural front teeth, which addition may be swaged separately from plate, and the two soldered together.

Q. When a single natural tooth remains how is the plate outlined ?

A. An opening corresponding to the size of the tooth is cut in the plate for the tooth to pass through it.

Q. How may a lower plate be constructed so as to prevent its buccal edge from irritating the soft tissues ?

A. By building a layer of wax $\frac{1}{8}$ inch deep over the outline of this portion of the plate edge and thinning it to a sharp edge where wax joins the alveolar wall.

Q. Where the crest of the alveolar ridge is sharp what is the usual practice ?

A. To build a layer of wax 1-16 of an inch thick over the sharp edge on the model which will throw the greatest pressure of the plate upon alveolar walls.

Q. Where hard nodular spaces occupy the median line of the roof of the mouth, and in the lower jaw are found on the inner or lingual surface of the alveolar ridge (near the bicuspids usually) how should the model be prepared ?

A. The portions of the model representing such hard nodular parts should be covered with wax, so that the soft tissues will yield to the pressure of plate, which will press uniformly upon all parts. Another remedy is to scrape from the impression a layer of the plaster surface sufficient to represent the yielding of the soft tissues.

Q. How may a rim be swaged on a plate?

A. By forming a flange on plaster model at as sharp an angle as will permit of its being drawn from the sand mould, and of width and outline according to size and location of rim; cut pattern for plate allowing for excess of rim; after swaging, the rim can be turned over more, and when the teeth are soldered to plate, it is burnished to fit closely against the upper edges of gum portions.

Q. How adjust a soldered rim to plate?

A. The plain rim in the form of a strip of metal, may be soldered to plate as soon as it is swaged and trimmed, using binding or annealed wire clamps to secure it at different points during the soldering; the plate for a rim should always extend for a line or two beyond outer edge of rim, so that the latter can be easily soldered; after the teeth are soldered to plate, the edge is cut down to rim burnished against the upper edges of the gum portion; a better fitting rim is made by first grinding up and arranging the teeth, an impression taken of the surfaces of teeth and plate to which the rim is to be adjusted, and sectional dies and counter-dies made, between which the two sections of the rim are swaged; the process of soldering to plate is the same as for plain rim; after the rim is attached to plate, the teeth are returned to their places, and the case invested for backing and soldering the teeth.

Q. What is the process of fitting the plain rim or a half-round wire?

A. Begin at median line and bend the annealed rim with fingers and plyers (as this rim is continuous) until it is accurately adapted, and bevel each end so as to meet the backing of the last molar on each side in a close joint, and then secure with wire clamps which bind it against plate rim at different points; begin soldering it at median line with small amount of solder, and continue until end of ridge is reached; the free ends bent around tuberosities or condyles are soldered at same time as the teeth.

Q. What is the best alloy to give Clasps elasticity?

A. Gold with two grains of platinum to the pennyweight; or silver with either platinum or iridium.

Q. What forms of alloy are used for clasps?

A. Either in that of plate or half-round wire.

Q. What advantage has half-round wire for clasps?

A. It can be bent in any direction so as to fit irregular and short teeth.

Q. At what points should a clasp be elastic?

A. At the free ends which encircle most of the crown of a tooth; hence a clasp should be soldered to plate so as to leave the greater portion free.

Q. Where should the strongest portion of a clasp be?

A. At the point where it is attached to plate.

Q. How should clasps bind upon the teeth in adjusting them?

A. Not so tightly as to prevent their being readily removed from mouth without change of shape or position; the final adjustment being done when the case is finished.

Q. How are clasps fitted to teeth?

A. By clasp-bender plyers, or swaging between dies; formed either on the zinc die, or by some on teeth in mouth.

Q. What is the general form of a clasp before it is soldered to plate?

A. Of such a form as will enable it to fit accurately the palatal side and well down to gum at neck, which necessitates filing its lower edge concave, and except in cases of a tooth standing alone, the clasp should pass between the teeth or pass as far as possible into interspace between teeth to obtain a firm hold on tooth; this is necessary in the case of a double clasp passing around two teeth.

Q. How should lower teeth, canines, and all teeth where gum has receded from necks, be clasped?

A. Clasp should fit tooth at greatest diameter of crown.

Q. What are half-clasps or stays?

A. Those made to embrace palatal portion of crown, with the ends passing into the interspaces; the model being slightly scraped to enable them to spring over projecting part of teeth.

Q. How should clasps be made for lower teeth generally?

A. They should embrace tooth near cutting edge or grinding surface, and small hooks attached to them by catching over grinding surface will prevent plate from pressing too hard on gum.

Q. What is done after clasps are fitted to tooth?

A. They are adjusted to plate by filing the latter to accommodate the clasp as it fits tooth in mouth; then the clasps are cemented to plate, all carefully tried in mouth; if cement breaks in removing clasps and plate from mouth, the sharp fracture will be the guide for readjustment; then the case is invested and clasps soldered to plate.

Q. How far should wings of plate extend beyond clasps?

A. Far enough to sustain some pressure, and thus relieve the clasped teeth.

Q. What are the different forms of clasps used to secure dentures in mouth?

A. Plain band, scalloped clasp, standard clasp; the latter standing some distance from plate line, and attached to plate by a standard.

Q. What is average thickness of clasps?

A. Twice that of the plate, as a general rule.

Q. What is used in metal work to obtain the articulation of a full denture?

A. The metal plates after being adapted to mouth, as there is no necessity for temporary or base plates, as in vulcanite work. (For *Obtaining* "*Bite*" or *Occlusion*, see Vulcanite.)

Q. What may cause a clicking sound when artificial teeth occlude?

A. When the plate or plates are not uniformly supported on the alveolar ridges, owing to faulty adaptation.

Q. In selecting the teeth what is to be determined?

A. Whether gum or plain teeth are to be used; whether single gum or sectional blocks will answer best.

Q. What kind of teeth are used when natural gum is prominent?

A. Plain teeth.

Q. Where a denture is made soon after extraction of natural teeth?

A. Plain teeth.

Q. Where roots remain high up in gum?

A. Teeth with partial gums.

Q. Where natural front teeth of lower jaw project greatly?

A. Plain teeth.

Q. Where teeth have been extracted for some time and absorption is considerable?

A. Gum teeth; for full dentures sectional blocks.

Q. Where lip is very long and does not rise sufficient to show the plate?

A. Plain teeth may be used.

Q. What teeth are the most readily arranged, and can be made somewhat irregular to add to natural appearance?

A. Plain teeth.

Q. What teeth are generally best for lower dentures?

A. Plain teeth, or gum teeth with long crowns and short gums.

Q. In grinding teeth to fit to a gum which is greatly absorbed or a portion of process cut away in extracting the tooth?

A. Hide the space by selecting a long tooth and grinding it so that it will project into the space, scraping plaster model at point where tooth is to rest; or a gum tooth with a partial gum may be adapted to such a space if it extends high on ridge.

Q. In arranging plain teeth where roots have been recently extracted?

A. Make them press well into gums, and first grind the base of each tooth to fit model, and afterwards scrape model uniformly, so that the teeth held by wax can be pressed up to plaster surface.

Q. How should roots be treated over which artificial teeth are placed?

A. Cut them away about one sixteenth of an inch below level of gum, the inner edge less than outer, and root surface made level and smooth, and pulp canal filled; make a good joint of base of artificial tooth with surface of root.

Q. What have to be considered in arranging artificial teeth?

A. Length, fulness, inclination, curve, position, spaces between them, etc.

Q. When single teeth are to rest partly on plate and partly on gum?

A. Grind base of teeth to gum first without plate, and then by cutting or filling plate extension, and some little additional grinding adapt tooth.

Q. How fit gum teeth that adjoin natural teeth?

A. Do not let artificial gum extend nearer cutting edge than the gum of the natural teeth.

Q. If space between two natural teeth is too narrow for an artificial tooth?

A. May reduce width of latter, or may place artificial tooth slightly irregular.

Q. If the space is too wide for one or two of same class of teeth?

A. May use an additional tooth and slightly change width of each tooth.

Q. How may the base of a tooth be accurately fitted to prominences and depressions on ridge of metal plate?

A. By coating ridge during grinding with rouge and oil, or other coloring, so that points where tooth rests on ridge may be colored on tooth.

Q. What is a general rule in grinding teeth as regards length?

A. To leave them slightly long so as to allow for the subsequent imbedding of plate in mucous membrane.

Q. Describe order of arrangement for full upper or lower sets?

A. The centrals first, then laterals, cuspids, first bicuspids, in pairs, arranging posterior teeth according to articulation. For full upper and lower sets, some arrange corresponding teeth in each jaw in pairs beginning with inferior centrals; others arrange one set and then the opposite set; lower front teeth are usually placed vertically and are a little longer than the upper; but the length of lips regulates the length of teeth, as the upper should show only the tips when mouth is open and lips not raised, and lower teeth should be made to meet upper.

Q. Is loss of stability due more to length of upper than lower teeth?

A. Of upper.

Q. What should be position of median line of set?

A. Without malformation, the median line of face should divide space between central incisors of both jaws for entire length of their crowns.

Q. What approximal inclination?

A. Centrals lean slightly towards each other, laterals a little more than centrals, cuspids like centrals, bicuspids and molars vertical.

Q. How much should front teeth lap?

A. Cutting edges should just pass each other; more lap will cause lisping, and much will endanger stability from too great leverage.

Q. Upon what teeth should the pressure of mastication be brought to bear?

A. Posterior teeth.

Q. How should the grinding surfaces of posterior teeth curve?

A. According to curve of jaws.

Q. How may this be done?

A. By setting the inferior second bicuspids and first molars somewhat shorter or longer than the first bicuspids and second molars; in any case there should be a tendency of the upper to press backward the lower teeth.

Q. When there is projection of lower jaw (not too great)?

A. Set lower front teeth straight, and the upper inclining outwards to meet them.

Q. How should lower bicuspids and molars be placed in relation to ridge?

A. Directly on ridge, and nearly perpendicular; or if the difference between jaws is great, they may incline slightly inwards.

Q. What is the rule in regard to spaces between the teeth?

A. Let there be no space for air to escape in speaking, so that a whistling or hissing sound may be prevented; no spaces for food to lodge between the posterior teeth.

Q. How are teeth held in place during grinding?

A. By cement of wax and rosin; add enough of rosin until it becomes hard and brittle when cold; warm plate to attach cement; each tooth or block may be held in place with fingers, and melted cement dropped on; or a roll of cement may be placed on ridge of plate and thus support teeth pressed into it; for teeth standing alone use gum shellac.

Q. Why are teeth after being arranged, tried in the mouth?

A. To determine if they are properly arranged, and to make any changes necessary.

Q. How may fracture of gum teeth by their expansion be guarded against?

A. If closely jointed, a strip of thin soft paper should be placed in each joint between the gums, and thus prevent contact.

Q. What is the next step after grinding?

A. Investing—securing them in a non-conducting material, so that their position on plate may not be changed during the backing and soldering processes.

Q. What is the investment composed of?

A. Plaster of Paris 4 parts; white beach sand 5 parts; pulverized asbestos 1 part; or 3 or 4 parts of abestos to 1 part of plaster.

Q. What care is necessary in investing a set?

A. That the investment fills under or concave surface of plate, that no vacancies are left about plate, teeth, or clasps; that the teeth are well covered, and securely held in place, and protected from flame of blowpipe; that edges of plate are covered; that the surfaces to be soldered are well exposed to flame of blowpipe, and free from overhanging portions of investment.

Q. When investment is hard what is the next step?

A. To trim it, and pick out the cement holding teeth.

Q. How are the teeth prepared for backing up?

A. Some prefer removing them from investment to back them; others prefer to back them without loosening or removing; first cleansing surfaces of plate where solder is to flow, and pins of teeth, and scraping plate surface bright.

Q. What else must be done to the pins?

A. Remove small prominences of porcelain at their base, and straighten them with plyers.

Q. What thickness of backings is necessary?

A. Depends upon length, position and style of teeth; average thickness for gold is No. 22; for silver No. 20.

Q. How wide should the backings be made?

A. Nearly as wide as tooth; a little wider if they are to be united.

Q. How high upon teeth?

A. If front teeth are liable to much strain, the backings should extend to cutting edges; if otherwise, backings should extend half-way between upper pin and cutting edge of tooth.

Q. What shape of backings?

A. The top to correspond to cutting edges and grinding surfaces of teeth, and the corners rounded.

Q. What will strengthen backings?

A. When made of an alloy of gold and platinum.

Q. Describe process of Backing by removing teeth from investment?

A. Cut metal into strips of width corresponding to that of teeth; round corners of one end of strip and bevel the sides on outer surface; then place end of strip on base of lead counter-die with paper under it, and with a round-faced hammer make it concave; then remove each tooth from investment successively, and place the concave surface of end of strip against inner surface of tooth over upper tooth pin and by a lateral motion mark the position for upper hole in strip; then punch the first hole and return strip to tooth so that upper pin enters the hole just made; then rotate strip on pin so that a semicircular mark is made to locate hole for lower pin; then remove strip and punch the lower hole according to the mark; then place strip in position on tooth, and fit it to the surface; then draw a line across strip at base of tooth with a sharp pointed instrument; then remove strip, countersink holes on outer surface, and cut off backing from strip according to line made on it at base of tooth, allowing it to be a little long so that it may be adapted to surface of plate; then return backing to tooth, and with flat flyers, pinch the pins towards each other, which will leave a space for solder to flow into alongside of each pin; then file pins down to level with surface of backing, and fit base of backing to surface of plate; then return tooth to investment, and, after all are backed, secure them in place with their investment batter, covering all exposed parts of teeth.

Q. How are teeth riveted to backings, instead of pinching pins towards each other?

A. By first countersinking holes on outer surface of backing, then split pins with a sharp knife-blade or graver by two cross cuts, so that heads of pins fill up countersinks; if the pins project too far through holes they can be filled shorter before splitting ends.

Q. What advantage in having united backings instead of separate?

A. Shorter and more cleanly.

Q. What is method of forming backings of platinum and gold, and attaching them to teeth before attaching them to plate?

A. Use for first backings thin strips of platinum, and shape as for gold backings, with a flange turned at base conforming to surface of plate, and to determine thickness; the first pin is cut or filed shorter than the second for same purpose; after backing teeth with the thin platinum, each is invested and scraps of the plate are melted on the platinum so as to completely cover it, the gold rising in thickness to height of the pins and also to edge of flange bent up at base; the backings are then filed smooth, and the teeth returned to their places in the original investment, and the base of each backing soldered to plate.

Q. What metal in a solder permits the use of such an alloy almost as fine as the plate?

A. Zinc, as a gold solder composed of 1½ grains of zinc to each pennyweight of same gold as the plate upon which it is to be used, gives a free flowing solder and one almost as fine as the plate.

Q. If solder is made from pure gold what is a good formula?

A. Pure gold 18 grains, silver solder 5 grains, zinc 1½ grains, which gives almost 18 carat solder; the silver solder used in this formula consists of fine silver with one third its weight of brass.

Q. What is the general rule for fineness of gold solder?

A. Use 16 carat solder on an 18 carat plate.

Q. What is the formula for a very free flowing silver solder?

A. Fine silver alloyed with ⅛ its weight of brass, and for every pennyweight of this alloy ½ to 1 grain of zinc.

Q. Describe the *Preparation for Soldering Process?*

A. Protect all places where the solder is not to flow with a solution of whiting in alcohol or water; mix the borax until it is of the consistency of cream; apply it to all places where solder is to flow, with a camel's-hair brush; coat the pieces of solder with borax and apply each piece with solder plyers, small square pieces over pins, and oblong pieces at base of each backing, and along joint if backings are to be united; if small pieces of plate are to be added to fill up any space over which solder is to flow, as solder will not bridge spaces, they are to be applied like pieces of solder; gold foil may also be used to fill spaces; too much solder is objectionable, and if too little is first applied more can be added during soldering.

Q. Describe process of Soldering?

A. Heat the case slowly and uniformly in a furnace, oven, or gas stove, until plate is of a dull red color, or to nearly the fusing point of solder; if the hand furnace is used for heating up, the top can then be removed and the lower part used as a support, if not, the case is placed on a solder-support; the large flame of the blowpipe (mouth or automatic) is then so directed that it covers the entire investment, but does not bear directly on the solder; and when all parts of plate are heated more than the solder, the flame is reduced to a pointed blue one, and directed on the solder.

Q. What is the effect of directing the soldering flame on solder before the plate is heated to fusing point of solder?

A. The solder will roll up into a ball.

Q. Where has solder a tendency to flow?

A. Towards the hottest point.

Q. How may the flow of solder be directed?

A. By the heat (or flame of blowpipe); or by the heated point of a long excavator.

Q. What does good soldering consist in?

A. Fusing and flowing solder at proper place, uniting all pieces, and leaving a smooth surface.

Q. How is the case treated after soldering?

A. Placed under cover to cool slowly; some prefer wrapping case in folds of newspaper; then taken from investment by breaking the latter away, and put in a solution of equal parts of sulphuric acid and water, to dissolve fused borax and cleanse the gold; heating acid solution will hasten this process; common alum solution may be used instead of the acid; then wash in a solution of soda and water to remove acid, and examine the teeth.

Q. What are the conditions for a successful soldering operation?

A. Careful investment; careful cleansing of surfaces to be united; careful application of the borax flux and solder; careful preparatory heating up; proper application of flame of blowpipe; gradual and careful cooling off.

Q. Describe the *Finishing Process?*

A. Shape, make smooth and uniform the surface covered by the solder, removing the line where the solder joins the plate, by means of scrapers, files, Scotch-stone, brush or felt wheels and cones, or corks charged with tripoli or rotten-stone, and polish with whiting, prepared chalk, or rouge.

Q. How adjust a new tooth to an old set?

A. Select a duplicate of the lost tooth with long pins, and after grinding so that pins rest against old backing, cover the inside surface of backing with a thin coating of wax, press the tooth against wax and punch, or better, drill new holes in backing, and proceed as for backing and soldering a new set.

Q. How may a new tooth be riveted to an old backing?

A. Determine position of holes and drill them as just described, but countersink them deeply, so as to give a good head to each pin; then place surface of tooth on base of a lead counter-die with thin paper between the two, and with a small riveting hammer strike light blows around outer edge of each pin so as to flatten and thicken it, and continue this, first on one pin and then on the other, so that both may be thickened together; when countersinks are thus filled by the spreading of ends of pins, direct blows may be given on tops of pins at the end of the riveting to make the surface of each pin uniform; the tooth should be firmly held on lead during process.

Q. What grade of solder should be used in repairing a set, the carat of plate unknown?

A. A low grade, 14 or 15 carat solder.

Q. How is a cracked gold plate repaired?

A. By allowing crack to remain open and soldering a piece of plate over it.

METALLIC BASE WITH VULCANITE OR CELLULOID ATTACHMENT.

Q. What are the advantages of attaching porcelain teeth to a metallic plate by means of rubber or celluloid?

A. Cleanliness, purity, less liability to fracture, facility with which such a combination set can be repaired, and less liability of change of shape of plate during the construction of the denture, such as may occur in soldered work.

Q. What metals may be employed for the plate in such work?

A. Gold, platinum, aluminum, cast-metal, electro-deposit, and silver when a layer of tin foil covers the surface to which the rubber is attached—only necessary in case of silver and rubber, not with celluloid.

Q. Describe the method?

A. After constructing the metallic plate and obtaining the "bite," the process is the same as for ordinary gold work, the teeth being ground and arranged, and held temporarily by means of adhesive wax upon the labial surface; each point, where it is desirable to solder on the plate the attachments for the rubber or celluloid, is then marked on the plate with a sharp pointed excavator, and in such positions as will not interfere with the arrangement of the teeth, and which will also permit of being concealed within the plastic material; the attachments, in the form of pins or loops, after removing the teeth and cleansing the plate of wax, are then soldered on; the loops may be formed of thin platinum wire, or strips of plate so bent as to afford secure hold for the plastic material; the plate, after being subjected to the acid bath, is then placed upon the die to determine its adaptation; the teeth are replaced, and the set waxed up, when it is ready for investment in the flask, to be packed and vulcanized as usual. Another means of securing the plastic material to the plate is by raising spurs over the ridge with a sharp pointed chisel; when an aluminum plate is used as a base, the plastic material may be secured by punching holes over the ridge and reaming them on both surfaces, or by spurs, or by cutting or punching loops with Gaskill's instrument; cast-metal plates may be prepared for securing the plastic material by cutting out the wax on the labial surface, and from between the teeth, before flasking for the casting process.

Q. How are plates retained by *Spiral Springs?*

A. An old and almost obsolete method, and only resorted to at the present time when some anatomical configuration of the mouth renders the retention of a denture difficult by the more usual methods; the cases in which such springs are used are flatness of alveolar ridges to an extreme degree, excessive contraction of area on which the plate rests, excessive sponginess of soft tissues of mouth.

Q. What does such an appliance consist of?

A. Two springs made of coiled wire and of tubular form, the ends of which are anchored in the buccal walls of the back part of the two dentures, upper and lower, on the right and left sides. When the two sets are in position in mouth, the bent springs exert upward and downward pressure and thus keep the sets in position.

Continuous Gum Work.

Q. What is Continuous gum work?

A. Teeth arranged on a base plate of platinum, or platinum and iridium, and a porcelain continuous gum built around them, extending over lingual surface of plate, and afterwards fused in a furnace.

Q. What kind of teeth are used?

A. Teeth with long necks and long pins.

Q. What are the teeth soldered with?

A. Pure gold, or gold and platinum alloy.

Q. What is average thickness of upper and lower platinum plates?

A. No. 29 for upper, and two thicknesses of No. 29 for lower plates, the under one large enough to have its edge turned up as a rim.

Q. In swaging what precaution should be taken?

A. To cover face of die with thin wet muslin to prevent metals of die and counter-die from contaminating plate.

Q. Are backings to teeth necessary?

A. No, a rim of platinum is soldered to ridge of plate on lingual surface, and the pins of teeth are bent down over rim, and soldered to it; or pins may be bent down to plate surface and soldered, or the lateral pins of adjoining teeth may be twisted together and soldered when bent down to plate.

Q. How is the soldering done?

A. By introducing case into the heated muffle of furnace, or with blowpipe.

Q. Is the case invested in plaster and asbestos?

A. Yes, to secure position of teeth according to the antagonism; after the teeth are soldered the portion of investment about them is removed, but that under the plate is left as a support or base.

Q. How is the set prepared for the body and enamel?

A. By first cleansing teeth of all particles of investment and immersing the set taken from the support, in sulphuric acid, when it is washed.

Q. What is the Body?

A. A colorless mineral compound composed of spar, quartz, German clay, Bohemian glass and French china.

Q. How is the Body applied?

A. In a plastic state by a small spatula and camel's-hair brush, and carved in form of gum, and rugæ of mouth.

Q. Is the Body baked before the enamel?

A. Yes, by putting set on a slide and slowly introducing it into the muffle of furnace, and semi-vitrifying the body.

Q. What is then done?

A. It is slowly and carefully withdrawn and cooled in another muffle, to prevent fracture of teeth.

Q. What is the next process?

A. More body is added to fill up cracks made by the first baking, and it is baked a second time, and cooled as before.

Q. What is then done?

A. The surface of body is covered with plastic flesh-colored enamel, applied with a camel's-hair brush, and set is again placed in furnace and subjected to a higher heat than before, by which the enamel flows evenly and smoothly, leaving a glassy surface; the piece is then cooled as before.

Q. What is the best fuel for continuous gum furnace?

A. Coke.

Q. What other furnace is sometimes used?

A. Gas furnace.

Q. How may a new tooth be added to an old set?

A. After being adapted to space made by removing part of old tooth, by grinding it out, body is packed around the new tooth, which is backed, then the body is enameled and again returned to furnace to fuse the enamel.

Q. How may a difference of color between old and new enamels be prevented?

A. By covering old gum with fresh gum-enamel.

Q. What is the enamel composed of?

A. Gum frit, flux, granulated body and cryolite.

Q. What is granulated body?

A. Silex, feldspar, caustic potash, and titanium.

Q. What is flux?

A. Silex, feld spar, borax glass, cryolite, caustic potash and titanium.

Q. When the first application of the body is made in sufficient quantity by patting small portions taken upon the end of spaluta or in close contact with the roots of the porcelain teeth and on other portions of the plate, and on buccal and labial surfaces of alveolar portion, and excess of water rising to surface absorbed by bibulous paper or soft linen, how may the contraction of the body in baking be prevented from changing position of teeth?

A. By marking the body into distinct sections by means of incisions made between each tooth as deep as the platinum plate on both the outer and inner surfaces; all particles of the body must be removed from the teeth, which are coated with sandarach varnish to prevent their fusing together.

Q. Describe the first baking process?

A. The denture placed upon a fire-clay slab, is first thoroughly dried by placing it near the open mouth of muffle of furnace on the projecting ledge, and advanced slowly into the rather cool muffle until it has reached a point about an inch and a half from its rear end; the heat of the furnace is then increased until the muffle reaches a bright-red heat, and such a heat maintained until the body fuses thoroughly; this may require about 10 minutes, when the denture is quickly removed to the cooling muffle, where it is permitted to remain for 30 minutes; any change of form in the plate can be remedied by placing it upon the model and tapping on a piece of soft pine wood, placed across the molars, with a mallet.

Q. What is the object of a *Second coating of body?*

A. To remedy any imperfections of the first applied body, such as cracks, etc., and to form the contour for facial expression, to build up rugæ on palatine surface, and to form plumpers where such are necessary in giving fulness to the cheeks.

Q. How is the second baking made?

A. Like the first, but the body need not be fused smooth, and when completed cooled for 30 minutes, and again placed upon the model for adjustment.

Q. How is the *Enamel* applied?

A. The mixture is made thinner than the coatings of body, and the finer gum outlines restored, and the outline of gums made more perfect, and the shading of the enamel completed.

Q. How is the baking of the enamel made?

A. The denture is dried very slowly at the mouth of muffle, and gradually pushed into and near the rear portion, and carefully watched.

Any deficiencies can be remedied by the application of fresh enamel. The enamel baking requires from 8 to 10 minutes, and the same precautions are to be observed against sudden cooling as in the case of the body. The glazing of the enamel indicates its fusing.

Q. Describe the *Finishing Process?*

A. Smooth the rim of denture with fine files and Scotch stone, and obliterate all file-marks; polish the platinum surface with the burnisher and soap; cleanse palatine surface of plate with powdered pumice, and inner surface of vacuum chamber by burnisher and soap.

Q. How may Continuous Gum Set be repaired?

A. Where tooth has been broken off, after immersing in sulphuric acid to remove secretions, select and grind a suitable tooth, first grinding away any remains of original tooth; secure new tooth in position with adhesive wax; invest with plaster and asbestos; after hardening of investment, remove wax, cleanse pins, and apply body; bake body, one application being sufficient; thoroughly dry investment, and bake in furnace; after cooling apply the enamel and bake finally.

ARTIFICIAL DENTURES OF FUSIBLE ALLOYS.

Q. What does this method consist in?

A. Making plates by pouring a fusible metal made plastic by heat.

Q. What are the different fusible metals now used?

A. Wood's, Weston's, Watt's, Reese's, Essig's, Carroll's aluminum.

Q. Are the manipulations of all of them practically the same?

A. Yes.

Q. What metals form these fusible alloys?

A. Pure tin, bismuth, cadmium, lead, gold, silver, aluminum.

Q. What is the model for such work composed of?

A. Plaster of Paris $\frac{7}{8}$, fine pumice stone $\frac{1}{8}$; or equal parts of plaster and soap stone, or plaster and pumice stone, or plaster and whiting.

Q. How is the vacuum chamber formed on model?

A. By cutting out form in impression; or building on model with batter of plaster and pumice; or placing a vacuum form of wax covered with bird's-eye linen, in roof of mouth previous to taking impression.

Q. How may the method of building up a vacuum cavity form be neatly done?

A. By covering surface of model with base plate wax, and then placing on this in proper position a form of chamber cut out of paper, by this paper-form the cavity is cut in the wax down to the model, and plaster surface roughened and moistened; the batter is then poured into the cavity in the wax; and after it hardens and wax is removed, the edges and surface are trimmed and smoothed; or the vacuum form may be included in impression.

Q. What is used as a base-plate on which to mount the teeth, etc.?

A. Thick tin foil burnished to model and covered by wax base-plate.

Q. How are the teeth mounted and the trial plate made?

A. Same manner as for vulcanite.

Q. What kind of teeth are used?

A. All kinds, but usually vulcanite or celluloid teeth.

Q. What flask is generally used?

A. Watt's moulding flask; or ordinary vulcanite flask in the posterior part of which an opening 5/8 inch in diameter is cut with a half-round file for a gateway, and small hole for vent.

Q. How is such a case invested or flasked?

A. Same as vulcanite, except that investment consists of plaster 3/4, fine pumice 1/4, and two small gullies are cut from heels of plate to each of the funnel-shaped openings of flask; the two halves of flask are held together by a clamp with handle.

Q. When the two halves of flask are put together after removing the base-plate and wax, how is the mould prepared for the metal?

A. It is slowly dried in an oven or on gas stove, until no moisture appears on a mirror held over openings in flask.

Q. Is too high a temperature of mould objectionable?

A. Yes, as metal will not chill in mould quick enough, and may escape at smallest crack between sections of flask.

Q. When should the pouring of the metal cease?

A. As soon as it rises in the little vent holes.

Q. What does the finishing consist in?

A. Filing, scraping, sand papering, and polishing with whiting.

Q. What have fusible alloys been principally used for?

A. For lower dentures where weight is necessary to retain set.

Q. Describe the method of casting a full lower denture, gum teeth, of *Weston* or *Watt Metal?*

A. Use rubber teeth and grind off thin edges of gum portion to a right angle with the labial and buccal surfaces of teeth to prevent the gum fracturing by unequal expansion or contraction; then upon a model composed of the materials before referred to, arrange the teeth in wax in proper manner; in grinding the joints bring the body of the gums of each block or tooth squarely together, as closely as at edges of gum; avoid excess of wax, and when finishing cover the pins well, and in arranging for rim do not let it overlap the gum; the wax should be modeled perfectly smooth to avoid after trouble in finishing; invest the same as for vulcanite in equal parts of plaster and fine, clean sand; when plaster investment has set, warm it before opening to soften, but not melt the wax; open flask and remove the wax carefully and wash out remains with hot water; then cut a funnel-shaped gate in the investment through which to pour the metal; this may be ¼ inch in diameter where it opens in the mould, directly posterior to last molars; the vent to be ½ size of gate and directly opposite it. Dry flask thoroughly from 3 to 5 hours, or until it is perfectly dry; any moisture remaining can be detected by holding a mirror over the venthole; then melt metal carefully in a clean iron ladle, but not too hot, with flask heated so that it can hardly be held in the hand, and pour the metal. It should require little or no scraping or filing; use sand paper first, next felt wheels and pumice, and finish with whiting.

Q. Describe process of replacing broken block?

A. Cut out broken pieces and fit block same as rubber-work; fill the dovetail with wax; invest in plaster and sand; open flask, wash out the wax; cut a gate and vent; dry carefully; then heat case to 200° or 210° F.; pour metal in gate.

Q. How attach a single gum tooth when broken off?

A. Invest as for a gold or silver plate; dry out and heat, moisten parts to be united with muriate of zinc; use blowpipe or soldering iron, and solder with same metal as base.

Q. At what temperature does Weston's metal melt?

A. 444° F.

Q. What does the *Aluminium Cast Base* Process consist in?

A. Forcing the molten alloyed aluminium into the mould by air generated by rubber bulb.

Q. What is *Reese's Gold Alloy Cast Base* composed of?

A. Gold 1 part, silver 2 parts, tin 20 parts.

Q. What is *Kingsley's Base* composed of?

A. Pure tin 16 parts, bismuth 1 part.

Q. What is the *Electro-Metallic Process* for making Electro-deposit Plates?

A. Depositing, by a battery, gold and silver directly upon surface of plaster model and thus forming a plate, or set of teeth.

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Q. How is the Plaster Model prepared ?

A. By building on reliefs, chamber, and rim outlining ridge with plaster; then boil model for a few minutes in wax or paraffin, and coat plate-surface with plumbago.

Q. How is the gold first deposited ?

A. A definite thickness of gold is first deposited, and upon the gold a deposit of silver is made which in like manner is covered by another deposit of gold; the plate remains in the deposit solution for 4 or 5 days.

Q. What is the object of the intermediate deposit of silver ?

A. To give strength, as all deposited metals are weak, but silver is stronger than gold.

Q. May the gold be deposited upon a thin, swaged silver plate ?

A. Yes, but better adaptation is secured by the first method.

Q. What objection is there to soldering such a plate ?

A. The annealing will render plate too pliable.

Q. How are the teeth attached ?

A. By depositing the gold and silver on and around the pins, or by vulcanite attachment held by checking surface of plate; another deposit of gold is made after set of teeth is vulcanized.

ARTIFICIAL CROWNS ON NATURAL ROOTS.

Q. What is the object of "pivoting" roots of teeth ?

A. The preservation of the root, and to obviate necessity of wearing a plate.

Q. What kind of pivots or posts are used ?

A. Wooden and metallic; the use of the latter has almost entirely superseded that of the former.

Q. Describe the method of inserting a crown on wooden pivot ?

A. Exposed end of root is made concave from side to side by files and corundum wheels, and shortened below level of margin of gum; pulp-canal enlarged for pivot, which is made of seasoned hickory, or locust wood, condensed by forcing through draw-plate holes; pulp-canal beyond pivot is closed by filling; a temporary pivot of soft wood is first used to determine position of crown; the permanent pivot is made to fit tightly enlarged portion of canal, and before inserting in root is tightly fitted in hole of crown; the canal is then dried and crown with pivot of proper length and diameter, is forced into place; if root canal opening and hole in crown do not correspond in direction, a larger pivot is used for canal portion, and cut away at desired angle;

when pivot becomes wet, it expands and holds very firmly; in the root more tightly than in crown; a close joint should be made between crown and root.

Q. How are metallic pivots made and inserted when plain plate teeth are used?

A. The teeth are backed with gold or thin platinum over which gold is flowed; a disk of metal is made to cover and fit accurately the concave (or flat) exposed surface of root, and a pivot of metal (gold, or gold and iridium, or platinum) is soldered to the under surface of disk at a point where its direction will correspond to hole in root; pivot is generally made square tapering to a point, and is attached to root by gutta percha or oxyphosphate or oxychloride of zinc.

Q. How are crowns attached to pivots such as the Logan, Mack, Gates, Foster, How, Bonwill, Meriam, Weston, Leech, and others?

A. By first inserting pivot securely in enlarged root-canal, and then securing crown to pivot by bending over it the long pins of crown and filling over them gold, or, more usually, amalgam. In Logan crown the pivot is secured in crown when it is backed, and adjusted to root and secured by zinc filling material or gutta percha; sometimes a gold tube is fitted into enlarged root-canal, and pivot made to fit tube tightly; in other cases the pivot is made of tube-form and split for some distance from its free end by a saw or fine separating file, and after it is attached to crown and inserted into root, the tube pivot is filled through an opening in palatal surface of crown, with gold or tinfoil which expands the end of pivot and holds crown securely to root.

Q. What does a Collar-Crown consist of?

A. A plate or disk of metal to cover exposed end of root with a thin piece of gold plate soldered to it, so as to form a rim or collar for better protection of root, and wide enough to extend a little beneath free edge of gum, thus forming a cap to the root; the metallic pivot is attached to under surface of this cap.

Q. How should root be prepared for collar-crowns?

A. Cut root down nearly to surface of gum, but not near enough to make it bleed, or lacerate gingival margin; ream out root-canal with a Talbott reamer, more towards palatine than towards labial side; make a square or oblong pivot or post tapering to a point; then cut grooves in sides of root-canal, then cut away root a little below level of gum all around, but a little deeper on labial side, so as to have point under margin of gum, and leave root on palatine side high enough for collar; then with a cone-shaped drill cut away around end of root the projecting portion, so that the collar will fit the root closely at its lower edge; the collar is fitted in making to the prepared surface of root, and is ⅛ inch wide and very thin (of platinum or pure gold); then a disk or cap for collar is made of same material as collar, and the pivot passes through a hole in top of cap that it may be soldered to it; after soldering the post to cap, try in mouth and burnish lower edge of cap to root; the porcelain crown or facing is then backed, and soldered to cap and post; like an inlay, a porcelain facing must be selected a shade lighter than adjoining teeth, as it becomes darker after backing; the post is barbed on edges and secured in root with zinc cement or gutta percha. Some cut away labial surface of root considerably, that base of facing may go under free margin of gum.

Q. What are "All Porcelain Crowns," such as the Bonwill, etc.?

A. Crowns with concave or countersunk base, a triangular opening from base to pivot at or near cutting edge of incisors, a peripheral margin or border to rest flat on root, with concavity of base on palatal side at a more acute angle than on proximate; in incisor crowns an anchorage, by a depression undercut between labial and palatine surfaces opening on palatine; bicuspids and molars have retaining-pits nearer grinding surface.

Q. How are these crowns attached to the pivots or posts secured in roots?

A. By amalgam or gutta percha; amalgam for outer surface if gutta percha is used within.

GOLD CAP-CROWNS.

Q. Define Crown-Work?

A. The adaptation of artificial crowns to cervical portion of natural roots, and the contiguous membrane and restoration of articulation and anatomical contour.

Q. What is the object of all gold cap-crowns?

A. The capping and hermetically inclosing with gold the crown, or any portion of it, and neck of tooth or root, for permanently preserving it.

Q. What do they consist in?

A. Seamless caps of fine gold made by a die or stamping press; or in sections consisting of a band and top soldered together; or a band around crown made wider than length of crown, so that slots may be cut in projecting portion; and then bending the separated parts inward over grinding surface of crown, and finally flowing solder over them and thus forming the grinding surface of cap.

Q. How should a Cap-Crown be adapted?

A. Palatal portion should go well up under free edge of gum, and cut out at edge of root, if necessary, at cervico-labial edge; the edges that pass under gum should be burnished to sides of root.

Q. How are such crowns attached?

A. To crown, if sufficient remains, by zinc cement; otherwise to root by an iridio-platinum pin, fitted tightly to root-canal and first soldered to crown.

Q. How should a natural crown be prepared for a cap-crown of gold?

A. By carefully removing all decay, treating and filling (if necessary) root-canals, building up with gutta percha or zinc cement contour of crown (to restore lost part), and taking an impression in moldine and securing a metal die over which to fit gold crown.

Q. How are gold crowns with porcelain fronts or facings made by Dr. G. Evans' process?

A. A model of restored tooth-crown is secured; two casts, one of coronal form of tooth, and other of only palatal and proximal portions are made using moldine in tubes with fusible metal. A piece of gold or platinum crown plate, No. 34 U. S. Standard gauge, about length and circumference of tooth, is then struck up on palato-approximal cast; it is then transferred to coronal cast, which is previously trimmed about the thickness of the gold plate upon approximal surfaces, and worked down to exact form of tooth on anterior portion; the metal form of tooth is cut even at incisive edge, the seam down front beveled and lapped, marked, and slightly opened, and removed from die; by the mark, the gold is pressed back to form assumed on die, and fitted to natural crown, previously trimmed and shaped, and joint on labial side soldered; into open incisive edge, a narrow strip of gold one-sixteenth of inch and thick enough to fill space, is fitted and soldered; the crown is then filled with plaster, labial portion cut away so as to leave upper part to form band and lower part the incisive edge; a porcelain tooth of proper shade and form is ground and thinned down, the pins ground away in process, but left thickest at incisive edge; this porcelain facing is then removed, and platinum foil adapted to its back, and turned just barely over its edges, the upper and lower of which are slightly tapered off; the porcelain front is then adjusted on crown, and cemented on one side with wax, and crown invested in plaster and marble dust, so that seam along edge of platinum and gold is exposed on cemented side and one end; the seam is then soldered with 20 carat solder; solder is not to be flowed on porcelain or too much borax used; then the crown is again invested and remainder of seam soldered, the excess of porcelain on inside of crown is ground away; when fitted crown is attached with zinc cement.

Q. How are roots of teeth prepared for gold collar crowns?

A. Where pulp is alive, labial surface and cutting-edge should be ground down as much as can be done without exposing pulp to irritation; palatal portion at an angle from cervical border to cutting-edge, enough to level its prominence of contour and form a slight space between it and antagonizing teeth. Teeth pulpless, are ground to margin of gum at labial portion and slightly above margin on posterior half. Leave as much as possible of natural molar and bicuspid crowns; as anchorage, amalgam can be built securely in enlarged pulp-chambers, and built up to restore form of crown for attachment of gold or porcelain-faced crowns; or pins or screws can be inserted in root-canal, and cemented with zinc cement and amalgam.

Q. How may a front tooth greatly abraded be crowned?

A. If pulp is alive, remove portion of labial surface, and form artificial crown similar to a gold collar crown without post.

Q. How is the *Parr Crown* adjusted?

A. The root is prepared and a band and cap made same as a gold collar crown; a hole is made in cap, and a post fitted to canal, a disk of gold as large as cap on root is adjusted on post above cap, by making hole in gold in which post fits tightly; the gold plate or disk is adapted to cap on root and burnished close around post forming an outside cap; post and outer cap are then removed, soldered together and fitted to inner cap, and edge of outer cap trimmed even with it; porcelain tooth to form crown is fitted and attached to outer cap, which is cemented in position.

Q. Describe the *Brown Crown?*

A. Has a curved base; the canal is reamed for reception of post; use a Willard countersinking burr to cut away points in contact with base of crown; if necessary to trim the base of crown itself, use a diamond disk with safe edges, ream out canal so that post fits it snugly; set with gutta percha.

Q. Describe the *Downie Crown?*

A. A combination of the all-porcelain crown with a band or ferrule; the root is prepared as for a Richmond Crown; a suitable plain, cross-pin tooth is selected, and a square iridio-platinum wire is used for the post, which tapers to one end and is flattened at the other end, on each side of which end a notch is filed; the platinum pins of the crown are bent over the flattened end of the post; after temporarily attaching the crown and post with adhesive wax, and properly adjusting them in mouth, they are invested in silex and plaster (3 to 2); after investment has set, the wax is removed by boiling water; the body is then applied in such a quantity and manner as will restore the contour of crown, and baked in a Downie furnace, or a Sharpe furnace. Vulcanite teeth may be used, but if so, the post should be soldered between the platinum pins with pure gold.

Q. Name some of the other crowns in use?

A. Richmond, Logan, Downie, Bonwill, Flagg, Brown, How Crowns.

Q. In constructing collars for crowns with porcelain facings, and all-gold crowns made in sections, what should be the carat and standard guage of the gold used?

A. 22 carats fine, and No. 28 to 30 standard guage.

Q. How is it best to crown a superior cuspid root for a female, the root being strong and healthy?

A. If no dentinal tissue but root remains, sterilize and seal root at apex, and place a porcelain-faced Richmond crown if the bite is heavy; a Downie or Logan crown if translucency is desired and the bite is not too heavy.

Q. How is it best to crown an inferior second bicuspid root for a male, the root being strong and healthy?

A. If any amount of the crown remains above the gum, sterilize and seal the root, and make a stump, and cap with an all-gold shell-crown—barrel crown; or where there is a heavy bite (nothing but the root remaining), an all-metal Richmond crown may be used, if a light bite, a porcelain-faced Richmond collar-crown may be used.

Q. When it is imperative to crown a superior central root, the root having a small hole through its side midway between its apex and the margin of the gum, how may it be done?

A. A root-canal with a perforating peridental ulceration may be treated with iodoform paste, the perforation being sealed with either a gutta percha or tin foil disk, or with a small piece of fine, sterilized sponge. The root should be treated for two weeks before crowning, and is then doubtful.

Q. Explain the cause of fracture of porcelain facings in soldering?

A. Contraction of the backing when adapted over the edges of the porcelain in a curve, instead of at a right or slightly obtuse angle; or by melting solder on the porcelain unprotected by a backing of platinum; or the solder, or borax, as it cools, contracting on the porcelain, or on a very thin edge of metal covering it.

Q. What is the best form of gold solder for filling the inner occluding surface of a seamless gold crown?

A. Fluxed gold solder filings—5 parts of gold filings mixed with 1 part of finely pulverized borax.

Q. What are the proportions of an investment of marble dust and plaster for soldering a single gold crown?

A. Marble-dust 2 parts, plaster 1 part.

BRIDGE-WORK.

Q. What is *Bridge-work?*

A. The replacement of a portion of the teeth by bridging the vacant spaces with artificial teeth supported by anchorage to adjoining natural teeth.

Q. What are the rules that govern the number and position of anchorage teeth?

A. (Evans, Dr. G.) One central root will support two centrals; two centrals will support four incisors; the cuspid roots will support the six anterior teeth; one molar or bicuspid on one side, and a bicuspid or molar on the other with one or two roots between, will support a bridge between them; one right and one left molar, with the two cuspids, will support bridge of entire arch; a bridge on one side of mouth can be supported by two or three teeth or roots on that side.

Q. What preparation of roots to support bridges?

A. The same as for ordinary cap and other crowns, but the cutting and trimming of sides of roots and teeth and enlarging of root canals, should be in parallel lines for easy adjustment.

Q. With a case where the roots of the two upper cuspids and crowns of right upper second and left upper first and second molars remain in mouth, what is first done (Evans, Dr. G.)?

A. Cap right molar with gold crown; cap two cuspid roots with collar crowns and posts; adjust artificial teeth (porcelain fronts) in mouth on wax without the gold crowns; then return to model, and build up on labial surfaces of teeth enough of investment of calcined marble-dust and plaster to hold them in position; remove wax exposing inner surfaces, then remove porcelain teeth and fronts (except fronts for roots capped), and base ground from a line on palatal surface below pins, straight to labio-cervical edge, to form self-cleansing spaces; back incisors with thin platinum or pure gold, and allow backings to extend just over cutting edge, as a protection, and to edge of self-cleansing space; back the bicuspid and molar fronts in same manner after grinding off their tips; then strike up a cap of pure gold, or gold and platinum, to represent grinding surfaces, and fill concave portion by melting in scraps of gold; then grind surface smooth and fit to tip of porcelain front to form occluding surface according to articulation with lower teeth, and fill space with wax; this metal surface protects the porcelain; then cut and fit to sides triangular pieces of gold plate or platinum foil; let them extend slightly over sides, and invest tooth, leaving back open like a pocket, the end of bridge on left side is to be anchored in a slot cut in the molar; this bar is made of iridio-platinum wire filed square, adjusted to tooth and cap with wax and tried in mouth; invest all the incisors, and the porcelain fronts of cuspid crowns, at same time; and in soldering melt twenty carat gold plate into the pockets, and flow gold over backings of incisors and cuspid fronts sufficient to shape them, then trim and finish each tooth; then attach teeth on model with wax and apply investment of marble dust two parts, plaster one part, until all the bridge is covered except space along backings and crowns where they are to be united in soldering; place in space between backings, pieces of gold or platinum plate and solder over these; then finish with wheels and points.

Q. How is such a bridge adjusted in mouth?

A. By first trying in and arranging articulation, then permanently attach bridge by first barbing the posts, and cement the crowns on with oxyphosphate of zinc, and anchor end of bar in slot of right first molar by either a gold or amalgam filling.

Q. How are small pieces of Bridge-work constructed, (Dr. G. Evans)?

A. First make crowns for anchorage teeth or roots, and temporarily place in position; grind and back the teeth, adjust them, cement with resin and wax in proper position between the crowns; then remove crowns and teeth together in an impression cup filled with investment; the inside surface of cup should be serrated and coated with wax; then warm impression cup and remove its contents; cover exposed parts of crowns and teeth with more investment, and expose parts to be filled in and soldered; solder and finish.

Q. What are Removable Plate Bridges?

A. Those with a plate to span space and support teeth between abutments, the posts and collars moving evenly on and off the supporting roots and crowns.

Q. What is the difference between a removable bridge and a plate with clasps?

A. The principle is much the same in each. Both are bad, but the plate retained by means of clasps is by far worse in its ultimate destruction of the clasped teeth. The clasp-plate receives its support solely from the alveolar ridge and palatal muco-periosteum, and is steadied only by the clasps. The removable bridge receives its support entirely from the removable crowns attached to and properly protecting suitable abutment teeth. The removable bridge is more stable, and not so destructive, but eventually is a failure.

Q. What is the Mandrel System, (Dr. Starr)?

A. A method of determining the configuration of the necks of teeth, and shaping and adapting the collar crowns accordingly by means of seven mandrels, six of which have double ends, their shape modeled upon the general forms of necks of teeth.

Q. What is Dr. Parmly Brown's Porcelain Bridge-work?

A. Formed entirely of porcelain with an iridio-platinum bar running through denture as a sustaining piece, thus showing a perfect continuity of porcelain surface; the Brown crown, owing to its great strength, is well adapted as an abutment crown for an all-porcelain bridge.

Q. How are the ends of bar anchored?

A. Either in a crown as a post, or in a filling in approximal surface of adjoining tooth; ordinary plate teeth used, the pins riveted to or bent over bar, and a porcelain body filled around the rivets and bar of each tooth and baked same as continuous gum.

Q. What are the metals used for collars, caps or crowns, and for backings and posts in bridge-work?

A. 22, 23 and 24 carat gold plate for collars, for crowns, and gold seamless crowns; pure platinum for same, and iridio-platinum wire for posts.

Q. What grade of solders?

A. 22 carat for crown-work, and 20 carat for crown- and bridge-work, also 18 carat; and 14 carat for strengthening seamless crowns.

Q. What is Dr. G. Evans' formula for solder 20 carats fine?

A. Zinc 1½ grs., pure gold 20 grs., silver solder 3 grs., the zinc being burnt out in soldering process.

Q. What is Dr. Dorance's formula for 20 carat solder?

A. An alloy consisting of 1 part pure silver, 2 parts pure zinc, 3 parts pure copper; four grains of this alloy melted with 20 grains of pure gold will give a 20 carat fine solder.

Q. What is Dr. Low's formula for a 19 carat bridge-work solder?

A. 1 dwt of pure gold; 2 grs. copper; 4 grs. silver.

Q. How is it best to bridge in the six superior anterior teeth, having the left cuspid, right, central and lateral roots, all the roots being firm and healthy, *but out of their normal positions?*

A. There are few cases of irregularity in placement but what the Richmond porcelain-faced collar-crown and its variations may not be adapted to with stability and pleasing effect. In the case described, the right lateral root may be ignored as a weak point and complicating the abutments, therefore it would be better to sterilize and seal, and cap same in a tiny gold shell at gingival line; devitalize and excise the right canine, sterilize and seal root; and construct three porcelain-faced Richmond collar-crowns for the left canine, right central and right canine, and to expect ample support from these.

Q. When making bridges having for their abutments the inferior left cuspid and second molar, and superior left cuspid and second molar (both in same mouth), how can the articulation be obtained?

A. A good and simple method is as follows: The abutment crown being in occluding position, a bite and impression can be taken at one and the same time by the use of modeling composition in the double Downie tray. With the patient's teeth in occlusion, the tray is moved laterally, and then removed, and lined with a slight layer of setting plaster, replaced in the mouth, and both an impression and a bite obtained in plaster, thus insuring accuracy. A bite may be taken with the occluding crowns in position, in modeling composition, or in wax, but there is always risk of lateral displacement. Well carved occlusions really demand no bite, as the models always take the correct position.

Porcelain Teeth.

Q. What are the chief ingredients of porcelain teeth?

A. Feldspar, silica or flint, and kaolin.

Q. What is Kaolin?

A. Decomposed feldspar, consisting of nearly equal proportions of alumina and silica.

Q. What is feldspar?

A. An essential part of most of the primitive rocks; a double silicate of aluminum and potassium.

Q. What is silica or flint or quartz?

A. Exists more or less pure in white sand; best is from rock quartz or rock crystal; silicic oxide, a compound of silicon and oxygen.

Q. Give a formula for bodies of moulded block teeth?

A. Kaolin 1 oz., silica 3 oz., feldspar 18 grains, titanium oxide 65 grains, starch 10 grains to each ounce; medium color.

Q. Give a formula for bodies for carved blocks?

A. Kaolin 1 oz., silica 3½ oz., feldspar 14 oz., titanium oxide 40 grains, no starch for carved blocks; medium color.

Q. Give formula for a blue frit or color for enamel?

A. Platinum (dissolved in aqua regia) 1 pennyweight, feldspar 1 oz., plate glass 20 grains.

Q. Give a formula for gum frit?

A. Purple of Cassius 16 grains, feldspar 700 grains, flux 175 grains.

Q. Give a formula for gum enamel?

A. Frit 1 pennyweight, feldspar 3 pennyweights.

Q. What are used to color and tint artificial teeth?

A. Titanium, platinum sponge, oxide of cobalt, oxide of gold (purple of Cassius), oxide of magnesia, oxide of uranium, oxide of silver.

Q. Give relation of shape and color of teeth belonging to each basal temperament?

A. Bilious:—Golden yellow color, flat face, large and angular. Sanguine:—Soft yellow, round face and bold. Nervous:—Transparent blue or gray, graceful, semi-round face. Lymphatic:—Opaque white, spheroidal and rather broad face.

Q. What advantages are claimed for *Pinless Teeth?*

A. Natural appearance in close bites, close conformity in contour to natural organs, being more acceptable to tongue, render articulation easier and more distinct, strength.

Atmospheric Pressure.

Q. What is the pressure of the atmosphere at level of sea?

A. 13 to 15 lbs. to the square inch.

Q. Why is a pressure of ten tons weight on external surface of body not apparent?

A. Because all portions of body feel it alike on every side.

Q. What does atmospheric pressure acting on all sides, but unequally distributed, become?

A. A physical force which may be made to exert a prodigious power.

Q. If two surfaces are brought into such contact as to entirely exclude air, what degree of force holds them together?

A. A force proportioned to extent of surface of contact.

Q. If touching at their edges, so that an air-tight space is included from which air may be exhausted, upon what will the adhesion depend?

A. 1st. Upon the completeness of exhaustion. 2d. Upon the superficial area bounded by lines of contact.

Q. When are these two conditions of adhesion aimed at?

A. In plates of artificial dentures with and without vacuum cavities.

Q. How accomplished in plates without vacuum cavities?

A. By perfect adaptation or contact.

Q. How in plates with such cavities?

A. By contact combined with the power of a vacuum.

Q. Does the adherence between surfaces by atmospheric pressure though it may exist in combination with adhesion, assume the nature of an attraction?

A. Not in the least.

Q. What are two leaves of cohesive gold, or two surfaces of a smoothly cut lead bullet, or two highly polished surfaces of ground glass, examples of?

A. Cohesive attraction existing between similar particles; in the case of the leaves of cohesive gold it is called welding.

Q. What is water rising in capillary tubes, and water suspended in drops from a polished surface, or between two surfaces of smooth glass, examples of?

A. Adhesive attraction existing between dissimilar forms of matter.

Q. What holds a properly adapted plate to mucous surface?

A. Partly adhesion, partly attraction, but chiefly atmospheric pressure.

Q. How many pounds should the surface of an upper plate 3 to 5 inches square, if air could be perfectly excluded, sustain from its centre?

A. A weight of 45 to 75 lbs., a force sufficient to tear off the mucous membrane.

Q. What is the nearest approach in dental practice to such a degree of adhesion?

A. A plaster impression of the mouth.

Q. Why is it that an impression when returned to mouth after once being withdrawn, will no longer adhere with same force?

A. Because it is impossible to avoid including air between the surfaces; and pressure on plate acts around edges equally as at centre, and can only partially displace the air; the air bubbles are flattened by pressure and spread over surface, not excluded.

Q. Why cannot a plate be made to act as a boy's leather disk in raising a weight?

A. Because with the plate air is unavoidably enclosed, and pressure on plate acts around edges equally as at centre, and can only partially displace the air, and the air-bubbles are flattened by pressure and spread over surface, not excluded; with the leather-disk the air is entirely pressed out and a more perfect vacuum is formed.

Q. What are the three methods of overcoming the difficulty and disposing of the air?

A. By suction, to draw out some of the air.

By pressure, to force much of it out.

By means of a vacuum cavity at or near the centre of plate to collect it into a comparatively small space, and thus relieve the edges of cavity.

Q. What is the general rule in regard to the position of a vacuum cavity or chamber in a plate?

A. The cavity should be in the area subjected to the least movement, which area will be about the centre of gravity.

Q. What should such a cavity or chamber represent as to shape?

A. The outlines of the dental arch—a parabola.

Q. What kind of outlines should such cavities have?

A. Sharp outlines, as otherwise they do not afford firm adhesion.

Q. What form of mouth will render such cavities unnecessary?

A. When the alveolar ridge is well defined, a moderately deep arch, tissues not too thick and yielding, and where the absorption of the process is completed.

Q. In what cases is the vacuum cavity indispensable?

A. In partial cases not supported by clasps.

Q. Where a hard nodular area may occupy the position usually regarded as proper for the cavity what is the remedy?

A. Two lateral vacuum cavities oval in shape, rather deep, their edges covering the soft areas.

Q. When are vacuum cavities of a crescent form applicable?

A. Where the hard area does not extend too far forward.

Q. How should the walls of such cavities as differ from the common forms, be shaped?

A. Of such an inclination that no undercuts are formed, each wall being almost parallel with the axis of the model, and be made sharp and well defined, so as to prevent dragging about such a vacuum cavity in making the sand mould.

Q. In full cases where a vacuum cavity is not desired, what is it necessary to secure?

A. A perfect adaptation, or close fit, of the plate to the palate and alveolar ridge, so that the pressure may be evenly distributed.

Q. In partial cases how is it best for the cavity to be formed?

A. To cut the form of the vacuum cavity in the impression, and thus avoid the slipping out of place of a metal form held by pins.

Q. What is a general rule in regard to the size of a vacuum cavity?

A. About ¼ the area of space inclosed by a line drawn around centre of alveolar ridge and the heel or back line of the plate.

Q. What advice may be given to a patient wearing a denture with vacuum cavity, when a new denture is about to be constructed?

A. To dispense with the wearing of the old denture for several days before the impression for the new one is taken, so that all marks made by the old chamber may disappear from the palatal portion of mouth.

Deformities of Palate.

Q. What are the three distinct causes of deformities of hard palate?

A. Congenital deficiency as in cleft palate; perforation and lesion of hard and soft palates from mechanical injuries, such as shot wounds.

Q. What is the nature of syphilitic perforations of hard palate?

A. Generally in median line, often oval in shape, less frequently round, aperture beveled off at expense of palatal surface, giving a funnel-shape; usually located in anterior third of palate.

Q. When ulceration has caused a cleft, what are usually present?

A. Strong cicatrices drawing cleft widely open.

Q. To obtain an impression for artificial palate what preparatory treatment is necessary?

A. To paint parts with solution of bromide of ammonium, or tannin 1 drachm, and glycerine four ounces, or a 4 per cent. solution of muriate of cocaine.

Q. What material answers best for such an impression?

A. Plaster of Paris.

Q. What form of impression cap?

A. One especially prepared; should fit closely in front to teeth, and at back leave a space about 1/8 inch from its surface to corresponding surface of soft palate.

Q. What must be avoided?

A. An excess of plaster, and its falling on base of tongue or into throat, and thus cause retching.

Q. How should the plaster models be used?

A. They should be duplicated in type metal.

Q. How is impression of deep cases generally obtained?

A. In two parts, one part at a time, and afterwards joined together.

Q. Can artificial teeth be added to such an appliance?

A. Yes, if necessary.

Q. How are artificial palates divided?

A. Into Obturators and Artificial Velum.

Q. What is an Obturator?

A. A hard, non-elastic appliance to fit into an opening or perforation in hard palate and close it completely.

Q. What is an Artificial Velum?

A. An elastic movable valve applied to congenital fissures of soft palate, and under the control of the surrounding and adjacent muscles, closing and opening the passages at will.

Q. How many of the sounds of articulate language depend upon the integrity of soft palate for perfect enunciation?

A. More than three-fourths; hence the necessity for the same movement in an artificial palate.

Q. How do the surrounding muscles control such an appliance?

A. Artificial velum extends across the opening and rests on the muscles of either side. The levator muscles throw it up with all sounds requiring closure of nasal passage; the thickness of the velum brings its posterior surface in close contact with the superior constricter muscle, affording in pronunciation of guttural sounds, a firmer resistance to pressure of tongue than is possible with a thin obdurator; a hinge connects the movable with stationary part; such movements as above are made so free and easy that there is no moving of the plate as would occur if the appliance was rigid. The weight of the velum itself renders its descent certain if a nasal sound follows a guttural.

Q. What artificial palates have given satisfaction?

A. Stearn's and Kingsley's.

Q. What is the nature of the rubber used for velum?

A. A soft elastic vulcanite; hardened sufficiently by heating up to 230° F. and gradually increasing every 2 hours to 250° and 260° F. for six hours.

Bacteriology.

Q. Define *Bacteriology?*

A. The science of bacteria; or living organisms.

Q. What are *Bacteria?*

A. Mico-organisms; or microbes.

Q. What is the general signification of organisms?

A. Micro-organism means a small body; microbe signifies a small life; Bacterium (plural bacteria), a small staff; Bacillus (plural bacilli), a small rod.

Q. What is *Organic Matter?*

A. That which is the product of function or growth; everything that has organs, or in which function exists, or has once existed, is organic.

Q. How is the Organic world divided?

A. Into two great kingdoms—Animal and Vegetable.

Q. What can the Animal assimilate?

A. Only organic matter.

Q. What is *Inorganic Matter?*

A. That which exists as it was first created; no animal can utilize for digestive purposes any inorganic matter whatever.

Q. Into what two classes is the Vegetable Kingdom divided?

A. Phanerogam and Cryptogam.

Q. What do the Phanerogams include?

A. All plants which have blossoms, and which are propagated by seed.

Q. What do the Cryptogams include?

A. Those plants which never blossom, their propagation being by spores, or by minute embryos of the plant itself.

Q. What do the leafy cryptogams include?

A. The ferns, mosses, and some lichens.

Q. What are *Thallogens* or *Thallophytes?*

A. The division of cryptogams that are unicellular in structure, and without leaves, stems, or branches.

Q. How are they divided?

A. Into *Fungi*, *Algæ*, and *Lichens*.

Q. What are *Fungi?*

A. Those without the green coloring matter (chlorophyll) of plants, and live only on organic matter; the parasites of both the animal and vegetable kingdom.

Q. What are *Algæ?*

A. Those which contain the green coloring matter of plants, but live upon inorganic matter and are usually found growing in water.

Q. What are *Lichens?*

A. Those in the form of mosses growing on rocks and trees.

Q. How are fungi divided according to shape?

A. Into round, rod, and screw forms; the round or *coccus* forms are subdivided into *micrococci*, or small cocci; *macrococci*, or large cocci; *diplococci*, or double cocci; *streptococci*, or chain cocci; and *staphylococci*, or those which grow in clusters, like a bunch of grapes. The rod forms are divided into *bacilli*, or straight rods; *clostridium*, or spindle-shaped; and *leptothrix*, or thread-like. The screw forms are divided into *vibriones*, or undulating screws; *spirilla*, or rigid; *spirocheta*, or flexible screws.

Q. How are Fungi classed according to their action?

A. *Zymogenic* (fermentative); *Pathogenic* (disease producing); *Chromogenic* (coloring); *Aerogenic* (gas forming); *Saprogenic* (putrefactive); *Pyogenic* (pus forming); and *Saprophytic* (parasitic).

Q. What is *Fermentation?*

A. The change brought about in an organic medium by the presence of a ferment.

Q. How are the ferments divided?

A. *Organic*—those of the organisms whose growth or proliferation is by assimilation of the elements of the fermentable substance, which they have the power to decompose; *Inorganic*—those of digestion; the gastric and intestinal juices, the saliva, etc., contain ferments that decompose and change the fermentable foods, and reduce them to a condition in which they may be assimilated, or built into tissue.

Q. What conditions are necessary for the proper growth and proliferation of the fungi?

A. They require a proper soil or menstrua, a proper amount of moisture, a proper temperature (between 80° and 100° F.); and are destroyed or cease to vegetate when the temperature is either too high or too low.

Q. Name three *Media* suitable for the culture of Bacteria?

A. Solid Media, such as pieces of sterilized potato; those having animal or vegetable gelatine for a base; and fluid media, such as infusion of hay, or other vegetable substances; for the parasitic form beef bouillon.

Q. Name the *Media* which the fungi naturally find?

A. Sugar solutions from fermentable sugars formed by the change of starch into grape sugar; extracts or tissues of animals; those that live in the tissues find that what is normal to the body is normal to them.

Q. How do Micro-organisms multiply?

A. By fission; fission is the division of an organism into two or more parts by a constriction of its body.

Q. What is the largest form of micro-organism found in the mouth, and only in the mouth, and not capable of being cultivated?

A. The *Bacillus Maximus* of Miller.

Q. What micro-organism is instrumental in causing Dental Caries?

A. The *Streptococcus Media.*

Q. What is the most constant fungus found in the mouth?

A. The *Caries Fungus.*

Q. What micro-organisms produce Suppuration?

A. Staphylococcus pyogenes aureus, Staphylococcus pyogenes albus, Micrococcus pyogenes tenuis, and Streptococcus pyogenes.

Q. What kind of acid do the micro-organisms composing the caries fungi generate?

A. Lactic acid.

Q. How do Pathogenic Bacteria affect living tissue?

A. By the excretion of certain poisonous substances called *Ptomaines.*

Q. Through what channels do Bacteria gain access to the system?

A. Through skin and mucous membranes, the alimentary tract, and respiratory organs.

Q. In bacteriology, what is meant by *Segmentation?*

A. The spontaneous division of a micro-organism into sections, each section being complete in itself, and in turn subdividing into others.

Q. What is meant by *Gemmation?*

A. The process of proliferation by budding; that is the growth of one organism out of another, and its final separation from the parent.

Q. When does Spore-formation occur?

A. When, in certain stages of its existence, an organism undergoes special changes; in these the interior breaks up into very minute embryos, which are liberated and disseminated by the bursting of the external envelope.

Q. How does the growth of micro-organisms proceed?

A. By the decomposition of the medium in which they exist; they assimilate such elements as enter into their own composition, and in so doing form various waste products, and give rise to new combinations of such elements of the medium as are rejected.

Q. With what rapidity do they multiply?

A. With almost inconceivable rapidity.

Q. What is the action of the Putrefactive micro-organisms?

A. They decompose nitrogenous matter by their growth, with the evolution of offensive gases as their by-products.

Q. What are *Ærobic* and what are *Anærobic* fungi?

A. Some fungi grow only in the presence of air or oxygen, and are called *ærobic;* others grow in tissues or cavities to which air has no access, and are called *anærobic.*

Q. Are the Bacteria generally self-limiting?

A. Yes; when the medium in which they are growing becomes sufficiently contaminated they will die; thus, if an acid producing organism has made its menstruum sufficiently acid, it will die unless the acid is neutralized by an alkali, in which case it goes on proliferating, provided the pabulum is not exhausted.

Q. How may one micro-organism destroy and take the place of another?

A. By its superior activity and power of decomposition, or through its production of a chemical compound that is fatal to the first organism.

Q. How do the merely parasitic bacteria exist?

A. They live at the expense of that on which they grow, and are found in connection with putrefactive changes.

Q. What is the penetrating power of micro-organisms?

A. They penetrate every place that air can go.

Q. What as to their quantity and size?

A. So innumerable are the different species, and so minute their size, many of them being invisible even under the microscope of highest power, that everything conceivable becomes infected with the seeds of disease and decay.

Q. What is the most resisting, or material, factor in the prevention of zymotic or infectious diseases?

A. The power of healthy animal function.

Q. As the human body under ordinary circumstances successfully resists infection, and prevents undue proliferation of pathogenic organisms, what condition of body will favor their development and action?

A. A condition weakened in tone or depressed from any causes.

Q. What is the theory of Metchnikoff?

A. That the resistive power of the body is inherent in the ameboid white blood corpuscles, which, in a state of health, envelop and digest the bacteria; and when these are imperfect, diminished in number, or reduced in functional activity, that the infective organisms may obtain such a preponderance as to overcome all resistance, and run their course, until they cause death, or become self-limiting through the formation of their own products, and the exhaustion of the media in which they grow.

Q. What is the influence of any putrefactive or decomposing matter in regard to the multiplication of bacteria?

A. They multiply greatly in its presence; hence, all decaying matter should be destroyed as far as possible, by some quicker and more hygienic process than its decomposition by the fungi.

Q. As a septic condition is caused by the state of infection brought about by disease-producing or putrefactive micro-organisms, what remedies will combat a septic condition?

A. Any that are antiseptic and germicidal in their action. All the disease-producing bacteria are very readily communicated, either by direct contact and contamination, or through their spores, which may be floating in the infected air. Infection may be carried on the hands, in clothing, or by instruments; hence the necessity for effective sterilization.

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