

*From Superstition to Science
From Myth & Magic
To Experimental Design*

.

Throughout human history, the heart has figured enormously—if metaphorically—in nearly every aspect of civilization.

The human heart--the most diverse, most changeable, most versatile part of creation.

Goethe



The heart is the first organ that lives.

Michael Servitus

The heart has long been regarded as the essence of life, the seat of love and affection. Sweetheart, broken-hearted, heartless, heartfelt, soft-hearted, hard-hearted are parts of our vocabulary. Some eat their hearts out, others wear hearts on their sleeve, still others are asked to have a heart, while a few have hearts of gold.



In 1933, Michael DeBakey, while an intern at Charity Hospital in New Orleans, saw a pulsating human heart through a stab wound. “I saw it beating. It was beautiful, a work of art, an awe-inspiring sight. Something that God makes.”

Five thousand years ago, the Egyptians believed that the soul resided within the heart which was the only organ returned to the body after embalming. Before doing so, the heart was placed on a scale and weighed against a symbol of Maat, the goddess of Justice, for the posthumous judgment of Osiris. The brain was discarded as superfluous.



Ritual, Myth and Magic



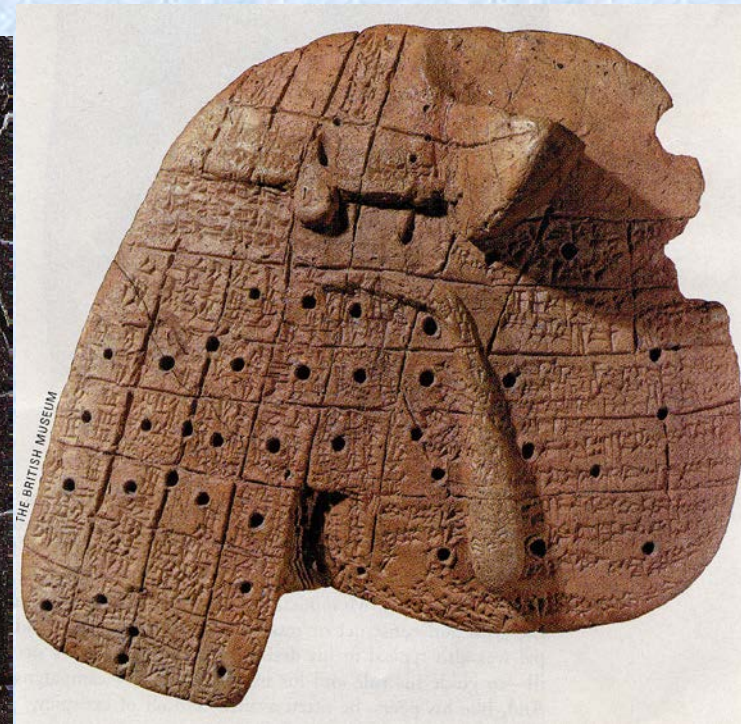
Ancient Mesopotamia

It was here that cultural history originated more than 5,000 years ago. But it was the liver, not the heart, that was regarded as the blood-filled source of the life force.

Third millennium BC *Mesopotamia*



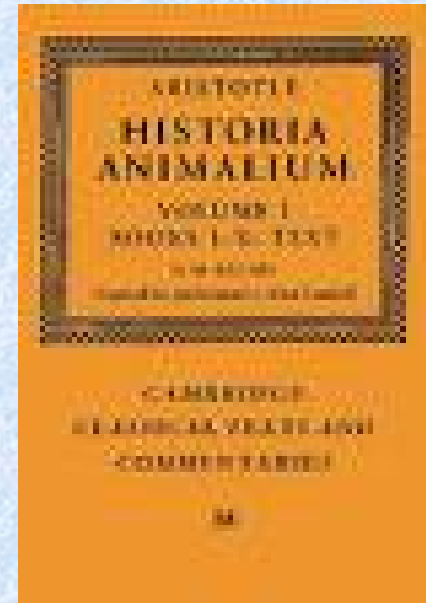
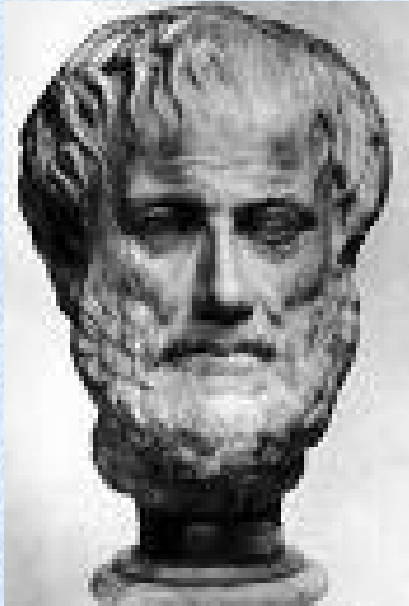
•
**Ritual slaughter of a ram for
examination of its liver.**



**Model of the liver for
comparison with the
ram.**



For ancient Hebrews, the sign of life was the breath, not the beating heart. “*And the Lord God...breathed into his nostrils the breath of life, and man became a living soul.*”



Aristotle regarded the heart as a living creature inside its possessor, the first to form in the embryo, the most important organ in the *body---both a fact and an image, both real and symbolic, both literal and figurative.*

Rembrandt's "The Anatomy Lesson of Dr. Tulp"

Learning from the Dead



Although Aristotle was not a physician, he dissected over 50 species, and founded the discipline of *comparative anatomy*.

He arranged the various zoological forms on the basis of increasing perfection, extending from lower to higher animals-
-a prelude to Darwinian evolution.

Rebirth

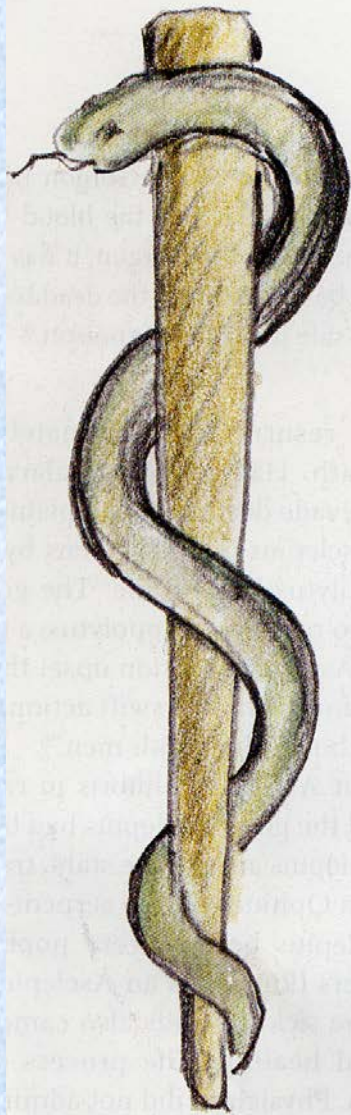
The Symbol of Healing



The snake sloughs its old skin and is symbolically reborn, hence the association of rebirth with healing.

The staff (*caduceum* Latin, *keryx* Greek) exists as two different serpentine images.

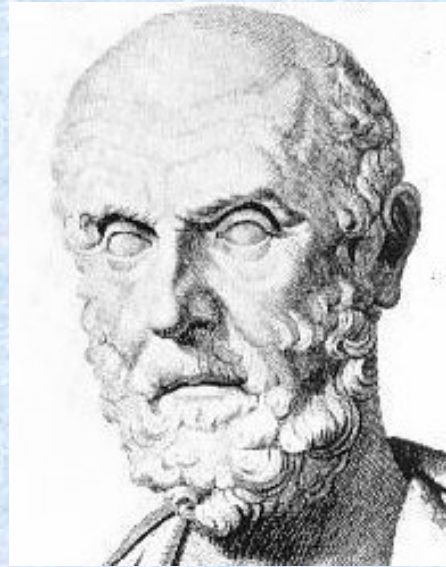
The single
entwined snake belonged
to *Aesculapius*, the god of
medicine.



The double
entwined snakes
belonged to Hermes,
messenger of the
gods and prince of
thieves.



A Major Step Forward

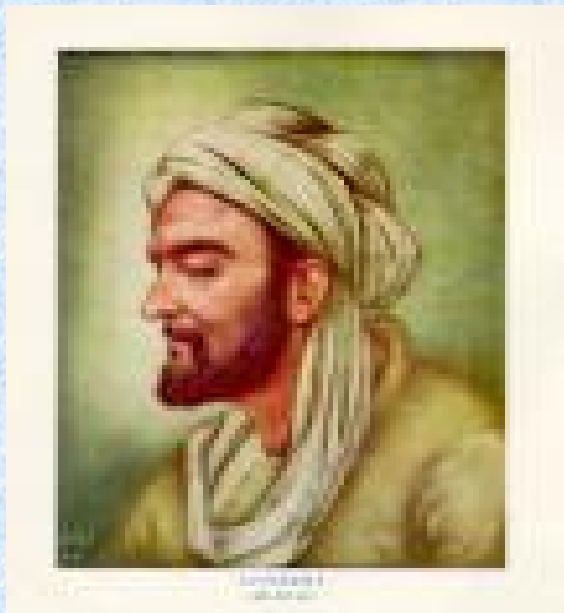


In ancient Greece, Hippocrates (460-377 BC) replaced supernatural temple medicine with *rational medicine*, a change that coincided with the Golden Age of Athens and the world view of pre-Socratic philosophers.

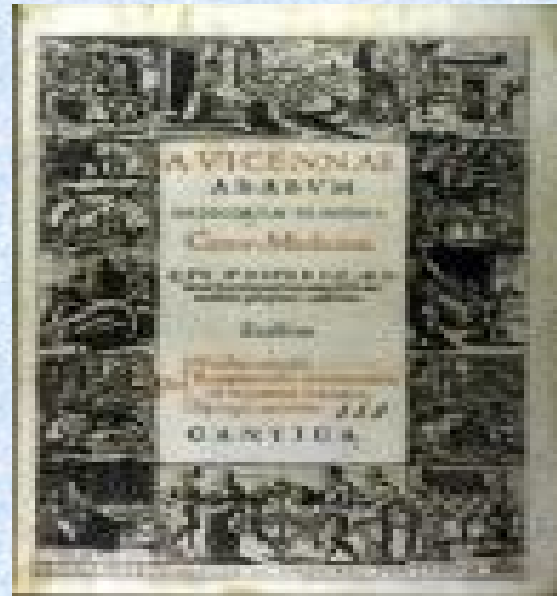
A Major Step Backward



Galen (131-200 AD) virtually destroyed Hippocratic teaching by forcing medicine to conform to the emerging Christian world view that illness was the work of an all-powerful god. Galen's principles dominated medicine for 1,500 years, virtually paralyzing innovative thinking.



Avicenna (980-1037)



Qanun

Avicenna, the most renowned physician in the Arab world, subscribed to the theories of Galen.

His *Cannon (Qanun)* served as a reference longer than virtually any textbook in the history of medicine.

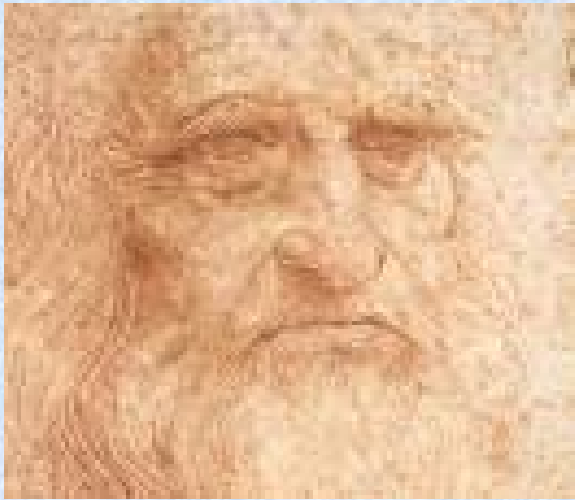
The Sixteenth Century



Modern medicine dates from the publication of Vesalius's magnificently illustrated book – *De Humanis Corporis Fabrica* (1543).

Vesalius was then 29 years old.

The Italian Renaissance



Leonardo da Vinci did his anatomical dissections at night to avoid accusations of heresy. The dissecting room was lighted with candles which made the experience even more macabre. *“You will perhaps be impeded by the fear of living through the night hours in the company of corpses, quartered and flayed and frightening to behold.”*

The Pulmonary Circulation



Michael Servetus disregarded Galen's three varieties of spirits, admitting but one-- *the vital spirit* --which was contained in red blood flowing into the heart from the lungs.

“The vital spirit is engendered by the mingling of inspired air with the more subtle portion of the blood which the right ventricle of the heart communicates to the left.”

The Price of Progress

With intuitive genius, Servitus proposed that “*within the lungs, we find a new kind of vessels proceeding from the arteries to the veins... extremely minute vessels or capillary arteries.*” This was proposed a century before Malpighi discovered the pulmonary capillary circulation.

The date of Servitus’ birth is disputed, but the date of his death is beyond doubt because the Calvinists accused him of heresy, and in 1553, burned him at the stake together with his books. To increase his agony, he was burned slowly.



The Seventeenth Century

William Harvey

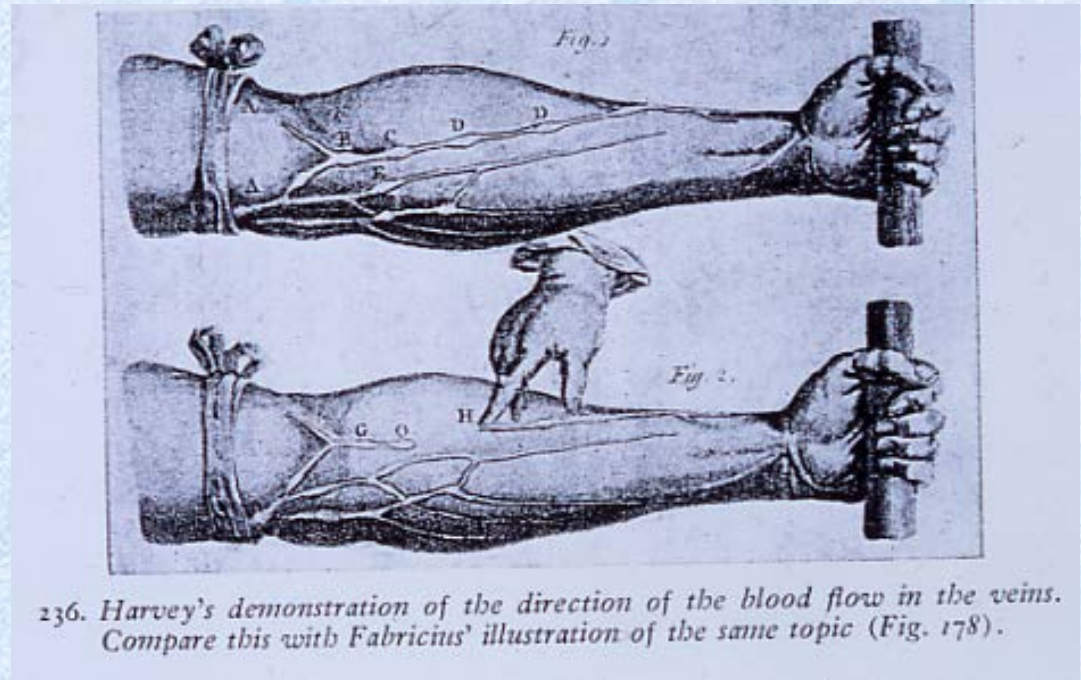


De Motu Cordis (1628), one of the most celebrated books in the history of medicine

Harvey's Creative Imagination



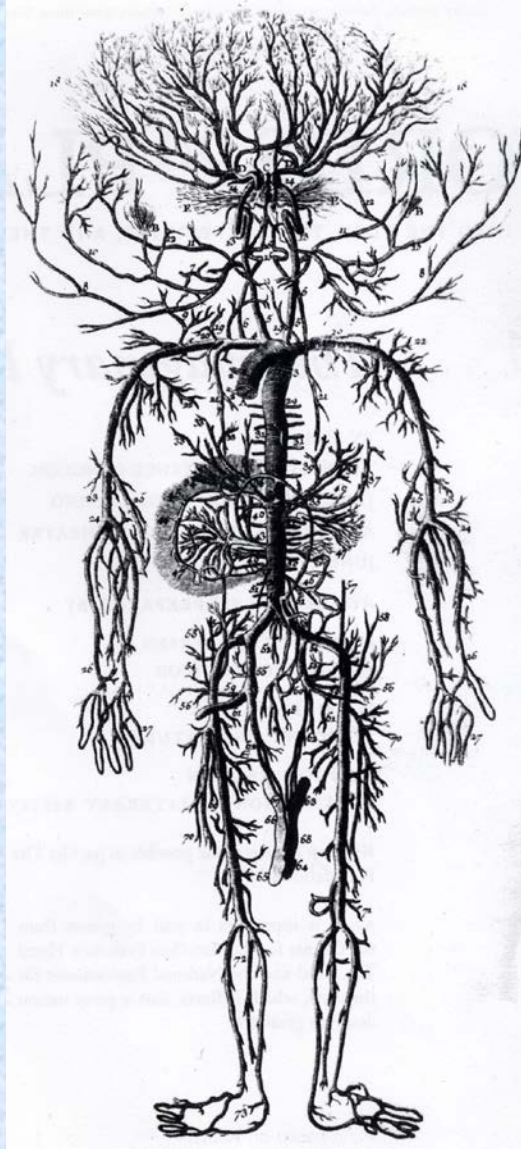
WILLIAM HARVEY (1578-1657)



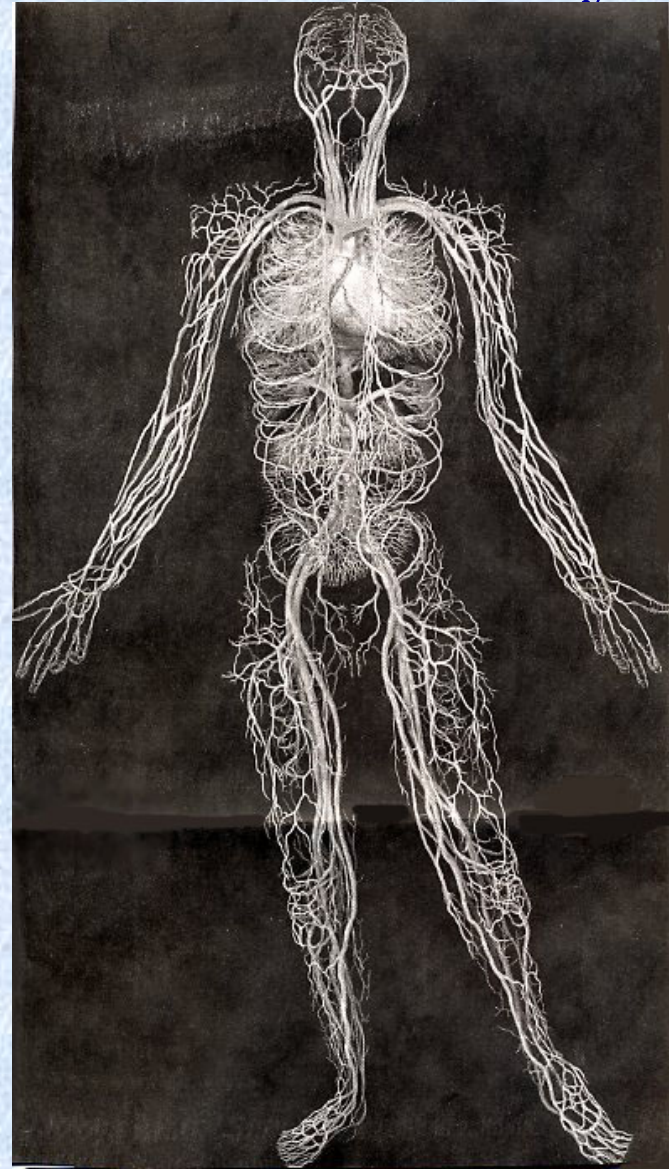
After witnessing the experiments of Hildanus Fabricius of Padua, Harvey demonstrated that veins swell below a ligature, preventing reflux of blood from the heart. This observation served as the basis for *De Motu Cordis et Sanguinis* in which Harvey set forth his concept of the circulation.

Human Arterial Circulation

17th Century

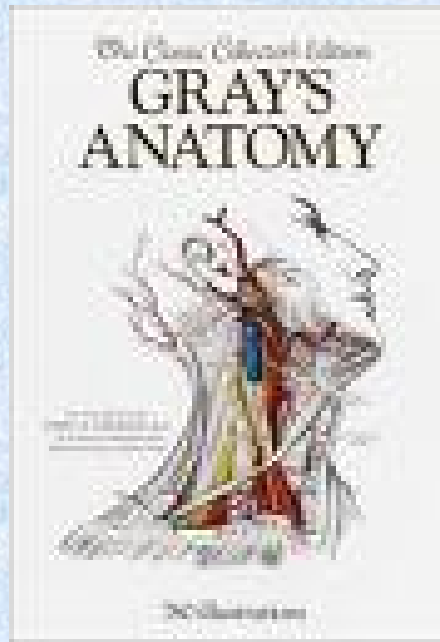


21st Century





From the dawn of cultural history, the magical pulsation of the heart has been one of the enigmas and mysteries of human life. Can hearts of gold pulsate?



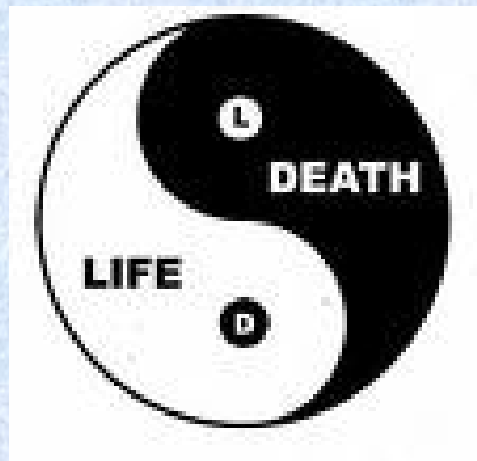
On my 40th birthday, a copy of the 28th edition of **Gray's Anatomy** was inscribed to me by the Editor, Charles Mayo Goss, who taught me anatomy as a medical student, and with whom I maintained close friendship until his death. The inscription read, *“In honor of the 40th anniversary of the birth and in celebration of first beatings of the heart of Joseph Perloff, a fine clinician and scholar from his old professor, Charles Mayo Goss.”*



Death of the Buddha



Death of the Buddha



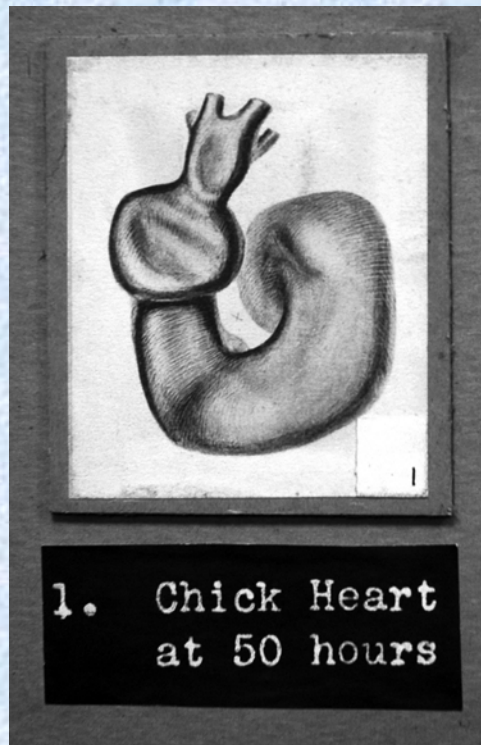
That the *heart beat is necessary for life* is one of the few dogmas that has enjoyed equal popularity among both cardiovascular physiologists and the lay public. It has long been the conventional wisdom that the embryonic heart begins to beat in order to pump blood for convective transport. However, data from developmental biology have called this seemingly intuitive dogma into question.



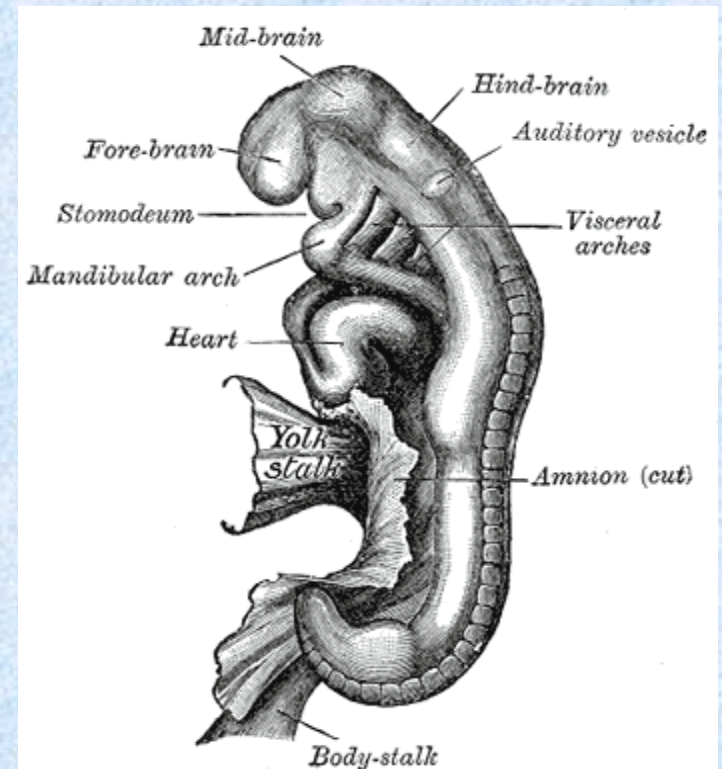
The heart cannot function without beating.

But the heart can beat without functioning.

The embryonic heart begins to beat 18 to 21 days after conception. At this stage, the heart has no circulatory function, but if the beat stops, the embryo dies.



Maude Abbott Atlas
1936



20 week embryo

Four thousand years ago, the Chinese looked upon the beating heart as the organ that pumped blood throughout the body.



From the Yellow Emperor 2696-2598 BC

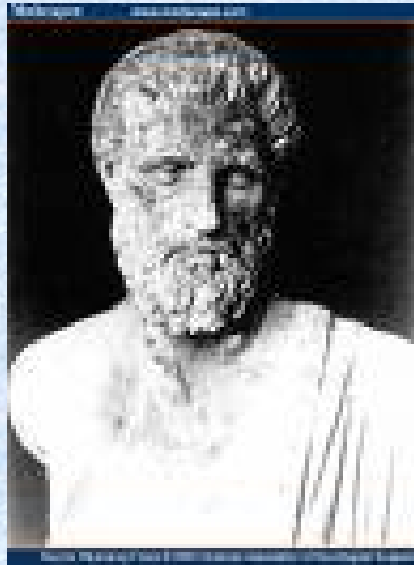
The Ancient Art of Feeling the Pulse



For male patient, feel
left hand pulse first



25. For female patient,
feel the right hand pulse
first



Herophilus (344 BC) recognized that the arterial pulse and the heartbeat were synchronous. He constructed a water clock to count the pulse, analyzed its rate and rhythm, was influenced by musical theories, and evolved an entire rhythmical pulse lore.

John Floyer (1649-1734)

The Physician's Pulse Watch



2000 Years after Herophilis, John Floyer employed a London watch maker who devised a second hand and a lever that stopped the mechanism. The pulse could then be timed precisely.

Seventeenth Century

Francis Bacon, 1st Viscount St Alban

English philosopher, statesman
and essayist, and a catalyst of the
scientific revolution



18th Century England

A Country Doctor

The Foxglove



William Withering



Digitalis, finger-shaped corollas of the foxglove.

The Foxglove In My Garden



Gypsy Mystic and Clinical Scientist



One of Withering's dying patients took a gypsy's remedy and survived. Withering hunted down the gypsy and discovered that the vital ingredient of the magic potion was *foxglove*. Withering tried every bit of the plant in all sorts of ways. After experimenting on 163 patients, he found that the best formulation was dried powdered leaf given by mouth.

William Harvey

Language of the heart

"...with each movement of the heart, when there is the delivery of a quantity of blood from the veins to the arteries, a pulse takes place and can be heard within the chest."

De Mortu Cordis (1628)

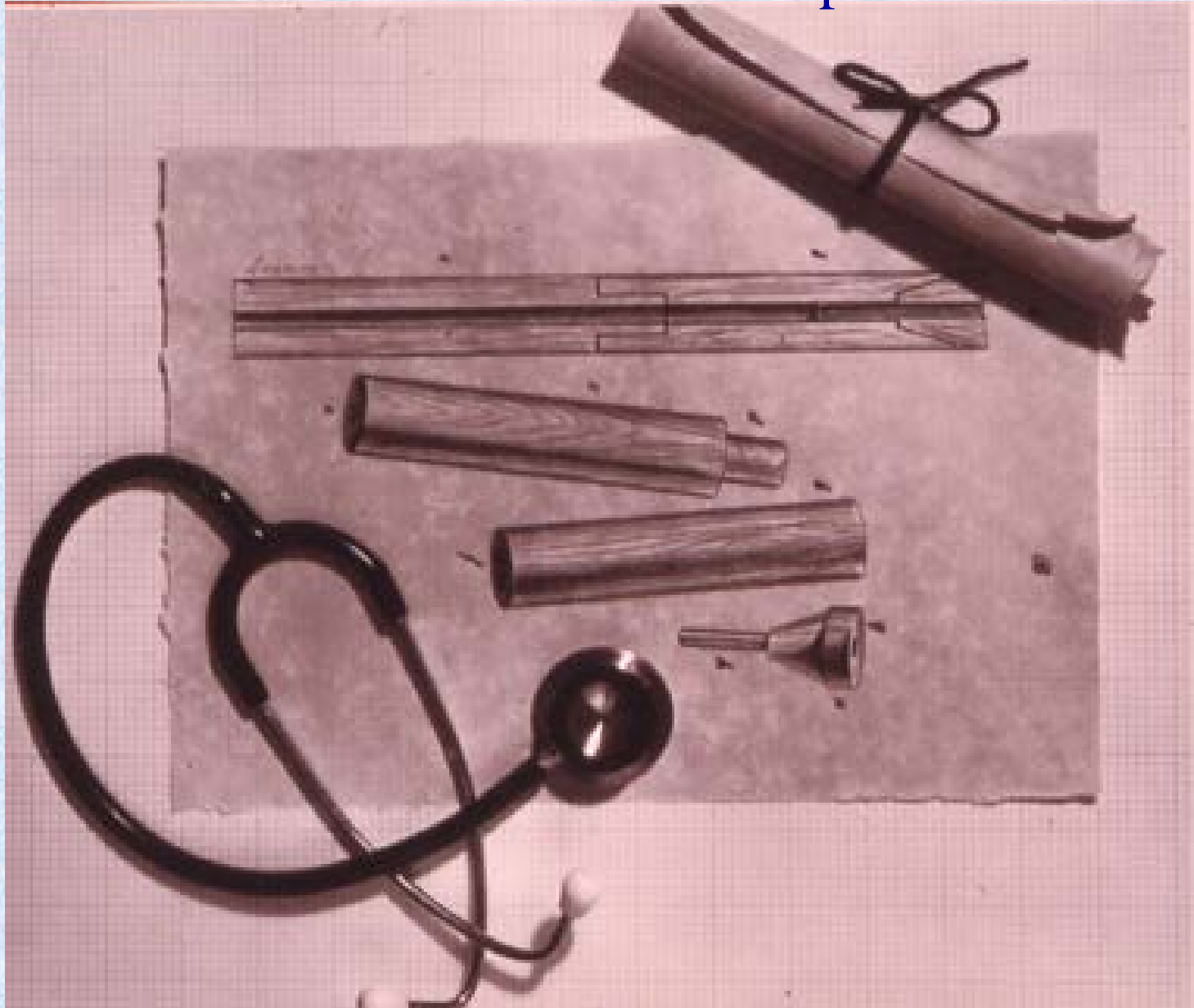
200 Years After Harvey
Rene Laennec 1816



Before the Stethoscope
Mediate Auscultation



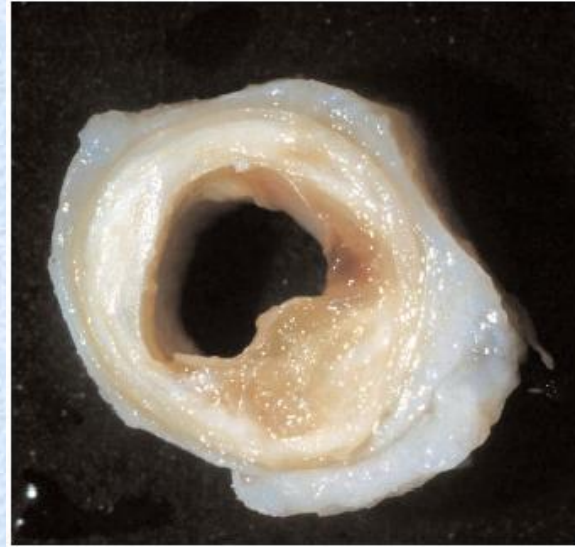
A Quire of Paper Rolled Into A Cylinder The First Stethoscope



***Laennec's* discovery of the stethoscope advanced physical diagnostic medicine beyond anything previously imagined.**



The Nineteenth Century



Rudolph Virchow's hypothesis that coronary artery atheroma resulted from an inflammatory intimal reaction predated by a century and a half the current focus on inflammation in the pathogenesis of atherosclerosis.



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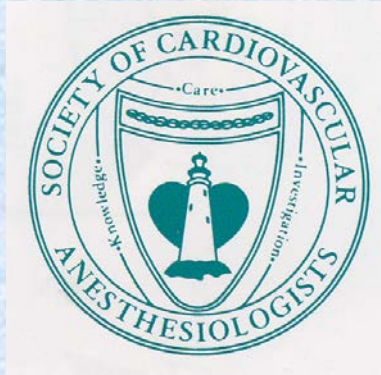
Coronary Artery Disease

Previously regarded as a cholesterol storage disease, coronary atherosclerosis is now considered an inflammatory disorder as Virchow proposed 150 years ago.

C-reactive protein is used as a clinical biomarker of an inflammatory process.

Made in America

The Pivotal Role of Anaesthesia



Anaesthesia (*an* without + *aesthesia* sensation Gr) was a term introduced by Oliver Wendell Holmes. Within a span of just four years (1842 to 1846) anesthesia was born in the United States, and remains among America's greatest contributions to medicine.

Before Anesthesia

Operations were brief and bloody. The floor of the operating room was covered with sawdust which absorbed the blood, and was swept away at the end of each procedure.



OR 19th Century



Sawdust on the floor

Ethereal Ether

In March 1842, ether was first used during surgery by Crawford W. Long, a modest country practitioner in Jefferson County, Georgia. Seven years elapsed before Long published his observations that received but little attention, although no greater boon has ever come to mankind than the power thus granted to induce temporary but complete insensibility to pain.



Crawford W. Long

Humphry Davy's self experiments with nitric oxide failed to pursue the application to anesthesia.

The Ether Dome

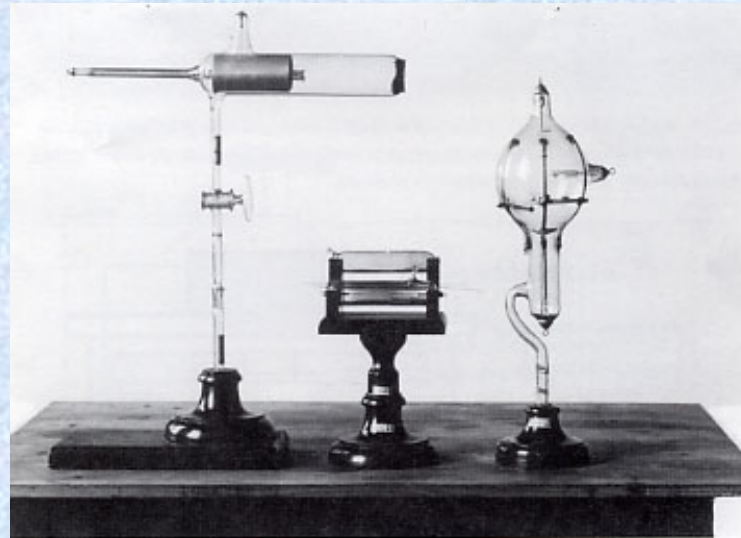
William Thomas Green Morton used ether anesthesia at the Massachusetts General Hospital in October 1846. Within a month the event was published in the *Boston Medical and Surgical Journal*. In the next month, ether was used in London, and in the succeeding year ether anesthesia was widespread throughout Europe.



Nineteenth Century Wilhelm Roentgen



A New Kind of
Rays



Vacuum tubes from
Roentgen's laboratory
*Deusches Museum
Munchen*



1895

Twentieth Century

The internal structure of the living heart was revealed for the first time.

Four decades after Roentgen discovered his new kind of rays, **angiography** had its inception with injection of contrast materials into blood vessels of cadavers and animals. In 1937 Castellanos in Havana visualized the right cardiac chambers in infants and children.

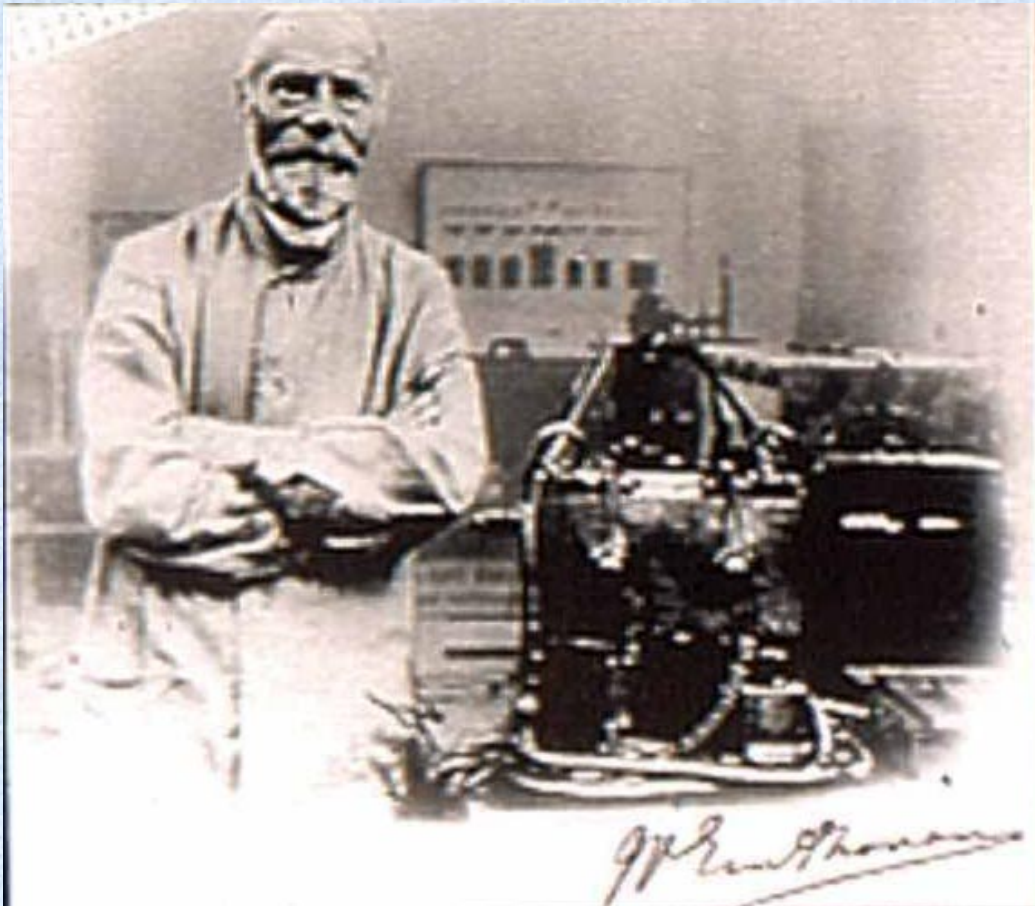


Fig 1 Agustin W. Castellanos, M.D. (1902-2000)

Robb and Steinberg at York Hospital introduced angiography in adults.



Twentieth Century



**Willem Einthoven
(1860-1927)**

Father of electrocardiography

1903

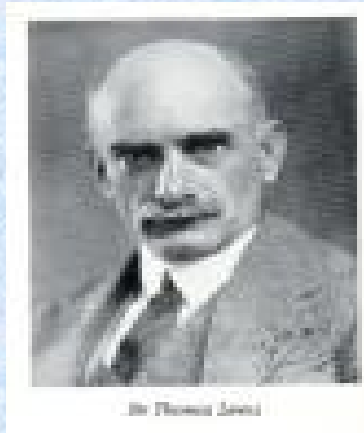
The Electrocardiogram

Hallmark of Modern Medicine

The early history of electrocardiography (1900-1945) was dominated by *Willem Einthoven* in the Netherlands, *Sir Thomas Lewis* in England and *Frank N. Wilson* in the United States, pioneers that laid the foundation for electrocardiography as a modern clinical science.



Einthoven



Lewis

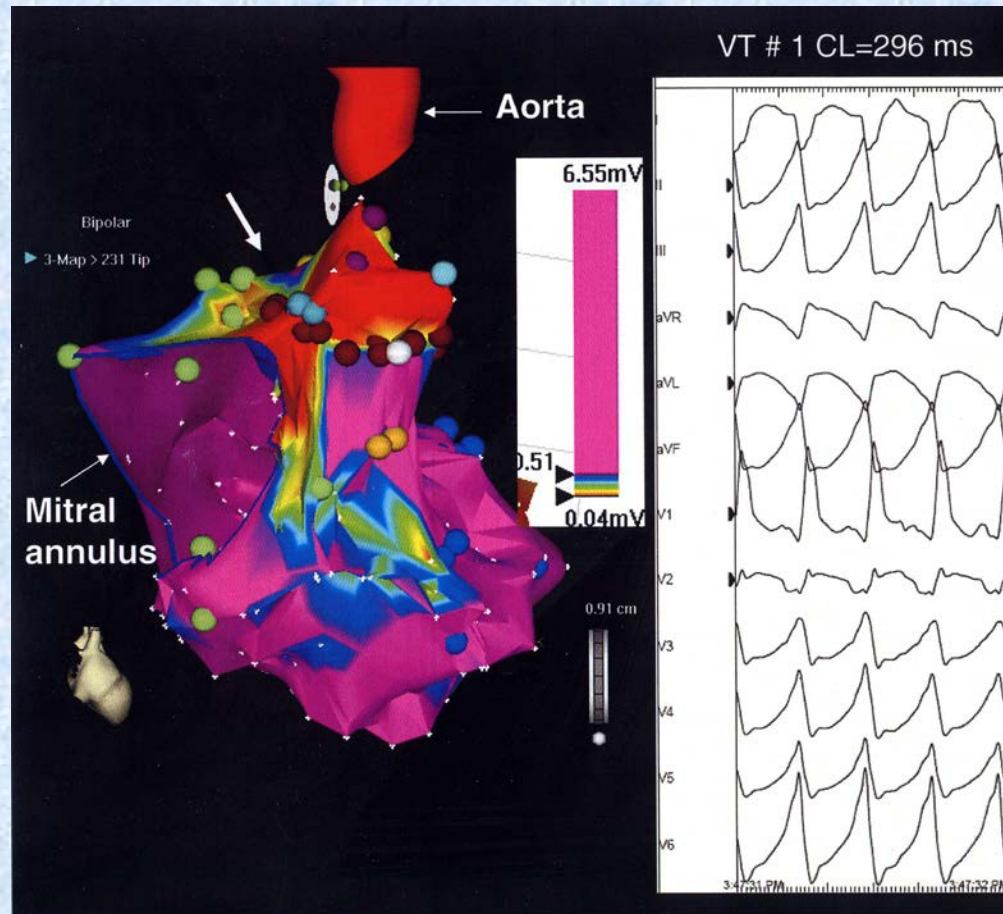


Wilson

1906, *Sunao Tawara* working in Ludwig Aschoff's laboratory in Marburg, published in German his epoch-making monograph on the atrioventricular node, now known as the Node of Tawara..



From Electrocardiography to 21st Century Cardiac Electrophysiology



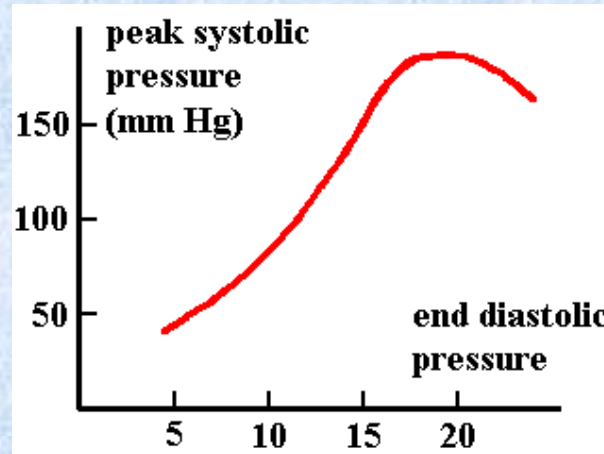
Color Coded Electromechanical Mapping

The Twentieth Century



In 1915, Ernest Henry Starling delivered at Cambridge the prestigious Linacre Lecture that was published in 1918, and was subsequently designated *Starling's Law of the Heart*.

Starling's Law

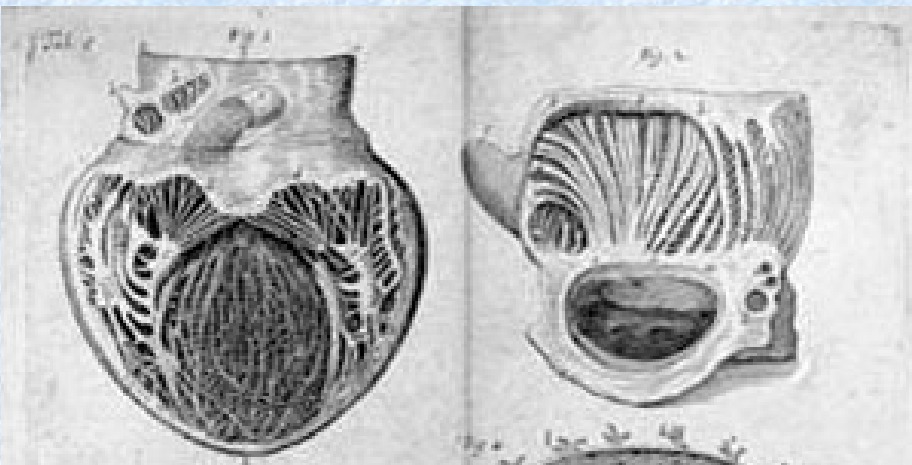


“The heart, freed from all its nervous connections, has the power of automatically adjusting the force and extent of its contractions to the task which is set for it by the two factors determining its work, *viz*: the inflow into the heart from the veins, and the resistance offered to the outflow by the arterial pressure.”

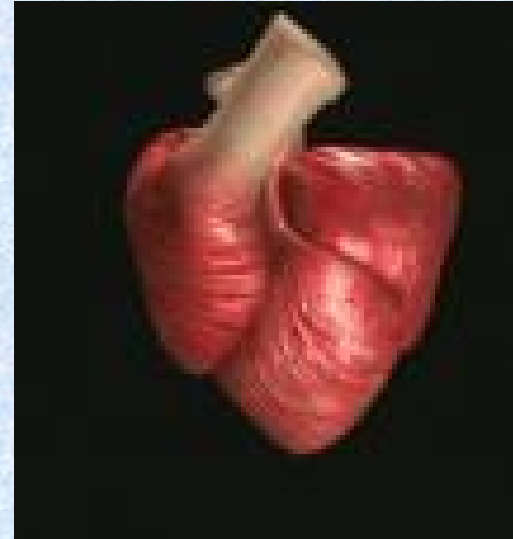
17th Century



The scroll-like structure
of cardiac muscle



20th Century

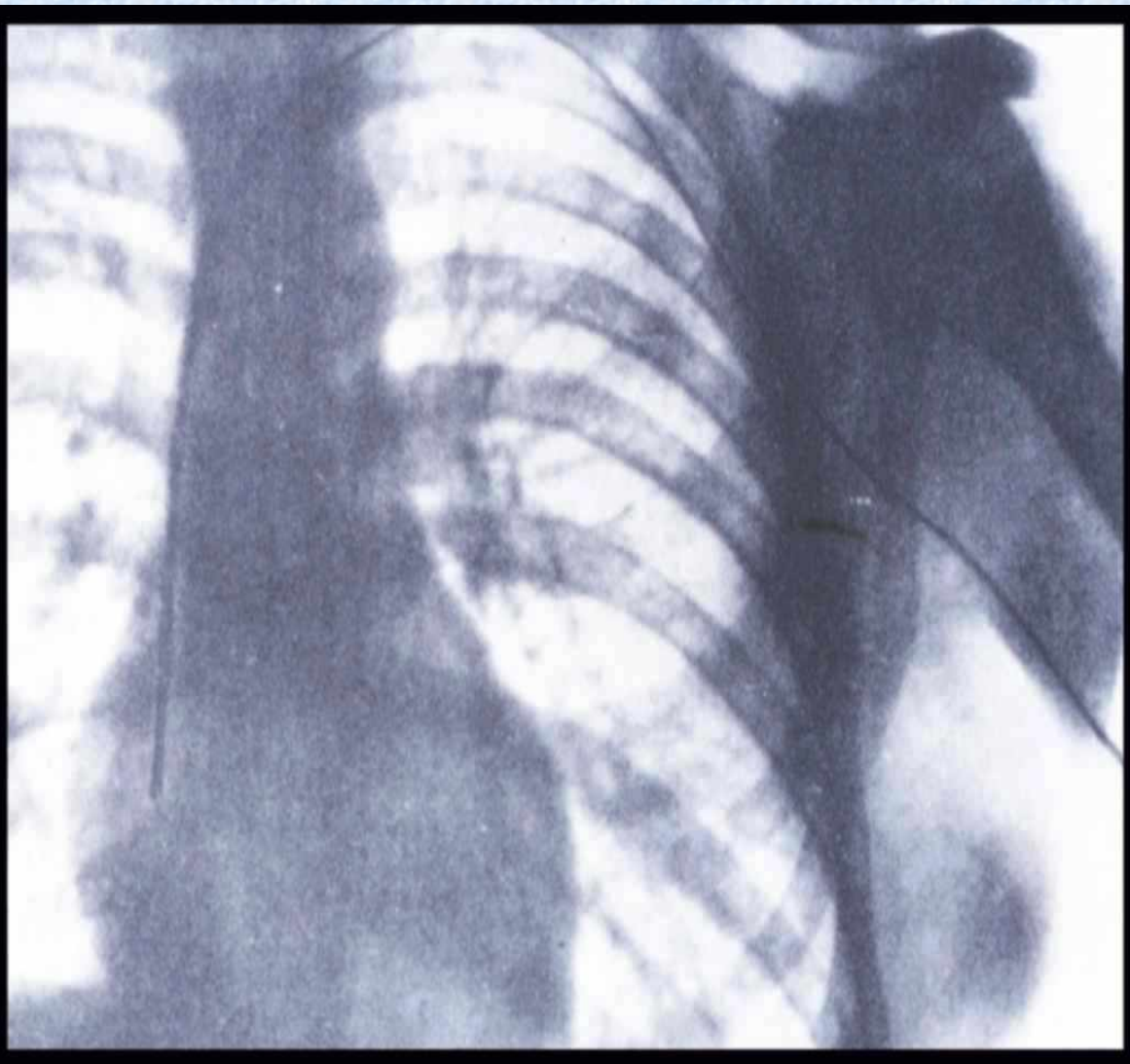


The *helical heart* promotes twisting
of cardiac muscle and ventricular
ejection, followed
by untwisting that promotes filling
for the next beat.

Two Hearts Beating as One

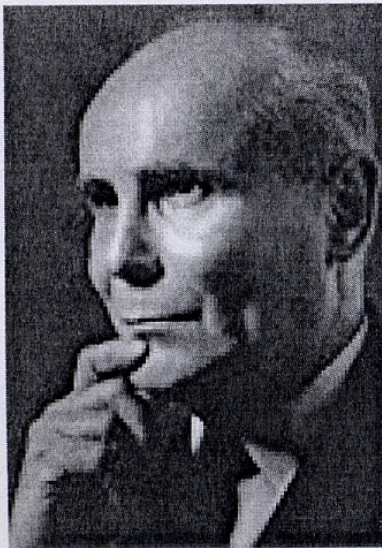
The Cardiac Catheter

Werner Forssmann 1929



Nobel Prize in Physiology or Medicine 1956

For their discoveries concerning heart
catheterization and pathological
changes in the circulatory system



**Andre Frederic
Cournand**



**Werner
Forssmann**



**Dickinson W.
Richards**

We Few, We Very Few



Maude Abbott



Helen Taussig



St Jude
Patron Saint of Hopeless Causes

Congenital Heart Disease

The human heart in conflict with itself.

William Faulkner

Before World War II, congenital malformations of the heart were regarded as *hopeless futilities*, an occupation appropriate for the few women in medicine. *Maude Abbott* was advised by William Osler to devote herself to the anatomic specimens in the McGill collection, and *Helen Taussig* was advised to occupy herself with the hopeless futilities in the Harriet Lane Children's Clinic at Hopkins. *Congenital heart disease in adults was an oxymoron.*



Maude Abbott McGill

ATLAS
OF
CONGENITAL CARDIAC
DISEASE
MAUDE E. ABBOTT

1936



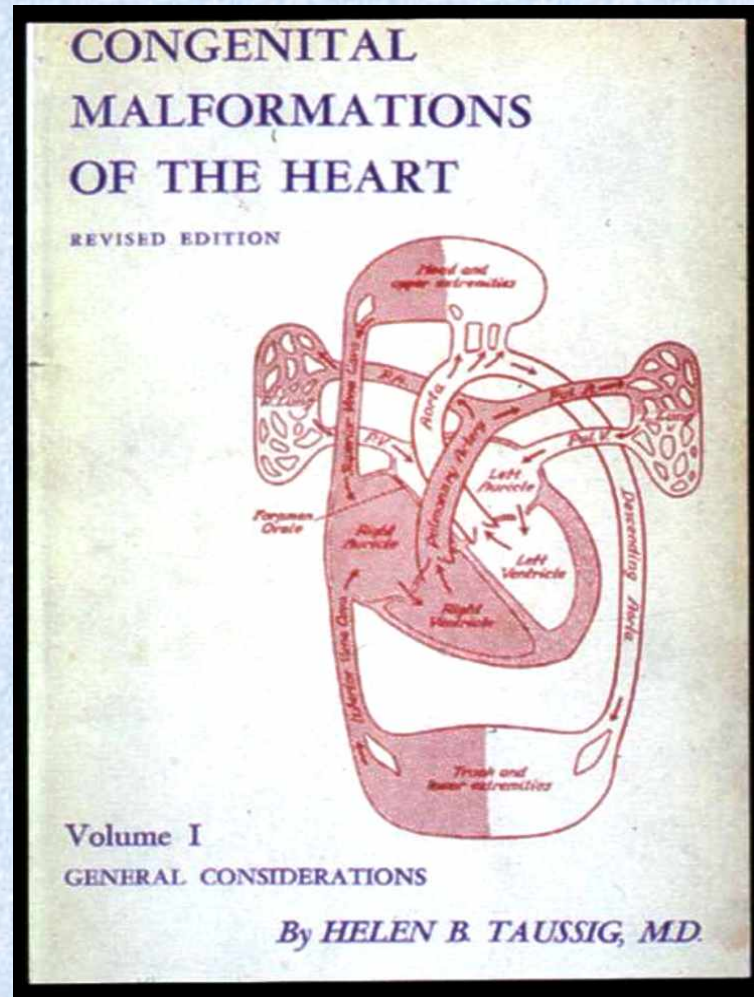
A Landmark Book

The Osler Library



Ahmanson/UCLA Adult Congenital Heart Disease Center

Helen Brooke Taussig



1947

Another Landmark



Ahmanson/UCLA Adult Congenital Heart Disease Center

Echocardiography

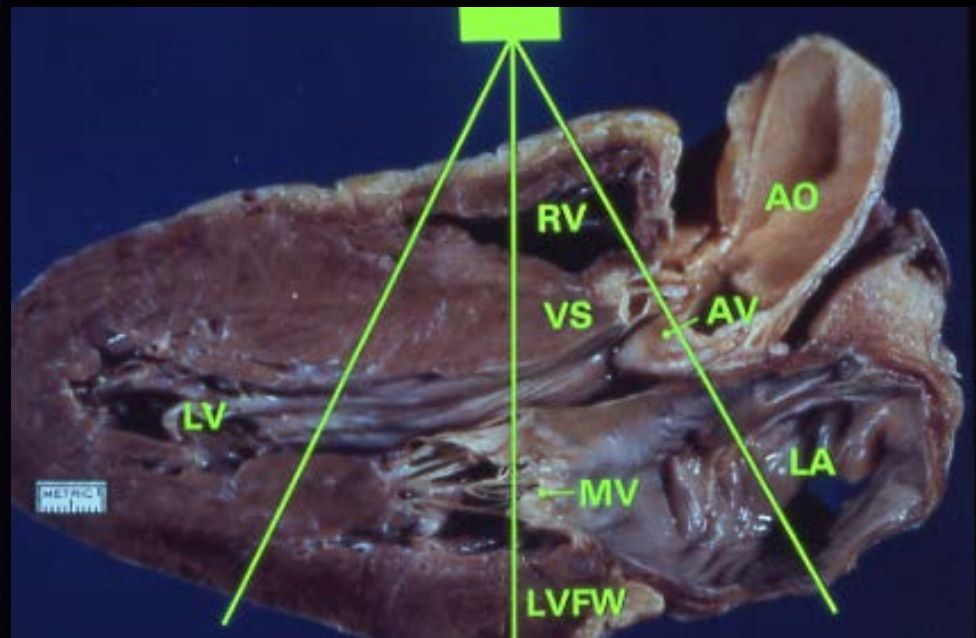
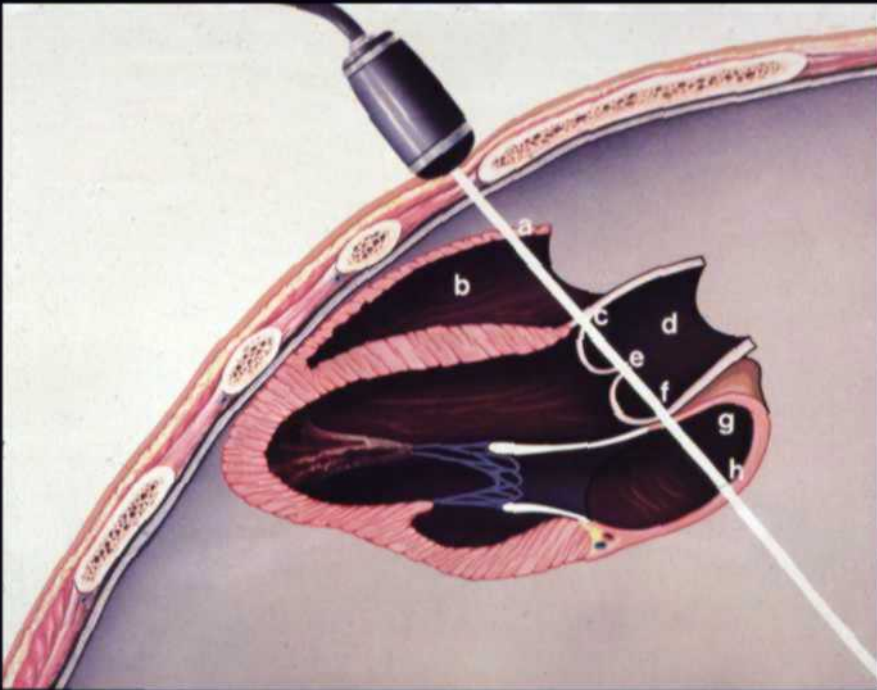


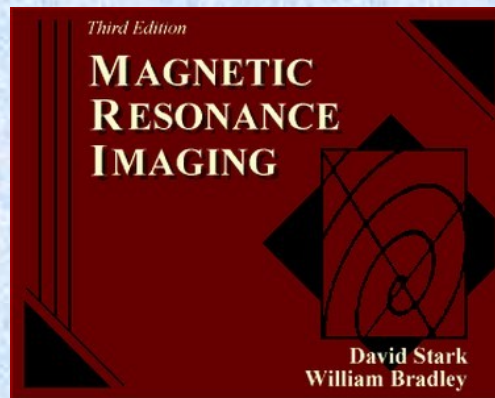
Karl Theo (Theodore) Dussik
1908 - 1968

*In 1941 Karl Dussik, an Austrian,
first employed ultrasound for medical
diagnosis.*

Echocardiography

Diagnostic Pathway to the Promised Land

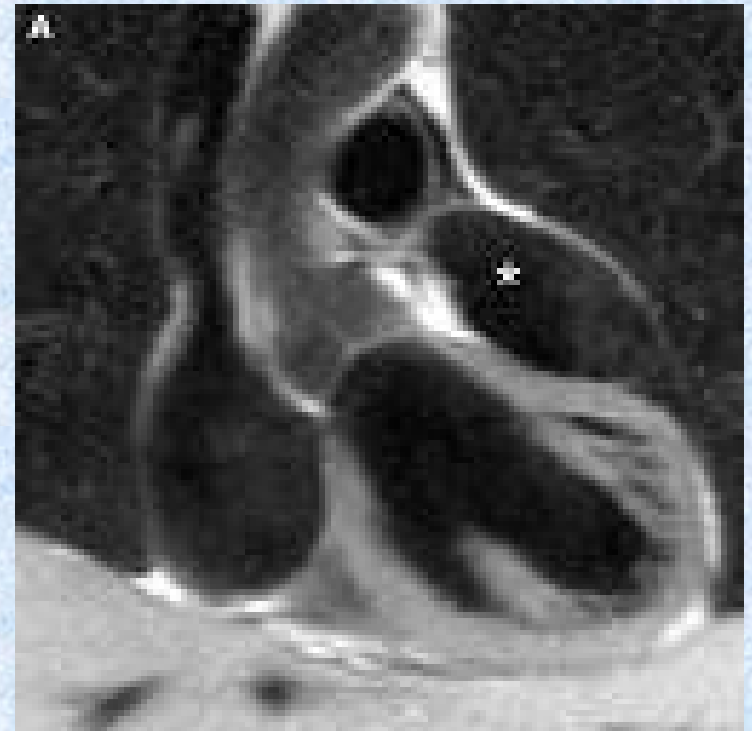




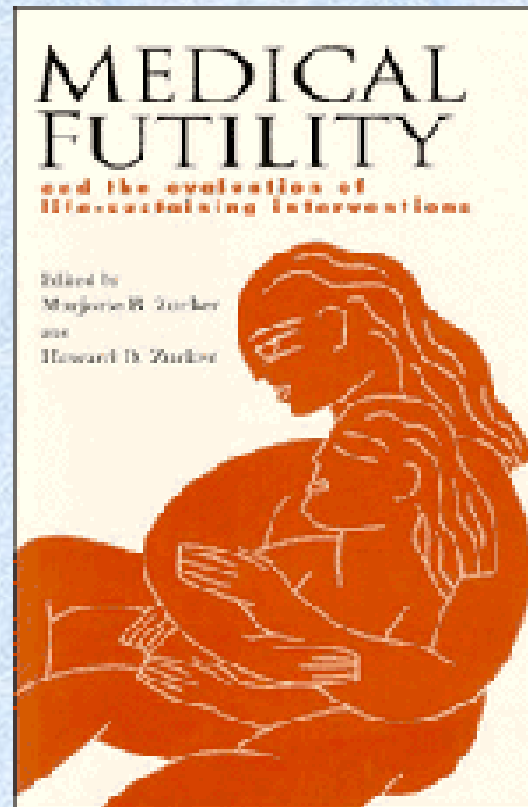
A powerful magnetic field aligns hydrogen atoms in body water.



The Magnet



The Image



Surgery for congenital heart disease should be born of hope, not of desperation.

A Hopeful First Step



**SURGICAL LIGATION OF A PATENT
DUCTUS
ARTERIOSUS: REPORT OF FIRST
SUCCESSFUL CASE
R.E. GROSS
and J. P. HUBBARD
1939**



The Next Step

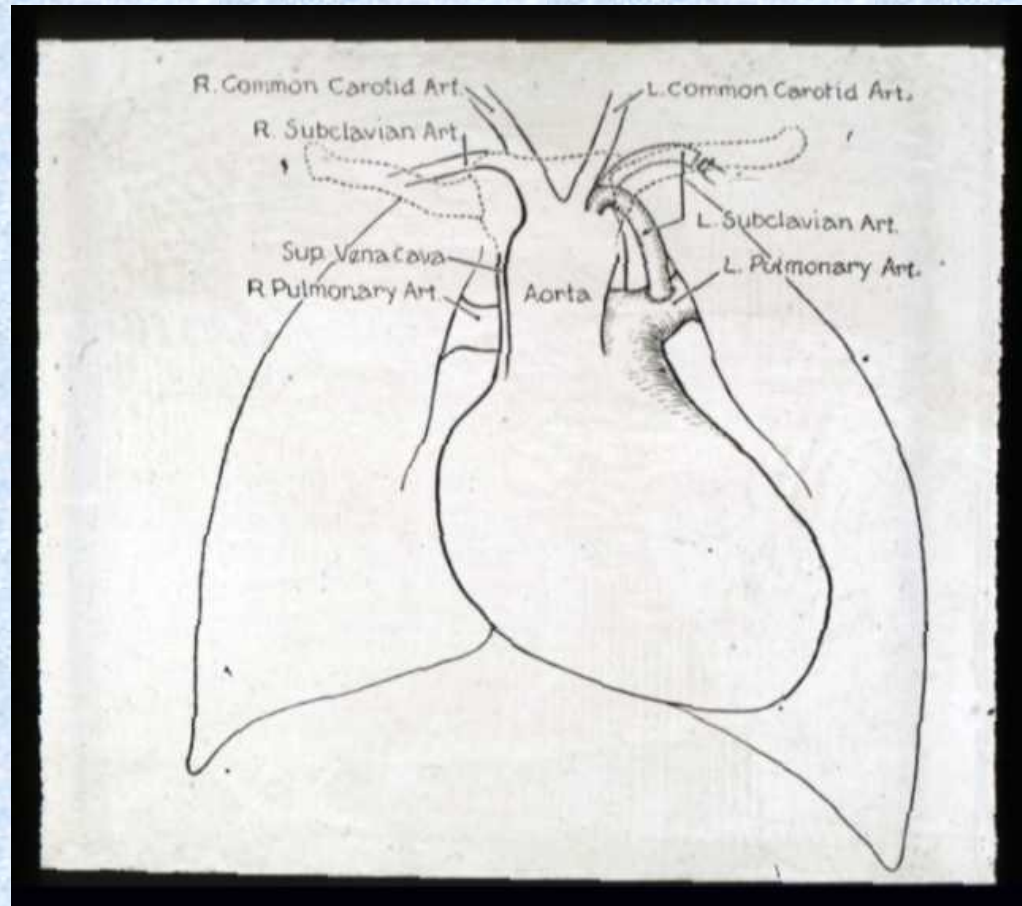


In 1944, Alfred Blalock sutured the end of a subclavian artery to the side of a pulmonary artery in an infant with Fallot's tetralogy, establishing the now legendary Blalock-Taussig shunt.



A Landmark Operation 1944

The Blalock/Taussig Shunt □



The Future of Children



The heart will never be normal, but the life lead can be normal.

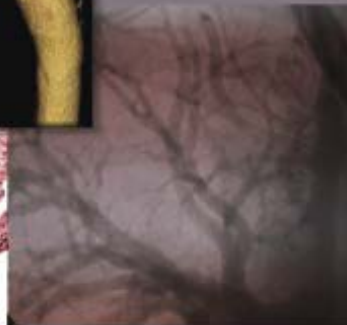
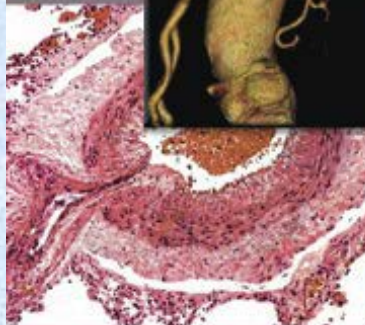


Ahmanson/UCLA Adult Congenital Heart Disease Center

2008

Congenital Heart Disease in Adults

3rd Edition



Joseph K. Perloff

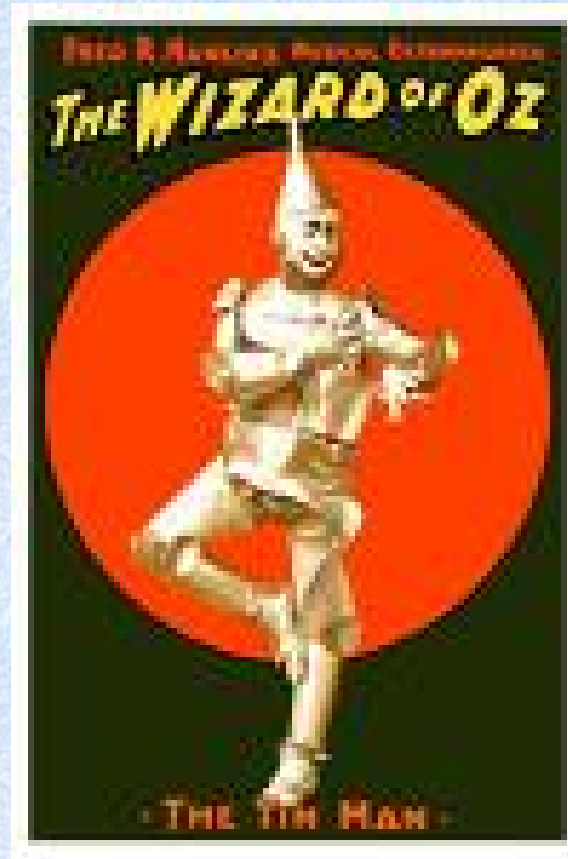
John S. Child

Jamil A. Aboulhosn

SAUNDERS
ELSEVIER

Cadiac Transplantation

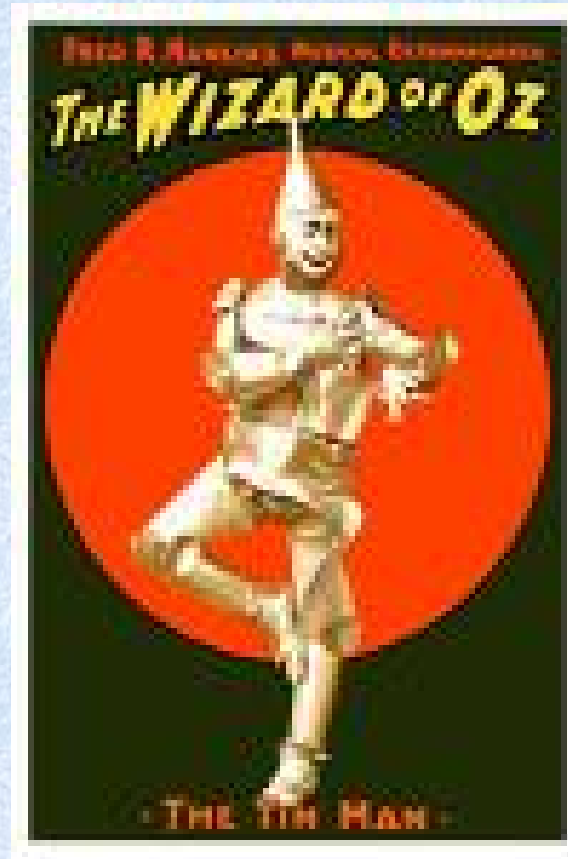
If I only had a heart



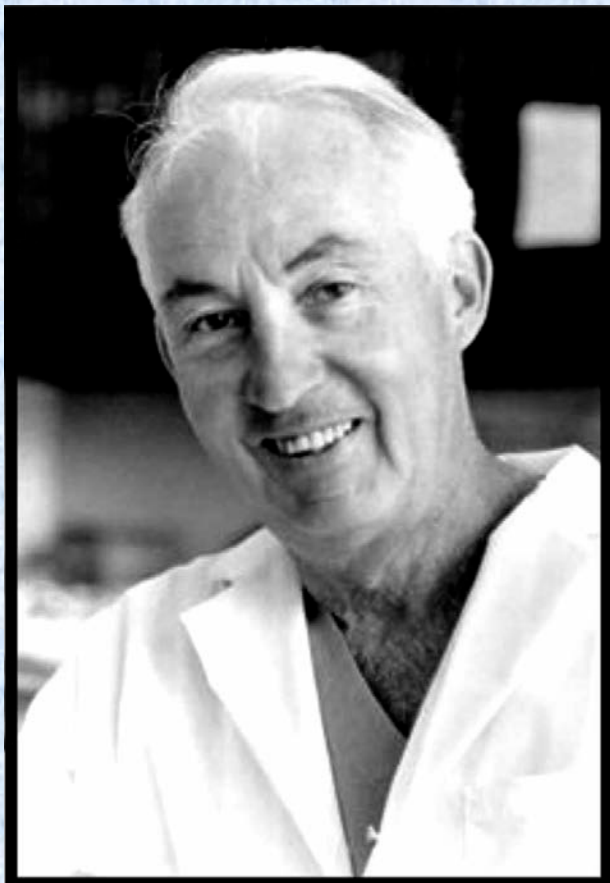
The Tin Woodman

Cadiac Transplantation

If I only had a heart

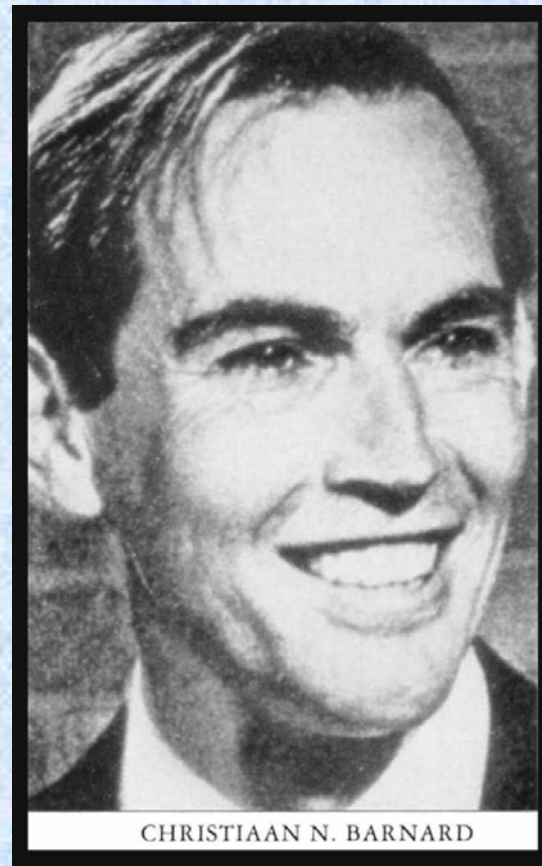


The Tin Woodman



1960

Lower and Shumway--
first successful orthotopic
cardiac transplantation.



1966

Christiaan Barnard-- first human
cardiac transplantation.



Ahmanson/UCLA Adult Congenital Heart Disease Center

1938
A Popular Song



For the ancients, the soul resided in the heart---a mystic organ. Death meant that the soul departed from the heart. Where does the soul reside when a heart is transplanted ? What have Shumway and Bernard done with our souls?

**Thank
You**