

History of Dentistry 2001

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HISTORY OF DENTISTRY 2001

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This book and course is dedicated to Dr. Charles Vacanti, Dental Historian, who died in late 1994

Dentistry - Past and Present

Dental ailments have remained remarkably similar throughout history. Decay, toothaches, periodontal disease and premature tooth loss were documented in ancient chronicles. The exact time that dental art made its appearance isn't known; however, there is ample proof of its existence among the civilizations of Egypt, Etruscans of Central Italy, Assyrians, China, etc. Since Dental History is such a broad field, a few of the highlights of dentistry will be mentioned in order of importance and chronology.

I. Pre-historic era.

A. At the beginning, life consisted of simple creatures of the sea, which consisted of masses of protoplasmic cells.

B. By engulfing themselves around a desired morsel, they were able to absorb food. Later a slit developed, the forerunner of the oral cavity and great gut.

C. Much later tentacles and feelers developed around this slit. The tentacles helped to carry the food to the slit, oral cavity and great gut.

D. Then nature took the outer layer of skin and carried it inward to the oral cavity.

This skin contained tentacles which were the forerunners of our teeth. These tentacles, also called shagreen, were calcified.

E. Some of these sea creatures developed lungs and became amphibians. Some began to spend time on land. At first they crawled on their bellies, later they developed limbs and feet and arose from the ground. Faced with a new environment including a mixed diet, the creatures evolved into stronger animals made up of hard bone and tough muscle fiber. Originally three single tentacles fused and became tri-conodonts. These later changed into teeth very similar to the teeth of the Catarrine Apes (who inhabited the earth about 40,000,000 years ago in the middle of the Tertiary Period). The descendants of these apes have the same dental formula as man. Somehow fire and its benefits were discovered. Cooking made sea food more palatable. Fish and shell fish became the staple diet as well as nuts, fruits, and the flesh of animals. Due to this food supply many of the tribes of Egypt and China thrived in the river valleys. Later cultivated grains such as rice, wheat and barley were added to the diet. If we set the beginning of history at 4000 B.C., toothaches can be traced to the earliest records. In the Egyptian manuscripts known as Eber's Papyri, which dates back to 3700 B.C., dental maladies such as toothaches and sore gums are mentioned. Also about 3000 years ago, the Chinese were concerned about the condition of their teeth and gums. In manuscripts of that period, at least nine dental ailments were listed and also prescriptions for their treatment. Ancient petrified skulls showed the presence of decay. In the Giza Pyramids skulls were found with evidence of tooth decay. Be it Asia, Africa or America among the Co-magnon (direct ancestor of man) who painted walls of caves 20,000 B.C., we find all men suffered their share of dental ills.

Magic played an important part in the treatment of dental ills, and people of early ages had odd beliefs concerning teeth. The Egyptians believed that the mouse was under the direct protection of the sun, therefore if one had a toothache the split body of a warm mouse was applied to the affected side. In India the cuspid of Buddha was enshrined in a famous temple (at Kandi) and prayed to in fertility rites. Prayers were offered up to saints for the relief of pain. St. Apollonia of Alexandria, 249 A.D., was one such saint. She is now the Patron Saint of Dentistry.

II. Egyptians and Chinese

The first known dentist was an Egyptian named Hesi-Re (3000 B.C.). He was the chief toothist to the Pharaohs. He was also a physician, indicating an association between medicine and dentistry. In the 5th century B.C. Herodotus, a historian, described the medical art in Egypt: "The art of medicine is distributed thus: Each physician is a physician of one disease and no more; and the whole country is full of physicians, for some profess themselves to be physicians of the eyes, others of the head, others of the teeth, others of affections of the stomach, and others of more obscure ailments".

Dentistry today is somewhat specialized. The eight specialities are as follows:

1. 1901 Orthodontics
2. 1918 Oral Surgery
3. 1918 Periodontics
4. 1918 Prosthodontics
5. 1927 Pedodontics
6. 1937 Public Health
7. 1946 Oral Pathology
8. 1963 Endodontics

The first evidence of a surgical operation was found in Egypt. A mandible with two perforations just below the root of the first molar indicated the establishment of drainage of an abscessed tooth. The approximate date is 2750 B.C.

The splinting of teeth also was practiced by Egyptians; evidence by a specimen from Cizeh, 2500 B.C. It shows two molars fastened with heavy gold wire.

The Chinese were known to have treated dental ills with knife, cautery, and acupuncture, a technique whereby they punctured different areas of the body with a needle. There is no evidence of mechanical dentistry at that time, 2700 B.C., however. Marco Polo stated that the Chinese did cover teeth with thin gold leaf only as decorations, 1280 A.D. The earliest practice of the prosthetic arts was among the ancient Phoenicians circa 500 B.C. Hammurabi, ruler of all lower Mesopotamia (1760 B.C.), established a state controlled economy in which fees charged by physicians were set. His law code contained two paragraphs dealing with teeth:

"If a person knocks out the teeth of an equal, his teeth shall be knocked out."

"If he knocks out the tooth of a freed slave, he shall pay one third of a mine."

Teeth were knocked out as a form of punishment among these early people.

II. The Greeks, Etruscans and Romans

A. The Greeks

The contribution of the Greeks was mostly on the medical side. The ancient Greek physician, **Aesculapius** - 1250 B.C. - gained great fame for medical knowledge and skill. In time he was deified. Apollo was listed as his father. Aesculapius originated the art of bandaging and use of purgatives. He also advocated cleaning of teeth and extractions.

Hippocrates (500 B.C.) was supposed to be a descendant of Aesculapius. Hippocrates became famous both as practitioner and writer on medical subjects. He did not believe in magic. He stressed nature's role in healing. Hippocrates raised the art of medicine to a high level. Also in one of his texts (*Peri-Arthron*) he devoted 32 paragraphs to the dentition. He appreciated the importance of teeth. He accurately described the technique for reducing a fracture of the jaw and also for replacing a dislocated mandible. He was familiar with extraction forceps for this is mentioned in one of his writings. Aristotle - 384 B.C. - who follows Hippocrates, accurately described extraction forceps and in his book *De Partibus Animalium* devoted a complete chapter to the teeth. He also stated figs and soft sweets produce decay. He called it a putrefactive process instead of fermentative.

B. The Etruscans

Etruscans (100 - 400 B.C.) in the hills of Central Italy made the greatest contribution in restorative dentistry. In Italian museums there are numerous specimens of crowns and bridges which were the equal of many made in Europe and America up until 1870 when the dental engine was invented. A very unusual specimen is a bridge constructed about 2500 years ago. This consists of several gold bands fastened to natural teeth and supporting three artificial teeth, two of which are made from a calf's tooth grooved in the center to appear like two central incisors. Etruscan art, seen at its best in Florence, reflects some oriental influence but essentially it is their own. Conquered in 309 B.C., they were absorbed by the Roman Empire.

C. The Romans

Famous Roman physicians are named below:

1. **Celsus** (25 B.C. - 50 A.D.) like Hippocrates did not believe in magic. He believed that General Physical deterioration caused dental diseases. For toothaches he prescribed:

- a. Hot water fomentations
- b. Narcotics
- c. Mustard seed
- d. Counter irritants
- e. Use of the cautery
- f. Alum for soft tissue disease
- g. Extraction of badly broken down teeth. He recommended filling the cavity with lead prior to extraction as a means of lessening the chance of fracturing the crown.
- h. Gave the technique for reducing fractures
- I. Gave first technique for tooth straightening or positioning.

2. **Archigenus** (100 A.D.)

- a. Recognized pulpitis
- b. Invented the dental drill to open into pulp chamber

3. **Galen** (200 A.D.) considered the greatest physician since Hippocrates, was the first to recognize that a toothache could be:

- a. Pulpitis (inflammation of the pulp)
- b. Pericementitis (inflammation of radicular portion of the tooth)

He classified teeth into centrals, cuspids and molars.

The Romans were not especially gifted in their dental art. They borrowed their medicine from the Greeks and restorative dentistry from the Etruscans.

IV. The Hebrews

As for the Hebrews, first evidence of dentistry among the Jews, relief of toothache and artificial restorations may be found in a collection of books known as the Talmud (352 A.D. - 407). In this collection, mention is made that women were more particular about facial appearance than were men. It stated that teeth were made of gold, silver and wood. The worm was blamed for decay. Also stated that gum disease started in the mouth but ended in the gut. One treatment for abscess was as follows:

Rx: Take earth near the outhouse, mix with honey then eat it.

As for extractions - all cultures expressed anxiety about removing a cuspid for fear of eye injury. This superstition continues today. The Hebrews are known for ethics, morals and religion. Despite numerous Hebrew writings that have survived, there is little written about dentistry.

V. The Middle Ages

After the fall of Rome (410 A.D.) the clever and rational approaches of Hippocrates and

Celsus had disappeared; magic and superstitious nostrums became accepted cures. Then came **Albucasis**, a Spanish moor of Cordova (1013 A.D.). He is considered the great Exponent of Dental Surgery in the middle ages. In his book we find what is perhaps the first illustration of dental instruments. They are as follows:

1. 14 scalers
 2. Elevators for surgery
 3. Cautery
 4. Forceps for surgery
 5. Dental saws and files for removal of caries
- Besides being a famous surgeon and competent writer, he was also a greater teacher. He insisted on arriving at an accurate diagnosis. He believed in the referred pain theory. He accurately described technique for extractions, with special emphasis on careful manipulation of soft tissue. He also described treatment for partially luxated teeth.

VI. The Barber-Surgeons

At the onset of the Middle Ages, whatever knowledge had remained found its way into the monasteries. The monks became physicians and dentists. Barbers had acted as assistants to the monks. When the pope in 1163 ruled that any operation involving the shedding of blood was incompatible with the priestly office, the barber took over the practice of Surgery. The barber surgeons were not the only ones doing extractions, another group made up of Vagabonds were known as tooth drawers. They plied their trade in public squares. For awhile then, dentistry was carried on by barber-surgeons both in France and England. However, in France in 1700 anyone desiring to practice oral surgery and restorative dentistry had to take a regular prescribed examination.

VII. Founding of Universities and Introduction of Dental Texts

Around 1300 universities like those at Paris, Oxford and Bologna were founded and important books made their appearance. One such text, *Chirurgia Magna*, was written by the famous French surgeon **Guy de Chauliac** in 1386. In this text he devoted some space to pathology and therapeutics of the teeth. Chauliac was first to coin the term dentator and dentists. The English term dentist came from his original terms. Following Chauliac came **Giovanni de Arcoli** in 1400. His opinions and instruments were somewhat modern. His pelican for extraction of teeth was used for years and his root forceps could be used today. He advised good oral cleaning habits and to avoid hot and cold substances and sweet stuffs. He was first to mention filling teeth with gold.

I. Famous Scientists and Their Research

Most of the great surgeons had no knowledge of Anatomy but their teachings were not refuted until **Vesalius**, 1500 of Belgium, rebelled and became an anatomist at the University of Padua, Italy. He freed the mind of the medical profession and laid the foundation for true scientific research which is the basis of our present day medical practice. He accurately described the teeth and pulp chambers. Fallopius was another anatomist, a pupil of Vesalius. He is credited with the descriptions of the dental follicle, tri-geminal nerve, auditory nerve, LX nerve, the glosso pharyngeal, and hard and soft palate. He stated that teeth were not true bone.

II. Other Famous Scientists

A. Eustachius (1500) - complete anatomical description of teeth and their development, the periodontal membrane and alveoli. He was credited with the first complete dental book, ninety five pages of anatomy, embryology, physiology, blood and nerve supply of the teeth. In this text, he completely describes the anatomy of the teeth, their development, the alveolus and the periodontal membrane.

B. Leonardo da Vinci (end of 15th Century) - he described the anatomy of the jaws, teeth and maxillary sinus. These drawings are the first to accurately describe the maxillary sinus. However, credit has been given to Dr. Nathaniel Highmore of England (1650).

C. Ambrose Pare (16th Century) - he was born in Paris. He was a Barber -Surgeon at 16 years of age and became a member of the College of Surgeons at age 37. He was the first to describe Palatal Obturators, and transplant techniques, etc. His instruments though crude could be used today. He was not interested in restorative dentistry. He believed toothache was due to worms attacking the teeth.

D. Leeuwenhoek (17th Century) - invented the microscope. He described the dental tubuli and was the first to see organisms of the mouth

E. Malpighi (17th Century) - great Italian anatomist. He was founder of histology and made great use of the microscope for tissue studies. **F. M. Bourdet** (mid 18th Century) - described use of gold for baseplates

G. Purman of Breslau (middle 17th Century) - known for wax impressions.

H. Charles Goodyear (1840) - discovered vulcanite rubber. It was used for denture bases. This discovery led to false teeth for the millions. Dentures were called vulcanite dentures.

I. Philip Pfaff (18th Century) - German. He introduced plaster for pouring up models.

J. E.J. Dunning (1844) - plaster of Paris impressions, first shown in America.

K. John Greenwood (1789) - dentures for George Washington were made by him.

L. Pierre Fauchard (18th Century - 1728) - Father of Scientific Dentistry. Wrote a great text "Surgeon Dentist". He also wrote a complete work on Odontology in two volumes, 843 pages. He recognized the intimate relationship between oral conditions and general health. He advocated the use of lead (plombagel) to fill cavities. He removed all decay and if the pulp was exposed, he used the cautery. He prescribed oil of cloves and cinnamon for pulpitis. He described partial dentures and full dentures in his text. He constructed dentures with springs and used human teeth. Gold dowels were used in root canals filled with lead. He was also known as Father of Orthodontics. He was married 3 times. Only three children grew to maturity, one Jean Baptiste became a famous comedian. Fauchard died in 1768 at the age of 83.

III. Authors Who Followed Fauchard

A. Robert Bunon (1743) - printed the first dental therapeutics text, dentistry's first pharmacopeia.

B. John Hunter - "Natural History of the Human Teeth" in 1771.

C. Thomas Berdmore - "Disorders and Deformities of Teeth and Gums" in 1768.

D. Joseph Fox - Pupil of Hunter; wrote text, same title "Natural History of the Human Teeth".

He amplified the work of his teacher and influenced dentistry in England and U.S.

These men on the continent and in England were not physicians or surgeons writing on the teeth but dentists recording their observations. Their objective: to build this emerging branch of the healing art into a scientific profession.

IV. Women in Dentistry

The first woman dentist in England was a widow of Dr. Povey - 1719. When he died she took over his practice.

The first woman dentist in the United States was Emeline Rupert Jones of Connecticut. She too, took over her husband's practice after he died. In 1854, soon after they were married, she offered to assist him. He refused, stating that dentistry was no occupation for frail and clumsy fingers. Secretly she filled several hundred extracted teeth and demonstrated her skill to her husband. He then let her operate on a few of his patients. After his death, she took over and practiced for a least 50 years. She was accepted in both the Connecticut State Dental Society in 1893 and National Dental Association in 1914.

The honor of being the first woman graduate dentist goes to Dr. Lucy Hobbs, 1865. She graduated from the Ohio Dental College.

Creighton University Boyne School of Dental Science:

1. Dr. Ellen Kelley - first woman graduate - 1908.
2. Dr. Marilyn Bradshaw - 1949 Last female graduate until:
3. Dr. Cheri Lewis - 1976 - first woman since Dr. Bradshaw.

DENTAL HISTORY HIGHLIGHTS IN CHRONOLOGICAL ORDER

- +100,000 B.C. Homo Mousteriensis shows that prehistoric Man had to contend with impacted teeth, the retention of deciduous teeth, caries, fractures and rickets.
- 3000-525 B.C. Confirmation of Herodotus' statements as to the specialization in medicine in Ancient Egypt that there were individuals who treated only the eye, or teeth, the earliest known dentist being **Hesi-Re**, Great One (Chief) of the Toothers and the Physicians.
- 2750 B.C. Mandible of the Old Kingdom period showing evidence of having had a surgical operation to relieve an alveolar abscess.
- 2500 B.C. Egyptian, earliest evidence of simple retentive dental prosthesis as found in Tomb 984 at Gizeh, the linking together of the lower left second and third molar with gold wire woven around the gingival margins of the teeth.
- c. 1900 B.C. Code of Hammurabi established the civil and penal responsibility of the physician, dental penalties as to the extraction of teeth.
- 1700 B.C. The Edwin Smith Surgical Papyrus transcribed from an earlier manuscript c.2700 B.C. "A fascinating revelation of the human mind struggling with the first stages of science." Contains methods for reducing fractures of the mandible.
- 700-510 B.C. Etruscan period of dentistry. In what is now middle Italy, some twelve examples of their fixed or removable bridgework have been preserved in various museums.
- 669-626 B.C. King Ashurbanipal of Assyria, patron of arts and science. Collection of Babylonian cuneiform tables and a library. Tooth worm theory. 5th Century Examples of Phoenician simple retentive dental prosthetics found at Sidon. Evidence of dental practice in India.
- 490-425 B.C. Herodotus, the Greek historian and traveler, describes Egypt as being the home of medical specialists. Confirmation of this found by Hermann Junker in 1914 .
- 480 B.C. Roman period begins. Dentistry was probably practiced before medicine.

- 460-370 B.C. **Hippocrates**, the founder of Medicine, freed medicine from philosophic ideas and superstition. First to recognize the teeth in utero, Humoral pathology. Earliest recorded information as to the teeth in his De Carnibus, use of gold wire for fractures. Instruction on how to handle instruments. Text peri-arthron. Technique for dislocated jaw.
- 450 B.C. Roman Laws of the Twelve Tables, containing the earliest record of dentistry in Ancient Rome, and the permission to bury the dead with gold dental work with "which the teeth may be bound together."
- 3rd & 4th Centuries B.C. Evidence of Roman dentistry. The use of gold shell crowns.
- 384-322 B.C. Aristotle, pupil of Plato. Theory of chemical combination. First to make a study of comparative anatomy of the teeth. Mentions the extraction of teeth with forceps.
- 30 A.D. Celsus wrote his De Medicina, the manuscript having been discovered in Milan in 1443 and published in 1478. He is the earliest to mention the filling of teeth with lint or lead, however to extract the tooth more readily and not for its preservation. Suggested the binding of teeth in fractures of the jaw and orthodontic treatment. 48-117 A.D.
- Archigenes of Apameia (Syria), a Roman physician, alludes to the practice of dentistry and the use of the drill in filling teeth "right down to the center of the tooth, to give vent to the accumulated pus."
- 130-201 A.D. **Galen**, the Prince of Physicians, born in Pargamos; in 162 began to practice in Rome and in 168 was appointed imperial physician. His treatise (Venice 1490) was a standard textbook for centuries, being a rival of the Hippocratic system of medicine. Was the earliest to mention the nerves of teeth. In removing the carious defect, he recommended the file. Mentioned pulpitis and pericementitis.
- 249 A.D. **St. Apollonia**, the Patron Saint of Dentistry, had her teeth extracted in Alexandria. Her saint day is commemorated on February 9th
- 936-1013 A.D. **Albucasis** (Abul-Qasim), Spanish-Arabian physician born near Cordova, was one of the most learned physicians and surgeons of his

time. His *Dechirurgia*, one of the great surgical treatises, contains illustrations of both surgical and dental instruments with detailed description of the use of them. He describes a method of transplanting teeth and the use of gold wire to ligate loose ones. Besides improving the type of extracting forceps he devised many elevators and scalers. One of the earliest to devise a method to correct deformities in the mouth and dental arches.

1308-1745 A.D. France, Guild of Barber-Surgeons founded and remained active until 1745.

1363 A.D. In two manuscripts in the Vatican Library we find the earliest use of the term dentist.

Guy de Chauliac completes his celebrated work on surgery (published in 1478) and therein we obtain a clear and concise idea of the condition of dentistry during the fourteenth century. Coined term dentators.

1452-1519 A.D. Leonardo da Vinci, who inspired the work of **Vesalius**, was an anatomist and original dissector of the human body. His manuscript presents the earliest accurate drawings of the skull, teeth, associated structures and maxillary sinus.

c. 1460 A.D. Earliest English medical manuscript Guy de Chauliac's Surgery.

1468 A.D. Barbers in England obtain charter from King Edward IV.

1498 A.D. Invention of the modern toothbrush by the Chinese, June 24.

1514 A.D. Publication of Giovanni's da Vigo's work on surgery that passed through innumerable editions wherein we find the earliest printed record of the filling of teeth with gold foil after first excavating and shaping the cavity.

1538 A.D. Andreas Vesalius, the famous anatomist, was the first to use wood cuts to illustrate his writings; therein is to be found much relating to the tooth.

1542 A.D. **Amroise Pare**, famous military surgeon, revived the old method of compression of nerve trunks to produce local anesthesia. Mentions transplantation and filling of teeth and ligation

- of teeth with gold wire. Described obturators.
- 1543 A.D. Andreas Vesalius. Important observations on the development of teeth.
- 1561 A.D. Gabriel Fallopius writes about the dental follicle and development of teeth.
- 1651 A.D. Nathaniel Highmore describes maxillary sinus in the superior maxillary bone.
- 1683 A.D. **Anton van Leeuwenhoek** discovered by use of microscope (1673) microorganisms (animalcules) in teeth and describes their tubular construction. 1728 A.D. First edition of Pierre Fauchard (founder of modern dentistry) textbook on "The Surgeon Dentist."
- 1728 A.D. **Pierre Fauchard's** great work "Le Chirurgien Dentiste"
- 1733-1735 A.D. **James Reading and James Mills** first tooth-drawers in New York and perhaps in America.
- 1756 A.D. **Philipp Pfaff** made plaster models and describes taking the bite. Practiced capping the pulp.
- 1759 A.D. The designation dentist first began to be used.
- 1763 A.D. **John Baker, M.D.** Surgeon Dentist. The earliest qualified dentist to practice in Boston and in America.
- 1766 A.D. Robert Woofendale, pupil of Berdmore, arrives in America and locates in New York.
- Thomas Berdmore of London publishes the first English dental textbook in which he claims the use of sugar to be deleterious. Becomes Dentist to his Majesty.
- 1769 A.D. Title of Doctor began to be used.
- 1771 A.D. **John Hunter**, comparative anatomist and surgeon, publishes his classic description of the anatomy of the human teeth. In transplanting teeth, he demanded the removal of the pulp before filling the teeth.
- 1774 A.D. The introduction of porcelain into dentistry by French apothecary **Duchatenu**.
- 1778 A.D. Body of General Joseph Warren identified by dental work done in the mouth by Paul Revere.
- 1779 A.D. **Isaac Greenwood, Sr.**, began to practice dentistry in Boston.

- 1784 A.D. Isaac Greenwood, Jr., begins his dental practice in New York.
- 1788 A.D. Improvement and development of porcelain dentures by **deChemant**. 1791 A.D. Establishing of the first dental clinic in the Dispensary of the City of New York.
- 1793 A.D. Benjamin Bell's interest in dental pathology and therapy led him to important observations on the pulp and pericementum. Improved on the turnkey.
- 1794 A.D. Earliest use of mineral paste teeth in America by Le Breton.
- John Greenwood began to swage gold bases for dentures. Made George Washington's dentures.
- 1801 A.D. First dental book to be published in America by Richard Cortland Skinner.
- 1806 A.D. Individual porcelain teeth with baked-in metal pins, invented by **Fonzi**.
- 1819 A.D. Mixing of coin silver fillings and mercury into a silver paste, by Tavenu in France, Bell in England.
- 1832 A.D. Snell - first dental chair.
- 1836 A.D. Arsenic introduced for the killing of pulps, by Spooner.
- 1839 A.D. First dental periodical, the American Journal of Dental Science.
- 1840 A.D. The American Society of Dental Surgeons, first national dental organization.
The Baltimore College of Dental Surgery, the first school in the world for the training of dentists was founded by Harris and Harden.
- 1842 A.D. **Crawford W. Long** discovers ether anesthetic, but does not publicize it.
- 1844 A.D. Beginning of large scale manufacture of porcelain teeth by **S.S. White**.
- Discovery of nitrous oxide anesthesia by **H. Wells**.
- Use of plaster of Paris for impressions.
- 1851 A.D. Patent for hard rubber (Vulcanite) granted to **Nelson Goodyear**.
- 1855 A.D. Cohesive gold foil for filling teeth, introduced by **Robert Arthur**.

- 1859 A.D. Organization of American Dental Association on a representative basis.
- 1864 A.D. Rubber dam suggested by **Sanford C. Barnum**.
- 1866 A.D. Organization of college faculties.
- 1868 A.D. Combination of nitrous oxide and oxygen for prolonged anesthesia, by Edmund Andrews.
- 1872 A.D. First foot-engine, invented by Morrison
- 1877 A.D. Hydraulic chair invented by Wilkinson.
- 1863 A.D. Organization of National Association of Dental Examiners.
- 1884 A.D. Keller suggests cocaine hydrochlorate for topical anesthesia.
- W.S. Halstead** used conductive anaesthesia in the mandible.
- 1887 A.D. Gutta percha root canal points.
- 1890 A.D. **W.D. Miller** describes microorganism of the human mouth.
- 1891 A.D. Extension for prevention and scientific cavity preparation promulgated by **G.V. Black**. 1892 A.D. The establishment of a three-year course in dental colleges.
- 1893 A.D. System of dental nomenclature by G.V. Black
- 1895 A.D. **Roentgen** discovers the x-ray.
- G.V. Black** develops the balanced amalgam alloys.
- 1896 A.D. **C. Edward Kells** demonstrates use of Roentgen rays in dentistry.
- 1897 A.D. **B.F. Philbrook**, presents paper on "Cast Gold Fillings," anticipating the **Taggart** inlay method.
- American Dental Association and Southern Dental Association consolidate under the name of National Dental Association.
- 1899 A.D. One year of high school's a requirement for admission to dental school.
- 1901 A.D. Weston A. Price recommends the use of x-ray in root canal work.
- 1903 A.D. Four years course in dental colleges established.

- 1906 A.D. Einhorn recommends novacaine and adrenalin combination for local anesthesia.
- 1907 A.D. William H. Taggart demonstrates the cast gold inlay.
- 1909 A.D. Dental Educational Counsel of America organized.
- 1912 A.D. National Dental Association organized on a district basis.
- 1914 A.D. J. Leon Williams develops typical tooth forms.
- 1915 A.D. **McKay and Black** publish results of investigation of fluoride in drinking water.
- 1921 A.D. Entrance requirement in dental college raised to four years of high school and one year of college.
1922 A.D. National Dental Association changed name to American Dental Association.
- Association publication changed from National to Journal of the American Dental Association.
- 1932 A.D. New type of denture materials introduced.
- 1953 A.D. Dr. Nelson's turbo-jet drill, 60,000 RPM.
- 1956 A.D. Air-rotor drill, 250,000 RPM **Dr. Robert Borden.**

DENTISTRY IN THE UNITED STATES

The first dentist on our shores was William Dinly in 1630. He was an import, brought over by the Plymouth Colony. Rumor has it that Dinly was lost in a snow storm while making a house call. Possibly there were tooth-drawers in our settlements. Maybe even the blacksmiths engaged in a little tooth tugging. After all, didn't they make the pinchers? No mention is made of tooth extractors until 1734 when James Mills placed an advertisement in the New York Journal, "teeth drawn and all broken stumps taken out, very safely, and with much care, by James Mills, who was instructed by James Reading, deceased, so famous for drawing teeth. He is to be spoken with at the shop of the deceased, near the old market slip". Very little is known about James Reading.

Later, about 1738, William Whitehead announced in a Philadelphia newspaper that he was an "operator of the teeth". Another was a French trained dentist, Sieur Roguet, who also advertised in 1749. His specialty was curing "stinking breath" by extracting decayed teeth and roots. He replaced them with dentures made of African ivory. Due to their cost and poor performance however, dentures were rare and considered a luxury at that time

From the landing of the Pilgrims until 1765, nearly 150 years later, six tooth drawers came to the United States.

Mention is made of Peter Hawkins, a black, who was both preacher and tooth puller. His practice was so extensive that he made his rounds on a very raw-boned horse. Hawkins was probably the first black specialist extractor on this continent, if not on any other continent.

One of the early American dentists was Paul Revere, who practiced in Boston in 1768. Another was John Baker in 1767. He, too, advertised how great a dentist he was and also how good his dentures were. He trained Paul Revere in prosthetics. When Baker left, Paul Revere placed the following ad in a local newspaper:

"All persons who had false teeth made by John Baker, and they became loose, may have them fastened by Paul Revere who learned the methods from John Baker."

When Dr. Joseph Warren fell at Bunker Hill, Paul Revere identified his body by two artificial teeth he made for him. This was probably one of the first instances of forensic identification by examination of the teeth. There is some dispute whether or not Paul Revere treated George Washington. This could be true. One dentist bill of Washington's came from the office of John Baker. Afterwards George Washington employed the services of John Greenwood in 1798. He is credited with making Washington's dentures. George's teeth were always stained and Dr. Greenwood believed this was due to the President's drinking of port wine. Dr. Greenwood instructed George Washington on how to prevent and also how to remove this stain. Perhaps George also soaked them in wine overnight. George's denture were of the reverse spring type. The lower was supported by a lone bicuspid which later became abscessed and had to be removed.

Shortly after the War of 1812 nearly every community along the Atlantic coast had one or more dentists. As for what set American dentistry apart, perhaps it was Yankee ingenuity or ambition. In any case, American dentistry is generally thought of as being the foremost dental system in the world. As with most other disciplines, however, the world continues to shrink and dentistry continues becoming more uniform and universal all over the world.

Professional journalism appeared on the American dental scene. One such, “The American Journal of Dental Science”, was published in 1839. Dr. Chapin Harris was one of its leading contributors as was Dr. Hayden. Later Drs. Harris and Hayden founded the first separate dental school, at Baltimore, Maryland in 1840. The course was 16 weeks. The class had 5 members and only 2 graduated. This school has recently been restored and is known as the foremost center of dental history in the country.

The first publication of organized dentistry appeared in 1913 as “The Official Bulletin of the National Dental Association”. The second volume was known as “The Journal of the American Dental Association”, published by the American Dental Association which was founded in 1859 in Niagara Falls, New York by 25 men representing eight dental groups. In 1869, the southern states formed the Southern Dental Association. In 1897, the Southern Dental Association merged with the American Dental Association and the society was then known as the National Dental Association. Then, in 1922 with an active membership of 33,000, the name once again changed to the American Dental Association. Two important collateral groups are: The American Association of Dental Schools and the National Association of Dental Examiners. It boasts of various councils, e.g. council on Dental Education, and Council on Dental Therapeutics. The main purpose of the American Dental Association is: to cultivate the science and art of Dentistry, and all collateral branches, to elevate and sustain the professional character of Dentists, to promote among them mutual improvements, social intercourse and good feeling, and to collectively represent and have cognizance of the common interests of the dental profession in every part of the United States.

HISTORICAL BACKGROUND OF RESTORATIVE DENTAL MATERIALS AND EQUIPMENT

I. Restorative Materials.

A. Gold Foil

1. Giovanni di Arcoli, 15th Century described filling of cavity with gold leaf.
2. Pierre Fauchard, 1728, used gold for restorations, and denture bases.
3. In 1812, a manufacturer in Hartford, Connecticut specialized in beaten gold leaf for dental purposes.
4. In 1855, Dr. Arthur described a technique for using cohesive gold foil. the passing of gold foil through a flame would remove impurities and cause it to adhere to each other. One important condition for perfect cohesiveness was that the cavity had to be free of saliva. This wasn't overcome until Dr. Barnum invented the rubber dam in 1864. The dam plus the dental engine helped gold foil achieve a high degree of perfection. In the early 1900s a leading authority on gold foil was Dr. Charles Woodbury who taught for many years at Creighton

B. Amalgam

First used as a silver paste by M. Taveau of Paris in 1826, amalgam at first had its drawbacks. Some mixtures caused expansion resulting in fractured teeth. G.V. Black experimented with silver amalgam and developed a suitable formula which met all requirements. He found in his research that if alloy fillings are heated to a certain temperature they would remain stable for a long period.

C. Gutta Percha

A rubber-like material which came into use in 1848. It is used as a temporary filling and also extensively used in Endodontics.

D. Zinc Oxyphosphate Cement

1. Came into use in 1880.
2. Used in cementing crowns, inlays, and as a protective base over nearly exposed pulps.

E. Porcelain

1. Used since the 1800s for denture teeth
2. All porcelain crowns used since 1900, generally unacceptable
3. Porcelain fused to metal crowns developed in late 1950s

F. Gold Inlay

1. A new and accurate method of casting gold inlays was announced by Dr. William H. Taggart in 1907.
2. This technique was called the disappearing wax technique. He patented this technique but lost his patents when it was discovered that Dr. Philbrook of Denison, Iowa had written an article concerning gold inlay castings 25 years earlier. A copy of this article was found in the dental library of the University of Iowa.

G. Composite

1. Acrylic Resin was used for anterior filling in the 1940s, but was unacceptable because of leakage.
2. Bowen adds silica filler to produce first composite, 1962 combined with acid etch bonding technique
3. UV cured composites developed 1970s, Light cured composites early 1980s.

II. Equipment

A. Chairs

1. The first dental chair by James Snell in 1832.
2. The first hydraulic chair by Wilkerson in 1877.

B. Dental drills

1. Hand operated gear-driven by John Lewis in 1838.
2. The first foot or treadle engine by Dr. Morrison in 1872.
3. The first electric dental engine by Dr. Green in 1874.
4. The air abrasive drill by Dr. Black in 1945.
5. The water-turbine handpiece by Dr. Nelson in 1954.
6. The air-turbine handpiece by Dr. Borden in 1957.

Chemical methods, abrasives and lasers have been advocated for tooth removal, but as yet have not been sufficiently developed for widespread use.

Vulcanite Dentures

Before restorative dental care was popular (or possible), the only treatment for dental pain was extraction of the teeth, resulting in partial or complete edentulism. Unfortunately in those times there were no materials or techniques for the fabrication of satisfactory dentures. The biggest problem was the lack of a durable and affordable denture base material (porcelain denture teeth were fairly well developed). Unsatisfactory materials included cast metal, swaged gold, and gutta percha. A good review of these early prosthodontic problems can be found in the story of George Washington's dentures.

In any case, Nelson Goodyear (brother of Charles Goodyear) discovered how to make hard rubber products in 1851. This hard rubber (as contrasted to flexible rubber), was named Vulcanite. This product found wide use in the fabrication of denture bases, where it soon replaced all previously used materials, being far superior in cost and function (the main disadvantage of these denture bases is their dark red color). The fit of these bases allowed self retaining dentures, making earlier spring type dentures obsolete. These Vulcanite dentures were the first functional, durable and affordable dentures, marking a great advance in dental treatment.

Through a number of legal maneuvers, the Goodyear company obtained a patent for Vulcanite dentures in 1864. They proceeded to license dentists who used their material, and charged a royalty for all dentures made. Dentists who would not comply were sued. Although many dentists bought licenses, the dental profession as a whole opposed the patent and licensure. A number of court cases followed, with the Goodyear company generally prevailing.

The struggle reached a climax when Goodyear hired Josiah Bacon to prosecute non-compliant dentists, which he did across the country with almost malicious vigor. One he filed suit against was a well respected dentist named Samuel Chalfant. This so distressed Chalfant that he shot and killed Bacon in California in 1879. Chalfant served 10 years for second degree murder and resumed his practice upon his release. The Goodyear patents expired in 1881, and the company did not again seek to license dentists or dental products.

Vulcanite dentures were very popular until the 1940s, when acrylic (pink plastic) denture bases replaced them. A few patients still have vulcanite dentures (we occasionally see one in the clinic), and some prefer them to modern dentures despite their unflattering appearance. The Goodyear-Vulcanite story raises ethical questions as to whether companies or individuals should profit excessively from products which benefit the welfare of mankind.

A similar dental situation occurred in the early 1900s later when a Dr. Taggart patented the procedure for making gold dental inlays, and attempted to license dentists and equipment. This patent was invalidated when it was found that a Dr. Philbrook (Denison, Iowa) had documented the procedure previously.

George Washington's Dentures

Due to his fame, a remarkably complete record remains of the dental problems of George Washington. Washington had poor teeth, and began losing them by his early twenties. Since there were no satisfactory filling materials or procedures at that time, decay usually proceeded until the patient had a toothache, the only remedy being extraction (without anesthesia). At the time of Washington's inauguration in 1790, he had only a lower premolar left, which was lost some time after. His diaries record many instances of prolonged toothaches, and his dental problems did not end with the loss of his teeth. He had a hair-trigger temper, which some attributed to his continual dental discomfort.

Although Washington employed the best dentists of his day (John Greenwood was his favorite), the many dentures made for him were unsatisfactory. Due to materials and procedures, the dentures made at that time fit the gingiva poorly. Although plaster was used to take impressions of the arches, the denture bases were carved or hammered to only approximate fit. Contrary to popular myth, George's teeth were not made of wood. Washington's last lower denture was carved from a single piece of hippopotamus tusk, the upper was swaged from a sheet of gold with ivory teeth riveted to it. Since the upper fit so poorly and had no retention, springs were attached to the upper and lower plates and pushed them against the tissue. It is probable that there was little understanding of occlusion, so the uppers did not fit the lowers well. This type of denture could not have been comfortable.

Although these dentures were mainly cosmetic, Washington attempted to wear them for official occasions and dinners, although he did limit his speaking engagements. Even with these dentures, his mouth was badly sunken and some painters padded his mouth with cotton when producing his portraits (which show no teeth). The ivory used for the teeth stained quickly, and when Washington complained about this, Greenwood advised him to remove them when he drank Port (red) wine. These dentures are presently in the Smithsonian Institute. Mrs. Washington had similar dental problems, although she did not lose all of her teeth and wore partials. Common people of that time probably did not attempt to have dentures fitted, and even with their fame and affluence the Washingtons did not have a very satisfactory prosthodontic result.

Until the late 1800s, catalogs listed "masticators", which crushed food so that it could be consumed by those without teeth. Naturally retained upper dentures seem to have been discovered accidentally, one case documented by a Dr. Gardette of Philadelphia in 1800. It was not until the middle 1800s when plaster investment was developed, that cast metal bases could be made to fit well enough for retention on a routine basis. Gold was the preferred material for these bases, obviously at some cost. These were known as "suction dentures" and preceded Vulcanite dentures, mentioned in another section.

Amalgam

Mercury-silver amalgam is one of the great success stories of modern dentistry, yet the material has been controversial since its earliest days. Many metallic powders (most commonly silver alloys), can be mixed with mercury to form amalgams, which are soft and then harden to metallic solids. Early attempts to use amalgam as a dental restoration were often failures, however. First, the ingredients and proportions were usually inconsistent, leading to early breakdown of the filling or tooth fracture from excessive expansion. Silver was obtained from many sources, often shaved from coins. The proportions and mixing procedure with mercury were also variable. Practitioners usually made the materials themselves. The second problem was that tooth preparation was usually haphazard, both from poor instrumentation and inadequate dental training. Because of these failures, in the middle to late 1800s silver amalgam was often associated with incompetent practitioners, leading to many conflicts in the dental profession and the “amalgam wars”.

Although G.V. Black is known for many other accomplishments, perhaps his greatest success was in the development of usable amalgams around 1900. After much research, he determined the correct proportions of silver, zinc, copper and tin and the proper processing of the powder. He also determined the right percentage of mercury and the proper mixing procedure. Along with the material he developed a systematic and scientific approach to cavity preparation, which was equally responsible for success. Concurrent development of better drills and instruments aided these efforts. Interestingly, dentistry was also maturing at that time, with formal training and licensure becoming more common.

With G.V.Black’s amalgam and tooth preparation system, for the first time it was possible to successfully repair cavities quickly and inexpensively in the general population. While other restorative materials such as gold foil and gold inlays were also in successful use during that period, they were not as widely used because of the time required and the cost. Throughout most of the 20th century, dental amalgam was the predominant material for the general repair of carious teeth.

Although amalgam continues to develop and improve through the present time, it is not without problems. Perhaps the greatest disadvantage is the silvery or dark appearance, which is somewhat acceptable in posterior teeth but very un-esthetic in the anterior teeth. The second problem concerns the mercury in amalgam. While some forms of mercury are very toxic and harmful, there has been no scientific evidence that the mercury in dental amalgams causes health problems in the general population. Nonetheless, many individuals and groups ascribe a wide variety of ills to the presence or release of mercury from amalgam restorations with the press often giving credence to these theories, so the controversy continues.

Composite materials and adhesive systems continue to develop at a rapid pace. Although presently more technique sensitive than amalgams, they can be bonded to tooth structure and they are certainly more esthetic. Although composites continue to make gains, amalgam is still widely used. In any case, amalgam’s place in history is secure as the first widely used material to successfully and inexpensively repair routine cavities.

Fluoride

Fluorine is an extremely reactive gas and is never found in its pure state, but always combined with other elements (fluorides). Before 1900, most water was consumed directly from the source, and had very little treatment. In some western cities, it was noted that people (especially children) who had grown up in these communities had teeth mottled with white or brown spots. Anecdotally, in the late 1800s it was noted that many of these people with mottled teeth had few cavities. Much later it was found that this mottling was caused by an excess of natural fluoride in the water.

One such observer was Dr. Fredrick McKay, who practiced in Colorado Springs, Colorado. He (and other observers) thought that this phenomenon might be due to something in the water, but methods of chemical analysis were inadequate to confirm this theory. Dr. McKay turned to Dr. G. V. Black, and in 1918 they published the first article about this observation, and theorized that the cause may be fluoride in the water. McKay also advised Oakley, Idaho to change from deep well water to shallow well water, and he observed that the mottling ceased.

The relationship of fluoride in water and dental caries was strengthened by a study done in the 1930s by the Public Health Service and Dr. H. T. Dean, who also developed the DMF (decayed, missing, filled) index for use in these fluoride studies. Better methods of chemical analysis also aided in these investigations. These studies found the optimal amount of fluoride in water (usually around 1ppm). It was also found that dental enamel took up fluoride and became much more resistant to decalcification by the acids produced by plaque.

The final confirmation was during the large controlled studies in Michigan (Grand Rapids) and New York during the 1940s, in which children with fluoridated water were compared with similar unfluoridated communities. As predicted, caries decreased by 50 to 63% when water was fluoridated. Some cities have adequate natural fluoride in the water, and a few have to remove excess fluoride to prevent mottling. (Omaha did not fluoridate water until 1969).

Despite the proven efficacy and safety of fluoridated water, controversy surrounded the addition of fluoride to public water supplies, and many communities do not add fluoride or have stopped adding fluoride to water, although overall fluoridation continues to increase. (After 40 years of ballot and legal wrangling, Los Angeles began fluoridation in 1999). Some groups ascribe a variety of vague ills to fluoridation, and others object to any chemical added to water as an infringement of personal freedom. Other groups still associate fluoridation with a vast conspiracy. Pseudoscience and misinformation are now easily distributed on the internet.

Although fluoridation is generally well accepted, even communities not fluoridating water have seen caries decrease, probably because of better overall dental hygiene and the widespread use of fluoride in toothpastes. In any case, fluoridation of public water is one of the great public health successes of the 20th century.

DISCOVERY AND FIRST USE OF INHALATION ANESTHESIA and LOCAL ANESTHESIA

by
C.J. Vacanti, D.D.S.

Since prehistoric times, man has sought ways to lessen pain. With varying degrees of success he has utilized: mandrake, opium and other poppy extracts, henbane, fermented and distilled beverages, nerve compresses, cold, extreme fatigue from prohibiting sleep, bleeding to the point of fainting and shock, and hypnosis.

New ideas for anesthesia stemmed from hilarious parties or demonstrations. These so-called "ether frolics" or "laughing gas" demonstrations had long been a form of amusement among the young people of the eighteenth and nineteenth centuries here in America. As one of these parties (ether frolics) in 1842, a young physician, Crawford W. Long of Georgia, conceived the idea of administering to a patient sufficient ether to inhale so that an operation could be performed without pain to the patient. After selecting his patient, Dr. Long removed a tumor from the neck while the patient was under the influence of ether. In that year, 1842, Dr. Long claimed three administrations of ether. Since that year, up to 1849, he had performed one or more surgical operations annually on patients under the influence of ether. Inasmuch as Dr. Long failed to introduce the method into his general practice, to write on the subject, to demonstrate, or to lecture on it, it was apparent that he was not impressed with this great discovery.

On the other hand, a young conscientious dentist, Dr. Horace Wells of Hartford, Connecticut, was more alert. Being a very sensitive individual, the suffering he caused during the extraction of teeth troubled him greatly. These feelings prompted him to give considerable thought to the subject of pain relief during extractions. In 1838, he wrote, "An Essay on Teeth, Comprising a Brief Description of Their Formation, Diseases, and Proper Treatment". Horace Wells was a profound student. Constantly enlarging his knowledge, he attended a lecture on chemical phenomena by Gardner Q. Colton, a traveling chemist, on December 10, 1844. After manufacturing some nitrous oxide, known as "laughing gas", Mr. Colton invited spectators to come forward and inhale the fumes. This was to amuse the crowd. Horace Wells took note that no sign was exhibited when the volunteers, under the influence of nitrous oxide, stumbled and scraped their shins on the heavy benches. Immediately, Wells conceived the idea of Inhalation Anesthesia. Though history notes that Sir Humphrey Davy, in 1799, published an account of his research and experiments with nitrous oxide, Horace Wells was not aware of it. (Henry Hill Hickmann followed Davy in realizing the possibilities of gases as clinical anesthetics. Because of failures of medical men of his time to utilize any anesthesia successfully, in the 1820's he was rebuffed both in England and France, and died without being able to put his ideas to effective use.) Following the lecture, Wells talked with Colton and asked him to bring a bag of the gas to his office the next day. Wells had an aching tooth and felt that by inhaling sufficient nitrous oxide, the tooth could be extracted painlessly. Colton at first had objected because he was fearful that a large quantity of the gas might prove fatal. Wells had the courage of his convictions and persuaded Colton to bring the gas. On December 11, 1844, Wells, sitting in his own dental chair, inhaled the gas until he lost consciousness. Dr. Riggs, a friend and former pupil of Dr. Wells stepped forward and extracted the arching third molar (wisdom tooth). On regaining consciousness, Wells exclaimed, "A new era in tooth pulling". After several weeks of experimenting with nitrous oxide, he went to Boston, the medical center of the New England States. There, through a friend, a former partner, William T.G. Morton, he arranged to lecture and demonstrated nitrous oxide before the medical students of John C. Warren. This demonstration failed because Wells, being a little nervous, withdrew the bag too soon and the patient cried out when the tooth was extracted. Later, the patient confessed that he felt no pain.

Returning to Hartford, Wells continued to use nitrous oxide and taught other dentists to use it. When urged to patent this discovery, Wells said, "No! Let it be as free as the air we breathe." William Thomas Green Morton received the idea of inhalation anesthesia from Wells' demonstration. After experimenting with ether, he continued to use it at the suggestion of Charles T. Jackson, a Physician Chemist of Boston, in place of nitrous oxide. He extracted a tooth for a patient under its influence. However, the ether was disguised. Morton saturated a handkerchief with it, giving it to the patient, he remarked that it was something better than mesmerization. The patient inhaled it and soon was unconscious. The tooth was removed painlessly. This took place on September 20, 1846, two years after Wells first discovered surgical anesthesia.

Morton then demonstrated ether as a practical anesthetic to the Harvard medical class. The surgeon in charge was Dr. John C. Warren. He is the man credited with giving both Morton and Wells their big opportunity to demonstrate publicly their anesthetic agents. Morton's exhibition was such a success that Dr. Warren turned to the class and said, "Gentlemen, this is no humbug." With this, Morton's fame spread. Dr. Johnson became jealous of this fame and a terrific controversy arose between Morton, Wells and Jackson. Morton patented the ether under the name of Letheon and secretly promised to pay a percentage to Jackson. Morton, wealthiest of the three, gave up dentistry and became the first specialist in anesthesia. Wells, deranged by self-experimentation with chloroform, committed suicide in 1848. In 1864, the American Dental Association gave full credit to Horace Wells for the discovery of practical anesthesia and its introduction to the United States of America.

Local anesthetics were first used in 1884. It was then that Koller, a young intern and house surgeon, first announced the use of cocaine to anesthetize the eye. That same year, William S. Halstead, surgeon at John Hopkins Hospital, demonstrated that the injection of a nerve trunk in any part of its course is followed by local anesthesia in its entire peripheral distribution. The nerve he first blocked was the mandibular branch of the trigeminal.

Novocain (procaine hydrochloride) was introduced into the practice of medicine by Professor Braun in 1905. Novocaine is a comparatively weak anesthetic agent possessing a low degree of toxicity. It is still potent enough to provide a safe, sure analgesia under practically all circumstances. It is readily absorbed following injection into the tissues. It is detoxified in the liver and also rapidly hydrolyzed in the plasma. When infiltrated around free nerve endings and fibers, onset of analgesia is almost immediate. At most, the onset is from 3 to 5 minutes. A two percent solution of novocaine is recommended for use in dental practice. This percentage will give approximately 12-15 minutes of analgesia. The addition of epinephrine 1:100,000 per milliliter prolongs analgesis to 30-45 minutes. A 1:50,000 per milliliter produces 60-90 minutes of analgesia. According to a report by the New York Heart Association on the use of epinephrine, it is recommended for any one session that no more than 10 milliliters of 1:50,000 epinephrine no more than 0.2 mg of epinephrine be used in any form. Dental surgery performed under these conditions on a cardiac patient will present no special hazards.

Novocaine is now seldom used. It has been replaced by stronger anesthetics such as: Primacaine, 1.5% solution, which is four times more potent than novocaine and slightly more toxic. Tetracaine, 0.15% solution, which is relatively toxic and 10 times as potent as novocaine

Lidocaine (Xylocaine) Hydrochloride 2% solution was discovered in 1943 by two Swedish chemists, Nils Lofgven and Bengt Lundquist. After many experiments, Xylocaine was introduced to the medical and dental professions. Its acceptance by the dental profession of the United States in 1950 was rapid and dramatic. Soon afterwards, it was made available to hospitals. Xylocaine did not

just happen, its recognition as one of the greatest contributions to the field of local anesthesia constitutes a success story but unlimited credit must be given to first, its discoverers, and the countless number of scientists and clinicians whose untiring efforts established the effectiveness and safety of Xylocaine.

Lidocaine (Xylocaine) diffuses readily through the tissues, and nerve sheath giving a rapid onset of analgesia. It is detoxified in the liver and possesses slight vaso-constricting properties. Xylocaine has an early cortical depressant effect and it, thereby, potentiates the hypnotic effect of barbiturates. Therefore, in cases of pre-medication with barbiturates, the dosage should be decreased if Xylocaine is used. Xylocaine has been used effectively and safely in dentistry and in various specialties of medicine such as: Urology, Ophthalmology, Otorhinolaryngology, Proctology, and Dermatology. Xylocaine is rapidly replacing novocain. It has been widely accepted by obstetricians who have become aware of its effectiveness and safety. The spread of Xylocaine has been phenomenal. It has even replaced novocaine in the field of intravenous anesthesia, the advantages being many, such as: a very low incidence of postoperative nausea, vomiting and chest complications.

The idea of using anesthetic solutions or drugs in cartridges was developed by Harvey Cook during World War I. The idea was conceived from the cartridges used in rifles. Dr. Cook fashioned his own syringes and cartridges. From this humble beginning, new agents and different types of syringes have sprung. The local anesthetics we use today have made dentistry and medicine more serviceable to the public. The medical and dental professions are thankful to men such as: Wells, Warren and Cook for their great contributions.

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THE DISCOVERY OF THE X-RAY

William Conrad Roentgen was a German Professor and the Director of the laboratory, University of Wurtzberg, Germany. In 1895, Professor Roentgen and two associates were experimenting with the passage of high voltage electric current through electrodes in a vacuum tube. During one experiment, Professor Roentgen was about to turn off the current when he noticed a strange glow on a table a few feet away. Upon examination, Roentgen found that the glow came from a few barium crystals on a piece of paper. Since the room was dark and the vacuum tube was covered with a black screen, he wondered where the light came from. He examined the tube and found it to be in good condition. He turned the current off and the glow disappeared. He did this several times and concluded that some kind of ray, a powerful ray, was penetrating the dark screen and was causing the crystals to glow. For the next eight weeks he conducted experiments with many materials, trying to block the rays emitted and concluded that lead and platinum could stop the rays. He also discovered that the rays would expose film without light. Not knowing what the rays were, he called them X-rays. Professor Roentgen was the first human to observe what no other human had ever seen, a perfectly clear outline of the bones in his hand clearly visible through the flesh. For this great discovery, he was given the honorary title "Doctor of Medicine" and also awarded the Nobel Prize in 1901 for physics. Roentgen refused to patent his discovery, saying it was free for the benefit of mankind.

Plans for X-ray generators were published in journals, and scientists around the world soon had their own machines working (an early one was made here at Creighton). The speed at which X-rays were accepted was remarkable. Five months after Roentgen's discovery, in the United States Dr. W. J. Morton demonstrated films from skulls.

Dr. C. Edmund Kells, a New Orleans dentist, demonstrated the first films taken on a live patient 3 months later in 1896. Kells was a prolific inventor and writer, in dentistry and other fields. (He was one of the first to use electricity in a dental office). He often held the film in the patient's mouth during the long exposures, or used his hand as the object while adjusting the exposure, since these early machines had unpredictable emissions. Unfortunately, he did not realize the dangers from his own continual X-ray exposure and developed cancer in his right hand, which later progressed through his arm and shoulder. After forty-two operations, the intense suffering caused him to take his own life in 1928, at the age of 72.

Coolidge, who worked for General Electric in the US, was a leader in the development of usable X-ray equipment. Nonetheless, despite wide acceptance in the medical field, X-ray machines were not commonly seen in dental offices until the 1920s.

CREIGHTON UNIVERSITY CHRONOLOGY

prepared by Roland J. Reichmuth

- 1856 Edward and John Creighton come to Omaha
- 1860 Edward Creighton surveys route for transcontinental telegraph
- 1874 Edward Creighton dies at age 54, Nov. 5
- 1876 Mary Lucretia Creighton, wife of Edward, dies Jan. 12, leaving \$100,000 for establishment of a free school for boys in honor of her husband.
- 1878 Classes begin with 120 students and a faculty of five Jesuits and two lay people, Sept. 2.
- 1879 Creighton University incorporated under Nebraska law. Bishop James O'Connor transfers his trust to the Jesuits.
- 1882 Jesuit Province considers closing Creighton
- 1887 St. John's Church Cornerstone laid, June 26.
- 1891 First Baccalaureate degrees granted to five graduates, June 24. Elementary classes discontinued.
- 1892 Medical School opens with 36 students, June 1. Alumni Association formed.
- 1895 John Creighton made Count of the Papal Court.
- 1897 New Medical School opens at 14th and Davenport
- 1904 Law School opens with 18 students, Oct. 3.
- 1905 School of Dentistry started. School of Pharmacy begins with 35 students.
- 1907 Count John Creighton dies, Feb. 7.
- 1913 First Summer Session.
- 1916 Gymnasium completed.
- 1920 New Law School and new Dental School built on 26 and California St. Colleges of Commerce, Finance and Journalism opened.
- 1923 Women begin attending teachers courses.
- 1924 Arts and Sciences College begins charging tuition.

- 1925 Fifteen thousand seat stadium completed. Duchesne College affiliated with CU.
- 1926 Graduate School becomes a separate entity.
- 1928 Nursing Program begins.
- 1929 College of St. Mary affiliated with Creighton.
- 1930 Administration building enlarged and main entrance is located on the south rather than the east.
- 1933 Journalism separates from the College of Commerce to become the School of Journalism.
- 1945 School of Dentistry closed for short time. Intercollegiate football discontinued.
- 1952 College of Arts and Sciences becomes officially coeducational
- 1956 Deglman Hall and Brandeis Student Center completed. Women allowed on Student Board of Governors.
- 1958 Creighton Prep moves off campus.
- 1960 Stadium and old auditorium razed to make room for the College of Business Administration and the Reinert Alumni Memorial Library.
- 1961 Gallagher Hall finished.
- 1963 Criss I Building completed.
- 1965 Interstate Highway constructed on two sides of campus. Swanson Hall is completed.
- 1966 Kiewit Hall and Becker Dining Hall completed.
- 1967 Department of Fine Arts established. Criss II and Rigge Science Buildings completed.
- 1968 Board of Directors for the University is expanded to include 13 laymen and 8 Jesuits.
- 1973 New Boyne School of Dental Sciences opened.
- 1974 Ahmanson Law Center finished. Ground is broken for new St. Joseph Hospital.

- 1975 Wareham Hall is razed for construction of Kiewit Physical Fitness Center. Institute for Latin American Concern (ILAC) begins sending students to Dominican Republic to learn first hand about the problems of the Third World.
- 1976 Criss III building completed.
- 1977 New St. Joseph Hospital opens on west edge of campus. ILAC health teams begin serving the poor of the Dominican Republic.
- 1978 Creighton University Centennial.
- 1983 University College established.
- 1984 American Medical International, Inc. (AMI) acquires ownership of St. Joseph Hospital, which remains Creighton's primary teaching hospital.
- 1985 Creighton launches five-year \$70 million capital fund drive, the Campaign for Creighton. Leroy L. Wade Computer Center in College of Business Administration is opened.
- 1986 Old Gymnasium renovated: new math/computer science facilities, basketball practice court, locker and training room installed.
- 1987 New Student Center constructed.
- 1988 Creighton Athletic Complex dedicated. Campaign for Creighton exceeds goal.
- 1989 \$6.5 million renovation of campus buildings completed.

**The History of The
Creighton University School of Dentistry
Charles J. Vacanti, B.S., D.D.S.**

The Omaha College of Dentistry operated in downtown Omaha and graduated their first class in 1898. In 1905 they closed, and their program was transferred to Creighton University. Some of the previous students continued with Creighton. The first class was held on October 2, 1905 in the Creighton Institute in downtown Omaha, which also housed the School of Law. A 1905 publication reported the School as one of the finest available, "having all modern equipment, including facilities for instruction in dental surgery unsurpassed by any college in the West".

In addition to educating dentists, the Creighton School of Dentistry demonstrated unusual foresight in offering two other courses in its first year of operation. One was Nebraska's first dental assistant course, a 30-week program offering "both didactic and practical instruction in operative and prosthetic techniques, therapeutics, pathology and dental anatomy". The other course was a postgraduate course offered for the practicing dentist. During its first 12 years, the School of Dentistry graduated students after three years of study in compliance with the rules of the National Association of Dental Faculties. A four-year course was adopted in 1917 at the recommendation of the Dental Education Council of America (because of this transition there were only two graduates in the class of 1920).

From 1921 until 1973, the School of Dentistry occupied a building at 26th and California Streets on the Creighton Campus. The three-story building had 33,000 square feet of space. The top story was the clinic, which measured 60 feet by 143 feet and contained 53 dental chairs. Also housed in the building was the research laboratory of Dr. J.S. Foote, the eminent histologist whose subject was histo-pathology of the hard tissues of the mouth with special attention to the bone. Dr. Foote's work was financed by a grant from the National Dental Association. It was one of Nebraska's earliest dental research grants.

During World War II and the immediate postwar years, the School of Dentistry faced a crisis brought about by lack of finances, faculty, and students. Confronted with this, the University Administrators decided to close the School. Local dental alumni contacted the administrators and offered their help. Because of their overwhelming generosity, the School survived. The Reverend Henry W. Linn, Vice President for University Relations then contacted dental alumni all over the country and asked for their help. They too, responded generously. After World War II, the G.I. Bill enabled many veterans to commence or continue interrupted college studies. As a result, dental school enrollment increased to forty per class. The faculty and staff also increased.

In the late 1940's Creighton began experimenting with closed-circuit television for lectures and demonstrations on dental subjects. Dr. Lawrence Donahoe performed the first televised dental operation in the United States in the Summer of 1948. Approximately 450 educators from 12 states watched the televised demonstration of treatment for periodontal disease. It was during this period that the School of Dentistry started to move forward.

In the early fifties, a young graduate oral surgeon, Dr. Benjamin L. Lynch, was appointed Dean. Dr. Lynch and his young faculty continued the progress. Dr. Lynch was awarded Clinical Professor Emeritus of Oral Surgery in 1986.

Many new changes were wrought in the sixties and seventies. Under the leadership of Dean Raymond Shaddy, Associate Dean John J. Butkus and Dean Robert V. Vining; and with special grants from the Federal Government, the school of Dentistry was renovated with the most modern equipment.

It was thought at that time that there would soon be a much greater demand for Dentists. In order to accommodate larger classes and newer instructional methods, a larger facility was needed. Aided by a generous gift from Dr. Henry N. and Maude Boyne, construction of the third School of Dentistry at

Creighton University began in June, 1971 after five years of planning. Many dedicated people, some of whom are not living today, contributed to the total effort of transferring yesterday's needs to today's reality.

The Dr. Harry N. and Maude Boyne School of Dental Science Building was completed in 1973; being named for two Council Bluffs, Iowa natives with a long history of dedication to Creighton University. The building contains 150,00 square feet of space on three levels, in addition to interstitial mechanical levels. It was constructed at a cost of 10.5 million and is located in close proximity to Creighton's other health sciences schools, the Bio-Information Center and Saint Joseph Hospital. The Dr. Harry N. and Maude Boyne School of Dental Science Building is designed for maximum flexibility to accommodate changes in oral health education concepts and oral health care delivery systems.

The adult clinic consists of a large U-shaped general clinic containing 118 operatories surrounded by support facilities such as clinical laboratories, dispensaries, consultation rooms, reception area and clinical offices. Oral Surgery, Implants, Perio Surgery and Radiology also have separate Main Floor clinics.

The operatories in the General Clinic are contained within cubicles of a special interdigitated design. This design provides ample area for the utilization of dental auxiliaries.

The Creighton dental education program emphasizes both depth and breadth of the clinical experience. Students are directed toward clinical experience and proficiency, that is especially required for the self-sufficient or "isolated" practitioner of dentistry. The demand for clinical excellence, along with the ever expanding knowledge base in the biological sciences, is reflected by maintenance of the four-year educational program. Over 50,000 patient visits are recorded each year by the clinics. Patient care begins in the freshman year on a limited basis and accelerates throughout the four year program. In addition, the Department of Community Dentistry annually conducts regional public education and preventive dentistry programs that reach over 10,000 grade school children.

Dean Vining was instrumental in the formation of two new departments. In 1977, Endodontics was granted departmental status and Dr. Charles J. Vacanti, who developed the Endodontic curriculum, was named its Founding Chairman. Dr. Marvin O. Ludlow is the present Chairman. In 1982 Dean Vining proposed that a new method of delivering patient care be instituted; thus the Department of Comprehensive Dental Care was formed. Dr. Ralph R. Herrman was named first Chairman. This program simulated general office practice; affording a better transition for students going into private practice from dental school. This also gave senior students an opportunity to do more dentistry than previously. This program has enjoyed the approval of faculty, staff, students, and patients.

The middle eighties found the School in search of a new Dean. Dr. Gerald C. Brundo, a 1969 graduate of the Creighton University School of Dentistry and Assistant Dean for Academic Affairs at U.C.L.A., was selected. Under the leadership of this young man and a youthful administrative staff, the School of Dentistry has continued to move forward, especially, in the field of dental research. Dean Brundo's interest in research led to the appointment of Dr. Wayne Barkmeier as Assistant Dean for Research. Since his appointment on September 1, 1985, Dr. Barkmeier has received several research grants and has stimulated faculty participation in his programs. In addition to his research funding, Dr. Barkmeier also received National Institute of Health funding for Advanced Educational Program in General Dentistry commencing July 1, 1987. In 1994 Dr. Barkmeier was named Dean.

In 1982, a new program was initiated in which students from Idaho took their first year of instruction in Idaho, and started their second year at Creighton. Utah followed with a similar program in 1983. Both states subsidize the tuition of students accepted into this program.

Due to the increased cost of space, in 1994 the departments of Occupational Therapy and Physical Therapy took most of the space on the first floor. Only the classrooms are used by the dental program on the first floor. The freshman and sophomore preclinical laboratories were moved to the third floor, and Pedodontics was moved into the space formerly occupied by the AEGD and faculty practice. Faculty practice was moved into the former oral diagnosis suite.

Creighton Dental Deans:

1905-1906	Dr. C.O. Metzler
1906-1907	Rev. M.J. Ryan
1907-1908	Rev.W. J. Whelan
1908-1933	Dr. A.H. Hipple
1933-1945	Dr. F.J. Viner
1945-1950	Dr. H.E. King
1950-1954	Dr. J. H. Pence
1954-1955	Dr. B.J. Lynch
1955-1957	Dr. R.H. Schemel
1957-1961	Dr. B.J. Lynch
1961-1962	Dr. G.W. Quinn
1962-1971	Dr. R.W. Shaddy
1971-1983	Dr. R.V. Vining
1983-1984	Dr. R.W. Shaddy
1984-1994	Dr. G.C. Brundo
1994-	Dr. Wayne Barkmeier

Acting Deans:

1950	Rev. E.J. Stumpf
1962	Dr. J. J. Butkus

Dental Insigne

Dental Insigne: In 1964 a design or insigne for dentistry was described and portrayed in the report of the Bureau of Library and Indexing Service with a resolution that it be approved as the official emblem for dentistry in the United States. The Reference Committee on President's Address and Administrative Matters referred the resolution back to the Bureau for further study and report at the 1965 annual session. After further study it was suggested that the earlier symbol of dentistry be reinstated officially because it had achieved widespread use and acceptance since its first adoption in 1940 (Trans. 1940:320). It has continued in use although this action was reinstated in 1949 when all actions approved prior to 1945 were abrogated by the House (Trans 1949:234).

This design uses as its central figure a serpent entwined about an ancient Arabian cautery in the manner of the single of Aesculapius, the Greek god of medicine, coiled about a rod. The Greek Letter D (delta), for dentistry, and the Greek letter O (omicron), for odont (tooth) form the periphery of the design. The word "Dentistry" appears on the lowest part of the letter O. In the background are 32 leaves and 20 berries, representative of two dentitions. Because colors are sometimes asked for, the following are suggested: the background in a shade of lilac, the official academic color of dentistry (Descriptive Color Names Dictionary of the Containers Cooperation of America, 1950, color chip 12 ge); the letter O in gold; the letter A in black; the cautery in gold outlined in black; and the leaves and berries merely outlined in black on the lilac background.



THE LEGEND OF THE CAP and GOWN

Long ago, in ancient Greece, when formal education was for the very rich or the very determined, a wise old teacher was approached by a group of noblemen. "Our sons have completed their studies and it is time for them to return to their homes and live in the style fitting their station. Tomorrow we will present them at a great banquet. Be sure they are appropriately dressed in their finest robes and jewels."

The following day, the banquet hall was filled with royalty and nobility dressed in dazzling finery. The great moment came when the students entered with their beloved teacher. A cry arose from the crowd, for there were their young men dressed, not in the garments of the noble. But in simple sackcloth robes, each carrying a mortar board - the mark of a common workman.

"What is the meaning to this? Cried the noblemen. "Our sons were to be dressed in their finest garments!" The wise teacher replied, "But they are! Your sons are dressed in the clothing of the mason, for their destiny is to build. Some will build cities, some will build lives - but all will be builders on the solid foundation of knowledge."

And to this day all graduates wear a cap and gown proudly, symbolizing the value of education, and the fact that they are builders of their future and the future of our world.

Academic Costumes in American Universities & Colleges

In the United States, as a result of our English heritage, caps and gowns have been used from colonial times, particularly at Columbia (King's College), New York University, the University of Pennsylvania, Bryn Mawr, Yale and others. About 1885 there was a widespread student movement in America to wear caps and gowns at Commencement ceremonies. The graduating students seem to feel a need for a significant and dignified apparel for the occasion, and the democratic as well as the traditional qualities of the cap and gown appealed to them. The faculties were quick to approve this practical and dignified graduation dress, and soon members of the academic ceremonies, and an occasional hood even appeared, though fashioned after no particular code as to pattern and color.

In 1894, as the result of an article written for The University Magazine by Mr. Gardner C. Leonard, strongly urging the adoption of a uniform academic costume system. The Intercollegiate Commission, a group of leading American educators, met at Columbia college to draft a code.

This Commission consisted of President Seth Low of Columbia, Dr. Charles Ray Palmer of Yale, Chancellor McCracken of New York University and Colonel John J. McCook of Princeton, who had seen the blue of devices on army uniforms in differentiating the various army corps and who had carefully studied the traditional colors as used in the older universities of Italy, France, and Great Britain to mark the different degrees.

In 1895 the Commission presented to American institutions of higher learning the Inter-collegiate Code. This simple, adaptable code regulated the design or pattern of the gowns and hoods and the colors and materials to be used. Its subsequent adoption by fully 95 percent of the college universities in the country has given America a beautiful and impressive yet extremely simple method of signifying scholastic honors.

The Code provides for three types of gowns. Those worn by bachelors are made of black worsted material and have long, pointed sleeves. Masters may wear either black silk or black woolen gowns, made with a long closed sleeve with an arc of a circle appearing near the bottom, and a slit for the arm. The doctors' gowns are black silk with a full, round, open sleeve. They are faced with velvet and have three bars of velvet on each sleeve. The color of the velvet trim may be black or the same color as the velvet, indicative of the faculty, which edges the hood. The black Oxford or mortarboard style cap is worn for all degrees, but only the doctor's cap may be made of velvet and only doctors or presidents of institutions may wear a gold tassel on the cap.

If you will compare the illustration of the Oxford gowns on page 8 with the American gowns shown facing page 10, you will notice that the American master's gown is almost exactly like the Oxford M.A. gown, while our bachelor's gown is similar to the Oxford scholar's gown. In conferring on our doctors the right to wear a gown with full, round sleeves, a cap of velvet and gold tassel, the Intercollegiate Commission gave special honors in dress to the highest scholastic attainments, a typically American and democratic adaptation of the original English custom of reserving these honors for noblemen.

It is the hood, however, which is the most important and distinctive feature of the American Code. The system established by the Intercollegiate Commission, when understood, enables anyone attending an academic function in this country to distinguish at a glance the bachelors, masters, and doctors, and at the same time recognize the university which has given the degree.

The doctor's hood, of black cloth matching the gown, is four feet in length and made with a wide panel, as shown in the colored illustration. The master's and bachelor's hoods are three and one-half and three feet in length respectively. They are made of black cloth matching the gowns and follow the Oxford shape. The hoods for all the degrees are lined with silk in the official academic color or colors of the institution conferring the degree. These colors are not, by the way, necessarily the same as the school's athletic colors, though in many cases they are.

The Commission solved the problem regarding the lining of hoods conferred by universities or colleges having more than one official color by using the chevron, as heraldic device. For example, the official Princeton colors are orange and black, so a Princeton hood is lined with orange with a black chevron. The red and blue of the University of Pennsylvania are confined in a similar fashion. Likewise the purple and gold of Northwestern University, whose athletic colors, it will be noted, are purple and white. As America has so many schools, it is natural that the same color must be used more than once. This problem has been solved by using different shades of a color.

The binding or trim of all the hoods is of velvet or velveteen, two inches, three inches and five inches wide for the bachelor's, master's and doctor's degrees respectively. The color of this velvet trim indicates the department or faculty to which the degree pertains, each department having been assigned a different color by the Intercollegiate Code; for instance, white is for arts, red for theology, blue for philosophy, and so on.

In assigning the colors to signify the respective faculties, the Intercollegiate Commission retained the historical associations. The white border used for the departments of arts and letters is taken from the white fur trimming of the Oxford and Cambridge bachelor of arts hoods. Red, the traditional color of the church throughout all ages, indicates a degree in theology. The royal purple of King's Court signifies the law. Green, the color of medicinal herbs, stands for the faculty of medicine. Blue, the color of wisdom and truth, signifies philosophy. Golden yellow indicates science, because through research untold wealth has been given to the world. The Oxford pink has been adhered to for a degree in the department of music, white olive was selected for pharmacy because it is closely allied with the green of medicine, and the russet brown of forestry is a tribute to the old-time dress of the English foresters.

As we have stated earlier, in German universities the academic hood is never used or given when a degree is conferred, though full black robes are worn by professors on ceremonial occasions. As, however, there are a larger number of professors in the United States and elsewhere holding German degrees in faculties where the Intercollegiate system is used, it has become the custom for them to use the hoods of their appropriate degree and to line the hoods with the colors of the German University, placing upon the lining the German tri-chevron of black, white and red. This custom was inaugurated in 1895 at the University of Chicago by a conference of professors of German and other nationalities who were outfitting under the American systems and who designated this symbolism to indicate the source of the degrees which represented so much of modern German research.

At the University of Paris the academic costume is a black gown over which a colored scarf is worn, the broader portion of the scarf hanging a short way down the back and the narrower portion to below the waist. Doctor's scarves have three rows of ermine at each end, licentiates' (masters) have two rows, and bachelors' one. Each university in France has a distinctive color. But graduates of the University of Paris residing in the United States use the black American hood appropriate for their degree with a crimson and gold lining across which is laid a tri-chevron of blue, white and red.

Graduates of the universities of Switzerland residing in the United States also use the black hood appropriate for their degree, lined in the color or colors of the university, on which is laid a white cross.

The simplicity of this uniform American system of academic dress will be more readily appreciated when it is contrasted with the arbitrary code adhered to by each separate English university. Take, for instance, the degree of doctor divinity:

Oxford, Cambridge and the University of Edinburgh clings to a black cloth lined with purple silk.

Still further confusion arises because some of the British universities give the same hood for different degrees. The Oxford hoods for D.C.L. and M.D. are identical-scarlet cloth with a crimson silk lining. A blue silk hood trimmed with white fur is given for three degrees B.C.L., M.B. and Mus. B. The familiar Cambridge hood of scarlet cloth lined with pink silk is by no means distinctive, for it may designate either D.D., LL.D. or M.D. As so it goes, each British and Colonial institution of learning has its own authoritative hood for each degree. Consequently at a gathering of university dignitaries in England, one would have to be conversant with all the hoods in order to determine where a graduate received his degree or which faculty it represented.

How simple and comprehensible the American system is by comparison, with the colors representing the different faculties being the same for all schools, the design of the gowns and hoods representing the three degrees also the same for all schools, and the school from which the degree is received clearly indicated by the color or colors shown in the hood lining.

Current correct usage of academic costumes

Colleges and Universities

1. The president and members of the governing body of a college or university are entitled to wear doctor's gown, even if they do not hold doctor's degrees, but their hoods may represent only degrees actually held by the wearers.
2. A faculty member official of any institution who has received his degree elsewhere (including those holding degrees from foreign universities) is entitled to wear a hood for the appropriate degree lined with the colors of his resident school, but only during the period of his association with that school.
3. The cap is an essential part of the academic costume and should be worn with it at all times except, of course, when the men remove theirs during prayer.
4. The gold tassel on the doctor's cap is so fastened that it drapes over the left front quarter of the cap. From this design it has become customary in most schools to leave the tassel draped over the left temple at all times. Formerly it was the accepted custom in many schools for the graduates to change the tassel from one side to the other after receiving the diploma, but the custom of allowing the tassel to remain on the left side at all times is now generally followed. However, the important thing is that all graduates wear their tassels alike.
5. It is the custom in many schools to differentiate the graduates of the different departments of study by using tassels of the official department colors as established by the Intercollegiate Coded. Black tassels, however, are equally correct for all degrees. the gold tassel is usually worn only by doctors or by presidents of colleges of universities although in some instances it is also worn by the dens of the various faculties.
6. If more than one degree is held, the gown and hood of the highest degree, naturally are worn. The doctor's gown and hood may have the velvet rimming divided to indicate the two degrees, though usually the highest degree taken is the one indicated by the color of the velvet. The color or colors of only one school may be shown in the hood lining.
7. The doctor's and master's gown are always worn open, while the bachelor's gown is closed at the top only. Any attempt to close the gowns completely has no foundation either in tradition or comfort, as the gowns are made to be worn open.
8. At all ceremonies where honorary degrees are conferred, it is proper for candidates to wear gowns significant of the degree to be received, but not to assume the hood until the degree has been actually bestowed. Usually the hood conferred in honorary degrees is a gift from the institution to the candidate, while the candidate usually provides his own gown.
9. The wording of the degree and not the department in which major work was done determines the color for the velvet of the hood. For instance, a degree conferred as "Master of Science in Engineering" requires the gold-yellow of Science and not the orange of Engineering. similarly a degree conferred as "Bachelor of Arts in Education" would require the white of Arts rather than the light blue of Education.
10. At Harvard, which follows its own code, the hoods for the three degrees are all of the Oxford shape, though varying in size, and are without velvet trimming. The degree is indicated by colored "crowfeet" on the front panels of the gown.
11. Feminine candidates may wear a white collar attached to the bachelor gown, but only when no hood is worn. The white collar should never be worn with the master's or doctor's gowns or with a hood.

Following is a list of the colors established by the Intercollegiate Code to represent the different department of learning:

AGRICULTURE	Maize
ARTS and LETTERS	White
BUSINESS ADMINISTRATION, COMMERCE	Drab
CHIROPODY	Nile Green
DENTISTRY	Lilac
ECONOMICS	Copper
EDUCATION	Light Blue
ENGINEERING	Orange
FINE ARTS	Brown
FORESTRY	Russet
HUMANICS	Dark Crimson
LAW	Purple
LIBRARY SCIENCE	Lemon
MEDICINE	Green
MUSIC	Pink
NAPRAPATHY	Cerise
NURSING	Apricot
OPTOMETRY	Orchid
ORATORY	Silver Gray
OSTEOPATHY	Green
PHARMACY	Olive
PHILANTHROPY	Rose
PHILOSOPHY	Blue
PHYSICAL EDUCATION	Sage Green
PUBLIC HEALTH	Salmon
SCIENCE	Gold Yellow
SOCIAL SCIENCE	Citron
THEOLOGY or DIVINITY	Scarlet
VETERINARY SCIENCE	Grey