Cardiology Origins

Past, Present, and Future
of
Cardiology and Cardiac Surgery

*** Intersections with UAB ***

A Visual Tour

7th Annual Ed Waits Respiratory Care Conference
June 20, 2018
James R. Boogaerts, MD, PhD

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Knowledge that will change your world

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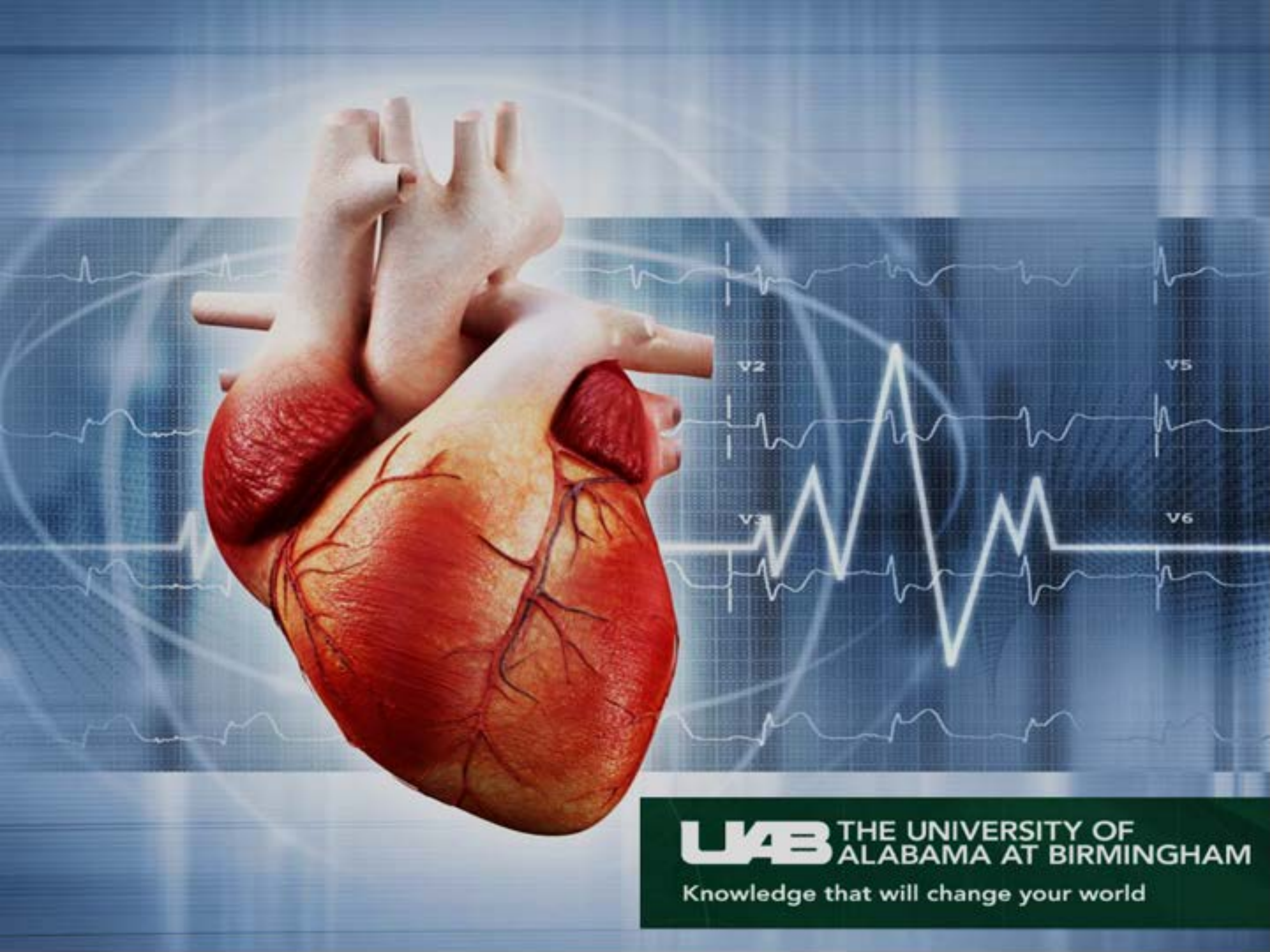

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The Greek god of healing, Asclepius.

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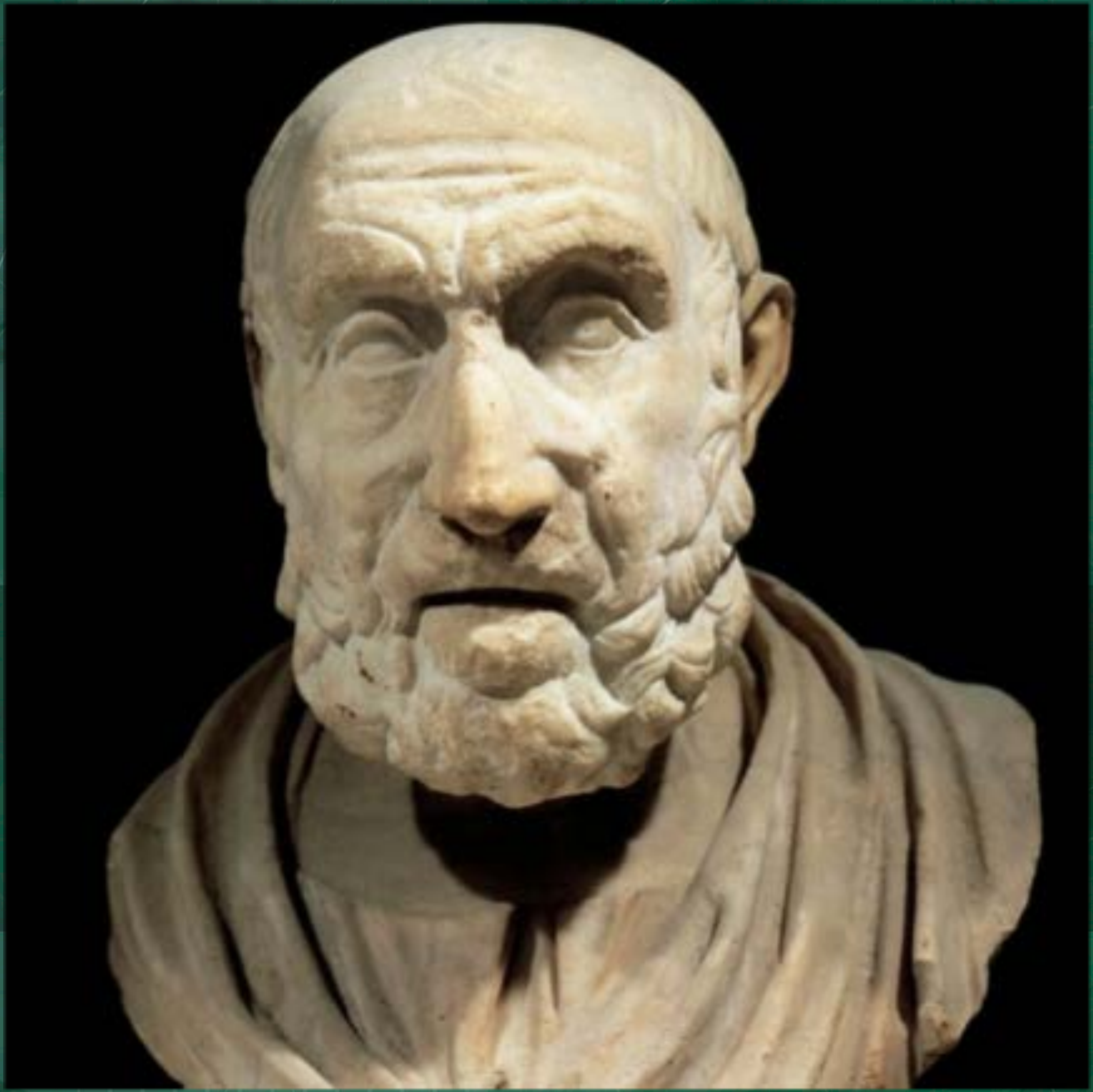
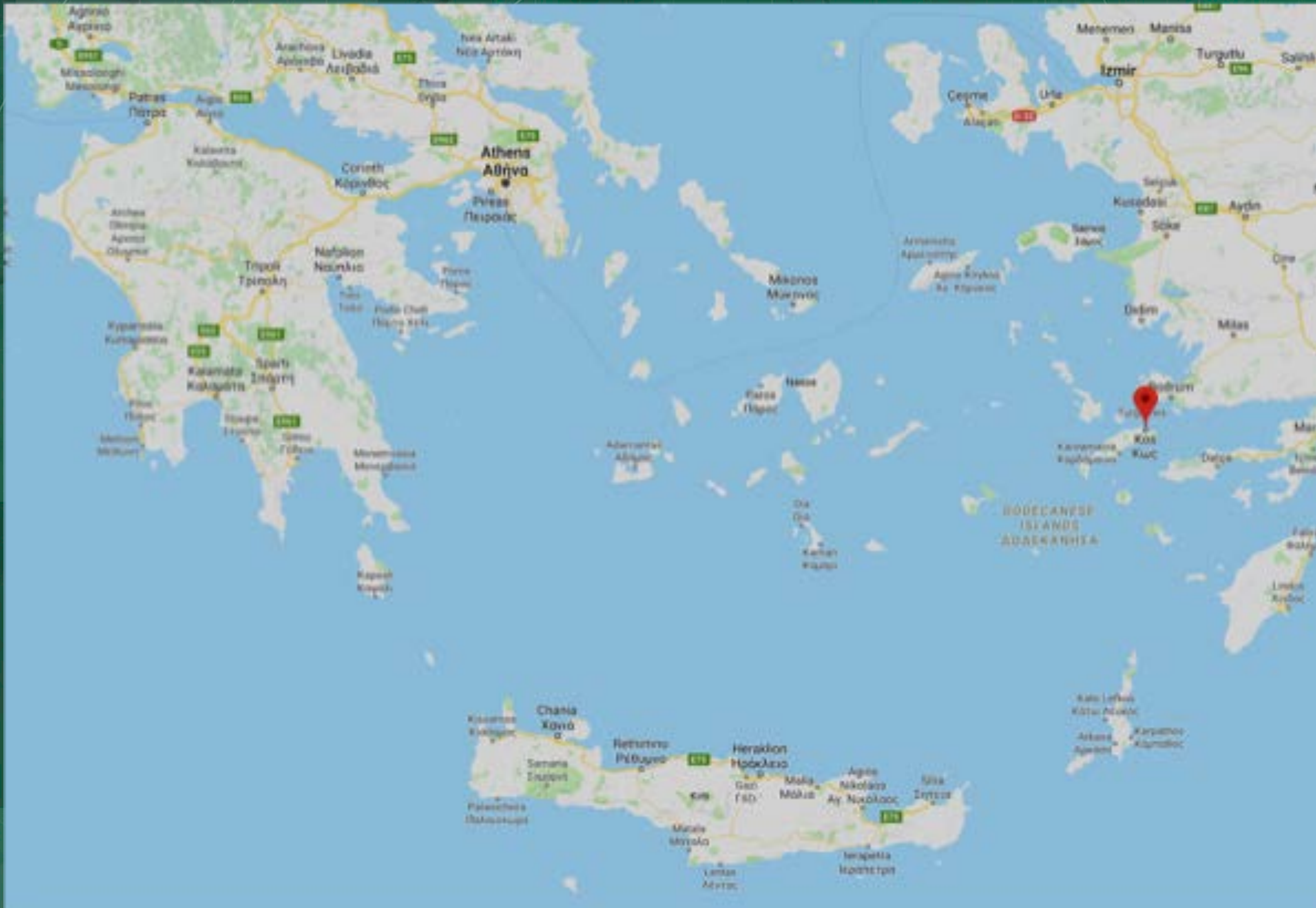


Hippocrates was born on the Aegean island of Kos around the middle of the fifth century, BCE, during the age of Pericles.
His formal name was Hippocrates Asclepiades, meaning "descendant of (the doctor-god) Asclepios."

Hippocrates was likely given a solid education in the basic subjects. He went on to a formal secondary school before learning medicine from his father and another physician Herodicos.



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"Tree of Hippocrates", an oriental plane tree in Kos, Greece.

Science & Environment

DNA fingerprint for Hippocrates' legendary tree

By Jane O'Brien
BBC News, Washington

28 April 2014

Share

A clone of the Hippo... Library of Medicine this month

Legend has it that Hippocrates, the ancient Greek "father" of medicine, taught his students under a tree on the island of Kos.

More than 25 centuries later, experts in the US have produced the first DNA barcode of the Oriental plane that is believed to be its descendant.

The original tree died centuries ago but the Greeks believe one of its descendents grows in the same place.

In 2013, the National Library of Medicine tree was pronounced dead and felled (invasive fungus: *Ceratocystis platani*). In 2014, a clone of the tree was dedicated and planted in the same spot.

"I've been worried for 25 years, no question. And I got more worried as the nurseries and propagators I contacted were failing," says Mr. Mueller.

"It was only the ***Archangel Ancient Tree Archive*** with their special techniques - they were the ones to save the tree for us."

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UAB's rarest tree: Platanus orientalis, Oriental Plane Tree

Back story: According to legend, the Platanus orientalis is a descendant of the tree under which Hippocrates, often called the father of Western medicine, taught students of medicine on the Greek island of Kos around 400 B.C.

Location: Located in the 15th Street Greenway east of the Hill Student Center, the tree was donated by friends and planted in 2016 in honor of the late William Brown Deal, M.D., dean emeritus of the School of Medicine.

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Clone of Tree of Hippocrates on UAB campus

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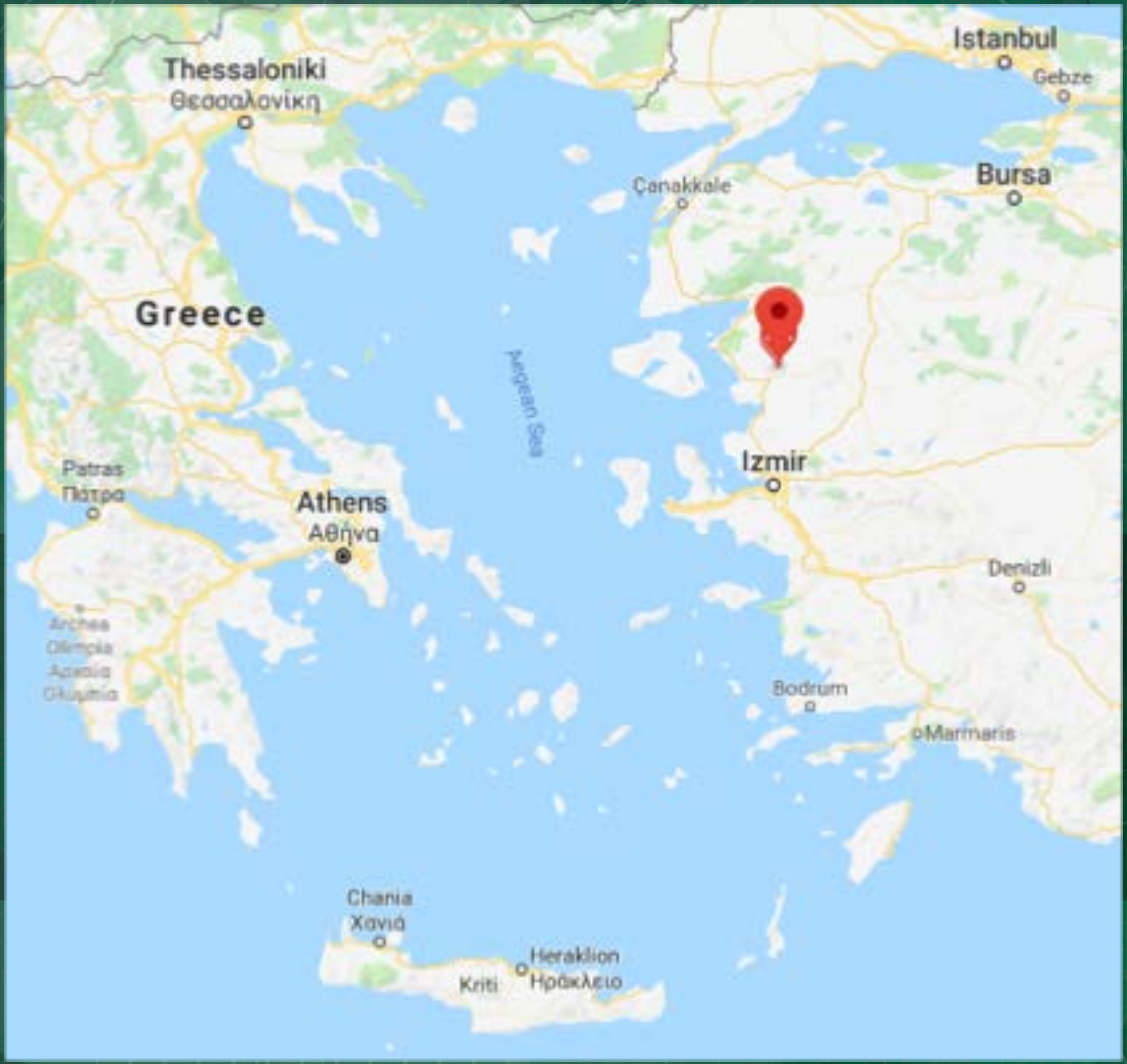
Galen of Pergamum

Κλαύδιος Γαληνός

born 129 CE in Pergamum, Anatolia [now Turkey]

- Greek physician, writer, and philosopher who exercised a dominant influence on medical theory and practice in Europe from the Middle Ages until the mid-17th century.
- His authority in the Byzantine world and the Muslim Middle East was similarly long-lived.



Galen was born in Pergamum 129 CE, and both there and in other academic centres of the Aegean pursued his medical studies before being appointed **physician to the Pergamene gladiators** in 157.

Becoming dissatisfied with this type of practice he emigrated to **Rome**, where he soon won acknowledgement as the foremost medical authority of his time and where, with one brief interruption, he remained until his death in 199

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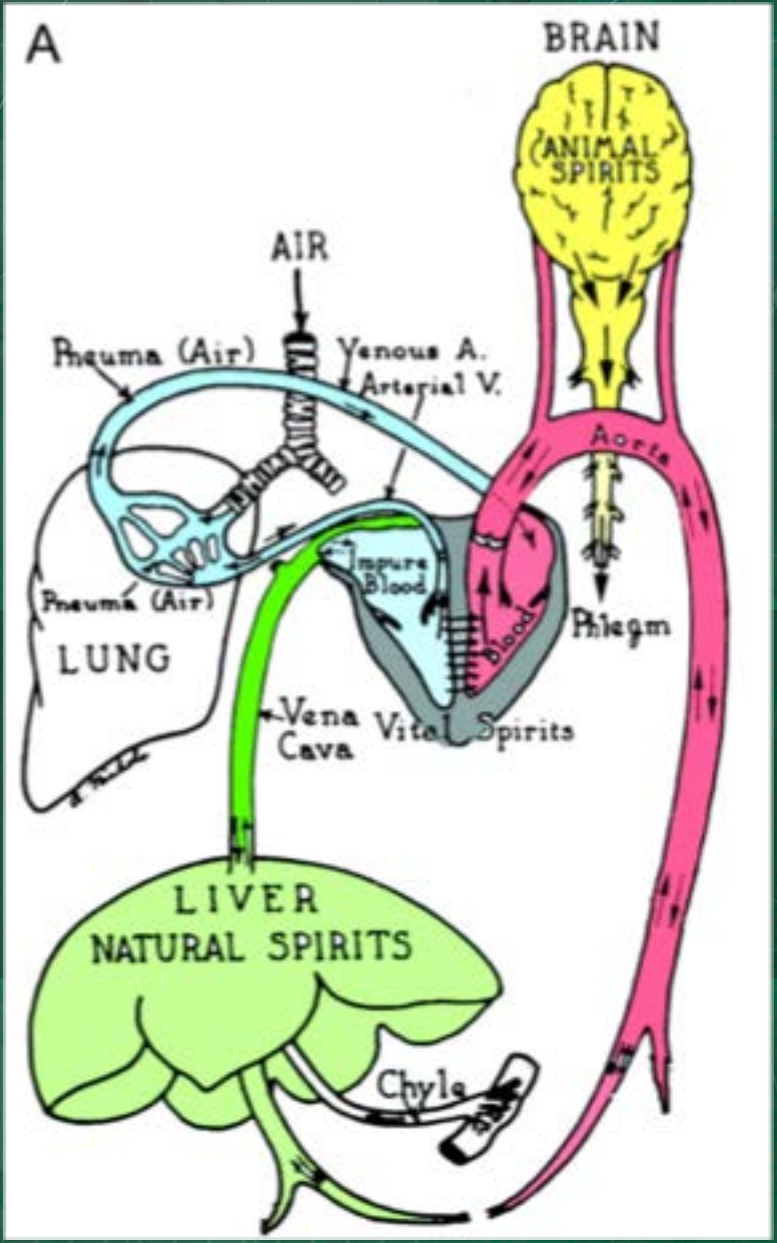
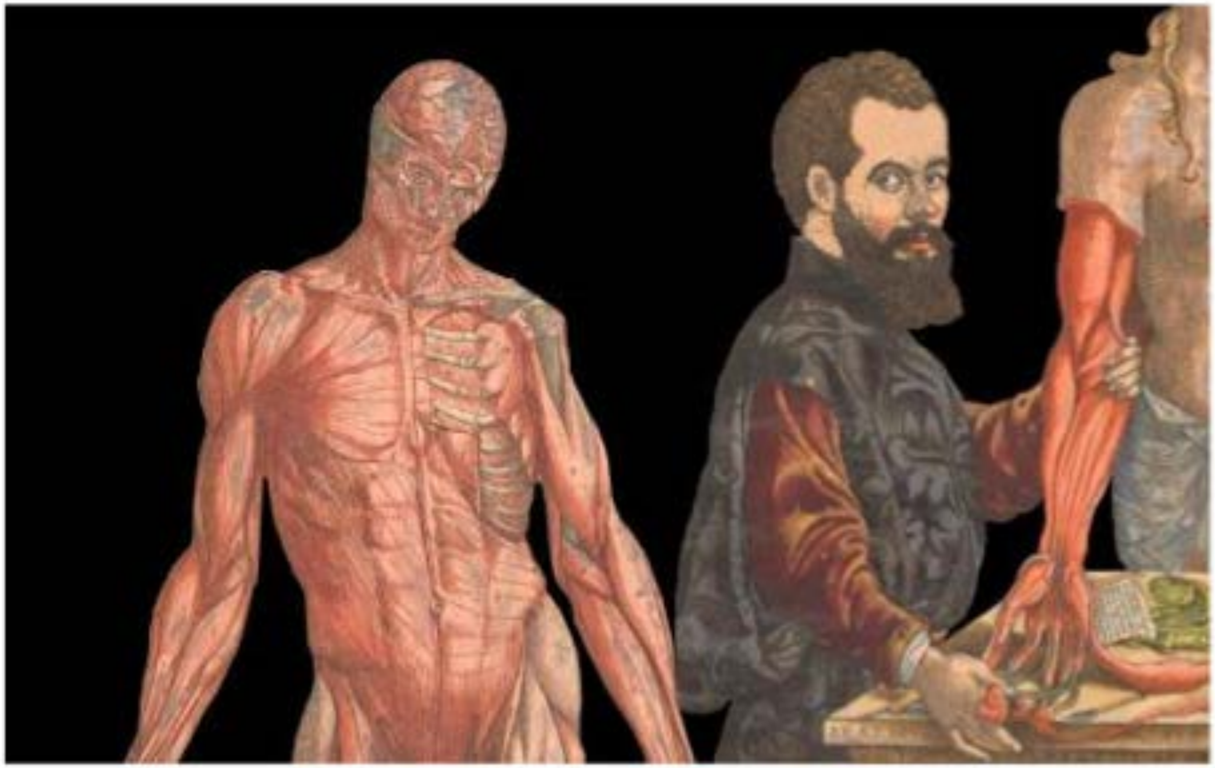


Anatomy - c 175

Galen produced over 500 medical treatises, *handwritten* by scribes in **Greek** - at a time when **Latin** was the language of the **Roman Empire.**

14 centuries later …

Andreas Vesalius



1543

Andreas Vesalius founded modern anatomy.
After years of meticulous dissections, observations, and drawings, his book,
De Humani Corporus Fabrica
\- ***The Fabric of the Human Body -***
was printed in **1543.**

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De Humani Corporus Fabrica

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(90 years earlier) moveable-type printing press 1455

Johannes Gutenberg

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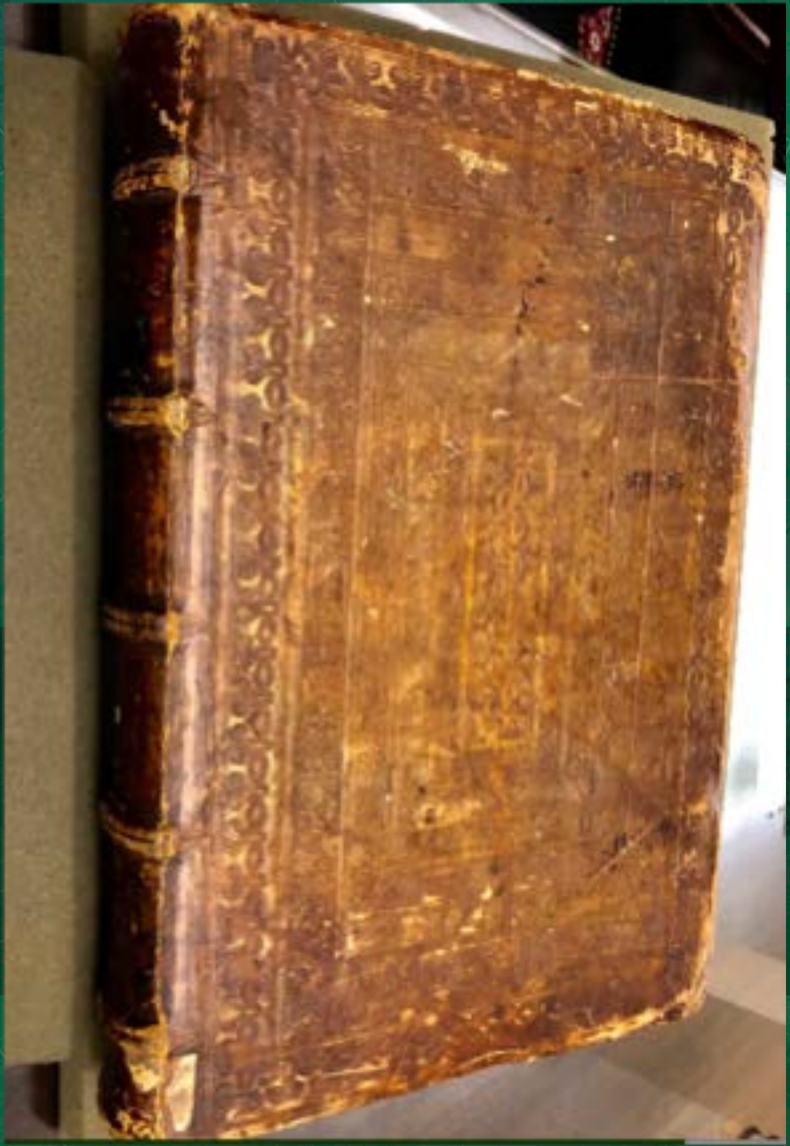

1st edition - 1543 -

… in UAB rare books collection

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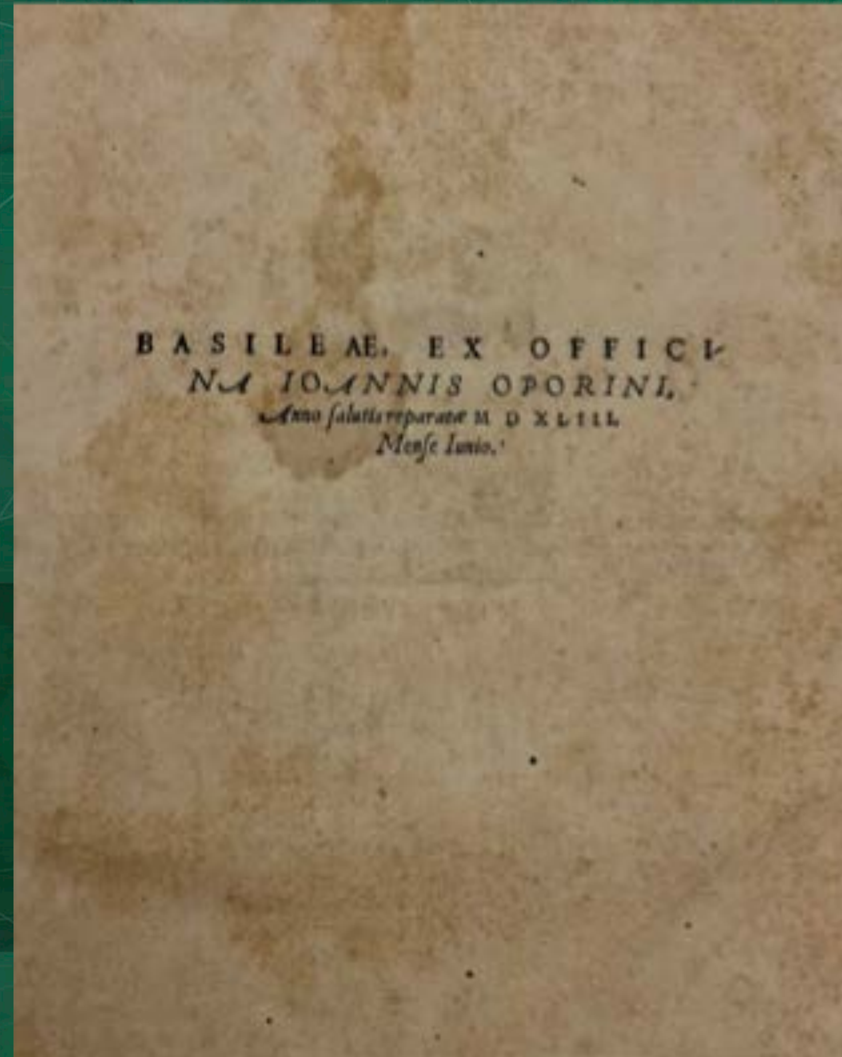
BASILEAE, EX OFFICI-
NA IOANNIS OPORINI,
Anno salutis reparatae M D XLIII.
Mense Iunio.

ANDREAE VESALII BRVXELLENSIS, DE HVMANI CORPORIS FABRICA LIBER PRIMVS, IIS QVAE uniuersum corpus sustinent ac suffulciunt, quibusque omnia stabiliuntur & adnascuntur dedicatus.

QVID OS, QVISQVE IPSIVS VSVS & differentiae. Caput I.

OS CAETERARVM hominis partium est durissimum, & aridissimum, maximeque terrestre & frigidum, & sensus denique praeter solos dentes expers. Huius enim temperamenti summus rerum opifex Deus substantiam meritò efformauit, corpori uniuerso fundamenti instar subijciendam. Nam quod parietes & trabes in domibus, & in tentorijs pali, & in nauibus carinae simul cum costis praestant, id in hominis fabrica ossium praebet substantia. Ossium siquidem alia roboris nomine tanquam corporis fulcra procreantur, è quorum numero sunt tibiarum & femorum ossa, & dorsi uertebrae, ac omnis ferè ossium contextus. Alia reliquis partibus ueluti propugnacula, naturaeque ualli & muri à natura obijciuntur, quemadmodum caluaria, uertebrarum spinae, & transuersi earundem processus, pectoris os, costae. Alia quorundam ossium articulis praeficiuntur, ne illi plus satis laxè mouerantur, aut in ni-

Ossis natura. Ossium usus. Ossa differunt ab usu.

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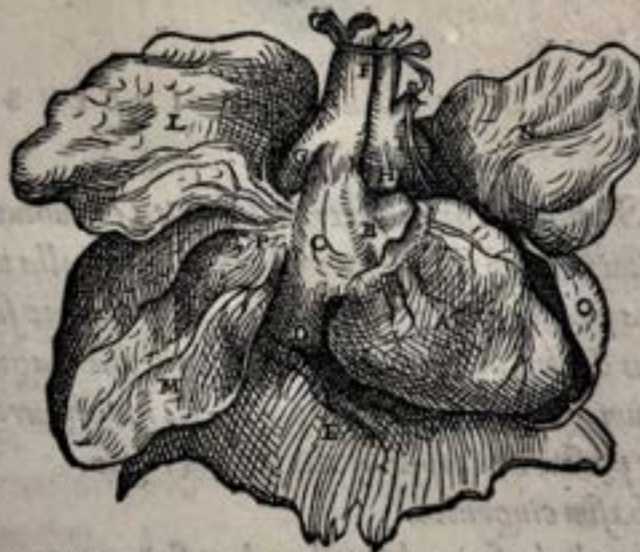
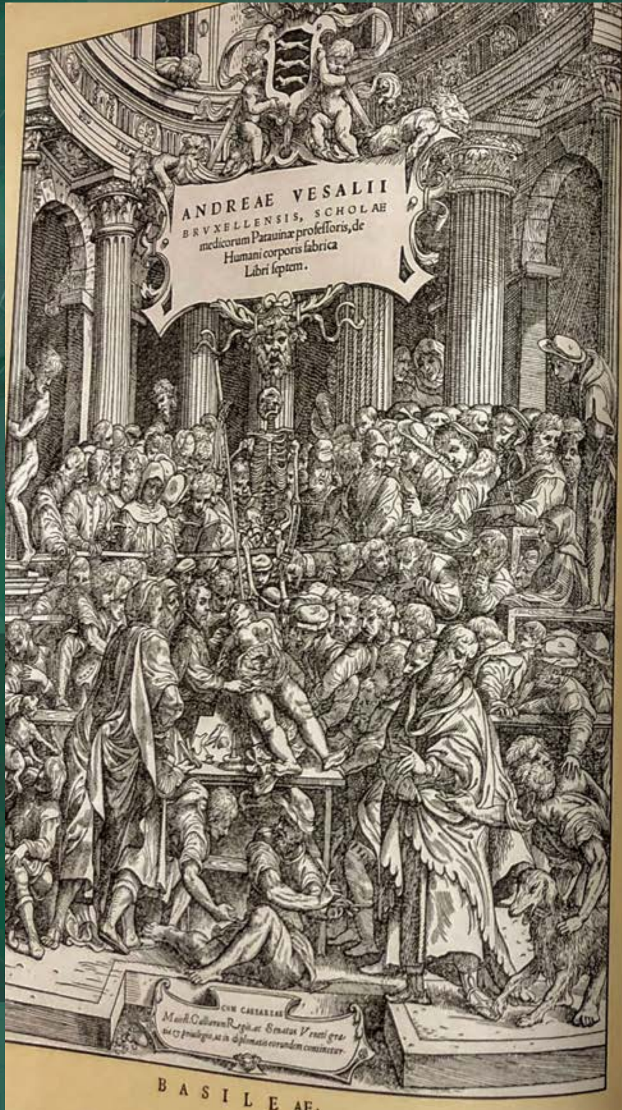
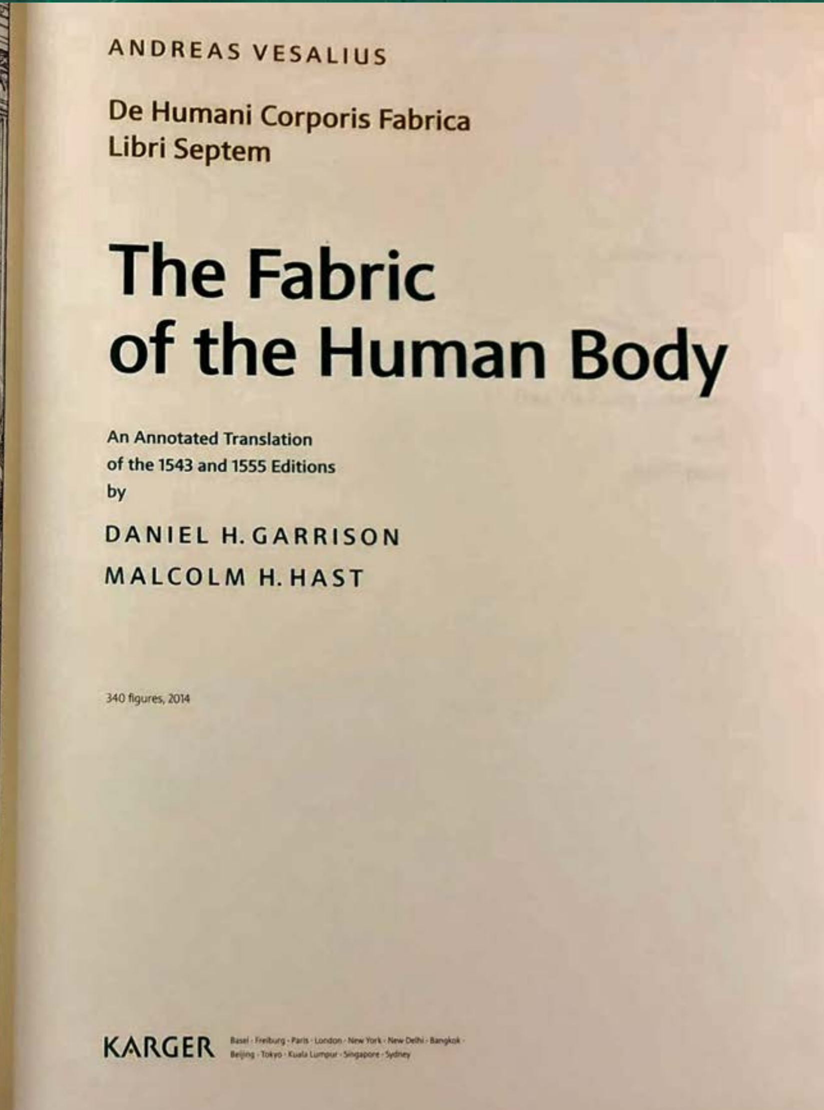
QVINTA SEXTI LIBRI
FIGVRA.



QVINTAE FIGVRAE, ET IPSIVS CHA-
racterum Index.




ANDREAS VESALIUS

De Humani Corporis Fabrica
Libri Septem

The Fabric
of the Human Body

An Annotated Translation
of the 1543 and 1555 Editions
by

DANIEL H. GARRISON
MALCOLM H. HAST

340 figures, 2014

KARGER Basel · Freiburg · Paris · London · New York · New Delhi · Bangkok · Beijing · Tokyo · Kuala Lumpur · Singapore · Sydney

New Fabrica - 2014

…in **UAB** rare books collection

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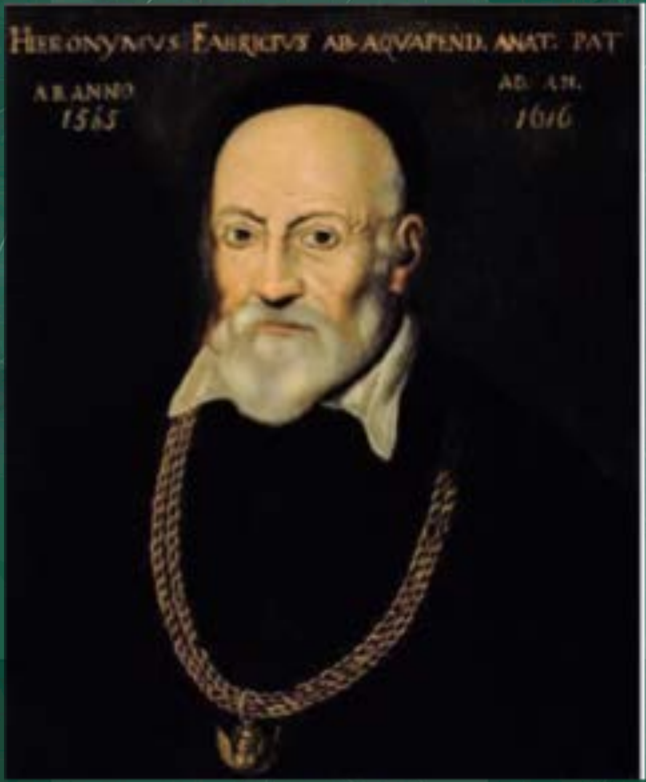
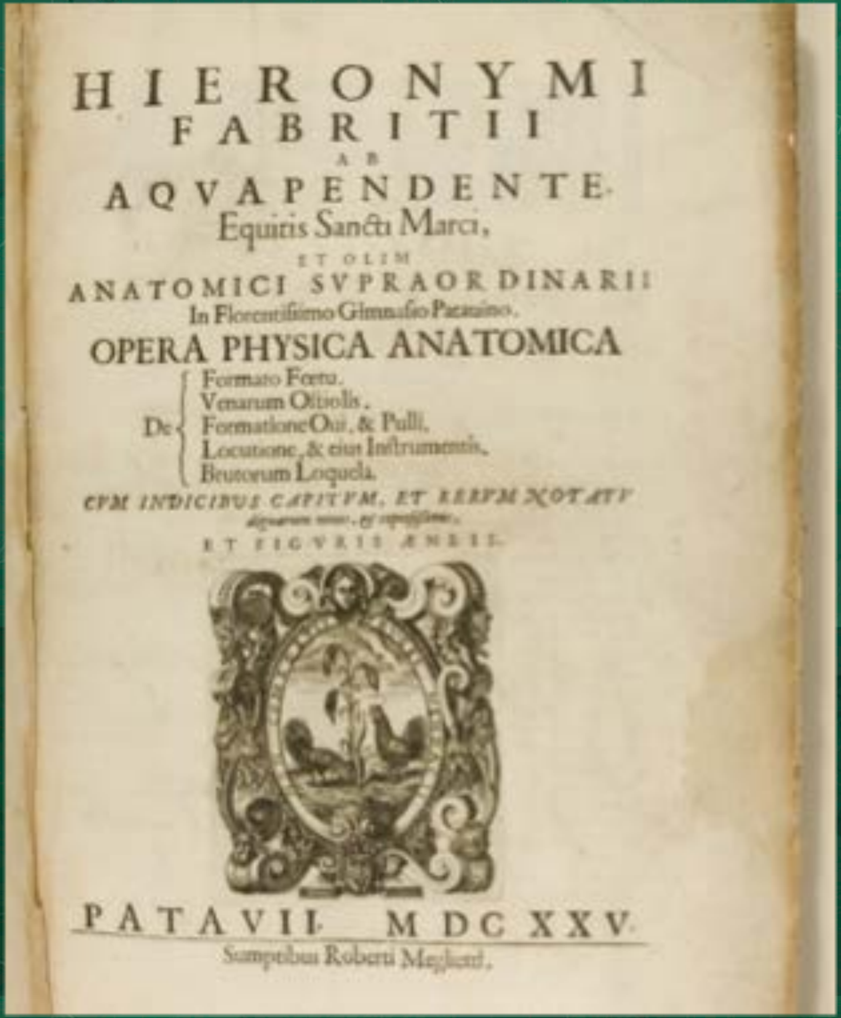


1625


HIERONYMI
FABRITII
AB
AQVAPENDENTE
Equitis Sancti Marci,
ET OLIM
ANATOMICI SVPRAORDINARII
In Florentissimo Gimnasio Patauino.
OPERA PHYSICA ANATOMICA
De { Formato Fœtu.
Venarum Ostiolis.
Formatione Oui, & Pulli.
Locutione, & eius Instrumentis.
Brutorum Loquela.
CVM INDICIBVS CAPITVM, ET RERVM NOTATV
ET FIGVRIS ÆNEIS.

PATAVII MDCXXV
Sumptibus Roberti Meglietti.

Fabricius
University of Padua

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William Harvey, physician to two consecutive kings, studied blood circulation, and his ***Anatomical Exercise on the Motion of the Heart and Blood in Animals*** (**1628**) recorded his findings. Though Harvey understood that the heart pumped blood into the circulatory system, he had no knowledge of the influence of oxygen in the blood nor knowledge of the existence of capillaries.

(Oxygen was discovered 150 years later, in 1774.)

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De Motu Cordis - 1628
William Harvey

EXERCITATIO.
ANATOMICA DE
MOTV CORDIS ET SAN-
GVINIS IN ANIMALI-
BVS,
GVILIELMI HARVEI ANGLI,
Medici Regii, & Professoris Anatomiæ in Col-
legio Medicorum Londinensi.

FRANCOFVRTI,
Sumptibus GVILIELMI FITZERI.
ANNO M. DC. XXVIII.

To The Most Illustrious and Indomitable Prince CHARLES, KING *of* GREAT BRITAIN, FRANCE *and* IRELAND, DEFENDER *of the* FAITH

MOST ILLUSTRIOUS PRINCE!

The heart of animals is the foundation of their life, the sovereign of everything within them, the sun of their microcosm, that upon which all growth depends, from which all power proceeds. The King, in like manner, is the foundation of his kingdom, the sun of the world around him, the heart of the republic, the fountain whence all power, all grace doth flow.

Your Majesty's most devoted servant,
WILLIAM HARVEY

(London .... 1628.)

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*"William Harvey (1578-1657), who founded modern experimental physiology, was the first to establish not only the fact of the circulation but also the physical laws governing it, and is commonly reckoned the Father of Modern Medicine. He owed his interest in the movements of the blood to Fabricio, his tutor at Padua, who drew his attention to the valves in the veins, thus suggesting the idea of a *circular* as opposed to a to-and-fro motion. Harvey's great generalisation, based upon a long series of experiments in vivo, gave the coup de grâce to Galenic physiology.*

3 centuries later …

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Cardiology Origins

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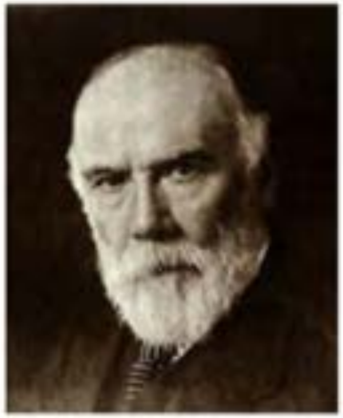
Cardiology Origins

In October of 1908, the **Chicago Cubs** won the **World Series**. As it turns out, the Cubs had won the previous year as well. Meanwhile, in London, a Scottish physician, James MacKenzie, who had published ***The Study of the Pulse*** in 1902, was completing the primal text of cardiovascular medicine, ***Diseases of the Heart*** (1908). The medical specialty of cardiology had been born.



At the same time, just across the English Channel, in Leiden, Willem Einthoven was pioneering development of the electrocardiogram. A London physician, Thomas Lewis, worked with Einthoven, and his contributions were recognized when Einthoven was later awarded the Nobel Prize in Physiology or Medicine "for his discovery of the mechanism of the electrocardiogram". From the Nobel award ceremony speech: " *Sir Thomas Lewis was the first who realized the importance of Einthoven's discovery and who followed his line of thought. His elegant demonstration of the QRS-complex in the electrocardiogram by means of an algebraic summation of dextro- and laevogram confirmed the correctness of Einthoven's interpretation.*"

This brief essay was written in 2016 to celebrate **the 70th anniversary** of the arrival - in Birmingham - of **Dr. John Burrett**, first cardiologist in Alabama.

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Lewis's first book, ***Mechanism and registration of the heartbeat*** was published in 1909.



An American physician, Paul Dudley White, was an internal medicine resident at Massachusetts General Hospital (**MGH**) when he received a Harvard Travelling Fellowship, allowing him to travel to London in October 1913 to study electrocardiography and cardiac physiology with Thomas Lewis. During his stay, he visited the cardiac clinics of Dr. James MacKenzie and Dr. John Parkinson, studying cardiac arrhythmias. His plans were for a longer stay, but the summer of 1914 saw the beginning of four years of war in Europe and beyond (see: "wwi"). Dr. White returned to Boston in July 1914, continuing his work at **MGH,** establishing its first electrocardiography lab. The war in Europe later interrupted his work again, as he spent over two years in the armed forces, returning home in August 1919.

In 1920, Paul White organized a cardiology training program at **MGH** for students, house staff, fellows, and graduate students. In addition, trainees from all over the U.S. and, indeed, from all over the world, came to study cardiovascular disease with Dr. White. While the duration of cardiology training was not always as long nor nearly as regimented as the many years required in today's programs, those who visited to study with Dr. White were learning from a master in the science and art of caring for patients with cardiovascular disease.

The cardiology training program of Paul Dudley White was well established at **MGH** by the time Dr. John Barton Burrett earned his M.D. in 1937 in Valhalla, NY, at New York Medical College, where his father, Dr. Claude A. Burrett, was dean. The following year, Dr. Burrett married Clara Bray, of Orlando, Florida, with family roots in Georgia. The newlyweds planned a visit to Florida and Cuba after their marriage, according to the July 3, 1938 announcement in the *New York Times*. The next year, the world was again in the throes of war in Europe, and this time also in Asia. During his time in the military, Dr. Burrett met an Alabama surgeon, Dr. Joseph Donald, who gave him the idea to move to Birmingham to practice medicine, after he had completed his medical training.

While working at **MGH** with Dr. White, Dr. Burrett learned much of what there was to know about the diagnosis of cardiovascular disease and best treatment to be offered to patients suffering with cardiac problems.

While working at **MGH** with Dr. White, Dr. Burrett learned much of what there was to know about the diagnosis of cardiovascular disease and best treatment to be offered to patients suffering with cardiac problems.

When the work that Dr. Burrett and Dr. White had done together was written up and published, the year was 1945. The article, "Large Interauricular Septal Defect with Particular Reference to Diagnosis and Longevity", which the two men co-authored, was published in the ***American Journal of Medical Science*** in **March, 1945.*** Its title gives a hint to the state of the art of cardiovascular intervention at the time. Surgical correction of congenital cardiac issues was literally in its infancy.**

Following his time in Boston with Paul Dudley White, Dr. John Burrett came to **Birmingham**, joining the faculty of the newly relocated **University of Alabama School of Medicine**. Dr. Burrett established **Cardiovascular Associates**, with its first office on Southside, in 1946, adding associates to his group, and establishing the *first cardiology group in the state of Alabama*.

The rest, as they say, is history.

###

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* As an historical tangent, this writer's father, Phillip J. Boogaerts, USMC, celebrated his 19th birthday that same month – March 1945 – as he left Iwo Jima with other Marines who had survived (see: "wwii"). One month earlier, on Mardi Gras day, six-year-old **Andreas Gruentzig** - who was to become a father of modern cardiology by inventing coronary angioplasty - was hiding with his mom in the basement of their Dresden home, while British and American bombers created a firestorm above them (see here).

** On November 29, 1944, at Johns Hopkins, **Dr. Helen Taussig** and **Dr. Alfred Blalock** decided to proceed with a pioneering procedure to surgically correct tetralogy of Fallot in a small child. Blalock was assisted in the OR by **Vivien Thomas**, a virtuoso surgical assistant, who worked with Blalock in the Hopkins surgical labs and who had developed many of the operative techniques that were used (see: "pump").

Burrett, J. B., and White, P. D.: Large Interauricular Septal Defect With Particular Reference to Diagnosis and Longevity. Am. J. M. Sc. **209**: 355, 1945.

Interauricular septal defects, which measure 1 cm. or more in diameter in individuals over 8 months of age, are of clinical significance and occur more frequently than do other congenital cardiovascular anomalies. Lesser defects are silent except in rare instances where they may permit the passage of small emboli from the right to the left auricle.

Burrett, J. B., and White, P. D.

Large Interauricular Septal Defect With Particular Reference to Diagnosis and Longevity. Am. J. Med. Sci. 209: 355

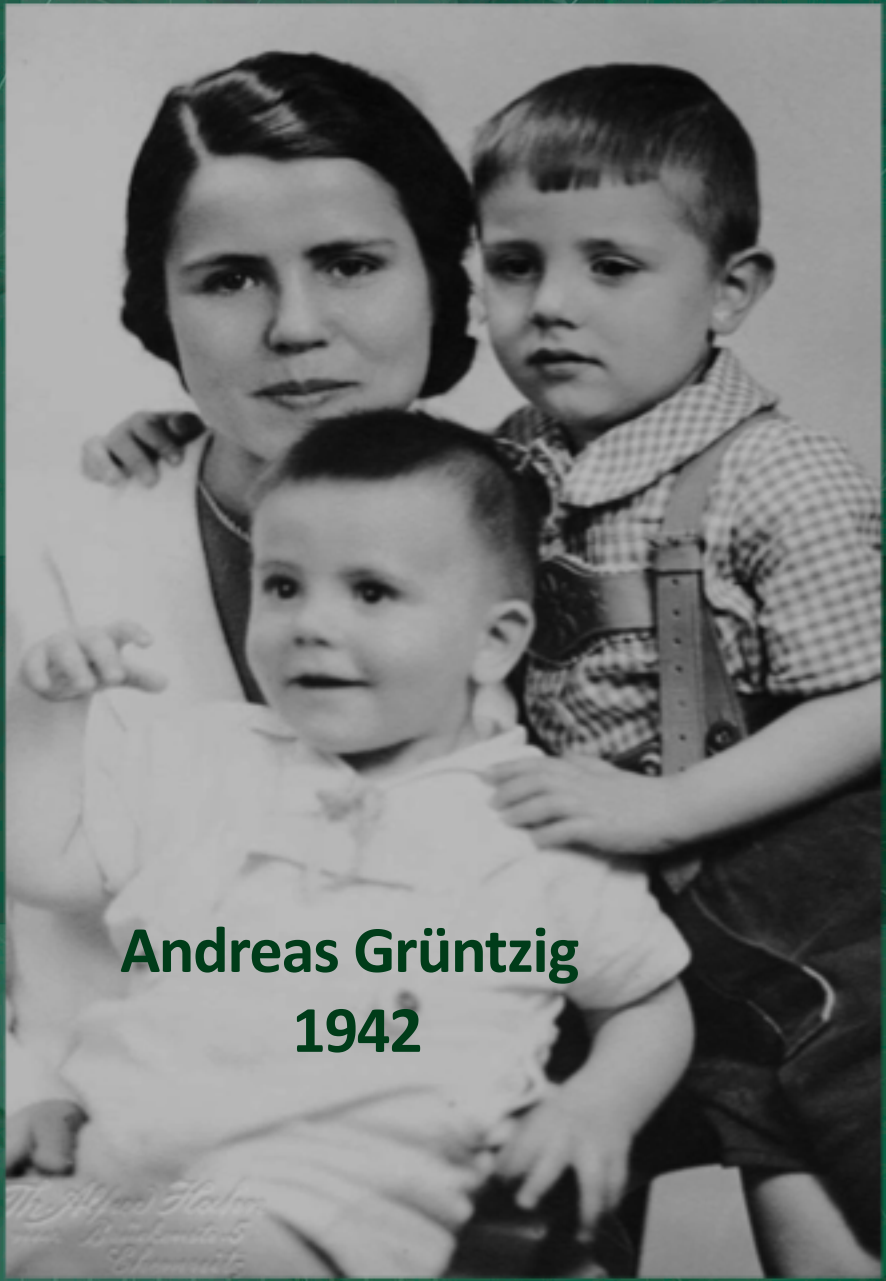
***American Heart Journal*, 1945.**

Interauricular septal defects, which measure 1 cm. or more in diameter in individuals over 8 months of age, are of clinical significance and occur more frequently than do other congenital cardiovascular anomalies. Lesser defects are silent except in rare instances whcrc they may permit the passage of small emboli from the right to the left auricle.

Paul Dudley White (left) with President Dwight D. Eisenhower.

Dr. Paul Dudley White, physician to President Dwight D. Eisenhower following his 1955 MI.

Tangent:


Andreas Grüntzig
1942

One month prior to the publication of the John Burrett / Paul Dudley White article, on **Mardi Gras day 1945**, *six-year-old* **Andreas Grüntzig** *- who was to become a father of modern cardiology by inventing coronary angioplasty - first case 1977 - was hiding with his mom in their basement, while British and American bombers created a firestorm above their* **Dresden** *home.*

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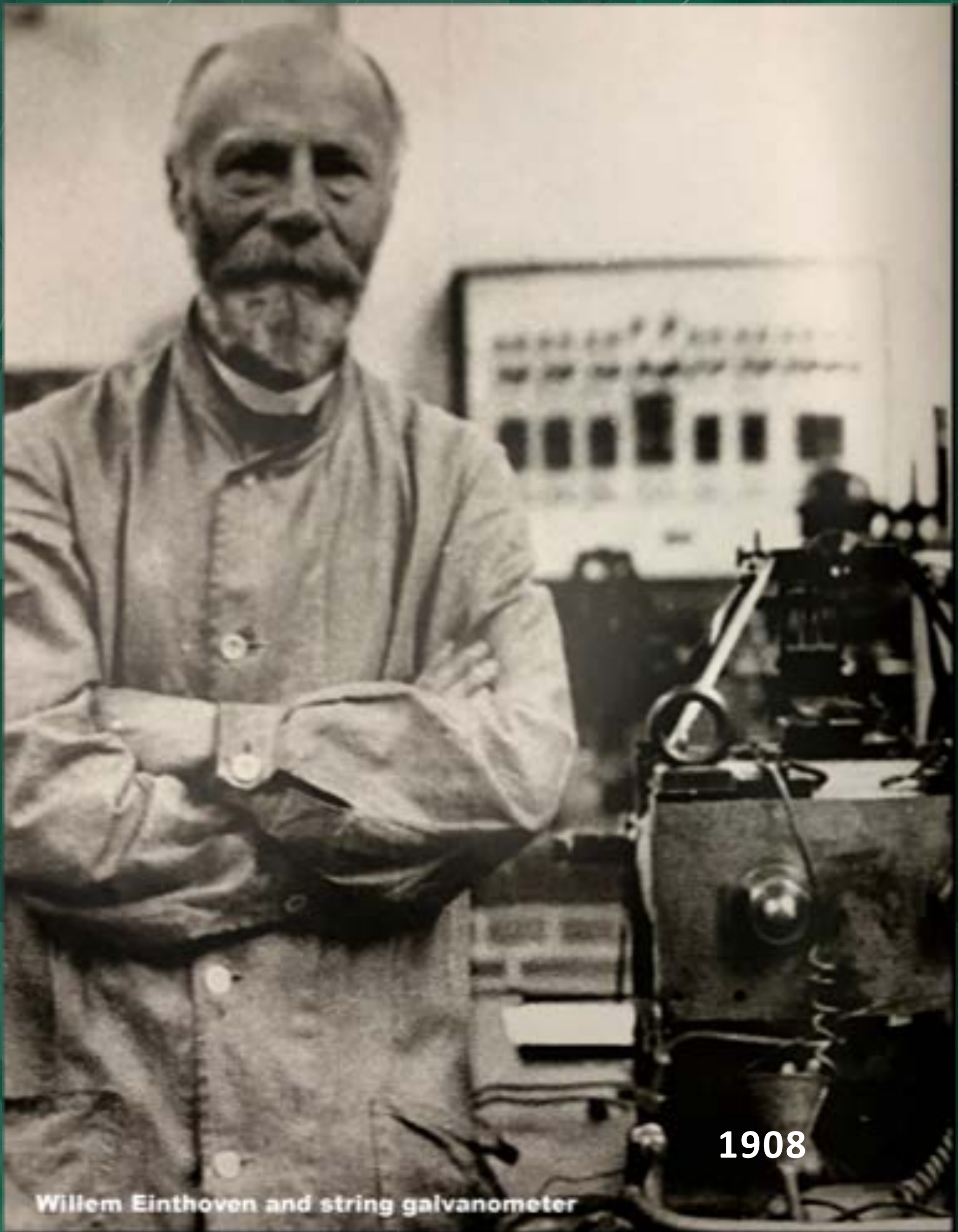

Willem Einthoven and string galvanometer

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first EKG at MGH c 1914

Tinsley R. Harrison
(1900-1978)

In June 1925, Tinsley R. Harrison arrived at the new Vanderbilt Hospital to serve as the first Chief Resident in Medicine. A graduate of Johns Hopkins, he was hired by Dr. G. Canby Robinson, first Dean and architect of the new Vanderbilt Medical School and Hospital generously financed by the General Education Board of the Rockefeller Foundation. Robinson thought highly of Harrison and awarded him a one year travelling fellowship in Europe before he assumed his duties as Chief Resident in Medicine at Vanderbilt.

Tinsley Harrison stayed at Vanderbilt from 1925 until 1941. During this time, his major focus was teaching, research, and experimental medicine. While at Vanderbilt, he published many articles including 15 scientific articles with his close friend Alfred Blalock, and published a book, Failure of the Circulation in 1936. Tinsley Harrison left Vanderbilt in 1941 to chair the Department of Internal Medicine at Bowman Gray. He subsequently chaired departments at Southwestern Medical College and the University of Alabama Medical Center. He is best known for his text-book, *Principles of Internal Medicine*, widely referred to as Harrisons.

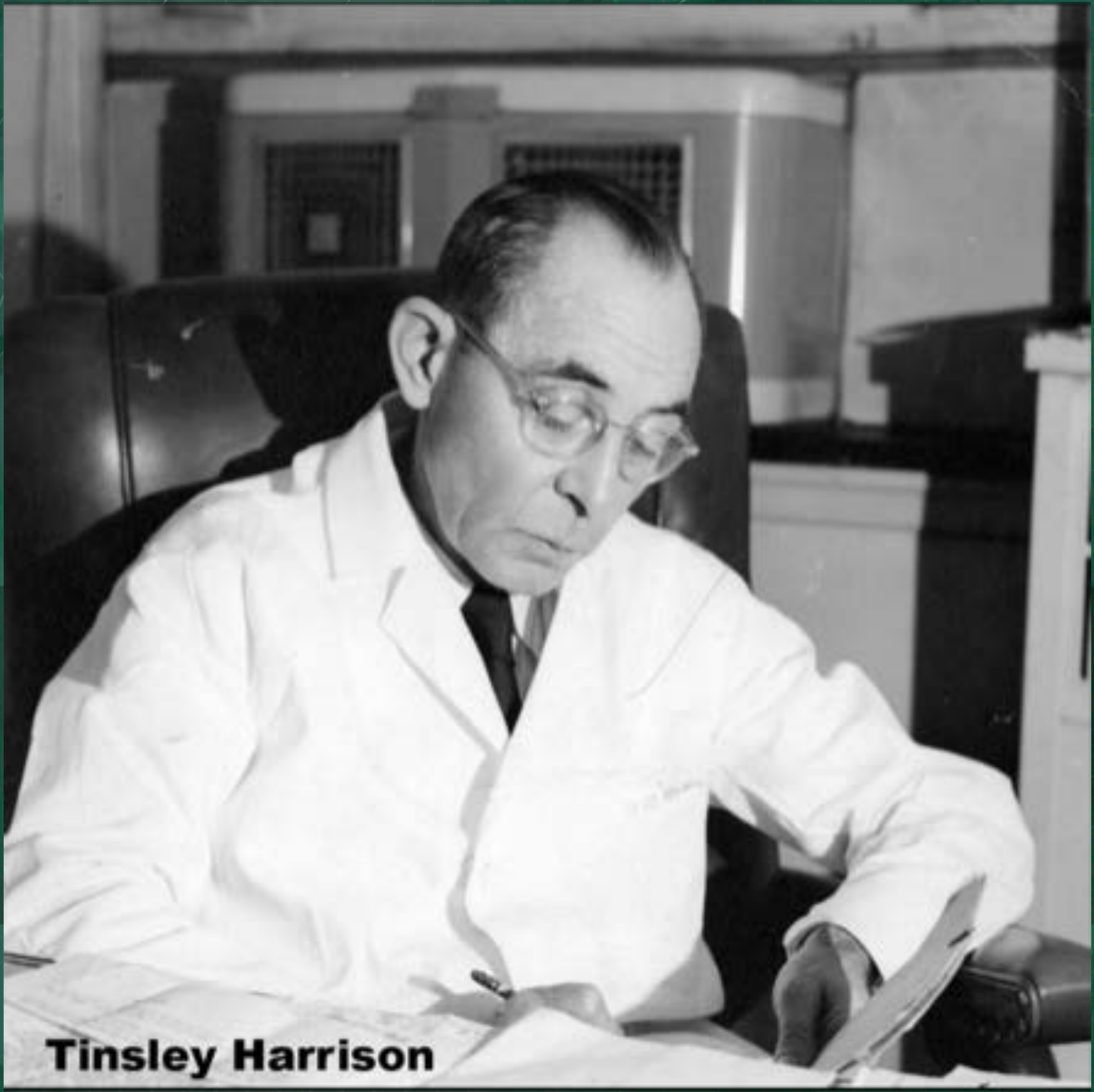
FAILURE
of
THE CIRCULATION

By
TINSLEY RANDOLPH HARRISON, M.D.
ASSOCIATE PROFESSOR OF MEDICINE,
VANDERBILT UNIVERSITY SCHOOL OF MEDICINE
NASHVILLE, TENNESSEE

BALTIMORE
THE WILLIAMS & WILKINS COMPANY
1939

Made in the United States of America

First Edition, March, 1935
Second Edition, April, 1939



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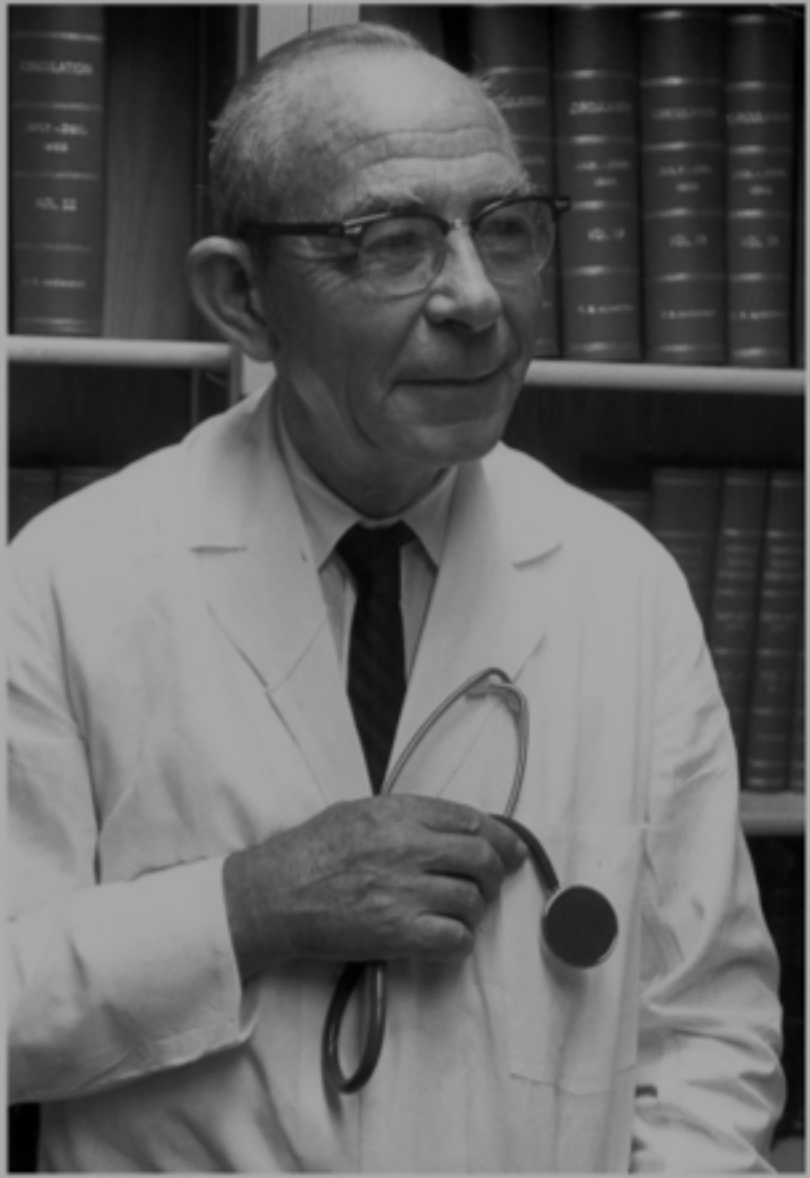

Tinsley Randolph Harrison at UAB, about 1970.

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Tinsley R. Harrison, M.D.: Teacher of Medicine

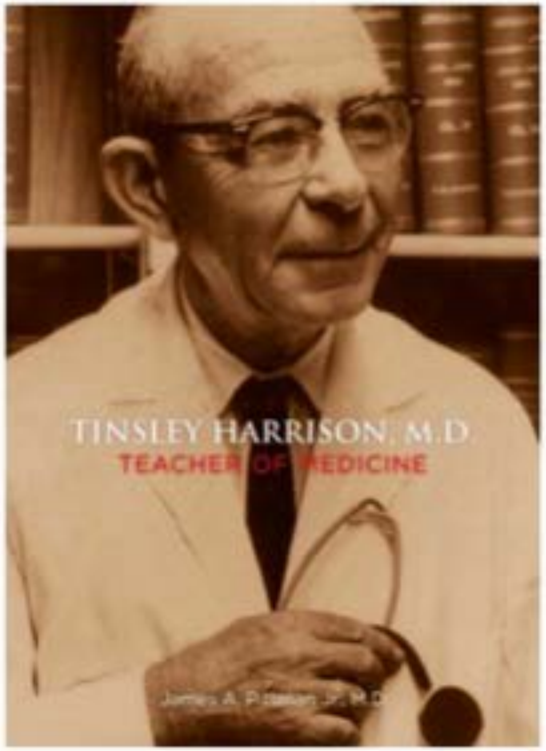
BY NEIL A. GRAUER

At the age of 3, Tinsley R. Harrison's destiny as a great teacher of medicine was decreed by no less than William Osler, an idol of Tinsley's father, Groce, a sixth-generation physician from Alabama.

Already an M.D., the elder Harrison wanted to study under Osler, so he got himself admitted to the first class of the Johns Hopkins University School of Medicine in 1893. Then, he unexpectedly met his future wife and chose to remain in Alabama and get married. A decade later, offered a significant career opportunity, he sought Osler's advice. After discussing Harrison's professional future, Osler asked how many children he had. Two sons and a daughter, Harrison replied. "Train those boys to be teachers of medicine!" Osler declared.

So it was that Tinsley (1900–1978) would graduate from the Johns Hopkins University School of Medicine in 1922 — where he was a classmate, roommate and tennis doubles partner of Johns Hopkins' future surgeon-in-chief Alfred Blalock — and ultimately become "one of the most important and pivotal medical doctors in U.S. history," according to his biographer and protégé, James Pittman Jr. (1927–2014).

Harrison is best remembered for *Harrison's Principles of Internal Medicine*, published in 1950, reprinted 16 times, translated into 14 languages, and perhaps the world's most-used and best-selling internal medical text. He was the first chair of medicine and dean of the Medical College of Alabama, now part of the University of Alabama at Birmingham — a position that Pittman, who had been a resident under Harrison, later held from 1973 to 1992.



TINSLEY R. HARRISON, M.D.: TEACHER OF MEDICINE

James A. Pittman Jr., M.D.
NewSouth Books (2014)

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Edict to surgeons regarding the heart:

"Noli me tangere."

"Don't touch me."

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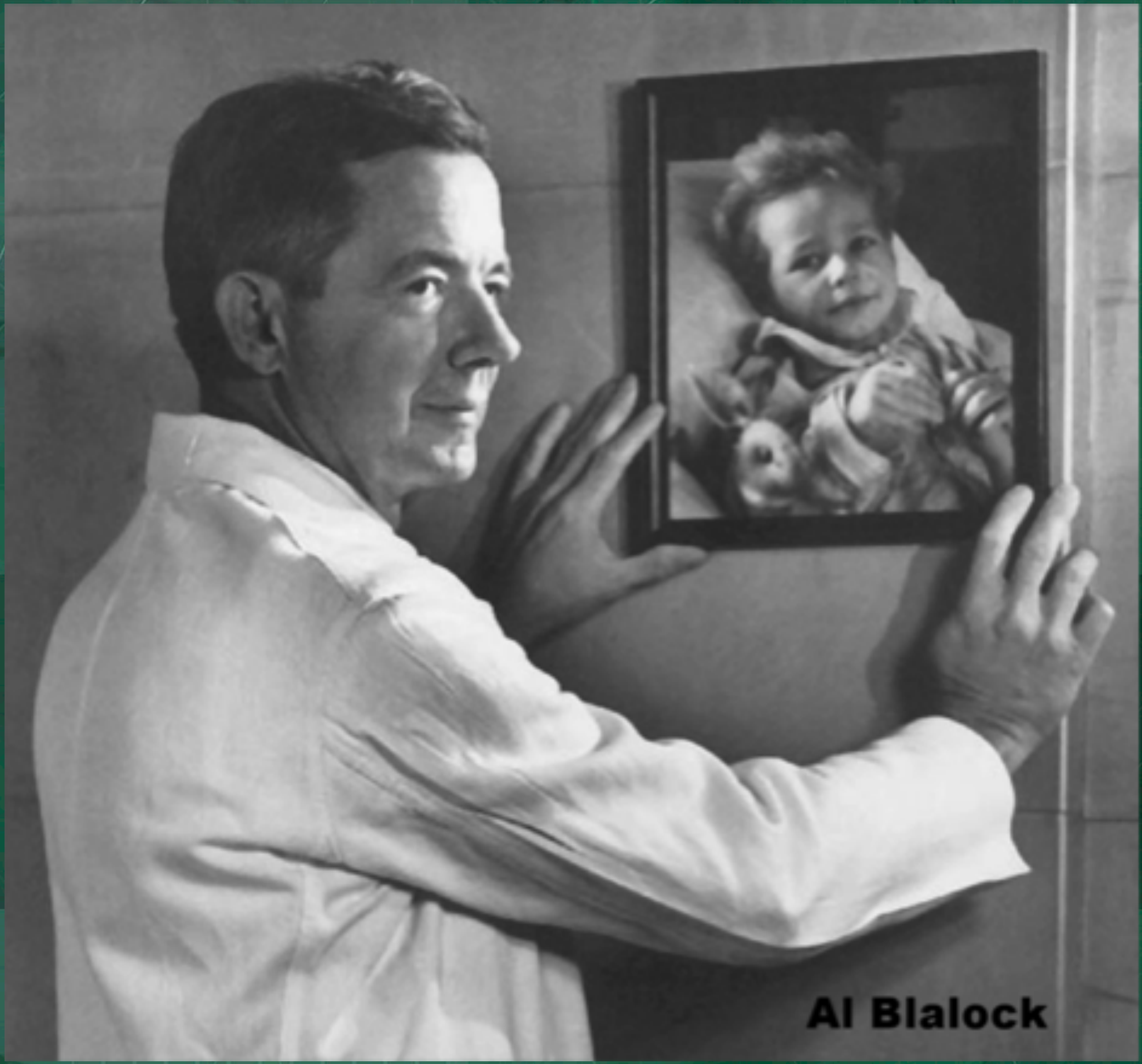
Al Blalock

Alfred Blalock, MD

(1899-1964)

Alfred Blalock was born in Culloden, Georgia on April 5, 1899. He graduated with an AB degree in 1918 and entered Johns Hopkins Medical School where he was awarded the M.D. in 1922. Blalock spent the next two and a half years at Hopkins, completing an Internship in Urology, and then an Assistant Residency on the General Surgical Service, followed by a Fellowship in Otolaryngology. During the summer of 1925, he moved to Boston to begin a Residency at the Peter Bent Brigham Hospital. However, he never unpacked his bags. Instead, he accepted the position of Resident Surgeon in the program of the newly constructed Vanderbilt University Hospital in Nashville, joining his good friend and fellow Southerner, Tinsley Harrison, who was Vanderbilt's first Chief Resident on the Medical Service. Alfred Blalock arrived in Nashville, TN on September 17, 1925 to work with Barney Brooks, Professor of Surgery and Chief of the Surgical Service.

At Vanderbilt, Blalock was active in teaching the 3rd and 4th year medical students and was placed in charge of the surgical research laboratory. Blalock's laboratory experiments at Vanderbilt proved that "surgical shock was due to loss of effective circulating blood volume" and formed the basis for the beneficial and extensive use of blood and plasma in the care of wounded men in W.W. II.* Another of his research interests was pulmonary hypertension. Using dogs, he devised an operation in which the subclavian artery was anastomosed to the pulmonary artery. "This failed to produce pulmonary hypertion, but was the procdedure used many years at Johns Hopkins in the original blue baby operation."*

1925 -Blalock arrives at Vanderbilt

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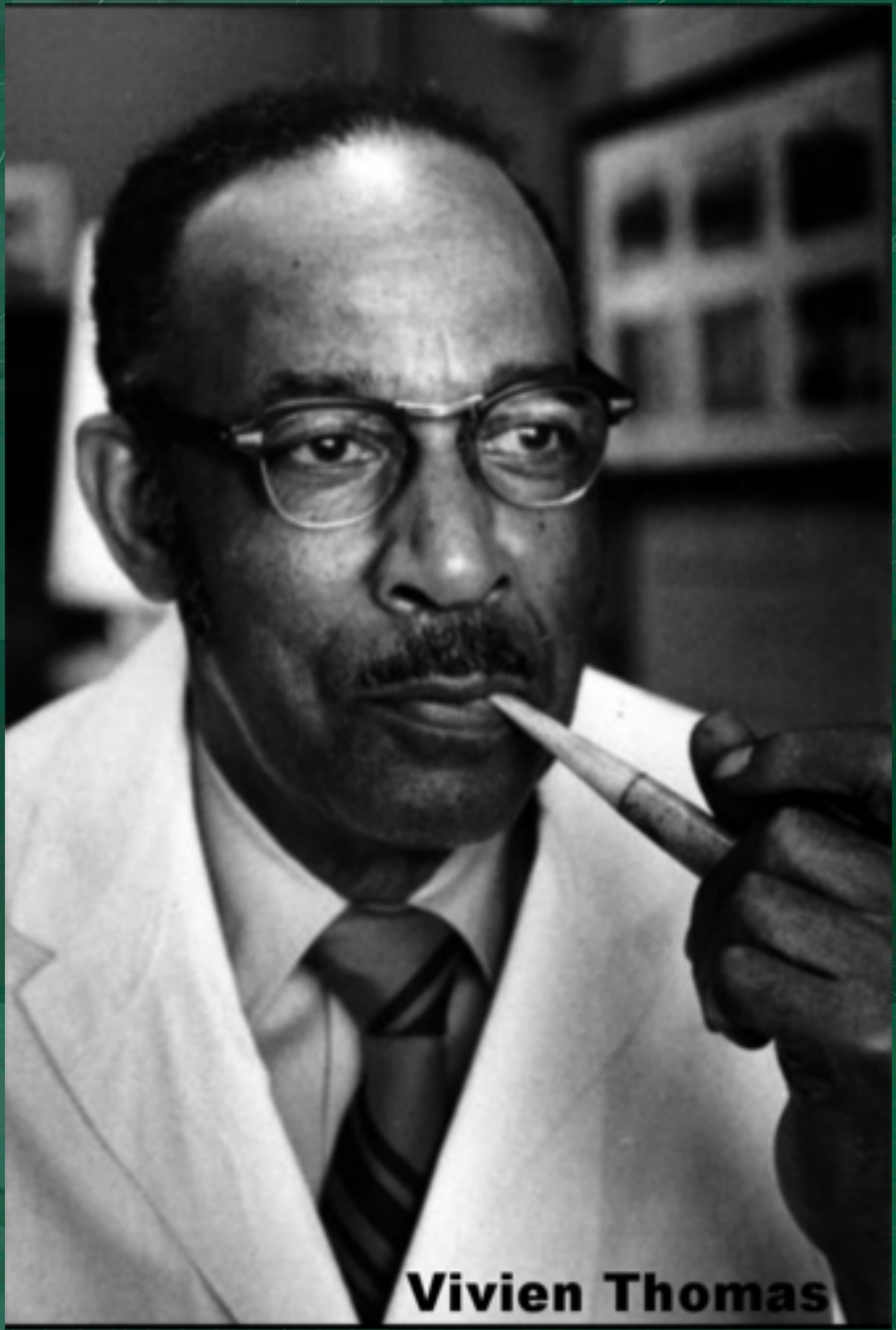

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Vivien T. Thomas

Dr. Vivien Theodore Thomas was born in Lake Providence, Louisiana in 1910. The grandson of a slave, he attended Cotton Picking High School (now known as Pearl-Cohn Magnet High School) in Nashville in the 1920s. Even though it was part of a racially segregated system, the school provided him with a high-quality education. In the wake of the stock market crash in October, he secured a job as a laboratory assistant in 1930 with Dr. Alfred Blalock at Vanderbilt University.

Tutored in anatomy and physiology by Blalock and his young research fellow, Dr. Joseph Beard, Thomas rapidly mastered complex surgical techniques and research methodology. In an era when institutional racism was the norm, Thomas was classified, and paid, as a janitor, despite the fact that by the mid-1930s he was doing the work of a postdoctoral researcher in Blalock's lab. Together he and Blalock did groundbreaking research into the causes of hemorrhagic and traumatic shock. This work later evolved into research on Crush syndrome and saved the lives of thousands of soldiers on the battlefields of World War II.

Blalock and Thomas began experimental work in vascular and cardiac surgery, defying medical taboos against operating upon the heart. It was this work that laid the foundation for the revolutionary lifesaving surgery they were to perform at Johns Hopkins a decade later. By 1940, the work Blalock had done with Thomas placed him at the forefront of American surgery, and when he was offered the position of Chief of Surgery at his alma mater, Johns Hopkins in 1941, he requested that Thomas accompany him. In 1943, while pursuing his shock research, Blalock was approached by renowned pediatric cardiologist Dr. Helen Taussig, who was seeking a surgical solution to a complex and fatal four-part heart anomaly called Tetralogy of Fallot (also known as blue baby syndrome, although other cardiac anomalies produce blueness, or cyanosis). Thomas was charged with the task of first creating a blue baby-like condition (cyanosis) in a dog, then correcting the condition by means of the pulmonary-to-subclavian anastomosis. In nearly two years of laboratory work involving some 200 dogs, demonstrated that the corrective procedure was not lethal, thus persuading Blalock that the operation could be safely attempted on a human patient. During this first procedure in 1944, Thomas stood on a step-stool behind Blalock coaching him through the procedure. When the procedure was published in the May 1945 issue of the Journal of the American Medical Association, Blalock and Taussig received sole credit for the Blalock-Taussig shunt. Thomas received no mention and, in Blalockâ€™s writings, he was never credited for his role.

Vivien Thomas Pioneered Surgery That Saved Millions Of Lives

Reprints

SCOTT S. SMITH

Vivien Thomas had no medical degree, but he still became one of surgery's greatest innovators. His mentor, Alfred Blalock, was a pioneering surgeon at Vanderbilt University in Nashville in the 1930s. He saw the raw talent in Thomas and hired him as his assistant at a time when the only other blacks at the school were janitors.

In 1941, they moved to Johns Hopkins University, shocking Baltimore's segregated society. They began searching for a cure for blue baby syndrome, a heart defect that reduced circulation and led to death.

But heart surgery didn't exist for even adults then, so they had to try it on anesthetized dogs.

"They functioned almost as a single mind, as Thomas' deft hands turned Blalock's ideas into elegant and detailed experiments," wrote Katie McCabe in an award-winning 1989 Washingtonian magazine article, "Like Something the Lord Made." "Blalock first operated on blue baby Eileen Saxon, with Thomas standing at his elbow on a step stool where he could see what Blalock was doing, since Thomas had done the procedure dozens of times, Blalock only once as his assistant. ... Underneath the sterile drapes, Eileen turned pink. ... It was the beginning of modern cardiac surgery."

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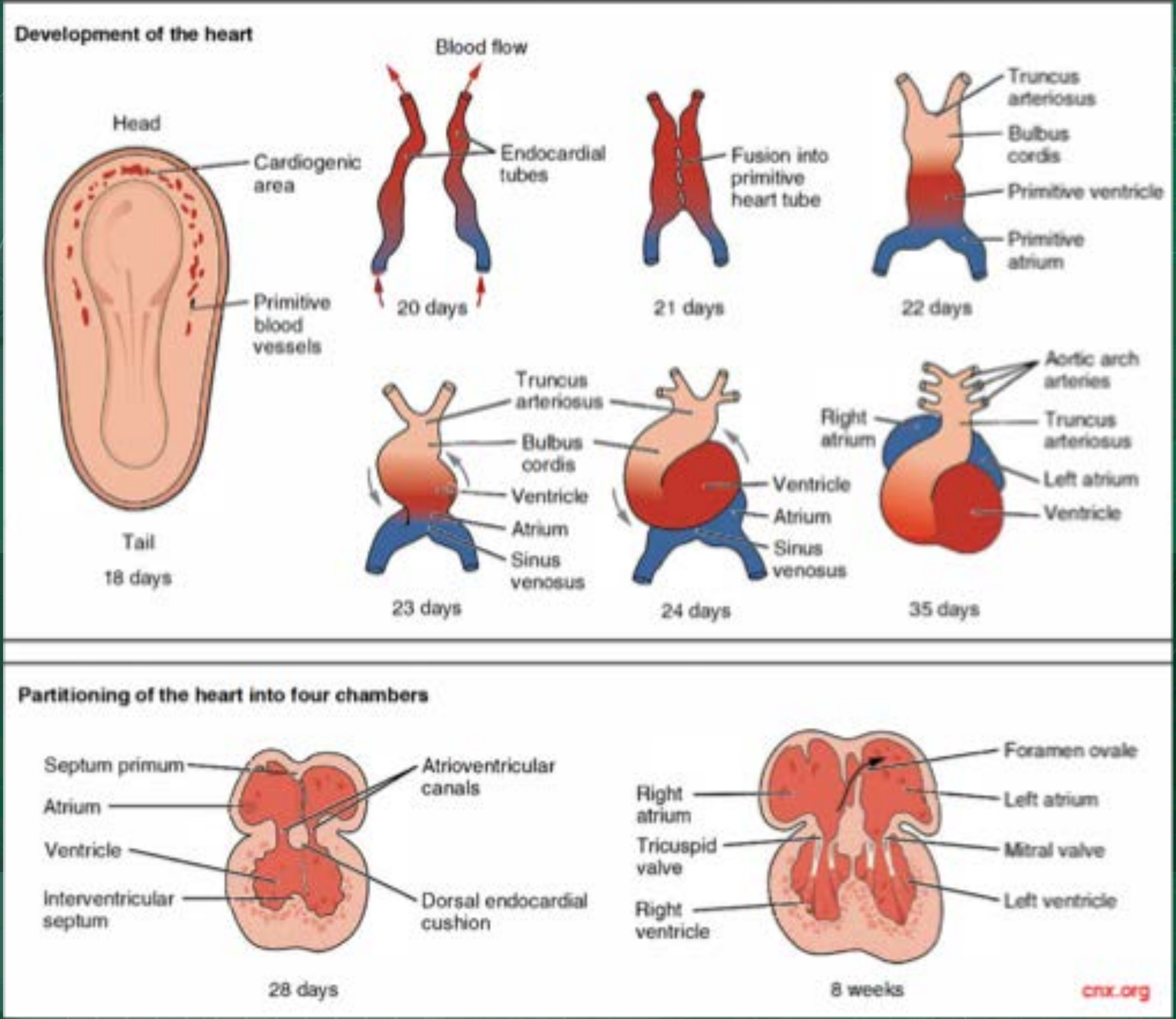
Helen Brooke Taussig is known as the founder of pediatric cardiology for her innovative work on "blue baby" syndrome. In 1944, Taussig, surgeon Alfred Blalock, and surgical technician Vivien Thomas developed an operation to correct the congenital heart defect that causes the syndrome. Since then, their operation has prolonged thousands of lives, and is considered a key step in the development of adult open heart surgery the following decade. Dr. Taussig also helped to avert a thalidomide birth defect crisis in the United States, testifying to the Food and Drug Administration on the terrible effects the drug had caused in Europe.

Helen Taussig was born 1898 in Cambridge, Massachusetts, to Frank W. Taussig, a well-known economist and professor at Harvard University, and Edith Guild, one of the first students at Radcliffe College. Her mother died when she was only 11, and her grandfather, a physician who had a strong interest in biology and zoology, may have influenced her decision to become a doctor.

Despite suffering from dyslexia—a reading impairment—Taussig excelled in higher education. She graduated from the Cambridge School for Girls in 1917 and became a champion tennis player during her two years of study at Radcliffe. She earned a B.A. degree from the University of California at Berkeley in 1921, and after studying at Harvard Medical School and Boston University she transferred to Johns Hopkins University School of Medicine to pursue her interest in cardiac research.

Anoxemia or "blue baby" syndrome, the congenital heart condition which Taussig specialized in, is caused by a defect that prevents the heart from receiving enough oxygen. Taussig used fluoroscopy, a new x-ray technique, to establish that babies suffering from anoxemia had a leaking septum (the wall that separates the chambers of the heart), and an underdeveloped artery leading from the heart to the lungs. In 1941 Taussig suggested an idea for an operation that might help children with "blue baby" to her colleagues at Hopkins—surgeon Alfred Blalock and surgical technician Vivien Thomas. On November 9, 1944 Taussig and Blalock first performed this new operation on a child with anoxemia, (after Thomas had experimented extensively with the procedure). They later repeated it successfully on two more patients. They published their results in the *Journal of the American Medical Association*. The technique was named the Blalock-Taussig operation, and was soon used worldwide. Taussig continued her research on cardiac birth defects and published her important work *Congenital Malformations of the Heart*, in 1947.



Development of the heart
Blood flow
Head
Cardiogenic area
Primitive blood vessels
Tail
18 days
Endocardial tubes
20 days
Fusion into primitive heart tube
21 days
Truncus arteriosus
Bulbus cordis
Primitive ventricle
Primitive atrium
22 days
Truncus arteriosus
Bulbus cordis
Ventricle
Atrium
Sinus venosus
23 days
24 days
Aortic arch arteries
Right atrium
Truncus arteriosus
Left atrium
Ventricle
35 days
Partitioning of the heart into four chambers
Septum primum
Atrium
Ventricle
Interventricular septum
Atrioventricular canals
Dorsal endocardial cushion
28 days
Right atrium
Tricuspid valve
Right ventricle
Foramen ovale
Left atrium
Mitral valve
Left ventricle
8 weeks
cnx.org

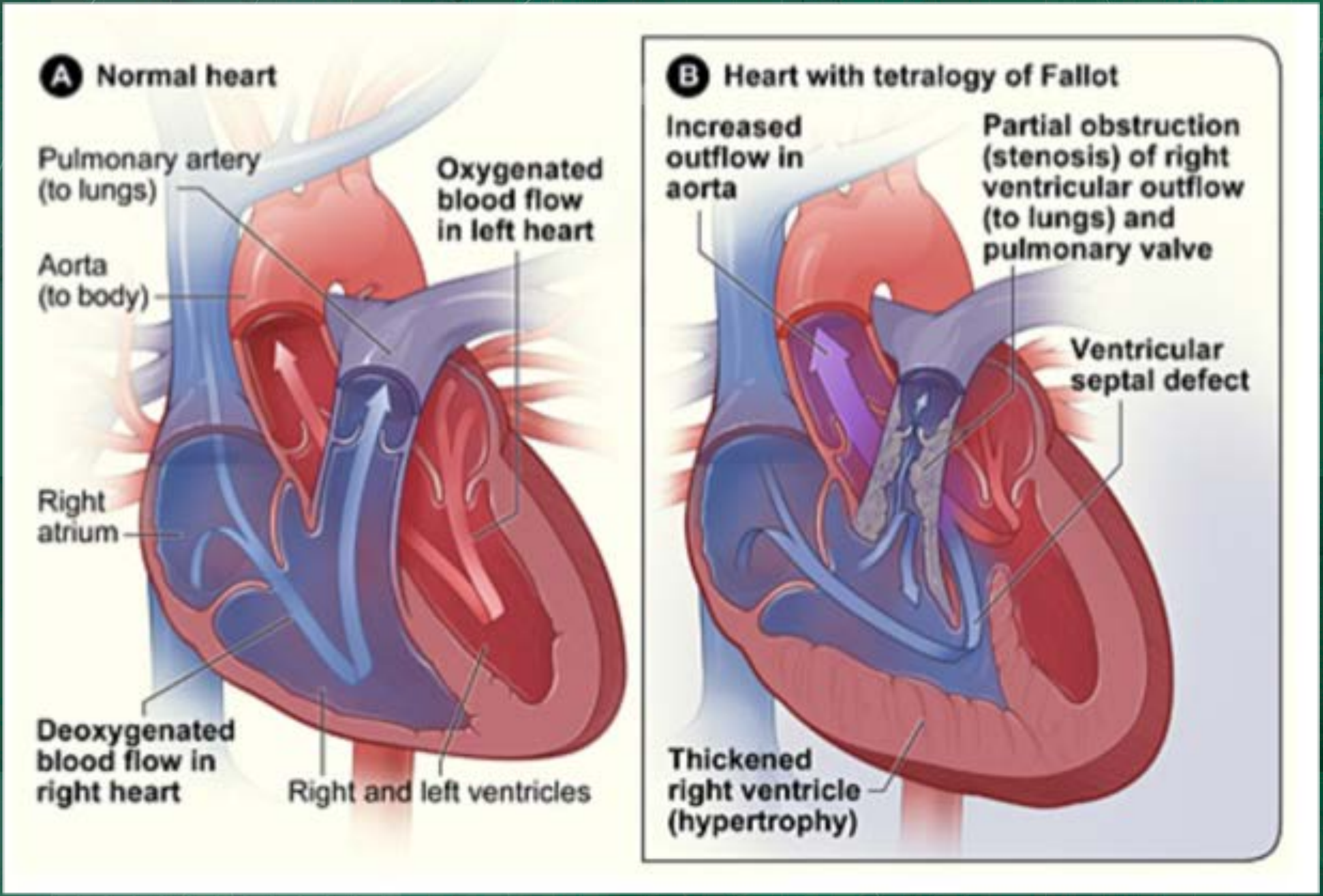


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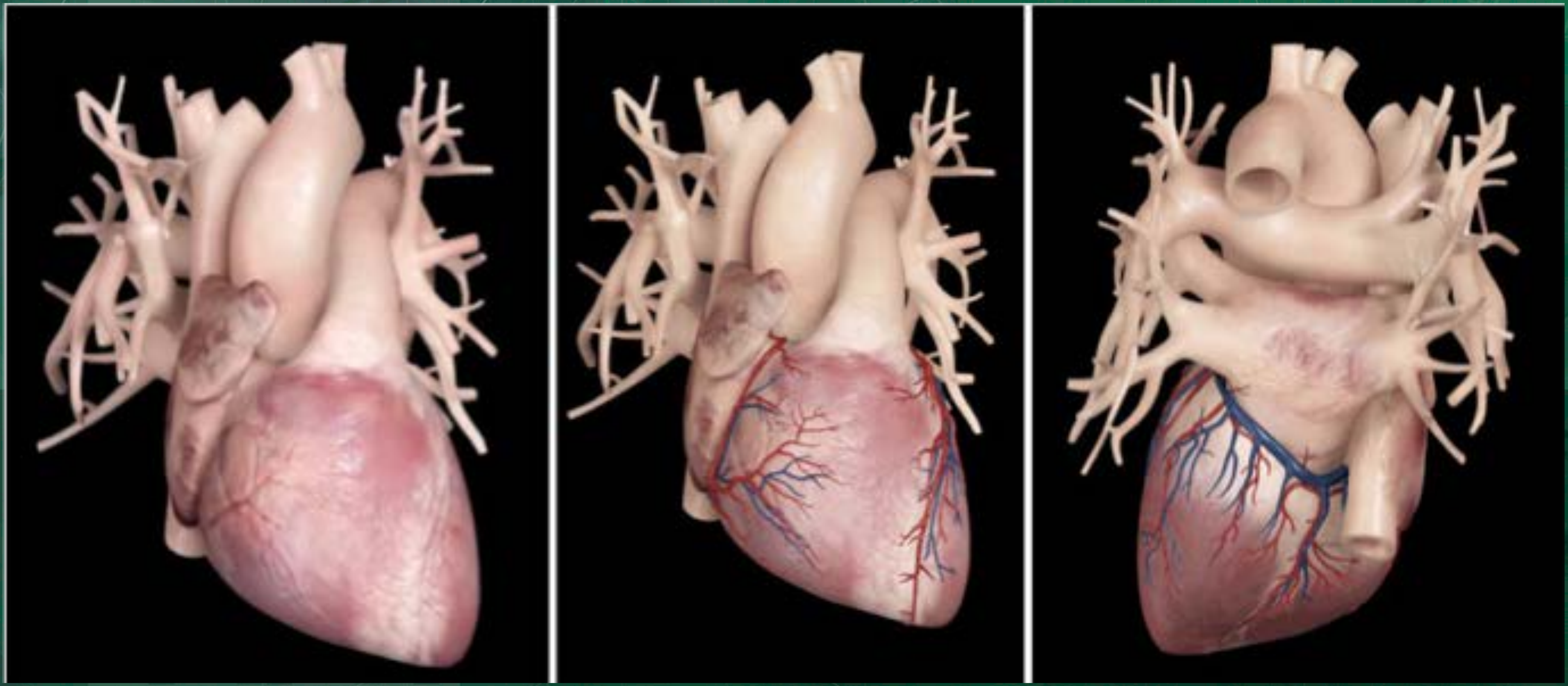
FIGURE 2. Dr Blalock and colleagues performing the "blue baby" operation on closed circuit television in 1947. He was assisted by Drs William Longmire and Denton Cooley with Mr Vivien Thomas standing behind him. (Reproduced with permission from the Johns Hopkins Medical Archives.)

Cardiac OR
Johns Hopkins -
Tetralogy of Fallot repair

Tangent:

Dr. Denton A. Cooley in 1969 after becoming the first surgeon to implant a totally artificial heart in a patient. Ralph Morse/Time Life Pictures, via Getty Images

Denton A. Cooley was born in 1920 in **Houston, Texas**. After receiving an M.D. in **1944** from **Johns Hopkins** University School of Medicine, in Baltimore, he completed a surgical residency under **Dr. Alfred Blalock** at that same institution. He then became the senior surgical registrar with Russell Brock at the Royal Brompton Hospital in London. In 1951, he joined the faculty of **Baylor** College of Medicine in **Houston**. In 1969, he resigned from Baylor to become chief surgeon at the **Texas Heart Institute** (THI), which he had founded in 1962.



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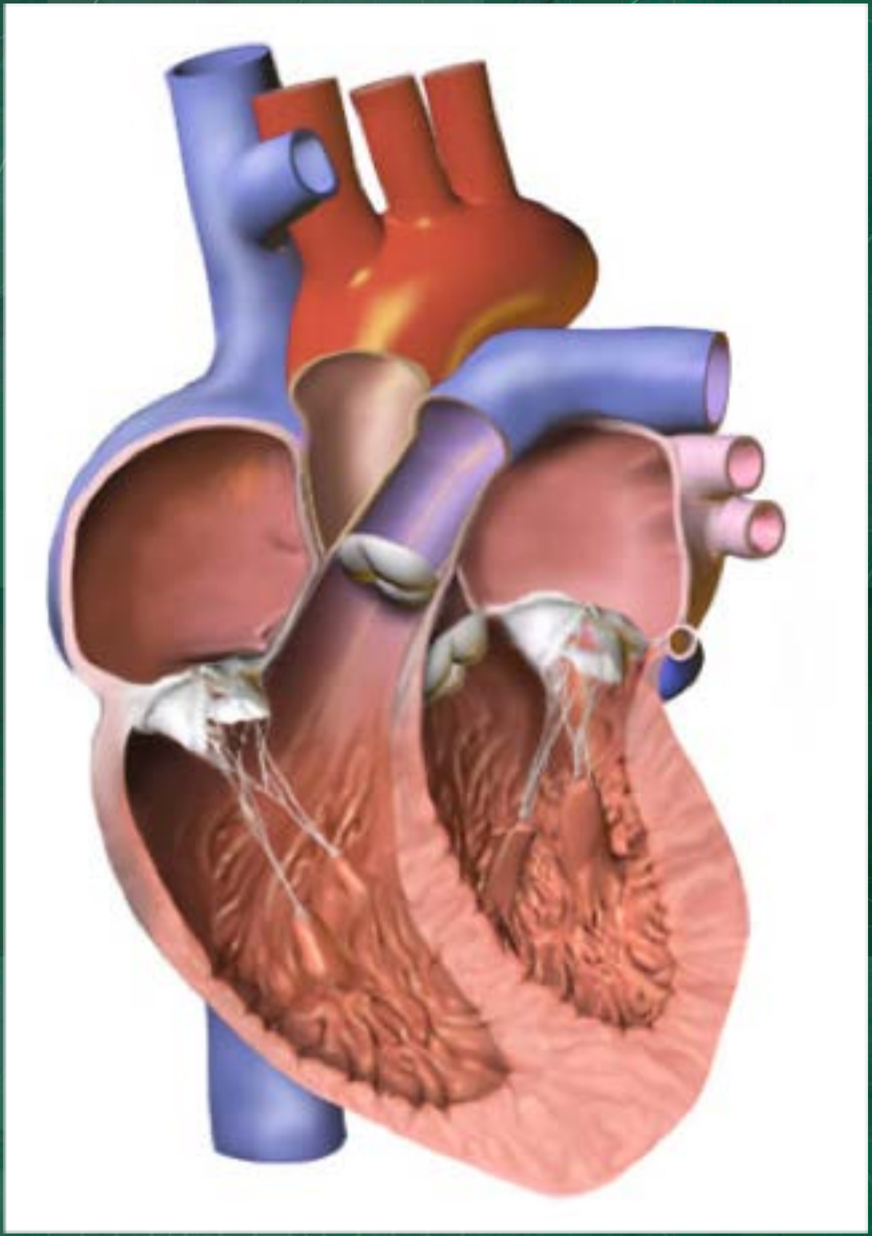

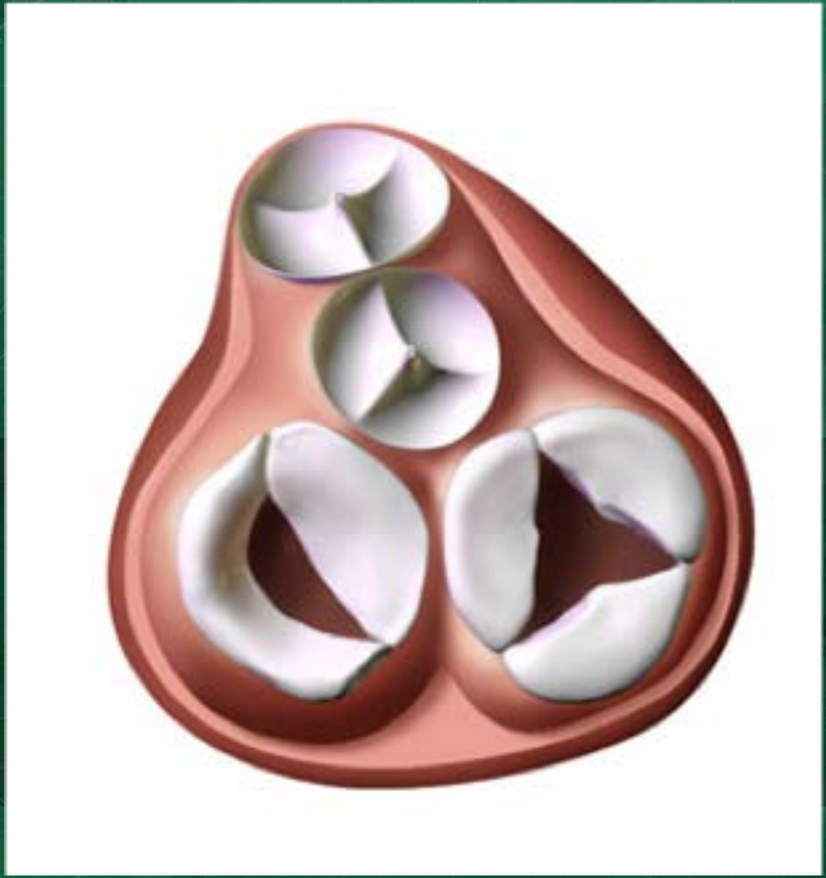

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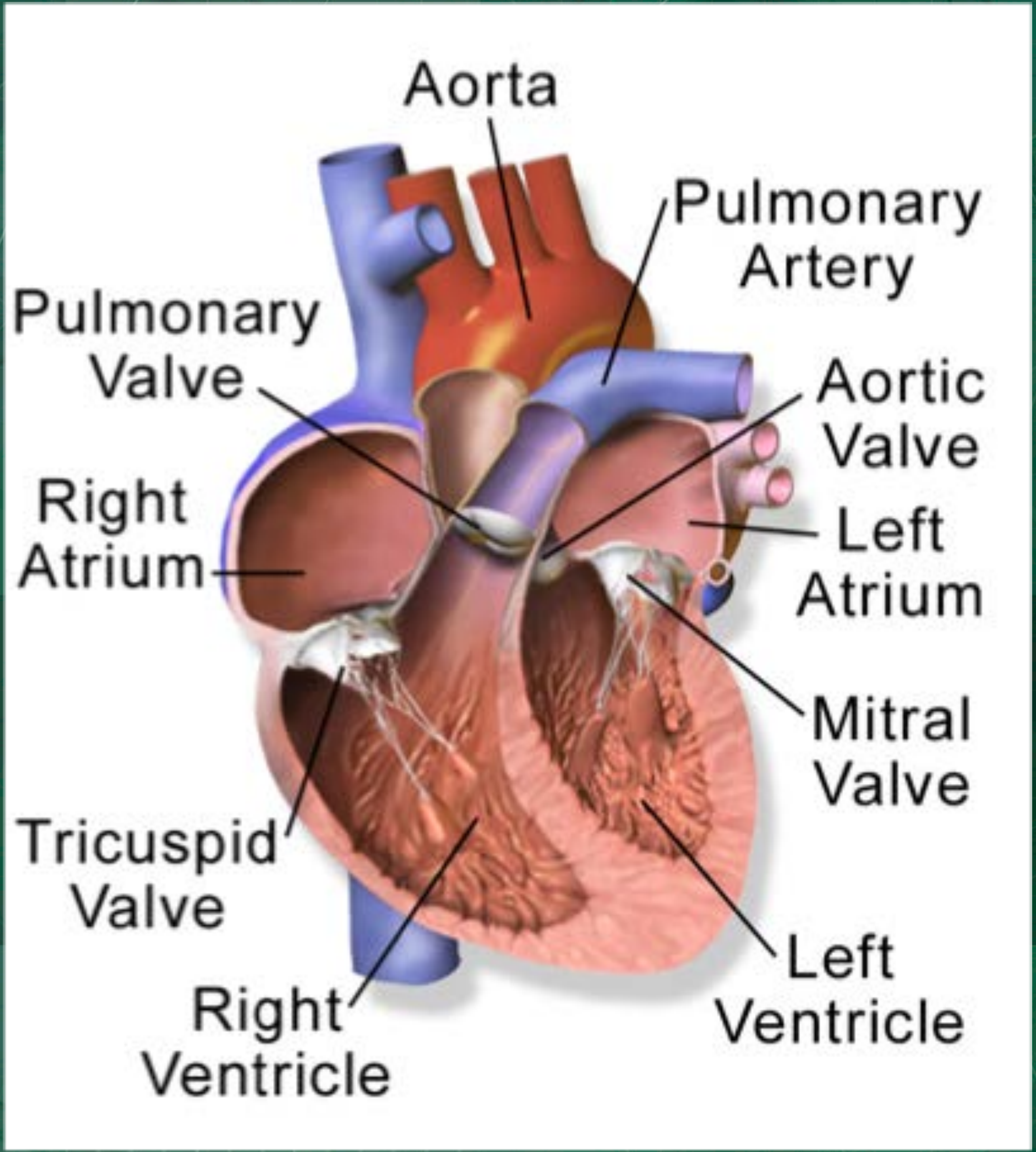
Aorta
Pulmonary Artery
Pulmonary Valve
Aortic Valve
Right Atrium
Left Atrium
Mitral Valve
Tricuspid Valve
Right Ventricle
Left Ventricle

normal conduction

normal valves

normal flow


3D4Medical
Heart Pro III
Mac App Store
App Store
App Store
Mac OS Version
iPhone Version
iPad Version

HLH 4 E Surgery

E S

OPERATION: Nov. 29, 1944
Dr. Alfred Blalock
Ether - Oxygen - Dr. Harmel

ANASTOMOSIS OF LEFT PULMONARY ARTERY TO LEFT SUBCLAVIAN ARTERY

This patient was an undernourished child who had cyanosis on frequent occasions. The diagnosis was pulmonary stenosis.

Under ether and oxygen, administered by the open method, an incision was made in the left chest extending from the edge of the sternum to the axillary line in the third interspace. The second and third costal cartilages were divided. The pleural cavity was entered. The left lung looked normal. No thrill was felt in palpating the heart and pulmonary artery. The left pulmonary artery was identified and was dissected free of the neighboring tissues. The left pulmonary artery seemed to be of normal size. The superior pulmonary vein, on the other hand, seemed considerably smaller than normal to me. I had hoped that the artery to the left upper lobe might be sufficiently long to allow an anastomosis, but this did not appear to be the case. The left subclavian artery was then identified and was dissected free of the neighboring tissues. The vertebral artery and the branches of the thyrocervical axis were doubly ligated and divided. The subclavian was so short that there would not have been sufficient length for our purposes, had this not been done. The subclavian artery was then ligated distal to the thyrocervical trunk. A bulldog clip was placed on the subclavian artery at a point just distal to its origin from the aorta. The subclavian artery was then divided just proximal to the ligature. Two bulldog clips were then placed on the left pulmonary artery, the

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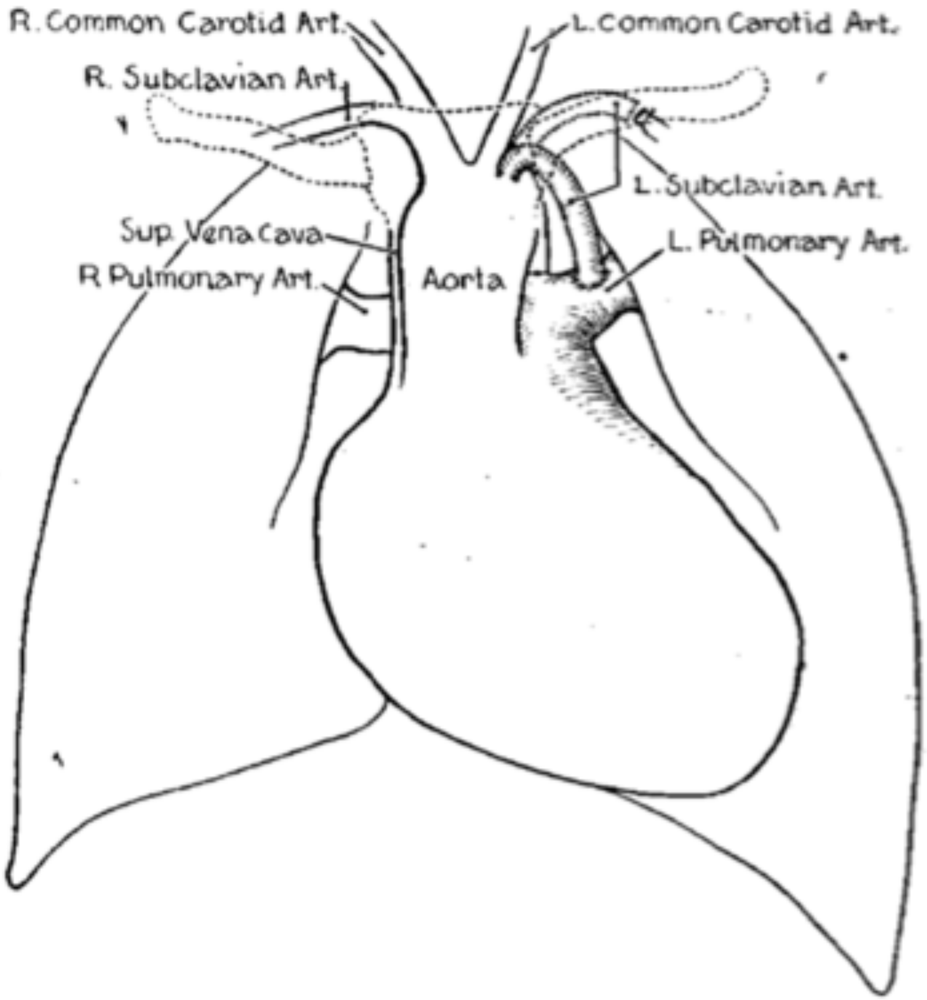

Fig. 3 (case 1).—Procedure used. The end of the left subclavian artery was anastomosed to the side of the left pulmonary artery.

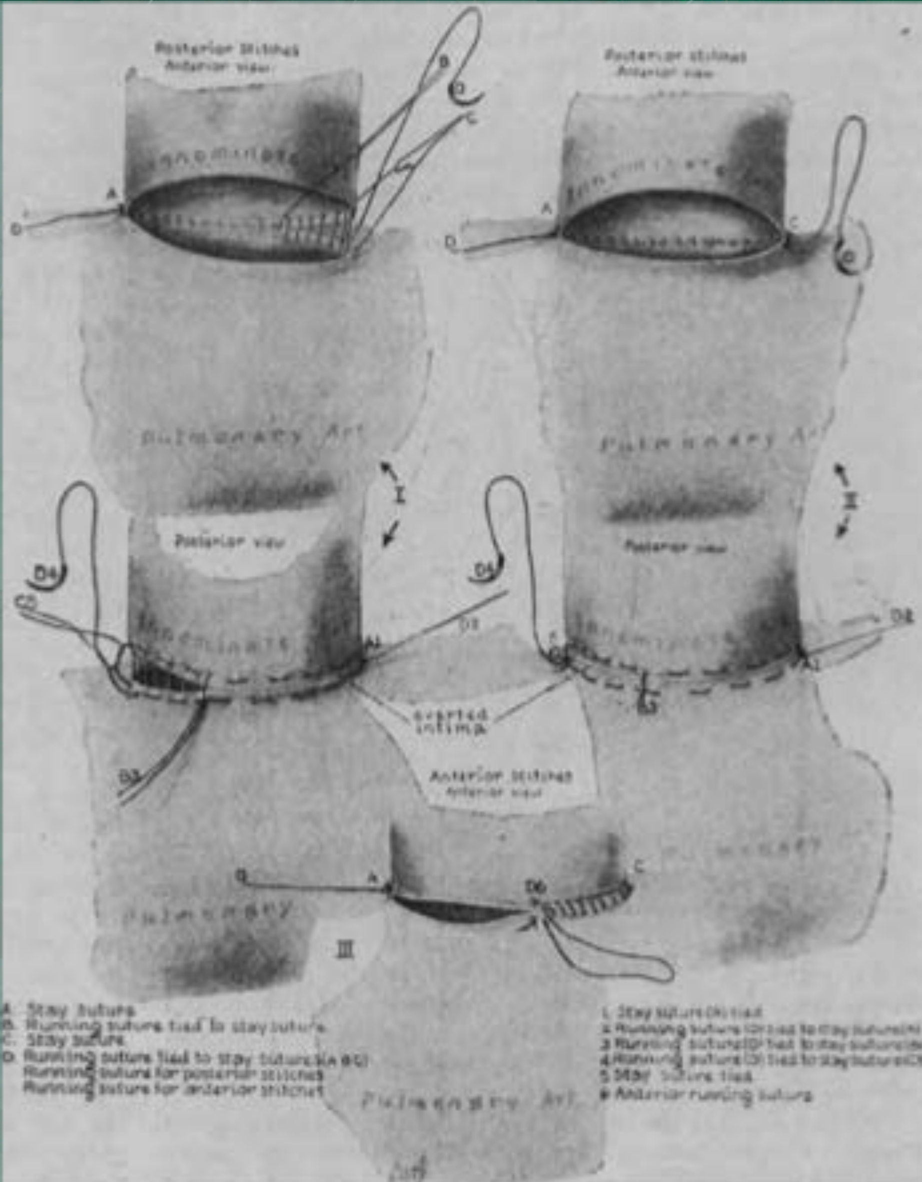

Fig. 2.—Details of the method by which the end of a systemic artery is anastomosed to the side of one of the pulmonary arteries.

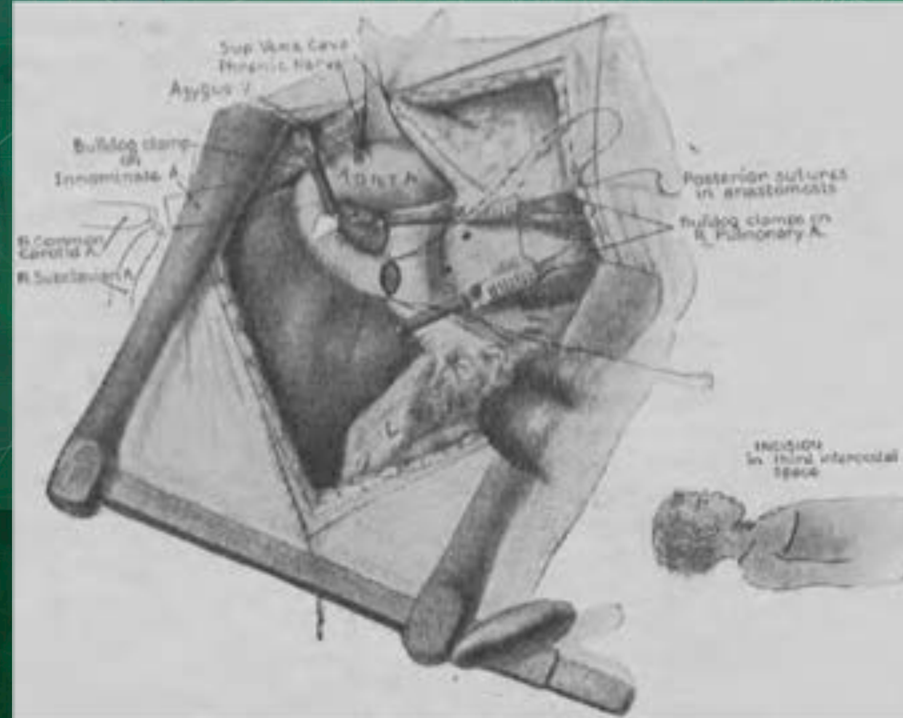

Fig. 1.—General exposure of the operative field on the right side. The end of the innominate artery is being anastomosed to the side of the right pulmonary artery. The posterior row of sutures is complete. The anterior row has not been inserted.

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20 years later …

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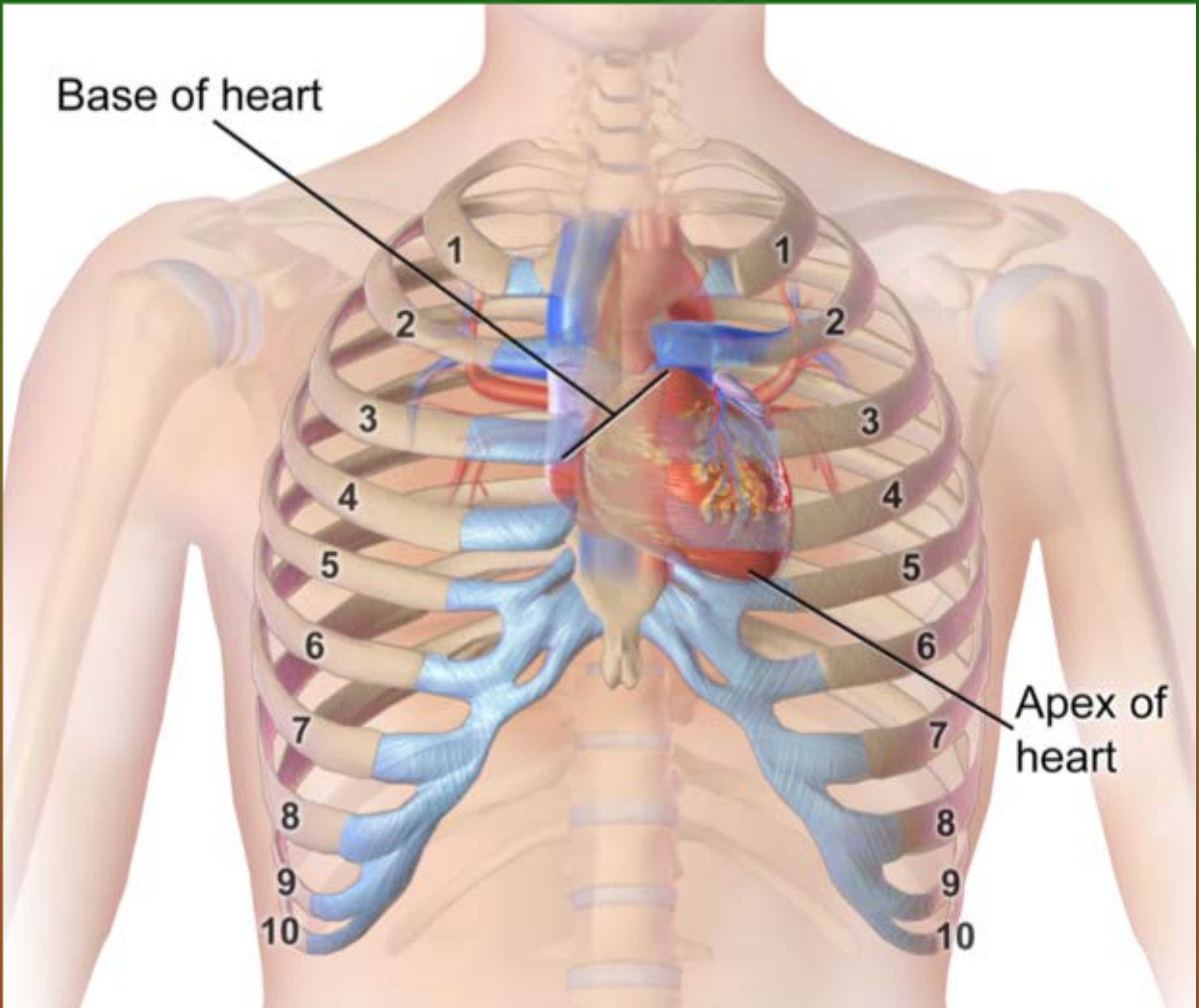
Base of heart
1
1
2
2
3
3
4
4
5
5
6
6
7
7
8
8
9
9
10
10
Apex of heart

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Michael DeBakey was born in 1908 in Lake Charles, Louisiana. DeBakey received his BS degree from Tulane University in New Orleans. In 1932, he received an M.D. degree from Tulane University School of Medicine. He remained in New Orleans to complete his internship and residency in surgery at Charity Hospital.

At age 23, while still in medical school at Tulane University, DeBakey developed the roller pump, the significance of which was not realized until 20 years later when it became an essential component of the heart–lung machine. The pump provided a continuous flow of blood during operations. This, in turn, made open-heart surgery possible. The roller pump had first been invented for blood transfusions by Eugene E. Allen from 1881 through 1890 and then forgotten.

Michael DeBakey

Tulane

School of Medicine

- continuous-flow roller pump for blood

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John Gibbon and pump oxygenator

- 1953. John Gibbon
  - the first successful cardiac surgery(ASD repair) using a pump-oxygenator

Jefferson Medical College
Philadelphia

- **1955. John Kirklin**
  - the second successful cardiac surgery(VSD repair) using a pump-oxygenator('Mayo-Gibbon bypass machine')

For a brief period of time (1955–1956), there were only 2 hospitals in the world where open heart surgery was being done on a daily basis: Lillehei at the University of Minnesota and, 60 miles away, John Kirklin at the Mayo Clinic. Surgeons came in droves from all over the world to see these 2 men at work.

In 1966, Dr Kirklin became surgeon-in-chief and chairman of the Department of Surgery at UAB.

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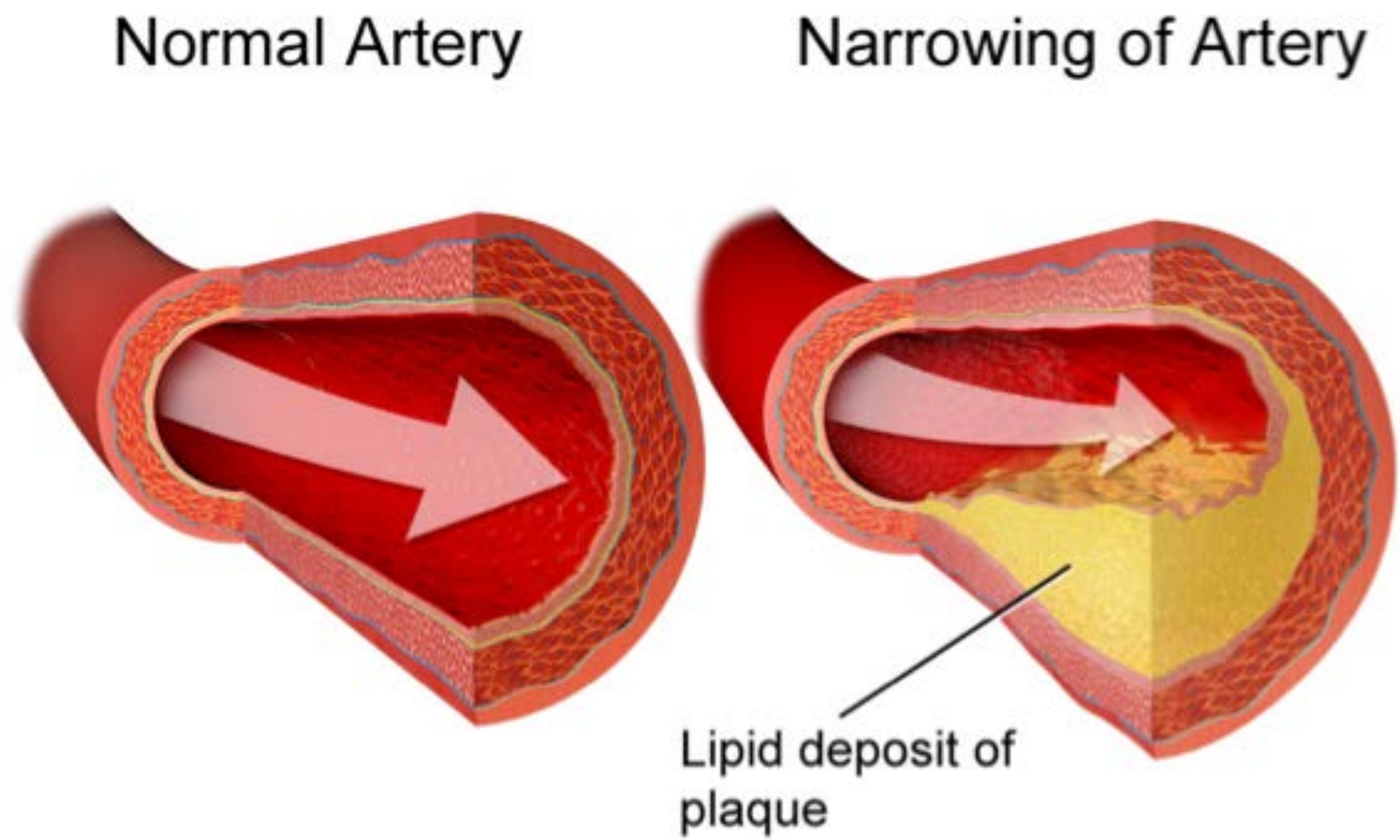

Coronary Artery Disease

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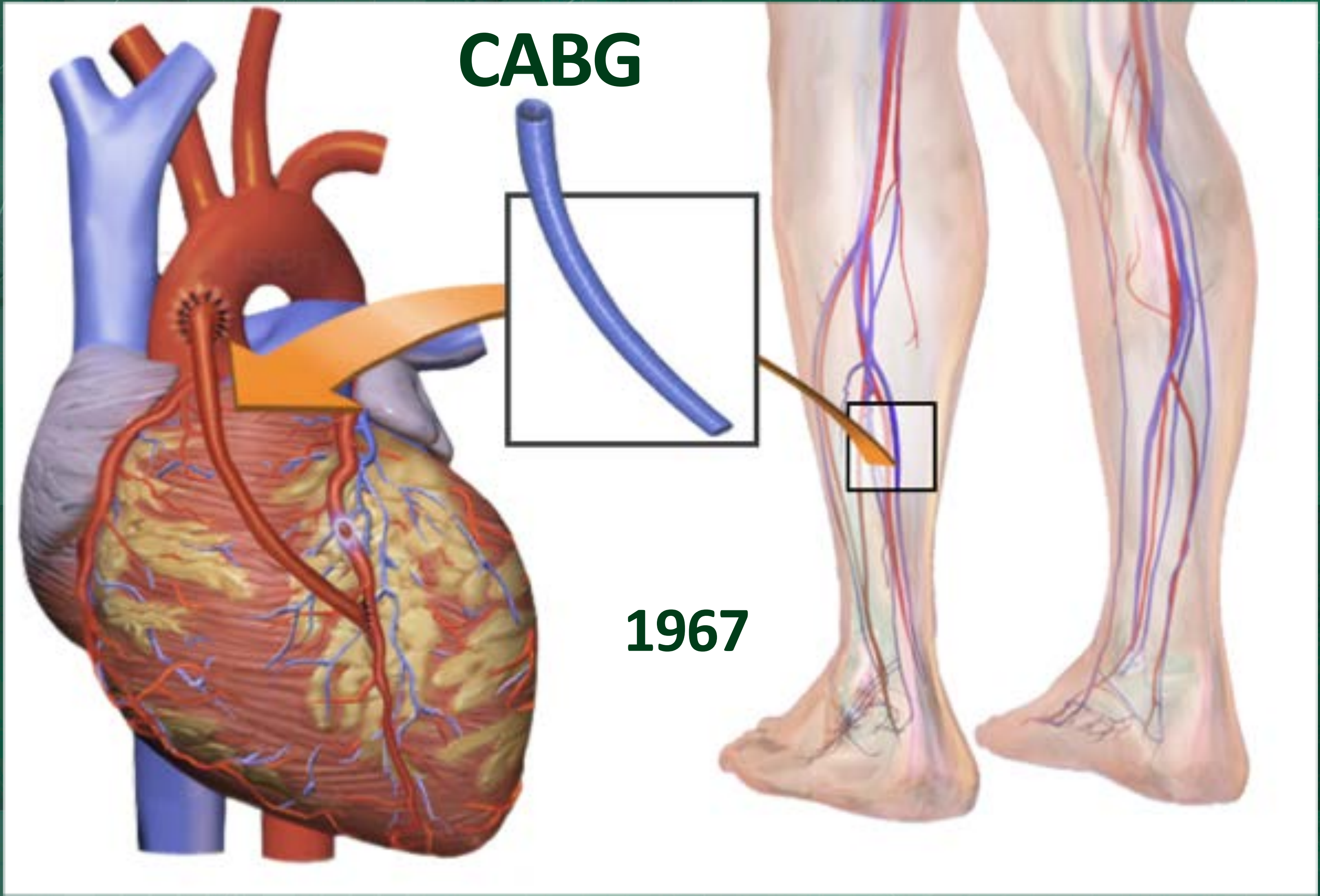
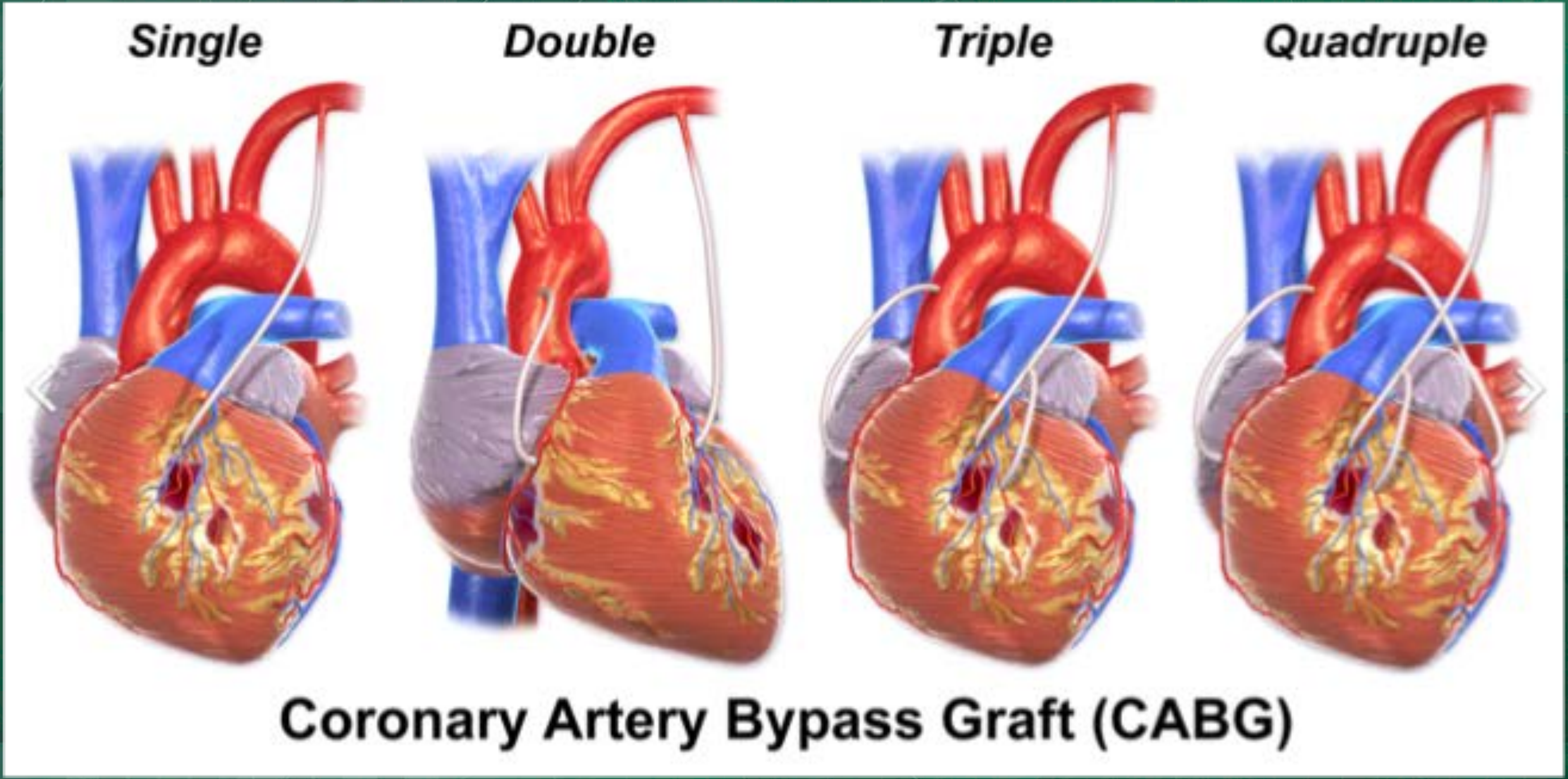
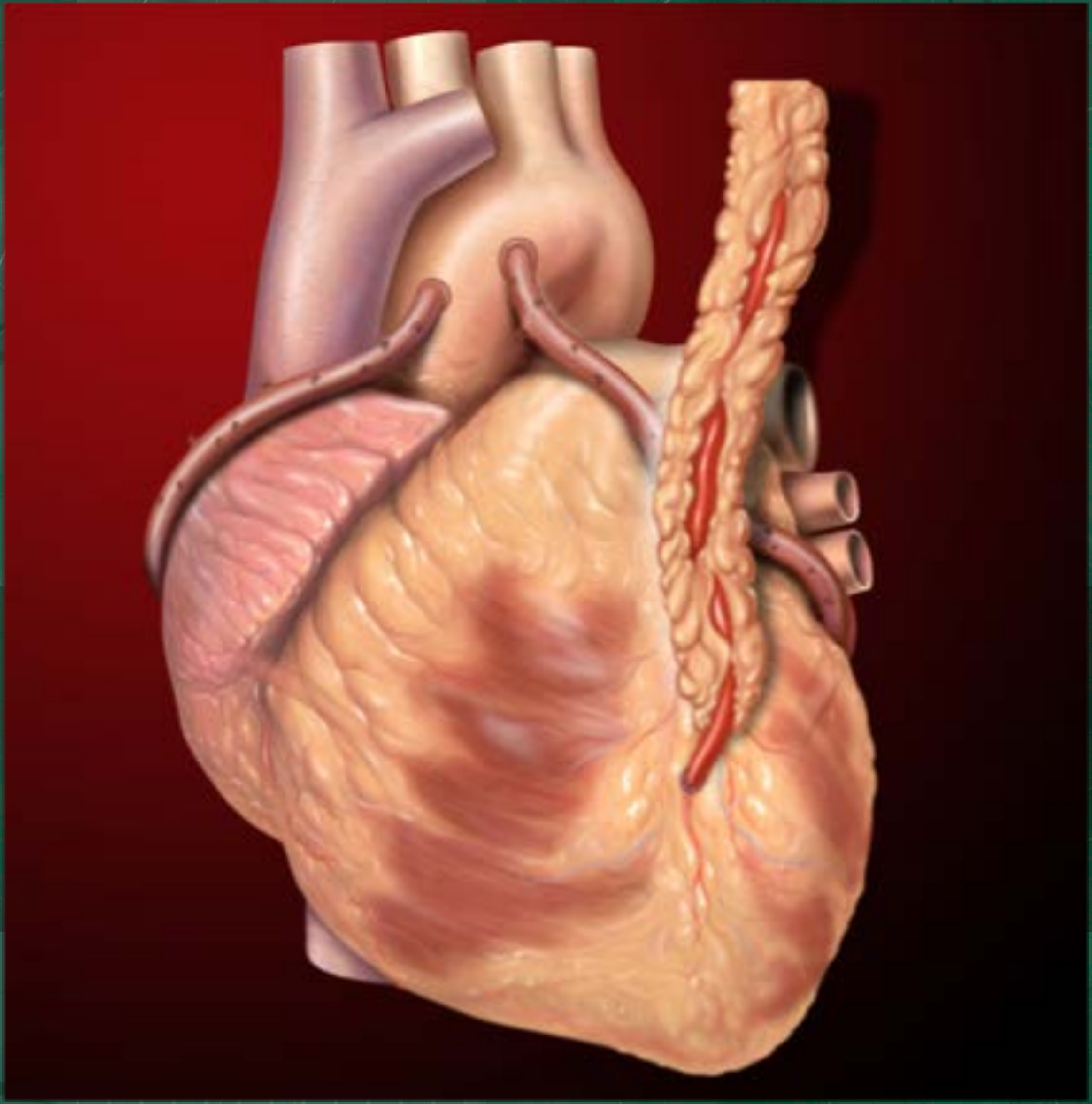
CABG



1967


Single
Double
Triple
Quadruple
Coronary Artery Bypass Graft (CABG)



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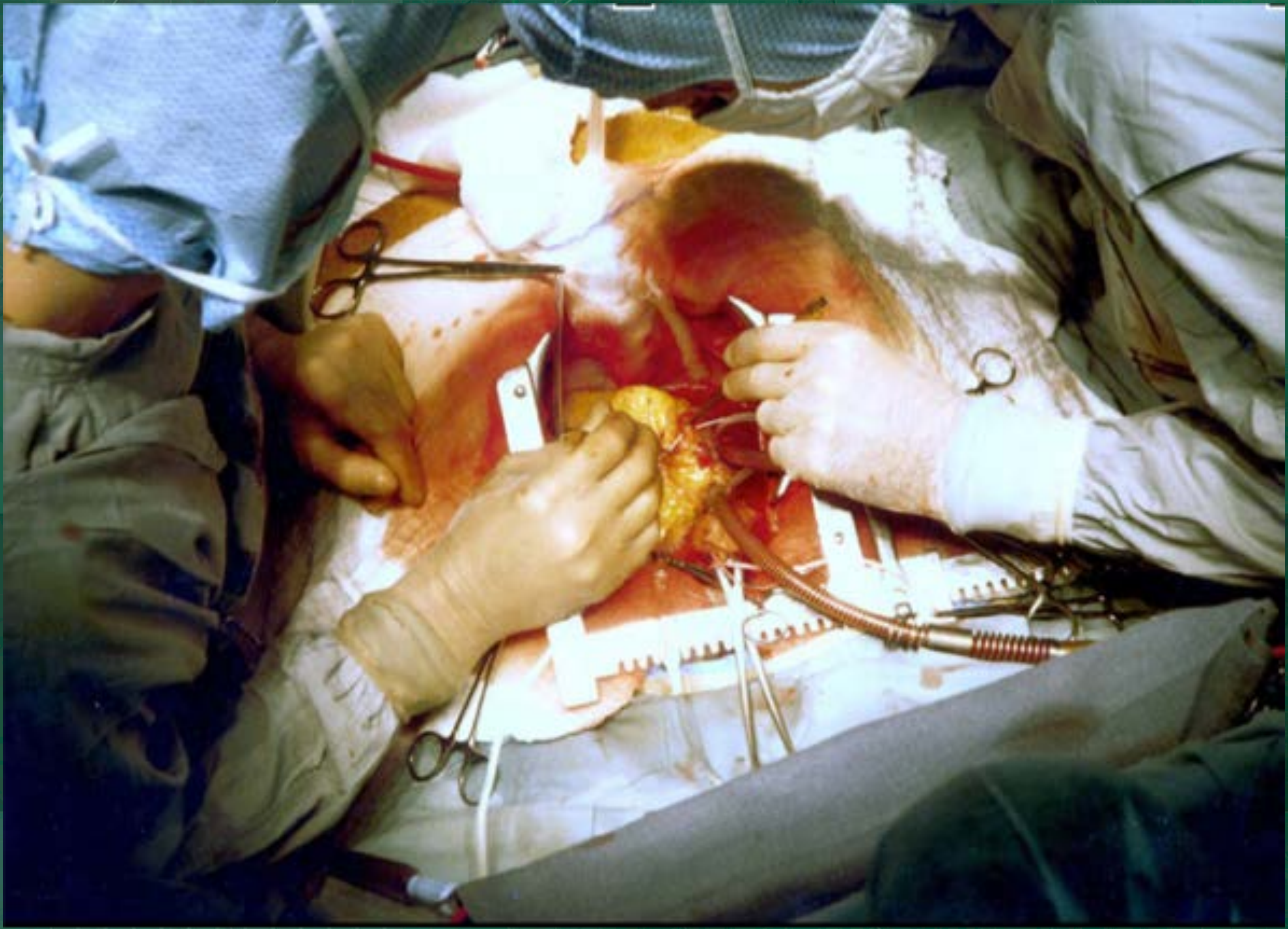

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10 years later …

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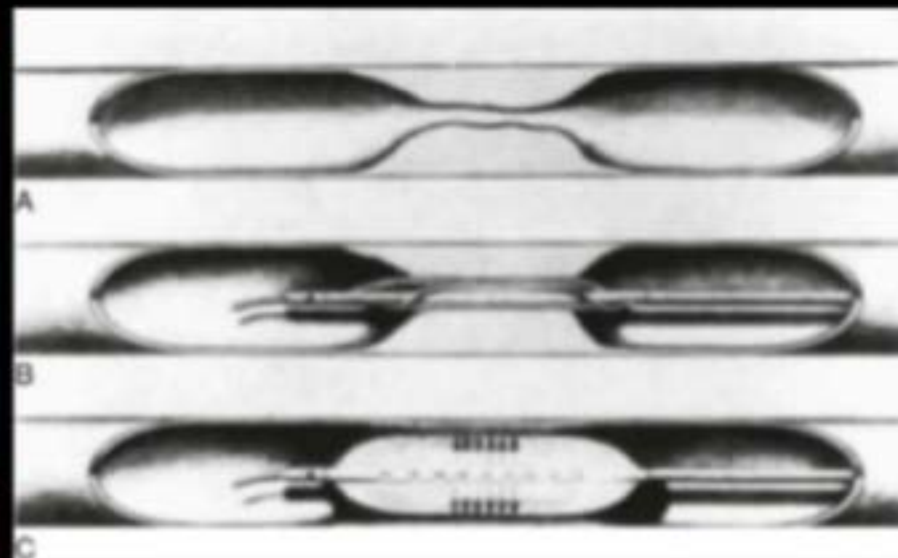

Andreas Gruentzig : German Cardiologist. Invented the Angioplasty Balloon in 1977

4. Charlie Dotter (left), Andreas Gruentzig (center), and Eberhardt Zeitler (right)

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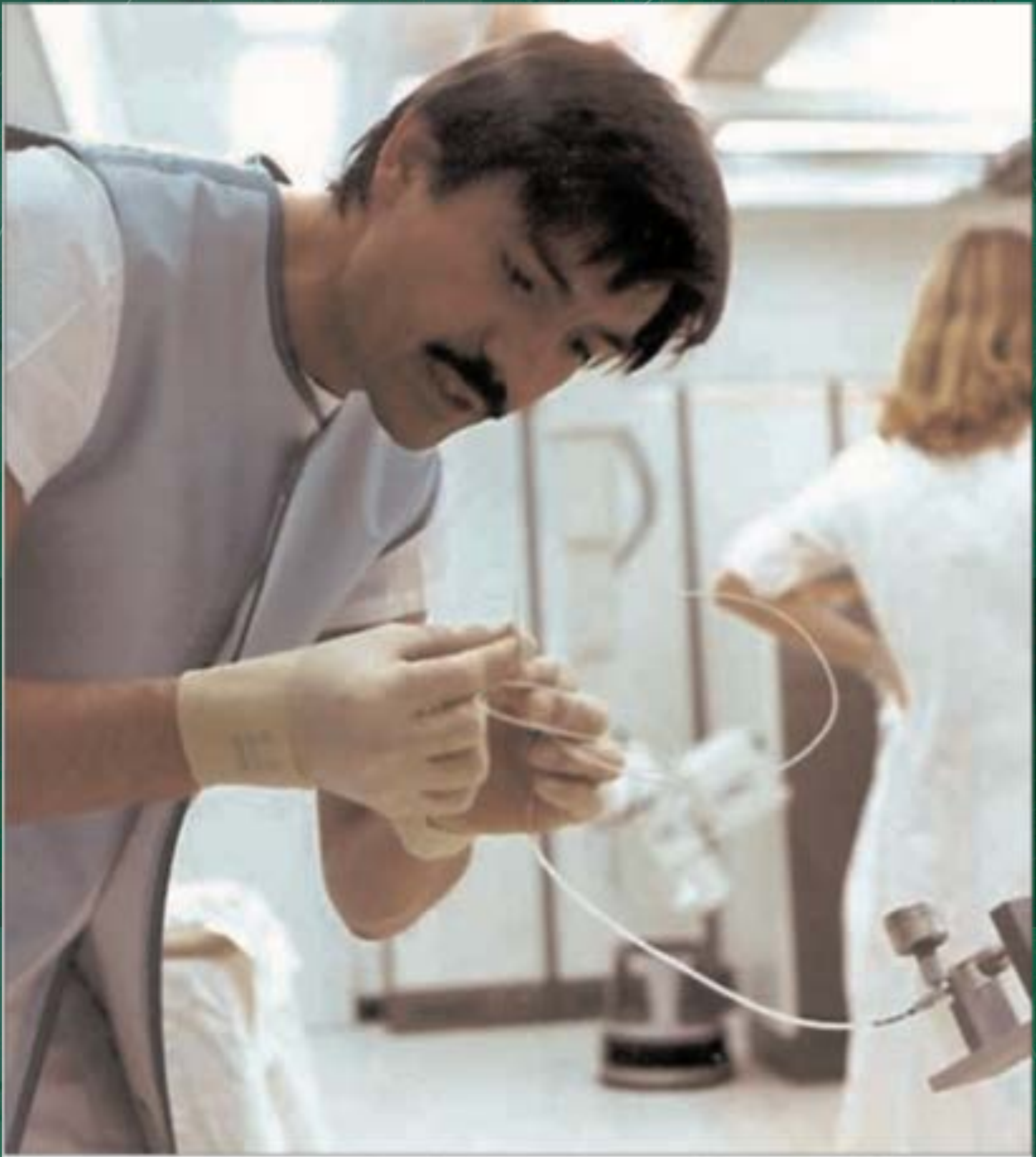

Figure 3. *Dr Grüntzig checking a catheter in his Zurich laboratory.*

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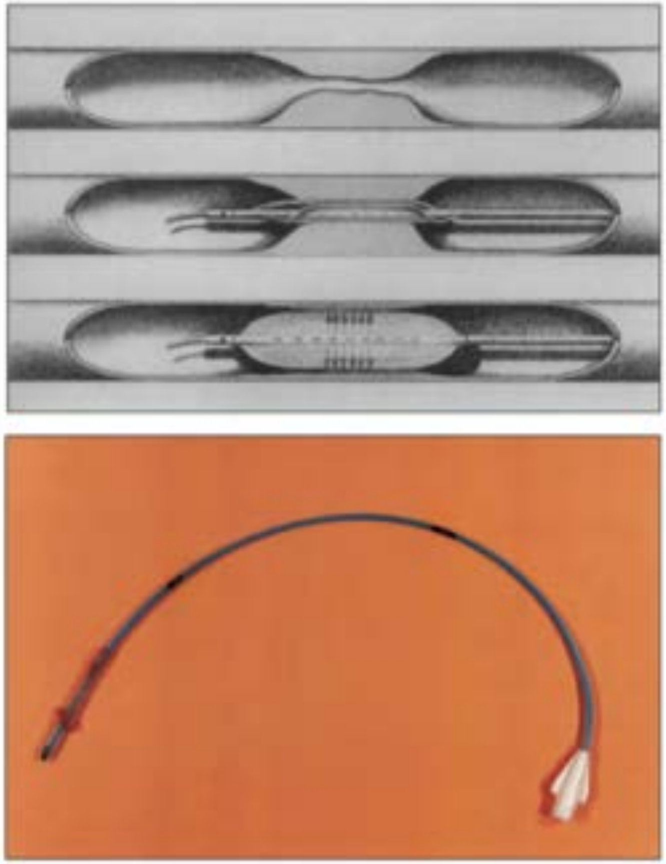

FIGURE 8 | Top: the Grüntzig balloon catheter principle. The double-lumen dilatation catheter (120) now contains a main lumen and an additional lumen. The main lumen allows insertion of the guide wire, pressure measurements, and injection of contrast dye. The balloon segment at the catheter tip can be positioned in the stenosed or occluded vascular segment and is filled with liquid via the additional lumen. By applying an equally distributed and constant pressure between 4 and 6 atmospheres, the atherosclerotic plaque occluding the artery is pressed against the vessel wall for 10–30 s. The maximum diameter of the inflated balloon is

FIGURE 9 | Top: Maria Schlumpf at the Grüntzig kitchen table sorting out materials used for building the hand-made balloon catheters. Catheters were built by both of them with the help of their spouses Michaela Grüntzig and Walter Schlumpf. Photograph ca. 1975. **Bottom:** Andreas Grüntzig and Pierre Levis in Atlanta, GA, USA, during the 1981 angioplasty course held at Emory University. Photographs reproduced with permission of Maria Schlumpf, Zürich.

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FIG. 1 Teaching, always teaching. Andreas Gruentzig, M.D. (right), Jay Hollman, M.D. (center), and Sally Deneen, R.T. (left).

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"Grand Rounds"

with Andreas R. Gruentzig, M.D.

10 years later …

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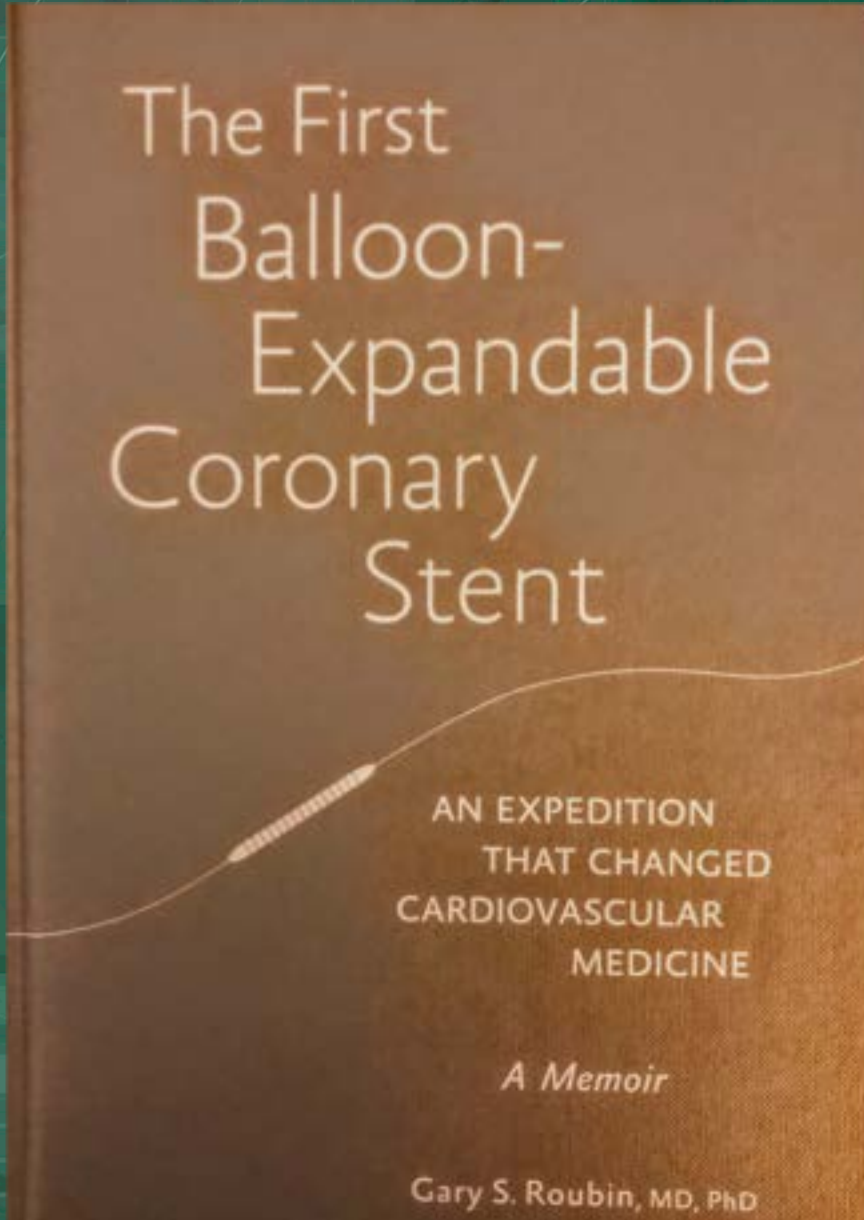

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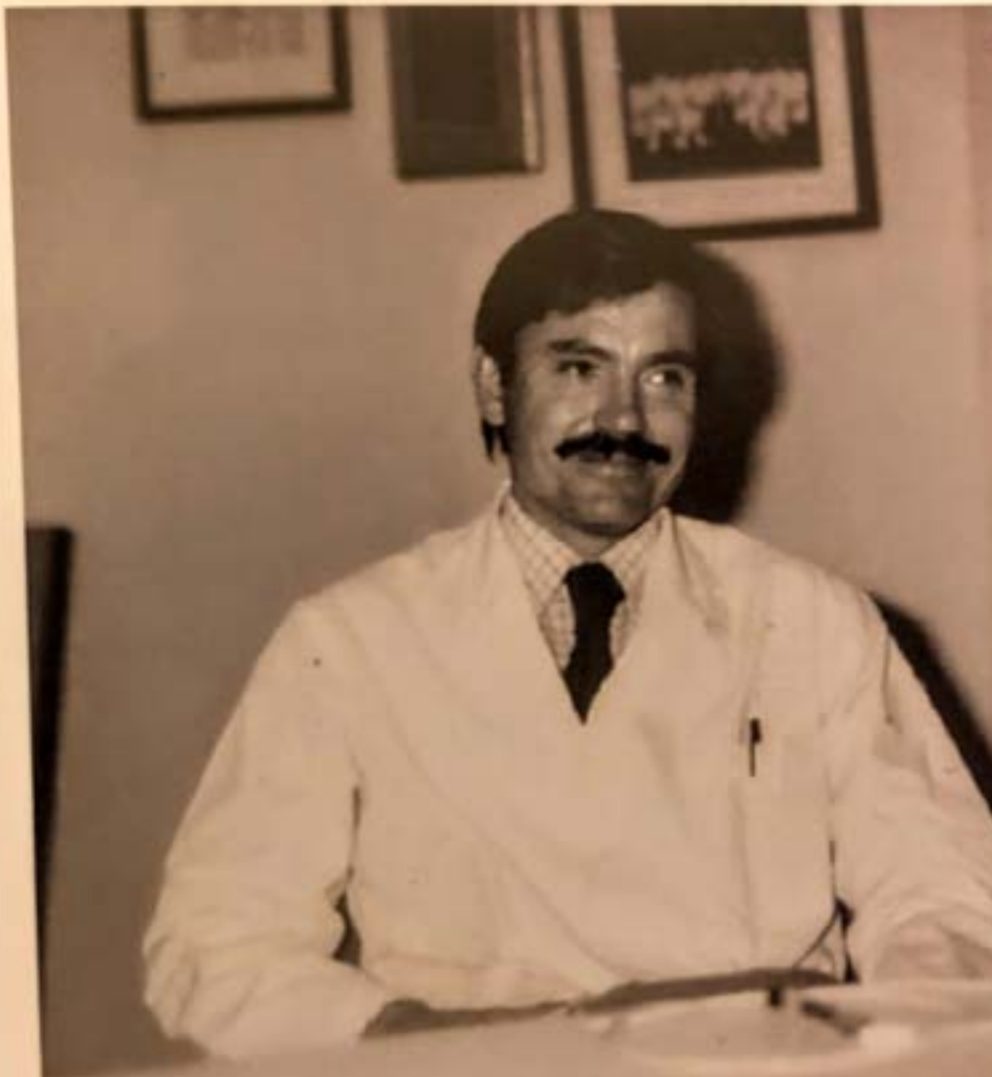
5(a). Andreas Roland Gruentzig in his office at Emory University Hospital in 1985. (Image: Gary Roubin personal archives)



5(b). Gary Roubin (left) working on the EAST study R01 grant submission with Andreas Gruentzig (right) at his Buckhead, Atlanta home in 1985. (Image: Gary Roubin personal archives)

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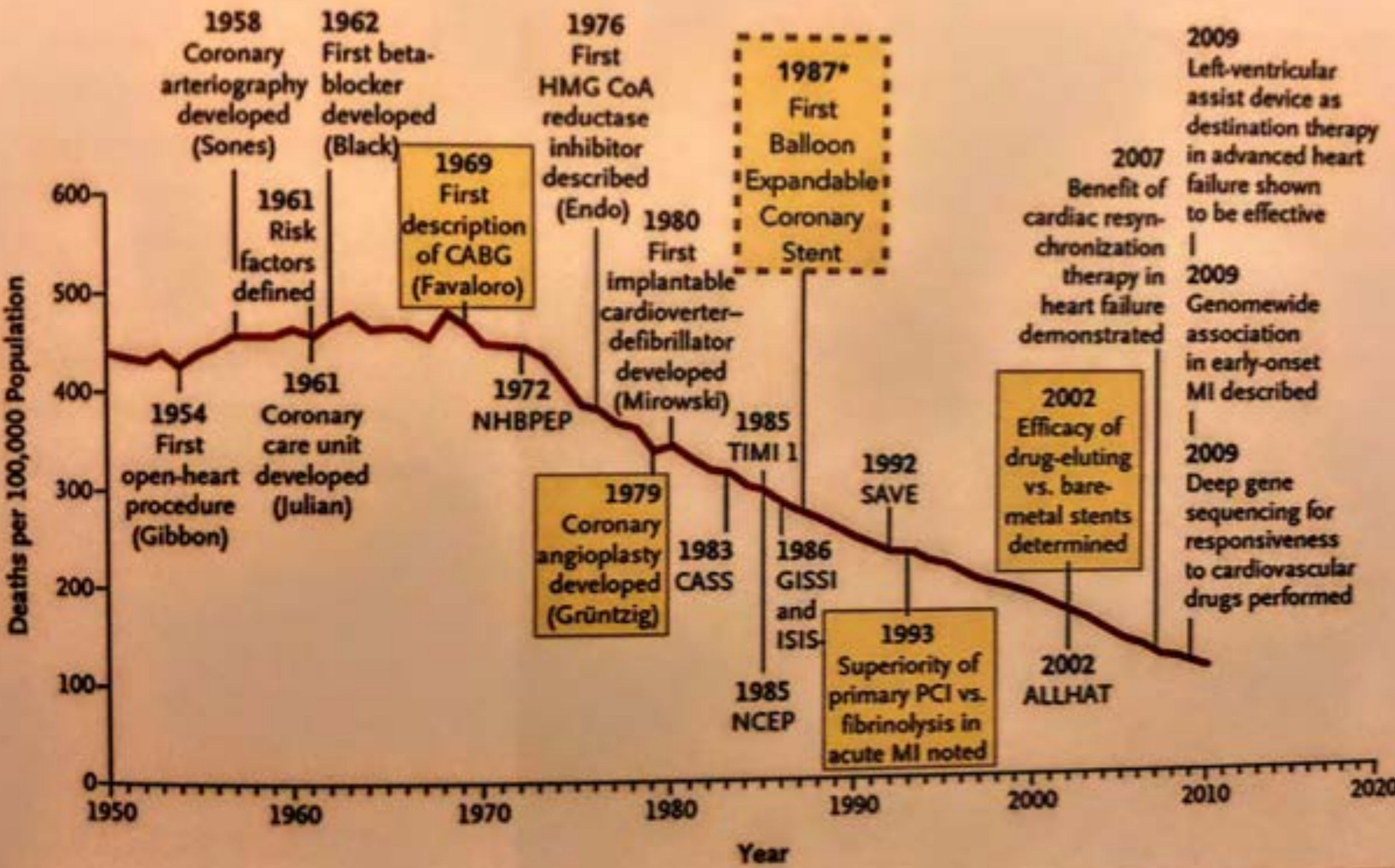

Decline in Deaths from Cardiovascular Disease in Relation to Scientific Advances.

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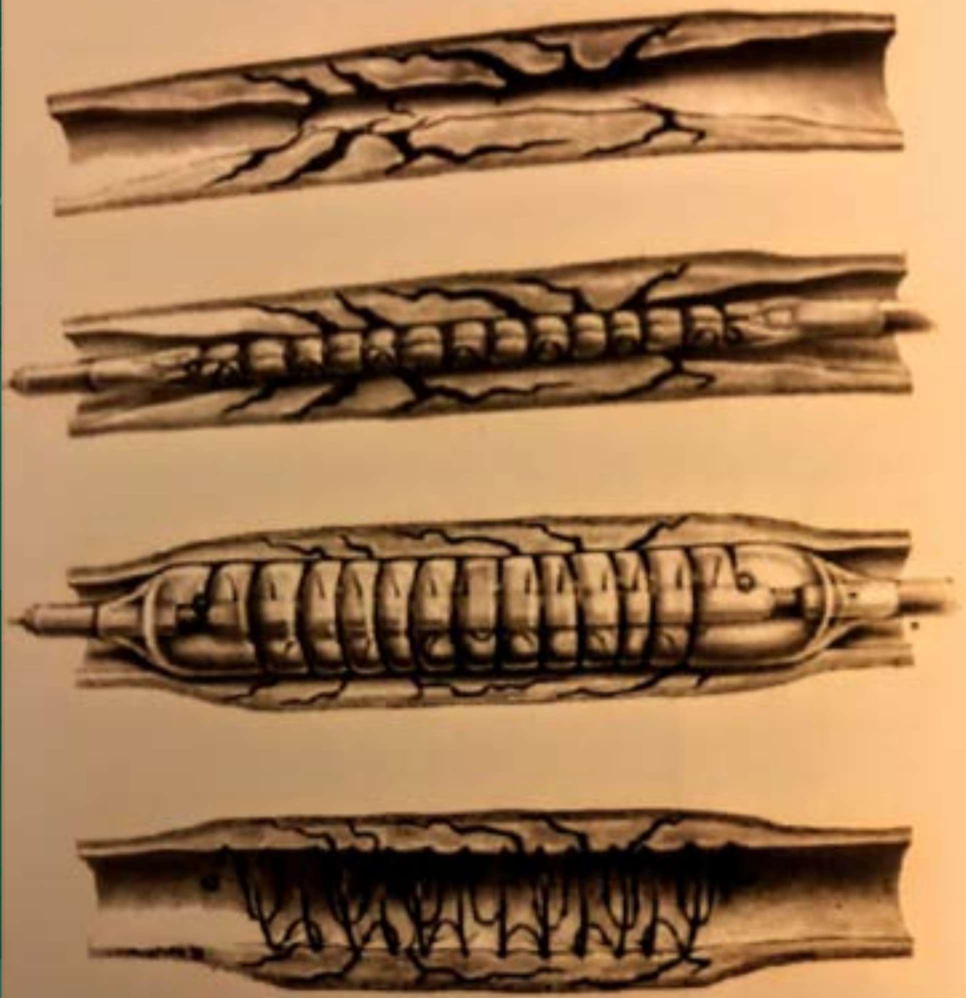
7(a). Cesare Gianturco: Master interventional radiologist and inventor of embolization coils, vena cava filters, self-expanding stents and co-inventor of the first balloon-expandable coronary stent in man. (Photograph courtesy Cook Medical)

7(b). Gianturco's dual-lumen PTA balloon. (Photograph courtesy Cook Medical)



10(a). Earliest graphic illustrations of stenting to solve vessel dissection and recoil after PTCA; this 'proof of principle' work was to underpin the success of coronary stenting for decades to come. (Original drawings from Roubin)

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Tangent:

Sandra Gianturco at UAB:

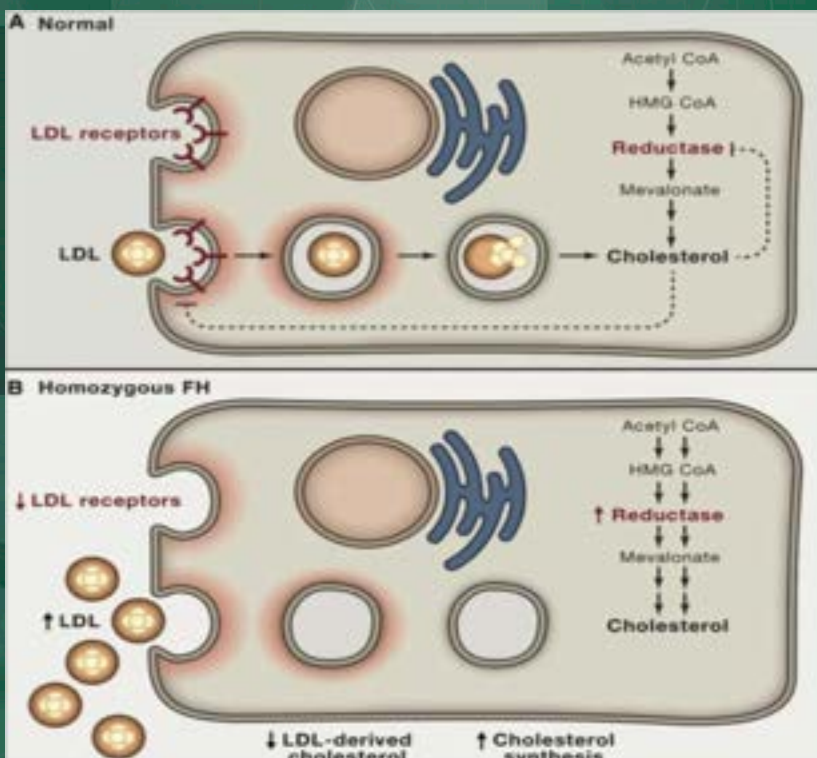
Clin. Cardiol. 22, (Suppl. II), II-7–II-14 (1999)

Pathophysiology of Triglyceride-Rich Lipoproteins in Atherothrombosis: Cellular Aspects

SANDRA H. GIANTURCO, PH.D. AND WILLIAM A. BRADLEY, PH.D.

Department of Medicine/Gerontology and Geriatrics, University of Alabama at Birmingham, Birmingham, Alabama, USA

Extensive research and publications at Baylor … and then at UAB



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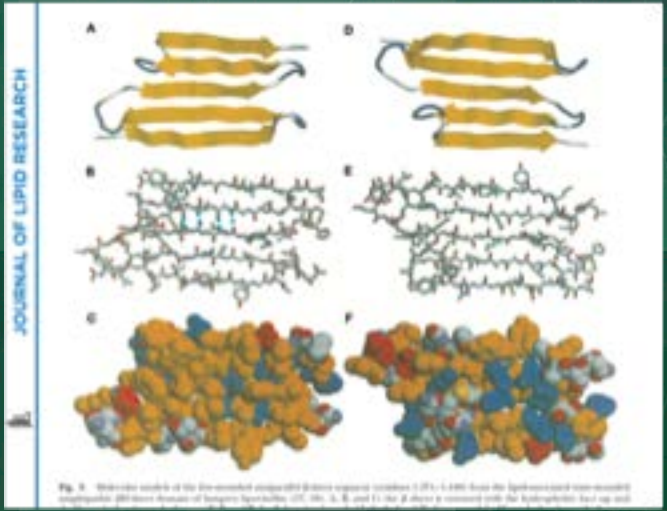
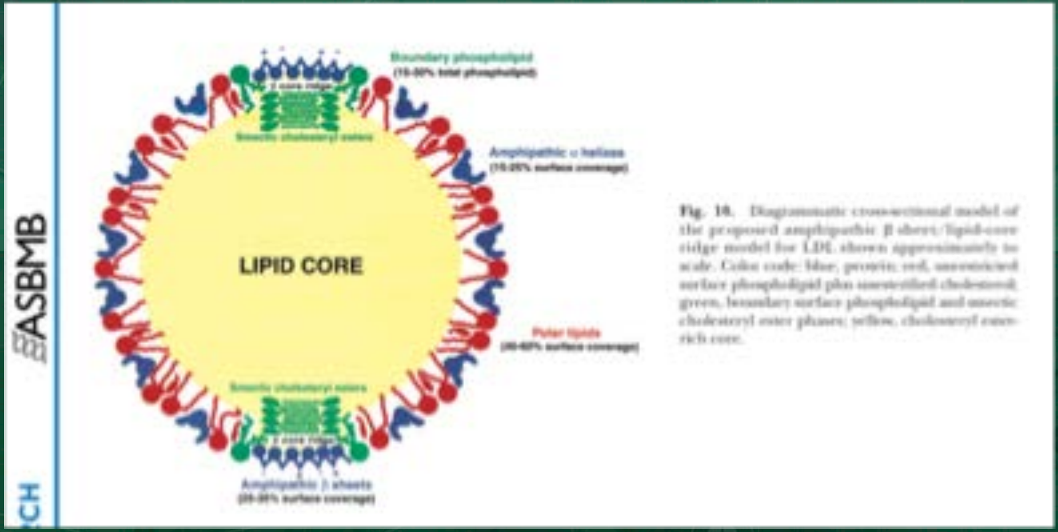
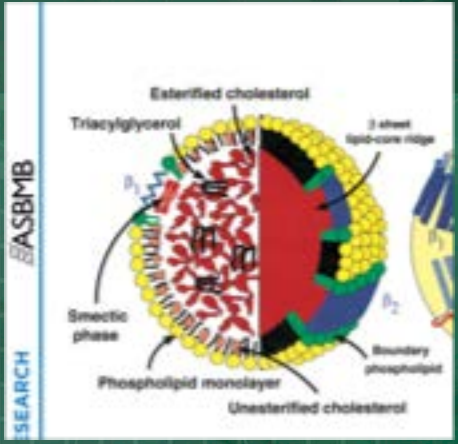
UAB Department of Medicine - Biochemistry and Molecular Genetics
Atherosclerosis Research Unit


review

Structure of apolipoprotein B-100 in low density lipoproteins







Journal of Lipid Research Volume 42, 2001

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Knowledge that will change your world

ROLE OF AMPHIPATHIC HELIXES IN HDL STRUCTURE/FUNCTION

G. M. Anantharamaiah, C. G. Brouillette, J. A. Engler, R. De Loof, Y. V. Venkatachalapathi, J. Boogaerts, and J. P. Segrest

Departments of Medicine, Biochemistry and the Atherosclerosis Unit, UAB Medical Center, Birmingham, Alabama 35294

ABSTRACT

In a recent analysis we classified amphipathic helix domains into a minimum of seven distinct classes. Four amphipathic helix classes are found in lipid-associating proteins: apolipoproteins, certain polypeptide hormones, polypeptide venoms and antibiotics, and certain complex transmembrane proteins. Three amphipathic helix classes are involved in both intra- and intermolecular protein-protein interactions: calmodulin-regulated protein kinases, coiled-coil containing proteins that include the so-called leucine zipper, and globular helical proteins.

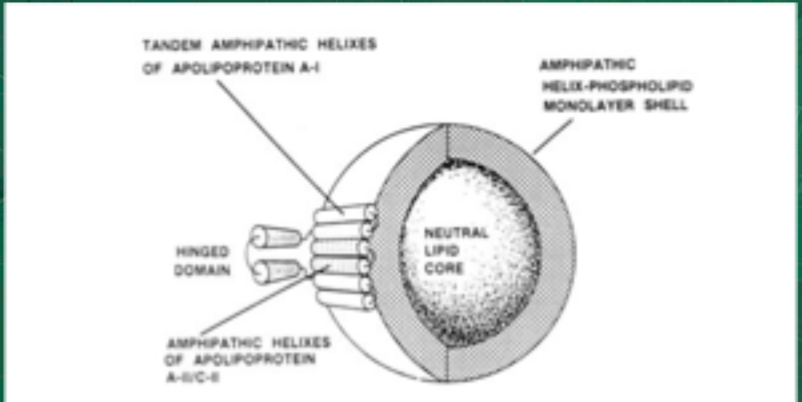


Fig. 10. Model of the "hinged-domain" hypothesis.

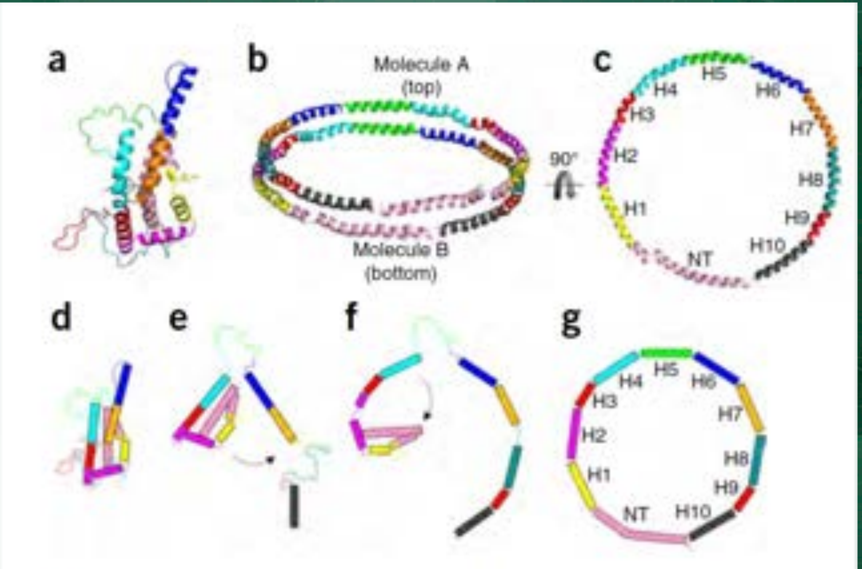
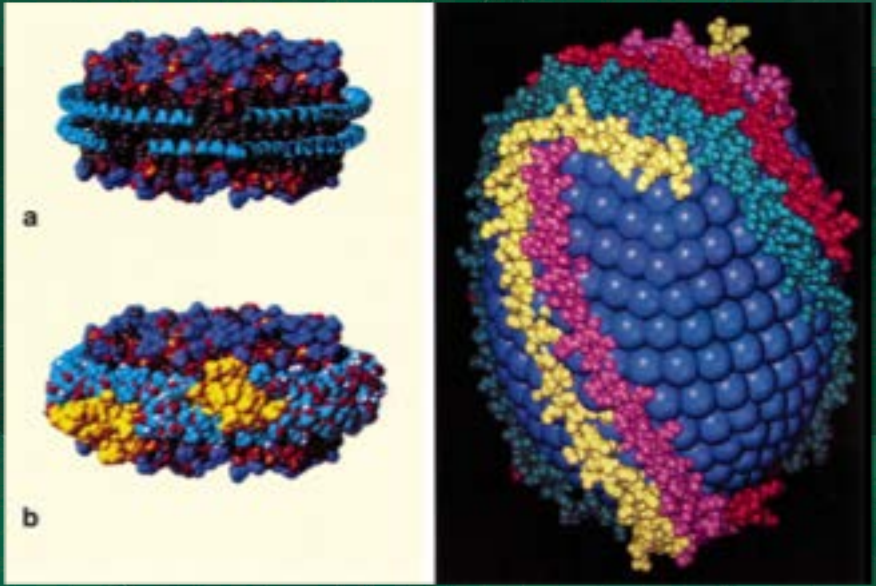


Figure 7 Hypothesis on lipid binding and the relationship to apoA-I arrangement on discoidal HDL. (**a**) The consensus model of full-length apoA-I. (**b**) Proposed arrangement of two molecules of apoA-I on discoidal HDL: the double-belt model. (**c**) Molecule B from the double-belt model



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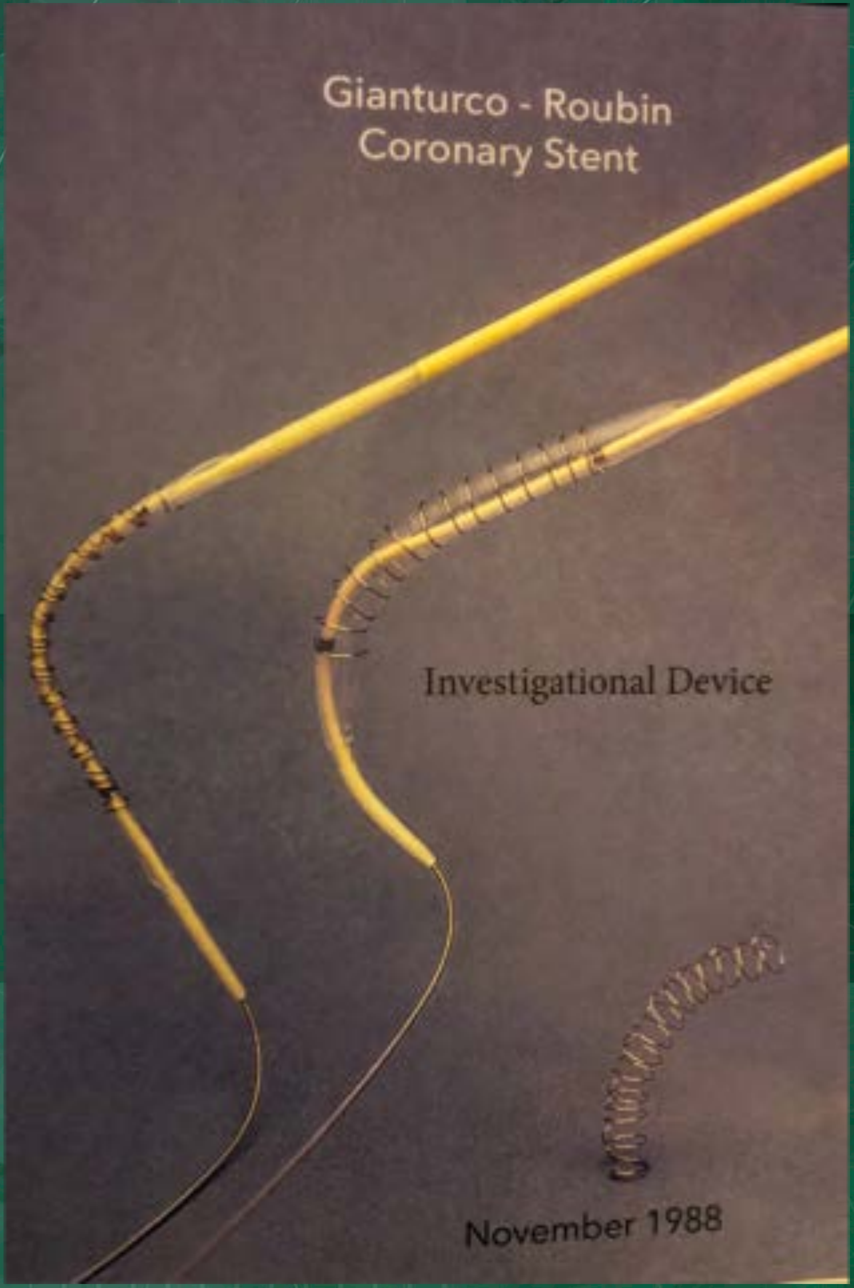

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Dr. Gary Roubin,
UAB cardiologist,
shows
Gianturco-Roubin
Flex stent
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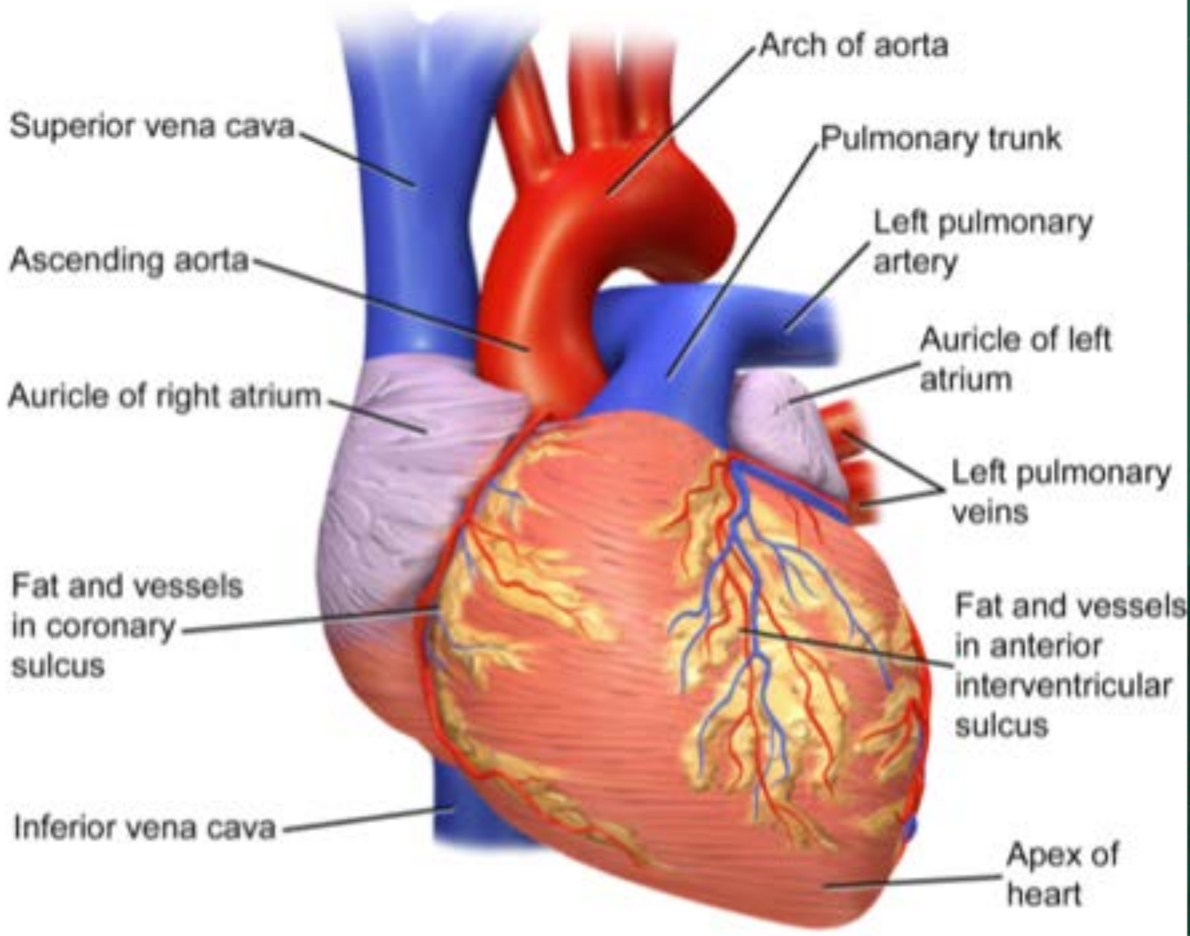
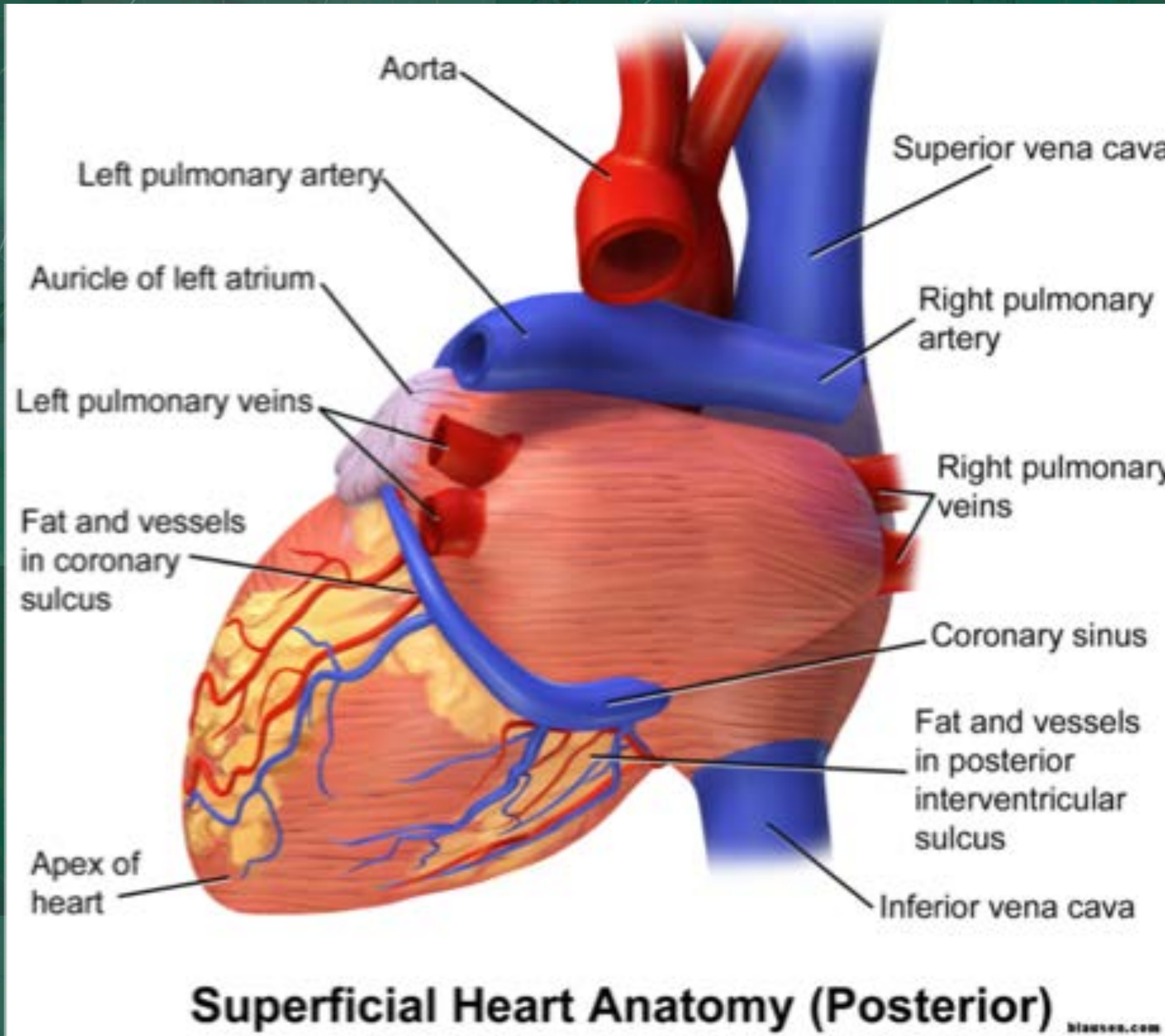


Superficial Heart Anatomy (Anterior)



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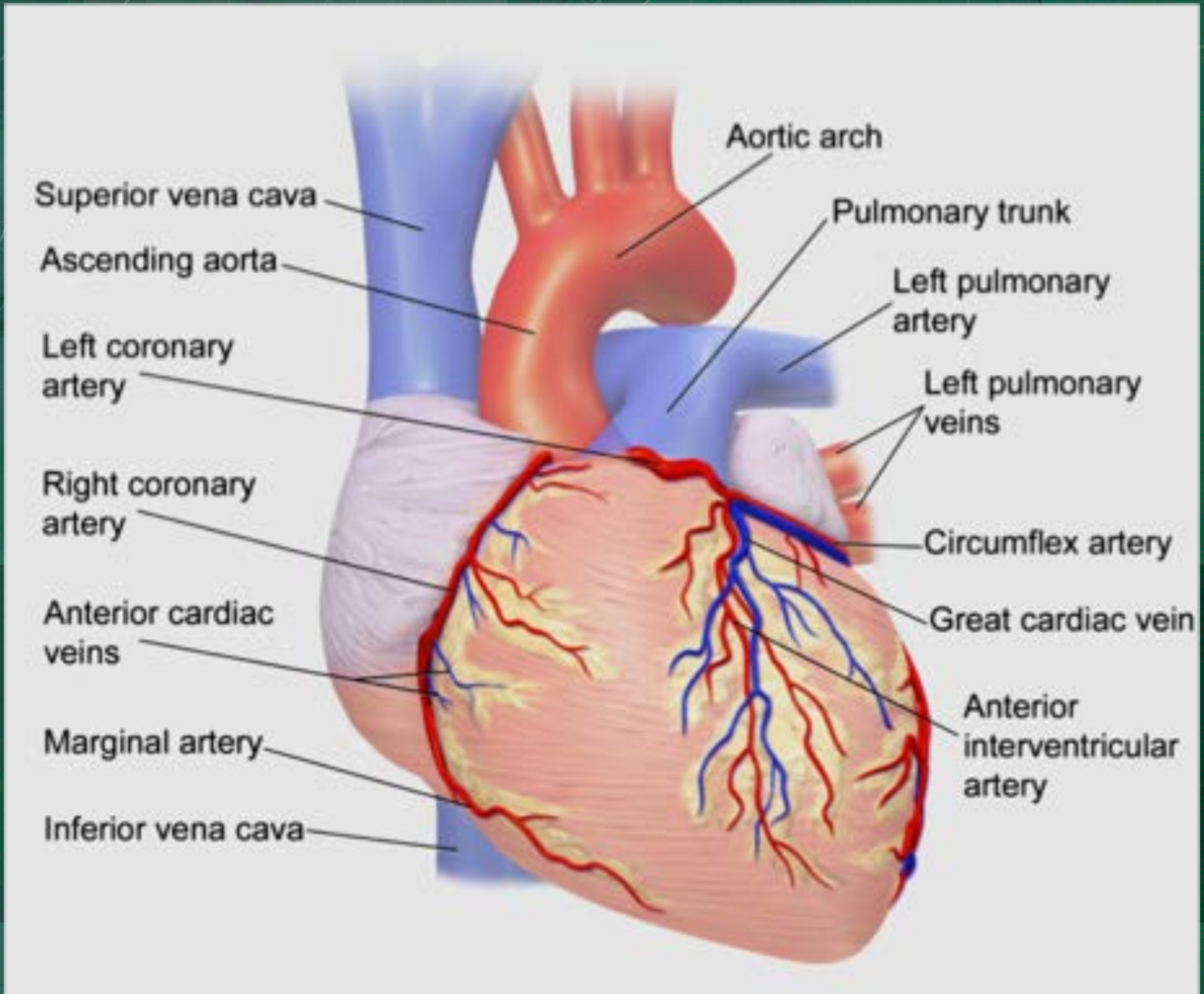
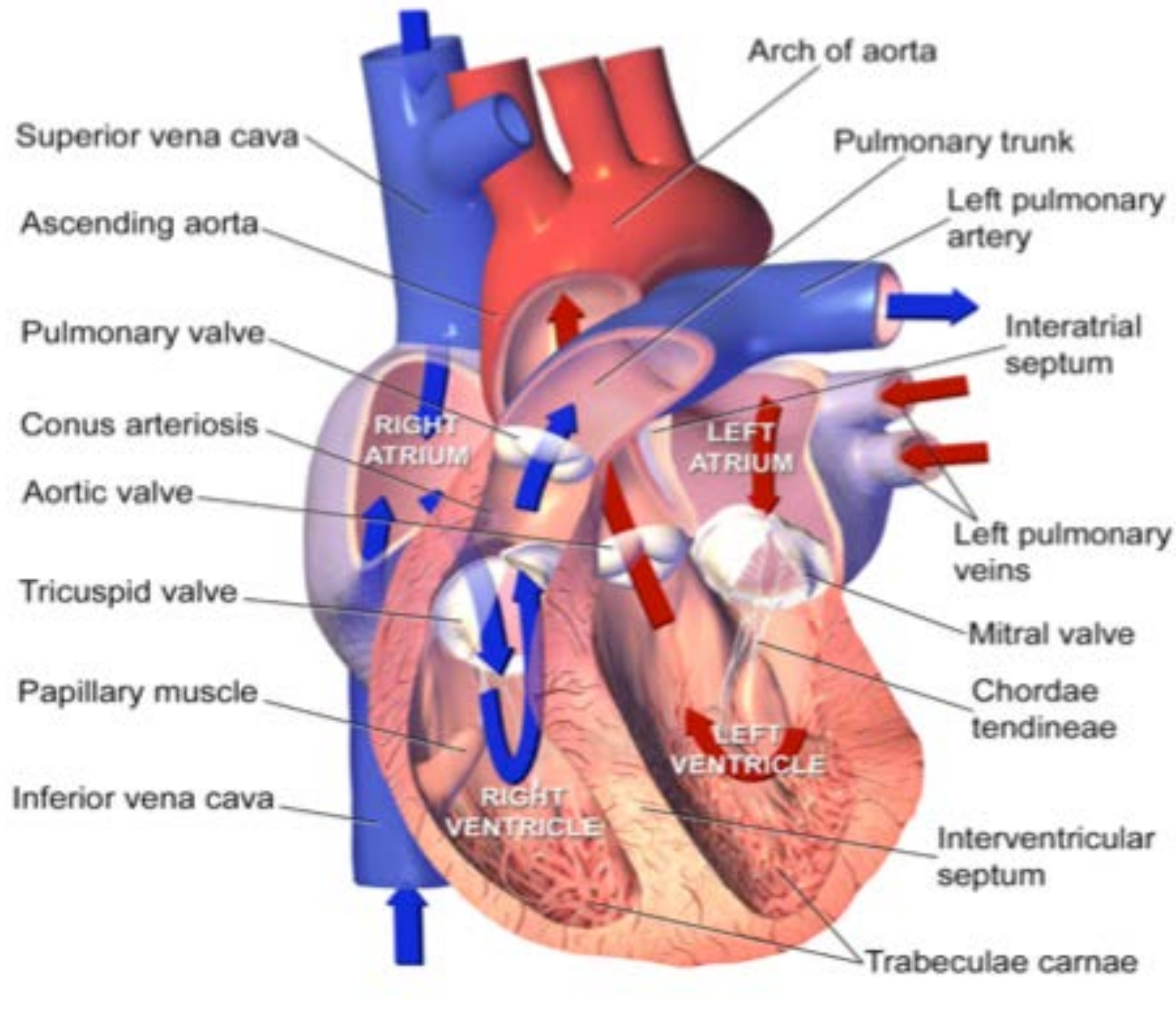


Coronary Circulation (Anterior)



Sectional Anatomy of the Heart

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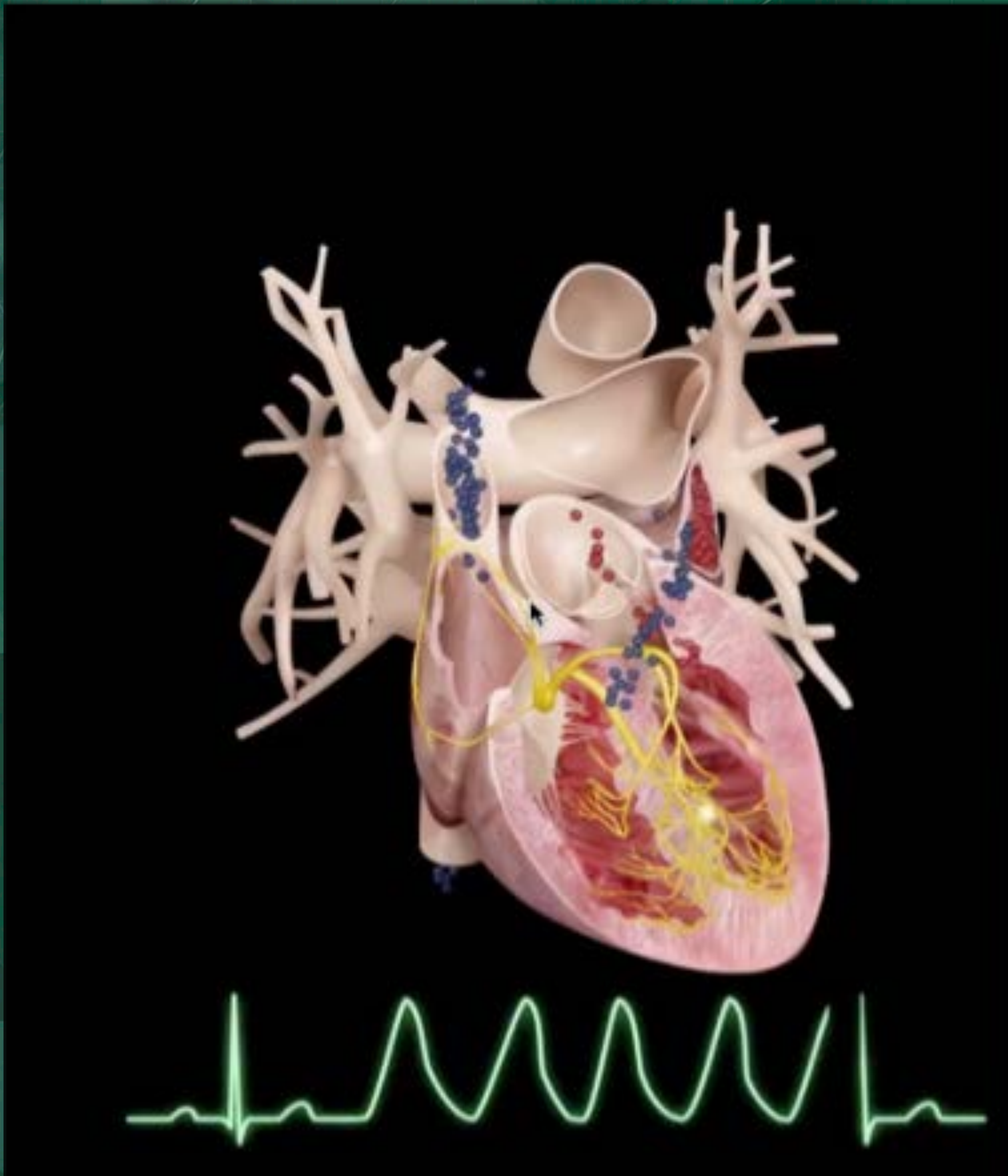

NSR -> VT

3D4Medical
Heart Pro III

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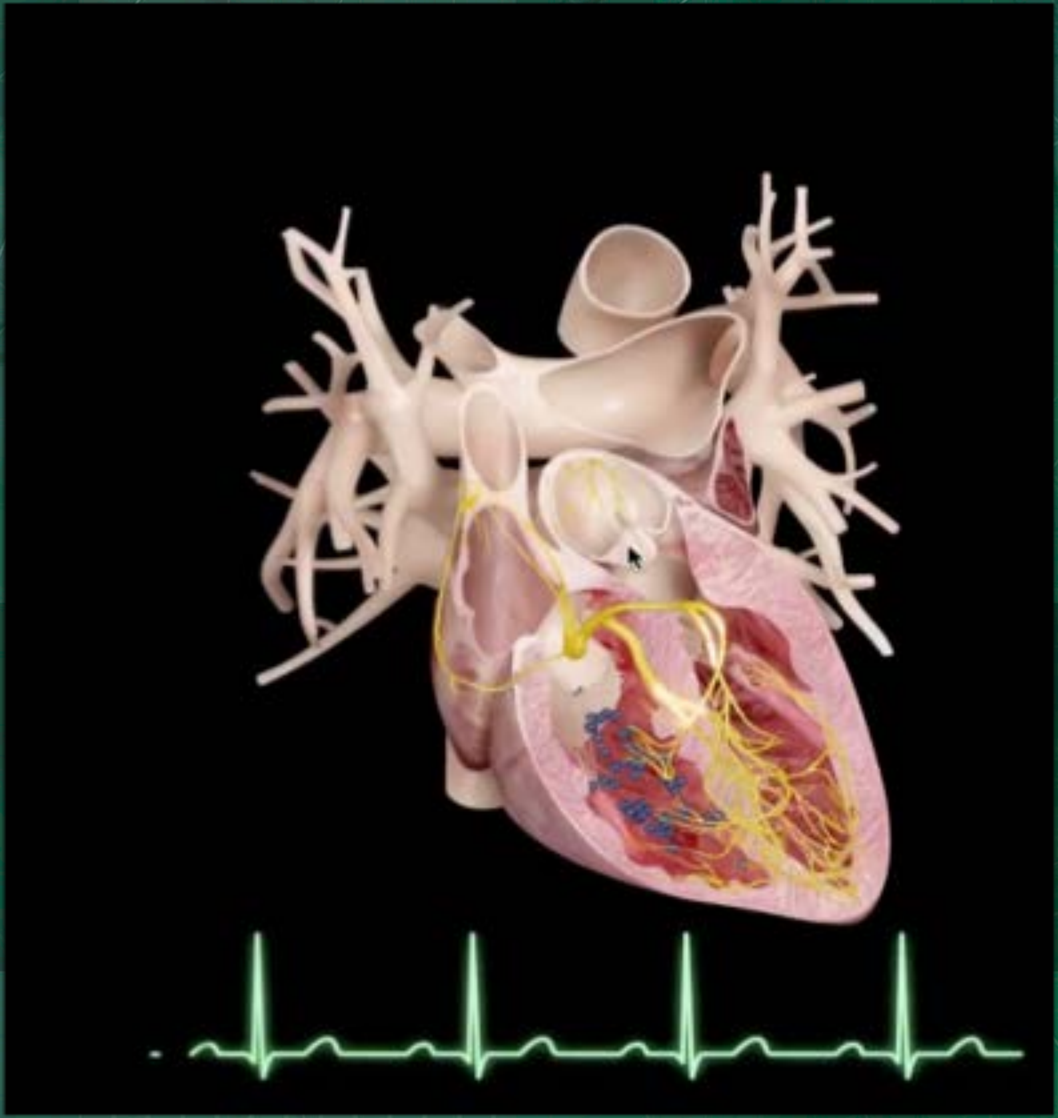

NSR -> VF

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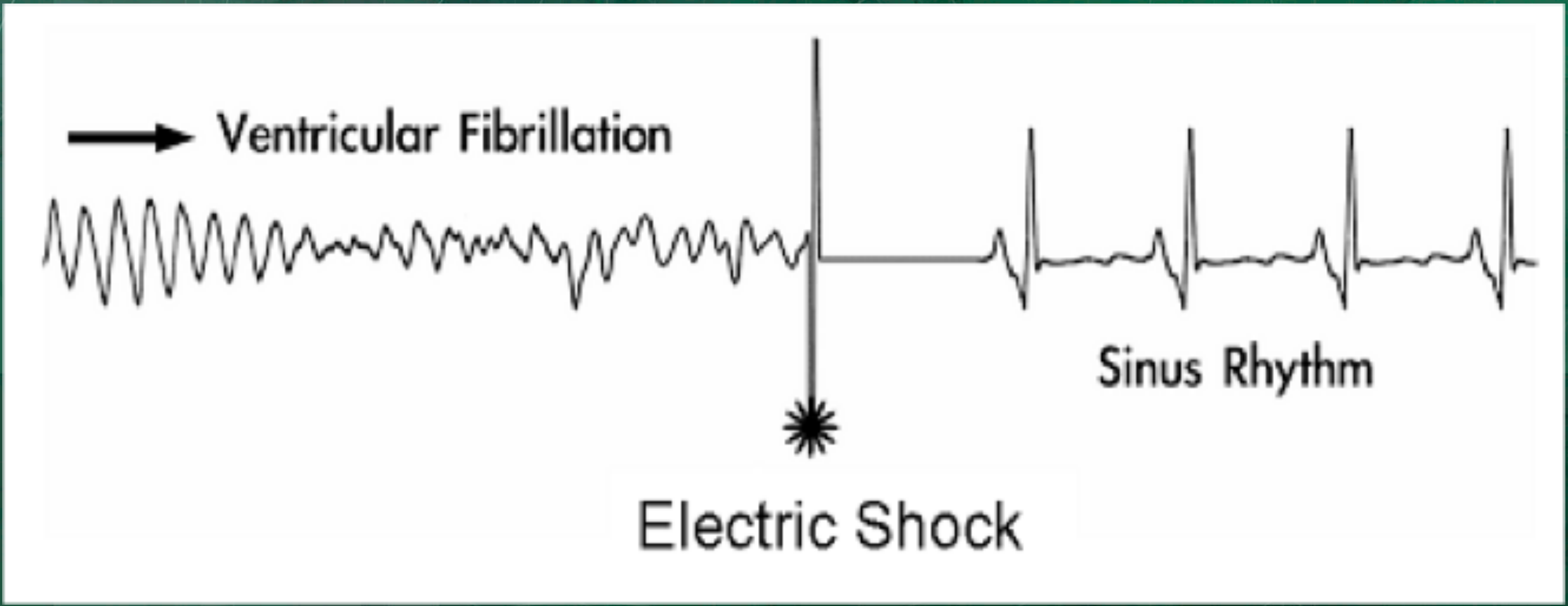

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Levi Watkins, Jr., son of legendary **Alabama State University** president Levi Watkins, was the first African-American to graduate from ***Vanderbilt University School of Medicine*** **-** in **1971** - and, in 1980, the first cardiac surgeon in the nation to perform a human implantation of the automatic implantable defibrillator.

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The NEW ENGLAND JOURNAL of MEDICINE

MEDICAL INTELLIGENCE ARCHIVE

Termination of Malignant Ventricular Arrhythmias with an Implanted Automatic Defibrillator in Human Beings

M. Mirowski, M.D., Philip R. Reid, M.D., Morton M. Mower, M.D., Levi Watkins, M.D., Vincent L. Gott, M.D., James F. Schauble, M.D., Alois Langer, Ph.D., M. S. Heilman, M.D., Steve A. Kolenik, M.S., Robert E. Fischell, M.S., and Myron L. Weisfeldt, M.D.

N Engl J Med 1980; 303:322-324 August 7, 1980

Article

The development of a clinically applicable, automatic, implantable defibrillator has been described previously.1 This electronic device is designed to monitor cardiac electrical activity, to recognize ventricular fibrillation and ventricular tachyarrhythmias with a sinusoidal wave form, and then to deliver corrective defibrillatory discharges. It is intended to protect patients at particularly high risk of sudden death whenever and wherever they are stricken by these lethal arrhythmias.

After extensive preclinical testing, 2 a pilot study of this new technique was recently initiated at The Johns Hopkins Hospital. This article decribes the first three patients in whom the automatic defibrillator was implanted to manage recurrent ventricular tachyarrhythmias that were refractory to medical therapy. Our results suggest that the device can successfully identify and reverse these malignant arrhythmias in human beings.

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These pigs have been genetically engineered to inactivate virus genes inside their DNA, a major barrier to pig-to-human transplants.

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SCIENCE

Genetically Engineering Pigs to Grow Organs for People

Scientists announce the birth of 37 pigs gene-edited to be better for human transplant.

SARAH ZHANG AUG 10, 2017

These pigs have been genetically engineered to inactivate virus genes inside their DNA, a major barrier to pig-to-human transplants. (COURTESY OF EGENESIS)

"It's great genetic-engineering work. It's an accomplishment to inactivate that many genes," says **Joseph Tector**, a xenotransplant researcher at the **University of Alabama at Birmingham.** Researchers like Tector, who is also a transplant surgeon, have been chipping away at the problem of immune incompatibility for years, though. CRISPR has sped up that research, too. The first pig gene implicated in the human immune response as one involved in making a molecule called alpha-gal. Making a pig that lacked alpha-gal via older genetic-engineering methods took three years. "Now from concept to pig on the ground, it's probably six months," says Tector.

Tector and **David Cooper**, another transplant pioneer, were both recently recruited to **UAB** for a xenotransplant program funded by United Therapeutics, a Maryland biotech company that wants to *manufacture transplantable organs*.

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Journal of Immunology Research
Volume 2017, Article ID 2534653, 11 pages
https://doi.org/10.1155/2017/2534653

Review Article

Porcine to Human Heart Transplantation: Is Clinical Application Now Appropriate?

Christopher G. A. McGregor[1,2] and Guerard W. Byrne[1,2]

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[2]*Department of Surgery, Mayo Clinic, Rochester, MN, USA*

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Academic Editor: Laura Iop

Cardiac xenotransplantation (CXTx) is a promising solution to the chronic shortage of donor hearts. Recent advancements in immune suppression have greatly improved the survival of heterotopic CXTx, now extended beyond 2 years, and life-supporting kidney XTx. Advances in donor genetic modification (B4GALNT2 and CMAH mutations) with proven Gal-deficient donors expressing human complement regulatory protein(s) have also accelerated, reducing donor pig organ antigenicity. These advances can now be combined and tested in life-supporting orthotopic preclinical studies in nonhuman primates and immunologically appropriate models confirming their efficacy and safety for a clinical CXTx program. Preclinical studies should also allow for organ rejection to develop xenospecific assays and therapies to reverse rejection. The complexity of future clinical CXTx presents a substantial and unique set of regulatory challenges which must be addressed to avoid delay; however, dependent on these prospective life-supporting preclinical studies in NHPs, it appears that the scientific path forward is well defined and the era of clinical CXTx is approaching.

… both now at UAB

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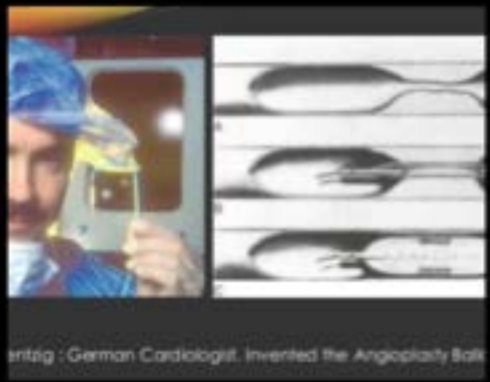

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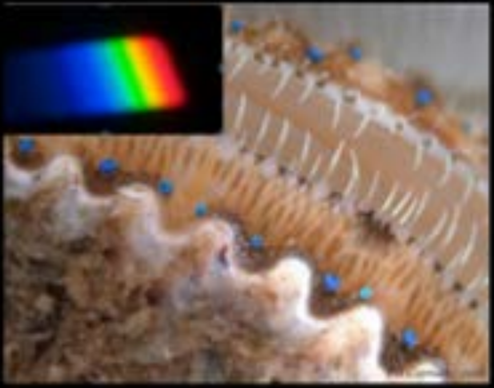

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with just a little knowing,

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