Insights into Medicine and Surgery

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About the Author

The author graduated from the University of Illinois College of Medicine in 1953. He learned general medicine and surgery, to deliver babies and to set fractured bones during an internship at the Cook County Hospital in Chicago. After serving as a medical officer in the navy, he trained in surgery, then practiced pediatric surgery at the Cook County and Children's Memorial Hospitals in Chicago.

These essays are selected from his 200 articles and book chapters in the medical literature, textbooks of surgery and books on medical history.

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MEDICINE AND SURGERY FROM ANCIENT TIMES TO THE 20TH CENTURY

Archeologic study of human remains, and the observations of early European explorers provide clues to the medical and surgical practices of our remote human ancestors. In many instances the herbal remedies and wound care of native people, especially in the Americas, was superior to that of the Europeans during the middle ages.

The intrusion of a foreign object was thought to be the cause of disease by many cultures, especially among Indigenous North Americans since the penetration of the skin by a thorn or the bite of an animal produced local pain and swelling as well as systemic symptoms. [1,2] The concept was reinforced when men began hurling missiles at each other, and arrows became imbedded in the body. The appearance of an *Ascaris Lumbricoides* in the stool of a sick child or a two-foot-long guinea worm, *Dracunculus medinensis*, emerging from a blister on the leg would confirm the idea that foreign objects were the cause of human illness. Object intrusion was a better theory of disease than bad air or God's punishment in Western medical tradition.

Our human ancestors learned to remove imbedded foreign bodies by sucking with the mouth. This technique became an almost universal method of treating illness. Shamans sucked on hollow tubes, such as reeds, horns or bird bones, to remove disease. [3,4] The application of hot cups to the skin to produce suction is another method. When combined with scarification or an incision, cupping was an effective way to drain an abscess. The induction of vomiting and purgation are other universal methods to rid the body of a foreign agent causing disease.

Explorers, missionaries and anthropologists observed and recorded the medical practices of North American Natives for nearly five hundred years. At the time of conquest, Native Americans used more than four hundred medicinal plants, including a cure for scurvy, coca leaves to relieve pain and cinchona bark for malaria. [5] Balsam of Peru, turpentine and other agents prevented wound infections. Lithospermum ruderale [Puccoon], used for birth control, contains natural estrogens that interfere with ovulation. [6]

Many Indian remedies found their way into folk medicine and even our pharmacopeia. Physicians still use Podophylin, a native remedy, for venereal warts. Cherokee Indians used the pulverized root of Spigelia marilandica, known as pinkroot, to treat intestinal worms. [7] Down from the common cattail was used to dress burns and as padding for infants' cradleboards. Pads of cattail and mosses were also used as diapers. Many herbs were used for several different complaints at all ages, but specific roots were used on the gums of babies during teething and herbal teas were used to treat infantile diarrhea.

The first Europeans to reach the North American continent remarked on the excellent health of the natives and the seeming absence of birth defects and deformities. They also noted the skill with which the Indigenous people treated wounds and their ability to survive injuries, even gunshots in viscera that would have killed a white man. With no knowledge of asepsis, they kept wounds scrupulously clean with washes, powders and poultices made of boiled herbs, egg whites, Balsam of Peru, resins and honey. Native Americans sutured wounds with sinews, human hair and needles made of fish bone, with wicks of cloth or bark for drainage. They controlled hemorrhage with spider webs, the down from birds and herbs. The Northern Cheyenne in Montana still use the spores of a brown puffball, Bovista Plumbea (a Lycoperdaceae), for bleeding and others applied the spores to umbilical cords of newborn infants to prevent infection. [8] Extracts from Lycoperdaceae produce significant antibiotic activity against a variety of bacteria. [9]

Two examples of surgery witnessed by a European attest to the skill of Native American surgeons. Naiuchi, a Zuni traditional healer, first gave a woman with a breast abscess a decoction of Datura [Jimson weed] that put her to sleep. He then incised the abscess with a sharp bit of flint and broke up the loculations with his finger. The lady slept through the procedure. The other case was a nine-year old girl with a curvature of the spine and a cold abscess that pointed in the left groin. The incision extended from the posterior crest of the ileum downward almost to the inguinal ring. The wound was cleaned with water and packed with pinon gum, squash seeds and mutton fat. She died, apparently with tuberculosis, several months later. [10]

Indigenous "specialists" were also adept at setting fractures and reducing dislocations. Ojibwa traditional healers treated broken bones by first washing the limb with warm water and rubbing the skin with grease and a poultice of wild ginger. Perhaps the heat and massage relaxed the muscles,

so the fracture could be reduced with a "quick jerk." The limb was then immobilized with wooden splints or wet rawhide, which formed a tough, hard cast when dried. Others applied wet clay that hardened to a form-fitting cast. Havasupai fracture doctors also used a mixture of hot ashes and wet sand to relax the muscles before reducing the fracture. [11]

Though Indigenous healers successfully treated colonists, the Europeans, especially the missionaries, dismissed native healing skills because the shamans who healed with herbs and surgery were considered pagans, even satanic. The healing practices of the shamans were founded on ancient traditions that were totally unlike Christianity. Individualistic Native American beliefs were based on dreams, the spirits of animals, departed ancestors and the forces of nature. [12] The shamans' healing often involved chanting, drumming and feats of magic to battle evil forces. A seventeenth-century Jesuit missionary referred to a shaman as a "juggler." [13]

The route to becoming a shaman often started with a dream or a severe illness that involved hallucinations or a near-death experience. They retreated to special places for solitude, fasting and sleep deprivation to induce an altered mental state. Initiates in some tribes used drugs such as Datura that first produce nausea and vomiting, then ecstatic dreams in color that leave a sensation of rebirth. A shaman interpreted the dreams of the initiate to determine the source of his power. [14] For example, tribes in the western Great Plains believed that visions of the bear gave the power to cure serious wounds. [15] The initiate then spent an apprenticeship with an older shaman to learn the rituals for healing and the traditions and taboos that protected the tribe. Europeans dismissed the drumming, chanting, prayer and dancing as pure witchcraft, but rhythmic sensory stimulation induces a powerful psychological impact and even an altered state of consciousness resembling anesthesia. Religious sects continue to use music and other repetitive activity to induce hypnotic states that appear to activate the body's healing systems. [16]

When there was no obvious cause for disease, such as a wound, snake bite or fracture, shamans claimed that a particular sickness was caused by an object "shot" magically into the victim's body by an enemy or some spiritual being. [17] The object might be a pebble, a snake, a worm or even a bit of leather that could be removed with incantations and by sucking the affected part. The shaman would produce an object and if the patient got well, he could claim a cure. This process of blaming object intrusion and treatment with suction may go back to the real thorns and spines that afflicted ancient peoples. Sucking was probably the earliest treatment for

real foreign bodies and is a universal treatment for snake bite. If, as some say, "magic is the father of medicine," then surgery may well be the mother of magic.

During the early part of the twentieth century, George Hunt, a well-educated Native American, became an assistant to Franz Boas, a pioneer anthropologist. In order to expose the "fraudulent practices" of shamans, Hunt went through the initiation ceremonies and learned the shaman's methods. As a part of his initiation, Hunt learned how to suck a bloody ball of eagle down from a patient and claim that he had removed the cause of disease. To his amazement, the patient recovered. Hunt became a skilled healer and cured many patients. [18] We should not be surprised, since patients often spontaneously recover, and doctors understand the power of a placebo.

Some shamans were best at treating mental illness. When a shaman was called to treat a young woman who could neither move nor speak, he first worked his chants, drumming and incantations. Then, with the aid of two assistants, he dunked her underwater in a nearby stream. She soon struggled and walked away—cured. This case reminded me of an intern colleague at the Cook County Hospital who had a patient "paralyzed" from the waist down. He listened to her story and examined her, while she was still on a wheeled cart. When he found that her sensation was normal, he lifted up one end of the cart, so the patient slid down and landed on her feet. She cussed out the intern and walked out of the hospital.

Some shamans were generalists, while others had specific power to cure certain diseases. The prospective patient or his family would give gifts to the shaman before the healing ritual. A Montana Gros Ventre Shaman, Little Man, had received his curing powers from a bear, an old man and a coyote. When a boy named Jimmy became ill with pain in his right side, the family called the shaman, according to the following account:

> "Little Man painted his body the way the bear had told him, sang his healing song four times and passed a bear claw through a smudge fire. He said, 'Tell me wherever it hurts, and I will work on it.' Jimmy said, 'Here on my right side.' The old man said, 'That's a bad place. I don't like to suck there because it might hurt your guts. But I will use this bear claw.' So he asked the boy, showing him the bear claw, 'Do you think you can stand this?' Jimmy said he could, and Little Man said, 'Well, make sure you can stand it.' He told the old lady to hold Jimmy's hands down and me to hold his feet down. The boy wriggled and made faces when the claw went in at the side.

> When Little Man jerked it out, a cherry seed and some ‘rotten gut’ came with it. Right after that he was well.” [19]

A bear claw is an unusual surgical instrument but would be sharp enough to make an incision through the abdominal wall. Was this magic, or did Little Man drain an appendiceal abscess? Older children with undiagnosed appendicitis often develop localized abscesses in the right lower part of their abdomen. In some cases, the abscess spontaneously resolves, and others are cured by simple drainage of the pus. Foreign bodies such as cherry pits, or a calcified fecalith which resembles a cherry pit, often cause appendicitis. This case may be an example of pure hokum, but it is just as likely that Little Man hypnotized the boy with his bear song and drained an abdominal abscess.

Indigenous people in America learned to fashion instruments from available materials. A hollow reed attached to an animal bladder was used to irrigate wounds or to give enemas, and bird beaks were used as forceps to extract foreign bodies. The following is an example of how a traditional healer combined magic with surgery to remove an imbedded arrowhead:

“Rattles Stones Like a Bell, a Mandan Plains shaman during the mid-eighteenth century, received his doctoring powers from the crane. Another shaman, Cherry Necklace, had tried to remove an arrowhead stuck in the bone of a wounded warrior, but the man was in so much pain that he wouldn’t go to sleep. The first shaman then consulted Rattles Like a Bell, who had two dried crane heads with the lower jaws attached and a stuffed crane. The shaman tied one of the dry heads around the patient’s neck and painted his face red. He sang his medicine song, which put the wounded man to sleep. While he was singing, the crane came alive and walked around the wounded man. As the man was going to sleep, he heard the crane calling ‘Konix’ and the traditional healer answering ‘Konix’ from the other side of the room. When he was asleep, the crane walked up to him and stuck his bill in the wound, using his bill as pinchers. After pulling several times, he succeeded in extracting the arrowhead. Matter and blood came out of the wound. The ‘doctor’ then led his patient to the river to bathe, while the people in the village watched.” [20]

This story rings true. The hypnotic singing put the willing patient in a trance, allowing removal of the arrow point. Both the Sandhill and the whooping cranes are magnificent birds that were once common throughout the west. Their long, strong bills could certainly be used as a forceps. Bathing the man in the river was a good way to irrigate the wound.

We know nothing about the incidence of birth defects in Native Americans or how deformed infants were treated. Some observers claimed that the Native Americans abandoned deformed infants, but there is considerable evidence that Native families were very careful of their children. In some tribes, due to their nomadic lifestyle, sick or aged relatives were left to die. A deformed child who could not keep up might also have been left behind. [21] The Sioux, by contrast, felt that a child was a great gift to be cherished. [22] The Cheyenne Elders, only two or three generations from the Indigenous massacres of the 1800s, remember that children were loved and protected. Mothers covered their infants with their own bodies to shield them from the soldiers' guns, and the rare child with a cleft lip or club foot grew to adulthood. A Navaho tale of the Stricken Twins, one blind and the other lame illustrates compassion. The blind twin carried his lame brother, who acted as his brother's eyes. [23]

Indigenous North Americans did not perform major amputations or trephinations, but skulls with holes indicating deliberate surgical trephination have been found in the Andes. The Incas used a slingshot that threw an inch and a half diameter stone and a club with a bronze head to bash the skulls of neighboring tribes. Inca skulls at the San Diego Museum demonstrated a variety of depressed skull fractures possibly due to hurled stones or war clubs. Other skulls suggest that the Incas used a drill to make small round holes. The absence of osteomyelitis in the skulls of survivors indicate the use of antisepsis to prevent infection. [24]

An Inca surgeon would have known that a depressed skull fracture causes coma with weakness or paralysis on the opposite side of the body. The next step would be an attempt to elevate the fracture with a lever. When this didn't work, the surgeon made a hole in the skull next to the fracture so he could introduce an instrument beneath the broken, depressed bone. This is exactly the procedure done today. It would not take a great step of imagination to believe that our ancient surgeon then opened the skull to release a blood clot. The finding of trephined children's skulls suggests that the operation was used to treat convulsions. In any event, the Inca surgeon appeared to treat his patients rationally. The oldest specimens of trephinated skulls date from as long ago as 3000 B C.E. a time when the stone-headed ax was a favored weapon. Romanian shepherds opened the skulls of sheep suffering from the staggers to remove the larva of Multiceps Multiceps, a parasite, is further evidence of trephination to relieve disease. [25]

The Inca surgeon cut through the scalp with a sharp stone knife, possibly using extracts of coca leaves as a topical anesthetic. He could have

controlled bleeding with pressure or with plants containing tannic acid. The surgeon chiseled away the outer and inner tables of the skull while avoiding injury to the dura mater. An alternative technique was to drill holes with a stone drill, twirled between the hands, and then to connect the holes by chiseling the bone. Among the Incas, the survival rate after trephination was approximately seventy-five percent since fifty-five percent of trephinated skulls show complete and sixteen percent demonstrate incomplete healing. [26] There are also skulls with multiple healed openings, indicating operations at different times with survival.

Our ancient forbears had by trial and error discovered ways to prevent infection and relieve pain, and there were "specialists" who cured disease with their hands. At the time of conquest, the medicine and surgery of Native Americans was in many ways superior to that of Europeans. Unfortunately, the ridicule of the conquerors and missionaries together with devastating new diseases such as smallpox undermined the natives' faith in their traditional healing practices.

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Egyptian Papyri

The earliest written record of wound care and medicine, written on papyrus that grows along the Nile River, dates from as early as 3000-2500 B.C.E. The papyrus was printed in pictorial signs or hieroglyphs. Doctor-priests used incantations, prayers and amulets to cure disease. [1] There were also conventional practitioners who used a wide range of drugs prepared from plants, animals and metal compounds. Thus, it is likely that Egyptian practice grew from the same combination of the supernatural and empiric medicine found in other ancient cultures.

An American, Mr. Edwin Smith, found the papyrus at Luxor, Egypt in 1862; James Henry Breasted of the Oriental Institute at the University of Chicago translated the hieroglyphs. Volume II of the translation consists of facsimiles of the original document on one page with a “clean” version on the facing page. Volume I contains the English translation with voluminous commentaries and interpretations. The general introduction provides the best references. [2]

The author of the papyrus systematically recorded a rational approach to forty-eight individual cases, suggesting that he was a surgeon. He described, for the first time, the meninges and the convolutions of the brain, the articulation of the mandible, the ribs, vertebrae, and blood vessels. He knew that the brain controlled the motions of the body, the importance of the pulse, and the role of the heart in blood circulation.

The section on head wounds starts with a simple skin laceration penetrating to the skull and ends with a compound, comminuted skull fracture that exposed the brain. The treatment of fractures of the nose, maxilla, zygoma and a dislocation of the mandible are rational and exhibit a good knowledge of anatomy. The author described wounds of the lip, chin and throat, crushed cervical vertebra, clavicular fractures, injuries to the shoulder and humerus, fractured ribs and a sprain of the spinal vertebra. The discussion of each case starts with the diagnosis and proceeds logically through examination and treatment.

In some cases, such as the open fracture of the skull, the surgeon predicted a fatal outcome and said, “an ailment not to be treated.” He did recommend

keeping the patient upright to avoid pressure on the brain. All of the cases except for a tumor and an abscess of the breast appeared to be injuries due to falls or battle. The wounds were classified as soft tissue only, penetration to bone, perforation through bone, compound fracture and a "smash" that caused a compound comminuted fracture, including penetration to the brain.

The author used a form of adhesive tape to approximate simple flesh wounds, and in the case of a gaping wound of the eyebrow, he said, "Thou shouldst draw together for him his gash with stitching." On the first day, he applied fresh meat, perhaps to control hemorrhage; on the following days, a mixture of honey and grease was applied with lint.

Honey is bacteriostatic, and the author also used a decoction of willow leaves containing salicin that may have had a mildly antiseptic effect. For infected wounds, he used a solution containing salts of copper and sodium, similar to the normal saline soaks used today. The author immobilized fractures with medicated compresses, linen bandages and padded wooden splints.

In Case Twelve, we can see his rational approach to a patient with a broken nose, as well as the stilted language of the translation:

> "If thou examined a man having a break in the chamber of his nose, and thou findest his nose bent, while his face is disfigured and the swelling which is over it is protruding, thou shouldst say concerning him; One having a break in the chamber of his nose. An ailment which I will treat. Thou shouldst force it to fall in, so that it is lying in its place, and clean out for him, the interior of both his nostrils with two swabs of linen until every worm of blood which coagulates in the inside of his two nostrils comes forth. Now afterward thou shouldst place two plugs of linen saturated with grease and put into his two nostrils. Thou shouldst place for him two stiff rolls of linen, bound on. Thou shouldst treat him afterwards with grease, honey and lint every day until he recovers."

The Papyrus Ebers, dating from about the same time as the Edwin Smith papyrus, is a collection of remedies for internal ailments, diseases of the eye and skin problems. The treatment for rectal prolapse included myrrh, frankincense, coriander, oil, and salt all boiled together and then applied to the "hinder part." Mostly, however, the magician-doctors relied on charms such as appeals to Horus to heal sick children. On the other hand, for a burned child, the appeal to Horus is combined with a salve made of gum and ram's hair. [4]

The early Egyptian surgeons used bronze instruments, a great leap forward over stone tools. The temple at Kom Ombo, an ancient settlement on the east bank of the Nile twenty miles north of Aswan, is dedicated to Horus, a healing God. One wall of the temple has carvings illustrating forceps, scalpels, hooks, saws and a speculum.

There are also illustrations of birth defects such as umbilical and inguinal hernia, club feet and dwarfs in statues and tomb reliefs. The royal proctologist (known as the herder of the anus) cared for the royal rectum. The ancient Egyptians probably did not perform elective surgery, but they took care of wounds with antisepsis to prevent infection. They were also the first to use stitches to close wounds. [5]

A carving from the tomb of Ankn-ma-hor at Saqquara in Egypt, dated approximately 2400 B.C., illustrates circumcision on teenage boys, the world's oldest depiction of a surgical operation. [6] Was this a religious rite of passage or was the operation performed for medical reasons? One medical indication for circumcision is an infected, swollen, painful foreskin that can't be retracted. Urination may be difficult. When warm soaks to the penis don't work, a small slit in the dorsum of the foreskin allows it to be retracted. It would only be a minor step to excise a part of the foreskin to prevent future problems.

Another explanation for circumcision follows from the mutilation of captured warriors in ancient Egypt. [7] At first an extremity was amputated, but if the prisoner survived, he was unfit for labor. The alternative, total castration by removal of the penis and testicles, carried too high a mortality rate. As a result, orchiectomy and later only circumcision marked these slaves. Eventually the Egyptians circumcised all slaves, including the Jews. By the time of the Jewish exodus from Egypt, circumcision had been adopted as a Jewish ritual. At some point in time, the operation was done in eight-day old infants instead of older boys. [8] Moses Maimonides, the great twelfth-century Jewish physician, scholar and theologian, discussed circumcision in his commentary on the Mishneh Torah, saying, "The foreskin is regarded as an abomination, for which the Gentiles are condemned in Scripture, as it is said, 'For all the nations are uncircumcised' [Jer. 9:25]. The patriarch Abraham was not called perfect until he had circumcised himself, as it is said, 'Walk before Me; and be perfect. And I will make My covenant between Me and you' [Gen. 17:1-2]. Whoever neglects the covenant of our ancestor Abraham and retains the foreskin or artificially obliterates the marks of circumcision, even if he has acquired much knowledge of the Torah and practices good deeds, will have no

portion in the world to come." [9] In his Guide for the Perplexed, Maimonides says circumcision is necessary to decrease sexual lust. [10]

Christians and Muslims adopted circumcision, and both male circumcision as well as excision of the clitoris in girls came to be practiced throughout much of the world, even in aboriginal Australia. [11] In Ottoman Turkey, circumcision of the Sultan's sons was an occasion for great festivities lasting 15 days. [12] There are detailed descriptions as well as lovely painted miniatures depicting the circumcisions of the sons of Mehmet in 1582 and the four sons of Ahmed III in 1720. The royal surgeons circumcised thousands of boys from poor families before operating on the princes. The ceremonies took place in a special courtyard of the great Topkapi Palace in Istanbul overlooking the Bosporus. Fountains with running water at the windows of the courtyard provided a sense of tranquility and dulled the boys' cries. Led by the royal eunuch, two men marched each boy to the courtyard. The foreskin was cut with curved scissors between ligatures and the wound was dressed with ashes or egg yolks boiled in rose water. The Sultan provided sport, music, fireworks, and gave gifts to the poor boys. Even today, in Istanbul, one can see young boys, dressed in robes and crowns, going with their families to the circumcision ceremony.

Through the years, "congenital phimosis" and the "adherent prepuce" became diseases requiring surgical treatment. By the nineteenth century the operation was performed to treat bedwetting, masturbation, urinary infection, neurosis and even epilepsy. Today, circumcision remains the most common pediatric operation, demanded by parents and performed for the prevention of cancer and AIDS. Circumcision stands as an enduring symbol of the historic relationship between religion and medicine. It was probably the first "elective" operation, and from its beginnings, only specialists whether priests, blacksmiths or surgeons performed the operation.

Another ancient form of ritual surgery, self-mutilation by amputation of a finger, is depicted in rock art. [13] The practice, which may have originated as a form of punishment or a way to protect children from evil, appears to have been most common in Australia and North America. When a Crow Indian died, his near relatives sacrificed a finger and when the tribe experienced high mortality from sickness or war, men hacked off all but their thumbs and enough fingers to shoot a bow or gun. They performed the amputations through the first or second joints, either by running a sharp knife around the joint or striking with a tomahawk. [14]

Castration was used as punishment and a way to mark enemy captives. The lack of a beard and a feminine voice made it easy to recognize slaves. It evolved into a way for rulers to have docile guards for the king's women. Since castration drove out sexual desire, princes and nobles used eunuchs to guard the harem. The word eunuch means guard or bed keeper in Greek. The avoidance of sexual sin and temptation also led to self-castration; St. Origen and St. Francis were self-imposed eunuchs.

The sultans and caliphs considered that removal of both the penis and testicles produced the safest eunuchs to watch over their harems. Since this operation carried a higher mortality rate, those whose testes and penis were removed were more valuable. The great eunuch factories of North Africa, often operated by Coptic monks, gathered thousands of boys every year and sold the survivors in markets all over Asia Minor. The helpless boy was tied down on a board and restrained with a collar around his neck. The operator then seized the penis and testicles and with one swoop of a razor-sharp knife slashed away the boy's manhood. A tube was placed in the urethra and the wound was packed to control hemorrhage. [15] Eunuchs often held prominent positions in courts, and in China young boys underwent the operation voluntarily. [16] Castration was also used to preserve a boy's singing voice. When Rome became a music center with the establishment of opera, eunuchs were in great demand and well-intentioned parents even allowed their children to be castrated to sing in church services.

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BLADDER STONES FROM ANCIENT INDIA TO THE WORLD

The *Sushruta Samhita* from dating to between 1200 and 600 B.C.E. accurately describes in considerable detail many diseases and surgical procedures. The manuscript is especially noted for the first description of lithotomy, the removal of bladder stones. [1]

Sushruta, a surgeon, learned anatomy by dissecting the corpses of infants. Hindu holy scriptures dictate that any dead human being must be burned rather than buried, but infants younger than two years and firstborn male children were exceptions to this rule. [2]

Sushruta differentiated arteries and veins centuries before William Harvey. [3] He also described common congenital malformations as well as congenital syphilis, tuberculosis, fractured bones and leprosy. Children with gross malformations were considered a source of shame and abandoned in the wilderness but he sutured cleft lips and possibly performed sigmoid colostomies to relieve the colon obstruction caused by Hirschsprung's disease. [4] Sushruta also described Caesarean section and rhinoplasty.

His description of perineal lithotomy for the removal of urinary bladder stones may be the first operation on a body cavity. The word lithotomy, coined from Greek 'lithos' (stone) and 'tomos' (cut), suggests the operation originated in Greece. However, the Sushruta Samhita described vesicolithotomy several centuries prior to Hippocrates.

Here his classic description of perineal lithotomy to remove bladder stones in children:

> "A person of strong physique and un-agitated mind [the attendant] should be made first to sit on a level board or table as high as the knee-joint. The patient should then be made to lie on his back on the table placing the upper part of his body on the attendant's lap, with his waist resting on an elevated cloth cushion. Then the elbows and knee-joints of the patient should be contracted and bound up with fastenings or with linen. After that the umbilical region of the abdomen of the patient should be well rubbed with oil or clarified butter and the left side of the umbilical region should be pressed down with the closed fist so that the stone comes within reach of the

> operator. The surgeon should then introduce into the rectum, the second and third fingers of his left hand, duly anointed and with the nails well pared. Then the fingers should be carried upward towards the rope of the perineum (i.e. in the middle line) so as to bring the stone between the rectum and the penis, when it should be so firmly and strongly pressed as to look like an elevated tumor, taking care that the bladder remains strongly contracted but at the same time even.
>
> An operation should not be proceeded with, nor an attempt made to extract the stone in a case, where, the stone on being handled, the patient would be found to drop down motionless with his head bent down and his eyes fixed in a vacant stare like that of a dead man, as an extraction in such a case is sure to be followed by death. The operation should only be continued in the absence of such an occurrence.
>
> An incision should then be made on the left side of the raphe of the perineum at the distance of a barleycorn and of sufficient width to allow the free egress of the stone. Several authorities recommend the opening to be on the right side of the raphe of the perineum for the convenience of extracting the stone from its cavity so that it may not break into pieces nor leave any broken particles behind, however small, as they would in such a case be sure to grow larger again. Hence, the entire stone should be extracted with the help of forceps, the points of which are not too sharp.
>
> After extraction of the stone, the patient should be made to sit in a cauldron full of warm water and fomented, thereby. In doing so, the possibility of an accumulation of blood in the bladder will be prevented; however, if blood be accumulated therein, a decoction of ksheera trees should be injected into the bladder with the help of a urethral catheter. [5]

Surgeons used this technique to remove bladder stones until well into the 19th century. How did knowledge of the operation reach the rest of the world from India? The first possibilities are the overland or sea routes that connected India with the west from pre-historic times. [6] Another avenue could have been the Greek mercenaries who accompanied Darius, a Persian Monarch, in 538 BC who invaded the Indus valley. [7] Greek surgeons successfully treated Alexander the Great for life threatening wounds, including a one caused by a steel tipped arrow that penetrated the general's chest. [8] These skilled surgeons would have sought out Indian surgeons and learned of Sushrutta's vesicolithotomy.

Soon after Alexander the Great founded Alexandria in 322 BC, it became the cultural and scientific center of Greece, where Euclid and Archimedes worked. After the death of Alexander, Ptolemy, his general, founded a research institute and a medical school. [9] Ammonius Lithotomos coined

the term lithotomy in 276 BC. His writings were most probably destroyed when Julius Caesar burned the Alexandrian library in 48 BC but Cornelius Celsus (25 BC - 50 AD) cited Ammonius in his encyclopedia, 'De Medicina.' [10] Ammonius invented an instrument to break large stones for easier removal and was a skilled lithotomist. His description of lithotomy for bladder stones is identical with Sushruta's.

During the first centuries of the Christian era, Greek science and medicine were transferred from Constantinople to Persia and Arabia. Indian surgeons also influenced the Arabian surgeons. [11]

Albucasis (936-1013 AD), an Islamic surgeon who practiced in Cordoba Spain, authored a chapter on bladder stones in children that appears to have been taken from the Sushruta Samhita. [12,13,14].

This ancient medical literature was lost during the dark ages, when itinerant, poorly trained lithotomists operated on patients with bladders stones. The Church forbade skilled physicians, who were often clerics, from performing surgery.

John Baptiste Morgagni, (1682-1771), at Padua, one of the first physicians to dissect the human body to detect the cause of disease described bladder inflammation found at the autopsy of a 14-year-old boy who had died, in great pain, 21 hours after an unskilled lithotomist had removed two small bladder stones. [15] He quoted both Hippocrates and Celsus and was skeptical of lithotomy. Morgagni suggested treatment with medicated water, prepared from the shells of oysters and experimented with injections of an effervescent mixture of alkali and acid into the bladders of dogs. He also observed teenage girls who had inserted needles or bodkins into their bladder through the urethra. Stones formed on these objects and eventually led urosepsis and death.

William Cheseldon (1688-1752), the leading English surgeon in the first half of the eighteenth century, brought perineal lithotomy to the peak of perfection. He apprenticed to a surgeon when he was 15 years of age and passed the examinations to become a barber surgeon after his 7-year apprenticeship. He taught anatomy at St. Thomas Hospital and published "*Anatomy of the Human Body*" in 1713. [16] Unlike earlier surgeons, Cheseldon used a urethral sound as a guide. He routinely did the operation in a little over one minute and once in 53 seconds. Only 3 of 125 children under 10 years of age died. [17] This extraordinary survival rate, prior to anesthesia and antisepsis, attests to his dexterity. Cheseldon's success is

attributed to his perineal incision lateral to midline that avoided the urethra as described by Sushruta.

John Cooper Forster who published "*The Surgical Diseases of Children*" in 1860 used a sound in the urethra to guide a lateral perineal incision into the neck of the bladder and a forceps to remove the stone. The wound healed in eight to ten days. [18] His illustration of a child held in the lithotomy position is essentially the same as that used by Sushruta, except, that with anesthesia, a nurse, rather than two strong men held the patient.

With the advent of antisepsis, a supra-pubic cystotomy became the operation of choice for the removal of stones. Bladder stones are now rare but are seen in arid countries and in children with neurogenic bladders and after reconstruction for congenital deformities. [19]

Lithotomy position from "The Surgical Diseases of Children" by John Cooper Forster

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HIPPOCRATES: CUTTING FOR STONE AND ABORTION

The medical texts attributed to the Greek physician, Hippocrates, was for centuries the primary source of medical knowledge in the western world. Greek physicians described the symptoms, signs and rational treatment for many diseases. The parts dealing with fractured bones, wounds and visible deformities are classics. They established hospitals far from plague ridden cities where patients rested, bathed and had clean water and pure air and with keen observation they accumulated a practical knowledge of disease, that they attributed to natural, rather than supernatural causes.

Why, then, did Hippocrates, a skilled physician advise his students to refrain from performing abortion and not to operate for bladder stones?

The Hippocratic oath, dating from the fourth or fifth centuries B.C. requires young physicians to swear by the healing Gods to adhere to high ethical standards. The oath includes admonitions against abortion and operating for bladder stones.

> *"I will not give a woman a pessary to induce abortions but I will keep pure and holy both in my life and art. I will not use the knife, not even verily, on sufferers from stone, but will give place to such as are craftsmen."*

Does the phrase to "keep pure and holy" suggest a moral or religious objection to abortion? Did Hippocrates object to using a pessary or to insert dangerous drugs into the vagina, or as with cutting for stone, was he leaving abortion to others who had more skill? Who were these craftsmen?

The answer may be found in a dialogue between Socrates and Theaetetus. Socrates, in his introductory dialogue with Theaetetus, said, "How absurd of you, never to have heard that I am the son of a midwife, a fine buxom woman called Phaenarete!" Socrates explains that midwives are women past the age of childbearing. Then he says, "Moreover with drugs and incantations midwives can either bring on the pangs of travail or alleviate them at their will, make a difficult labor easy and at an early stage **cause a miscarriage if they so decide**." [1] This statement by Socrates is good evidence that midwives were the "craftsmen" who performed abortions.

Ancient Greeks had no moral or religious objections to infanticide or abortion. They exposed "puny or malformed infants" to die. [2] An example is in the tragedy of *Oedipus Rex* when King Laius and Queen Jocasta abandoned their newborn baby to die with the tendons of his feet pierced and fettered because the king had dreamed his son would one day kill him. [3]

Hippocrates was well aware of the symptoms of bladder stones in children: "*Calculous children rub their privy parts and tear at them, as supposing the obstruction of urine is situated there.'* Despite his excellent clinical description, he treated bladder stones with diluted wine and forbade his students to "cut for stone." [4] This is perplexing since the *Corpus Hippocraticum* describes operations for empyema, fractures, rectal prolapse, and recurrent dislocation of the shoulder. [5] His reluctance to operate on bladder stones may have been due to a lack of knowledge of internal anatomy because the ancient Greeks did not allow human dissection. It is likely that Hippocrates' advised his students to leave these procedures to surgeons trained in the Indian method of perineal vesicolithotomy.

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An Arabian Surgeon in Spain

Greek physicians practiced and taught their arts in Constantinople and from there, Greek medicine reached Persia and Egypt. During the seventh century, the followers of Mohammed assimilated Greek and Indian medicine, established hospitals and preserved rational medical practice. Arabian medicine was superior to that practiced in Europe during the middle ages. Islam spread throughout the Middle East and then to Spain, bringing Greek-Arabian medicine back to Europe.

Abd al Rahman, who became the Caliph of Cordoba in 929, established a university which was for centuries the center of learning in Europe. [1] During this golden age of Spanish-Arabian harmony, Albucasis wrote one of the most remarkable and oft-quoted surgical textbooks of all time. Known in Arabic as Abu l-Qasim Khalaf ibn Abbas al-Zahrawi, he was born near Cordoba, Spain, in 1013 and died in 1106.

His book *On Surgery and Instruments*, comprising approximately one-fifth of his entire medical work, is available in a handsome English translation. [2] The author's purpose was to revive the art of surgery as taught by authors from Hippocrates to Paul of Aegina. In addition to reviewing the ancient works, he drew on his own experience as a practical surgeon to describe specific operations and instruments. Albucasis invented a tonsil guillotine, the concealed knife for opening abscesses in nervous patients, scissors, syringes, a lithotrite and a table for reducing fractures. He used animal gut as a suture and devised a paste consisting of flour and egg white that hardened to form a cast for fractures. During the second half of the twelfth century, the book was translated into Latin and for the next five hundred years influenced European surgery. [3]

The book opens with a lucid discussion of the advantages of the cautery and special instruments to cauterize specific lesions. We regard the "red hot iron" as a barbaric instrument, but Albucasis used it with great delicacy, much as we would use a needle-pointed electrosurgical instrument or the laser. At first glance, his use of the cautery for headache or sciatica makes little sense, until we remember that in certain pain syndromes the injection of a local anesthetic into a "trigger point" often relieves the pain. Albucasis

either cauterized or ligated the temporal artery for “throbbing” headaches. At one time, when there were problems with the hospital administration, I developed severe headaches, relieved by finger pressure or an ice cube on the temporal artery. Ligation of the artery completely stopped the headaches, proving the effectiveness of this ancient method.

For epilepsy in a boy, Albucasis used a fine-pointed cautery, applied to the occiput and each frontal prominence. Unfortunately, he does not give us any long-term results. His treatment of ingrown eyelashes required steady hands and great care: “Put the patient’s head on your lap and mark upon the eyelid the shape of a myrtle leaf, beginning near the lashes. Then apply cotton wool soaked in egg white. Then heat a cautery of this form and burn over the shape marked out, slowly with many small strokes till the whole surface of the skin marked out to the shape of the myrtle leaf be cauterized. The eyelid will contract, drawing the lashes away from the eye.” [4]

Albucasis used the cautery for everything from harelip to toothache and sciatica. When cauterizing “scrofulous” tumors, the surrounding tissues were protected from the heat by inserting the hot iron through a hollow cannula. To drain a liver abscess, he used a remarkable hollow, sharp-pointed trocar that would cut, cauterize and allow drainage of the pus. In later years, surgeons seared the entire wound or amputation stump to control bleeding, but Albucasis first stopped the bleeding with finger pressure on the artery, and then put several olivary-shaped cauteries in the fire until they were very hot. He promptly removed his finger and applied the cautery until the artery was sealed. If the cautery didn’t work, he tied a ligature around the artery or applied a tight bandage.

Albucasis describes several specific indications for cautery in children. He treated “humpback,” possibly tuberculosis of the spine, by cauterizing the most prominent vertebra with a circular-shaped iron; he warned against the cautery if the condition was due to a nervous spasm. The idea behind cauterization for hernia was to produce extensive scar tissue to obliterate the hernia sac and the canal. The boy lay on his back, while the surgeon reduced the intestine and omentum back into the abdomen. Then, with assistants, sitting on the patient’s legs and chest, the surgeon marked a semicircle pointing upward at the lower end of the hernia. A slender, white-hot cautery emitting “sizzling sparks” was inserted to the pubic bone. The wound was then dressed with butter and the boy kept in bed for forty days. One can only guess at the intense initial pain, but as in a third-degree burn, the nerve endings would have been immediately deadened. We can hope that the boy was given a good dose of opium and wine prior to the operation.

Albucasis also described a more anatomical operation for hernia in which he dissected the layers around the hernia sac and then incorporated the sac and all its layers, including the testicular vessels, with four sutures. He then removed the testicle. This operation would have been longer and possibly more painful than the cautery. Instead of simple drainage of hydroceles, he dissected and removed the sac with a knife or cautery. He treated varicoceles by ligation of the testicular veins.

Albucasis observed that hydrocephalus occurred in small infants and that the head would grow so large the child could not sit upright. The disease was fatal. He preferred not to treat these infants when the fluid was beneath the bone and the sutures were separated, but he describes incising the skin with a T-shaped cautery and draining the fluid. The wound was then dressed with bandages soaked in oil and wine.

When an infant was born with an imperforate auditory meatus, Albucasis cut away the membrane with a slender knife and kept the passage open with a medicated plug. He also opened an obstructed urinary meatus in a boy, at the time of birth, with a sharp scalpel and kept the opening patent with a lead sound. He describes tonsillectomy, excision of "scrofulous" neck nodes and suture ligature of umbilical hernia in children. Albucasis had a good understanding of male psychology when he referred to boys who at puberty developed an "abhorrent" female-like breast. The treatment was to make a semicircular incision on the breast and dissect away the excess tissue, pack the wound with a cicatrizing compound and sew the wound edges. Except for the scar-forming compound, this is essentially the same operation performed for gynecomastia today.

It is with circumcision that we learn of his sensitivity to the pain and apprehension of his patients. Albucasis said that since circumcision is the result of our deliberate action, we should plan the very best operation and the easiest way that leads to safety. He also pointed out that the "Ancients" (being Greek) made no mention of circumcision. Barbers and common practitioners, using a razor, sometimes amputated the tip of the penis along with the foreskin.

He used a bit of psychology before the operation:

> "…make the boy imagine that all we are going to do is tie a ligature at the tip of his penis and leave it for another day. Then amuse him and cheer him as much as you can, according to his intelligence; then stand him upright before you and hide the scissors in your sleeve or under your foot and do not let the boy's eye chance upon that or any other instrument. Then with

> your hand take hold of the tip of the penis, blow into the foreskin and draw it back until the glans penis is exposed and cleanse from it all the unclean matter that has collected. Then ligate the indicated place with a double ligature and a second right around beneath; then take hold at the site of the lower ligature with thumb and forefinger, very firmly, and cut between the ligatures [with some scissors]; then quickly push back the skin and draw out the glans penis; let a little blood flow, then wipe it with a piece of soft cloth, then sprinkle the ashes of dried gourds or else fine white flour. Apply on top of the powder a piece of linen with egg-yolk cooked in rosewater, beaten up with oil of roses." [5]

The instrument used in this case was a modern-type hinged scissors, suggesting that Arabian surgeons were the first to use this instrument rather than shears. Note that Albucasis didn't use the cautery for circumcision. You can almost hear him tell his students not to use the cautery for fear of burning the penis. Almost a thousand years later, there was a case report of a boy who lost his entire penis after a circumcision performed with an electro-cautery unit.

The symptoms of bladder stones, the optimum age for operation and the technique of perineal lithotomy are so similar to previous descriptions that we believe there was a connection to Indian surgeons. Albucasis adds a few new tricks. First, he notes the association of rectal prolapse due to the boy's straining to urinate against a blocked urethra, and he has the boy jump from a height in order to lodge the stone at the outlet of the bladder immediately prior to surgery. If the stone was too large to remove through the perineal incision, he crushed it with some special rough-jawed forceps. He also had a new instrument to remove stones impacted in the urethra. This is "a drill of the finest steel with a triangular point" and a wooden handle. The drill was gently pushed through the urethra until it touched the stone. By twirling the drill, the stone was penetrated, broken up and then washed out with urine. The forceps and drill anticipate lithotripsy.

Albucasis recognized three types of inter-sex abnormalities. One, must have been a true hermaphrodite because the clitoris was enlarged to the size of a male penis and there were testicle-like structures. His treatment was complete amputation of the clitoris. He is less clear in his description of inter-sex abnormalities in males. One form may have been a severe form of hypospadius, but he still recommended amputation of the penis.

His discussion of imperforate anus is similar to that of Paul of Aegina when he says that the midwife should perforate the membrane with her fingernail

or a sharp knife, taking care to avoid the sphincter muscles. The wound is kept open with wool dipped in oil and wine or a lead tube.

Albucasis was much bolder in advising limb amputation for gangrene, and even after the bites of venomous serpents. He cut through normal tissue above the gangrene with a broad knife and protected healthy tissue with linen while he sawed through the bone. He cauterized specific vessels and used styptics to control bleeding. His treated open wounds with wine and resins, performed trephination for head injuries and reduced fractures and dislocations follows his predecessors in a similar manner as Hippocrates.

It is worthwhile looking at his treatment of compound fractures, especially because in later years, a compound fracture was an indication for amputation. When bones protruded through the skin, Albucasis reduced the fragments to their proper position, using a metal lever as described by Hippocrates. He chiseled or sawed away sharp splinters of bone and when the bones were replaced in their proper position, he dressed the wound with "sharp wine." After applying splints, he left the bandages loose to allow drainage. He wisely observed that a wound that remained unhealed after many days and continued to drain contained loose bone fragments that had to be removed.

One of his cases demonstrates a patient's fortitude and the persistence of an obviously great surgeon. The patient was a thirty-year old man who had multiple chronic draining sinuses in his leg for two years. The draining pus was evil-smelling, and the man was wasted, jaundiced and near death. With a probe, Albucasis determined that the sinus tracts communicated with one another and led to bone. He cut down and removed what appeared to be all the diseased, dead bone. When the wound refused to heal, he repeated the operation twice more until he had chiseled and sawed away all the diseased bone. New bone grew, the wound healed, and the man was cured. [6]

Albucasis is far and away the most well-rounded surgeon prior to modern times. It is easy to criticize his extensive use of the cautery and for employing bloodletting and cupping. He was, after all, handicapped by a lack of knowledge of anatomy, since the Muslims, like the Christians, forbade human dissection.

One of the first acts of the Prophet Mohammed was to prevent pagans from burying female newborn infants alive and from sacrificing children to the gods. Whether Albucasis' concern for infants with birth defects was an extension of a basic Muslim philosophy or a result of the tolerance and

liberalism of the Spanish he treated these infants and improved the lot of children.

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PERCIVAL POTT, AN ENGLISH GENTLEMAN SURGEON

During the 18th century with the quackery of the dark ages well past, surgery became a respectable profession. Percival Pott is an outstanding example of a surgeon with an enquiring mind who furthered the care of the sick and wounded.

Percival Pott, at age fifteen, apprenticed to Edward Nourse, a surgeon at St. Bartholomew's Hospital. He paid 210 pounds for his seven-year apprenticeship. Pott attended lectures at the barber-surgeon's hall and became Nourse's prosector for anatomical demonstrations. The court of Examiners of the Barber Surgeons Company awarded Pott the "Grand Diploma," the equivalent of board certification in 1736.

The length of surgical training at that time was not too different from today. In 1744, Percival Pott became an assistant surgeon and five years later a full surgeon at St. Bartholomew's Hospital. He had a large practice, served St. Bartholomew's for fifty years, and trained many surgeons, including John Jones of New York, who wrote the first American textbook of surgery. [1]

He married Sarah Cruttendon, the daughter of the director of the East India Company. The marriage must have ensured his place in London society.

In 1756, Pott was riding to see a patient when the horse threw him to the ground. He suffered a compound fracture of the tibia. Several of his surgical colleagues recommended amputation, the safest treatment for a compound fracture at that time. Pott convinced Edward Nourse, his mentor, to clean the wound and splint the fracture. He survived with his leg intact. [2] During his convalescence, he commenced a career in medical writing that led to fourteen major monographs on subjects ranging from hernias to head injuries and diseases of the eye.

The same year as his injury, he published the first edition of *A Treatise on Ruptures and an Account of a Particular Kind of Rupture Attendant on Newborn Children*. The second edition of this monograph was 198 pages long and had a chapter on congenital hernias. [3] Based on anatomical

dissections, Pott described the failure of closure of the procesus vaginalis as the cause for congenital or indirect hernia. He describes a child with a hernia:

> *"If the subject is an infant, the case is not often attended with much difficulty or hazard; the softness and ductility of their fibers generally rendering the reduction easy as well as the descent; and tho from neglect or inattention it may well fall down again, and yet it is as easily replaced, and seldom causes any mischief: I say seldom because I have seen an infant, one-year-old, die of a strangulated hernia which had not been down two days, with all the symptoms of intestinal mortification."*

If the reduction was difficult, Pott induced relaxation with warm baths, flexion of the thighs, or bleeding to the point of swooning. When the child was limp from the loss of blood, one could reduce the hernia. After reduction of the hernia, Pott applied a bandage or truss to prevent the hernia from recurring, and with time the sac might close, effecting a permanent cure.

An operation was indicated if the hernia could not be reduced. Pott cut through the skin and fascia, made a small incision into the hernia sac, and then inserted a probe to avoid injury to the intestine. Imagine, how difficult it must have been to replace loops of intestine into the abdominal cavity in an awake, terrified, squirming infant. But Pott apparently accomplished this feat. He closed the deep layers of the wound and the opening of the hernia sac with a running suture. Pott was the first surgeon to save the testicle during hernia repair. He observed that the peritoneal sac was the source of pathology, but later surgeons closed the internal ring and performed fascial repairs in children. Almost two hundred years after Percival Pott's observation, Willis Potts, an American surgeon cured pediatric hernias with simple ligation of the sac. [4]

Pott first used the term "puffy tumor" in his monograph on head injuries: [5]

> *"If the symptoms of pressure, such as stupidity, loss of sense, voluntary motion, etc. appear some few days after the head has suffered injury from external mischief, they do most probably imply an effusion of fluid somewhere—in the substance of the brain, in its' ventricles, between its' membranes or on the surface of the dura mater, and the formation of matter between it and the skull, in consequence of contusion is generally indicated and preceded by one [sign] which I have hardly ever known to fail: I mean a puffy, circumscribed and spontaneous separation of the pericranium from the skull under the tumor."*

Pott advised immediate operation to drain the fluid or remove diseased bone. One of his patients was a nine-year-old boy who suffered a blow on the head during a game of cricket. The boy had a swelling over his forehead and had "lost his sense." Pott, with a trephine and elevator, raised the depressed fracture. The boy recovered.

The puffy tumor a fluctuant, swollen mass over the forehead is more likely caused by osteomyelitis of the frontal bone with sub-periosteal pus. The etiology is usually a neglected frontal sinusitis which may be complicated by a cavernous sinus thrombosis or a brain abscess. It is now rare, but as in the days of Percival Pott, requires urgent surgical intervention. [6]

The fractured tibia suffered by Pott after he was thrown from a horse is now known as "Pott's fracture," as described in his 1768 monograph on fractures and dislocations. [7]

> *"If the tibia and fibula both be broken, they are both, generally displaced in such a manner, that the inferior extremity, or that connected to the foot, is drawn under that part of the fractured bone, that is connected with the knee; making by this means a deformed unequal tumefaction in the fractured part and rendering the broken limb shorter than it ought to be."*

He went on to say, "Extremely difficult to put to rights and still more to keep it in place." Pott included a drawing of the displaced foot and a skeletal illustration of the displaced fractured tibia. Without the benefit of X-rays, his illustration is amazingly accurate and reflects his detailed knowledge of anatomy.

John Charnley's description of the Pott's fracture in his classic, "Closed Reduction of Common Fractures" is almost identical to that of Percival Pott. He even mentions the difficulty of closed reduction and maintaining the position of the bones. [8]

There is no better example of Percival Pott's clinical acumen than his observations on deformities of the vertebrae and paralysis of the lower extremities. [9] Physicians at that time attributed the deformity and paralysis to trauma or lifting a heavy weight. Pott was skeptical of this theory because infants and children had the same symptoms with no history of injury. At autopsy, Pott discovered carious vertebrae, thickened ligaments, and a quantity of sanies (pus) between the rotted bones.

A chance conversation with a colleague who had drained pus from a patient with curvature of the spine and lower extremity palsy with good results

confirmed his suspicions. He “made an issue by an incision on one side of a projection” in an infant with a curvature in the middle of his neck and paralysis. At the end of a month, the infant was “manifestly better” but died with smallpox. At autopsy, Pott found the vertebrae larger than usual and more open and “spongy.”

Pott operated on more patients to drain para-vertebral abscesses, in some instances with results that greatly exceeded my most sanguine expectations, by restoring several most miserable and totally helpless people to the use of their limbs, and to a capacity of enjoying life themselves, as well as being useful to others.

Antibiotics essentially eliminated tuberculosis of the spine by the middle of the twentieth century. It is still a problem in developing countries and is known as Pott’s disease. [10,11]

Percival Pott was the first to connect cancer to an environmental toxin when he attributed cancer of the scrotum to soot in the scrotal rugae of chimney sweeps. [12] At that time in England, young, impoverished boys were forced to work in chimneys where they were burned, bruised, and almost suffocated. Pott took pity on these poor urchins and made detailed examinations of their lesions. The cancer was a painful sore with hard, rising edges that invaded the dartos, the testicle, and then traveled up the spermatic cord to the lymph glands in the groin. Eventually, the cancer invaded the abdomen. This elegant description of a squamous cell carcinoma attests to Pott’s knowledge of anatomy and pathology. He said:

> *“If there be any chance of putting a stop to or preventing this mischief, it must be immediate removal of the part affected; I mean that part of the scrotum where the sore is, for if it be suffered to remain until the virus has seized the testicle, it is generally too late even for castration.”*

Potts published his work on scrotal cancer in 1775. Parliament enacted a bill that chimney sweeps must be at least twenty-one years old. The law was not enforced until 1875.

Percival Pott is still today, one of the great names in surgery. The many eponyms involving his name have helped countless students remember obscure diseases.

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THE UNIVERSITY OF EDINBURGH

During the Middle Ages, disease was thought to be God's punishment for transgressions. Quacks pretended to make diagnoses by studying the stars or the entrails of animals. Priests, the only educated class treated the sick with prayer or herbal remedies but were not allowed to shed blood. Uneducated, itinerant barbers travelled from town to town, cutting for bladder stones, removing tumors and amputating diseased limbs. Wound infection and death followed in their wake.

The University of Edinburgh School of Medicine made the transition from the dark days of the dark age to become the world's foremost center for scientific, humane medical care and education during the 18th and 19th centuries.

The barber surgeons of Edinburgh incorporated in 1508 and by the end of the century required a six-year apprenticeship. The surgeons and barbers separated in 1718. In 1778, King George III signed an act creating the Royal College of Surgeons of Edinburgh. [1]

During the late 18th and early 19th centuries Scottish Presbyterians sought asylum in Holland and Scottish students studied at Leiden where there was a well-equipped medical school. [2] Archibald Pitcairn, a Scot was a professor at Leiden with John Munro founded the Edinburgh medical school in 1697. From the beginning, the medical school combined study of the humanities with science and bed-side teaching. The students were well grounded in the classics, anatomy and learned the physical signs of disease from sick patients. [3]

Alexander Munro, son of John Munro studied medicine in London, Paris and Leiden; The Edinburgh town council appointed him to be the professor of surgery and anatomy in 1720. He and his father were instrumental in founding the Royal Edinburgh Infirmary as a hospital for the poor and a place for medical students to learn medicine.

The Munro's taught anatomy and surgery throughout the eighteenth century and a physician, John Rutherford gave a course of lectures on practical medicine at the Royal Infirmary. These lectures were the basis for what

became known as the Edinburgh method of teaching. The fame of the school spread and between 1726 and 1799, 195 students came from North America to study at Edinburgh. Benjamin Rush, who signed the Declaration of Independence, Caspar Wistar and Phylip Syng Physic who founded the first medical school in America at the University of Pennsylvania were Edinburgh graduates.

In addition to lectures and anatomical dissection, students observed operations at the hospital. John Bell, one of the leading surgeons suggested that an operation to remove an ovarian tumor might be possible. Ephraim McDowell from Danville Kentucky studied with Bell in 1793-94. In 1809, he carried out Bell's suggestion to surgically remove an ovarian tumor. His patient survived the operation and lived for many years. [4]

Some Edinburgh medical students, such as Charles Darwin, were repelled by suffering patients and abandoned medicine. James Simpson at first planned to give up medicine, but instead discovered the anesthetic, chloroform, which was easier to produce and had fewer side effects than ether. Simpson advocated anesthesia for childbirth, became the world's foremost obstetrician-gynecologist and surgeon to the Queen.

Surgeons needed bodies to teach students and to practice operations. The bodies of executed criminals and unwanted orphans used for dissection were in short supply. This led to robbing graves. The usual practice was to open the head of the grave, pull the body from its casket, place the body in a bag and sell the body to professors at the school. The demand for bodies led to more grave robbing until two body snatchers, William Hare and his accomplice, William Burke, secured bodies by strangling inmates of their boarding house. They murdered at least sixteen victims, some of whom were found in the dissecting room of Robert Knox, a popular professor at the school. Public clamor led to his retirement despite the support of his students.

Robert Liston studied the classics and mathematics at the University of Edinburgh and then went into medicine. By 1815, he was an anatomical dissector and house surgeon at the Royal Infirmary. He also studied surgery in London for a year and was a fellow of both the Royal College of Surgeons of Edinburgh and London. Liston, the most brilliant surgeon of his time advocated rapid operations and to stretch the skin during the initial incision to reduce pain. [5] He could apply pressure to the femoral artery with one hand and with the other amputate a leg at the thigh. Liston became the

Surgeon to the Royal Infirmary in 1828 but five years later went to London. He was the first surgeon in England to use ether as an anesthetic.

James Syme, Liston's assistant in 1818, gave lectures and did anatomical demonstrations for students. When Liston went to London, Syme became the Surgeon in Chief at the Royal Infirmary, a position he held until 1869 when Joseph Lister, his son-in-law succeeded him.

Syme performed jaw resection for tumors and nasal reconstruction even before the introduction of anesthesia. [6] His method of amputating the forefoot is still termed the 'Syme amputation.' After the introduction of anesthesia, the numbers of operations increased so much that in 1853, he had a new surgical hospital constructed at the Royal Infirmary. James Syme may well be the first modern surgeon. He inspired students and young surgeons, adopted advances in surgery and was kind to his patients. Syme's assistants were 'house surgeons' who spent their entire time caring for patients in the hospital. This system of surgical education was the forerunner of the residency program initiated by Halsted at the Johns Hopkins University in the early 1900's.

Joseph Lister visited Edinburgh to observe Syme in 1843. Lister had graduated from the University College Hospital in London and had already passed the examination for the Royal College of Surgeons. He had planned to study surgery on the Continent, but after observing Syme and the superior surgical facilities and the ready exchange of ideas at Edinburgh, Lister stayed as Syme's assistant and house surgeon. [7]

Joseph Lister's work with antisepsis would revolutionize surgery by eliminating infection.

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LISTER AND ANTISEPSIS

The 19th century saw the introduction of three great advances in medicine and surgery. The first, ether anesthesia, that eliminated pain during surgery, occurred in Boston, Massachusetts in 1846 This major discovery increased the numbers of operations, but almost every wound became infected, and many patients died with sepsis. The painstaking scientific work of Joseph Lister in Glasgow and later Edinburgh nearly banished wound infection. Conrad Roentgen, a German physicist, in 1895 discovered the mysterious 'ray' that allowed physicians to literally 'see' inside the body.

Joseph Lister, born in 1827 to a Quaker family in Upton, England, decided at an early age to become a surgeon. At the age of seventeen he attended University College in London, took a B.A. degree and then qualified in medicine at University College Hospital. [1]

On December 21, 1846, while a first-year student, Lister observed Robert Liston perform a thigh amputation with the patient under ether. This was the first operation under ether in England. [2]

As a house surgeon in London, Lister was profoundly disturbed by the terrible suffering of septic patients; he was responsible for treating cases of hospital gangrene by scraping away the slough and applying a caustic chemical. He described the progress of the disease in a case that demonstrates his early interest in the chemical treatment of wounds:

> "*The only exception to this rule was a very stout woman, in whom the disease attacked an enormous wound of the forearm caused by an accident that raised a very large flap of skin. In that case the caustic application removed indeed the pain and the extensive inflammatory blush; but when the slough separated, a small brown spot was seen at one place among the otherwise healthy granulations, and this spread with astonishing rapidity over the entire sore. The treatment was tried again and again with the same result, till the deep structures of the limb having become seriously involved, Mr. Erichsen resolved to amputate. On the evening before the day of the operation, I again put the patient under chloroform, and after scraping the sore very thoroughly, allowed the liquid caustic to lie in pools upon it for a quarter of an hour to destroy as effectually as possible all material in the sore that might otherwise infect the amputation wound. With a similar*

> *object, I washed the skin of the limb with soap and water including the shoulder, where it had been decided to perform the amputation. The stump healed perfectly kindly." [3]*

In September 1853, Lister went to Edinburgh to observe James Syme, the Surgeon in Chief at the Royal Infirmary, known the world over for his operative and teaching skills. [4] Lister soon became Syme's devoted friend and in 1856, he married Dr. Symes' daughter Agnes. Four years later he was called to Glasgow as surgeon to the Royal Infirmary. There, he continued research that led to his discovery of the antiseptic properties of carbolic acid. His writings from early on in Glasgow demonstrate inventive skills:

> *"I had a very satisfactory case the other day, giving me the first opportunity of using to advantage on the living body an instrument which I made some time ago for extracting foreign bodies from the ear. Children often put in objects of a rounded shape, such as small stones, beads, etc., and when they are nearly as large as the meatus auditorious, it is extremely difficult to get them out. Attempts with forceps only push them further in and thus, the irritation is increased, and inflammation, it may be fatal inflammation is induced. The instrument I have contrived is a hook with the lower end curved that can be passed between the wall of the canal and the foreign body, then turned and withdrawn with the object. The patient was a little girl who had put in a large iron bead two days before. She could not sleep the night before I extracted it, but next night, she slept well." [5]*

While an assistant surgeon in Edinburgh, Lister published his first clinical paper. The patient was a six-year-old girl whose legs became deathly pale following scarlet fever. One leg turned gangrenous; Lister performed an above-the-knee amputation and dissected the amputated leg. He found an organized clot in an inflamed popliteal artery that extended into the anterior tibial artery. In typical fashion, he used this case to discuss blood coagulation. [6]

Most of Lister's practice in Glasgow was orthopedic trauma or complications of tuberculosis, such as joint infections and psoas abscesses. Prior to the introduction of antisepsis, compound fractures, osteomyelitis and joint infections required amputation. A few surgeons had success in salvaging limbs after excision of joints, but excision of the wrist joint was unsuccessful until 1865 when Lister reported on fifteen patients in whom he had excised the wrist joint for tuberculosis or trauma. Eight of these patients were children or teenagers. [7]

The idea for successful wrist joint excision came to him when a seventeen-year-old boy who had fallen down a mine shaft presented with a compound dislocation of the wrist:

> "*The articular ends of the radius and ulna protruded interiorly for about an inch and a half through an irregular wound. I sawed off the exposed portions of the bone and placed the limb in a splint. At the end of five months, his hand was nearly as supple and strong as the other*."

He then studied the anatomy of the wrist joint, in order to preserve the nerves and tendons to the fingers while removing the carpal bones and all involved cartilage in patients with tuberculosis of the joint. He said this about preserving function: "*…to save a hand from amputation and restore its use-fullness is an object worthy of any labor involved in it."*

Until 1865, all hospitals were unsanitary and had running water. Lister's ward in the Glasgow infirmary often had to be closed because of postoperative pyemia and hospital gangrene. Attempts to improve cleanliness with soap and water and open windows did little to prevent infection. Most surgeons accepted the idea that these diseases were due to overcrowding, dirt and air pollution, but some, accustomed to "a good old surgical stink," hardly noticed the sickly odor that pervaded the wards. [8]

A few surgeons, such as Ignaz Phillip Semmelweis in Vienna, realized that simple hand washing could reduce the incidence of puerperal fever. Sadly, the medical profession ignored and ridiculed Semmelweis. There were scattered attempts to prevent wound infections by the application of substances such as alcohol, tincture of benzoic and coal tar products. In 1865, Lister learned from the work of Louis Pasteur that putrefaction or wound suppuration was a form of fermentation caused by microscopic "beings" carried by the air. After careful study, he decided to exclude air and microorganisms from the wound with carbolic acid. His article, "A New Method of Treating Compound Fractures, Abscesses, Etc." appeared in the journal *Lancet* in 1867. [9]

The first patient on whom Lister used the carbolic-acid method, an eleven-year-old boy named James G., was admitted to the Glasgow Royal Infirmary on August 12, 1865 with a compound fracture of the left leg caused by the wheel of an empty cart passing over the limb a little below the middle. A probe passed into the wound went some inches beyond the site of the fracture. Lister's house surgeon applied lint dipped in carbolic acid over the wound. When carbolic acid irritated the skin, he applied a dressing soaked in a solution of one-part carbolic acid in twenty parts of

olive oil. After six weeks, the bones were firmly united and two days later the "sore" was entirely healed. Four of Lister's original eleven patients with compound fractures treated with carbolic acid were children, usually with terrible injuries. A crowd omnibus ran over the right leg of a seven-year-old boy. He was in shock from blood loss, his tibia was broken, the skin wound extended from the knee to ankle and muscles were contused. With the boy under chloroform, the entire wound was irrigated with carbolic acid, the skin flaps were replaced but not sutured, and the bone positioned with the leg extended. Despite extensive sloughing of the wound and exposed bone, Lister saved the limb with applications of carbolic and nitric acid. After many months, and many debridements, the wound healed.

He also applied his antiseptic technique to the treatment of abscesses and infected joints. He treated two in 1867 for large tuberculosis abscesses. One was a five-year old boy with a psoas abscess reaching from the umbilicus to mid-thigh. After draining a "pound of pus," Lister wiped out the interior of the wound with a rag dipped in carbolic acid and applied a carbolic dressing. He also used carbolic acid to treat an infected ankle joint in a boy after draining pus and later reported that the ankle was free from pain and drained only a small amount of clear liquid. [10] In August of 1867, Lister presented a penetrating wound of the thorax, a gunshot wound and the case of a boy whose arm had become entangled in machinery to the British Medical Association:

> "*There was a wound six inches long and three inches broad, and the skin was very extensively undermined beyond its limits, while the soft parts were generally so much lacerated that a pair of dressing forceps introduced at the wound and pushed directly inwards appeared beneath the skin at the opposite aspect of the limb. From this wound several tags of muscle were hanging, and among them was one consisting of the triceps in almost its entire thickness; while the lower fragment of bone, which was broken high up, was protruding four inches and a half, stripped of muscle, the skin being tucked in under it. Without the assistance of the antiseptic treatment, I should certainly have thought of nothing else but amputation at the shoulder joint; but, as the radial pulse could be felt and the fingers had sensation, I did not hesitate to try to save the limb and adopted the plan of treatment described above, wrapping the arm from the shoulder to below the elbow in the antiseptic application, the whole interior of the wound, together with the protruding bone, having previously been freely treated with strong carbolic acid*." [11]

This wound, which would tax today's surgeons, healed. In those days, the healing of a wound this severe without infection was miraculous.

In 1869, Lister replaced James Syme as professor of surgery at the University of Edinburgh and became chief surgeon to the Royal Infirmary. He continued to teach, lecture, do research and carry on a busy practice while propagating the antiseptic method. His students, house officers and visitors who came to see his technique became enthusiastic followers, but the profession at large ignored Lister and ridiculed his germ theory. In 1877, he accepted the call to become professor of surgery at Kings' College in London so he could convince more surgeons to follow his antiseptic technique.

After many frustrating years the profession recognized his great work and Lister was showered with honors. Throughout his life, he continued to do research in bacteriology, chemical antiseptics, anesthesia, and especially absorbable, sterile catgut ligatures. He introduced heat sterilization and was the first to demonstrate that ligatures could be cut short and left in the wound. In adults he operated on cancers of the breast, tongue and penis and diseases of the bones and joints, placed skin grafts on open wounds and treated incarcerated hernias. His practice in Edinburgh must have included large numbers of children because he said there were often two or three children in a bed. [12]

Throughout his writings, he fondly referred to his pediatric patients: "*I opened in a little, sickly, dwindled child a conjoint psoas and lumbar abscess, associated with spinal disease. I emptied the extensive cavity by free incision in the lumbar part and dressed with gauze."*

Within a week of opening the abscess, the discharge was only a few minims of serum per diem and the boy had already picked up wonderfully in general health. [13] After he removed a rib and drained thirty ounces of pus from an empyema in a six-year-old boy, treated with antiseptic dressings, he said*, "I was delighted to see, on coming back after a fortnight's absence, how plump the emaciated little fellow had become."*

During his presidential address to the British Association for the Advancement of Science in 1896, Lister told how the introduction of anesthesia 50 years earlier had revolutionized the practice of surgery. He discussed the recent discovery of roentgen rays, but most of his lecture was on Pasteur's work in bacteriology and his treatment for rabies. He discussed the identification of the staphylococcus and streptococcus bacteria that caused erysipelas, the tubercle bacillus and the discovery of an antitoxin for diphtheria. Lister himself made many original observations in the field of

bacteriology and had almost single-handedly demonstrated how germs caused infections in surgical wounds.

During the latter part of the nineteenth century, acceptance of the germ theory and Lister's antiseptic technique led to more advances in the fight against infection. Steam sterilization was used for instruments and linens; gowns replaced blood-stained frock coats, and surgeons vigorously scrubbed their hands and the patient's skin with chemical antiseptics. They had also learned to cover their faces and hair with caps and masks. These advancements led to new operations for stomach cancer, congenital pyloric stenosis, intussusception, appendicitis, hydrocephalus and spina bifida.

Lister's most valued trait was his invariable gentleness and sympathy. Once a small urchin in the wards, following Lister with his eyes, confided in a bystander, "*It's us wee yins he likes best and next, it's the auld women."*

The poet, William Ernest Henley spent twenty months, [1873-75] on Lister's service in the Edinburgh Royal Infirmary. Henley's left foot had already been amputated because of tuberculosis. When his right foot became infected, surgeons in London advised another amputation, but the poet had learned of Lister's success in saving infected limbs. Henley's poems describe the grim dingy waiting rooms, his fellow patients, the nurses, house surgeons, his many nights, languishing in bed and, of course, Lister. [14]

His brow spreads large and placid and his eye
Is deep and bright, with steady looks that still
Soft lines of tranquil thought, his face fulfill
His face at once benign and proud and shy
If envy scout, if ignorance deny
His faultless patience, his unyielding will
Beautiful gentleness and great splendid skill
Innumerable gratitudes reply
His wise, rare smile I sweet with certainly
And seems in all his patients to compel
Such love and faith as failure cannot qual
We hold him for another Herakles
Battling with custom, prejudice, disease
As once the son of Zeus with Death and Hell

After being summoned to treat Queen Victoria for an axillary abscess, Lister was made a baronet in 1883 and a lord in 1897. In London, a monument in his honor bears a single word: "LISTER."

Although asepsis has almost supplanted Lister's work, we still swabbed the stump of the appendix with carbolic acid and alcohol during the 1960s, and an over-the-counter preparation containing phenol is still one of the best remedies for itching insect bites. A few of us continued to irrigate traumatic wounds with antiseptics at least until the early twenty-first century.

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JOSEPH BELL, SURGEON, HUMANITARIAN AND THE MODEL FOR SHERLOCK HOLMES

Dr. Joseph Bell entered the University of Edinburgh Medical School in 1853 and graduated in 1859 when he was 21 years old. Both of his grandfathers had been surgeons and his father practiced ophthalmology in Edinburgh. [1] With his distinguished heritage, Bell could have rested on his laurels, but he worked hard and excelled in the classics and surgery.

He became a 'dresser' for Dr. Syme which allowed him to see operations and to look after surgical dressings. His graduation thesis on epithelial tumors was a factor in his becoming a house surgeon at the Royal Infirmary and an assistant to Dr. Syme.

In 1864, during an epidemic of diphtheria, he worked around the clock, caring for children. The disease produced a thick membrane within the trachea that obstructed the airway, leaving children blue and gasping for breath. The treatment, a tracheotomy, or the placement of a metal tube in the windpipe through a surgical incision helped, but the tube soon became obstructed with thick pus. There were no suction machines to remove thick pus, so Bell devised a pipette for mouth suction to remove the material to relieve obstructed airways. As a result, he contracted diphtheria and was left with a partially paralyzed vocal cord and a weak leg. His voice, thereafter, was weak and he walked with a limp. [2]

While he was a house surgeon, he demonstrated anatomy at the medical school. He was popular with students for his ability to teach and his power of observation that led to his superior diagnostic skill. At the age of twenty-two, while a house surgeon, he presented a paper to the Royal Medical Society on a pulsating tumor of the orbit, that he cured by ligating the common carotid artery. The "tumor" must have been an aneurysm.

While Bell was a house officer under Syme, Lister was working with antisepsis. In 1865, the hospital board appointed Bell to be Syme's clinical assistant and in 1871, he became a full surgeon in charge of the wards. He started the Nightingale system of nursing, took the nurses on Saturday ward rounds and insisted on cleanliness in every part of the hospital.

He was one of the first to embrace Lister's antiseptic surgery but went even further by rolling up the sleeves of a clean white shirt and washing his hands and arms, instead of wearing the traditional frock coat while operating.

Dr. Bell taught a course on operative surgery and published "*A Manual of the Operations in Surgery*" for students and house surgeons. This book covered all phases of operative technique, with anatomical accuracy. He taught clinical surgery for thirty-six years, [1833-1869].

Tuberculosis is mainly a disease of the lungs, but before there was effective antibiotic treatment, tuberculosis of the bones and joints was a common problem, especially in children. The disease destroyed joints and often required amputation of the affected extremity. Lister's antiseptic treatment allowed a surgeon to excise the diseased cartilage and bone and save the limb. Excision of the joint left the patient with a rigid immovable joint, but the fingers could grasp objects and the foot was still functional.

In the 1883 edition, his remarks on tuberculosis of the joints in children reflect his concern for social conditions in Edinburgh. Many of his patients were from poor, working-class people who lived in abject poverty with an inadequate diet. Bell said, "*The patient has youth on his side, could we give him fresh sea air, a good diet and cod liver oil, etc. we might very likely obtain an ankyloses, [rigid joint, but a saved limb], but he may die while trying for this ankyloses and also his ankyloses may so lame and deform him that an amputation may still be required*." [3]

A story about a twenty-seven-year-old man whose both legs had been crushed by several loaded wagons illustrate Dr. Bell's skill as a surgeon. "*I was in hospital at the time and so with as little delay as possible he was placed on the operating table. I obtained his leave to remove both legs above the knee; but his pulse was very feeble, and he was intensely nervous, throwing his arms wildly about, panting for breath, and looking very ill, cold and exhausted*."

This is a perfect description of traumatic shock. A patient this ill brought to a hospital emergency room today would be in great danger of dying. Dr. Bell amputated both legs, with strict attention to antisepsis. The operation was completed, the amputation stumps bandaged, and the patient was in his bed within 24 and a half minutes after his admission to the hospital. Within a week, he was out in the garden and his amputation stumps healed without infection. [4] A patient with this type of injury would do no better in a modern hospital with blood transfusion, modern surgery and antibiotics.

Dr. Joseph Bell is best known as the model for the detective, Sherlock Holmes. He had great powers of observation—which he taught to his students in the outpatient surgical clinic. The clinic was held in the surgical amphitheater of the Royal Infirmary. Tiers of seats were arranged in a semicircle around the "cockpit" with the operating table in the center. Students occupied the highest seats in the back, dressers next and house surgeons were in the front tier. Visitors were seated on chairs in the cockpit. Dr. Bell was always in the center.

There was a great variety of patients from those with diseases of the skin to cancers. Dr. Bell's clerk, a medical student along with his staff obtained a basic history from each patient then brought the patient to Dr. Bell where they gave the patient's history the physical findings and a tentative diagnosis. Dr. Bell would listen to the complaint and observe, with his 'eagle-like' eyes, the calluses on the patient's hands, the mud on his boots, the gait, dress and speech. By observing these seemingly minor details, he would deduce the patient's occupation, where he lived and the medical diagnosis.

One of his tricks to develop the power of observation in his students was to "test" urine or any foul-smelling liquid by inserting his third finger into a vial of the liquid, then put his index finger in his mouth to 'taste-test' the liquid. He would then pass the foul liquid to the students to perform a similar "test." Very few had observed his trick of switching fingers.

Arthur Conan Doyle, while he was a medical student in 1878 was Dr. Bell's outpatient clerk. At the time, Dr. Bell was 36 years old, sparse, lean and tall with an angular nose and unkempt hair. He had long sensitive fingers and his gray eyes twinkled with shrewdness. This was almost the same way that Dr. Watson described Sherlock Holmes during their first meeting at 221B Baker Street. [5]

In 1887, Dr. Bell retired from the Royal Infirmary. That same year he was president of the Royal College of Surgeons. He became the first surgeon to take charge of a ward at the Royal Edinburgh Hospital for Sick Children. [6] His ward was soon filled to overflowing with children suffering with tuberculosis of the lymph nodes or joints, burns, cleft lip, hernias, club foot, spina bifida and phimosis.

His great humanity, a long tradition of the Edinburgh school is illustrated by what he said about the poor children with tuberculosis: "*A depressing lot of cases, some will say; but for the child's marvelous good nature and*

infinite fun once they recognize you mean friendship, their exuberant vitality renders it almost impossible for a child to die if only you can avoid shock and hemorrhage."

In his book, "Notes on Surgery for Nurses" [7], he says:

> "*Never deceive a child, tell it honestly that the dressing or movement you are going to make will hurt…but also that you will hurt as little as possible, and it will help you loyally. Don't make favorites; children are much sharper than you think, and a quiet child. May soon get a sore heart if you take less notice of it than the more cheerful one in the next bed. You must always have one great rule to guide you about sick children---they don't cry or moan for fun, but because they are ill and in pain, or from a nameless weariness if not in actual pain. Healthy children may yell and scream as an evidence and result of original iniquity, but sick children don't. If you once get a child's confidence and love it, it is marvelously loyal and utterly trustful. Adults can read and amuse themselves, but a child's convalescence will often be much hastened by toys, cheering words, and fun of the mildest types. The stages in sick children are more rapid. Death is imminent before you are aware; yet if staved off, recovery is like a miracle."*

Joseph Bell resigned as active surgeon to the Children's Hospital in 1897 but continued as a consultant until his death in 1911. He continued doing charitable work and had a busy private practice with both rich and poor patients. A colleague said of him, "Every child in Edinburgh is indebted to this great man, rich poor, church and unchurched." [8] At his funeral, an undertaker's helper wept huge tears into the open grave because Dr. Bell had treated his son for free for many years.

Dr. Joseph Bell's career spanned the later 19th century, the hundred years that saw the two great advances in medicine, anesthesia and the recognition of bacteria as the cause of disease. Dr. Bell unlike many doctors of his time incorporated these advances but also brought kindness and empathy to his patients. Together, these attributes are the result of the training in science and humanities offered by the Edinburgh school.

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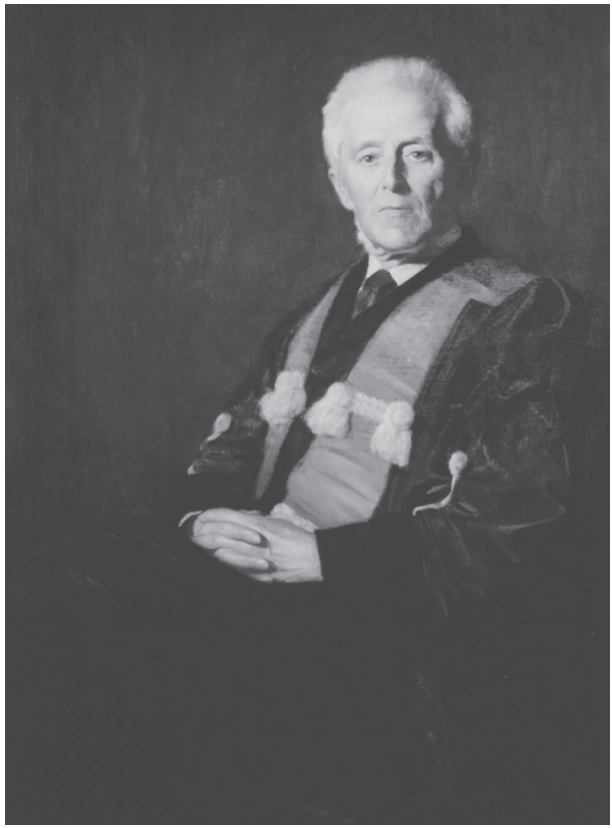
Dr. Bell operating in the Children's Hospital



Dr. Joseph Bell, in his Royal College of Surgeons robe. Painting in the museum of the R.C.S. Edinburgh

ARTHUR CONAN DOYLE

Arthur Conan Doyle has a world-wide reputation as an author. His experiences as a student and as a young physician provide insight into medical education at Edinburgh and medical practice during the latter part of the 19th century. Doyle's description of medical students demonstrates the sometimes-brusque attitude of students toward patients. Perhaps, this is a defense mechanism against the horror of seeing disease at first hand for the first time. Most students, at least the good ones soon get over this attitude.

Sir Arthur Conan Doyle was born on May 22, 1859, at 11 Picardy Place, Edinburgh, Scotland. The original building was torn down long ago but a statue of Sherlock Holmes wearing his deer stalker cap stands at the site.

Conan Doyle's father was an alcoholic and his poverty-stricken family was forced to live in in the rat-infested old town. The family moved from one rented apartment to another in poor neighborhoods. His saintly mother took in lodgers to support the family. Fortunately, his well-off uncles provided the young Conan Doyle with a classic Jesuit education. His teachers encouraged him to write and in addition to the usual subjects, he learned Latin, Greek and German.

Conan Doyle entered the University of Edinburgh Medical School at the age of 17 in 1876. Edinburgh was and still is one of the world's great medical schools. Unlike schools in the United States that required only two years of lectures for graduation, the Edinburgh School provided four years of study in the sciences, humanities and clinical medicine.

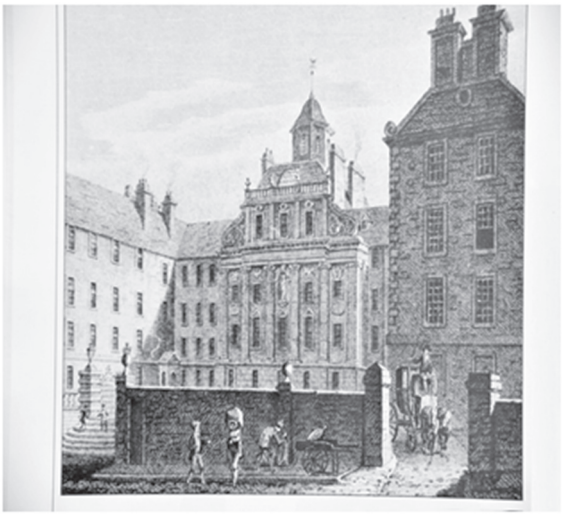
The faculty included James Simpson who discovered the anesthetic properties of chloroform and Joseph Lister, the founder of antiseptic surgery and a foremost surgeon during much of the 19th century.

Statue of Sherlock Holmes near Picardy Street, the home of Conan Doyle in Edinburgh

Prominent students at the University included Charles Darwin who was repulsed by an operation in the days prior to anesthesia. Robert Lewis Stevenson, a law student preceded Conan Doyle at the University by one year. J. M. Barrie was a contemporary and the poet, William Ernest Henley was a patient of Lister's at the time Conan Doyle was a student. Barrie and Doyle became fast friends and Doyle corresponded with Stevenson.

Conan Doyle described his medical education in one of his earliest short stories, "*The Firm of Girdlestone*," as a long grind and a business arrangement between the students and professors. He studied botany, chemistry, physiology, anatomy, surgery, medicine and midwifery. Human anatomy is the cornerstone of a medical education, but bodies were in short supply.

Until the middle of the 19th century, grave robbers supplied bodies for dissection. The infamous pair, William Burke and William Hare, not satisfied with waiting for their victims to die, committed 16 murders and sold the corpses to Dr. Robert Knox an anatomy professor. Perhaps, Conan Doyle studied the skeleton of William Burke that resides in the anatomical museum of the Royal College of Surgeons, Edinburgh.



The medical school

As a child, he may even have sung the skipping tune.

Up the close and down the stairs
But and ben wi Burke and Hare
Burkes the Butcher and Hare's the thief
Knox the boy that buys the beef

Dr. Joseph Bell, a fourth generation Edinburgh surgeon was one of the most influential and charismatic professors. Dr. Bell was a keen diagnostician who could at a glance determine a patient's occupation, nationality and medical diagnosis. Although Conan Doyle claimed he was a mediocre student, Dr. Bell selected him, when he was a second-year student to be his clinical clerk. Dr. Bell later said, "*Arthur was one of my best students. He was always interested in anything connected with diagnosis*."

Skeleton of William Burke, museum of Royal College of Surgeons, Edinburgh

The clerk took notes on each patient, arrived at a tentative diagnosis and presented the case to Dr. Bell in the great amphitheater of the Royal Infirmary. Conan Doyle described the waiting patients, the clerk and the amphitheater in his short story, "*His First Operation*."

> "*They passed under an archway and down a long stone-flagged corridor with drab colored doors on either side, each marked with a number. Some of them were ajar, and the novice glanced into them with tingling nerves. He was reassured to catch a glimpse of cheery fires, lines of white-counter-paned beds and a profusion of colorful texts upon the wall. The corridor opened upon a small hall, with a fringe of poorly clad people seated all around upon benches. A young man, with a pair of scissors stuck like a flower in his buttonhole and a notebook in his hand, was passing from one to the other, whispering and writing.*
>
> *"Anything good?" asked the third year's man.*
>
> *"You should have been here yesterday," said the outpatient clerk, glancing up. "We had a regular field day. A popliteal aneurism, a Colles' fracture, a*

spina bifida, a tropical abscess, and an elephantiasis. How's that for a single haul?"

"I'm sorry I missed it. But they'll come again, I suppose. What's up with the old gentleman?"

A broken workman was sitting in the shadow, rocking himself slowly to and fro, and groaning. A woman beside him was trying to console him, patting his shoulder with a hand which was spotted over with curious little white blisters.

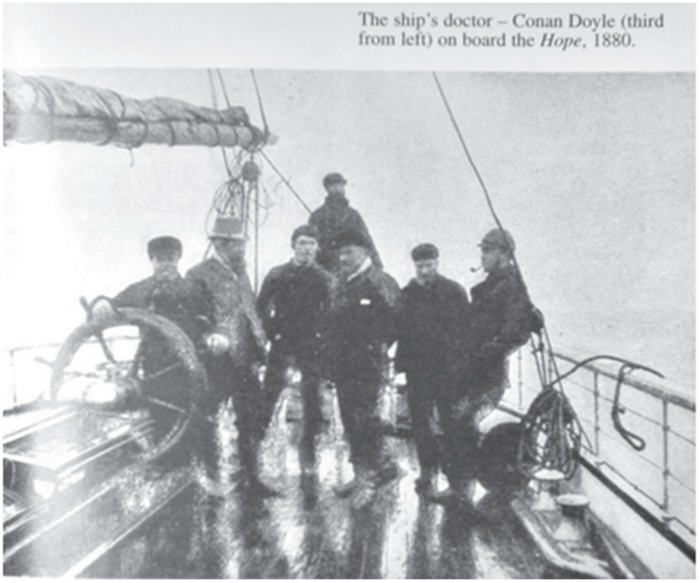
"It's a fine carbuncle," said the clerk, with the air of a connoisseur who describes his orchids to one who can appreciate them. "It's on his back and the passage is draughty, so we must not look at it, must we daddy? Pemphigus," he added carelessly, pointing to the woman's disfigured hands. Would you care to snip and take out a metacarpal?"

"No thank you. We are due at Archer's. Come on!" and they rejoined the throng which was hurrying to the theatre of the famous surgeon.

The tiers of horseshoe benches rising from the floor to the ceiling were already packed, and the novice as he entered saw vague curving lines of faces in front of him and heard the deep buzz of a hundred voices, and sounds of laughter from somewhere above him. His companion spied an opening on the second bench and they both squeezed into it."

Arthur Conan Doyle worked to pay his tuition and to help support his family. One of his first jobs was ship's surgeon on the Arctic whaling ship, *The Hope of Peterhead*. He apparently had few medical duties, although he probably treated cuts, bruises and broken bones that resulted from falls or fights. He spent most of his time reading, hunting seals, harpooning whales and boxing with his mates. The ship's captain named him, "The Great Northern Diver" as a result of his falls into the sea.

The whaler Hope



Conan Doyle with his shipmates

"I went out on the whaler a struggling youth, I came back a powerful, full grown man," He said.

By working as a physician's assistant, he earned money and gained experience in minor surgery, filling prescriptions and delivering babies.

He commenced writing short stories while he was assisting Dr. Hoare in Birmingham, but his first medical essay was on the serious side effects of the drug Gelseminine, a plant extract of the Yellow Jasmine. The drug which contains potent alkaloids was used to treat pain such as sciatica and migraine as well as muscle spasm and epilepsy. Conan Doyle discovered, by self-experimentation, that with increased doses, the drug had serious side effects. He published his paper in the British Medical and Surgical Journal, [1879. 2, 483]. It would be extraordinary, even today for a medical student to publish a paper in a prestigious medical journal. The drug is still available as an over-the-counter homeopathic preparation.

In 1881, he graduated with a Bachelor's in Medicine and a Master's in Surgery. By any measure, Conan Doyle had an outstanding medical education. Although he claimed to be a mediocre student Doyle had several "firsts" for his studies. He acquired the finer points of diagnosis from Dr. Bell and as a physician assistant he learned the practical aspects of medical practice. Another student paid him a great compliment: "he had a kind and considerate manner towards poor people."

Self-caricature, 'license to kill'

Dr. Arthur Conan Doyle M.B. C.M., graduate of the University of Edinburgh.

Graduation Portrait

With no other prospects, he went as ship's surgeon on the steamship *Mayumba* to the West Coast of Africa; he treated sea sickness and tropical fevers. On his return, still with no prospects, he took a position with a former classmate, George Turnavine Budd. Conan Doyle recognized Budd as unethical and soon left. Conan Doyle regarded medicine as a profession devoted to philanthropic altruism, rather than a way to make money.

In his autobiography and in the "*Stark Munro Letters,"* he described the excision of a cancer from the nose of an old soldier who had for many years held a clay pipe between his chin and nose. He wrote, "*Of course, there could be no question as to diagnosis. It was an epitheliomatous cancer, caused by the irritation of tobacco smoke."*

In this statement, Conan Doyle demonstrated his diagnostic skill and was years ahead of his time by attributing the cancer to tobacco smoke.

It was about the same time, or perhaps during his practice in , he removed a dermoid cyst from the eyebrow of a young man. Dermoid cysts are related

to teratomas, a rare form of tumor that contains many different tissue elements. Conan Doyle not only recognized the pathology as a dermoid cyst but identified its contents, "a rudimentary jaw and teeth." He wrote, "*I think that every cell in the body has the power, latent as it may be by which it may produce the whole individual*." This extraordinary observation indicates a deep knowledge of human pathology and development. It wasn't until the 21st century that we understood the potential of stem cells to reproduce various tissues in the body.

In the summer of 1882, Dr. Arthur Conan Doyle hung his brass plate, engraved "Dr. Arthur Conan Doyle, Physician and Surgeon" at 1 Bush Gardens in , a suburb of Portsmouth. He also put a red lamp over his door, which instead of the usual meaning, indicated a physician's residence. For the next eight years, until January 1890, Conan Doyle practiced general medicine and commenced his career as a writer.

The young doctor at 1 Bush Gardens

His first patient was "a little anaemic old maid, a chronic hypochondriac." His practice grew slowly, prodded on with a bit of self-promotion, such as the time he treated a man who had been thrown by a horse and sustained bruises. Conan Doyle immediately reported the incident to the local

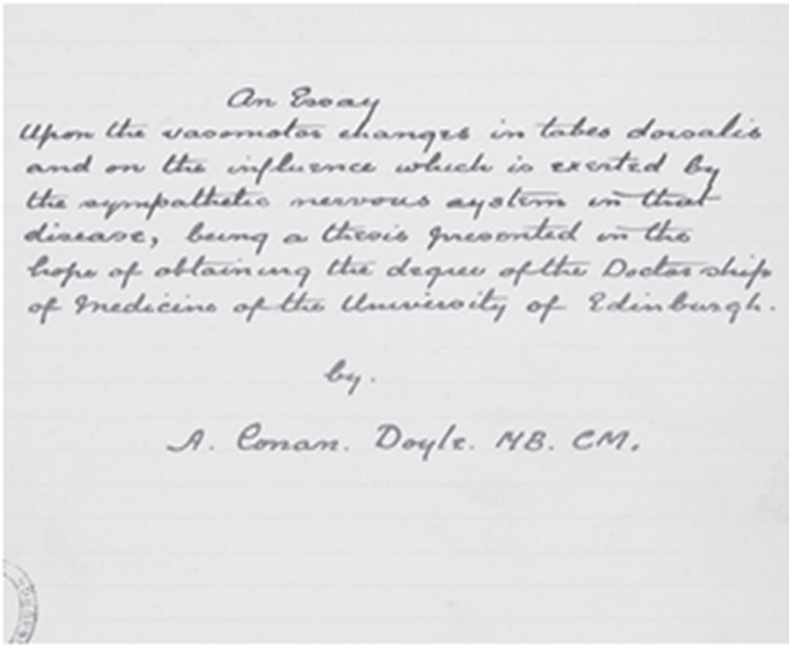
newspaper. He did the same after treating a man for a stab wound of the chest. He vaccinated babies, treated children with measles, an old man with consumption, [tuberculosis] another old fellow with cirrhosis, heart trouble, kidney disease and an enlarged spleen as well as patients with minor injuries. There was a grocer with epilepsy and a lady with dyspepsia who, shortly after seeing Conan Doyle died with a bleeding gastric ulcer. He had no way to make the diagnosis of an ulcer prior to her death, since there were no X-rays. Apparently, he did a good bit of obstetrics because, in 1889, he delivered his own daughter at home. He truly had a general practice and won a reputation as being a hardworking, compassionate, skillful physician. He dispensed his own ointments, tinctures, pills and powders. As his practice grew, he made a comfortable living. His interest in preventive medicine led him to advocate vaccinating soldiers and sailors against smallpox and the testing of "harlots" for venereal disease.

In 1885, Dr. Conan Doyle submitted a medical thesis and took an oral examination to qualify as a Doctor of Medicine. This was unusual because most practicing physicians were satisfied with a bachelor's degree. His thesis, entitled, '*An Essay upon the Vasomotor Changes in Tabes Dorsalis and on the Influence, which is exerted by the sympathetic nervous system on that disease'* is an 88-page, handwritten document.

He opens with "*It is with diffidence that a young medical man must approach the subject upon which so many master minds have pondered with views contrary to the authorities in a provincial town without pathology and histology*." Conan Doyle compensated for his lack of access to a laboratory by extensively reviewing the English, German and French literature.

"Tabes dorsalis" is neurosyphilis but when he wrote his thesis, the medical profession was divided on whether syphilis caused the disease. The sailors who explored the new world brought syphilis to Europe during the 16th century where it spread rapidly. Since he practiced near Portsmouth, a naval base, Conan Doyle would have encountered cases of syphilis among the sailors. He attributed the disease to the "poison" of syphilis even though the causative bacteria, Treponema Pallidum was not identified until 1905. He reviewed the anatomy of the nervous system, the lightening pains, unstable gait, problems with vision, skin and bone changes, the dementia and the psychiatric aspects of the Tabes dorsalis. He even quoted the German poet, Heine who suffered with neurosyphilis. Most of his thesis is still true today, but he wrongly attributed the disease to an interrupted blood flow to the spinal cord. He compared the symptoms of the disease to ergot poisoning that constricts blood vessels and even suggested a vasodilator for treatment.

He tried nitroglycerine on one patient and was ahead of his time, when he insisted upon what we now term, "informed consent." He wrote, "*Empiric experiments of this sort should only be tried with the knowledge and consent of the patient*."


An Essay
Upon the vasomotor changes in tabes dorsalis
and on the influence which is exerted by
the sympathetic nervous system in that
disease, being a thesis presented in the
hope of obtaining the degree of the Doctorship
of Medicine of the University of Edinburgh.

by.

A. Conan. Doyle. MB. CM.

Handwritten first page - Conan-Doyle's medical thesis.

Conan Doyle's doctoral thesis is for the most part scientifically correct, shows flashes of literary brilliance and demonstrates his interest in medicine.

In November 1890, Conan Doyle made a special trip to Berlin to investigate Robert Koch's claim of discovering a cure for tuberculosis. Koch was the world's pre-eminent bacteriologist who in 1884 had identified the bacteria responsible for cholera and tuberculosis. Conan Doyle decided that Koch's vaccine had little effect on tuberculosis. He then wrote about his findings in a letter to the Daily Telegraph. Very few young physicians would have the courage to contradict one of the world's most prominent scientists, but he was correct.

During the later years of his practice he learned to do refractions and prescribe glasses at the Portsmouth Eye Hospital. In December 1890, Conan Doyle left Southsea to attend lectures on diseases of the eye in Vienna. He had difficulty understanding the lectures and left after a few months to establish an eye practice in London. He had no patients and after a bout with influenza, he gave up his practice to write full time.

His medical career was not quite over; Conan Doyle was honor bound to take part in the Boer war. As a voluntary physician, he helped organize a front-line military hospital. When he arrived, the hospital was filled with soldiers suffering with typhoid fever and cholera due to contaminated drinking water. The field hospital built for fifty beds held three hundred and fifty sick soldiers. In his words the situation was "*death in its vilest, filthiest form*." An associate wrote of Dr. Conan Doyle; *It was difficult to associate him, [Conan Doyle] with the author of Sherlock Holmes: He was a doctor pure and simple, an enthusiastic doctor too. I never saw a man throw himself into duty as thoroughly heart-and-soul. – He threw open the door of one of the wards and what I saw baffles description. The only thing I can liken it to is a slaughterhouse.*

It fascinated me to watch the cheery doctor carrying the sunshine with him, wherever he went, worshipped by all." After the war, a soldier who had been under his care wrote, "*As one who was under your care at Bloemfontain in Langman's hospital, I and others owe my life to your kindness and care."*

In his book, "*The Great Boer War*," written two months after his return to England, he related his concern for the need of sanitation and better organization in the military medical department.

In 1910, he addressed the medical students at St. Mary's Hospital in London on "*The Romance of Medicine*." His talk, published in the St. Mary's Hospital gazette relates his experience as a practitioner and tells how diseases in world leaders, such as Napoleon changed the course of history. He warned the students against materialism and emphasized the humanness of medicine. He said, "*There is another fact which life will teach you—the value of kindliness and humanity as well as knowledge—A strong and kindly personality is as valuable as learning in a medical man."*

Conan Doyle introduced disease, drugs and doctors into his Sherlock Holmes stories. Two of his novels have a medical theme and he wrote nineteen short stories about doctors and disease. These stories include descriptions of difficult childbirths, an elderly doctor who had not kept up

with scientific advances but had the healing touch and a poignant tale about a young man who committed suicide when he discovered he had congenital syphilis.

There are critics who claim Dr. Arthur Conan Doyle became a writer because he was a failure in medicine. It is true, he did not succeed as an eye specialist, but he was a skilled, highly regarded physician who took a special interest in syphilis and tuberculosis, two diseases that were common during the 19th century. More of Conan Doyle's literary output has a medical theme than other physician authors such as Somerset Maugham, Anton Chekov and Oliver Wendell Holmes, who was one of Conan Doyle's literary heroes.

In his later years, possibly as a result of notoriety for being the model for Sherlock Holmes, Dr. Joseph Bell consulted on forensic matters with Scotland Yard. Like Holmes, Dr. Bell used his powers of observation and character analysis to solve crimes. During the elections of 1904, Dr. Bell supported Arthur Conan Doyle's stand for parliament. Dr. Bell continued to visit hospital patients and make house calls until his final illness in 1911.

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MAX WILMS AND HIS TUMOR

The introduction of ether anesthesia in America and Lister's antisepsis in the 19th century revolutionized medicine and surgery. Unfortunately, English and American surgeons ridiculed the germ theory of disease and antisepsis. German surgeons embraced antisepsis and went further by introducing asepsis that with steam sterilization not only excluded bacteria from the wound, but from the instruments and linen.

Medical education in Germany included intense study of the basic sciences and long periods of training as an assistant to a professor. German speaking doctors led the world in science, medicine and surgery during the early years of the 20th century until interrupted by war.

Carl Max Wilhelm Wilms is a prime example of the German speaking surgeon-scientist whose studies in pathology and embryology increased our knowledge of one of the most common childhood cancers. At the beginning of his study, Wilm's tumor was incurable, but by the middle years of the 20th century, the combination of surgery, radiation and chemotherapy saved the lives of children afflicted with this cancer.

Max Wilms was born in 1867 in Hunshoven, Aachen near the border of Germany with the Netherlands and Belgium. The town is now incorporated into Geilenkirchen a six-hundred-year-old city. [1,2] He was baptized Carolus Maximilianus Wilhelmus Wilms and attended school in Solingen and later in Cologne. His father encouraged Wilms to study law, but he quit after one semester in law school. In 1886, he studied medicine at Munich. Despite having to repeat several courses, he obtained a degree at Bonn in 1890. His forty-page doctorate thesis reviewed five patients who had undergone resection of the esophagus.

Wilms then spent six months in obligatory military service. He aspired to be a surgeon, but in 1892 joined the Pathology Institute at Geissen with Eugen Bostroem, the professor of pathology. Bostroem was interested in kidney pathology and had reported a child with an enormous 'rhabdomyosarcoma' of the kidney. [3] Wilms continued his training with Otto Leichtenstern the head physician of the city hospital of Cologne. Leichtenstern, one of the most distinguished physicians of his time, wrote

on many topics including the role of 2-naphylamine, an aniline dye in causing bladder cancer. [4]

In 1897, when Wilms became an assistant to Professor Frederick Trendelenburg at the Leipzig University. The German system for training surgeons was the model that William Stewart Halsted introduced into the United States. Frederich Trendelenburg [1844-1924] published on all phases of surgery and performed pioneering operations. The head down position for shock is still remembered as the "Trendelenburg" position. [5, 6]

Wilms published his monograph and qualified as a surgeon in 1899. Professor Trendelenburg pronounced him as one of the "fittest young docents in surgery in Germany." In 1907, Wilms became the Professor of surgery and Director of the surgical clinic at the University Hospital in Basel. In 1910, at the age of 42 years, he was appointed Professor of surgery and Chief of surgery at the University Clinic in Heidelberg. [Figure 1] He operated on the neck, chest, abdomen and extremities and developed new techniques for prostatectomy and thoracoplasty. He performed the Ramstedt operation for hypertrophic pyloric stenosis in five minutes.

At the onset of World War I, he was appointed chief surgeon and consultant to the reserve army corps of Baden. In January 1915, he was transferred to garrison duty in Kassel, and in March 1915, was assigned duty with the reserves at Heidelberg, where he also lectured at the university.

While he was in Heidelberg, Wilms published 60 articles on topics as diverse as endocarditis, teratomas, dermoid cysts, bone development and intestinal obstruction. He co-edited a three volume, 1841 page "Lehrbuch Der Chirurgie," that covered every surgical specialty. [7] Wilms also invented a mercury manometer to measure spinal fluid pressure and devised an X-ray table to better visualize the esophagus.

In May of 1918, he operated upon a French prisoner of war with diphtheria. His patient survived, but Wilms became septic and died.

The childhood cancer that became known as "Wilm's tumor" has a long, interesting history. The Hunterian Museum of the Royal College of Surgeons of England has two specimens of bilateral kidney tumors that appear to come from an infant or young child. They were prepared by John Hunter sometime between 1763 and 1793, the year he died. J. Bruce Beckwith prepared microscopic sections and proved these specimens are the first known Wilms tumors. [8,9] In 1814, Thomas Rance, a London physician discovered a flank mass in a 17 months old child. A mass

appeared in the other flank and the child died at thirty months of age. At autopsy, the tumors occupied most of the abdominal cavity. [10] The clinical course of this patient and the gross appearance of the tumors are compatible with Wilms tumor, although there was no microscopic examination. Ebenezer Gairdner of Edinburgh, in 1828 reported a 'Fungus Haematodes of the Kidneys' in a three-year-old girl who had progressive abdominal swelling for two years. At autopsy, both kidneys were replaced by lobulated, degenerated tumors. [11] A seven-year-old boy with a rapidly growing tumor was presented to the Pathological Society of London in 1856. At autopsy, the gelatinous, necrotic tumor weighed 31 pounds. A microscopic description merely confirmed the diagnosis of cancer; there were no details. [12]

In 1872, C.J. Eberth, a German pathologist, observed spindle cells, striated muscle bundles and undifferentiated round cells in a 17-month old infant with bilateral tumors and metastases. He suggested that elements of the tumor arose from the Wolffian body and was the first to observe the mixed nature of the tumor. [13] Other German pathologists found what appeared to be both carcinoma and sarcoma. [14, 15] These tumors were variously diagnosed as sarcoma, adenomyosarcoma, malignant embryoma, malignant nephroma and many others. In 1894, Birch-Hirschfeld, a pathologist, made the diagnosis of adenoma myosarcomaosum in a tumor that had been removed by Albert Doderlein, a professor of obstetrics and gynecology at Leipzig. [16] The child survived the nephrectomy. Birsch-Hirshfeld said all childhood renal tumors represented a single entity that developed from the Wolffian body. In the German literature, they were often referred to as "Birch-Hirschfeld" tumors.

William Osler, in 1880, while at McGill University in Montreal, made the first microscopic description of Wilms tumor in North America. [17] His first patient, a 19-month old boy, died 12 hours after a vaccination. The child's left kidney contained a grayish-white spongy tumor, seven centimeters in diameter composed of round cells, the size of blood corpuscles, with a large nucleus, spindle cells and striped muscle cells. Osler commented: "I have rarely seen in any specimen, the 'sarcous cells' so well marked."

His second patient, a three-and-a-half-year-old girl who died with a 'choking fit,' had a 15 by 7.5-centimeter tumor in her right kidney. The tumor extending through the renal vein and vena cava to obstruct the tricuspid and pulmonary valves. Osler diagnosed striated myo-sarcoma

although, he described two types of cells and used the term, “mixed tumor” and said these were “oncologic curiosities.”

These early case reports documented a high incidence of bilaterality, lung metastasis and the tumors’ huge size with few symptoms. Osler’s case also indicates the possibility of direct tumor extension to the heart.

In 1897, George Walker, an assistant resident surgeon at Johns Hopkins, published a 170-page article in the Annals of Surgery that included 112 references to sarcoma of the kidney in children. [18] In two tumors from patients operated upon by Drs. Halsted and Finney, Walker found a variety of spindle cells and small round cells with a deeply staining nucleus around blood vessels. He wrote, “From a study of these tumors it would seem that they were pure sarcomata, being thus distinguished from the mixed and glandular types, which are present in a large number of cases and serve to obscure their nature.” He also reviewed the histology in 142 cases from the literature and noted the presence of thin walled vessels with an endothelial lining, cartilage and striated muscle cells. In view of the young age of the patients and the finding of tumors at birth and in a fetus, Walker decided that the tumor developed in embryonic cells from the Wolffian body.

Mixed tumors of the kidney was the first of three monographs by Max Wilms. [19] The second was on mixed tumors of the uterus and vagina and the third was on the head and neck, especially, the parotid gland. Wilms aimed to define mixed tumors, clarify their origins and to correct misconceptions resulting from observations on a single microscopic section. He emphasized the need to study many sections from different parts of the tumor. Wilms credited Birch-Hirschfeld for observing the commonality of these tumors but he disputed the theory of origin from the Woffian body. After his detailed review of the literature Wilms presented eight further cases. He included hand drawn sketches of the gross pathology, illustrations from texts of embryology and colored micro-photographs. He eloquently described cells as “beautiful striated muscle fibers” or showing “very exquisite striation.” He used a staining technique that allowed him to see elastic fibers in connective tissue and recognized the round cells previously identified as sarcoma were really epithelial elements forming glandular alveoli. Thus, tumors formerly diagnosed as sarcomas were really a mixture of connective tissue, smooth and striated muscle and epithelial cells arranged around a lumen forming glands. He stated, “those plump sarcoma-similar cells are not connective tissue cells but embryonic precursors of epithelium.” Almost half of the eighty-page monograph is devoted to tracing the origin of various tumor elements back to the mesoblastic somite,

the mesenchyme and the mesonephros blastema. Wilms unified a morphologically diverse group of tumors. In future decades, pathologists would recognize a diversity of cell types but Wilms basic concept endured for more than a century.

Hugo Ribbert, a professor of pathology in Zurich used the term, "Wilms Tumoren" in a review of Wilms monograph published in January 1900 and stated that Wilms had significantly advanced the doctrine of tumor genesis.

The history of the treatment of the childhood cancer, that came to be known as Wilm's tumor is an example of how astute English physicians first recognized a rare, untreatable tumor, then a German scientist-surgeon elucidated it's pathology and then how American surgeons and a German trained pathologist developed methods of treatment that led to almost one hundred percent survival rate.

On June 7, 1877, in the Leeds Infirmary in Leeds, England, Thomas Richard Jessup performed a nephrectomy on a two-year-old boy for a malignant tumor of the left kidney. [22] Mr. Jessup wrapped the child in cotton batting to maintain body warmth and with chloroform anesthesia and antisepsis stripped out the tumor with gentle finger dissection. He placed a "whipcord ligature" around the renal vessels and ureter. The operation lasted fifty-five minutes. After the operation, the child was given milk, beer and morphine and discharged home on the 14th postoperative day. The child died with a recurrence nine months later. Mr. Jessup was a consultant in both medical and surgical cases, and in 1901 was the Senior Vice President of the Royal College of Surgeons.

Roswell Park, a surgeon in Buffalo New York, in 1885, removed a kidney tumor, weighing four pounds, from a two-year-old child. [23] Seven months later, at the time of his report, Dr. Park claimed to have the first long term survivor of a nephrectomy in a child. Park became famous for operating on President William McKinley after an anarchist shot the president in 1901.

Robert Abbe, surgeon to the St. Lukes Hospital, New York, in 1893 reported on two children who survived nephrectomy for malignant tumors. One was still living at one year after surgery and the other was in good health after one and a half years. [24] Abbe attributed his success to minimal blood loss, maintaining body temperature, hypodermic injections of brandy and strychnine and hot black coffee enemas.

Despite these early successes, Walker found only 28 immediate survivors after 74 operations; five children survived three years or longer. [25]

In 1916, Alfred Friedlander at the Cincinnati General hospital demonstrated that radiotherapy diminished the size of the tumor and caused tissue necrosis but did not affect survival. [26]

Only one of seventeen children treated in the Children's Memorial and Presbyterian Hospitals of Chicago with combinations of surgery and radiation survived. [27] Many had far advanced lesions and others, operated upon through a flank incision were considered inoperable.

William E. Ladd, the great pioneering pediatric surgeon at the Boston Children's Hospital, in 1941, established the eponym and outlined rational principles of treatment in his paper, Embryoma of the Kidney, [Wilms' Tumor]. [27] Ladd used only physical examination and intravenous pyelography for diagnosis. He pointed out the dangers of aspiration biopsy and opposed pre-operative radiation. He recommended immediate operation through a vertical, trans-peritoneal incision, ligation of the renal vein and artery prior to mobilizing the tumor and removal of peri-nephric fat with lymph nodes. He had no inoperable cases and no operative mortality in 23 nephrectomies after 1932. In sixty patients operated upon since 1914, Ladd reported 14 patients who were alive from 2 to 20 years following surgery.

The Surgery of Infancy and Infancy and Childhood, by Robert Gross, published in 1953 is the bedrock of pediatric surgery. Dr. Gross, with his chapter heading, Embryoma of the Kidney [Wilms' tumor] acknowledged Max Wilms. [29] Gross achieved a 47 percent cure in thirty-eight patients operated upon between 1940 and 1947 with immediate operation, a long transperitoneal incision, early ligation of the vessels and postoperative radiation. Dr. Gross removed all tumors, regardless of size, had no operative deaths, and in children less than one year of age, there was an 80 percent cure rate regardless of size. He attributed his success to the use of intravenous fluids and blood transfusions. Dr. Gross indicated his indebtedness to Dr. Sidney Farber for his collection of Wilms' tumor specimens.

Sydney Farber [1903-1973] took his first year of medical school at the University of Heidelberg in Germany. He then entered Harvard Medical School, graduated in 1927, became a resident in pathology and was the first full time pathologist at the Boston Children's Hospital. Dr. Giulio D'Angio remembers Dr. Farber's library was lined with German textbooks and that Farber was an extraordinary, disciplined physician, scientist and humanitarian. [30]

In 1955, Farber and his group demonstrated the effectiveness of Actinomycin-D, an antibiotic derived from Streptomyces Parvulus in the treatment of Wilms' tumors, but did not report his findings until 1960, [31] The Eli Lilly Pharmaceutical Company provided the drug, free of charge before that time. Initially, we injected the drug prior to and during surgery with three doses postoperatively. The idea was to destroy cancer cells released during surgical manipulation. Treatment with Actinomycin D combined with post-operative radiation improved the survival of children with Wilms tumors, even those with lung metastases.

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Professor Max Wilms at Heidelberg. UAH Pos I 03299. Copyright: University Archives Heidelberg. Photographer and year unknown. Permission to use portrait obtained from Heidelberg University Archives.

VIGNETTES FROM AMERICAN SURGERY

EPHRAIGM MCDOWEL A PIONEER SURGEON

In 1809, Jane Crawford's physicians thought she had an overdue pregnancy and called Ephraim McDowell, a surgeon, who lived sixty miles away in Danville Kentucky. [1] McDowell diagnosed an ovarian tumor and advised surgery even though at that time, no surgeon had dared to open the abdomen.

McDowell was born in Virginia, but his family moved to Danville Kentucky, where he served a medical apprenticeship for three years. In 1793, he went to the University of Edinburgh where he studied with John Bell, a distinguished surgeon. He returned to Danville and developed a busy practice that included amputations, tracheotomies, operations for strangulated hernia and perineal lithotomies for bladder stones. Unlike surgeons who operated in a blood-stained frock coat, McDowell was "scrupulously clean," compassionate and competent. [2] McDowell insisted that Mrs. Crawford journey to his home in Danville where he had a special room for surgery. He did the operation on Christmas day, 1809.

> "*The day having arrived and the patient being on the table, I marked with a pen the course of the incision to be made. Desiring him, [his assistant] to make the external opening, which in part he did. I then took the knife and completed the operation*."

The tumor was too large to be delivered from the abdomen so after ligating the Fallopian tube, he cut into the ovary, drained fifteen pounds of a dirty gelatinous material and then removed the tumor. Dr. McDowell tipped his patient to her side to drain blood, then closed the abdomen with interrupted sutures and adhesive tape. She lived to the age of 78 years.

In 1817, McDowell operated on his second patient, an enslaved woman with an ovarian tumor. There was considerable bleeding and at the end of the operation, she complained of cold and chilliness. McDowell gave her laudanum and cherry bounce, a mixture of brandy and cherry juice. She recovered. A third patient had suffered with pain and distention for eighteen months following a pregnancy. Her physicians and McDowell thought she had fluid in the abdomen. With a needle and syringe, he removed thirteen quarts of fluid. Two months later he again removed viscid fluid and made the diagnosis of an ovarian tumor. During the operation, he encountered bleeding, adhesions and sixteen quarts of fluid within the abdomen and the

ovary. She died on the third post-operative day. The cyst contained hair and bone, typical for a cystic teratoma that may have ruptured during the pregnancy, causing a chemical peritonitis. Her death was likely due to her advanced, chronic illness.

By 1819, Dr. McDowell had performed five laparotomies for removal of ovarian tumors. [3,4] His fame spread and in 1822, he removed an ovarian tumor from the wife of General Overton who had been an officer in the Revolutionary war. Mrs. Overton, who was fifty- five at the time of the operation lived to the age of seventy- seven years. [5]

In a letter written in 1829 to a medical student, Dr. MacDowell said that he had operated on eleven patients and had lost only one. [6] Ephraim McDowell died the next year.

Many physicians claimed Dr. McDowell lied, but criticism gave way to acclaim. In 1929, his statue was placed in the National statuary Hall collection and on the 150th anniversary of his operation on Jane Crawford, the post office issued a commemorative stamp in his honor.

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J. MARION SIMS, MD: WOMAN'S SURGEON

In June 1845, a physician asked Dr. J. Marion Sims to see a seventeen-year-old slave girl who had been in labor for several days. Sims delivered the baby with forceps. The mother lived, but the pressure of baby's head caused a necrosis of vaginal tissue and fistulae between the bladder and the rectum with the vagina. [1]

Women with vesico or recto-vaginal fistulae suffer urinary or fecal leakage with, constant burning and pain. their clothing is soaked, and the odor is intolerable. Many are forced to live in isolation because of the foul odor and some commit suicide. In 1845, there was no cure for these poor women.

J. Marion Sims spent two years at South Carolina College, had a medical apprenticeship and attended the Medical College of Charleston. He then studied at the Jefferson Medical School in Philadelphia and took an additional course in surgical anatomy. He practiced in several small Alabama settlements but because of recurrent fevers and debility, Sims moved to Montgomery where he developed a successful surgical practice. He built a hospital to care for his Negro patients.

European surgeons had tried but were unsuccessful in closing vaginal fistulae. However, doctors referred two more patients with vesico-vaginal fistulae to Sims, who declared them inoperable. By chance a pony threw a woman, who immediately had severe back and pelvic pain. Sims diagnosed retroversion of the uterus, put her on her knees, with her head resting on her hands and pushed the uterus into place. While in this position, air distended her vagina, enabling Sims to see inside. Sims went to his hospital and placed one of his patients in the knee chest position and with a spoon for a speculum visualized the fistula. He thought he could repair the defect.

His first operation in 1845 was on a woman whose posterior wall of the bladder was completely destroyed. Sims closed the defect with silk sutures, but later, urine leaked from two suture holes. Over four years, Sims operated repeatedly but, in every case, there were residual defects. He had difficulty

in keeping a catheter in the bladder to drain urine and avoid pressure on the suture line, but he devised a curved metal cannula to drain urine.

Sim's biography and medical papers attest to his compassion, admission of mistakes and how his patients, desperate for a cure, often begged for another operation. [2] His observation of inflammation around the silk sutures led him to have a jeweler make silver wire sutures as fine as horse's hair. He would operate on his first patient thirty times before succeeding in closing both of her fistulae. Without knowing that silver inhibits bacteria, his use of silver wire sutures held with crimped lead shot was surgical genius.

Sims again suffered fever with diarrhea and in 1853, went to New York, hoping that the northern climate would improve his health. When he left Montgomery, Sim's assured his servants that he would not put them into slavery. In a letter to his wife, he said, "*Consult the interests of the Negroes by asking them to select homes and let them know that it lacerates our hearts as much as it does theirs.*" [3]

In New York, Sims founded a thirty-bed hospital for women where he operated without charge. His success with closing vaginal fistulae resulted in more referrals and fame. He also had a few long-term survivors after surgery for cancer of the cervix. [4] Sims developed an international reputation and in 1861, set off for a grand tour of Europe to demonstrate his techniques.

Sims insisted that women with cancer be treated in the Woman's Hospital, but many physicians thought these cancers were contagious, even of venereal origin. In 1874 he insisted that women with cancer be admitted to the woman's hospital. The trustees asked him to resign. This rebuke did not affect his reputation because in 1875, he was elected president of the American Medical Association and in 1878 was made the Honorary President of the International Medical College in Geneva, Switzerland. In December 1881, the trustees re-instated Dr. Sims to the staff of the Women's Hospital. [5] He died two years later. Physicians and the public lauded Sims as the founder of gynecology.

Revisionist historians claim that Sims operated on enslaved women without their consent and without anesthesia even though he commenced his work prior to the advent of anesthesia and a century before physicians obtained written consent for medical procedures. [6, 7]

The critics do not consider the difference between medical procedures performed with expectation of benefit to the patient and experiments purely

for the sake of research. The first appendectomy, the first chemotherapy for cancer and vaccinations were 'experiments.' [8,9]

There is clear evidence that his patients gave verbal consent and cooperated with Sims. Consent was not obtained for medical experimentation until the work on Yellow Fever in 1900 and it was not until 1957, that "informed consent," a complete explanation of the treatment came about. Parents or legal guardians must give consent for minors. His first patient, at age 17 could not give consent for an operation today.

Sims commenced his work before ether anesthesia was reported in 1846. [10] He may have known of ether, but the anesthetic was untested and required a skilled physician. It would have been especially difficult to maintain an airway in an anesthetized patient in the knee chest position. Simpson, the Edinburgh surgeon who discovered chloroform, an advocate for obstetrical anesthesia, did not use anesthesia for fistula repair. In 1859, he remarked that "the tissues are less sensitive" due to pelvic nerve damage and the relative insensitivity of scar tissue. [11]

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WILLIAM STEWART HALSTED AND SURGERY OF THE BILIARY TRACT

William Stewart Halsted graduated with an MD degree from the Columbia College of Physicians and Surgeons after a surgical internship at Bellevue Hospital. He then studied anatomy and surgery in Germany. He commenced a surgical practice in New in 1880. Despite Lister's work with antisepsis, surgeons in the United States did not believe in germs and operated while wearing dirty frock coats without washing their hands. Halsted brought from Europe the best scientific methods in surgery and was one of the first surgeons in the United States to practice antiseptic surgery.

He is best known for introducing the graded residency system for training surgeons, his meticulous technique and his work with inguinal hernia and breast cancer while he was the first surgeon in chief at the Johns Hopkins Medical School.

Halsted is less well known for his contributions to surgery of the biliary tract. In 1882, when he was only 30 years old, he was dramatically summoned, by telegram, to Albany, New York. His mother was seriously ill, and her physicians were at a loss as to a diagnosis and treatment. Halsted found swelling and 'great tenderness in the region of her gallbladder. At two o'clock in the morning He operated on his mother, opened the gall bladder and removed seven gallstones. The operation was performed at home on a kitchen table with open drop ether. There were no diagnostic tests, no antibiotics and no intravenous fluids. When his mother died two years later, at autopsy, she had a large stone in her common bile duct.

Unfortunately, Halsted's career was interrupted by addiction brought about by self-experiments with cocaine as a local anesthetic. During his first years at Johns Hopkins, Halsted invented instruments and performed experiments in dogs for opening, exploring and suturing the common bile duct. By 1889, he had operated upon eight patients with varying conditions of the biliary tract.

The history of one of these patients sheds light on surgery during the late 19th century as well as Harvey Cushing, one of Halsted's first residents:

> Case V.A. *A 38-year-old female with choledochotomy performed twice within four and a half months. The gallbladder was small and contracted at the first operation when two stones were removed from the ampulla.*
>
> *Fifteen days after the second choledochostomy, she was on rectal alimentation with subcutaneous infusions. September 28—infusion again shortly after midnight. Involuntary stools and a small amount of vomitus. Is somewhat flighty at times. Pulse is thready, irregular and cannot be accurately counted.*
>
> *She is sighing and seems moribund. Too weak to recognize surroundings or members of family. I saw the patient for the first time since the third day after the operation, having returned to town as rapidly as possible to a telegram sent 48 hours ago. Dr. Cushing, house officer, who had attended her constantly, day and night, met me at the door of the hospital with the words, "no hope, she is dying." We went to her room; she was cold and almost unconscious, her eyes were open, the eyelids rolled up, the lower jaw dropped.*
>
> *She had more involuntary movements and could retain no nourishment. Her pulse was little more than a flutter and could not be counted. Immediately after this, the patient began to improve and went home well.*

Was her seemingly miraculous recovery due to Dr. Cushing's constant attention or did Dr. Halsted have the "healing touch?"

Halsted operated upon another patient with the presumed diagnosis of an intestinal obstruction, but found, instead, pancreatitis associated with a distended common bile duct. He suspected a stone but failed to find it at operation. Later, Dr. Opie found the stone impacted in the ampulla of Vater at autopsy. It was typical of his honesty to describe the case so that others would not make the same mistake.

During the last years of his life, Halsted had recurrent attacks of abdominal pain. After he developed jaundice, his former residents operated and found an enlarged liver and stones in the gallbladder and common duct. He had advocated drainage of the common bile duct through the cystic duct to avoid large losses of bile. His cystic duct was anomalous and so his surgeon placed the drain directly in the common bile duct. The large amount of drainage weakened him. As a result, he wrote a letter to the Journal of the American Medical Association recommending drainage through the cystic duct. He recovered from the operation, but in the summer of 1922, he again developed fever, jaundice and severe dehydration. At a second operation, he had a stone impacted in the ampulla of Vater. He died with gastrointestinal bleeding and pneumonia.

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THE MAYO'S, FATHER AND SONS

The father of the Mayo brothers, William Worall Mayo was born in a village near Manchester England in 1819. His father died when he was seven years old, but his mother managed to have him tutored in Latin and Greek and later he took private lessons with James Dalton, a chemist best known for developing the atomic theory. He then studied medicine.

At the age of twenty-six years he travelled to America and briefly worked as a chemist at Belleview Hospital in New York. In 1849, he apprenticed to a doctor in Indiana and then took a one-year course at the Indiana Medical College in La Porte, Indiana. He earned an MD and set out for the Minnesota territory with his new wife. He travelled about the territory, tried his hand at various enterprises and was involved in one of the last skirmishes with Native Americans.

In 1864, he developed a medical practice in Rochester, a small town in southern Minnesota. Rochester was the center for a large agricultural area and was on the railroad that connected Chicago with the west. Dr. Mayo's first surgical work was in repairing injuries from farm machinery. He also took an interest in gynecological problems and visited hospitals in the East to observe the removal of ovarian tumors.

William James Mayo was born in 1861 and Charles Horace four years later. They spent long hours together, playing, fishing, hunting and doing the chores. Charlie was more serious, and studious and had an aptitude for anything mechanical. When they were teenagers, Charlie put together a steam engine to run the well pump and turn wheels to do the family washing. Will was an average student and was bit withdrawn. They attended the local high school and had private lessons in German, French and Latin. They picked up chemistry and physics and a love of reading from their father. They did farm work and Charlie had a job at the local drugstore. The boys went on house calls with their father and watched as he diagnosed and treated his patients. They also assisted at surgery and autopsies. Charlie even gave anesthesia. The boys learned medical ethics from their father and not to charge patients who could not afford to pay.

In 1880, Will entered the University of Michigan medical school's four-year course with science and bedside teaching in the University hospital. During his senior year, the chief of surgery, Dr. Donald Maclean chose Will to be his assistant. Dr. Maclean was one of the first American surgeons to take up Lister's antiseptic surgery. After graduation, Dr. Will went back to Rochester to practice with his father. Charlie went to the Chicago Medical School which was affiliated with Northwestern University. He was an average student but managed to spend a good deal of time observing Nicholas Senn, Christian Fenger and other Chicago surgeons. In 1888, he finished a three-year course and joined his father and brother in practice.

The Mayo's, father and sons delivered babies, treated measles, whooping cough, diphtheria and all the ailments seen in a general practice. They rode horseback through floods, washed out roads and when the snow was too deep for a horse, they walked to their patients in the country. At first, their surgery was limited to the repair of accidental wounds, but during the decade of the 1880's the elder Mayo performed thirty-six operations to remove ovarian tumors. Their surgical practice increased as news of their success spread by word of mouth and newspaper stories. Doctors in the surrounding area often watched the operations and impressed with the skill of the Mayo's referred more cases to them.

From the beginning the brothers set aside time to study and travel to observe the work of other surgeons. They took turns traveling to Chicago on the night train to attend Christian Fenger's clinics at the Cook County Hospital and to observe surgeons such as Nicholas Senn and John B. Murphy. Fenger, an immigrant from Denmark, the 'Father of surgery in Chicago' was more interested in pathology than the patient. On one visit to Chicago, Dr. Charlie and his father observed John B. Murphy perform an intestinal anastomosis with his invention, the 'Murphy button.' This device allowed surgeons to make rapid, safe connections between the stomach or gallbladder with the intestine. It literally opened the door to surgery of the gastrointestinal tract. Soon after their return to Rochester, the brother's used the button to save the life of a patient. On trips to New York and to Germany, they learned Lister's antiseptic and later aseptic technique. At Johns Hopkins, they were impressed with William Halsted's slow, meticulous operations for hernia and breast cancer. They learned surgery by taking the best of what they saw. Back home, they operated, in the patient's home, often on a kitchen table or on planks across sawhorses.

In 1883, a tornado demolished Rochester and caused multiple injuries. The doctors turned a dance hall into an improvised hospital and Sisters from the

St. Francis convent took over the nursing. This led to the founding of St. Mary's Hospital. The Mayo's planned and supervised the construction of the forty-five-bed hospital with one operating room It was open to all patients regardless of their ability to pay. At first Protestants objected to a Catholic hospital, and money was in short supply. The Mayo's equipped the operating room and Dr. Charlie built the operating table. The nursing sisters worked long hours to care for patients and did all the marketing for food and supplies. By 1893, the hospital was caring for a thousand patients a year and was a great success, due in equal measure to the nursing sisters and the Doctors Mayo.

During the early years, the brothers assisted one another, and each did all sorts of operations. As a result of their study and travel they took up the great advances in surgery during the last decade of the 19th century. They obtained a sterilizer for instruments, used rubber gloves and performed all the latest operations. Dr. Will did more of the pelvic and abdominal operations while Dr. Charlie took over the eye, ear, nose and throat work and eventually did orthopedics and brain operations.

There was a tremendous backlog of patients suffering with chronic gastro-intestinal pain, "dyspepsia" and "colic." Reginald Fitz, a Harvard pathologist, recognized the appendix as the source pain in the right lower quadrant of the abdomen. Soon, surgeons, including the Mayo's advocated appendectomy for right lower quadrant abdominal pain. In 1895, they performed twelve operations on the appendix. These numbers grew rapidly in the ensuing years. Next was the removal of gallstones for recurrent episodes of 'colic' and operations for inguinal hernia. In 1894, Dr. Will commenced doing gastro-enterostomy with the Murphy button for pyloric obstruction. This led to complete removal of the stomach for cancer. By 1905, the Mayo's had performed 2,157 abdominal operations at the St. Mary's Hospital. Meanwhile, Dr. Charlie was doing tonsillectomies, excising knee joints, removing breast cancers and developed an operation for varicose veins.

At first their surgical practice was limited to Rochester and the immediate area, but as their fame grew patients poured in from throughout the Midwest. Part of this influx of patients was due to the appointment of the old Dr. Mayo as surgeon for the Chicago and Northwestern railway. Whenever a train derailed with multiple injured passengers or when a patient developed appendicitis in a distant town, the railroad arranged special fast trains for the doctors. This led to considerable favorable publicity and more patients.

By 1905, the old doctor, W.W. Mayo spent more time in politics and farming than medicine. The brothers could not keep up with their growing surgical practice and still see office patients. They hired experienced physicians to help with the diagnostic work. When Dr. Charlie married their nurse anesthetist, they hired a Chicago trained nurse to give anesthesia and then took on Dr. Christopher Graham, her brother who did obstetrics and laboratory work. They recruited doctors, who specialized in urology and optometry.

The most important addition to the staff was Henry Plummer, a graduate of Northwestern University, who had spent several summers working at the St. Mary's hospital. Dr. Plummer took over the clinical laboratory work and X-ray. He was also a superb clinician with a special interest in diseases of the thyroid. Dr. Plummer an eccentric but brilliant doctor also designed new clinic buildings and organized research laboratories.

During the early years, the brothers had assisted one another at surgery, but with the increased workload, they had separate schedules. Sister Joseph, a highly intelligent nurse with "nimble fingers" became Dr. Will's first assistant. In later years, residents assisted the brothers and often "opened and closed," but the brothers did the essential part of the operation

The Mayo's discussed papers at local medical meetings and as their personal experience grew, they presented papers on appendicitis, gallstones and stomach surgery to a wider audience of surgeons. In 1904, they reported their results with one thousand operations on the gallbladder and in 1905, at the American Surgical Association, Dr. Will reported 500 cases of gastroenterostomy. Surgeons in academic centers were astonished and doubtful about the numbers of cases and the excellent results. The brothers invited the skeptics to visit Rochester and see for themselves. Surgeons came, first from the United States and then from all over the world to marvel at the volume and excellence of the Mayo's surgery

The increased number of patients required expansion of the hospital, the clinic, the laboratories and the addition of more doctors. The Mayo Clinic was born, with the opening of a new building in 1914, with offices for the doctors, laboratories, a business office and a new filing system. The brothers envisioned and brought about the concept of a private group practice of closely integrated specialists. The next step was the Mayo Foundation for the education of residents and research.

Rochester was in the "goiter belt" and so, the Mayo's treated many patients with simple goiter, but until the 1920's, patients with exophthalmic or 'toxic' goiter were a major challenge. These patients suffered weight loss, severe tachycardia, restlessness and many died. There was no good medical treatment and surgery often resulted in "thyroid storm" with an uncontrolled rapid heart rate, coma and often death. Iodine was used to treat simple goiter and Dr. Henry Plummer and his research associates isolated thyroid extract to treat hypo-thyroidism. After considerable study, Dr. Plummer tried iodine in patients with exophthalmic goiter. Patients immediately improved and with pre-operative iodine surgeons were able to do thyroidectomies with less than a one percent mortality. This remarkable feat typified the cooperation of clinicians and researchers that exemplified the teamwork of the Mayo Clinic.

The brothers continued to operate three days a week and saw patients in the clinic in the afternoon. They attended the weekly staff meetings and continued to maintain the same humanitarian principles of patient care as their father.

In 1928, a new fifteen story clinic building opened and that same year, at age 67, Dr. Will did his last operation. Dr. Charlie retired a year and a half later after he had a retinal hemorrhage. Dr. Charlie died of pneumonia in the spring of 1939 and Dr. Will passed away two months later with stomach cancer.

During their lifetime the Mayo brothers were honored by foreign countries and medical societies all over the world. They were the presidents of the American College of Surgeons and almost every other major medical society in the United States. They published over six hundred medical papers and trained countless young surgeons. Today every operating room has a "Mayo" table for instruments, a Mayo retractor and the Mayo scissors. The clinic, which they planned, organized and often funded out of their own pockets is known throughout the world as an oasis of excellent medical care. Their concept of a not for profit, non-governmental integrated group practice could well be a model for health care today.

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HARVEY CUSHING: SURGEON, AUTHOR, SOLDIER, HISTORIAN, 1869-1939

Harvey Cushing contributed more to medical science, literature and medical history than any other physician, or for that matter any individual during the twentieth century. Dr. Cushing was a giant in his time and students still must learn about Cushing's syndrome.

Harvey Cushing was a third-generation physician, born to a family of New England Puritans who had migrated to Cleveland Ohio in the mid 1830's. His father and grandfather were successful physicians; family members on both sides were well educated and financially secure.

At Yale, Cushing studied Latin, Greek, literature and History but in his third year, he turned to medicine. He was captain of the baseball team, rowed and did gymnastics. He played the part of Miss Pochohantus in a school play and entered the stage with a double back handspring. He was elected to the Scroll and Key honor society and graduated from Yale with an AB degree.

Medical educators should take note of Cushing's education in language and history as well as science. A background in the humanities is good preparation for a life in medicine.

Cushing attended Harvard, one of the few medical schools in the country to require pathology, bacteriology and hands on laboratory work in addition to the study of patients. Reginald Fitz, who established appendicitis as the cause for right lower quadrant pain was a Harvard professor while Cushing was a student.

His education a Yale put him ahead of his classmates. He skipped lectures to do hospital work. Even in medical school, Cushing's notes were detailed and illustrated with sketches, often in color. While he was a second-year medical student, he gave an ether anesthetic to a patient with a strangulated hernia. Cushing blamed himself when the patient died on the operating table. During his fourth year in medical school, Cushing worked in the Children's Hospital and delivered babies in poor people's homes. Also,

during his fourth year, in 1895, he with a fellow student devised a chart to record the patient's temperature, pulse and respirations during anesthesia. At the time, there was no way to record blood pressure, but several years later, while in Pavia, Italy, he saw the Riva-Rocci pneumatic blood pressure apparatus and brought the instrument home. The anesthesia chart would be the only way to record a patient's vital signs while under anesthesia for the next 60 years. [1]

Cushing was constantly on call during his surgery internship at the Massachusetts General Hospital; after one long stint of work, said, "Had a great twenty-four hours." This enthusiastic statement should be taken as a rebuke by the current self-pitying house officers who complain about long hours.

Even as an intern, Cushing did not hesitate to criticize his superiors. Once, after an attending surgeon recommended an amputation, Cushing saved the leg by draining a tubercular abscess.

Following his internship, in 1896, Cushing became as assistant surgeon to William Halsted, the surgeon in chief at the new Johns Hopkins Hospital. At first, Cushing was disappointed with Halsted, who was slow, fussy and meticulous and was frequently absent from the hospital. He soon came to appreciate Halsted's technique and excellent results. He was not as busy as he had been during his internship and while a junior resident, Cushing did research and established the connection between typhoid fever and gallstones.

When Halsted promoted him to senior resident, Cushing re-organized the surgical service by introducing X-rays, anesthesia records and early operations for patients with intestinal perforation. He was in charge of the surgical service during Halsted's absences and operated on some of the "chief's" private patients. Despite being constantly on duty, he found time to study German, play tennis and do literary work. While still a resident, he operated upon Halsted's wife after an accident and did some of the first intestinal resections and the first splenectomy at Hopkins.

During his residency, Cushing had an attack of abdominal pain shortly after a "wretched dinner."

By his own account, the pain became constant and was localized below and medial to McBurney's point.

He took a small dose of morphine and calomel, but the pain persisted. The next morning, both Osler, the chief of medicine and Halsted examined

Cushing. His white blood count was 13,000. A few hours later, his count has risen to 23,000. At the time, Dr. Cushing, as a result of the influence of Reginald Fitz at Harvard was well aware of appendicitis and the role of the white blood count in making the diagnosis. Dr. Osler urged delay, apparently because the symptoms were atypical.

Dr. Halsted correctly diagnosed an inflamed appendix, deep in the pelvis. A fellow resident administered a chloroform anesthetic and Dr. Halsted along with several other Hopkins surgeons performed an appendectomy. The incision was not a small muscle splitting incision in the right lower quadrant, but a long rectus splitting incision. There was bleeding from the inferior epigastric artery, that led to a postoperative hematoma. Halsted closed the incision with silver wire sutures. Later, silk ligatures discharged from the wound. [2]

During his residency, Cushing practiced on 30 cadavers and then successfully performed a gasserian ganglionectomy on a patient with trigeminal neuralgia. The operation relieved the patient's unbearable facial pain and launched his career in neurosurgery.

In the summer of 1900, Cushing embarked on a fourteen-month surgical tour of Europe. He was critical of Victor Horsley the 'father' of English neurosurgery because of Horsley's rapid surgery with poor hemostasis. In Berne, Switzerland, he carried out research on circulation of blood in the brain and in dogs and monkeys created intracranial pressure to study the effect of pressure and the pulse rate. This work confirmed his interest in brain surgery. Cushing was appalled at the German surgeon's disregard for patients. He said, this about German surgeons; "*The patient is something to work on, interesting experimental material, but nothing more*." [3]

Upon his return to Hopkins, Cushing, at age 33 became an associate in charge of neurological surgery. He continued his work with trigeminal neuralgia and began to operate on patients with brain tumors, but with little success. It was often impossible to localize the tumor and hemorrhage was a major problem. He also became interested in diseases related to the pituitary gland and in the laboratory worked out a surgical approach to the pituitary. He would often spend all day in the operating room and then work in the laboratory at night. Within the next seven years he would become the world's authority on trigeminal neuralgia, brain tumors and diseases of the pituitary.

In addition to this strenuous load of clinical and laboratory work, Cushing found time to do literary work. He became fast friends with William Osler with whom he shared interests in literature and medical history. Cushing published many papers and book chapters to educate physicians and to enhance his reputation.

In 1910, he removed a para-sagittal meningioma from General Leonard Wood who been Theodore Roosevelt's commanding officer at the battle of San Juan Hill and later was the governor of the Moro Province during the Philippine insurrection. In 1904, while still in the Philippines Wood had a seizure and left sided weakness. A prominent Boston surgeon had excised a part Wood's brain tumor. But the symptoms recurred. Cushing, aware of the danger, reluctantly agreed to operate. He encountered severe bleeding and stopped the operation. Four days later, under local anesthesia, he completed the removal of the tumor. General Wood recovered but in 1927 had another recurrence. Cushing again operated, but there was profuse hemorrhage and Wood did not survive. Cushing blamed himself. [4]

Cushing was a perfectionist, who shaved the head, positioned the patient and attended to every detail of the operation. He continually honed his diagnostic ability and learned from his mistakes.

In 1912, Harvard invited Cushing to be the first Chief of Surgery at the new Peter Bent Brigham Hospital. There were delays in building the hospital and Cushing clashed with Harvard and the hospital directors over staffing and hospital organization. When the hospital finally opened, He continued his intense surgical work with brain tumors and the pituitary gland.

The outbreak of war in Europe interrupted Cushing's work. In 1915, he went to France with the Harvard Unit of the American Ambulance Corps. These were field hospitals staffed entirely by American university doctors. The Harvard unit took over a 160-bed hospital and treated soldiers with terrible war wounds. Cushing mainly operated on head injuries but worked on facial and extremity wounds as well. The surgeons worked in a rat infested, muddy tent hospital but Cushing learned war surgery. He was the first to use a magnet to remove shrapnel deep within the brain.

After his tour of duty with the Harvard Unit, he returned to Boston and resumed a heavy surgical schedule. Anticipating America's entry into the war, he worked with politicians and the army to obtain proper medical stores and equipment and to organize hospitals for the wounded. Cushing had little use for bureaucracy and was often at odds with the authorities.

In 1917, when the United States declared war on Germany, the first Americans to arrive in France were the volunteer doctors, nurses and auxiliary personnel of base hospitals four and five, organized by Dr. George Crile of Cleveland and Harvey Cushing. The Harvard unit replaced a British tent hospital in a miserable muddy field. They had a few surgical instruments but little else. Cushing went around channels to obtain medical equipment and ambulances. He also visited aid stations near the front and more than once was forced to dive into shell holes to avoid enemy fire. He operated on head wounds, taught other surgeons and engaged in research involving early debridement of wounds, antisepsis, trench foot and the blood transfusion. As a result of this research, the mortality from penetrating wounds dropped from 56 to 25 percent.

During one battle, his hospital took in 200 casualties and after the third battle of Ypres, he operated from early morning until two o'clock the next morning. In one day, he operated on eight soldiers with head wounds, often by the light of a candle while wearing muddy boots. Sadly, several of his patients developed gas gangrene in their wounds. In a pithy statement, he said, "yesterday's head has gas."

In one of the great tragedies of the war, Revere, the son of Sir William Osler and the great-great grandson of Paul Revere was wounded by shrapnel. He was taken to an American field hospital, where Cushing and other American surgeons operated on his intestinal perforations. Despite their best efforts and a blood transfusion, Revere Osler died.

Cushing was critical of the British for their indolence and the Americans for the lack military medical preparedness. Some hospital equipment dated to the Spanish-American war or even the Civil war.

The army came close to reprimanding or court-martialing him, ostensibly for security reasons. [5]

The army promoted him from major to lieutenant colonel and as the Americans prepared for battle, he was busy inspecting hospitals and equipment and training young surgeons. Throughout his military experience, he kept a diary, recording details of life on the battlefield, meals, visits to the front lines and case histories of every patient he operated upon. [6]

During the Argonne offensive, Cushing was demonstrating how to operate on a "head case" but was forced to quit when he had double vision. Later, he developed a fever with weakness and numbness in his legs and arms. He

was unable to button his shirt or walk. He gradually recovered from what was either complications related to the flu epidemic or a variety of the Guillen-Barre syndrome. He described himself as a "sick puppy dog" and was afraid he would not be able to operate again.

When the war ended, Cushing wrote a history of Harvard's base hospital that had handled 45,000 sick or wounded soldiers. He did not leave for home until February, nearly four months after the end of the war.

Harvey Cushing had reached middle age and was in poor health when, in 1919, he reassembled his surgical team at the Brigham Hospital. He tired easily and was unsteady on his feet but took up a heavy surgical load. He operated upon increasing numbers of patients with brain tumors, with ever improving results. He invented silver clips and with a physicist, W.T. Bovie, developed electrocautery, for hemostasis that allowed him to remove vascularized tumors from deep in the brain.

In addition to his surgical work, Cushing had a prodigious output of books and articles not only on neurosurgery, but his thoughts on medical education and practice. He sought a balance between science and the art of medicine. In a 1926 graduation address at the Jefferson Medical School, he said,

> *"If a doctor's life be not a divine vocation, then nothing is a vocation, and nothing is divine*" [7]

He was in constant demand as a speaker and in 1922-23, was president of the American College of Surgeons. His main duty was to give the annual oration. He won the Pulitzer Prize for his two-volume biography of Sir William Osler in 1925.

Cushing a heavy smoker, had progressively severe pain in his feet and legs, that led to gangrenous toes and hospitalization. In 1931, he left his hospital bed, with gangrenous toes and operated upon his 2000th brain tumor. The next year, at age sixty-three, he stepped from his position as surgeon in chief at the Brigham hospital and after finishing research on the pituitary he returned to Yale as a professor of neurology. He had more gangrenous toes and severe pain in his feet, which improved when he quit smoking. He died in 1939 with a myocardial infarction.

One of his residents summed up Cushing's attitude towards medicine; "*this Lesson, he taught me, that no one has any right to undertake the care of any patient unless he is willing to give that patient all of the time and thought that is necessary and of which he is capable."*

One of his serious imperfections was meanness to his assistants, but then, he did not hold a grudge. He was jealous of competitors, especially in matters of priority, but he wrote letters of congratulations when his former students excelled. He was kind and sympathetic with patients and personally changed dressings. He would clean patients and change bedpans.

Unfortunately, his single-minded devotion to surgery estranged him from his family. He was separated from his wife and children for long periods of time and when he was home, spent time in study and writing. He did take the time to do appendectomies on two of his children and removed a tubercular lymph node from another. His oldest son died in an alcohol related car crash; another son flunked out of Yale. One of his daughters married a son of Franklin Roosevelt. The marriages of his three daughters all ended in divorce. During his last years, Cushing was often alone and in poor health.

What made Cushing a great surgeon? First, he came from a medical family, he had near perfect hand eye coordination and he had been determined to win. He was a careful, meticulous technician. He was curious about all things, could ignore fatigue and was driven, but above all, Harvey Cushing was a humanist who put his patients first above all else in his life.

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MARK M. RAVITCH, MD: SURGEON, AUTHOR, TEACHER, SOLDIER

Mark Ravitch's parents were émigres from Russia. His father, a Menshevik, had been in prison and had left the country a step ahead of the Czarist police. His mother was a dentist and the family lived in the Bronx. While he was a student at the University of Oklahoma, in 1928, he and his mother visited relatives in Moscow. His ability to speak Russian helped in obtaining Russian surgical stapling instruments.

Ravitch graduated from the Johns Hopkins University School of Medicine in 1934 and stayed for a one-year surgical internship. He then spent a year on pediatrics and another in pathology before starting a surgical residency at Hopkins under Dean D. Lewis, who had followed William S. Halsted as the surgeon-in-chief. While still a house officer, he started a blood bank and one of his first papers reviewed the history and techniques of banking blood [1]. Lewis retired in 1939, so Ravitch finished his surgical training under Alfred Blalock.

Once, Ravitch asked if the department could buy a Von Petz stapling device for gastric surgery. Blalock said the instrument was too expensive. Ravitch tried to suture with an ordinary paper stapler in the animal laboratory. It didn't work, but the story indicates his early interest in surgical staples.

In 1943, he was commissioned as a major in the US Army Medical Corps. After his first assignment in England, he followed the D-Day Normandy invasion and then to Liege, Belgium. With "scrounged supplies" Ravitch set up a hospital in a cavalry school [2]. During the Battle of the Bulge he operated on wounded soldiers for 72 hours without interruption. At the end of the war, he returned to Hopkins, first as a senior resident, then as a professor of surgery and director of the blood bank.

From 1946-1952 he published several landmark papers. "*Anal Ileostomy with preservation of the sphincter*" described the ileal pull-through with total colon resection for benign disease [3]. Revolutionary at the time, the operation avoided a stoma and became a standard procedure for benign diseases of the colon and rectum.

His interest in intussusception began when he was a third-year medical student. After his return from the war, he resumed his research on the condition, which included creating intussusceptions in 28 dogs. The study, complete with cultures of the intestinal serosa and histologic studies, demonstrated the effectiveness of hydrostatic reduction. This experimental work resulted in *"Reduction of intussusception by hydrostatic pressure,*" published in 1948 [4]. His clinical study in infants, "*Intussusception in infants and children: analysis of 152 cases*," demonstrated both a lower mortality and morbidity with barium enema reduction than with surgery [5].

Prominent surgeons, such as Robert E. Gross of Boston and Willis J. Potts of Chicago, had achieved a near-zero mortality with surgical treatment and dismissed his technique of hydrostatic reduction. Surgeons were concerned about incomplete reduction, intestinal perforation, or missing lead points. Ravitch followed in 1959 with the publication of a 119-page monograph, "*Intussusception in Infants and Children* [6]." With superb illustrations, dozens of radiographs, and scores of references, it discussed every aspect of intussusception and became the definitive study on the condition [6]. Today retrograde reduction by air, saline or barium is the standard of care.

Surgeons had performed a variety of operations for patients with severe chest deformities but most looked upon pectus excavatum as a cosmetic problem and did not advise an operation. In 1949, Dr. Ravitch published detailed case histories with pre and postoperative X-rays on eight children, ranging in age from twenty two months to ten years whom he had operated upon for pectus excavatum [7]. He resected the deformed costal cartilages and did a transverse anterior wedge osteotomy of the sternum, with mattress sutures holding the sternum in place [7].

He used external traction with wire sutures in two children. One, who had pre-existing bronchiectasis died with overwhelming sepsis, which Dr. Ravitch attributed to surgical error. He never again used external traction or substernal bars but continued to advocate surgical treatment for pectus excavatum. He cited reduced exercise tolerance during the teen years and cardiac symptoms later in life [8, 9].

His 1977 monograph, "*Congenital Deformities of the Chest Wall and Their Operative Correction*," reviewed his thirty-year experience with pectus deformities as well as Poland's syndrome, ectopia cordis and Pentalogy of Cantrell, a comprehensive, well-illustrated text that confirmed his position as the world authority on chest wall deformities of the mid-20th century. [10]

In 1958, Russia was essentially closed to the outside world, but rumors that the Russians had developed techniques for the prolonged storage of blood aroused the interest of the US National Research Council. The council chose Ravitch as one of the scientists to study Russian blood banking. The Russians were uncooperative, but he managed to visit the Institute for Thoracic Surgery.

He struck up a friendship with the surgeon-in-chief at the Institute, Dr. N.M. Amosov. The administrators prohibited visits to patient wards, but Amosov brought the patients and their X-rays to his office. Ravitch later wrote, "*The very first patient proved to have had a resection of the right upper lobe of the lung, and in the X-ray, I could see what was obviously a line of metal staples* [11]." Amosov had used a stapling instrument to close the bronchus and seal the blood vessels in over 200 lung resections. Ravitch was further impressed when he observed Amosov perform lung resections with the stapler.

The government refused to sell him a stapling instrument. By chance, he found and bought the instrument from a medical supply store in St. Petersburg. Upon his return to America Ravitch, as the surgeon-in-chief of the Baltimore City Hospital, practiced in the animal laboratory, then used the stapler on lung resections in patients with tuberculosis. There were fewer bronchial fistulas with closure by staples than with sutures. With his chief resident, Felicien Steichen, Ravitch presented his experience with surgical staples to surgical conferences all over the world.

American surgeons were skeptical of the reliability of stapling devices and whether they offered any benefit over hand-sewn techniques. During the 1960's, Ravitch and Steichen worked with the newly formed United States Surgical Corporation to develop stapling instruments for anastomoses of the esophagus, intestine and rectum. As an example of his integrity, Ravitch never accepted money for his work as a consultant to the company. In 1970, Steichen joined Dr. Ravitch at the Montefiore hospital in Pittsburgh. They organized seminars and workshops all over the world to teach stapling techniques. Stapling instruments appropriate for insertion through laparoscopic ports opened the door for minimally invasive surgery.

Ravitch was the author of 453 papers, 101 book chapters, and 22 books, and was the editor of many medical journals. Before the founding of the *Journal of Pediatric Surgery*, he edited a section on pediatric surgery in the journal *Surgery*. In a 1974 he predicted that increased numbers of pediatric surgeons

in the general population would decrease the workload in training centers [12]. His prediction has proven to be true.

Ravitch, with Kenneth Welch, William Mustard, Clifford Benson, and William Snyder, co-edited the two-volume multi-authored textbook, "*Pediatric Surgery,*" that was for decades the definitive reference for pediatric surgeons [13]. One of his greatest works was "*A Century of Surgery: The History of the American Surgical Association, 1880-1980* [14]*."* This review of selected presentations at the annual meetings of the Association documents landmark achievements in the field and is a must-read for anyone interested in the history of surgery.

Dr. Ravitch was for a few years, the chief of pediatric surgery at the University of Chicago, but in 1970, he left Chicago to become the surgeon-in-chief at the Montefiore Hospital in Pittsburgh. He also held conferences for the residents at the Pittsburgh Children's Hospital. If a resident said a finding in the history or physical examination was normal, Dr. Ravitch would ask, "What exactly is normal?" He never let a trainee off the hook.

Dr. Ravitch never knew what cases would be presented, but after hearing the signs and symptoms, he would give his differential diagnosis, the work-up and the appropriate treatment. He was always spot-on. He was not a fast or highly skilled surgeon but his dissections for the pectus operation was meticulous and he always had good results. He taught residents how to scrub by coating their hands and forearms with lamp black. It took at least ten minutes to get rid of the lamp black.

If, in answer to his questions, the resident knew how to diagnose and treat intussusception, he would give him his monograph on intussusception. Dr. Ravitch had a broad knowledge of surgery. He spoke and wrote in twelve languages, so he could read foreign manuscripts without resorting to translations. He was warm, thoughtful, bright, generous and helpful. At the first pediatric surgery board examination in Puerto Rico, Dr. Ravitch was in the front row, smoking a huge cigar. It was a multiple-choice examination. During the exam he broke the silence. "I did all the research on this question and the correct answer is not one of the choices," he said in his very loud voice. "This test is a joke."

He did not have formal training in pediatric surgery but the year he spent as a resident in pediatrics is evidence of his early interest in children. He once said, "I look upon pediatric surgery as an interest area in surgery, but I don't think you can make a living as a pediatric surgeon" [15]." The only time

Ravitch restricted his practice to pediatric surgery was during 1966-1969 when he was the chief of pediatric surgery at the Wyler Children's Hospital of the University of Chicago.

Dr. Ravitch would have trouble adjusting to the current milieu in surgery. In his writings, he referred to surgeons as men. When he was a visiting professor at the Baltimore City Hospital during the 1970's, a woman resident held the retractors while he operated with the chief resident. During the operation, he called her "honey."

"*Second Thoughts of a Surgical Curmudgeon*," published a year before he died is series of essays and observations on everything from education to ethics [17]. In one of his essays he summed up his philosophy: "*Surgery is an intellectual discipline characterized by operations and defined by an attitude of responsibility towards the care of the sick*."

He was critical of modern education and was especially frustrated by the inability of students to express themselves in English. He was skeptical of fetal surgery and specialization within surgery. He thought terminal patients should not be sustained by useless life support but allowed to die with dignity. He believed that parents with their physician should decide the fate of babies born with severe anomalies. He derided the idea of limiting the working hours of house staff and ridiculed the 'informed' consent. Perhaps, we need more "straightforward surgeons" like Dr. Ravitch.

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MEMORABLE PATIENTS

ROMANTIC HEART

In the spring of 1950, during the last half of our second year of medical school we met our first live patients during a class on physical diagnosis, better known as "P-dog." The Eli Lilly drug company gave each student a black doctor's bag which we filled with a blood pressure cuff, a battery-powered otoscope for looking into ears, an ophthalmoscope for examining eyes, a wisp of cotton, a pin and a tuning fork to test sensation, and a rubber hammer to bang on the knee or elbow to check reflexes. Our most cherished tool, the emblem of the profession, was a bright, shining stethoscope.

We studied one of the greatest textbooks of all time, *Physical Diagnosis,* by Richard C. Cabot and F. Dennette Adams, two Boston physicians. This book, an encyclopedia of disease, described with words and pictures everything from the Koplik's spots of measles to syphilis. We memorized the chapters on how to take a history from a patient and how to perform a physical examination by smell, inspection, palpation, percussion, and auscultation (in which we used our stethoscope to listen for any unusual sounds in the body's organs). This was the real laying on of hands that, for centuries, was the hallmark of medical practice.

Our first class in physical diagnosis was on examination of the chest. The upperclassmen shook their heads in pity because the instructor, Dr. Remenchuk, had just finished his residency in internal medicine and was tough on students. My roommates and I practiced examining one another's hearts and lungs with our new stethoscopes. We then percussed the chest by striking with one finger on another placed between two ribs. The percussion note over an air-filled lung was a hollow sound, like tapping an empty barrel. The dull, flat note over the liver was like hitting a full keg of beer. Air flowing through the bronchi of the lungs sounded like a gentle wind rustling tree leaves. It was all very mysterious and exciting.

With our black doctor bags filled with new instruments, we went off to Ward 65 in the men's medical building of the Cook County Hospital, a run-down edifice with all the charm of a decaying tenement house. A half-dozen of us, resplendent in short white coats and carrying our black bags, waited while a nurse's aide attempted to wheel a stretcher with an old man onto the elevator. The operator, a political appointee, worked a crossword puzzle and

made no effort to assist. We gallantly helped her with the cart and refrained from joking. This was the real thing.

We gaped at eager interns working with patients while a red-haired nurse pushed a cart with medications toward the open ward, which was filled with wall-to-wall elderly men sprawled on ancient hospital beds. The class was held in the intern's lab, a small room with walls covered with peeling green paint. Hospital charts were randomly stacked on a desk next to a centrifuge and racks of test tubes. The counter was liberally stained with old blood and urine. We settled into a row of folding metal chairs facing a scratched blackboard. Dr. Remenchuk bustled into the room fifteen minutes late and tossed his heavy overcoat on an empty chair. He was young, short, and a little stout, with a high forehead and scant hair. His suit was dark and shabby with a stethoscope peeking from his coat pocket. He counted heads and said, "Great, everyone is here."

He wrote "History" at the top of the blackboard, underlined it twice, and added an exclamation point. "The history starts when you ask the patient what's wrong and continues with a detailed account of how his symptoms started." He paused long enough to write the word "RAPPORT" on the blackboard. "First, and most important, get to know your patient. Put him at ease."

Dr. Remenchuk then described the review of systems, which amounted to asking questions about symptoms related to every single organ system, such as dizziness, headaches, nausea, vomiting, pain, and constipation. We furiously took notes. He went on to the family history, including diseases in cousins and grandparents, even back to great-grandparents. We were also supposed to inquire into the patient's personal habits, drinking, smoking, and sex life. Dr. Remenchuk assured us that each and every question might provide a clue to the diagnosis.

*"*Any questions?"

A hand went up. "What is the best way to establish rapport with the patient?"

"Be polite and respectful, introduce yourself, and ask about the patient's family, his job, his hobbies, pets, anything. Let him talk about himself before you start asking questions OK, I need a volunteer to demonstrate examining the heart and lungs."

There were no volunteers. "You," Dr. Remenchuk pointed to Bill Snyder.

Bill took off his tie, shirt, and undershirt, revealing a hairless chest. His skin was as pale as a coal miner's. In those days, medical students never vacationed on Florida beaches.

Dr. Remenchuk demonstrated how to determine the borders and size of the heart by palpation and percussion and where to listen to the opening and closing of the aortic and mitral valves. We all listened to the *lub-dup, lub-dup* of poor Snyder's heart while the instructor created a diagram on the blackboard of the sequence of valve opening and closing.

"OK. Here are the names of your patients. Take a history, examine their hearts and lungs, write up your findings, and report back at eleven."

My patient was Rufus Jones in bed 21. I asked a nurse's aide, "Where is Rufus Jones?" She shook her head. Next, I asked an intern, who pointed to a large open ward. "Down there, near the end."

The open ward smelled of unwashed bodies, stale urine, and overflowing bedpans. Sagging cots stood along each wall, and a double row of cots ran down the middle of the ward. Motes of dust drifted in the shafts of a cold winter's sun which beamed through east-facing windows. Each patient's chart was hooked to the end of their bed. There was barely enough space between beds for a small metal table and a chair. The patients were in bed or sitting on hard metal chairs. They smoked cigarettes or stared into space. There was nothing to cheer a sick man.

The poor patient in bed number one sat bolt upright using every ounce of strength to suck oxygen from a rubber mask that was connected by a rubber tube to a green cylinder. In spite of the oxygen, a fellow with a great, bushy, yellow-stained beard in the next bed ground out a cigarette stub and said, "Hey Doc, kin ya spare *a cig*?" His open hospital gown exposed a fading tattoo of green, yellow, and blue dragons and snakes swirling around his chest. There was a merry twinkle in his eye as he held out a hand with yellow-stained fingers.

"Sorry, I don't smoke,"

"Bet you can't tell what's wrong with me," he said.

"Can't even guess."

"I got sifeelis of the brain. Caught it in China."

He went into gales of laughter while I went on to bed 21 at the far end of the ward. Rufus Jones was scarcely more than a teenager with deeply sunken eyes and skin drawn tight over his skull. He sat bolt upright with his legs extended to the end of the bed under a gray blanket. His stick-thin arms, and hands with long bony fingers and curving fingernails, rested loosely on top of the blanket. The skin of his face and arms was smooth, as if it had been rubbed with oil. He was dark as ebony. A rubber catheter taped to his nose led to a cylinder of oxygen.

I smiled. “Mr. Jones, I am here to examine your chest. Have you been here long?” His eyes fluttered open, but he made no reply.

“It is cold today. We’re lucky to be inside,” I said. He took a couple of long raspy breaths but made no answer.

“Do you go to school?” I asked. He didn’t answer.

I hadn’t established rapport but plunged ahead. “Mr. Jones, what brought you to the hospital?” His lips didn’t move, but he opened his mouth and gasped for air.

I raised my voice. “What is wrong with you?”

His lungs rattled, he coughed, and spittle streaked with blood dribbled down his chin. “Ah . . . got . . . romantic . . . heart.”

I could barely make out his words and wondered if he was making a joke. He closed his eyes and said nothing more.

“Is it OK if I check your pulse and heart?”

He barely nodded. I held his ice-cold hand and hunted for the radial pulse. There was a flicker, then the artery went *bump-bump-bump* and stopped. I thought he had died, but the *bump-bump-bump* returned, faster than I could count, then slowed, stopped, started, too fast to count, and then another long pause. I held his hand with my finger on his pulse for a long time until his fingers trembled and tightened. For a moment, his eyes looked into mine. I wondered if we had established rapport.

“Now, I am going to examine your heart and lungs.”

There was no response as I untied his hospital gown at the back of his neck. His ribs stood out, and his heart visibly pounded against his left rib cage

with the same irregularity as his pulse. I palpated and percussed, just as Dr. Remenchuk had demonstrated.

His heart was enormously enlarged. I fitted the uncomfortable earpieces of my new stethoscope and pressed the bell against his chest over his right lung. The lung sounded like water gurgling through pipes with extra high-pitched whistles. There was a continuous rumbling over his entire heart. I couldn't make out the opening and closing of the mitral or aortic valves. His blood, instead of flowing from the atrium into the ventricle and then out through the aorta, was sloshing back and forth. When I leaned over his chest to listen, his blanket came away, revealing grotesquely swollen legs.

I returned to the intern's lab in absolute despair. I had not established rapport, had not obtained a history, and did not understand the physical findings. I had written only a few lines on my paper. I was certainly going to flunk the course.

My colleagues had filled page after page with detailed information on everything from why their patient's grandmother died to the number of cigarettes they smoked per day. They had also written textbook descriptions of rales in patients with pneumonia and heart murmurs.

Dr. Remenchuk went through the papers, nodding with satisfaction, "Good, good," and with one student's history he said, "Excellent work."

He scowled over my scrawled half a page, "Is this the best you could do?"

"Yes sir. He was too sick to talk and his heart sometimes stopped."

Dr. Remenchuk said, "No doubt an interesting case. All of you, come along and I will demonstrate how to do a proper examination."

We followed him to bed 21. Except for more blood-stained spittle on his chin, Rufus Jones was exactly as I had left him. Without saying a word, Dr. Remenchuk pulled down the blanket and pushed a finger into a swollen leg. An indentation remained where he had pushed the skin, even after he lifted his finger. *"An excellent example of pitting edema, a sign of heart failure."*

We were arranged around the bed, but Rufus took no notice. His eyes were closed, and he remained motionless as our instructor untied and pulled down his gown.

"Oh, this is a very good case. The distended neck veins are another sign of heart failure, and the bounding carotid pulses indicate aortic regurgitation."

We watched intently while he placed a hand over the chest, percussed the borders of the heart, and finally listened with his stethoscope. Then, one by one, he had us listen to the heart while he described the sounds of blood regurgitating back into the heart through the aortic valve and the rumbling noise of blood squeezing through a narrow, scarred mitral valve.

During this time, Rufus remained perfectly still, except for an occasional flutter of an eyelash. Dr. Remenchuk did not speak to him but summarized his findings for our edification.

*"*What we have here are all the classical signs of rheumatic heart disease in severe failure. He has mitral valve stenosis and aortic regurgitation with an enlarged left atrium and biventricular hypertrophy. The irregular-irregular heartbeat is the result of atrial fibrillation, a bad sign*."* Dr. Remenchuck folded his stethoscope and said, "That's all." The other students followed him down the ward.

When I tied his gown, Rufus opened his eyes, focused on some distant point across the ward, then slightly inclined his head and looked me in the eye.

"Be he the head doctah?"

"No, he's a teacher."

"He said ma heart is big. Is that bad?"

"No, Rufus. Sometimes, it is good to have a big, romantic heart."

The next afternoon, I returned to Ward 65. Bed 21 was empty. The intern said he had died that morning and would be presented at the afternoon autopsy conference. I had only known Rufus for an hour or two, but he was my first real patient. I should have attended the autopsy, but instead, slunk away with a sense of failure.

THE POLISH GENERAL

The elevator door clanged open; a gurney with lopsided wheels clattered down the hallway to the examining room. Over the noise of the gurney rose the sound of anguished pain, such as I have never heard before or since.

"BOLLI, BOLLI, OH, BOLLI!" I set aside the test tube filled with urine and leaped to the treatment room just as the gurney rolled through the door. The patient was a pale, handsome man of about seventy with closely cropped white hair and a drooping, tobacco-stained mustache. His anguished cry was not the low moan of chronic distress, the "Ouch!" of a sudden sharp pain, nor the sob of a poor wretch with a headache.

"BOLLI, BOLLI, OH, BOLLI!" was the sound of real suffering that demanded immediate help. I took his wrist with what I hoped was a reassuring touch. His pulse was fast and weak. His skin and lips were dry; I didn't have a clue as to what was wrong. There was a jagged scar on the left side of his chest and a deep, poorly healed crease on his upper abdomen where a chunk of tissue was missing. The old scars didn't seem to be related to his pain. I thought he was having a heart attack, but his heart and lungs sounded normal. There was a tense, tender mass in his lower abdomen. It dawned on me that he had acute urinary retention with a hugely distended bladder. The old man bit his lip to stifle another scream when two men with the erect bearing of military officers, and four wailing women wearing black shawls, arrived. None of the women spoke English; one of the men interpreted.

I asked, "What is his trouble?"

The four women and two men talked back in forth in what I learned was Polish. Finally, one man whispered, "He can't piss."

"For how long?" I asked.

There was more discussion. The man said, "Maybe two, maybe three days. He has much pain. We have no money. Can you help him?" I sensed that he thought I was too young. "I will be his doctor. He has urinary retention, probably from an enlarged prostate gland. He needs a catheter," I said. The men still looked doubtful. "How did he get the scars?" I asked

The interpreter spread his hands. “The Germans surprised his men in the forest, killed many; they shot the General, but he lived.”

I had passed catheters under the watchful eye of a resident or attending man; this would be an easy job. A Foley catheter is a hollow tube that when inserted into the bladder drains urine. It has a balloon at the end. When the catheter is in the bladder, one inflates the balloon with saline, so the catheter stays in place.

I pulled on sterile gloves, swabbed his penis with an antiseptic, and lubricated the catheter. The catheter met an obstruction about halfway into his penis. I pushed and pushed until I dripped sweat on the sterile towel and the old man moaned “BOLLI, BOLLI!” I tried smaller catheters until a child-sized catheter passed the obstruction. Dark, cloudy urine flowed into the bottle on the floor.

He gave a long sigh and wrung my hand. “Dank you, dank you,” he said.

Bolli is the Polish word for pain, not unlike *duele* in Spanish. The language makes little difference since the sounds of pain are universal.

I felt a real sense of accomplishment because our first task as a physician is to relieve pain. There were more patients that night: a couple old fellows with heat stroke, an emaciated man with end-stage cancer, and the usual alcoholic in delirium tremens (DTs). By early morning, they were all settled with intravenous fluids and sedatives, but then, the pitiful cry, “BOLLI, BOLLI!”

The Polish General was again pale and suffering intense pain. The urinary catheter was obstructed with blood clots. The drainage bottle was almost half-filled with blood. I irrigated the catheter with saline and had to replace it. The bleeding continued. I couldn’t understand what had gone so horribly wrong until another intern explained: draining a chronically distended bladder too rapidly causes the sub-mucosal veins to rupture with massive bleeding. I should have let the urine drain slowly. There were innumerable catheter changes, saline irrigations, and two blood transfusions before the bleeding slowed to a trickle and finally stopped.

For a few days, the black-shawled women brought food and bustled about, making him comfortable. On the third or fourth day, he had a shaking chill and spiked a high fever. The obstruction and all the manipulation had caused a urinary tract infection. Antibiotics gave him terrible diarrhea, but the old man always said, “Dank you, dank you,” when I came to his bedside. He

drank gallons of Kool-Aid and gradually improved. One day, he got out of bed, carried his urine bottle to the bathroom, and washed and shaved. He needed a prostatectomy, but the urologists would not do the operation unless he had blood donors. There was always a crowd around his bed on visitor's day. A priest who spoke English said many people would donate blood for the General. "He is a great hero," the priest said.

"Why?" I asked.

"The Germans took many villagers to the forests to kill them with machine guns. The General and his men killed the *boches*. The villagers escaped, but in another battle, the Germans shot the General. Much later, when the Russians came, the General and a few men escaped to the Americans."

It took another week to obtain X-rays of his kidneys and a few more days until a bed was available on the urology ward. By then, he had a chronic urinary infection. The urologists removed his prostate, but he died the night following surgery. The death of the old Polish General weighed on my conscience because my stupidity had brought on the bleeding and infection that contributed to his death.

A Missed Diagnosis

There were always more patients and more cries of pain. The gray-faced man with chest and upper abdominal pain was the patient of another intern. The pain had started rather abruptly in the sternal area. The resident, who at the time was into cardiology did an electrocardiogram that seemed to confirm his clinical diagnosis of myocardial infarction. He was quite certain of the diagnosis.

In those days, the treatment for a heart attack was bed rest and morphine. For two days and one night, the poor suffering man held his hand over his lower chest and shrieked, "OH, OH, HELP! CUT IT OUT, CUT IT OUT!"

During my night on duty, I called the nursing supervisor to give him a quarter grain of morphine. The narcotic helped him for a half hour or so but when the morphine wore off, the pupils of his eyes became widely dilated and his lips turned down in a rictus of pain or terror of the thing that tore at his body. He clutched his lower sternum and screamed, "OH, AH, CUT IT OUT, CUT IT OUT!"

His anguished cries were like those of Philoctetes, the wretched Greek soldier in a play by Sophocles, whose companions had abandoned him on a lonely island because of the terrible smell from his infected foot. Philoctetes' cries of pain, "OH, AH, OH PAPAI, OH!" were as non-specific as our patient's cries for help. In desperation, Philoctetes begged Neoptolemus, "I AM EATEN UP WITH TORTURE. OH, OH, I BEG YOU BY THE GODS, TAKE OUT YOUR SWORD AND CUT MY HEEL OFF, CUT IT OFF!"

Sadly, none of us thought of other possibilities, but accepted the electrocardiogram's evidence of a heart attack. His cries of "CUT IT OUT!" were prophetic; he should have had an operation but died an agonizing death.

At the autopsy, the pathologist found fluid in his peritoneal cavity that had leaked from a dime-sized perforation of his duodenum. His heart was perfectly normal. The acid gastric juice that had flooded his peritoneal cavity had caused his terrible, unrelenting pain. Three sutures would have closed the perforation and he would have lived.

There were recriminations but it was from this experience we learned that, on rare occasions, a perforated ulcer can cause changes in the electrocardiogram. The patient's cries of pain were non-specific and he clutched the middle of his lower chest, more or less over his heart. It was, however, a terrible mistake. No one had the discipline to go through a differential diagnosis of chest and upper abdominal pain instead of relying on a lab test. If anyone had thought of a perforated ulcer, an abdominal X-ray would have made the diagnosis.

A Fake

One evening, about nine o'clock, Jack, a former classmate who was an intern on ward 55, one floor down, asked me to hold a patient while he did a spinal tap.

There wasn't much history. According to the admitting intern's note, the police had picked him up on Madison Street in front of a dilapidated hotel. It was the sort of place, where down and out men could find a place to sleep for a buck or two a night. The police thought he was dead drunk or on drugs. Since he was in deep coma, the intern in admitting had sent him directly to the ward, still in his clothing. His pants and shirt were of good quality but worn thin and faded.

The man was totally unresponsive to vocal stimuli, loud noises, pin pricks and other tests for sensation. When Jack picked up his arm, it fell back, totally flaccid.

His pupils reacted to light and all his tendon reflexes were normal and there was no sign of trauma to his head. There was no smell of alcohol on his breath, his blood sugar and the rest of his lab tests were normal.

He didn't have any of the usual causes for coma—diabetic acidocis, alcohol intoxication or head injury. That left unusual things like encephalitis, an intracranial bleed from an aneurysm or a weird meningitis. A spinal tap was the only test left to do.

Jack opened the package with the long 18-gauge needle, a glass tube, the manometer, to measure pressure and sterile tubes for cultures, protein and sugar.

My job was to turn him on his side, flex his back to open up the vertebra so the needle would not hit bone. I managed to get his hips flexed and his knees bent, so I could hold his legs and with the other arm, bend his head forward.

Jack scrubbed his back with an antiseptic and pulled on sterile gloves. Just as he touched the skin of the man's back with the needle, the patient straightened, sat up and got off the table.

“Damn you,” he said.

He was very nimble when he pulled on his clothing, skipped out of the examining room and ran down the stairs. That solved the puzzle of his strange symptoms; they were all faked.

This was an extreme case, but a lot of people faked symptoms to get admitted to the hospital for free meals, a bed and some attention. The cause of their complaints were often elusive and required several days of tests to determine if the patient had heart disease, pneumonia or some other problem. After a day or so, the social service worker would become involved to sort out lost pension or welfare checks or to find a home for the poor bum. Occasionally, the interns would teach a particularly bright patient to do simple chores such as every four-hour urine tests for sugar on diabetic patients. Others helped keep the ward reasonably clean. When their welfare check came and overcome by thirst, they would check out to the nearest saloon and stay dead drunk for weeks. When the winds off Lake Michigan became too cold to sleep out of doors, they would be back.

A Curious Belly Ache

Rosemary, my last patient of the day was a young teenager. She was pale, slender with mousy brown hair and down cast eyes but did not appear to be ill. Her father, Reverend Bennet, held a stack of X-rays and reports under his arm. The Reverend was portly, wore a three-piece suit and had heavy jowls. Her mother nervously twisted a handkerchief.

When they had settled into my outpatient office, I sat down and smiled at Rosemary.

“What is the trouble?” I asked.

“She has pains in her stomach. Our doctor says she has adhesions and needs another operation,” Reverend Bennet replied.

This was strange because adhesions, scar tissue, between loops of small intestine don’t cause chronic symptoms. When the adhesion causes kinking or twisting of the bowel with obstruction, there is acute, cramping abdominal pain. Rosemary did not appear to be in acute distress.

“When did the pain start?”

I directed the question to Rosemary, but her father answered. “About six months ago. It went away after the appendectomy but came back a month later.”

The Reverend told the story reluctantly in bits and pieces. Her pain had started gradually, always, worse in the morning. It did not seem to be sharp, cramping or constant, but intermittent. Some days she would feel well enough to attend school, but then, the pain would recur and worsened.

Her family doctor had done multiple tests and X-rays. He had prescribed several medications but nothing helped. During one bout he consulted a surgeon, who had performed an appendectomy.

“The congregation prayed for her recovery and our prayers were answered because she was fine for a month after the operation,” the Reverend said.

When the pain recurred, her doctor repeated all the tests and X-rays. Finally, he told the parents that she must have adhesions and needed another operation.

I examined her eyes, ears, nose and throat, listened to her heart and lungs, listened to her intestinal sounds and palpated her abdomen, hoping to find a clue to her pain. Several times when I probed her abdomen, she winced or said, “that hurts.” A few minutes later, when I touched the same spot, she made no complaint. Her appendix scar was tender, but here was no consistent tenderness elsewhere.

She had been X-rayed from head to toe. I especially looked at her gall bladder, stomach and bowel films. All were perfectly normal. The multiple blood tests were also normal. Her doctor had even tested for esoteric things like lactose intolerance and the irritable bowel syndrome.

The pathology report on the appendix was ambiguous. Pathologists sometimes fudge and describe mild inflammation because if a surgeon removes too many normal appendices the hospital might suspend his surgical privileges. I doubted that her appendix caused her symptoms, but then, why was she better after the operation?

I fiddled with my stethoscope and again felt her abdomen.

“Please, once again, tell me how the pain started?” I asked.

“Look here, she needs an operation for adhesions,” the Reverend said.

For the first time, her mother spoke. “It always starts in the morning, after she gets up. Sometimes she cries with the pain and can’t eat,” she said.

“That’s right, she can’t eat normal food,” the Reverend said.

“Mrs. Bennet, what happens when she has the pain?” I asked.

“She goes back to bed and stays in her room. I take her some toast and a soft-boiled egg. That makes her feel better and then she reads or watches television. By noon, she gets up and has soup and ice cream.”

“Rosemary, does the soup and ice cream help your pain?”

“Not always, but sometimes,” she said.

“Do you go to school in the afternoon when you feel better?’ I asked.

Her face fell and she seemed to draw into herself. Her mother answered. “No, she cries with pain if I send her to school.”

I had an inspiration. “What is wrong with school?” I asked.

“It, it is a new school. The kids make fun of me,” Rosemary said.

The Reverend grew red in the face. “School has nothing to do with it,” he spluttered.

Almost without thinking, and without diplomacy, I said. “A psychiatrist might help Rosemary.”

“Are you telling me that my daughter is a nut case, that this is all in her head?” The Reverend said.

He grabbed Rosemary and the stack of X-rays. On the way out of the door, he shouted. “I will find a doctor to operate on my daughter.”

The next day at lunch, I told Irving, the hospital child psychiatrist, about Rosemary.

Irving stirred sugar into his coffee. “These children are hard to treat if their parents won’t cooperate. It sounds like school phobia, with a lot of secondary gain,” he said. Irving launched into a lecture on the subject. The pediatricians at the table perked up their ears. It was a fairly common problem.

“These kids don’t fake symptoms but have real abdominal pain or headaches in response to the anxiety of changing schools or dislike of a teacher. Most parents have conferences with the teachers and sent the kid back to school. It’s helpful to build up the child’s self-esteem by learning a new skill, such as in athletics or else excel in academics. Unfortunately, in some cases, like Rosemary, the parents let them stay home. Watching TV, reading or just laying around the house is pleasurable, what we call secondary gain. By treating the child as an invalid the mothers get the reputation for being good mothers and so they have secondary gain as well,” Irving explained.

“But why did the appendectomy help her pain?” I asked.

“That gave her an even better reason to stay home and be the center of attention. Her pain came right back when she was supposed to attend school again.”

I wrote a long letter to the referring pediatrician, explaining why Rosemary didn't need another operation. He thanked me, but I never heard from the family again.

A Bleeder

Years after the Supreme Court's Roe vs. Wade decision, abortion is still contentious. Lost in the discussion is what happened to the thousands of unwanted children and the effect of illegal abortion on women prior to 1972.

During my internship on obstetrics, one of my patients was a thirteen-year-old girl. As her labor wore on, she screamed louder despite sedatives. During one of her labor pains, she shouted, "I don't want no baby!" The baby was in the breech position, and after almost twenty-four hours of labor, we did a Cesarean section.

Girls as young as twelve years had babies at the County Hospital, and it was not unusual for women to have two or more babies before their twentieth year. These young women and their children would never get out of poverty or off welfare. Some mothers left their unwanted infants in the nursery. The poor unclaimed infants went to a pediatric ward with over a hundred abandoned "boarder babies." It sometimes took years for the social workers to place these children in a foster home. It was really unbearable to visit this ward and see the vacant, despairing eyes of these infants and children.

Ward 41, surgical obstetrics, was where young women came after a self-induced abortion or a visit to the local "granny" who performed illegal abortions. Was abortion any greater a tragedy than the plight of the unwanted, abandoned children or those who would never get out of poverty or off welfare?

There were probably about as many abortions prior to Roe vs. Wade as there are now. Unfortunately, those illegal abortions often resulted in severe complications or death. A few compassionate private physicians performed abortions. If there were complications, the woman was admitted to a hospital with the diagnosis of heavy menstrual bleeding or a "miscarriage."

Many of the unfortunate women who came to the County hospital after an illegal abortion were in hemorrhagic or septic shock. We interns quickly learned to treat these patients with blood transfusions and antibiotics. If the bleeding continued, we performed a dilatation and curettage (D and C) of the uterus. This operation should be performed under general anesthesia, but since there were too few anesthetists, we put our patients under with

whopping big injections of morphine and phenobarbital. The residents demonstrated how to enlarge the cervix with metal dilators and scrape the interior of the uterus with a curette. Within a few days, I could treat hemorrhagic shock and do a D and C, but I was unprepared for a patient who arrived more dead than alive.

The attendant shouted, "EMERGENCY, EMERGENCY, I GOT A BLEEDER!" The gurney left a trail of blood from the corridor to the treatment room. The young woman was dressed in a blood-soaked dark skirt, blouse, stockings, and high-heeled shoes. Her skin was deathly white. I couldn't find a pulse at her wrist and thought she was a goner, but the ward nurse felt a weak flutter in her carotid artery. I made an incision at her elbow and, with more luck than skill, found a vein and started an intravenous injection of normal saline. The nurse put shock blocks underneath the feet of the bed while I made the familiar dash to the first floor and, from the door to the blood bank, yelled, "Three pints of O-negative!" For a change, the technician didn't argue. I ran up the stairs and returned to the ward just as the last of the saline had run in. She was still bleeding. The first pint of blood made no difference in her pulse or blood pressure, but she occasionally moaned like a wounded animal. Dawkins, the OB resident, found clotted blood and a trickle of yellow pus in her vagina. She cried out when he palpated her distended abdomen.

"She has peritonitis, probably a perforated, infected uterus from a botched abortion," he said. "Get more blood. She needs an operation."

For the next hour, we pumped blood into her vein, gave Ergotrate, penicillin, and streptomycin. The bleeding slowed, and she came awake long enough to clutch my hand and say, "Nick, Nick, Nick."

Her eyes were too bright, her cheeks were flushed with fever. Her pulse raced. She looked around the blood-spattered walls of the treatment room and asked, "Where am I?"

"The County hospital," I answered.

Tears rolled down her cheeks, "Who are you?"

"An intern. What is your name?"

She sobbed and her eyes wandered around the litter of old blood bottles, dirty linen, and bloody pads. "I am a graduate student."

This was a surprise, but where else could she have gone after an illegal abortion?

Abe Berger, the attending obstetrician-gynecologist, was handsome, stocky, middle-aged, with a neat gray mustache. Even at three in the morning, there was a flower in the buttonhole of his blue suit and a heavy gold chain across his vest. He had a great practice; rich ladies adored him. When Abe gently touched her abdomen, she winced and moaned.

"When did this happen? Who did this to you?" he asked.

She covered her face and sobbed. The nurse gave her a shot of scopolamine and morphine. During the long, jolting ride to the operating room on the eighth floor, she cried, "It wasn't supposed to hurt. Nick paid fifty dollars." She screamed when we lifted her onto the operating table, until, mercifully, the anesthetist put her to sleep with ether and oxygen.

I prepped her distended belly with soap, water, and iodine while Abe and the resident scrubbed. Abe opened her abdomen with one neat slash. Cloudy yellow fluid and old blood gushed onto the drapes. He packed away the intestine and lifted the swollen uterus out of the pelvis. A coat hanger, or other makeshift instrument, had made a ragged hole in her uterus and had gone through her colon. Abe cursed in Yiddish as he cleaned out the pus and sewed up the hole in the bowel. The uterus was infected and still bleeding. He had to remove it to save her life.

Abe looked at me with brooding brown eyes. "Talk to her. Get the name of the son of a bitch who did this."

Dawkins and I finished closing the abdomen. I wheeled her to the recovery room just as the sun rose over Lake Michigan. Abe took us across the street to the Greek restaurant for ham and eggs. I drank a lot of strong black coffee and was ready for another day.

She was delirious and tried to get out of bed. The nurses put her hands in leather restraints and moved her to a darkened, dirty, little side room for patients who were expected to die. Her eyes were too bright and her pulse too fast. I had to stick needles in her veins several times a day to keep up the intravenous fluids and antibiotics.

On the third day, her abdominal wound was swollen and red. She screamed and screamed when I removed the stitches to release foul-smelling pus. Her skin turned yellow, her cheeks were sunken, and there was a terrible odor

from the pus and her diarrhea. I changed the dressings, cleaned her wound every day, tried new antibiotics, and gave transfusions of fresh plasma. Her spiking fever gradually returned to normal and the wound began to heal. She refused to tell us her name and she had no visitors. Day after day, she stared at the green peeling paint; the room was deathly quiet. When Dawkins told her about the hysterectomy she said nothing.

Abe made rounds with the students and house staff on Friday afternoons. We walked the ward, stopping at each sagging bed while an intern recited the patients' histories.

Jane Doe was on her side with her back to the door. Abe sat on the edge of her bed and put his hand on her shoulder. "Look at me," he said. She slowly turned her ravaged face and gazed at him with eyes surrounded by dark circles. She looked like a madwoman, but with an air of tragic beauty. Abe gently stroked her tangled hair. "This is not the end of the world. You have a lot to live for," he said. Abe continued to stroke her hair, and for a moment, I thought there was a tear in his eye. "What is your major?" he asked.

She whispered the first words she had spoken in many days. "English literature." "Ah, good, now you will understand Thomas Hardy."

She clutched his hand as if to hold him forever. He stood and said, "Get out of bed and eat. You will get well."

At the end of rounds, Abe stared out a window and said, "The laws against abortion are so stupid."

He must have touched her soul, because Jane Doe got out of bed and ate the tasteless hospital food. The evening after, I removed her dressing and said, "The wound is healed." Jane Doe signed herself out of the hospital.

FOREVER GUILTY

We interns worked on the pediatric wards during the day and took call in the pediatric admitting/emergency room every third night. One night, about two in the morning, I collapsed on a cart and fell sound asleep. After a few moments, an attendant shook me awake.

The patient was an eight or nine-year-old boy accompanied by a neat, but poorly dressed elderly woman. She sat bolt upright on the edge of her chair and said, “He been throwin’ up, and his eyes turned yellow.”

I asked, “How long has he been sick?”

She answered, “Bout a week.”

Something snapped; I lost my temper. “A week!” I yelled. “This isn’t an emergency. You should have come in the daytime. Go home and bring him back tomorrow.”

I went to my room, had a shower, changed clothes, and went to the cafeteria for a plate of greasy scrambled eggs and black, sweet coffee. When I returned to the emergency room to finish my shift, the old lady in a black dress and a little, white straw hat was still sitting rigidly erect on the bench. The boy was stretched out, asleep.

They had not gone home. With a terrible sense of shame, I realized I had behaved badly.

We went back into the cubicle, and in an attempt to atone, I spent a long time getting the history. The boy was slender and small for his age, his skin was mocha colored, and his black hair was curly. He said, “I got sick and threw up, then it hurt in my right side. Auntie thought I had the flu and give me a spoonful of Castor oil.”

“When was that?” I asked.

“‘Bout a week ago. That afternoon, when Auntie left for work, I was too tired to go out and play, but I watched the other boys try to catch that big old ginger Tom cat that has the torn ear and the burned tail. Those boys

chased that old cat down the alley. Then, I got sick again and waited for Auntie."

The old lady finally spoke. "I ain't his aunt, but I take care of him ever since his mama ran away with that white man who played a trumpet. Folks at church claim that white man is his father."

Auntie was of that indeterminate age between fifty and seventy, with graying hair, a thickset body, and hands gnarled from years of hard work. She wore sturdy, black men's shoes with run-over heels. The old lady must have had asthma because she wheezed in the hot, close air.

"Why didn't you bring him in earlier?" I asked.

"He seemed better until today."

"But why wait until the middle of the night?"

"Docta, we lives down on Seventy-Ninth Street by the stockyards. I gotta take one bus to State Street, den another one to Madison, den I walks to my building. Those diesel fumes and that stockyard smell don't do my breathin' any good. Den I picks up those lawyer's cigarette butts and scrub floors until eleven at night, den I take the same buses back home and go up three flights of stairs. Dat's when I found him, all curled up on the couch with throw-up dribblin' down outta his mouth and his eyes were turned yeller."

She stopped to wheeze, covered her mouth and coughed. "I thought, Oh Lordy, he's worse. I'll have to carry him out to the County. We is so late because them buses don't run so often at night. It took a long time to get to Ashland and then we took the streetcars up to Harrison and walked over here," she said.

With her every word, I felt lower and lower. The boy was curled into a fetal position on the examining table. His skin was hot, his eyes were yellow, his liver was enlarged and tender. He had hepatitis.

I sent him to an isolation room and visited him a few days later. He was perfectly still under a sheet with his arm stretched out for the intravenous glucose. There were no pictures on the green painted walls and no radio or books. Later, I gave him a comic book, but he was too listless to read. He took a little food and gradually improved.

The internship came to an end a few days later. I went on to other things, but still think of that poor boy and am guilty over my bad behavior.

THE SHIP'S CAT

A sailor lounging on the hangar deck, probably one of my patients yelled, "Hey Doc, you gonna get your ass wetter'n hell." The choppy, cold, dark sea separated the two ships and scudding gray clouds hung low over the fleet. A sleek destroyer, pitching and rolling a quarter mile away was supposed to pick up downed pilots. Would they pick up a half-drowned doctor?

I climbed into the breeches buoy, settled on the canvas seat while a bosun's mate strapped the harness. My chair was connected by a rope and a pulley to an overhead cable and to lines leading to the cargo ship. When sailors heaved on the line the breeches buoy zipped along the cable. If the ships rolled together the high-line cable could go slack and I would dunk in the cold South China Sea. Sometimes unpopular officers were dunked on purpose. I dipped close, but never touched water. Within minutes, the officer of the deck welcomed me to *The Belatrix*, a general cargo ship that delivered supplies to the fleet. His collar was open, and he wore a non-regulation baseball cap. An enlisted man with a flapping shirttail escorted me to the sickbay. This was not the spit and polish Navy.

I was the junior medical officer, just out of internship on *The U.S. Hancock*, an aircraft carrier with the seventh fleet cruising the Strait of Taiwan. Another carrier, *The Lexington*, was about a mile away and across the sea, cruisers, destroyers and cargo ships sliced through the choppy seas. Probably a submarine or two, lurked beneath the surface. The Chinese had shelled Quemoy and Matsu, two tiny islands separating China from Taiwan. John Foster Dulles and President Eisenhower had threatened to use atomic weapons in defense of Taiwan. *The Hancock's* planes flew low to avoid radar and could deliver atomic bombs. This was the coldest time of the cold war.

I had been in sickbay, in the midst of treating sailors with athlete's feet, backaches, and gonorrhea left over from our last visit to Yokosuka when a message arrived from the radio shack. "The skipper of *The Belatrix* requests the services of a medical officer." The ship was vibrating at thirty knots and the thud of the catapult meant we were still launching planes. A half a dozen

sailors were lined up in the corridor outside my office. "Sorry guys, come back to evening sick call," I said. They stopped playing grab ass.

Mickey, a chronic complainer from the electronics division clutched his back. "Ooh Doc, I can't stand it that long. Please, let me stay on the ward."

"Ask the corpsmen for an aspirin," I said.

An A 4D single engine bomber was on the launch pad, but the Captain suspended flight operations long enough for me to run to the hangar deck and transfer to the cargo ship.

The sick bay on *The Belatrix* was down one deck and off a corridor through a watertight door. The Chief Pharmacists Mate, Fogg, rose when I entered the small treatment room. Fogg had wisps of gray hair and hash marks indicating service during WWII. He probably knew more about the ills of sailors than a medical officer just out of school. On this ship, he was the 'doctor.' "It looks like appendicitis," Fogg said. He led me into a separate room with a half dozen bunks for sick sailors.

I sat on the bunk by the young gunner's mate and best bedside manner tried to put him at ease. His name was Pete, he came from Cleveland, where his folks ran a grocery store. "Tell me about the pain," I said.

"It started with cramps, last night after lights out and then I vomited. My right side hurts like hell," he said. He winced with pain when I touched "McBurney's point" in the right lower quadrant of his belly. He had appendicitis and needed an operation. I had performed a few appendectomies, but only in the familiar surroundings of *The Hancock's* well-equipped sick bay. Here, the treatment room was supposed to double as an emergency operating room. Fortunately, one of the corpsmen was an OR technician.

"Give him a quarter grain of morphine and let's do it." I said, with youthful confidence.

The captain brought the ship to a steady course while we scrubbed. I inserted a needle into his back and injected a spinal anesthetic. Pete was groggy from the morphine and never felt the needle. The anesthetic worked like a charm. Fogg painted his abdomen with iodine, and applied the sterile drapes. The OR tech, a second-class corpsman, had laid out the sterile gowns, gloves and a tray of gleaming hemostats, scissors, two scalpels, needle holders and

rolls of catgut and silk sutures. Another corpsman at the head of the table kept tabs on Pete's pulse and blood pressure.

I took a deep breath, stepped up to the operating table, cut through the skin and muscles and tied off the bleeders. The peritoneum, a tough membrane was the last layer. Too deep a cut in the peritoneum could injure bowel. The night surgeons at the County Hospital always made a small incision with the scalpel and then inserted a finger to push away the bowel, then finished the incision with scissors. It worked just fine and to my great relief, the red, swollen appendix popped into the wound. It was an easy appendectomy. I felt like a real surgeon, but it was more luck than skill. Fogg pulled off the sterile drapes, while I felt Pete's pulse. It was steady and strong. He opened a sleepy eye. "All done, Doc?"

"Yeah, you are just fine," I said.

After the corpsmen took the patient to his bunk, Fogg asked, "Doc, would you mind seeing another patient?"

"I should go back to *The Hancock*," I said.

"They are still having flight ops."

"OK," I said,

Lubinski, the chief master-at-arms, had sagging blue jowls, broken veins on his nose, and hash marks halfway up his sleeve indicating thirty years of service. With a gravelly voice that had broken up many bar fights, he said, "Doc, know anything about cats?"

Pride prevented a truthful answer. I said, "Not much."

He gently placed a forlorn gray cat with a pink nose and dull, sunken eyes on the treatment table. The cat meowed piteously while the chief stroked her fur. Her name was Lulu. I was dumbfounded. It was against regulations to have pets on navy ships, and the master at arms was responsible for enforcing the rules.

He growled again, "You gotta do somethin." His buddies, hulking chief petty officers, crowded the room.

"How long has she been sick?" I asked.

"She's thrown up ever since I found her in an alley behind a Tijuana whorehouse, but now she can't even hold a spoon of water."

I was at a loss for words, but a corpsman came to my rescue. "We gave her a shot of penicillin yesterday. Would another help?"

"Sure, couldn't hurt," I said.

Another corpsman said, "She hasn't had a crap for almost a week. What about cascara?"

"Might help," I said. Another corpsman suggested vitamins. They expected a miracle cure, but I had no idea of what to do. "How did you get her on the ship?" I asked.

"We were a little drunk, sneaked her on board under my shirt. We sort of adopted her in the Chief's quarters. One of the guys takes her out on deck at night for air. None of the officers know about her."

There were bare patches on her skin. "What happened to her fur?"

"Dunno, but she licks herself all day."

Lulu opened her mouth and retched a couple of times until she spit up a spoonful of yellow liquid.

She lay very still. Lulu was really pitiful.

Lubinski cradled the cat in his huge tattooed arms. "Poor Lulu, poor Lulu. Doc, you gotta fix her."

The gunnery chief spoke up. "My aunt had an old yellow cat that threw up. The vet said he had hairballs and gave him mineral oil."

Something clicked. I remembered a bald child who had a big mass in her belly. The interns and residents thought she had cancer, but the kid admitted to eating her hair. A wise pediatrician, diagnosed trichobezaoer, a fancy name for a hairball. The surgeons opened her up and removed a wad of hair mixed with mucous and bits of paper.

I felt Lulu's belly. The cat was limp and there was a small lump in her upper abdomen. "I am pretty sure she has a hairball. She needs an operation. See a vet the next time you're in port," I said.

"She won't last that long," Lubinski growled.

The corpsmen, Lubinski, Fogg and their friends muttered. One hulking petty officer from the black gang clenched his fist. I might not get off the ship alive if I didn't do something, or would I be court-martialed for not reporting a pet on board ship? The cat moaned piteously. "OK, I'll operate, but no promises."

"That's the stuff, Doc," Lubinski said.

Lubinski held her, while Fogg poured a few drops of ether on gauze over her face. When the cat stopped struggling, I painted her skin with iodine and put sterile towels around her belly, then suited up with gown and gloves. The corpsmen had re-sterilized the instruments. It looked like the real thing, except for the crowd. I made a small incision and the miniscule stomach, filled with matted hair and mucous bulged into the wound. The whole operation to open the stomach, removing the hair and suturing the stomach couldn't have lasted more than twenty minutes, but I lost more sweat than doing the appendectomy.

When it was over, Lulu whimpered like a baby and after a while, opened her eyes and pawed at the towels.

Lubinski shook hands and said, "Doc, if you get into trouble, let me know. I kin fix anything in the navy."

The Hancock had secured from air operations and the bosun's had already rigged the high line. When I climbed into the breeches buoy, the sides of *The Belatrix* were lined with sailors. "Thanks a lot, Doc," they yelled. I was back to the ship in time for supper. Later at sick call, Mickey was back, but this time he had a headache.

The next day, the skipper of *The Belatrix* sent a radio message. "We appreciate the services of your medical officer. Both patients are recovering nicely."

Reverend Ezra is Sick

The politicians paid surgical residents at the Cook County Hospital seventy-five dollars a month plus room, board and laundry. The pay was more than enough for single residents, but I was married with a couple of kids.

Dr. Gulick paid twenty-five bucks to work in his clinic from five to eight in the evening and he let us keep the ten dollar fees for house calls after the clinic closed. Gulick was an all-around doctor, a listener, empathetic, and a good on-the-spot diagnostician. Gulick pulled patients out of heart failure or diabetic acidosis and had an easy way with drunks, derelicts, and whores. He could have had a Gold Coast practice but would not put up with rich people's bullshit.

Gulick knew how to game the system. Every street accident became a whiplash injury, worth at least a couple of grand. He probably split with the lawyers. Who cared? The insurance companies were rich. He didn't do abortions, which, in the 1950's, were still illegal. He sent the poor girls to someone who did a safe job.

His storefront office on Madison Street was next door to a saloon and across the street from a cheap hotel that rented rooms by the month. Emma Jean, an imposing middle-aged Black lady, greeted patients from her desk by the front door. She kept records, collected money, chastised unruly patients and knew everyone on the street. The office was plain and simple. People waited on a bench by Emma Jean's desk. We saw patients in tiny partitioned rooms with war surplus examining tables and a hard-backed chair for the doctor. A room in the back of the office had shelves for bottles of medicine, a refrigerator for perishables like insulin and a small electric sterilizer for syringes, needles and a few surgical instruments that could have been relics from the first world war. The patients were all dirt poor but they would rather pay three bucks for an office visit and a dollar for a bottle of medicine than wait to see a County intern or take charity at the posh Presbyterian Hospital dispensary.

When there was a lull between patients, we mixed the ingredients and filled bottles with sugar water and alcohol that came in gallon jugs. The base mixture was about twenty percent alcohol. The green bottle with peppermint

and belladonna was for stomach upsets. We treated coughs with the brown bottle containing tincture of opium. The pink bottle for diarrhea contained bismuth. The dose was a tablespoon four times a day. A favorite was half mineral oil and half cascara for constipation. The mixture provided explosive but satisfying relief. Some patients, regardless of their ailment, wanted a two-dollar "shot" because an injection was thought to be more effective. The cold "shot" contained vitamin C. A shot of vitamin B1, our all-purpose "pick me up," was good for hangovers or impending DTs.

When things were busy, Gulick would stay for an hour or so after I arrived. He always did a quick but thorough examination, made snap diagnoses and dispensed medicine on the spot. His patients loved him. He always held their hand and said, "You will feel a lot better." They did too.

I arrived the clinic on a chilly October evening after operating most of the day and making rounds with the interns. A half a dozen patients occupied the chairs and a couple more were standing. They had coughs, colds, upset stomachs and headaches. One child had pulled a pot of boiling water from the stove and had scalded her face. I smeared Vaseline on the blisters, wrapped a bandage around her head and told her mother to take her to the County Children's Hospital. The only really sick patient was a week-old baby who squirted liquid stools. His skin was wrinkled, his eyes were sunken, and his mouth was dry as sandpaper. His teenage mother couldn't understand why peanut butter and condensed milk straight out of the can made him sick. He perked up after I injected a hundred cc's of saline under his skin. The poor thing sucked down a bottle of glucose water and gurgled happily. I explained to his mother how to make a formula with condensed milk, water, and corn syrup.

Just before closing time, a small, shivering, Negro boy, dressed in a dirty T-shirt and ragged jeans, brought a neatly folded scrap of paper. The note, printed in pencil, said, "come quik, rev. ezra is sik." There was no address. Emma Jean gave the boy a dime before he scampered back to the street.

"Reverend Ezra has a storefront church on Monroe Street and lives in the same building," Emma Jean said.

By some miracle, she found the address. I set off in my old Ford to an area of rickety tenements on the darkest streets in Chicago. The street signs were missing and the lights were out. After cruising up and down I spotted a faded sign written in neat block letters: "Sacred Church of Jesus. Rev. Ezra Jenkins, Pastor." I locked the Ford and peered through the window into the

church, hoping to find someone who knew the Reverend. A single dangling bulb lit the one room. A dozen or so folding chairs faced a wooden altar, but no one was in the church.

The building was one of those ancient four-story brick apartment buildings. The stairway leading up to the second floor was littered with trash. Something 'squished' under one foot, probably a dead rat. The flimsy plywood door opened on a vestibule, with a hall and stairs leading to the upper floors. I banged on a door. Children screamed and babies cried; there was no answer. This was not surprising. Visitors were either cops or bill collectors.

I yelled, "I am from Dr. Gulick."

The door opened a crack. A little girl said, "We doan need no doctor."

"I'm looking for Reverend Ezra."

"He doan live here, try the third floor."

I trudged upstairs and knocked on more doors. Usually on visits like this, no one answered. Sometimes, a person came to the door and said, "he be all bettah, don't need no docta no mo," or the relatives just wanted to know if Auntie was really dead. The usual patient was a fat old lady with multiple complaints, or a stick-skinny man with end-stage cancer. Finally, a muffled voice said, "Reverend Ezra, he be upstairs, last door."

The dark stairs were littered with old magazines, broken furniture and paper bags spilling garbage. Finally, with my dimming penlight, I found a handwritten sign: "Reverend Ezra Jenkins." I heard noisy breathing when an old woman opened the door.

Three wrinkled, white-haired ladies, dressed for church, sat on two sofas in the dimly lit room. Each had a Bible on her lap. A handsome, elderly man in a clean, pressed black suit and a white shirt sagged on an overstuffed chair. One lady rubbed his hand and another spooned soup into his mouth. His bare feet were swollen, and his head, with a frizz of white hair, lolled to one side. He was breathing hard.

He roused up and wheezed, "Thank you for coming."

"You got to help him," one lady said.

"What seems to be the trouble?"

"His legs swole up and he can't get around. He done run out of medicine last week."

When I rolled up his pants and pressed his legs, my finger left a deep imprint. He had four plus pitting edema, a sign of fluid retention from either kidney or heart failure. The pulse was fluttery, fast, and irregular. The jugular veins in his neck were distended. It took a while to get off his coat, shirt, and tie because he insisted that the ladies leave. I had no sooner pressed the stethoscope on his skinny chest, when loud praying came from the back room.

"OOO Jesus, save our Reverend Ezra. O Lord, OOO Lord, save our Reverend Ezra."

"Ladies, you be quiet so the doctah can hear," the Reverend said.

When the ladies quieted down, I heard fluid bubbling in both lungs. His heart made a few rapid thumps, stopped for a few seconds, then raced like a fire engine with blood whooshing back and forth through his aortic valve. His belly was distended with fluid. He was in advanced heart failure. I gave him a shot to get rid of the fluid and a dose of digitalis. He studied me with warm brown eyes while I helped him with his shirt and coat.

"Doctah, is it my heart again?" He asked.

"Yes, Reverend, I am afraid so. You need to go to the hospital."

"I likes the County. All the doctahs know me out there."

There was a telephone in the next apartment but it took a while to find the right police station. "This is Dr. R—from the County. I need an ambulance for a sick man at 2340 Monroe Street, last apartment on the third floor."

The duty sergeant made a slurping coffee drinking sound. "Be about an hour, get him to the door. We ain't carrying nobody down three flights."

Two husky neighbors carried the Reverend to the front door. The paddy wagon arrived after midnight, smelling of old cigarettes and vomit. In Chicago, the police wagons carried drunks, stray dogs, criminals, the sick and wounded, and sometimes all of them together. The two bored cops stood by while we put the old man on the cot and covered him with a thin, gray blanket. The wagon roared off and the ladies left. I forgot to collect the fee.

THE NAVEL OF THE WORLD: BELLY BUTTONS, INNIES AND OUTIES

In 1999, I traveled from Panama to Easter Island via the Galapagos, as a passenger/deckhand/ ship's surgeon on an old square-rigged sailing ship. Easter Island, the most remote, isolated place on earth was originally settled by Polynesians who had sailed thousands of miles to find a new home.

A rounded dark boulder surrounded by smaller stones on a lovely sandy beach marks the place where the Polynesians first landed on Easter Island. According to local mythology, the boulder is the navel of the world. The boulder was warmer than the surrounding stones and a compass placed on top would not tell north from south. No wonder it had spiritual significance.

The navel of the world reminded me of a patient I had cared for many years before. He was about ten years old and by a quirk of embryology, had an infected cyst in his umbilicus. A remnant of bladder tissue had caused the cyst. It was necessary to remove his umbilicus along with the cyst.

A few weeks later, the boy arrived in the clinic with his father. This was unusual because at the County Hospital, we rarely saw the fathers of our patients. "You took his navel away," the father said. The boy hopped up on to the examining table and took down his pants. There was a thin transvers scar where I had, indeed removed his navel along with the cyst. I tried to explain why it was necessary to remove the boy's umbilicus. After a moment's reflection, the boy's father asked, "can you make a new one?"

At first, the request for another operation seemed ridiculous, but then, I realized the importance of an umbilicus. It was our original connection to our mothers by way of the umbilical cord. After birth, it is the north star of the abdomen, our center, and how we relate up from down and right from left. A proper umbilicus will hold a jewel to enhance gyrating belly dancers.

Normally, the umbilical cord dries and after a few days drops off, leaving a nice crater in the middle of the abdomen. If the tissues don't close properly, a hernia may form at the umbilicus. These hernias usually spontaneously close by one year of age but may reappear during pregnancy. In Africa, an umbilical hernia is sometimes recognized as a symbol of fertility.

Mothers often request surgical repair of umbilical hernias and are disappointed when told that an operation isn't necessary because the hernia will cause no trouble and will spontaneously disappear.

At one time, I had a rule, that we didn't operate on umbilical hernias unless they were so large, the neighbor kids played with it. When we did operate, we took great care to tuck in skin flaps, so the child had an 'innie' that looked like a normal umbilicus.

I re-admitted the boy to the hospital and with great care, made two flaps of skin, which I tucked in to create a normal appearing umbilicus in the exact center of his old scar. It was a simple, cosmetic operation, but the boy and his family were happier than any of my other patients.

QUESTIONING 20TH CENTURY MEDICINE

ETHICAL DILEMMAS

I was always elated when a baby survived surgery and a long stay in the intensive care unit and went home with happy parents. Survival is the primary measure of success. As sicker and smaller babies lived, we saw more disabled children in our post-operative clinics. Some children had prolonged breathing problems, while others were deaf or partially blind.

I became especially alarmed when a mother brought in her seven-year-old son who had been born with his intestines herniated into his chest. His left lung was compressed and small, but after the operation to replace his intestine and to close the defect in his diaphragm he recovered without any special treatment, such as prolonged ventilation or support with a heart-lung machine. There were no complications after his operation. His mother said that had seemed normal until he started school. He couldn't concentrate, couldn't learn, couldn't get along with other children, and had repeated the first grade.

During, or shortly after, birth, he must have suffered brain damage, presumably due to the lack of oxygen. I became very worried about the fate of other children who had survived surgery and intensive care.

Our wonderful new technology and increasing surgical skill saved babies who formerly would have died. Unfortunately, each day brought a new crisis for the very smallest and sickest infants. These tiny babies suffered infections, lung collapse, airway obstructions, and brain damage. They required multiple operations, medication, breathing machines, and intravenous feedings. One life-threatening crisis followed another, often in the middle of the night. No one knew for certain what the outcome would be in any individual baby. Some would survive and eventually appear normal, while others would be mentally and developmentally disabled, blind, or deaf. Almost all of these tiny, premature infants had long-term nutritional and respiratory problems. Many times, I would look at a poor, wizened baby, supported by the most advanced technology and wonder if it would not be best to disconnect the machines and let nature take its course.

This was a difficult topic and troubling to discuss with parents or even other doctors. Some doctors thought that no matter what the outcome, we must

do everything to keep those babies alive. Others asked if the huge amount of time, effort, and money should not be spent in other areas of health care. I was more concerned about the terrible pain and suffering we were inflicting on babies who were unable to make a choice. Did we keep these infants alive to satisfy our own egos and professional goals? I often thought of those issues while watching gaunt, hollow-eyed children in third world countries rub their stomachs and point to their mouths while standing outside tour buses filled with rich Americans.

Some parents practically lived in the neonatal intensive care unit (NICU) and tried to make sense out of the medical procedures. Others rarely came to the unit, and still others were highly critical and hostile when there were complications. It's difficult to explain ordinary medical care to parents, but almost impossible when there is uncertainty and new, poorly understood problems.

Communication with parents is even more difficult when many specialists are involved. One doctor would tell the parents that the baby's heart was fine and that he'd be "okay." The parent would hear "fine" and expect things were going well. The next day, another doctor would say the baby had suffered a brain hemorrhage or intestinal gangrene and might never be normal. The parents were shocked and complained of poor communication.

When a baby dies, there is a sense of finality, an outpouring of grief, and the parents gradually recover enough to move forward with their lives. Ongoing uncertainty prolongs and intensifies the sense of loss and pain, especially when their poor, sick babies live with the support of drugs, machines, repeated procedures, and continuous nursing and medical care.

Physicians react to the uncertainty and atmosphere of continual crisis in different ways. I often had a sense of hopelessness and despair when operating on these infants because we could never restore them to normal. Most doctors maintained scientific detachment by focusing on laboratory results, X-ray studies, and esoteric findings, rather than on the patient as an individual. The "team" approach to medical care diffuses responsibility so that no one feels "This is my patient." I sometimes felt responsible for a piece of gut or lung, and not the whole individual, and would look for ways to avoid visiting the NICU, knowing that the "team" was on the job.

Birth defects, such as extra fingers or toes, pigmented skin lesions, lop ears, or club feet aren't life-threatening, but as the child matures, even these defects may cause mental anguish. We all know how teenage children suffer

from acne. More serious defects of the esophagus, gastrointestinal tract, or heart are life-threatening, but surgical treatment allows the child to live a near-normal life.

A third group of infants have such extensive and complicated deformities that operations may prolong life, but no treatment will restore normal function or appearance. Those patients pose major ethical problems. Approximately one in seven hundred babies has Down syndrome, in whom there is an extra chromosome 21. While I was in school, they were called "Mongols" because of their typically slanted eyes. Every medical student learned to make the diagnosis by recognizing the short, broad hands with a single palmar crease.

Babies with Down syndrome are placid, happy-appearing infants who require life-long care. Parents usually are very devoted to Down syndrome children, but as they grow older, a decision must be made about institutional care. Most families can't afford long-term care, and the government is loath to provide sufficient funds to care for disabled adults. A high percentage of babies with Down syndrome have associated life-threatening abnormalities, such as intestinal obstruction or congenital heart defects. For years, experienced, humane physicians thought these infants would have such intolerable lives that they should be allowed to die. My chief in cardiac surgery would not operate on these babies. At the other extreme, at least one group of heart surgeons used patients with Down syndrome to practice open-heart techniques.

As medical technology improved and more lives could be prolonged, the ethical debate intensified. Most physicians and surgeons came to the conclusion that we should abide by the family's wishes if they decided to withhold treatment and allow the baby to die. This decision is urgent because surgery for life-threatening birth defects, especially of the esophagus or gastrointestinal tract, is most successful when done on the first day of life. Thus, the decision to have an operation must be made at a time when the mother is still recovering, and the father is under great stress. Down syndrome is well known to the public, and most parents understand its significance but often don't know of the other birth defects. A few families wanted more time to think things over, but most fathers would just say, "Do whatever's necessary."

When a baby is terribly deformed, should we provide life-prolonging treatment or surgery? Some babies have their urinary bladder open on the abdominal wall, the umbilicus is covered with a thin membrane, the spinal

cord is abnormal, the small intestine is short, often twisted, and often the baby has club feet. The large bowel is shortened and opens in the middle of the bladder, and it is usually impossible to determine the sex. When left alone, these babies often refuse to eat and die within a few days. In the past, surgeons removed the exposed bladder and created two artificial openings on the abdominal wall for excretion, stool in one bag, urine in another. Little could be done about the sexual organs. These sad children required prolonged treatment, more operations, and had no hope for anything approaching a normal life.

Dr. Willis Potts described two of these babies who were admitted to the Children's Memorial Hospital during the 1950s. An operation to relieve the rectal obstruction was explained to one father, a practical farmer. He asked probing questions about his child's future, listened carefully, and announced, "There will be no operation." Dr. Potts agreed.

The parents of the other baby, devout Catholics, turned to their parish priest for advice. He told the parents that under unusual circumstances, it was not a sin to withhold treatment when extraordinary measures were required. Catholics believe that efforts must be made to eliminate sickness and suffering, to prevent death, and that life is sacred. On the other hand, Catholic theologians make a distinction between using ordinary and extraordinary measures to preserve life. If extraordinary treatment causes excess expense, pain, and suffering, and doesn't offer a hope for cure, it is ethical to withhold treatment. The problem is to distinguish clearly between what may properly be considered extraordinary means and what is ordinary.

To my thinking, extraordinary means to prolong life include treatment that causes recurrent pain—such as surgical procedures, repeated needle sticks, and multiple diagnostic procedures—when there is no hope of restoring the baby to a self-sufficient life. The definition of extraordinary means to save life continues to evolve. Other religious faiths have addressed these end-of-life issues as well. Jewish authorities feel that nothing must be done to hasten death, yet, when death is inevitable and healing seems to impede death rather than support life, it is permissible to provide supportive care to relieve pain and suffering rather than attempts to prolong life.

Debates about the care of severely disabled newborn infants were private matters between the parents, a physician, family members, and religious advisers until the early 1970s. Dr. Anthony Shaw, a pediatric surgeon, was troubled when parents of a baby born with esophageal atresia and Down syndrome asked, "Do we have a choice?"

This question led him to write a series of articles. One, "Dilemmas of Informed Consent," was published in the *New England Journal of Medicine*.[1] It was accompanied by a report from a major teaching hospital which described how forty-three severely malformed or premature infants had died with non-treatment over a period of three years. This article came to the attention of a United States Senate committee which investigated the deaths of newborn infants by "non-treatment."

A new field, Biomedical Ethics, arose out of this debate. One of the first problems to be considered was spina bifida. This is a condition in which the spinal column fails to close, leaving the spinal cord exposed to the air. Spina bifida is associated with hydrocephalus (water on the brain), which causes mental disability, paralysis of the legs, and incontinence for stool and urine. There are all degrees of disability, varying from mild lower limb weakness with minimal brain dysfunction to almost complete disability.

During the 1960s, some aggressive neurosurgeons began treating these babies with early closure of the spina bifida and the insertion of plastic tubes to drain fluid from the brain. The results of this treatment varied, but few of the more severely damaged babies ever enjoyed a self-sufficient life. Once the issue of non-treatment versus treatment reached the public eye, the argument became "life versus death." Until this time, parents and physicians considered the child's future quality of life in their decision-making. These arguments, which involved privacy, parents' rights, and medical decision-making, ended up in courts of law and politics.

Prior to the onset of this debate, I cared for a baby in which the decision was abruptly made by the parents in a very troubling manner. The baby, born to older parents, cried poorly and couldn't swallow. X-rays showed a blind-ending esophagus high in his neck. I worked all afternoon attempting to bring the two ends of the esophagus together, but they were so far apart, I had to make an opening in the baby's neck to drain saliva. The trachea had soft, floppy cartilages and collapsed each time he took a breath. I left a plastic tube in his trachea and connected him to an early-model ventilator. The father, a physician, watched his baby struggle against the breathing machine. He went home and discussed the problem with his family, which included a priest. He returned to the hospital, disconnected the baby from the ventilator, and took him home. The baby died. The father, who had cared for many disabled children, could not bear to see his own child suffer a life

[1] Shaw, A. MD. Dilemmas of Informed Consent. New England Journal of Medicine. 1973; 289: 885-890.

of pain and misery. I had to agree. I could have made an artificial esophagus, but there was little to do for the trachea. At best, the baby could have lived with a tracheotomy.

Even if I didn't always agree with the parents, I realized the importance of the family in the long-term treatment of the child. The operation was only one phase in the overall care of a patient with a birth defect. We could, in most cases, restore anatomy, but function was never optimal. The best example is the condition termed "imperforate anus," in which the rectum ends blindly and the baby cannot have a bowel movement. It was usually necessary to perform a colostomy, an operation that creates an artificial anus on the abdominal wall. For a year or so, the parents applied a plastic bag to collect fecal material. The next step was to place the rectum in its normal position. Finally, the colostomy would be closed, and the baby would commence to have stools through his anus. The rectal muscles were always poorly developed and fecal continence was delayed. Some children never controlled their bowel movements. Thus, the parent's attitude and care was a major factor in determining whether the child became a smelly, social outcast or a reasonably happy person. The same dilemma remains today. They have to accept long, frustrating years of treatment, many visits to the doctor, and even more operations. The need to involve the parents in the child's care over a number of years is one reason why I felt so strongly about the need for privacy between the family and physician in the decision-making process.

Unfortunately, the courts became involved in these decisions shortly after I arrived at the Children's Hospital. A pediatrician referred a baby with an esophageal atresia and a tracheal fistula. The baby's left arm was deformed and there was no hand. The father had many questions and, after conferring with his wife and other family members, decided against an operation. I was upset by the parents' decision because I thought the child could have a reasonably good quality of life. I consulted the hospital medical director who was a specialist in genetics. He thought the baby probably had a chromosomal abnormality and mental disability. He recommended abiding by the family's wishes. I called the referring pediatrician, who requested a judge to order the family to agree with an operation. I attended the hearing with another pediatric surgeon who testified that, although the outcome was doubtful, an operation should be performed. I then explained that I would not operate unless the family agreed. The judge ruled in favor of an operation and the family asked me to do it. The operation went well, and the baby went home. The family missed several post-operative appointments, and after several months, the baby's esophagus developed scar tissue and

he had difficulty swallowing. The family became hostile and I never saw them again. The hostility engendered by the legal intervention certainly made the physician-patient relationship difficult and perhaps led to parental neglect of their child.

The ethical debate over deformed infants heated up in April 1982, when "Baby Doe" was born with Down syndrome, esophageal atresia, and a fistula between the esophagus and the trachea. X-rays also demonstrated an enlarged heart. The obstetrician and a pediatrician discussed the baby with the parents, a well-educated, Catholic, professional couple with two other healthy children. The pediatrician had already arranged for the baby to be transferred to an Indiana medical center for surgical repair of the esophagus. When the family decided not to treat the baby, the pediatrician continued to insist on transferring the baby for an operation.

In the ensuing uproar, the parents were accused of infanticide. The obstetrician agreed with the family's decision, took charge of the infant, and ordered that the child be kept as comfortable as possible and given sedation, if necessary. There were no intravenous feedings or any other treatment. The hospital threatened legal action and attorneys called for an emergency judicial hearing to force the family to send the baby for an operation. The judge listened to the two medical opinions, one urging full treatment, including major surgery, and the other favoring supportive measures to keep the baby comfortable. There was no guarantee that the operation would succeed, and both parties agreed that the baby would be hopelessly mentally disabled. The judge decided that, since medical opinion was conflicting, the family had the right to decide the fate of their child. Immediately, right-to-life groups, the Department of Public Welfare, and other organizations leaped into the fray. They attempted to charge the family with child abuse, and the case was on its way to the Supreme Court when, at six days of age, the baby died of pneumonia.

Right-to-life organizations and lobbyists representing the disabled took their case to the conservative Reagan administration. C. Everett Koop, a pioneer pediatric surgeon, former chief of surgery at the Philadelphia Children's Hospital, and a fundamental Christian, was Reagan's surgeon general. He, with other members of the Reagan administration, secretly wrote the "Baby Doe" regulations, which required hospital nurseries to post warning signs that read: "DISCRIMINATORY FAILURE TO FEED AND CARE FOR HANDICAPPED INFANTS IN THIS FACILITY ARE PROHIBITED BY FEDERAL LAW."

The signs listed a hotline telephone number so anyone could call to report infractions of the rule. The Reagan administration, by pandering to its right-wing, Christian constituency, wiped out the principle of confidentiality between a physician and his patient. The administration that expressed concern for "family values" removed from families the basic right to determine the best and most humane treatment for their child. The government sent Baby Doe squads to hospitals all over the country in response to anonymous tips, but was unable to uncover evidence of infanticide or even neglect of handicapped infants. The government goon squads publicly and cruelly harassed parents and nursery workers.

The American Academy of Pediatrics, together with the National Association of Children's Hospitals, challenged the Baby Doe regulations. Eventually, a judge ruled against the regulations, but the debate continued. All of us who treated sick, newborn infants felt the government was looking over our shoulders. It didn't matter if a baby was deaf, blind, hopelessly deformed, and mentally disabled. Parents and physicians had no choice but to provide full treatment, which included surgery, artificial feeding, and multiple other painful, invasive procedures. When a sick baby's heart stopped, the nurses were compelled to massage the heart in an attempt to restart it.

I continue to believe that the decisions about deformed newborn infants should be made by the parents, the family, and their physician. These decisions are not easy and are arrived at after many tearful discussions, with the involvement of ethicists and religious advisors. An example was the baby who came to our intensive care unit from another medical center during the uproar over the Baby Doe regulations. On the basis of a prenatal ultrasound, the parents were told that their baby had a simple, congenital hernia into the umbilicus that could easily be repaired. When the defect turned out to be much more extensive, the parents brought the baby to our hospital. It was exactly the same defect that Dr. Potts described years before and which the Catholic ethicists had declared beyond reasonable care.

The bladder was bulging out through the lower abdomen. There was no anal opening, and the genitalia, although apparently male, was beyond repair. The parents were university professors and the baby's uncle was a physician. Since stool was coming out an opening in the middle of the bladder, the baby was in no immediate danger. I discussed the case with a pediatrician who had a strong interest in ethics. We agreed on offering the parents two choices; one was to do nothing and discharge the baby to home care, and the other was a "go for broke" operation to close the bladder, create an opening for the rectum, and transform the infant into a female. The

operation would be very difficult, risky, and the baby would possibly not survive surgery. Also, I doubted that she would ever gain control of urine or fecal excretion. If the parents opted to take the infant home, there was a risk that they could be charged with child neglect. The uncle, a physician, strongly advised against any treatment, feeling that the baby would suffer less if allowed to die.

The family struggled for several days and decided against an operation. Since the state could take the baby away from them, they decided to take her to a foreign country. I and the other doctors agreed. Suddenly one day, they changed their minds and decided upon an extensive operation, which to my knowledge had never been performed.

I couldn't sleep the night before, but fortified with a hearty breakfast, I spent the day closing the bladder, constructing a new rectum, and removing the penis to transform the baby into a female. I closed the huge, gaping wound in the anterior abdominal wall by suturing the widely separated pubic bones and muscles. The cosmetic result was not bad, and surprisingly, the baby tolerated the long operation and healed well. At the time, I thought it might be best for everyone if the baby died as a result of the surgery. But to my amazement, the mother had been pumping her breasts and was able to breastfeed the baby. She thrived. The mother quit her job and devoted every minute to the care of her child. Later, I referred her to a surgeon in Boston for more urinary reconstruction. With the aid of enemas, she eventually gained control of her bowel movements and, with self-catheterization, had urinary control. This sounds like a grand success, but no one can predict the ultimate outcome.

I did the same operation on several more patients with varied results. The bladder fell apart in one child and after more failed operations, she still had no control of her stool or urine. She had a totally miserable life. I am still uncertain if we should offer surgery in these pitiful cases.

During the later years of my practice, I saw older children who had great difficulty swallowing food because of severe brain damage. Some of those poor creatures had no bowel or bladder control, were unable to walk, and breathed through a tube in their throat. They were unable to communicate and required continuous care. Sometimes a request was made to surgically implant a tube in the patient's stomach to aid in feeding. That was usually for the convenience of the parents or personnel in an institution and not for the patient's benefit. There is a huge industry that profits by caring for those sad, unfortunate humans. I often asked myself if we should do operations to

prolong lives if those lives were not worth living. I certainly would not want to be kept alive in similar circumstances.

After I retired from the Children's Hospital, I saw an even more bizarre situation while working at the Cook County Hospital. A two-year-old child, abandoned by her parents, suffered a rare disorder in which her bowel simply didn't function. She had been hospitalized, fed intravenously, and supported by a ventilator since birth. She had undergone innumerable abdominal operations, a tracheotomy, and multiple insertions of intravenous tubes. She was in respiratory and liver failure, her bowel didn't work, and the tubes necessary for intravenous feedings frequently became infected.

There was hardly an organ in her body that functioned. She was sustained by technology. Her physicians had discussed the possibility of a liver and small bowel transplant with her aunt, who had custody of the child. None of the many physicians were willing to take the responsibility to say, "Enough is enough." I could not imagine anything more inhumane than keeping this child alive with continuing, painful, futile treatments. I requested a conference of all interested parties. Everyone agreed that the situation was hopeless and that a liver and bowel transplant was unlikely. A social worker then said, "But you can't just let the child die."

Our wisdom has lagged behind our technology and we are struggling in the dark to solve these vexing problems. I have been humbled by the challenges but feel that the decision about what to do with poor, sick, deformed babies is best made by the parents and their physician. There must be compassion, and no law should compel us to pursue vain and useless treatment to satisfy religious beliefs. The media should refrain from inflaming passions and further upsetting grieving parents and vexed physicians.

CONJOINED TWINS, ETHICS AND THE MEDIA

Conjoined twins have fascinated humans since earliest times. Artists illustrated twins in clay, stone statues, wood carvings and portraits. They were exhibited on stage, in freak shows and the circus. The worldwide news media and especially, the intrusive television camera has now replaced the circus as a means of exhibiting these unfortunates and their families to the public. The surgical separation of conjoined twins has raised ethical issues. Who decides to treat severely malformed infants? Is it right to sacrifice one twin to save the other or to allocate shared vital organs to the stronger twin?

The earliest illustrations of conjoined twins were found on clay tablets in a mound near the Tigris River. These records, assembled by the Assyrian King Ashurbanipal, belonged to the Royal Library of Nineveh. A double headed twin goddess dating from 6500 BC was also found in Turkey. [1,2] A terracotta figure with two heads, two arms and two legs, joined side by side, originally, from Mexico in the Museo de Colon on Gran Canaria in the Canary Islands. The Museo Anthropologico on Easter Island has a two headed figure and one of the great stone statues on Easter Island had two heads until one was taken to the British Museum. [3] [fig.1] The Canterbury Museum in Christchurch, New Zealand has a wood carving of two headed, female twins, joined side by side from Easter Island. [fig.2] The wood surface has a sheen and smoothness suggesting care and long handling. The details of the carved spine are anatomically correct.

The Museo de Tahiti et Des Isles has a small, wood carving of two men joined back to back, in a sitting position. The carving is an accurate depiction of twins joined at the sacrum—pyopagus twins. A pictograph on a large stone in the courtyard of the museum shows a small woman above two-headed twins, as if she had just given birth. The twins are joined side by side with six fingers on one hand and one foot appears to be clubbed. According to an island legend, a warrior returned home to find his wife dead, probably from a prolonged labor. He carved the pictograph in memory of his wife and children. A two headed man with a broad chest, with one foot pointing backward was found in the same area as the pictograph.

During the Middle Ages, physicians considered conjoined twins as monsters to be neglected or killed. They excited religious interest and many thought

conjoined twins were omens of the future or God's punishment for man's wickedness. The first autopsy in the new world was performed on twins joined at the abdomen on the island of Hispaniola in 1553. They lived for eight days. The priest asked for an autopsy to determine which twin had the "soul," so he would know which one to baptize. [5]

During 19th century, entrepreneurs exhibited conjoined twins on the stage. The Blazek twins, joined at the sacrum, with a shared single rectum and genitalia, played the violin and sang on stage. At the age of thirty-two, one became pregnant and delivered a normal infant. Chang and Eng, the "twins of Siam," joined at the abdomen by a thin band of tissue were exhibited in P.T. Barnum's circus. They became successful farmers, married, had children and lived to be a ripe old age. They refused surgical separation. [6]

Early attempts at surgical separation were on twins with minimal soft tissue connections or when one twin was in imminent danger of death. There were increasing numbers of separations during the 20th century with survival. [7] The success of these operations fanned the publics morbid interest in human suffering and the media, especially television, feeds on this interest with sensational stories that invade the privacy of families and patients. The media may well have influenced the family to seek surgical separation in twins who shared a six chambered heart and were ventilator dependent. Physicians at the Loyola Medical Center in Chicago and their consultants discouraged surgery and advised the family to withdraw ventilator support and provide humane care. The family, addicted to media attention, insisted on transfer to another institutions and surgical separation. Neither twin survived the heroic operation. [8]

In 1981, twins joined at the perineum with heads at either end with three legs at right angles to the body were born by Caesarean section. They shared single rectum and single external genitalia. The umbilical cord was around the neck of the smaller twin who had congenital heart disease and was neurologically impaired. The father, a physician, the mother, a nurse, and all the physicians involved did not think the twins could survive and advised supportive care only. A hospital employee leaked news of the twins to the press and the states attorney. The media seized the story and the state's attorney charged the parents with attempted murder. The state took custody and transferred the twins to the Children's Memorial Hospital in Chicago. With ventilator support and intravenous nutrition, the larger twin thrived but the smaller twin had bouts of congestive heart failure. The media continued to harass the family and the parents divorced. The mother regained custody

when the twins were a year old. I discussed surgical separation and allocating essential shared organs to the stronger twin. The mother agreed.

Many separations of conjoined twins involve elaborate preparation, special consultants and considerable publicity. To avoid further media coverage, we treated the separation as an ordinary operation, forbade spectators and photography in the operating room and minimized the number of operating personnel. Despite these precautions, as the last suture was tied, a member of the press called into the operating room. I refused to talk with him but later, a line of TV trucks was parked, like vultures outside the hospital.

The smaller twin survived in a vegetative state for three years and died with congestive heart failure. The stronger twin required multiple orthopedic procedures, including amputation of the poorly functioning shared leg and fitting with a prosthesis. He attended college, took part in sports and now is active and employed. He and his mother continue to suffer emotional wounds inflicted by media harassment.

Our team separated similar set of female twins. The smaller twin had severe encephalomalacia. The family agreed to allocate essential organs to the stronger twin but asked that every effort be made to ensure survival of both twins. The weaker twin survived for several months. The larger twin required further intestinal surgery but completed college and graduate school.

We cared for two twins, joined at the chest with shared hearts. There was no possibility of separation and after discussion, the parents agreed to withdraw support. The media was not involved. The families made their decisions in peace.

A fifth set of twins were joined at the abdomen, with shared livers. One twin, the smallest had an intestinal obstruction, an omphalocele and a patent ductus arteriosus. We separated the twins with the same precautions to avoid publicity as before, but the hospital public relations department insisted upon a press conference immediately following the operation. At the insistence of the administration, one surgeon attended the meeting. She said the operation was “routine.” The press lost interest. Both twins thrived.

The decision by the parents and physicians in our first patient appeared to be correct at the time, but the medical boundaries continually change. At this time, separation of ischiopagus twins is possible with the expectation that one twin will thrive. One the other hand supportive care, not surgery is the best decision for twins who share a heart.

In almost every set of conjoined twins, especially, the ischiopagus variety, one twin is weaker and has associated lethal congenital anomalies. The stronger twin supports the weaker. [9] In this situation, philosophers and theologians agree with sacrificing one twin to save the other and the allocation of vital organs to the twin who is most likely to survive. [10] The decision, however, rests on what is surgically possible.

Rock art, statues and wood carvings, the media of the past did not influence medical decisions or patient privacy. Today the press and television has replaced freak shows and the circus. Doctors, hospitals and other medical personnel may originate this media attention for personal publicity or a hospital's desire to raise funds. Ethicists have not, but should address this problem. Perhaps, an addition to the oath must forbid all discussions of a patient's health issues with the press. Mums the word!

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THE EDUCATION OF A SURGEON

In the not so distant past a surgeon was defined as a doctor who was skilled with the knife. At the time I attended medical school and trained in general surgery from 1949 to 1960, students learned general medicine as a basis for general practice or a specialty. First, there was a thorough grounding in the basic sciences, especially anatomy and pathology. We learned to appreciate disease by seeing, touching and smelling cancers or syphilitic aneurisms and learned to evaluate laboratory work by doing our own blood counts and bacteriologic stains. The finding of acid-fast bacillus in a patient's sputum brought together the patient's cough and the rales in his lung with our laboratory finding.

A course in physical diagnosis, based on that greatest of all medical textbooks, "Physical Diagnosis" by Richard C. Cabot and F. Dennette Adams, two gifted Boston physicians, preceded clinical clerkships. The stethoscope, used to detect rales, intestinal activity and cardiac murmurs was an important diagnostic tool, not just an ornament to hang around a technician's neck.

In two years of in-hospital study, we rotated from medicine to pediatrics to surgery and obstetrics along with shorter periods on specialties and outpatient clinics. We learned to look in ears, examine the eye grounds, and to do a pelvic examination. We followed the residents and attendings on rounds to pick up "pearls" and spent long hours holding retractors in the operating room. It was often tedious, but at the end of four years, students in my class could care for common problems in pediatrics or medicine, deliver a baby, cast a fracture, suture a laceration, do a spinal tap and diagnose appendicitis.

The now out-of-fashion rotating internship added to our understanding of the human condition and shaped students into "complete doctors." This further exposure to a variety of specialties allowed young doctors to better select their life's work. More than one intern who originally thought he would become an internist became bored with dispensing pills and chose surgery or obstetrics. We have all seen the tragedy of a clumsy resident who

chose surgery during medical school but should have been in a different specialty.

My general training was an excellent preparation for my tour of duty as a medical officer on an aircraft carrier in the navy. I treated the full spectrum of diseases, ingrown toenails, venereal disease, common aches and pains, allergies, fungus infections of the skin, pneumothorax and emotional disturbances. I did my first appendectomies with a spinal anesthetic at sea. There were also fractures, shoulder dislocations and a multiply injured pilot who required a tracheotomy.

The surgical residency at the Cook County Hospital in Chicago included six months on pathology, divided between the morgue and surgical pathology. The daily autopsy was an opportunity to learn surgical anatomy and the study of microscopic sections allowed us residents to correlate the patient's clinical picture with his cellular pathology. The mastery of surgical anatomy is essential for surgeons to find the avascular planes of dissection that make every operation bloodless and "easy". At the end of my career, I volunteered to cover for the pediatric surgeon at the Cook County Hospital. I knew something was very wrong with the training system when we were scrubbing for a left upper lobectomy. I asked the resident if he had dissected the blood supply of the lung at autopsy. He said, "I have never seen an autopsy."

The surgical residency at the Cook County Hospital during the late 1950's included rotation through fractures, neurosurgery, thoracic surgery and pediatric surgery. Several of my fellow residents who practiced in smaller communities managed head trauma and fractures along with the full gamut of general surgery, including the emergency resection of abdominal aneurysms.

I spent two additional years in thoracic/cardiac surgery and then practiced pediatric surgery, which included a full spectrum of disease, including tumors and malformations of the neck, tumors of the urinary system, thorax and congenital malformations of the gastrointestinal tract and lungs. Pediatric surgery was, indeed, general surgery of the infant and child. At one time or another, all my training was useful. I once explained to an orthopedic resident how to reduce and cast a Montegia fracture—a fracture of the ulna with dislocation of the radius.

As medical education tended toward early specialization, my residents in pediatric surgery who had completed general surgery—no longer knew how

to examine an ear or recognize the significance of the odor of ketones in a child with diabetes.

When I developed a small skin lesion, that any surgical intern could have removed in a half an hour, I went to a local clinic and consulted a "primary care physician" to remove the lesion. He said he couldn't do it and referred me to a dermatologist. Since I didn't have insurance, the office person asked for my credit card number. The first dermatologist did the biopsy then another dermatologist excised the lesion and a plastic surgeon closed the wound, all for $5000.

A few years later, I had some abdominal pain and low blood pressure. The E.R. and ICU doctors did not do a history or a physical examination, but with a battery of tests and scans they found a gangrenous gallbladder. The surgeon who said he was going to operate did not bother with an examination and admitted he had not seen my medical record. I told him to get lost. The next surgeon did a laparoscopic cholecystectomy, but left the post-operative care to hospitalists and a wound care doctor.

Politicians quibble over the delivery of medical care, but the real problem lies in medical education. The leaders of our medical schools must decide if their graduates will have sufficient education in general medicine to deserve the M.D. or if they are going to train specialists and sub-specialists. If someone plans to restrict his practice to knee replacements, there is no point in spending four years in medical school. A degree in mechanical engineering or robotics plus a couple of weeks' study of the leg from mid-thigh to mid-tibia followed by a few months' apprenticeship to someone who does knee implants would be sufficient training. That person would not be an M.D. but could be termed a K.T. or knee technician.

While the subspecialists carve patients into ever smaller bits and pieces, general care will be left to nurse practitioners working in drug stores or home care medical kits.

Our Sick Health Care System

I had never had health problems, smoked rarely, exercised, and always ate green, leafy vegetables. I had not signed up for Medicare part B and didn't have health insurance. Why line the pockets of the CEOs and administrators in the insurance industry?

When two skin lesions on my forehead persisted, I called the offices of two dermatologists. The clerks refused to give me an appointment when they learned that I didn't have insurance. I then visited a local walk-in clinic, thinking that any doctor could remove a bit of skin. It would have been an intern's job. The doctor said it was out of his line and wouldn't do it. His bill was one hundred dollars for a five-minute visit. The clinic doctor obtained an appointment for me to see a dermatologist. The skin doctor asked a couple of questions, biopsied the lesions, and charged $400. My skin lesions were cancer. Later, one of his partners spent an hour or so excising the skin cancers in a swank, private outpatient facility. The total bill, which I paid out of pocket, was $5,000.

When I complained, the dermatologist said that insurance would have paid most of his bill. A year or so later, I consulted an ophthalmologist about declining eyesight. She took a quick look at my eyes, then technicians performed a series of examinations with sophisticated machines. The problem was cataracts. The operation under local anesthesia and sedation took place in an investor-owned outpatient facility. The bill was $8,000. No wonder so many doctors drive Mercedes automobiles.

A few years later, while hiking in the Illinois woods, I stumbled against a stump and gashed my leg. Always before, I had closed cuts with tape, but this was more than I wanted to tackle. We went to a nearby medical center where I knew a surgeon. He very kindly met me in the emergency room and sutured the wound in the operating room under sedation. He did not send a bill. The hospital charges for anesthesia, an hour in the emergency room, an hour in the operating room, and a couple hours to recover came to $19,000. The itemization included $1,000 for an emergency room doctor whom I never saw. I paid the bill, and after months of haggling and a complaint to the state attorney general, the hospital refunded 10 percent of the bill. That was when I learned that hospitals inflate their charges and then negotiate

with insurance companies for a discount. If a patient pays out of pocket, there is no discount.

Not long after that episode, I had a bout of chest pain and shortness of breath, and a couple of days later the room turned gray and a translucent man appeared. When I woke up, I told my wife, Susan, it was a heart attack and not to take me to the hospital. I wanted no part of wires, tubes, monitors, and all the high-tech nonsense that goes with modern medicine. I tottered off to bed, took a couple of aspirin tablets, and remembered half a bottle of Irish whisky left over from a hunting trip. The treatment was complete when Buster, our fat, black cat, jumped onto the bed, nestled down, and insisted on being petted. I felt completely relaxed when he purred.

The pain recurred a time or two, but always responded to whisky and aspirin. A week later, when I felt better and wanted to go swimming, Susan insisted that I see an internist. He heard a few odd noises in my left lung. The EKG looked like a heart attack, but the doctor suspected pneumonia or a pulmonary embolus. After more procrastination, I had a CT scan. The clots in my pulmonary artery resembled migrating eels.

I was amused at my misdiagnosis of a heart attack. The internist prescribed anticoagulants. I took tennis lessons to improve pulmonary function and now play with old babes in short skirts. A well-hit tennis ball that scores a point is almost as satisfying as a good operation. My experiences as a patient convinced me that our system of medical care is broken.

In my hometown, during the Depression and the 1940's, people paid physicians with cash out of pocket. Doctors were unlikely to overcharge when the patient paid on the spot. This was the basic "fee for service" system with no third party. Physicians had an ethical duty to care for the sick regardless of their ability to pay.

Not-for-profit private health insurance companies, such as Blue Cross/Blue Shield, evolved from a sense of social welfare to pay the costs of hospitalization. Several companies offered insurance to their employees for on-the-job injuries and later for ordinary illness.

During and after World War II, some companies provided hospital insurance for their workers, and Kaiser in California pioneered the concept of prepaid coverage for health care. Most doctors, and the American Medical Association (AMA), violently opposed health insurance and especially prepaid health care. The AMA blocked Franklin Roosevelt's

proposed national health insurance program in 1935 and denounced President Truman's plan as "socialized medicine."

In 1971, and again in 1974, President Nixon proposed a plan to subsidize health insurance and would have provided insurance for poor people. Congress rejected the Nixon plan. In lieu of wage increases, businesses provided health insurance to more and more workers while the unemployed either paid or accepted charity.

Physicians continued to denounce "socialized medicine" but welcomed the huge sums that the government poured into medical research and the Veterans Administration. They enthusiastically supported the Hill-Burton Act of 1946, which disbursed billions of dollars for hospital construction. This led to an oversupply of hospital beds and an increase in expensive equipment, which contributed to rising costs of medical care during the 1960s.

That infusion of funds built an immense medical-scientific establishment; by 1970, nearly four million people were in the medical work force. The percentage of the GNP expended for health care rose even faster after 1965 with the advent of Medicare and Medicaid, which were supposed to eliminate charity patients and end the need for physicians to donate time to the needy. The demand for medical care increased; hospitals and physicians prospered. The government and private insurance paid hospital costs, including liberal payments for new buildings and equipment. The costs of medical care spiraled upward.

Huge for-profit corporations took over community hospitals, claiming that they would be more efficient. Unfortunately, not-for-profit hospitals such as the Children's Memorial in Chicago, took on many of the characteristics of for-profit enterprises with consultants, advertising, lobbyists, more administrators, bonuses for executives, and a decreased commitment to care for the poor.

At the same time, the CEOs of insurance companies received expensive corporate perks and huge salaries. By 1999, researchers at Harvard Medical School estimated the cost of health care administration was $294.3 billion a year, or $1,059 per patient.

Physicians were forced to spend almost as much time on paperwork to collect bills as on patients. Organizations such as the American College of Surgeons sponsored seminars to teach doctors how to cope with intricate coding systems in order to maximize their fees.

The changes in the delivery of care came home when a hard-eyed Blue Shield executive came to the hospital and said we could no longer admit children the day prior to elective surgery no matter how much pre-operative care they required. I was speechless with anger, but powerless. The insurance companies also said children should go to less expensive hospitals. I saw patients in consultation, only to learn that the child was forced to go elsewhere for the operation.

The cost of medical care continued to rise; millions of people could no longer afford health insurance. By the year 2003, over forty million Americans were without health coverage. Retired people, the unemployed, the self-employed, and the working poor went without care or into debt to pay medical bills. The uninsured did without blood pressure or blood sugar checkups, children were not immunized, and pregnant women lacked prenatal care. The diagnosis of common disorders such as appendicitis in childhood was often delayed. An uninsured, ten-year-old boy with a ruptured appendix, turned away from other emergency rooms, appeared at Children's Memorial Hospital in advanced septic shock. He required many weeks of intensive care for complications related to what should have been a simple problem.

Patients who had insurance saw higher out-of-pocket expenses because employers shifted more of the burden to employees and retired people. Some insurance companies, and the HMOs, refused coverage for many sick individuals or refused to cover elderly people with chronic illness.

Commercialization undermined the most basic ethical standards of medicine. The 1966 edition of the American Medical Association's "Opinions and Reports of the Judicial Council" made it unethical for physicians to advertise or otherwise entice patients. It also said the corporate practice of medicine was against the best interests of scientific medicine. In its code of ethics of 2004-2005, the AMA made no objection against advertising or corporate practice [1].

By lowering standards, organized medicine opened the way for physician entrepreneurs, hospitals, and drug companies to put financial objectives ahead of patient's welfare. Despite rising costs, driven by shareholder profit and exorbitant salaries for executives, the health of our citizens, as measured by infant mortality and longevity, lagged behind countries that have a government regulated program. By the year 2005, fifteen percent of our population had no health insurance and often went without care. From 1992 until 2005, United Health Group, the country's largest investor-owned

health insurance business, paid its chief executive $56 million, plus $500 million in stock options [2].

In 2014, six CEOs of health insurance companies were paid a combined total of $157.6 million, plus stock options [3]. Money that should be spent on patient care was wasted on lobbying and advertising. The large for-profit hospital chains further drove up costs by fraudulently billing for unnecessary tests and treatments. Increased costs have not improved the quality of care. A hospital consortium near my home in Southwest Florida controls all aspects of hospital care by preventing a patient's private physician from prescribing treatment for hospitalized patients. Instead, hospitalists employed by the hospital order the tests and prescribe treatment. These physicians spend little or no time talking to or examining patients, but order multiple scans, X-rays and blood tests. Every visit, even a walk in, "how are you," and out the door is electronically recorded and charged to Medicare or an insurance company. A patient in a hospital controlled by this consortium rarely sees a real nurse. Technicians record the patient's pulse and blood pressure with a machine, another draws blood for tests, another changes wound dressings. Instead of a nurse or a doctor encouraging a patient to cough and breath deep to avoid post-operative pneumonia, another technician arrives several times a day with a "breathing machine"—whether the patient needs it or not. Each procedure is electronically recorded and charged to Medicare or an insurance company. The little amenities that meant comfort for patients are gone, but the hospital consortium regularly makes a profit and the CEO, on top of his million dollar a year salary, along with the other administrators have hefty year-end bonuses.

The situation will likely become worse. Accord to the Wall Street Journal, corporate America is still attempting to solve the four trillion-dollar health care puzzle. [5] The giants of business are developing algorithms, using patient's records to guide medical decision making. Their object is to make health care more efficient. In plain terms, they want to reduce their own costs and increase profit by invading patient privacy and taking decision making patient care away from doctors. Every strategy to rein in these costs has failed, partly because health care institutions had powerful incentives to provide high technology tests and treatments, whether needed or not.

In 2009, President Obama presented a plan that would expand health insurance coverage to almost all citizens. The Affordable Care Act, colloquially called Obamacare, forced companies to insure pre-existing disease and supported preventative health services. The administration promised that in the long

run the new plan would reduce costs, but in 2014, health spending rose 5.6 percent, partly driven by rising prescription drug prices [4]. The government is unable to negotiate with the pharmaceutical industry which has strong political protection.

Dr. Arnold Relman, the former editor of the *New England Journal of Medicine*, would replace the for-profit insurance companies with a tax-supported single payer system [6].

Single payer systems save money by eliminating the executives and stockholders who profit from the HMOs and insurance companies. Doctors would save money and time by billing a single payer rather than paying dozens of office workers to sort through the billing procedures of many insurance companies. Hospitals would no longer spend huge sums on billing departments, and employers would not support employee health care.

Dr. Relman also advocated the formation of pre-paid physician group practices that would contract with the single payer organization to provide care. His plan would eliminate the fee-for-service system that rewards over-testing and over-treatment.

The Kaiser-Permanente system is a good example of how physicians can work together, provide excellent health care, and reduce costs. In these systems, physicians work for a salary, perhaps supplemented with bonuses for providing superior results or for night-time emergencies. The Mayo Clinic is another example of how physicians can work for a salary and deliver excellent care. Academic physicians associated with medical schools and teaching hospitals would be organized along the same lines.

This system must not be administered by government bureaucrats but by physicians and other health care professionals. Any doctor who has worked in a government institution, whether a veteran's or a city-county hospital, has experienced the inefficiency, and even insolence, of politically connected employees and administrators. Dr. Relman suggested an independent National Medical Care Agency similar to the Federal Trade Commission or the Federal Reserve Board [6]. The new agency would regulate and oversee the health care system but would not deal directly with, or employ, health care professionals. Physicians within the system would be responsible for their own management and the welfare of their patients.

Malpractice also needs reform. The word "malpractice" is derived from *mala praxis*, a term coined in a 1768 legal tome, "Commentaries on the Laws of England," to define medical errors or negligence. In this country,

during the mid-1800s, physicians made extravagant claims for their ability to cure diseases; lawyers, hustling for new business, encouraged patients to sue for poor medical results. New discoveries, such as the X-ray, increased patients' expectations, and doctors were held to still higher standards. Litigation was rare when patients knew and trusted their family physicians.

An innocent doctor may lose a malpractice suit; a smart lawyer can always find an expert witness who will testify for the patient. Trial lawyers argue that our legal system protects citizens from the negligence of professionals. That is certainly true, but the system often fails because about nine out of ten medical errors slip through the system. Even worse, doctors who habitually make mistakes are rarely disciplined. Hospitals struggle to ensure quality control, but there are many controversies over what is the best treatment for individual cases. It is difficult to differentiate bad doctors from good doctors who occasionally make mistakes. A study in 1990 by Harvard researchers concluded that 83 percent of malpractice claims were spurious and did not involve physician negligence. Advocates for tort reform claim malpractice increases medical costs because doctors order more tests and treatments [8]. A Rand Corporation study showed tort reform did not change the way doctors practiced [9]. Tort reform does not eliminate doctors who regularly hurt patients and makes it more difficult for patients to recover damages for injuries due to medical negligence.

One solution is the creation of impartial panels of physicians, lawyers, and a lay ombudsman to review cases. The panel, after studying the records and interviews with the patient and physician, could recommend dismissal, settlement, or in gray areas, referral to the courts. In cases of serious error or negligence the panel could recommend disciplinary action against negligent or incompetent physicians. The costs of the panel could be supported by a tax on insurance and professional licenses. Another solution would be special courts with judges skilled in malpractice cases who would appoint expert witnesses, rather than relying on those chosen by lawyers.

The rising cost of prescription drugs has become a pressing issue. A huge percentage of a pharmaceutical company's budget is for advertising and marketing. Drug companies influence physicians with gifts, seminars, expense-paid trips, and glossy advertisements in medical journals. They direct TV ads at patients who then demand the latest, most expensive drug. Physicians often prescribe these high-priced medications just to keep their patients happy. The insurance company pays the bill. Prescriptions are less expensive in Canada where drug advertising is prohibited. As a part of

health care reform, we should curtail advertising by drug companies, hospitals, and doctors.

Intense public education is essential to convince people to adopt healthier life styles, with more exercise and better eating habits. Doctors of the next generations must learn the importance of environmental pollution in human health. Pesticides, herbicides, and other toxic chemicals have accumulated in every human since World War II. Do these chemicals account for the rising incidence of cancer and birth defects? These are questions for the next generation of doctors who (along with everything else they need to learn) must fight for a healthy environment.

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ISLANDS AS A MICROCOSM OF THE WORLD

Modern medicine and surgery has extended human life and has made chronic illness more tolerable but human health still depends, as in the days of Hippocrates, on clean air, water, and good food. At one time, epidemics, famine, and war controlled human population, however, sanitation, vaccination and antiseptic wound care extended life and contributed to runaway overpopulation. Unfortunately, the human species by relentless subjugation of the earth has fouled our air and water and destroyed much of our viable land. Overpopulation and a dearth of natural resources led explorers to leave their homes to find new lands. The conquerors became colonists, reproduced dramatically and in a brief amount of time ravaged the environment of their newfound worlds. A few islands, found by the earliest settlers provide examples of what is happening to planet earth, an island in space.

I was sailing towards home, after a trans-Atlantic sailing trip, when at noon, four days out of Gibraltar, I glanced up from the compass to see, in the distance, Porto Santo of the Madeira Archipelago. A few hours later, I anchored in the same harbor where two ships sent by Prince Henry, the Navigator found refuge from a storm in 1418.

The island was starkly barren. There were no trees, no green leaves, not even a blade of grass. Deep ravines gouged in rock and gravel hills plunged into the sea. What terrible catastrophe had caused this destruction? A year after its discovery, Portugal colonized the island. One ship carried a female rabbit whose offspring devoured the native vegetation. The first settlers grew grapes, cereals and vegetables on rich volcanic soil and the surrounding ocean provided fish. The Portuguese established a sugar cane industry that enriched a few men but led to massive erosion. The descendants of the people who destroyed Porto Santo are now dependent on imported food and tourism.

The Canary Islands were known to the ancient Arabs and Phoenicians as the “Fortunate Isles” where happy spirits dwelt in peaceful gardens. The first Spanish colonists, in 1402, removed trees in order to terrace and irrigate hills. They grew enough food to provision the ships of Spanish exploration but over cultivation reduced Gran Canaria to a rocky desert. At the end of

the 20th century, Las Palmas sprawled into the surrounding hills and unsightly tourist developments face the sea. Despite centuries of outward migration, the Canary Islands are overpopulated with thirty percent unemployment. The Canaries are no longer "fortunate."

The Madeira and Canary Islands were the steppingstones to the trans-Atlantic voyages that led to the European discovery of the new world. When Columbus anchored off Hispaniola in 1492, the Island was lush with trees and plants. The Spanish started environmental destruction with gold mining and the introduction of cattle. In 1697, France acquired Haiti and imported slaves to grow sugar. This industry produced immense wealth but when the slaves rebelled in 1804 the island was almost entirely deforested, and erosion was well underway. During the 20th century, basic medical care reduced infant mortality but without birth control and despite massive outward migration, the population soared. Villagers plant corn on steep hillsides but tropical rains carry away seedlings. Sediment and sewage destroyed ocean reefs, depleting the fishery. Despite extensive outward migration, Haiti is over-populated, environmental destruction continues and the people are unable to develop a democratic system of government.

On another sailing trip, I visited Easter Island. When Polynesians arrived, the soil was fertile; eggs from bird rookeries and abundant fish provided food. The settlers erected huge stone monuments, apparently using tree trunks as rollers to move the statues. When the trees were gone there were no canoes for fishing. Birds found new nesting places to avoid human depredation. The guide pointed out gardens where the ancients had attempted to grow food on rocks and gravel. The inscrutable statues are reminders of a robust people whose descendants destroyed their own habitat and suffered hunger, warfare and disease.

The fate of these islands are signposts on the road that will lead to catastrophe: poverty, violence, environmental degradation and global warming. These dire events are as dangerous to human health as a cancer cell or virulent bacteria. Our children and great grandchildren are at great risk, but will we heed the warnings of a few small islands on the planet?