

# THE HISTORY OF CARDIAC SURGERY

The History of Cardiac Surgery: Evolution, growth, development and advances in Heart Surgery

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JANUARY 24, 2023

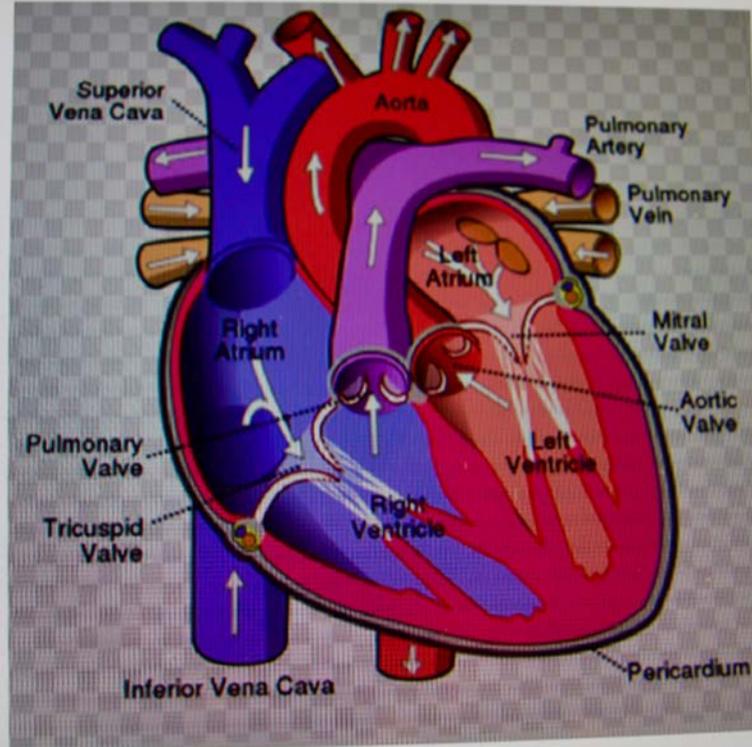
- BACKGROUND:
  1. From the earliest days of medicine until the mid-1900's, tampering with the heart was considered taboo.
  2. For centuries, people regarded the human heart as seat of our soul, our spirit, and emotions, and as such the organ was off limits to physicians and surgeons.
  3. In 1648, Jean Riolan, a French physician, described the heart as the "noblest organ in the body and source of a life-giving substance which supplied the rest of the body with nourishment."
  4. During the renaissance, physicians observed heart functions and failure but did more to impede medical progress than to further it.

# The human heart



# Cross-section of the heart

## ANATOMY OF THE HEART



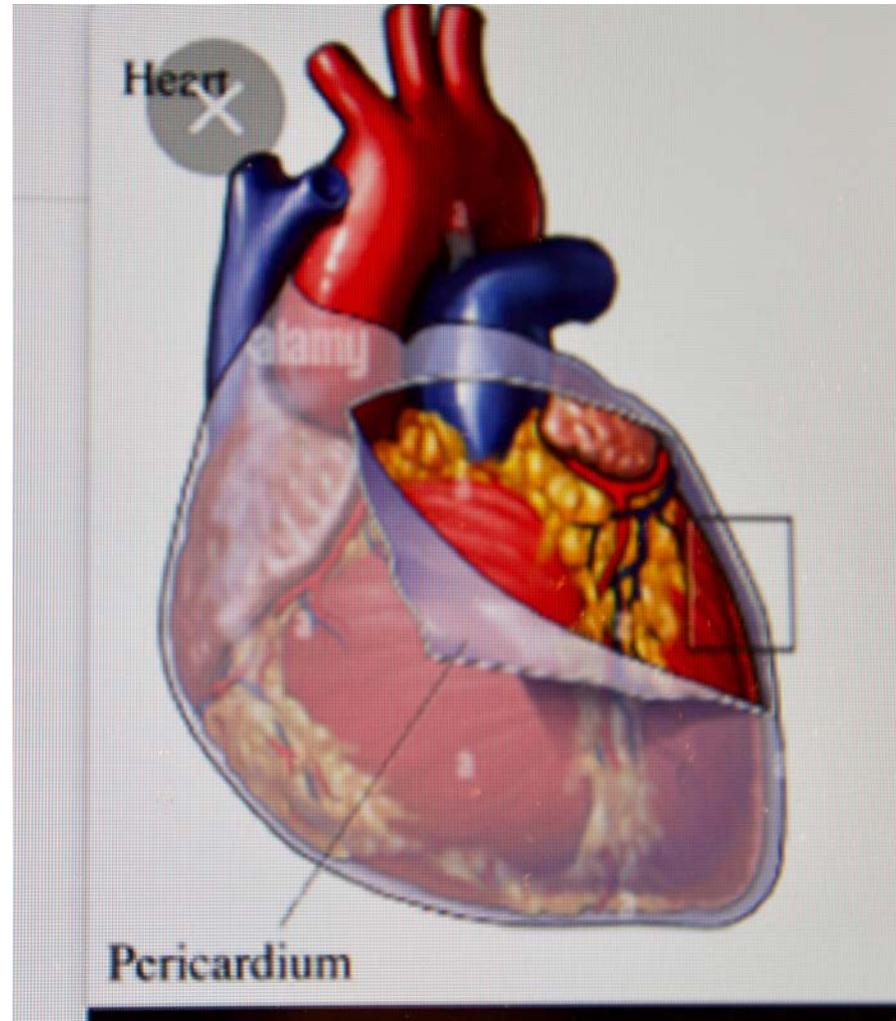
# FUN FACTS ABOUT THE HEART

1. The heart beats 100,000 times per day.
2. It pumps five to six quarts of blood per minute.
3. There are 60,000 miles of blood vessels in the human body.
4. Located at the top of your heart, the aorta is the main artery that carries blood away from your heart to the rest of your body. Its as large as a garden hose.
5. Newborn babies have the fastest heart beats.
6. LAUGHING IS GOOD FOR YOUR HEART.
7. Sneezing does not stop the heart from beating, but feel free to tell others “bless you” anyway.

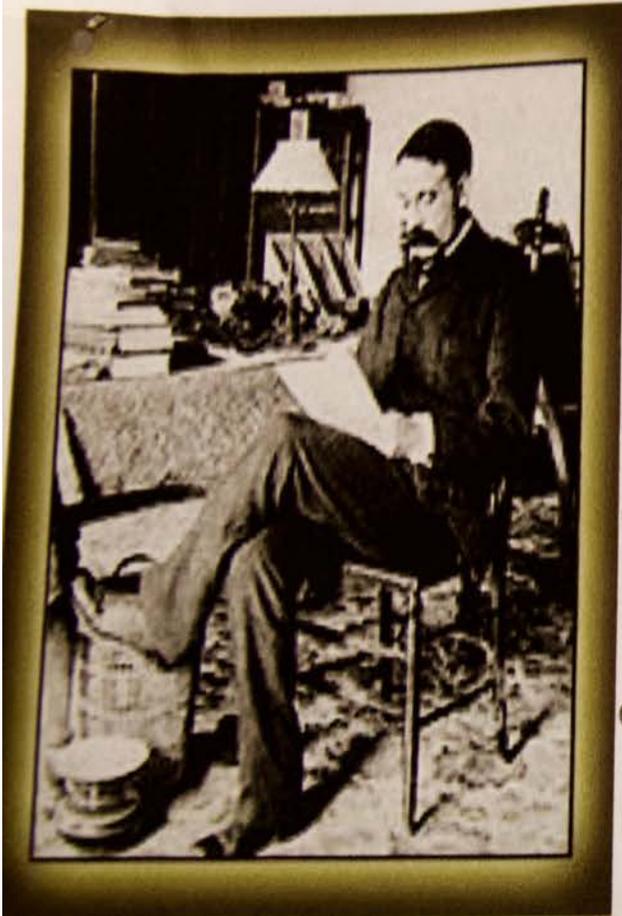
# BACKDROP

- The earliest operation on the pericardium(the sac that surrounds the heart) took place in 1801- Francisco Romero performed operative drainage of the pericardium.
- Henry Dalton (1891), first American on record to suture lacerated pericardium on a 22 years old-man with stabbed wound in the chest- patient survived.
- In 1893- Dr. Daniel Hale Williams became the first surgeon to performed open-heart surgery at the Provident Hospital in Chicago that he founded. The patient survived and was discharged on 51<sup>st</sup> hospital day.
- In 1896, Ludwig Rehn- a German surgeon, performed a successful cardiac operation- when he repaired a stab wound to the right ventricle by the direct suture.

# THE PERICARDIUM OF THE HEART



# DR. Daniel Hale Williams(1856-1931)

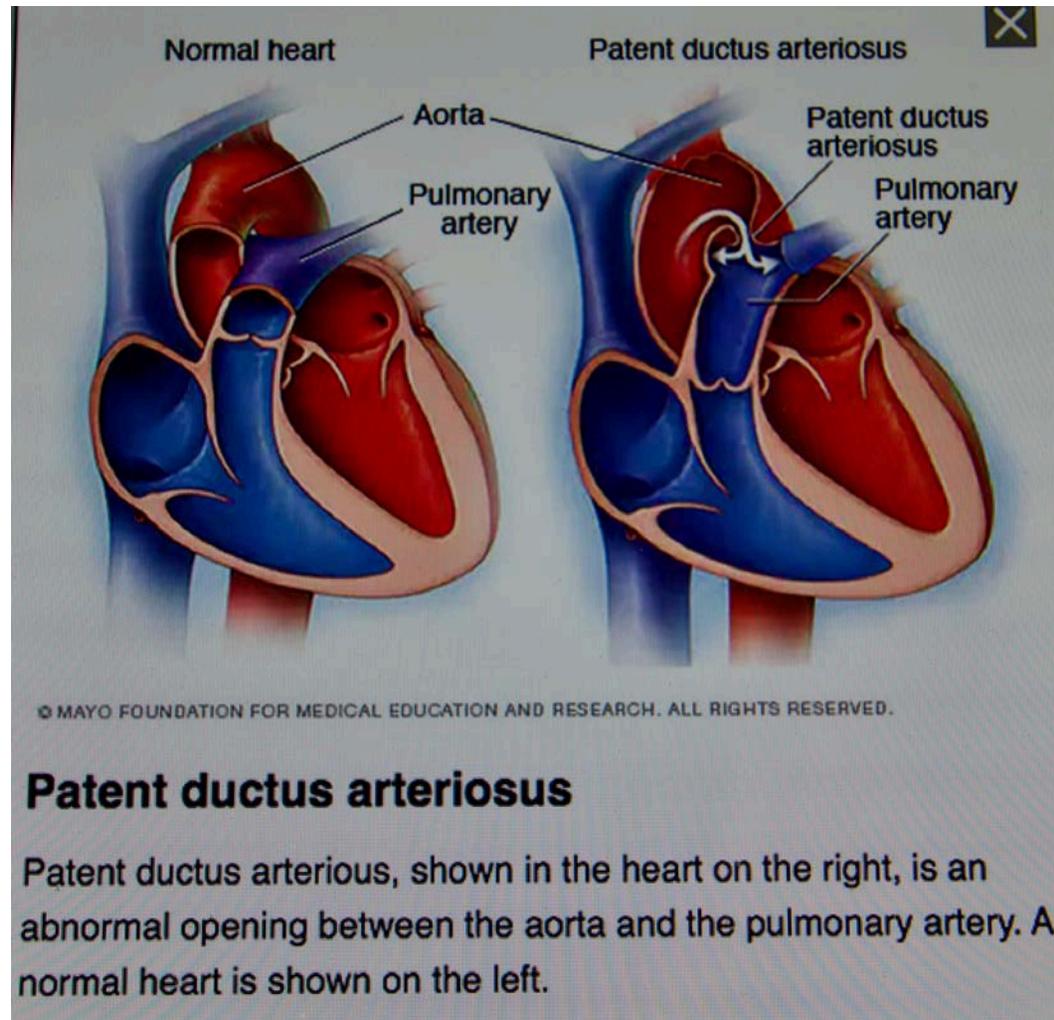


- Founded the first interracial hospital, Provident Hospital and Training School
- Created two hospital-based training programs for nursing
- Co-founded the National Medical Association
- The first African American physician admitted to the American College of Surgeons
- Dr. Williams's work and advocacy for African Americans presence in medicine is honored by educational institutions worldwide

# 20<sup>th</sup> CENTURY

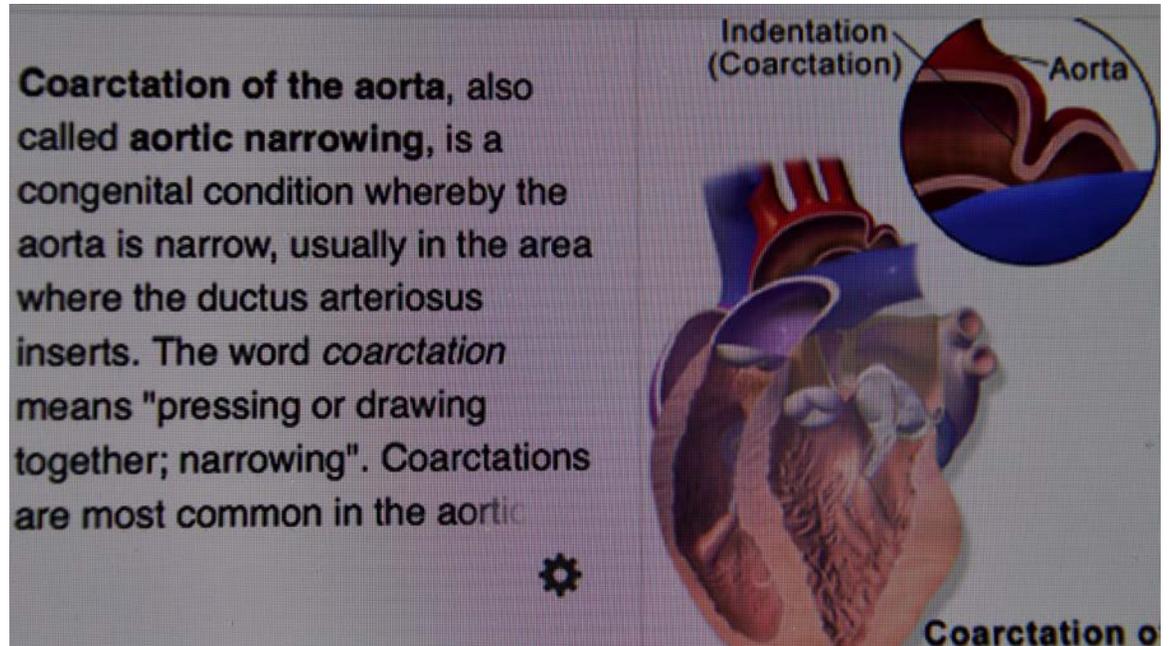
- BY the turn of the 20<sup>th</sup> century- medical science was booming, and yet heart surgery remained virtually non-existent. Scientists had pioneered major advances in anesthesia, antibiotics and blood transfusions, but successful surgery of the heart and chest was still decades away.
- Why??
- In 1925, Henry Souttar, at the Middlesex Hospital, London, operated successfully on a young woman with mitral valve disease- first successful operation anywhere in the world, on a patient heart valve. He was never referred another patient by his cardiology colleagues.
- In 1939, the history of congenital heart surgery started with the first successful surgery for patent ductus arteriosus(PDA)- Dr. Robert Gross, chief surgical resident performed the surgery while his mentor, was away on vacation.

# Ligation of Patent Ductus Arteriosus- Dr. Robert Gross, 1939



## COARCTATION (INDENTATION) OF AORTA

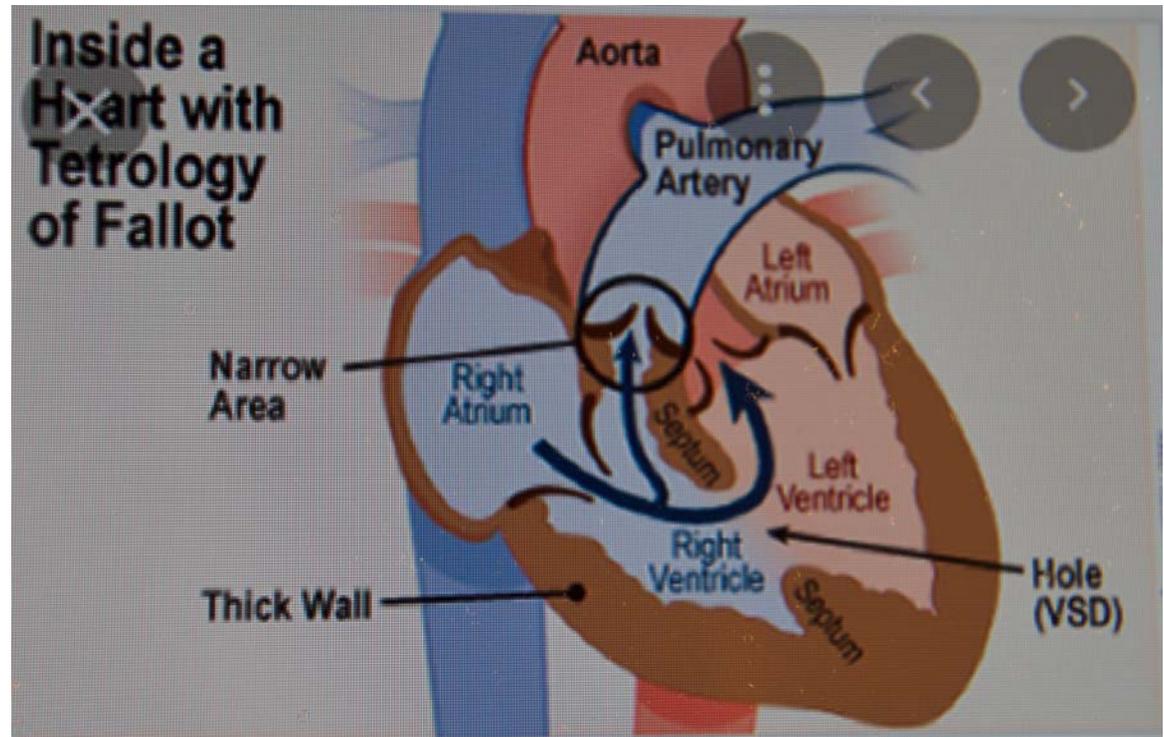
Successful surgical repair of Coarctation of Aorta was performed in Stockholm, Sweden by Crafoord and Nylin in 1944- on a 12-year old boy.



## TETRALOGY OF BALLOT(BLUE BABY)

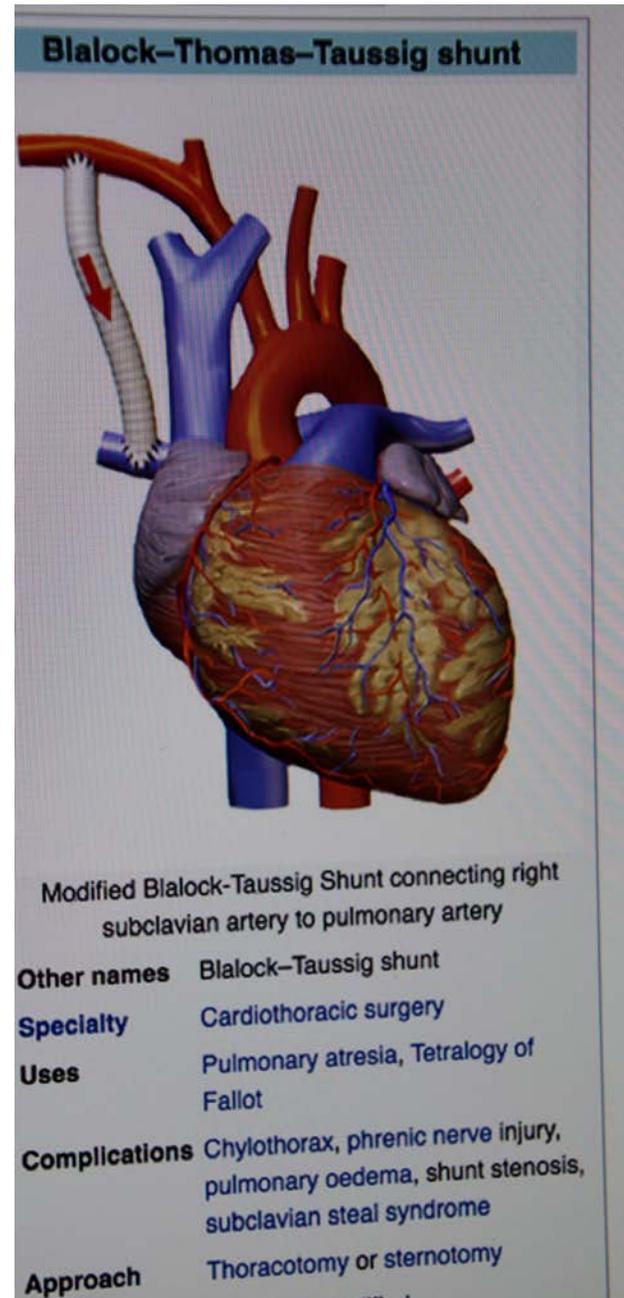
### DEFECTS:

1. VENTRICULAR SEPTAL DEFECT
2. PULMONARY STENOSIS
3. MISPLACED AORTA
4. THICKENED RIGHT VENTRICLE



# BLALOCK-THOMAS-TAUSSIG SHUNT FOR TETRALOGY OF FALLOT

PERFORMED ON A ONE-YEAR OLD GIRL AT JOHNS HOPKINS HOSPITAL, 11/29/1944.



# WORLD WAR II

- The need for improvements in cardiac surgery escalated with a fervor never seen before.
- Soldiers with shell fragments and bullets lodged inside their chests and hearts begged for help as military physicians pondered how to save them.
- To do nothing was dangerous, but to remove the foreign objects in the heart was almost surely fatal.



## **DR. DWIGHT HARKEN- YOUNG US ARMY SURGEON WWII**

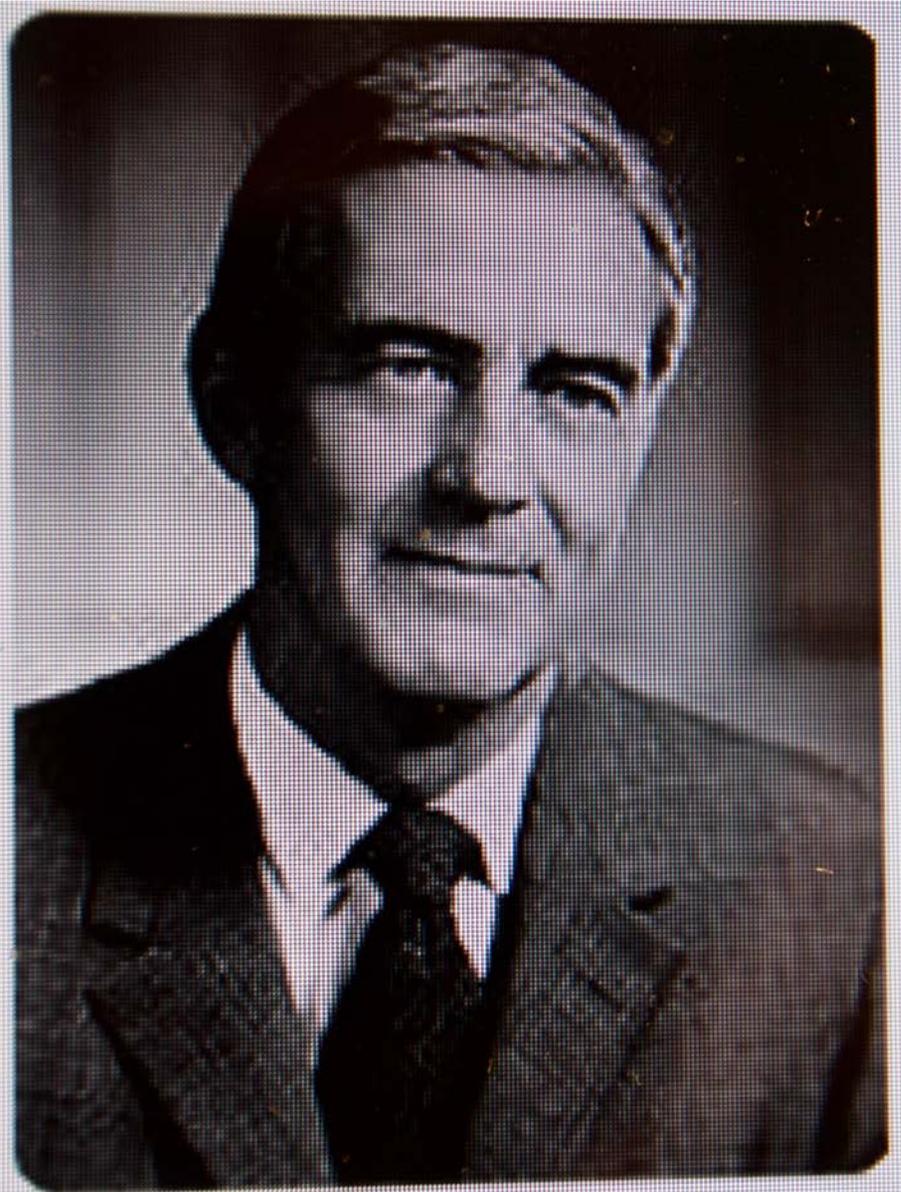
- 1) Conducted 3 different animal studies- sliced open a beating heart and removed the shrapnel with his own finger: a) 1<sup>st</sup> set of the experiment was total failure, all 14 animals died. b) 2<sup>nd</sup> set- 7 animals died. C) 3<sup>rd</sup> set- only 2 of 14 died.
- 2) Harken ready to try the technique on humans.
- 3) He removed 134 missiles from the chest, including 13 in the heart chambers, without losing a single patient.

# Advances of Cardiac Surgery Post World War II

- In 1948, four surgeons: Drs. Dwight Harken of Boston, Horace Smithy of Charlotte, Charles Bailey of Philadelphia and, Russell Brock of London- working independently performed surgery on the Mitral Valve.
- Dr. Harken established the 1<sup>st</sup> Intensive Care Unit. He was a professor of Cardio-Thoracic Surgery at Harvard and Director of Cardiac Surgery at the Peter Bent Brigham Hospital in Boston. He died in 1993 at age 83.

## **DR. WILLIAM BIGELOW- Father of Canadian Cardiac Surgery**

- 1). Dr. William Bigelow theorized that cold temperatures might be the key to open heart surgery. At hypothermic levels, the tissues of the body and brain required less oxygen and, therefore, could survive much more. He presented his experimental findings in dogs in 1950- American Thoracic Surgical Society.
- 2). He co-developed Electronic Cardiac Pacemaker.
- 3). He established the Canadian Cardio-Thoracic Training Program.
- 4). Past President- American Thoracic Surgery Society and Vascular Surgery as well.



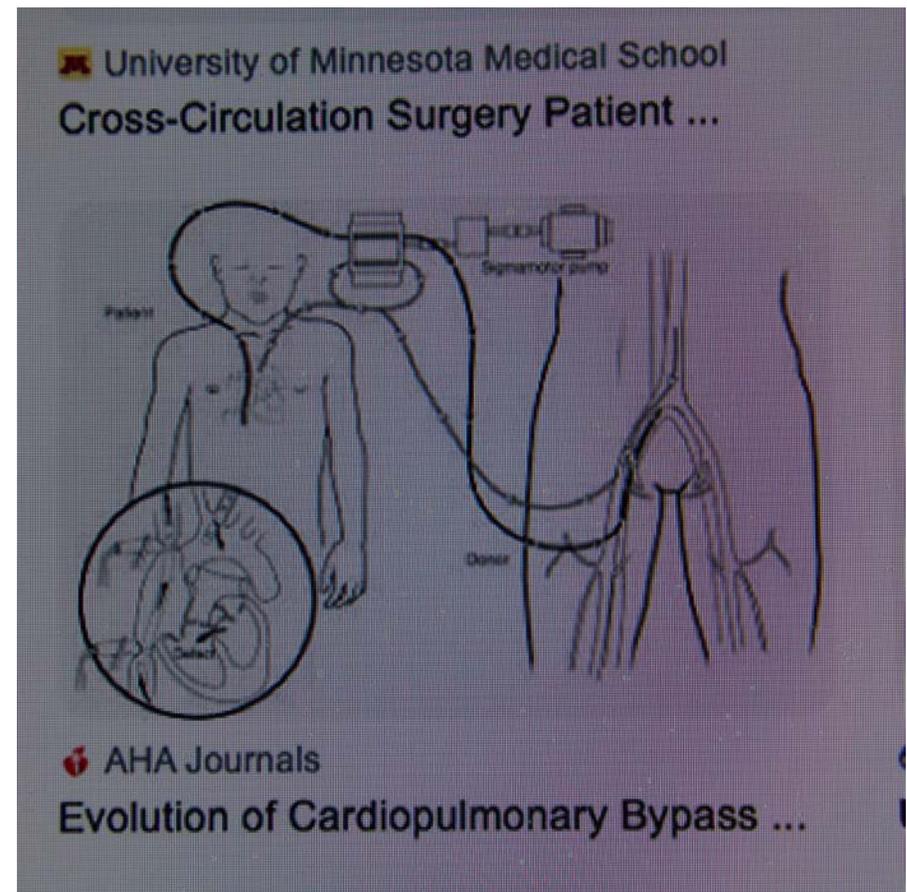
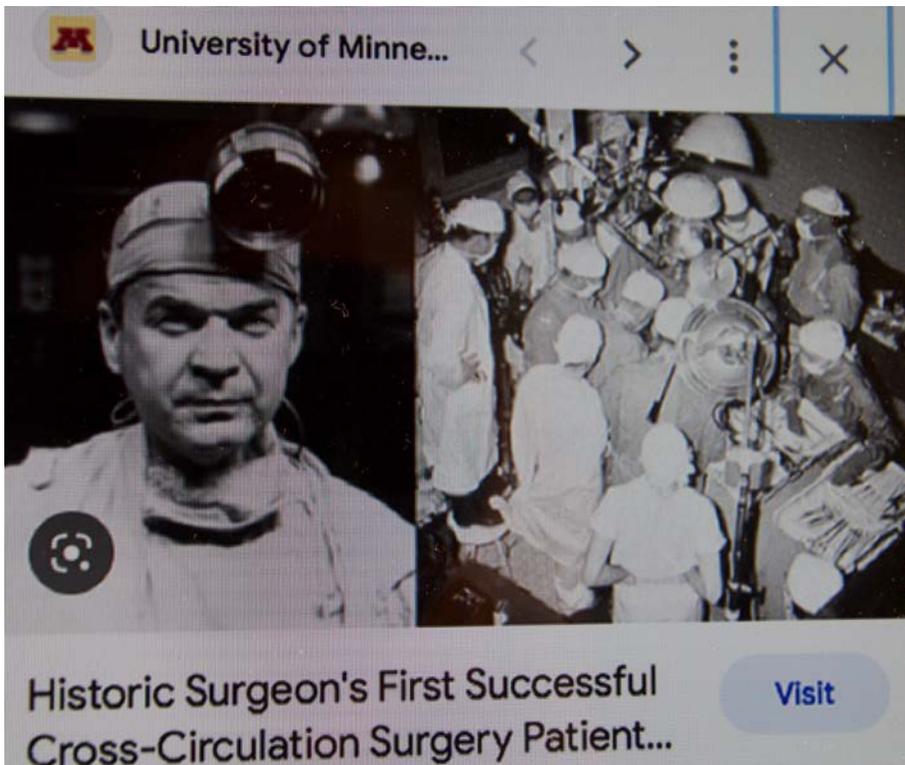
**Cardiovascular Sciences...**

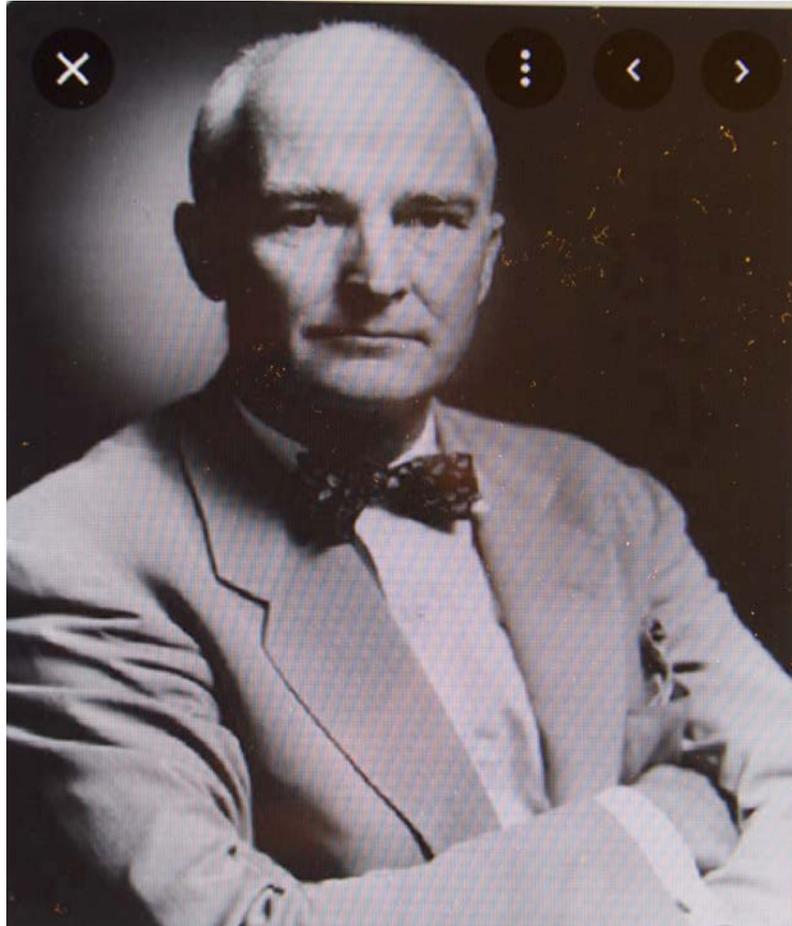
## C. WALTON LILLEHEI

1. Dr. C . Walton Lillehei along with Dr. John Lewis did the first successful open-heart operation, performed at the University of Minnesota, Sept. 2, 1952. They utilized the hypothermia technique.
2. In 1953, he performed first repair of VSD: using cross-circulation.
3. He invented bubble oxygenator which was used at the UM and many centers worldwide for years to come.
4. He developed and implanted the world's first prosthetic heart valves.
5. Co-developer of cardiac pacemakers.
6. Lillehei trained more than 150 cardiac surgeons from 40 nations, including Christiaan Barnard and Norman Shumway.
7. Because he pioneered a direct approach to open heart operations in the 1950's, Lillehei justifiably be called the "FATHER OF OPEN HEART SURGERY."
8. HE DIED IN 1999 AT AGE 81.



# Dr. Lillehei: Cross-Circulation Cardiac Surgery

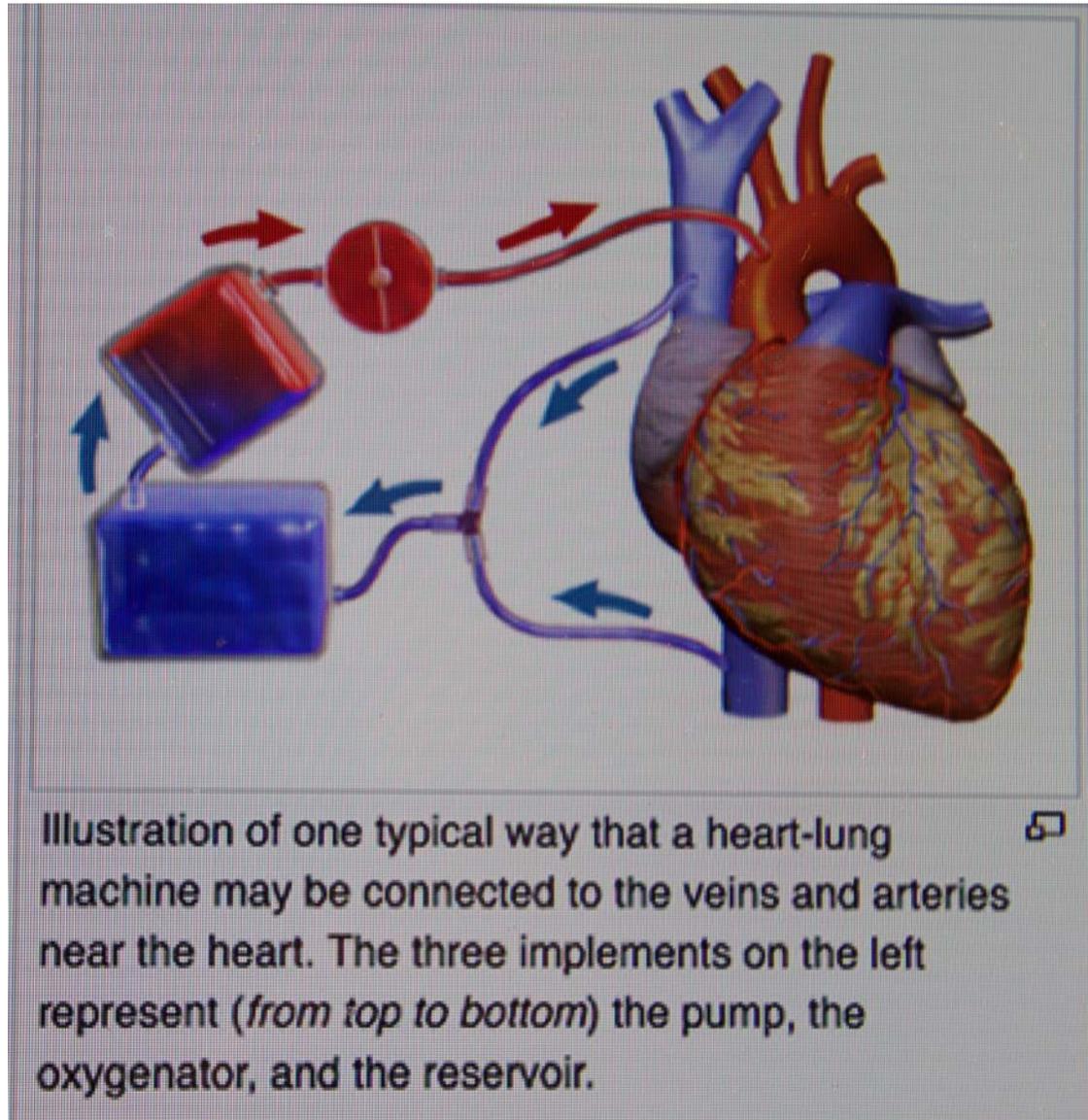




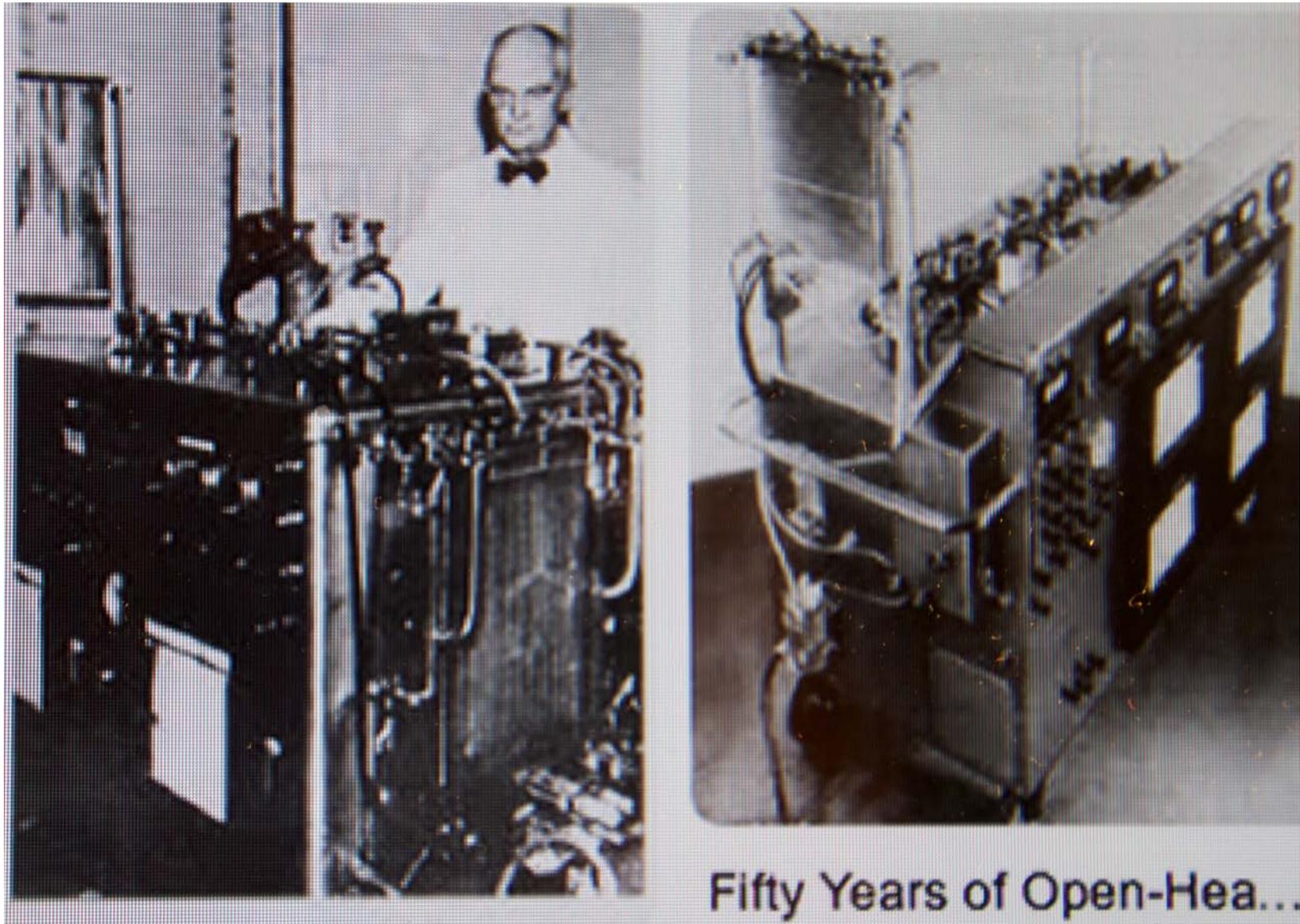
## **DR. JOHN GIBBON- INVENTOR OF HEART-LUNG MACHINE**

- 1) Gibbon's first opportunities to use his machine on humans failed tragically, March 1952.
- 2) A year later Gibbon conducted the first trial with total cardiopulmonary bypass, again a failure.
- 3) On May 6, 1953, he used heart-lung machine on a young woman with Atrial Septal Defect successfully.

# The Heart Lung machine illustration



# THE HEART LUNG MACHINE: New Era of heart surgery had begun



Fifty Years of Open-Hea...



**Dr. John Kirklin, Mayo Clinic, perfected the heart lung machine.**

He performed the first successful open heart surgery using the new Heart Lung machine, 1954.

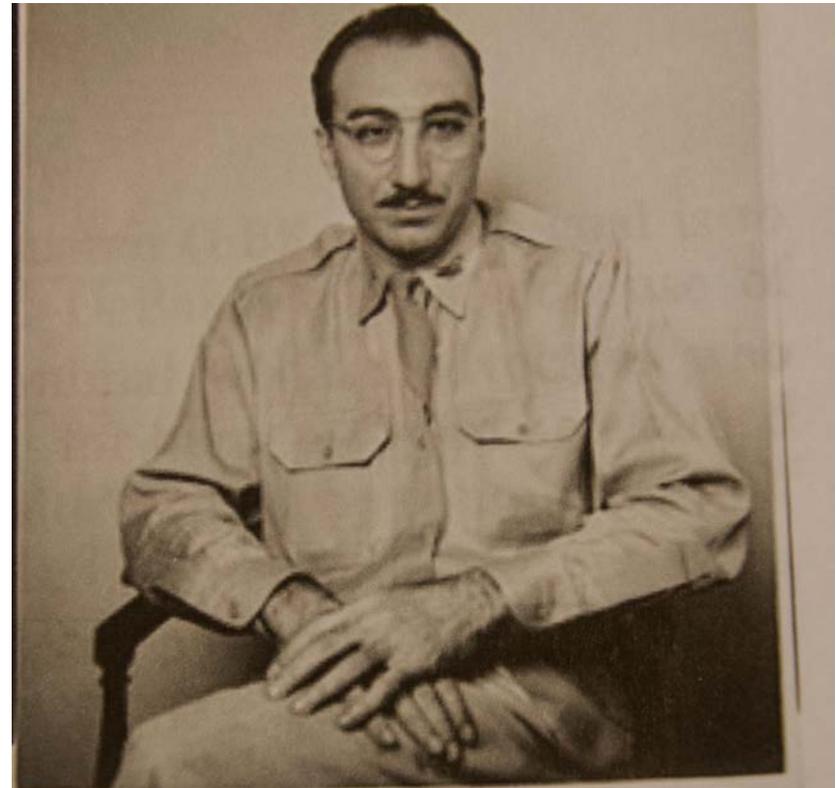
# MICHAEL Debakey



1935: DeBakey completed his surgical fellowship at the University of Strasbourg under Professor René Leriche.

# Colonel Michael DeBakey

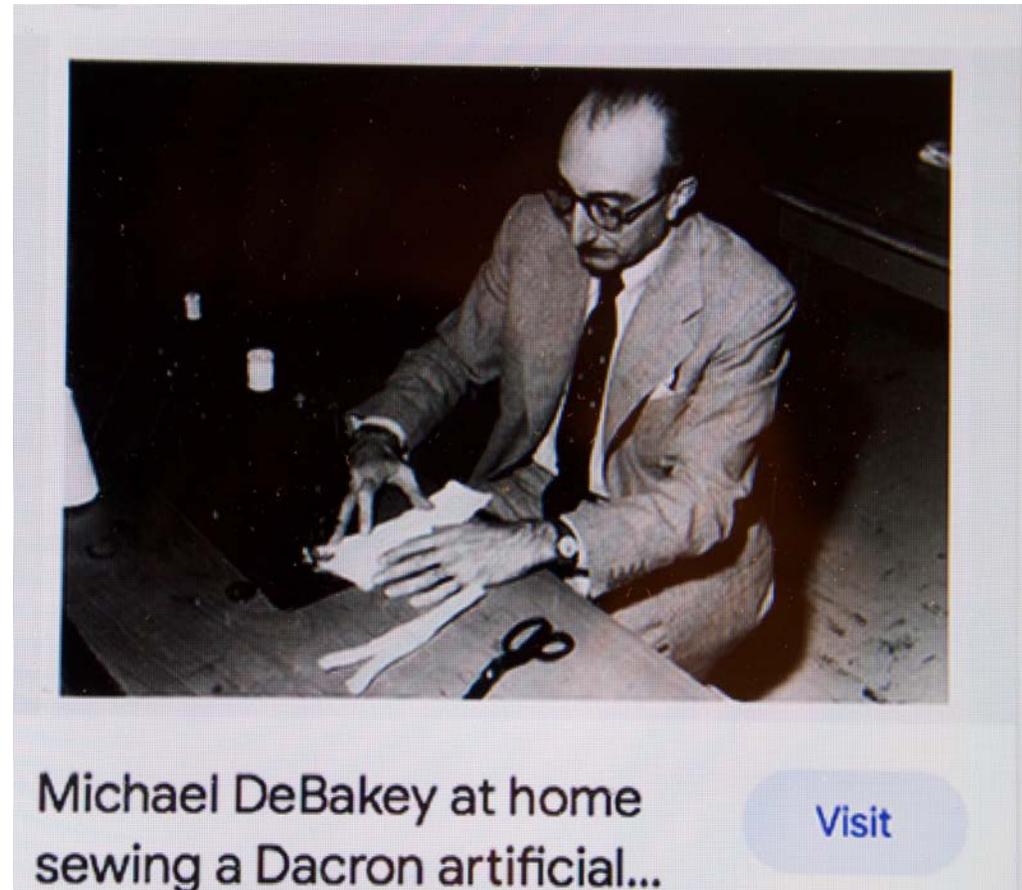
1. He served in the Surgical Consultants' Division- US Army Surgeon General Office.
2. Developed and deployed in 1943, the Mobile Auxiliary Surgical Hospital(MASH).
3. Organized and help developed the Veteran Administration Hospital(VA).
4. Architect of the National Research Council's Medical Follow-up agency for the wounded veterans.



Colonel Michael DeBakey, Medical Corps, US Army, October 1945-February 1946

## Dr. Michael DeBakey

1. He developed Roller-Pump essentially component of heart-lung machine.
2. In 1952- along with Dr. Denton Cooley were the first American surgeons to successful repair abdominal aneurysm, removing weakened-distended vessel and replacing it with cadaver aorta.
3. In 1953, the first to performed carotid endarterectomy for stroke.
4. He developed Dupont's Dacron material into a vascular grafts. First to repair dissecting aortic aneurysm.
5. In 1964, he did the first successful coronary bypass surgery. In 1968, multiple-organ transplant.
6. Despite the demands of surgery, teaching and administrative duties, DeBakey also devoted substantial time to surgical research and the development of total and partial mechanical hearts and cardiac assist devices.
7. Director- Cardiac Surgery at Baylor College of Medicine and received the Presidential Medal of Freedom and the Congressional Gold Medal.
8. He operated more 60,000 patients, wrote 1600 Medical Articles, authored many textbooks and trained thousands of Vascular and Cardiac surgeons.



# Top 10 causes of death USA

## Number of deaths for leading causes of death

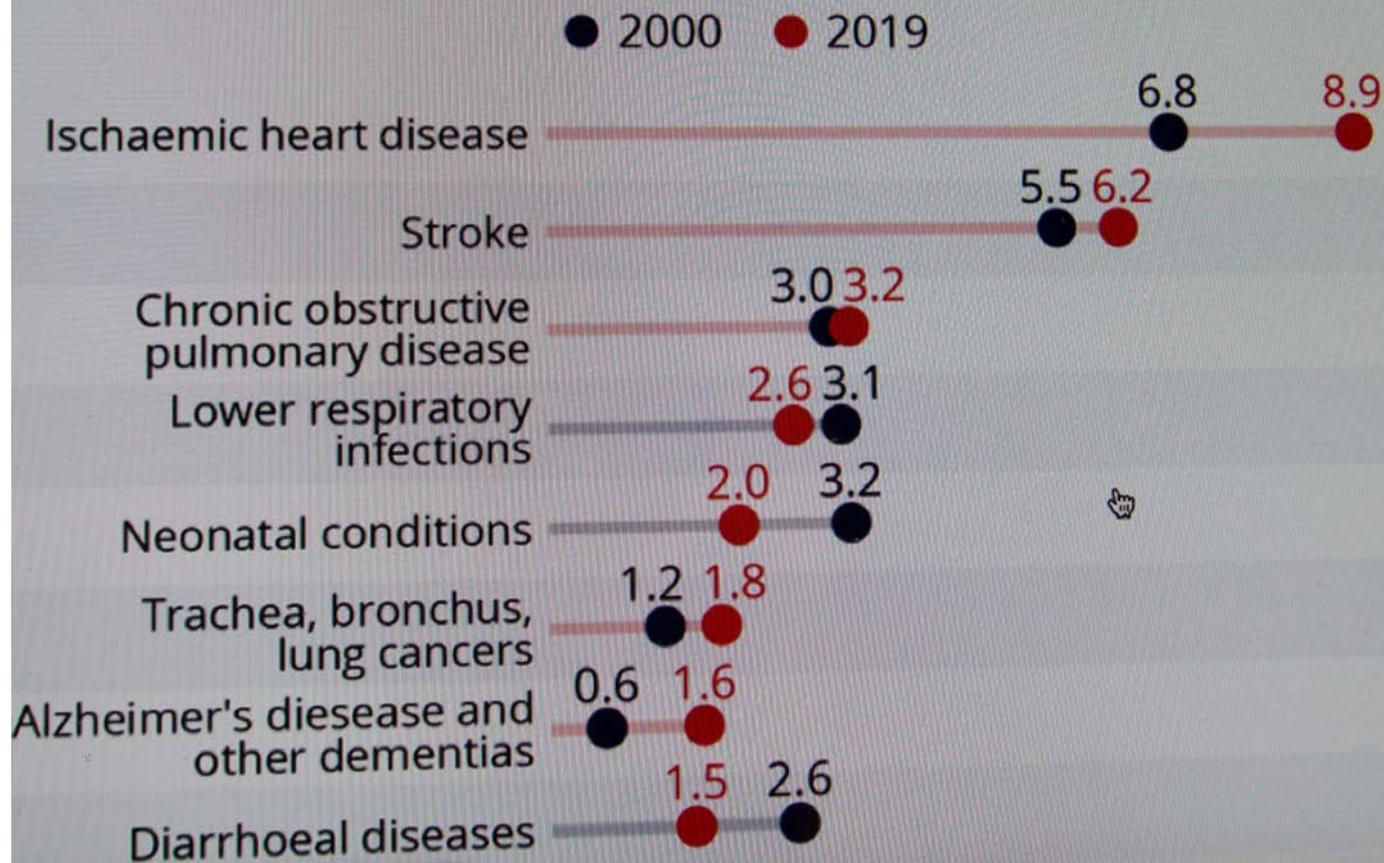
- Heart disease: 696,962
- Cancer: 602,350
- COVID-19: 350,831
- Accidents (unintentional injuries): 200,955
- Stroke (cerebrovascular diseases): 160,264
- Chronic lower respiratory diseases: 152,657
- Alzheimer's disease: 134,242
- Diabetes: 102,188
- Influenza and pneumonia: 53,544
- Nephritis, nephrotic syndrome, and nephrosis: 52,547

Source: [Mortality in the United States, 2020, data table for figure 4](#)

# Causes of Death World-Wide

## The World's Leading Causes Of Death

Total number of people who died from the following conditions (in millions)



WHO Coronavirus (COVID-19) Dashboard Overview Measures Table View Data More Resources



Cases

Total

**242,985**  
new cases in last 24hrs

**636,440,663**  
cumulative cases

**6,606,624**  
cumulative deaths

**Globally**, as of **4:24pm CET, 25 November 2022**, there have been **636,440,663 confirmed cases** including **6,606,624 deaths**, reported to WHO. As of **16 November 2022**, a total of **12,943,741,540 vaccine doses** have been administered.

# TYPES OF CARDIAC (HEART) SURGERY

1. Open Heart Surgery- surgeon makes a large incision (cut) in the chest to open the rib cage and operate on the heart. “Open” refers to the chest, not the heart.
2. Congenital Heart Surgery- corrective surgery to treat a genetic heart defect.
3. Valve Surgery- to repair or replace heart valve that is not working correctly.
4. Coronary Artery bypass graft (CABG) surgery- procedure used in which the block portion of the coronary artery is bypass with another piece of blood vessel.
5. Arrhythmia surgery- a procedure to correct heart rhythms such as atrial fibrillation or ventricular tachycardia.
6. Left Ventricular assist device (LVAD)- a mechanical device which aids in the pumping action of the blood- also total artificial heart(TAH).

# TYPES OF CARDIAC (HEART) SURGERY

- 7) Left Ventricular remodeling/surgical ventricular restoration- technique that provides the heart with more normal heart shape after heart attack.
- 8) Myectomy/Myotomy- surgical procedure that removes a portion of the enlarged heart wall.
- 9) Aneurysm Repair.
- 10) Insertion of a cardiac pacemaker or an implantable cardioverter defibrillator (ICD).
- 11) Heart Transplant- a surgical option to treat advanced heart failure, a condition that occurs when the heart can't pump enough blood to meet the needs of the body's organs.
- 12) Minimally Invasive catheter procedures.

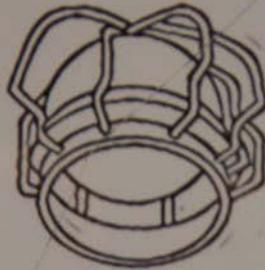
- THE 1960'S- EXPLOSIONS OF POSSIBILITIES

# Heart Valve Replacement Surgery

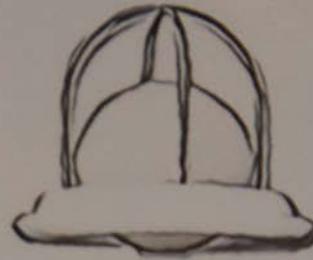
1. Dr. Charles Hufnagel, director of Surgery at Georgetown University Medical Center implanted an artificial valve (1952) in the aorta of a 30-year-old woman suffering from RHD. Invented the Hufnagel heart valve.
2. Dr. Albert Starr along with Lowell Edwards, a retired engineer perfected an effective and durable prosthetic valve- was a revolutionary breakthrough that would remain the standard for over three decades. He performed the first successful MV replacement in September 1960, using the Starr-Edwards prosthetic valve.
3. In 1963, Dr. Donald Ross- UK: used tissue valve; homograft (human), xenograft (bovine and porcine).



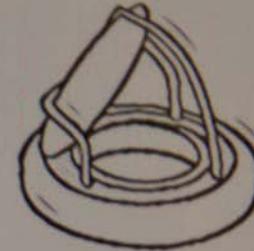
Hufnagel Valve



Harken Soroff



Starr-Edwards



Lillehei-Cutter



Björk-Shilley



St. Jude Regent



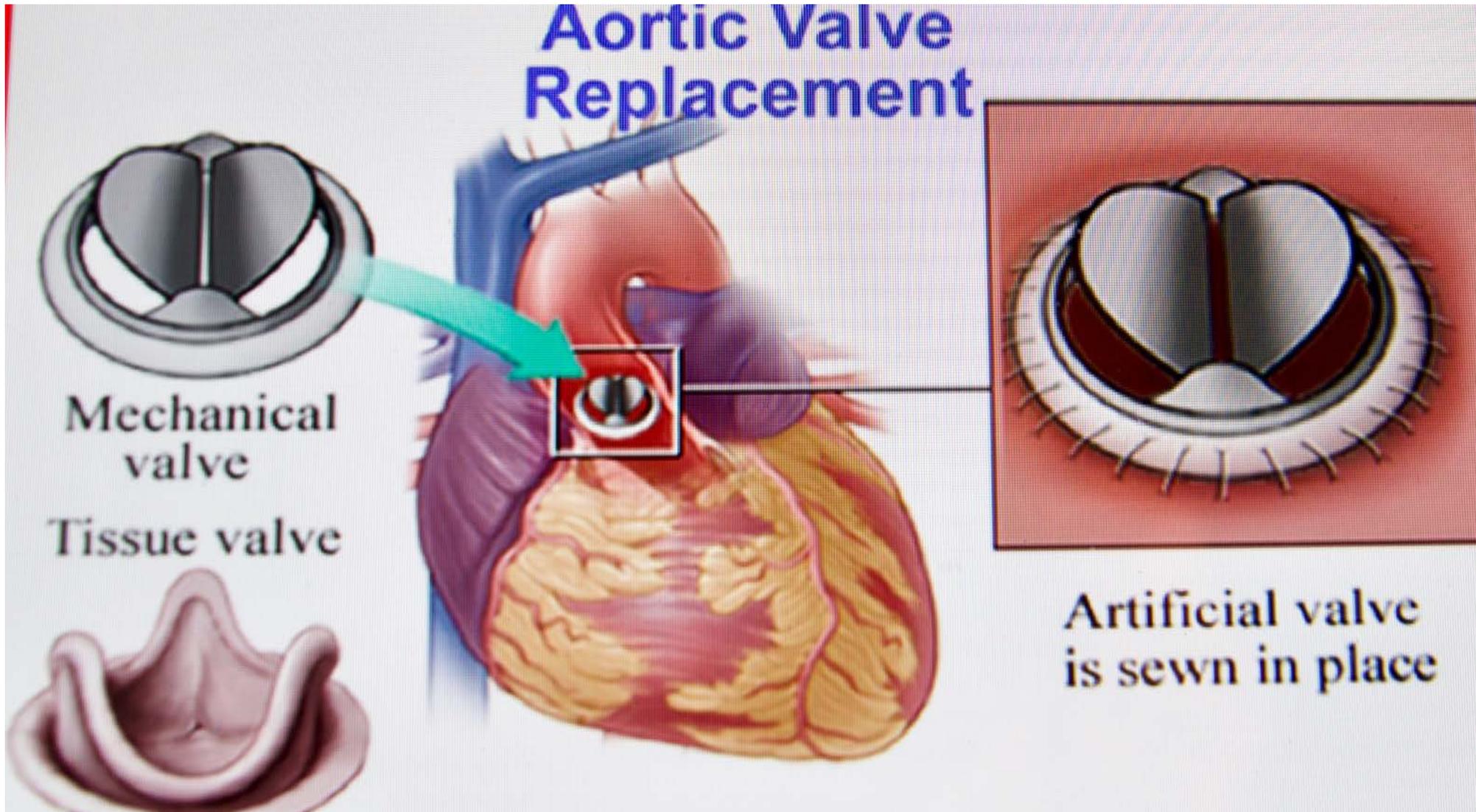
Carbomedics



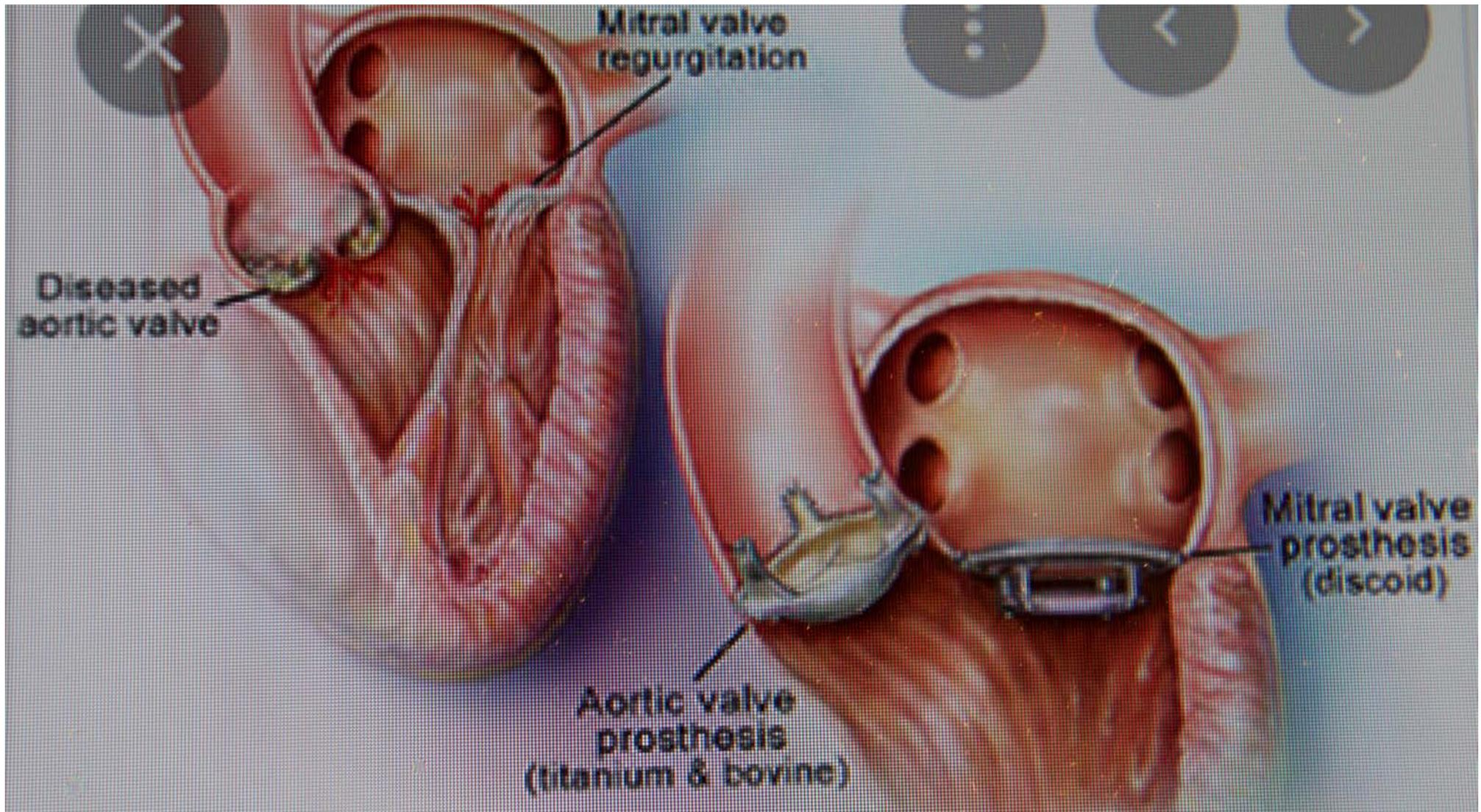
Medtronic Open  
Pivot

**Figure 1:** Mechanical heart valve evolution. From

# Aortic valve replaced by mechanical valve



# Aortic and Mitral valves replaced with mechanical valves



# CORONARY ARTERY BYPASS GRAFTING (CABG)

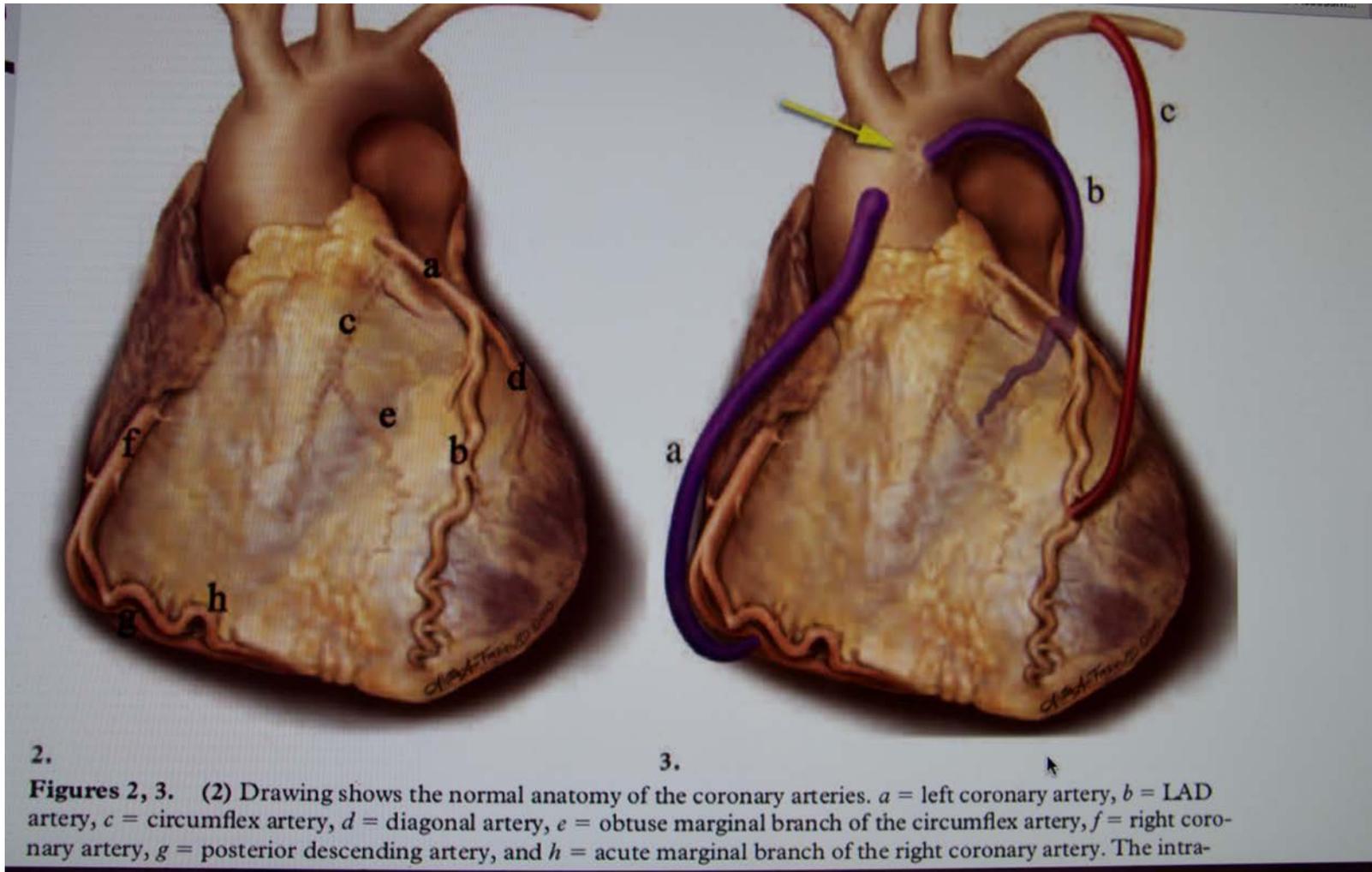
**Drs. Rene Favaloro and Mason Sones-  
Father of Coronary Angiography**



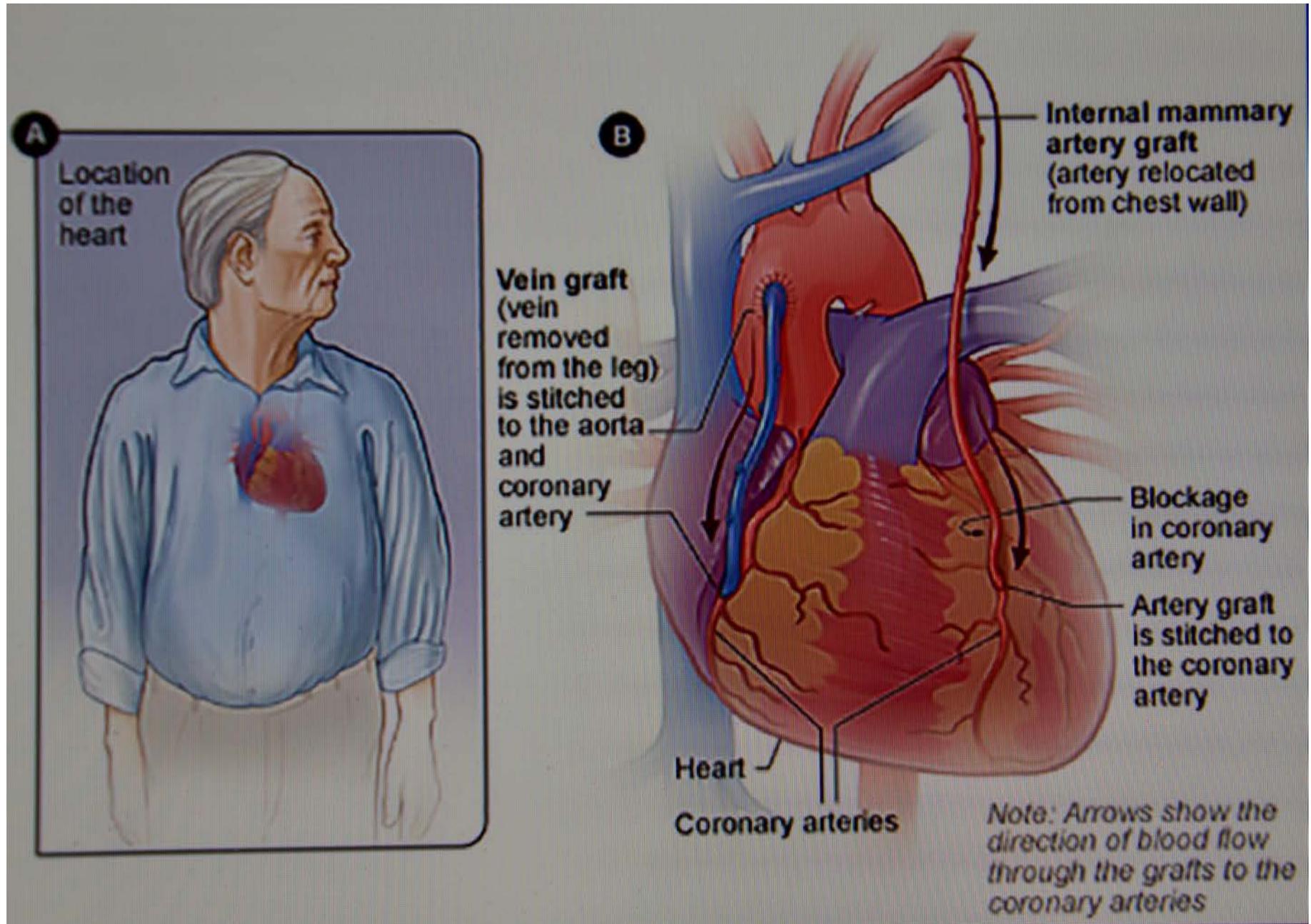
**Dr. Rene Favaloro- Father CABG**



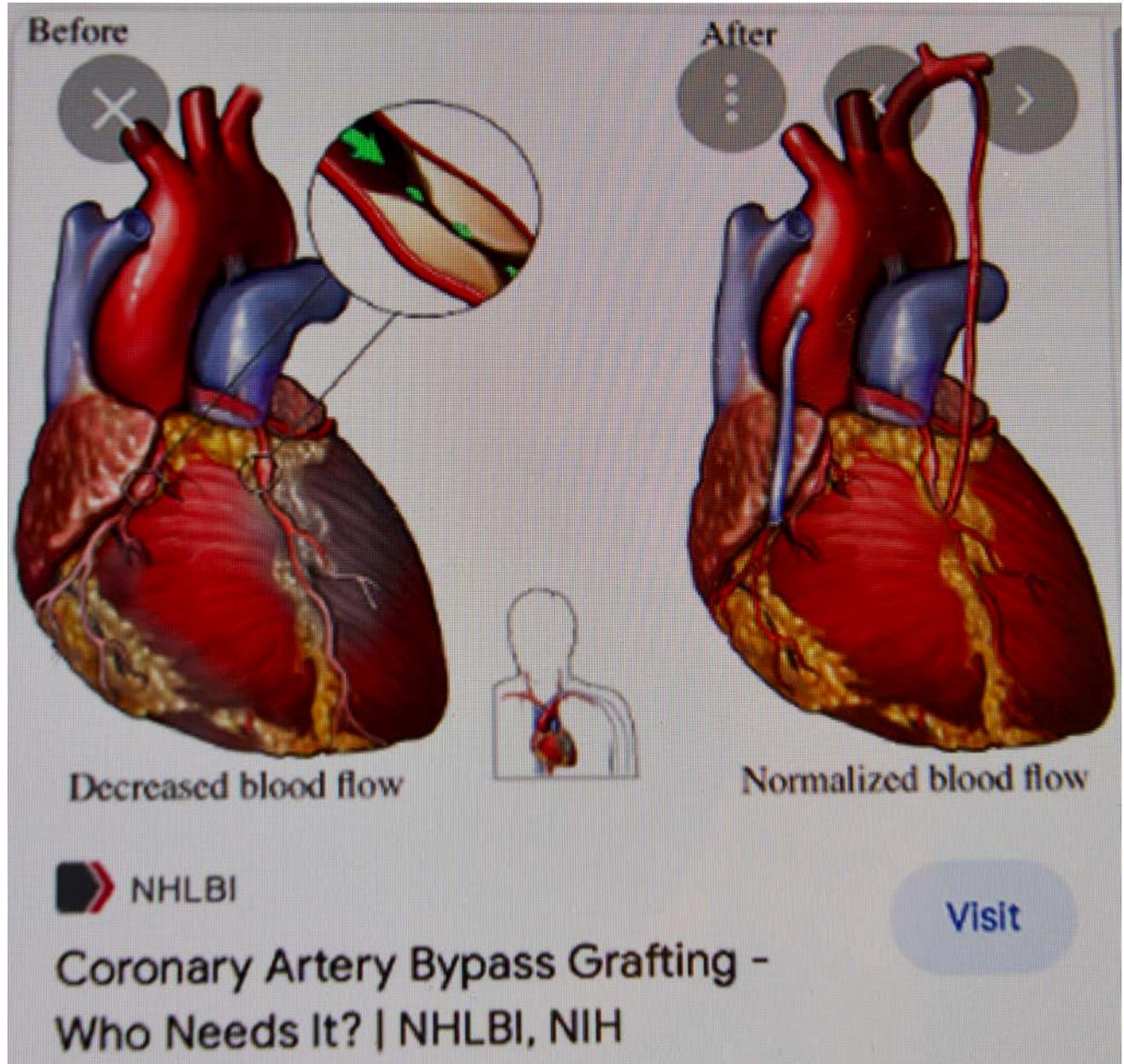
# Anatomy of Coronary Arteries



# Coronary Artery Bypass Graft



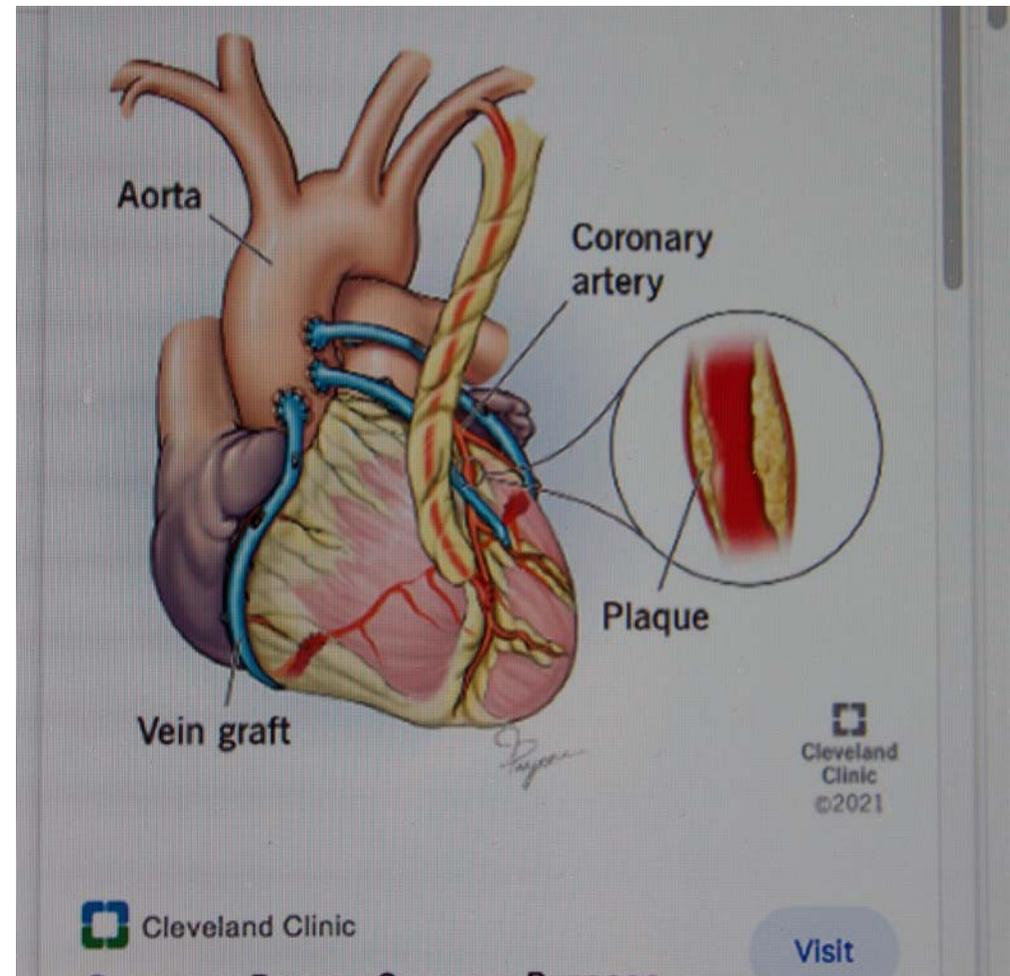
Relieving the  
arterial  
blockage and  
restoring the  
blood flow.



# Coronary Artery Bypass Grafting

**CABG- also called revascularization is the most Cardiac Surgery procedure in the USA**

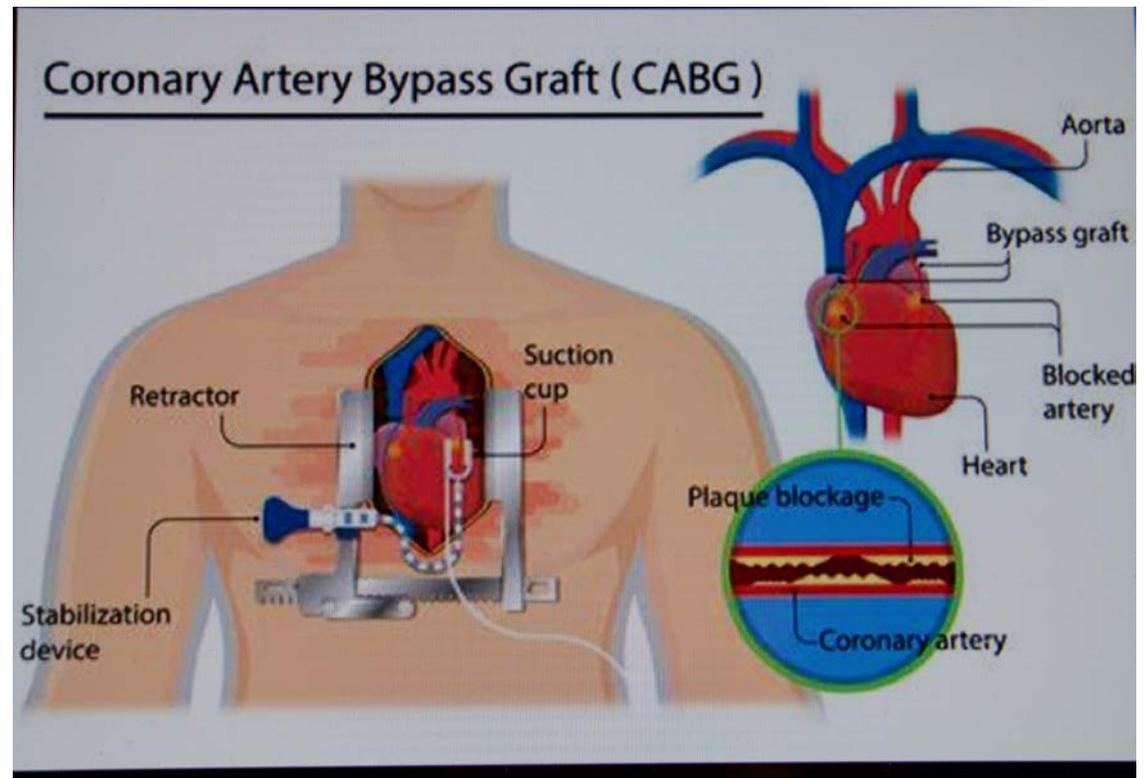
1. By 2000, the number of CABG reached a peak of 500,000 procedures a year in the USA. It has evolved and improved every decade.
2. It has a success rate of 98 plus percent.
3. The number of CABG procedure dropped significantly during the pandemic. Also because of introduction of PCI- percutaneous coronary intervention and coronary stent.



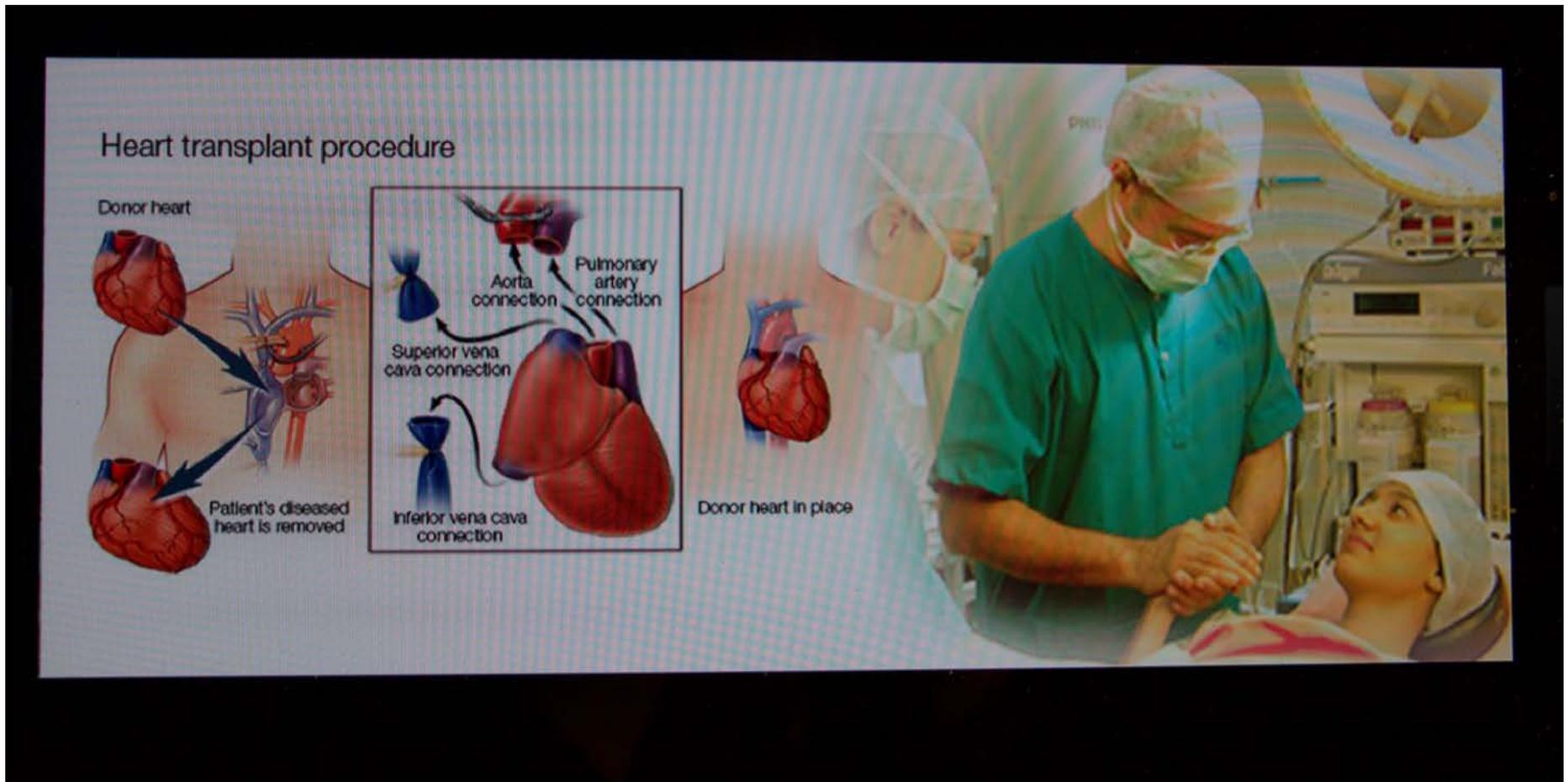
# Types of CABG

1. Off-pump CABG.  
Does not use a heart-lung machine.
2. On-pump CABG. Use a heart lung machine.
3. Minimally invasive CABG. This variation does not use a large incision and splitting/lifting of the sternum and rib cage

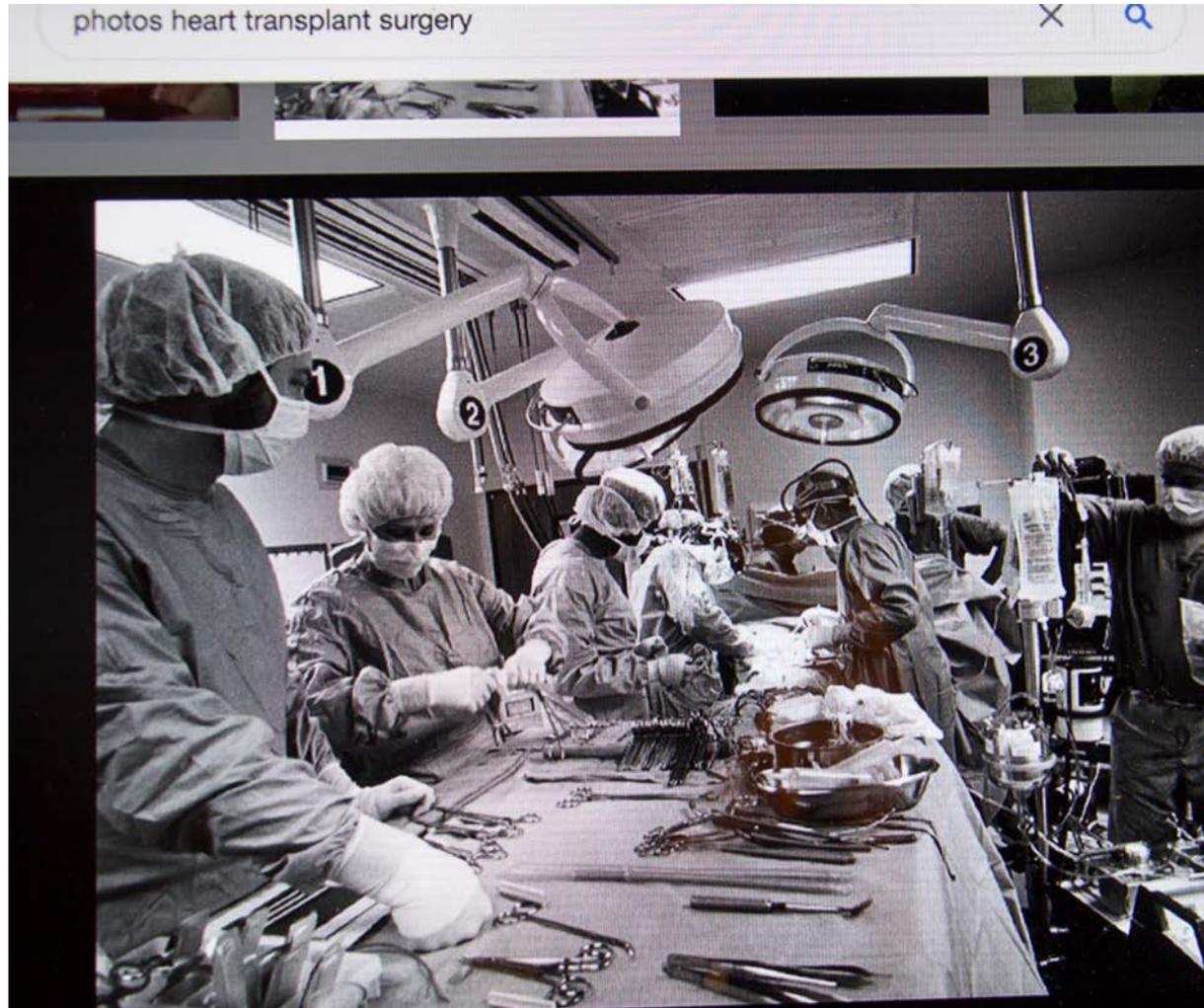
## Off-pump CABG



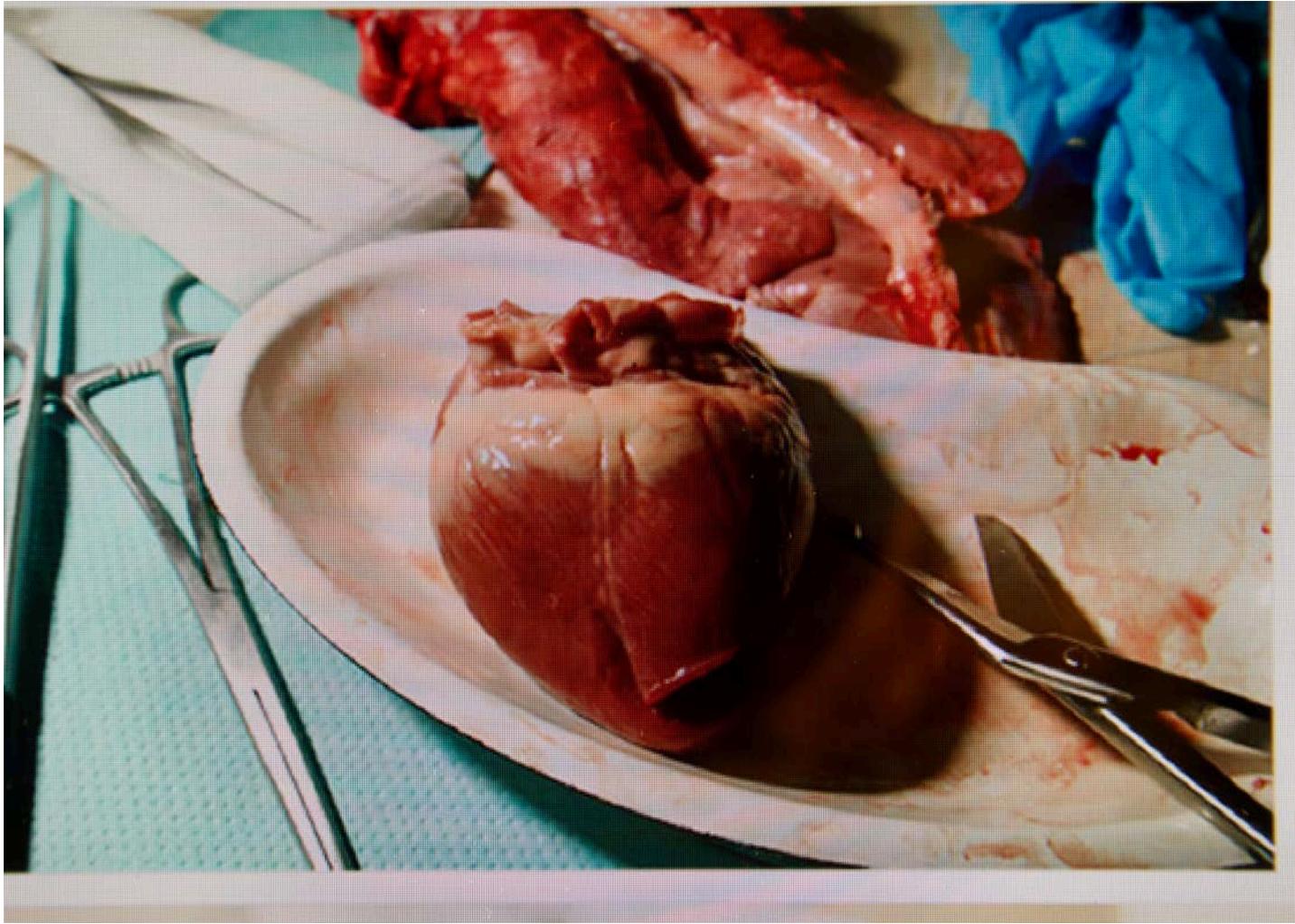
# Heart Transplant



# Heart transplant surgery operating suit



# Donor's heart



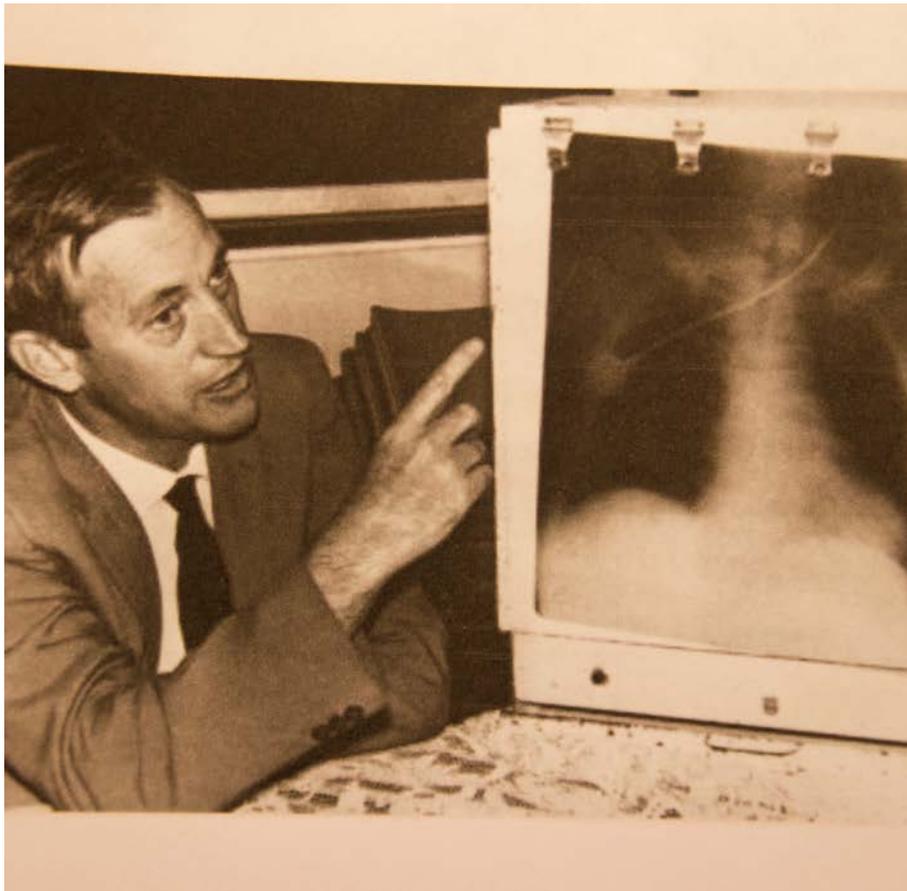


Doctor doing heart operation,closeup — Photo by bel

## Heart transplant surgery procedure

# First heart transplant in the world- December 3, 1967

**Christiaan Barnard: First Heart  
Transplant Surgeon**



**Lewis Washkanky, 53 year-old man, first  
heart transplant patient lived for 18 days**

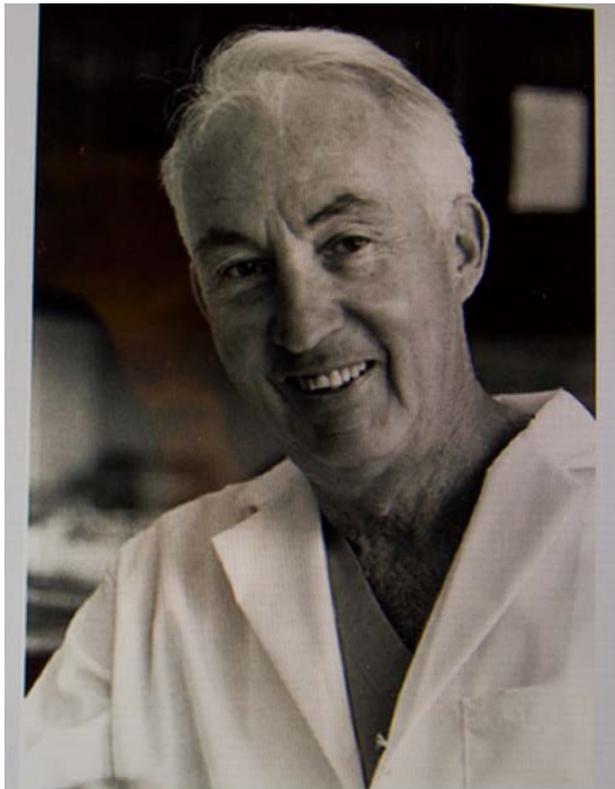


Figure 10.

Louis Washkanky as a patient in Groote Schuur Hospital (with Barnard after the heart transplant).

# Dr. Norman Shumway: 2/10/1923- 2/10/2006

**Second heart transplant patient  
in the US**



Norman Shumway, MD, PhD, was the father of heart transplantation and one of the pre-eminent heart surgeons of his time.

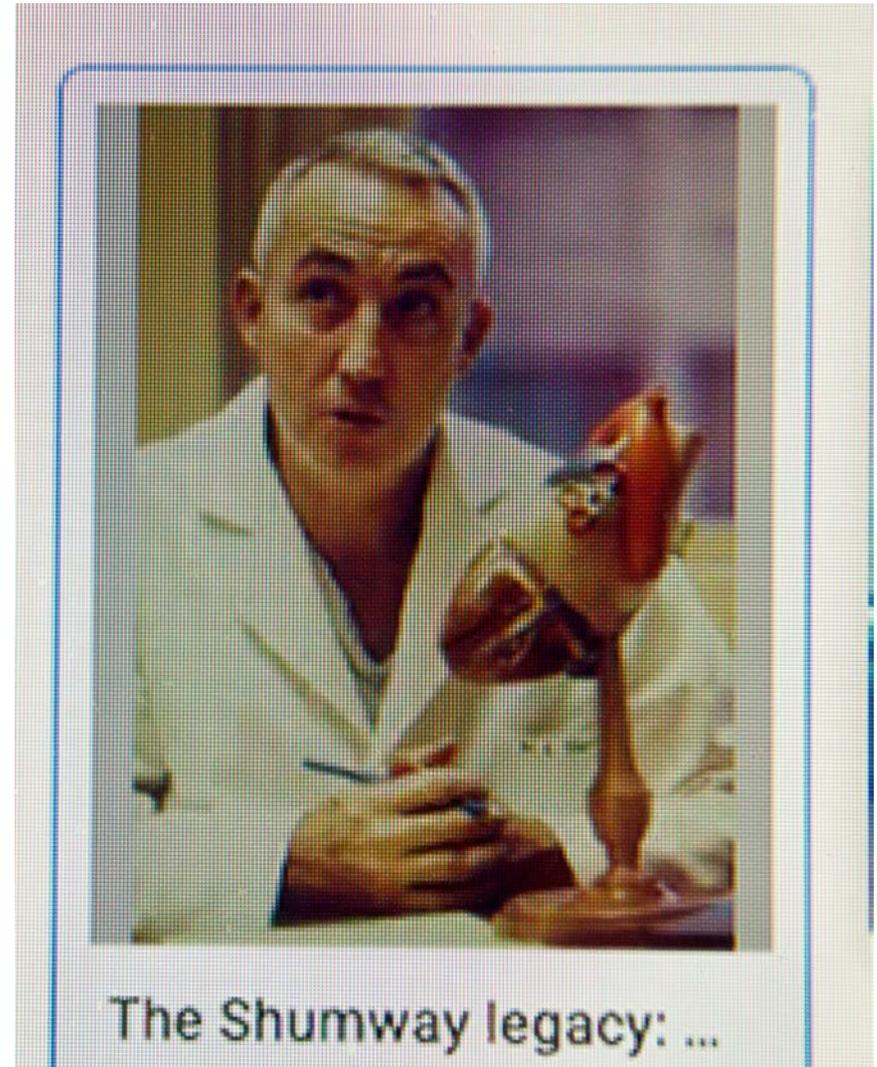


Shumway (left) and Donald Harrison meet the press after they perform the first adult human transplant in the United States on Jan. 6, 1968. The recipient, 54-year-old steel worker Mike Kasperak, lived for 14 days.

# Dr. Norman Shumway

## HEART TRANSPLANT PIONEER

1. Father of heart transplantation.
2. Pioneered the use of cyclosporine to counteract organ rejection.
3. In 1981, the first in the world to performed heart-lung transplantation.
4. He performed 800 heart transplants.



# Cardiac Surgeons: Drs. DeBakey, C. Barnard and A. Kantrowitz



December 24, 1967: South African heart surgeon Dr. Christiaan Barnard with Dr. Adrian Kantrowitz of Brooklyn, New York and Dr. Michael DeBakey of Houston, Texas on the CBS-TV program *Face The Nation* in Washington, D.C.

# Dr. Denton Cooley: 8/22/1920- 11/18/2016, age 96

Why was Denton Cooley important?

Dr. Cooley went on to **perform the first successful human heart transplants in the United States**, and was the **first surgeon anywhere to implant an artificial heart in a human being**. He performed more open-heart operations than any surgeon in the world, including over 20 human heart transplants.



<https://achievement.org> › Achievers ▾

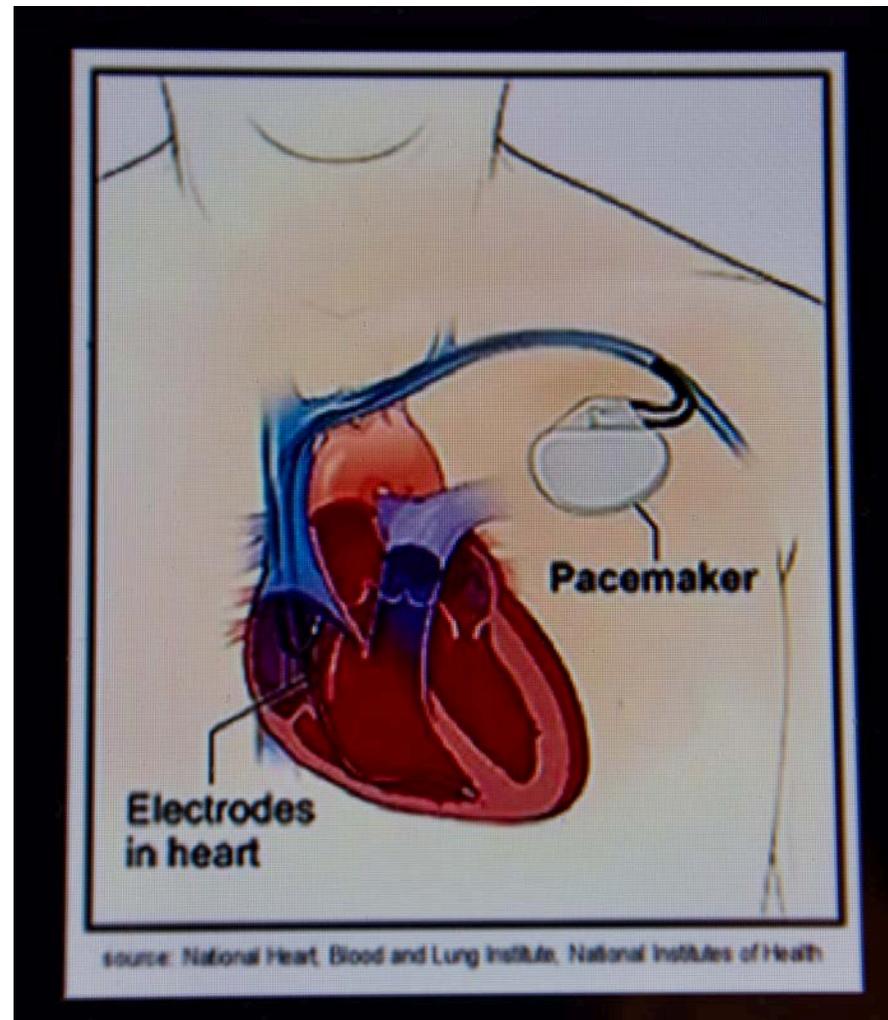
**Denton A. Cooley, M.D. | Academy of Achievement**

# DR. DENTON COOLEY

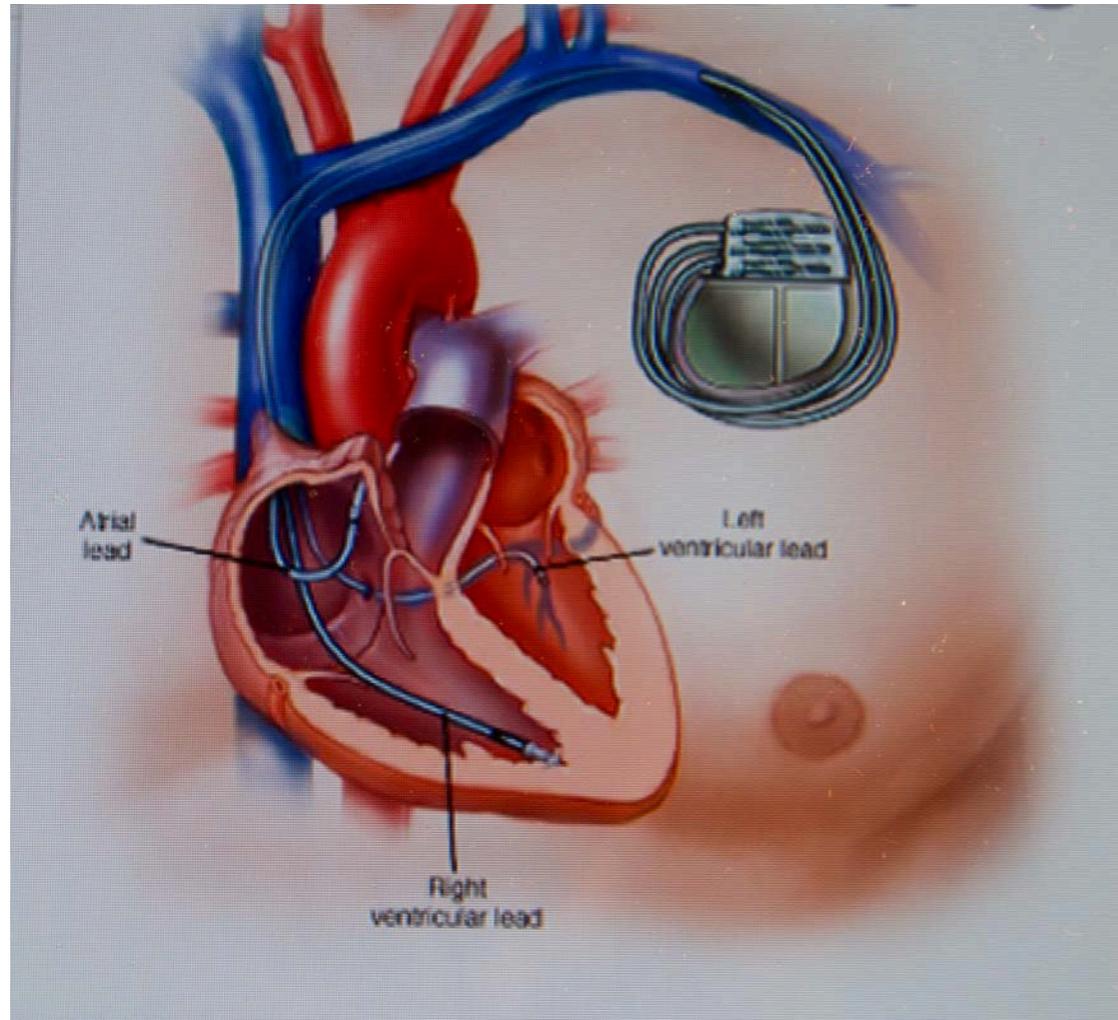
- Dr. Cooley's career spanned the history of modern cardiovascular surgery.
- Performed the first successful human heart transplant in the US (1968).
- First to implant mechanical devices- total artificial heart ( 1969) and left ventricular assist device ( 1978).
- In early days of open heart surgery, few surgeons did more than two operations per day.
- Dr. Cooley, a skilled surgeon could do up to 12 cases a day.
- He and his team performed 115,000 open heart operations.
- He authored or coauthored 1,330 scientific papers and 12 books.
- Recipient of Presidential Medal of Freedom. His name became synonymous with medical and technical excellence.



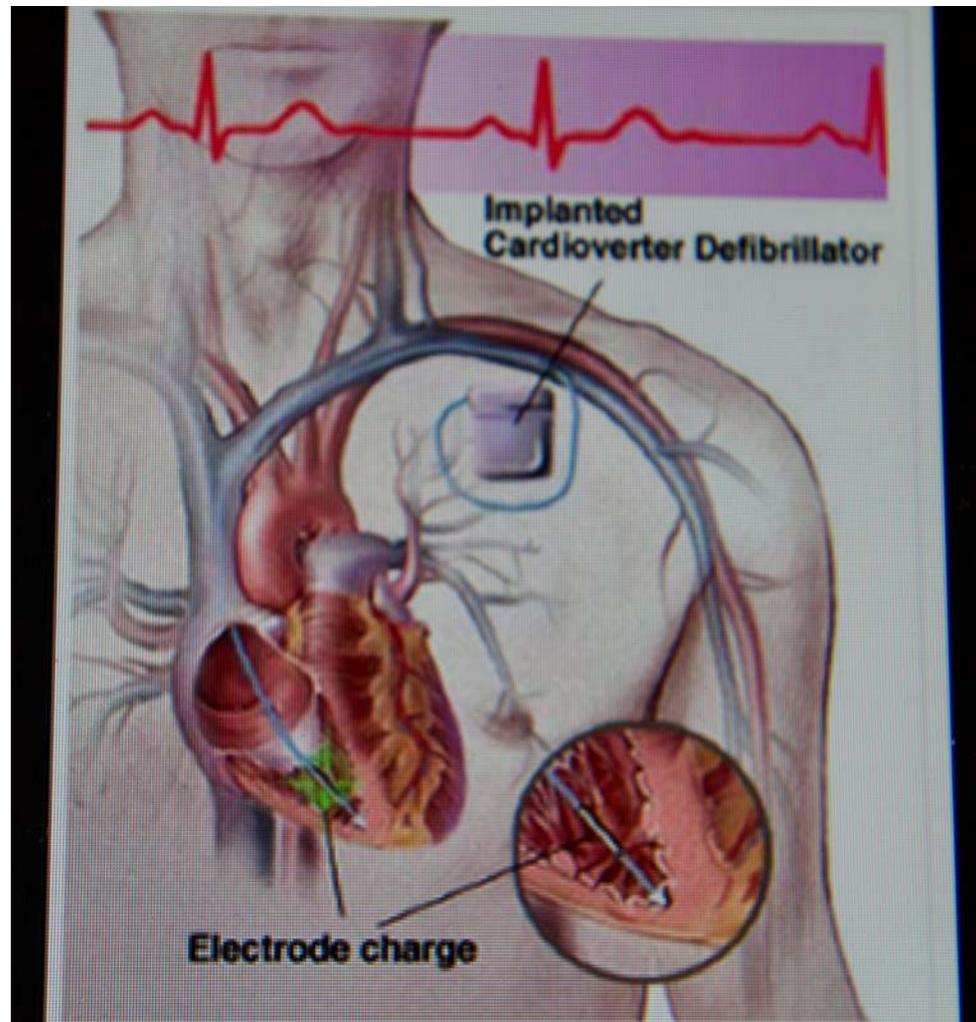
# Cardiac Pacemaker Insertion



# Cardiac Pacemaker Insertion



# Automatic implantable cardioverter-defibrillator ( AICD )

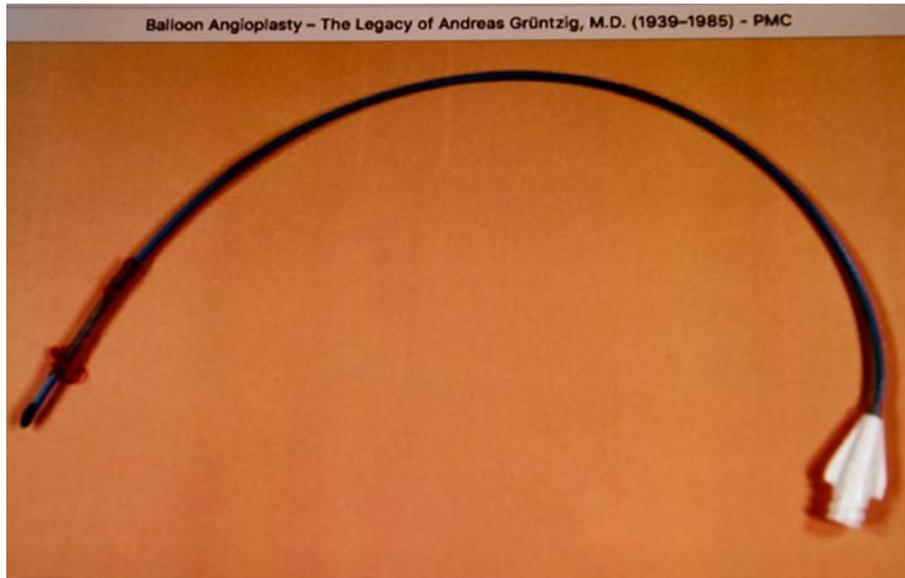


# Minimally Invasive Catheter Procedures

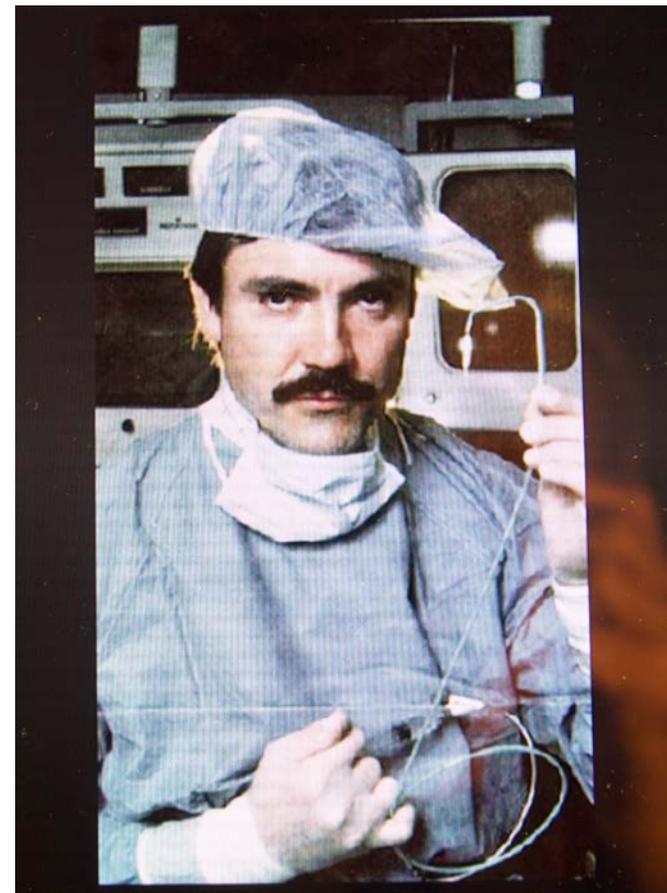
1. Percutaneous coronary intervention (PCI ) and percutaneous transluminal coronary angioplasty (PTCA ): is minimally invasive procedure to open blocked or stenosed coronary arteries allowing unobstructed blood flow to the myocardium ( heart muscle ).
2. Indications for PCI: (a) Acute ST-elevation myocardial infarction (b) Non-elevated ST elevation acute coronary syndrome- unstable angina. (c) Patient having stable heart disease but now having recurrent symptoms.(d) High grade chronic kidney disease. (e) High grade coronary artery lesion 70 % or more on a major artery.(f) Total occlusion of SVG.(g) High-risk stress test findings.

# ANDREAS GRUNTZIG: 1939-1985

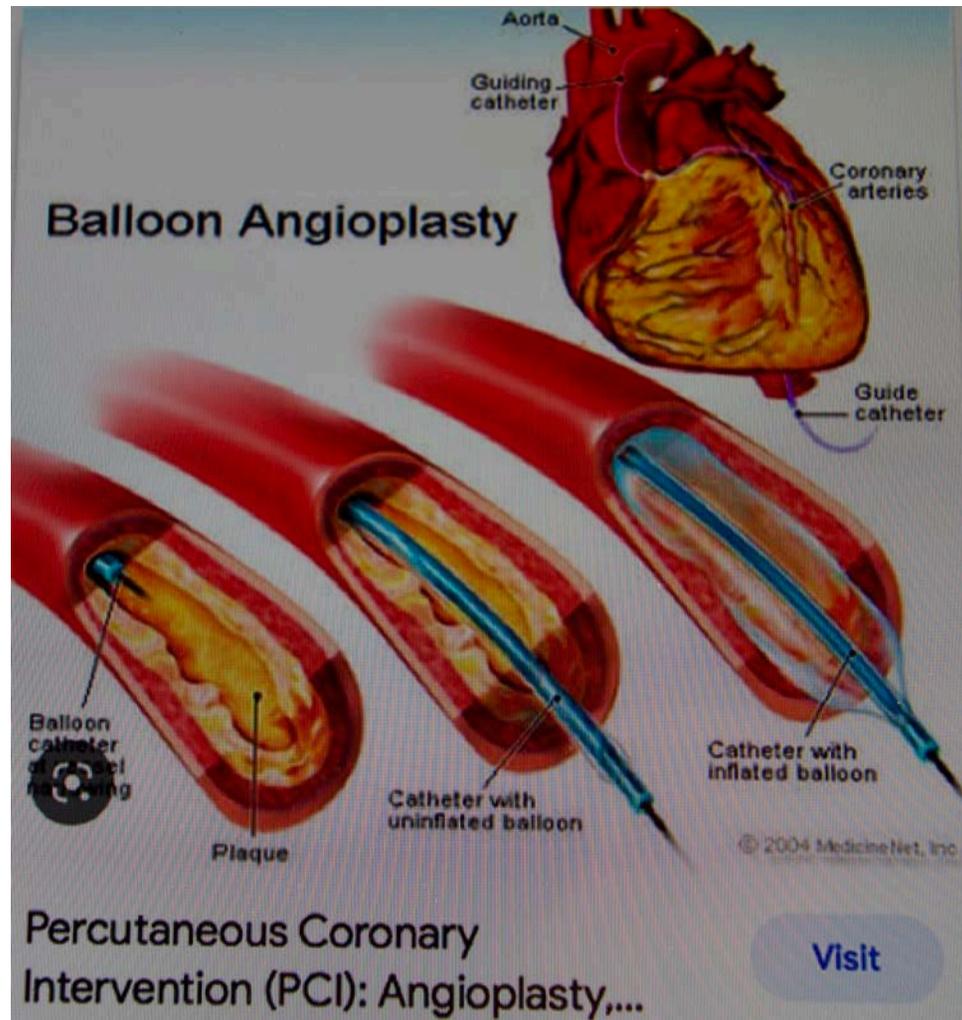
## Angioplasty Catheter



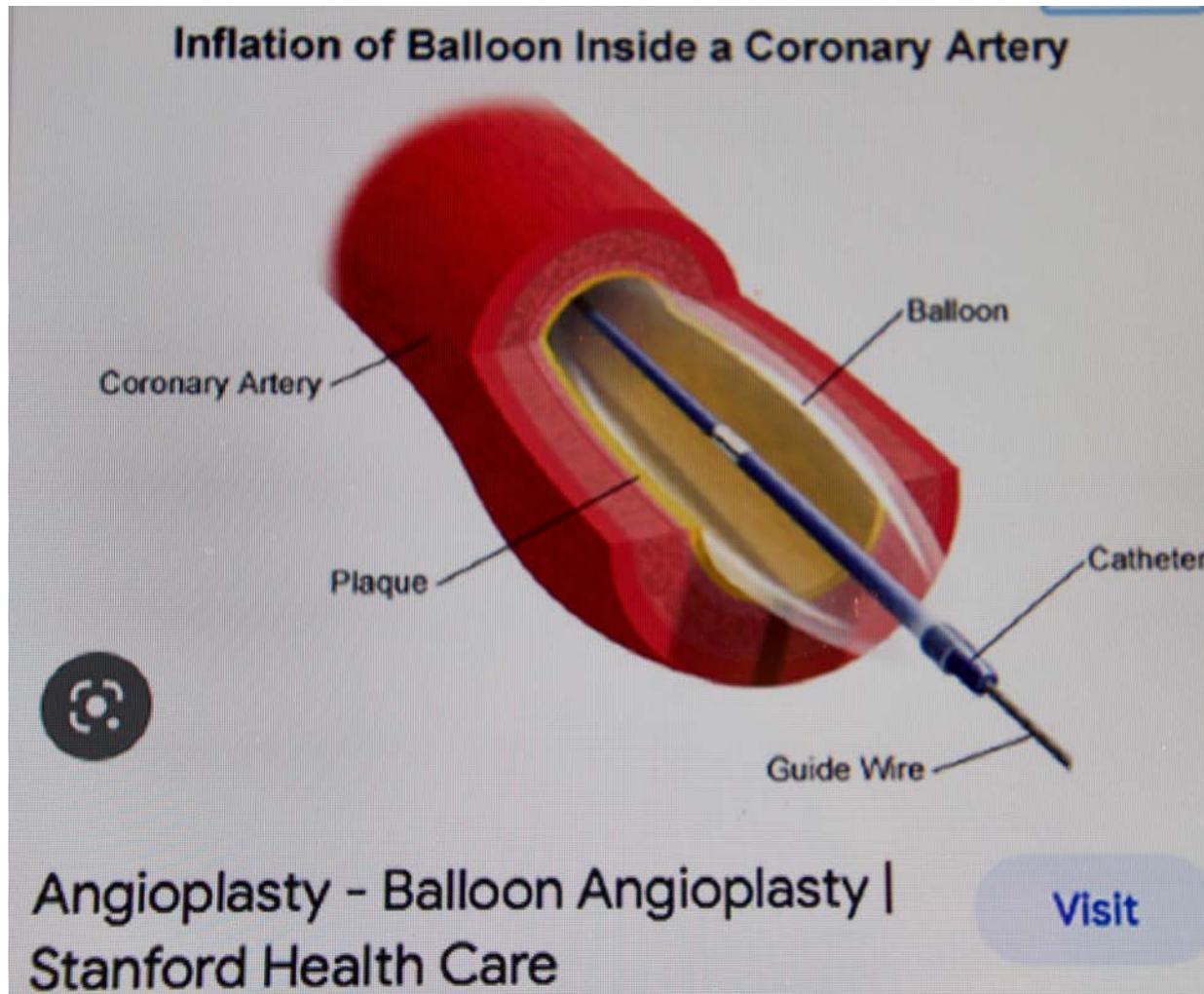
## Father of Percutaneous Catheter Intervention

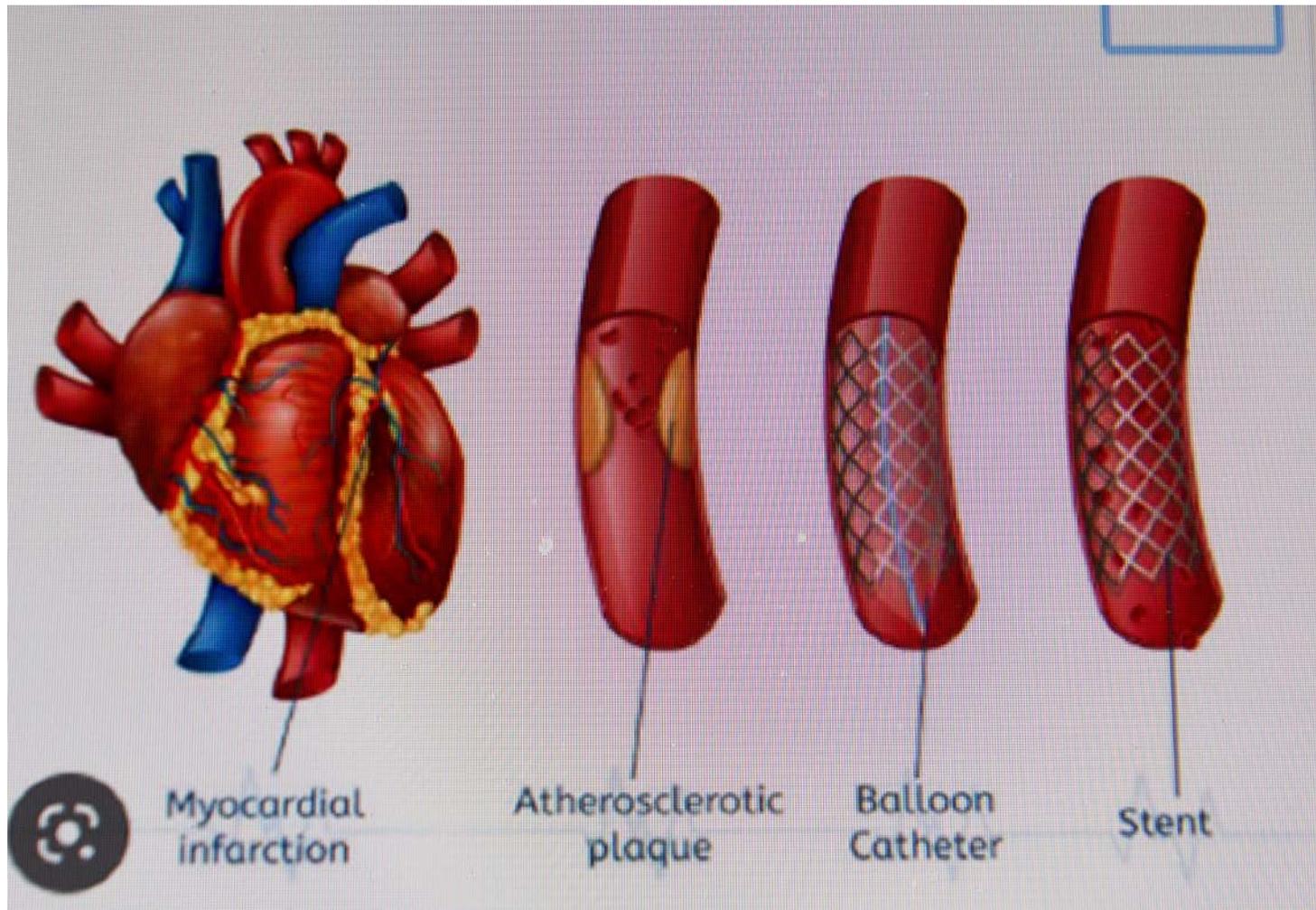


# Percutaneous Transluminal Coronary Angioplasty (PTCA)



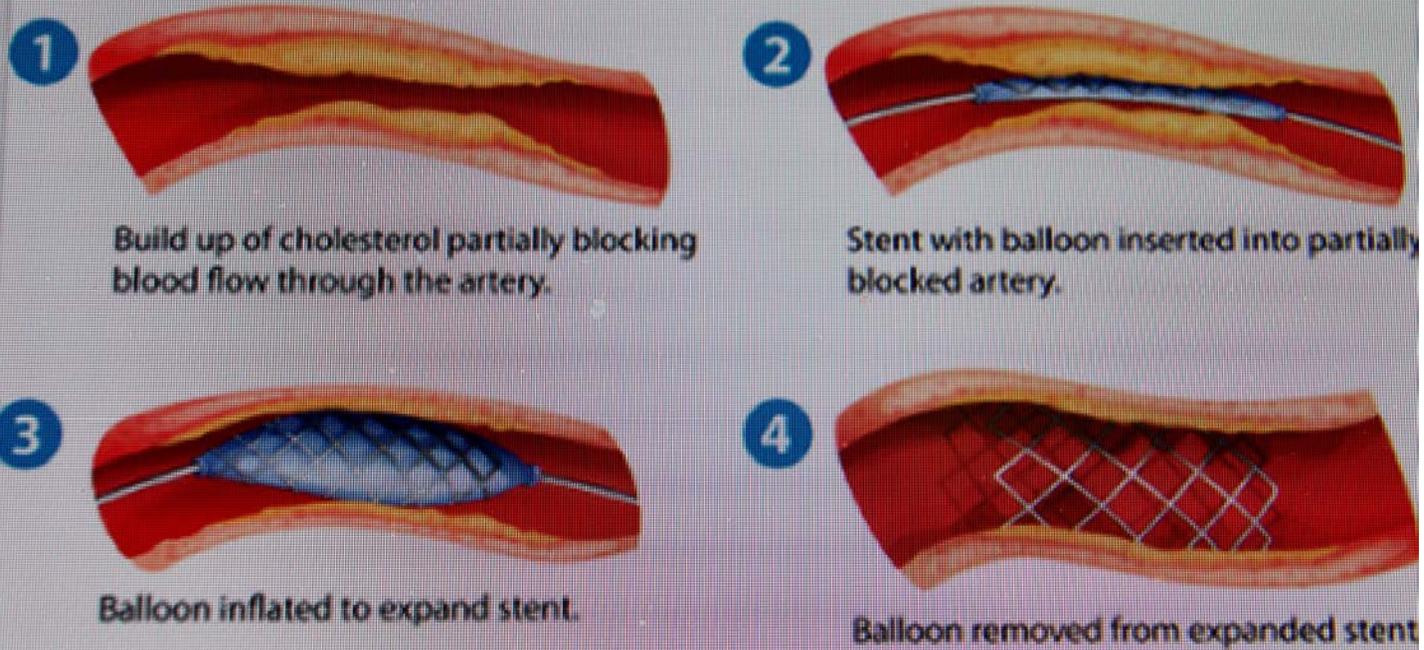
# Percutaneous transluminal coronary angioplasty ( PTCA )





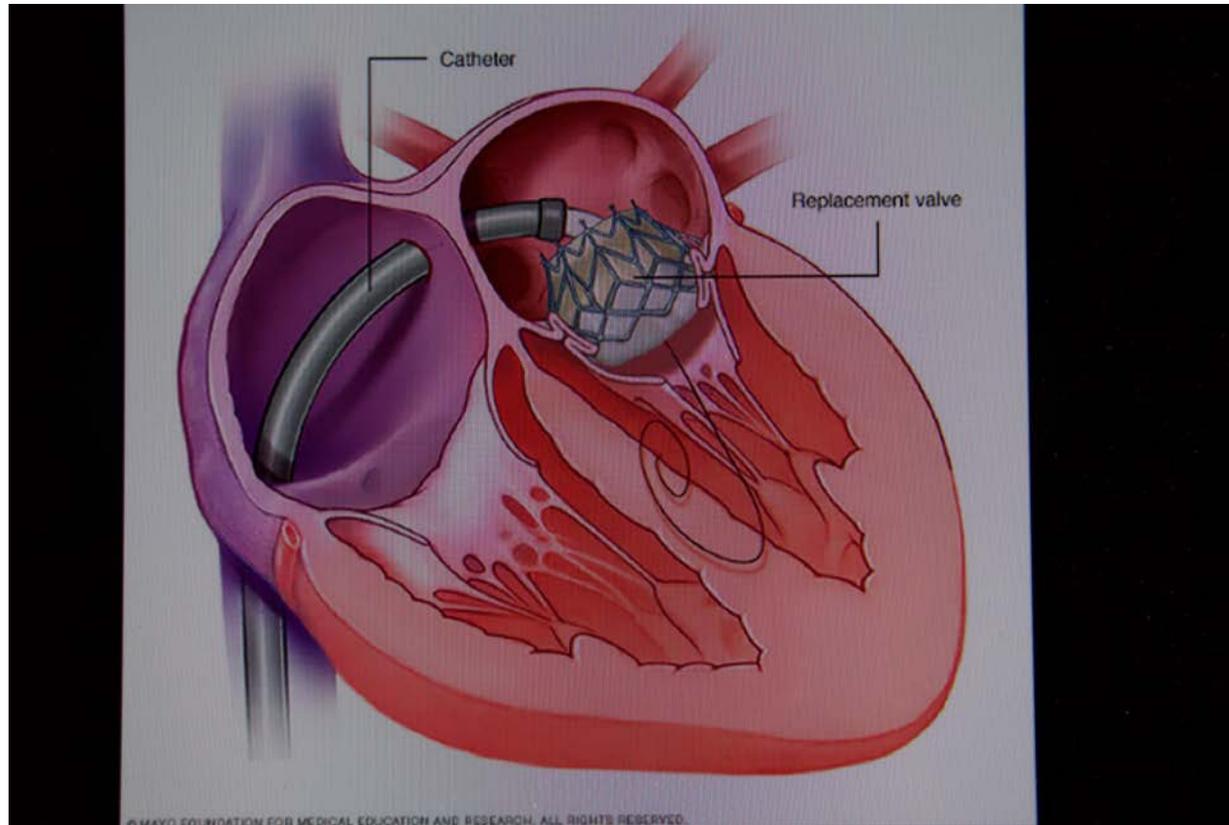
**PCI with stent deployment. Heart catheter passed through the artery in the arm or groin.**

# Stent with Balloon Angioplasty



## Percutaneous transluminal coronary angioplasty with stent placement

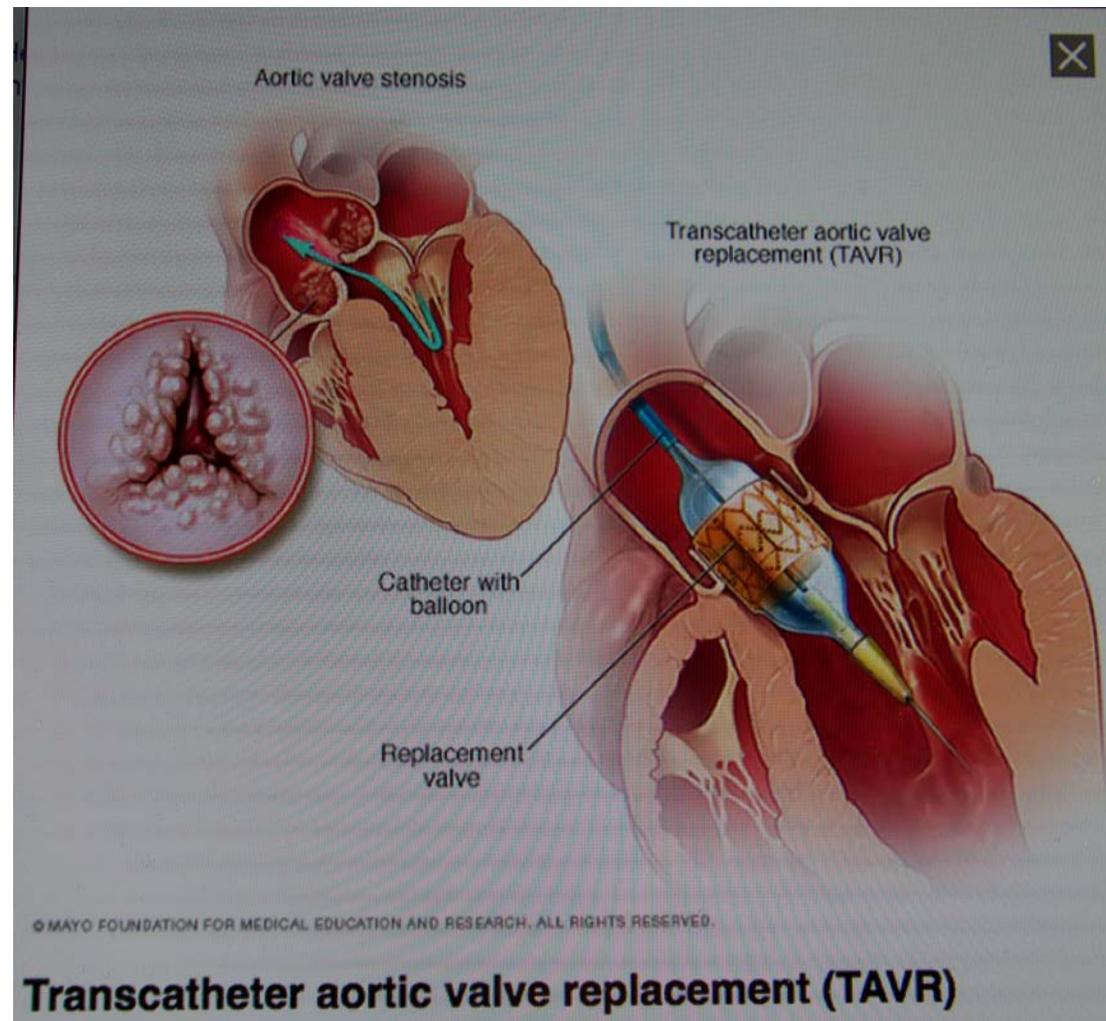
PCI- Balloon Angioplasty and Stent deployment



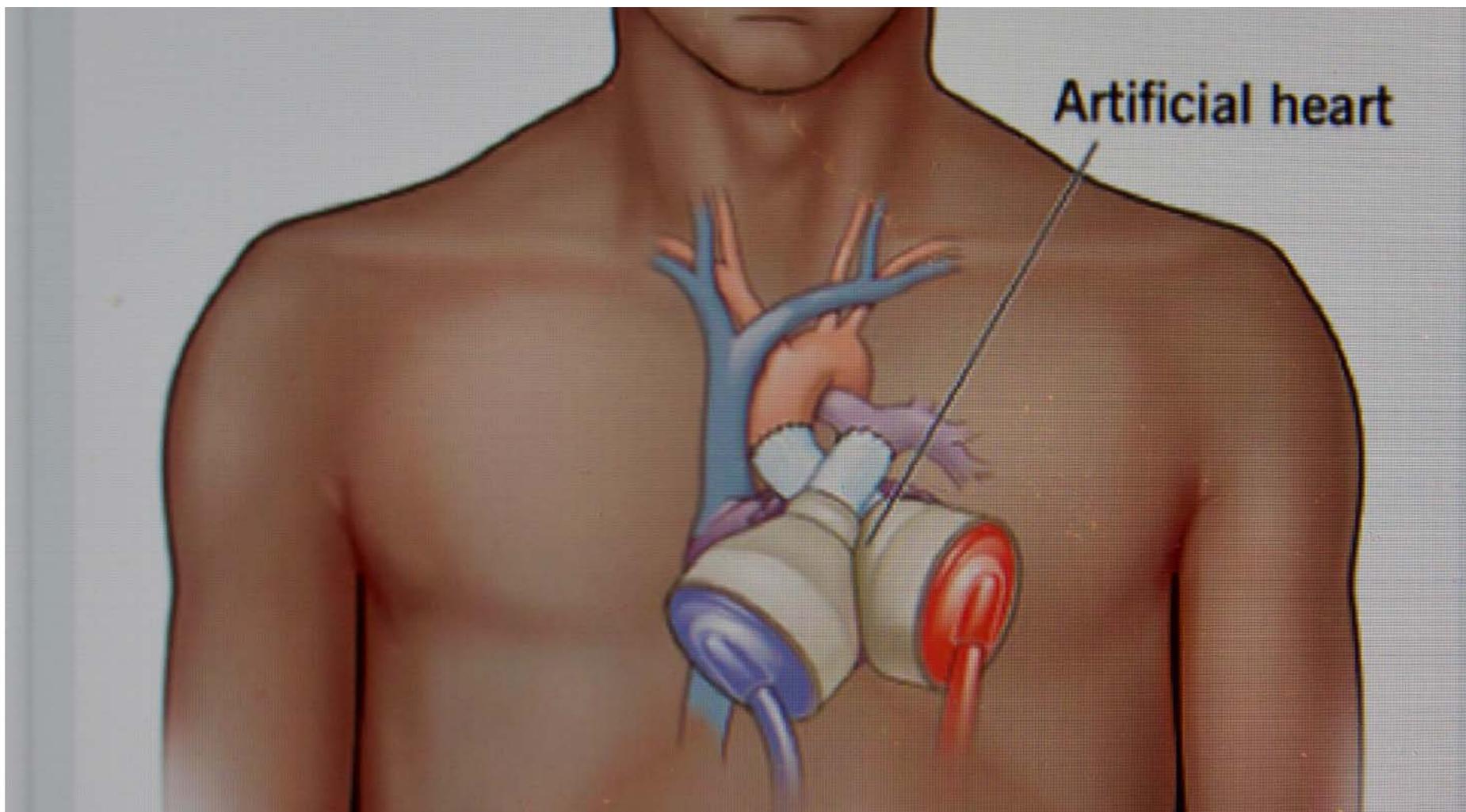
## Leaking Mitral valve

Transcatheter Replacement of the Mitral valve

# Aortic valve stenosis- TAVR

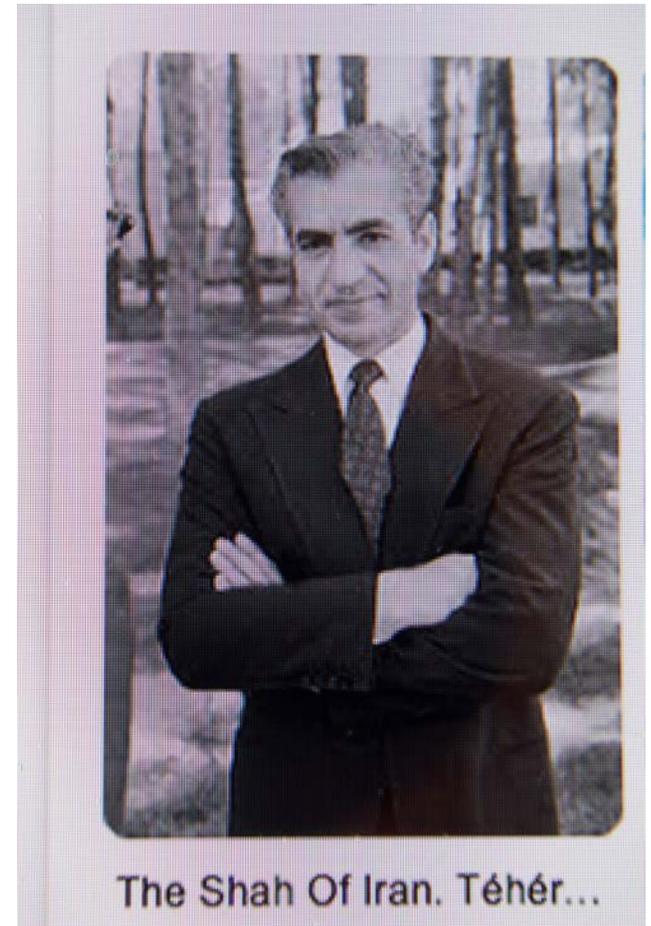


# Total Artificial Heart



## The Shah of Iran, died in exile, a broken emperor in an unraveling world.

1. The Shah left Iran Jan. 6, 1979- when Ayatollah Khomeini assumed control of the country.
2. The Ayatollah Khomeini warned President Carter and other Western leaders not give the shah refuge.
3. The Shah found himself adrift, shuttling from Morocco to the Bahamas, Mexico and after Carter relented, to New York for treatment of lymphatic cancer- 10/22/1979. Two weeks later, the Republican Guards seized the US embassy and took hostage of 52 Americans, demanding extradition of the Shah in return for hostages' release.
4. Extradition was refused, but later the Shah left for Panama then Cairo , where President Sadat granted asylum.



# The Saga- the Shah of Iran

- The Shah was a victim of many medical mistakes.
- He had at least Eight separate teams of doctors: his original Iran physicians, the French, the Mexicans, American doctors at Lackland Air Force Base in Texas and, Panamian medicos. And finally, the super team of Drs. Kean-DeBakey in Cairo.
- He was misdiagnosed with malaria, an operation in New York to remove gallstones and missed a few, and his enlarged spleen was not immediately treated.
- When the spleen was finally removed in Egypt by renowned American heart surgeon, Dr. Michael DeBakey, the pancreas was injured, and the Shah suffered an abscess and did not receive intravenous antibiotics.
- A French surgeon was called in to drain the infection, but the man who was once called himself the “king of kings” slipped into coma and died in July 1980.

# The Saga- the Shah of Iran

- Dr. Morton Coleman, oncologist at NY Hospital who treated the Shah, says between government officials, doctors and diplomats there were “too many cooks boiling the broth and there were huge political ramifications.”
- Bobak Kalhor- film maker, said “if the Shah was an average Joe walking into any major hospital in any major city in any country, he probably would have been cured.
- Dr. Michael DeBakey- a superstar, famed cardiac and vascular surgeon, performed abdominal surgery and splenectomy. It was theorized that he punctured the pancreas. “ IT WAS A WRONG-MISTAKE” Yogi Berra.

# QUESTIONS AND ANSWERS