

WOMEN IN PERFUSION

41st Annual Seminar of The American Academy of Cardiovascular Perfusion

February 5 – 8, 2020

Grand Sierra Resort

Reno, Nevada

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Revised(SS) and Christa Kampert: February 22, 2025

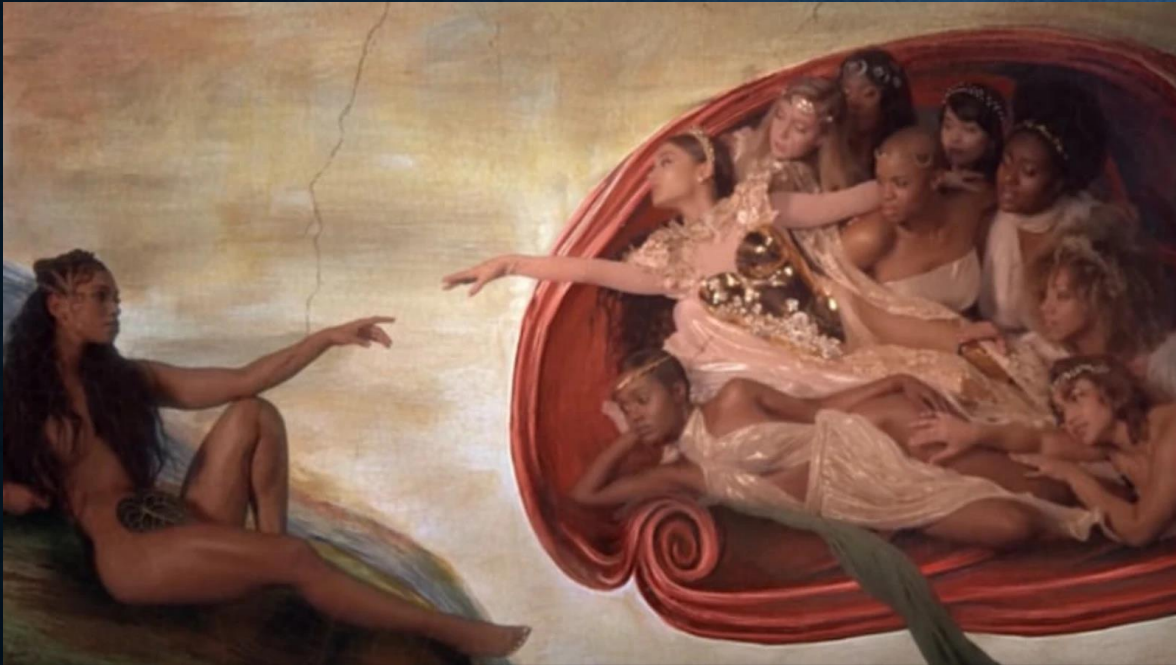
THE LIST OF WOMEN IN PERFUSION “THE MANY FIRSTS IN THE WORLD”

Women's Day: March 8, 2025

- 1934 The First Animal Survivor and Heart-Lung Machine, Mary Gibbon
- 1953 The first successful use of the Heart-Lung Machine, Mary Gibbon and Joanne Crothers
- 1957 The First Heart-Lung Machine Use In South America, Maria Cristina Paris
- 1960 The First Hemodilution Use, Modine Pierce
- 1960 The First Mechanical Caged Ball Valve Implantation, Betty Stephens
- 1967 The First Human Cardiac Transplantation, Dene Friedmann



GOD HAS BEEN A WOMAN SINCE THE BEGINNING OF TIME



Harmonia Rosales's 2017 reimagining of Michelangelo's "The Creation of Adam," depicting both God and the first man as Black women, for proof that daring to widen religious imagery can cause serious uproar.

"God is a Woman," some archeologists believe God was considered a female for the first 200,000 years of human life on earth.

- Before dominant world religions were established, in the earliest periods of human development, many belief-systems venerated a supreme female creator.
- Male-dominated religions sought to displace the matriarchal order.

THE HOLY BIBLE

18 “Then the Lord God said, “It is not good for the man to live alone. I will make a suitable companion to help him.”

Only with the creation of woman does man exist in complete and harmonious partnership and communion. With the coming into existence of both man and woman, creation is complete.

Genesis 2:18 Good News Translation

AROUND THE GLOBE

- 1820's Women's rights were severely limited, No major breakthroughs occurred during this time period
- During the American Civil War in the 1860's, many women became nurses
- Women's rights did not become a large "Cause" or action until the Progressive Period between 1890 to 1920, This Era witnessed the first-time women began to protest "FOR" their rights
- Women were primarily caretakers of the household, taking care of children

“The history of every country is carved by the hand of man, while the hope and love of humanity, is born of a woman's soul.”

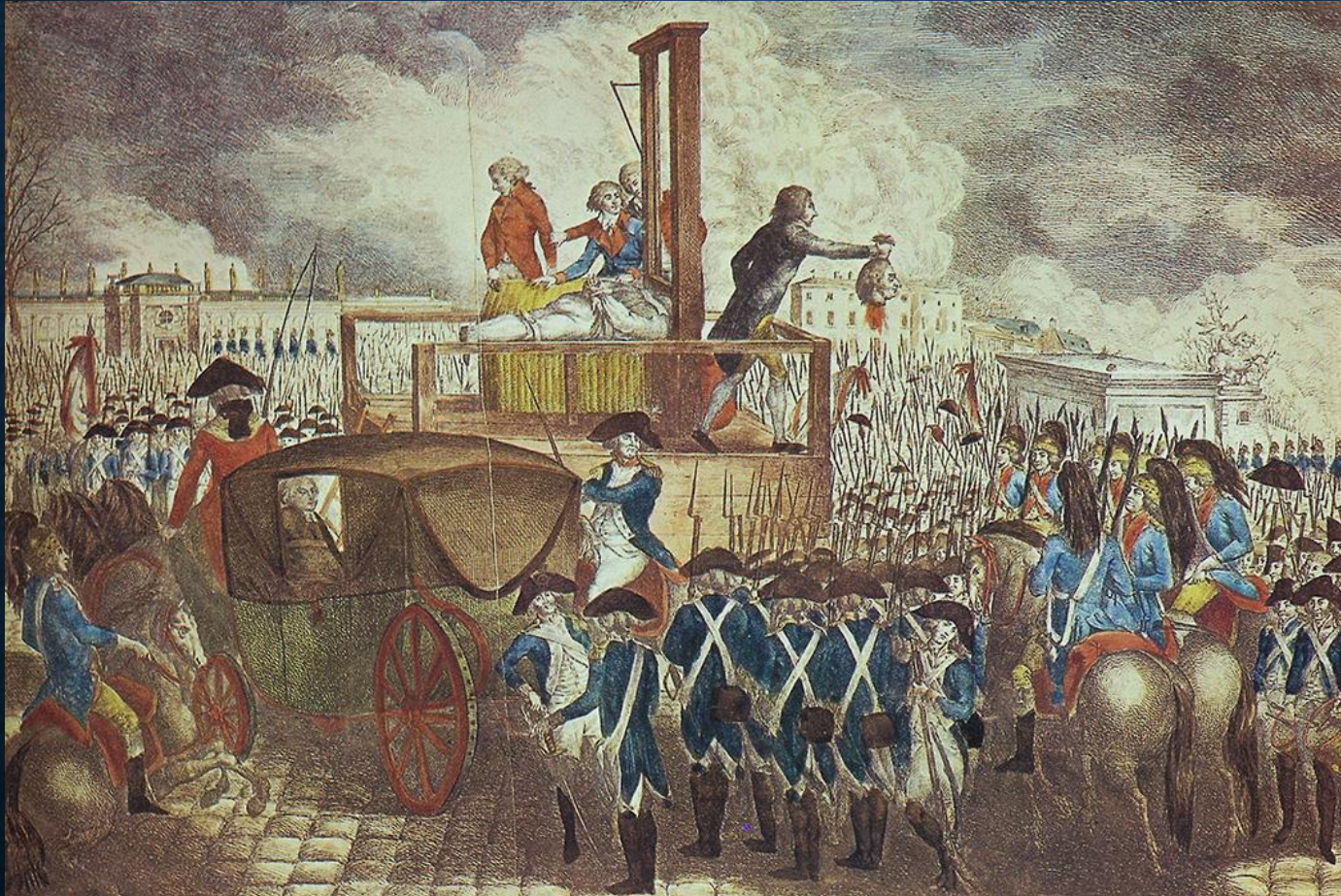
Joe Fazio

The Birth of Our Profession

“The Formative Years”

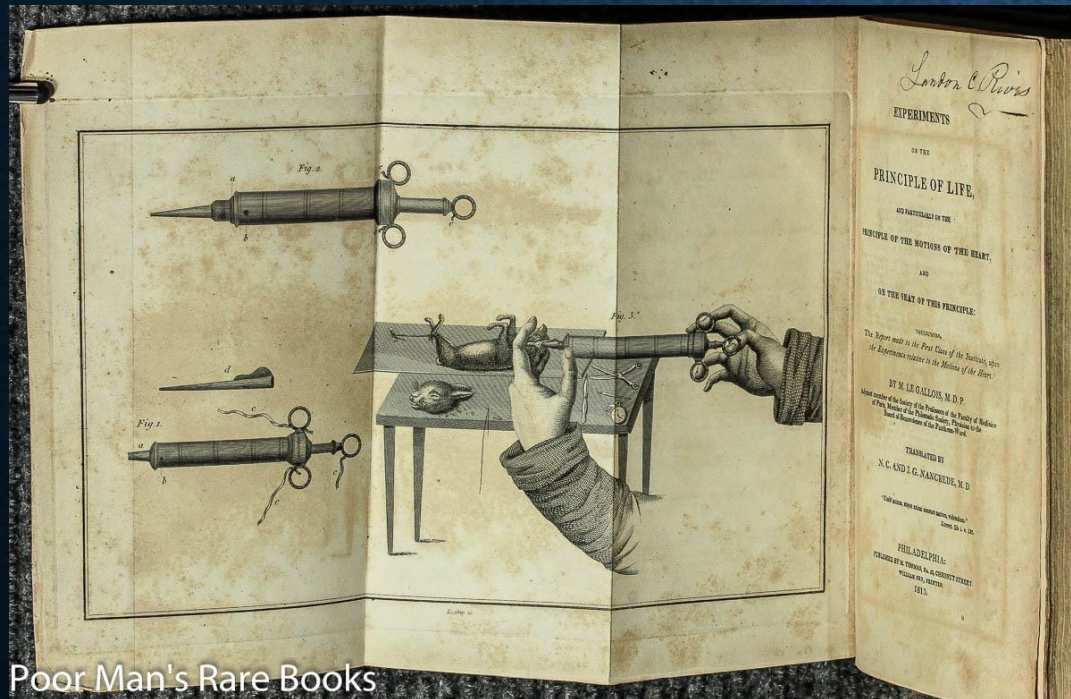
1813 - 1953

THE DECAPITATION EXPERIMENTS OF JULIEN JEAN CÉSAR LEGALLOIS



Execution of Louis XVI, 1793

FROM LABORATORY IDEAS TO CLINICAL PRACTICE 1813 - 1953

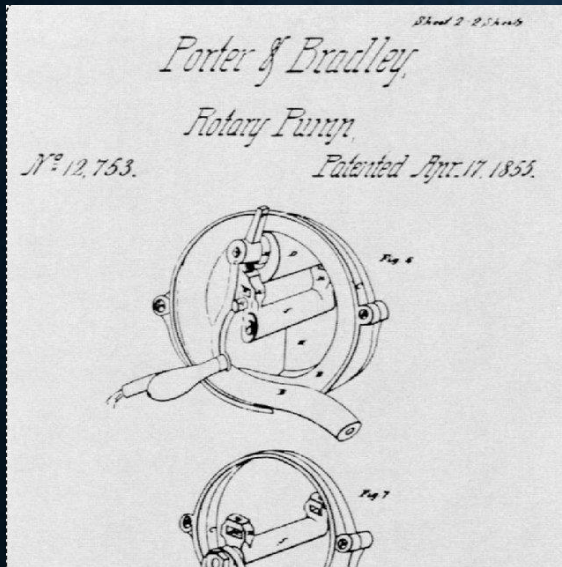


Poor Man's Rare Books

- 1813 Julien Jean Cesar LeGallois First proposed the “Idea” or possibility of preserving the body by artificial circulation
- 1828 Kay showed that the contractility of muscle could be restored by perfusing with blood

RUFUS PORTER & J.D. BRADLEY ROLLER PUMP 1855

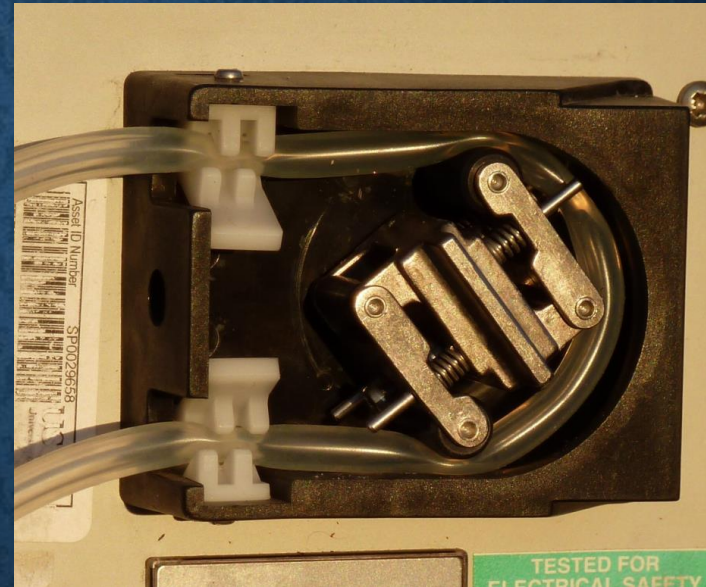
DALE-SHUSTER 1928, DEBAKEY 1934



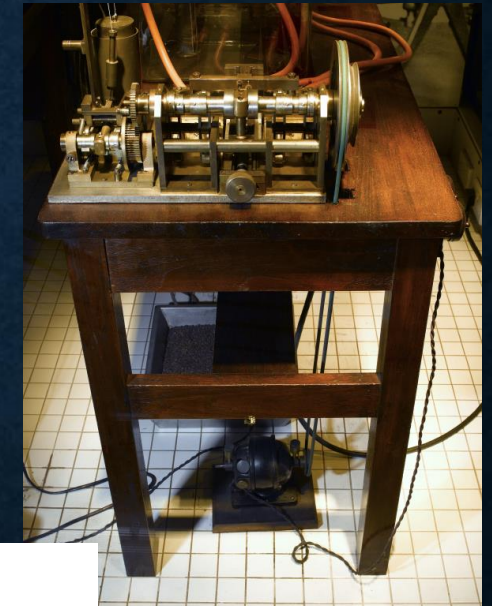
The Peristaltic Pump was first patented in the United States by Rufus Porter and J.D. Bradley in 1855 (U.S. Patent number 12753) 1856 as a well pump, and later by 1857 Eugene Allen in 1881 (U.S. Patent number 249285) for blood transfusions.



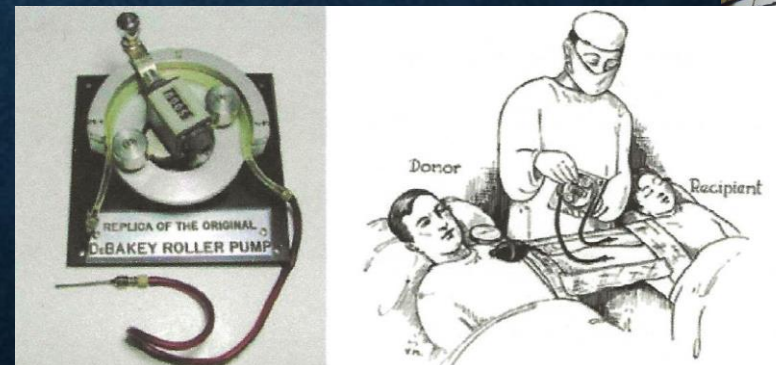
Transfusion roller pump invented by DeBakey in 1934
Courtesy Rudolph Matas Library, Tulane University



Peristaltic Pump

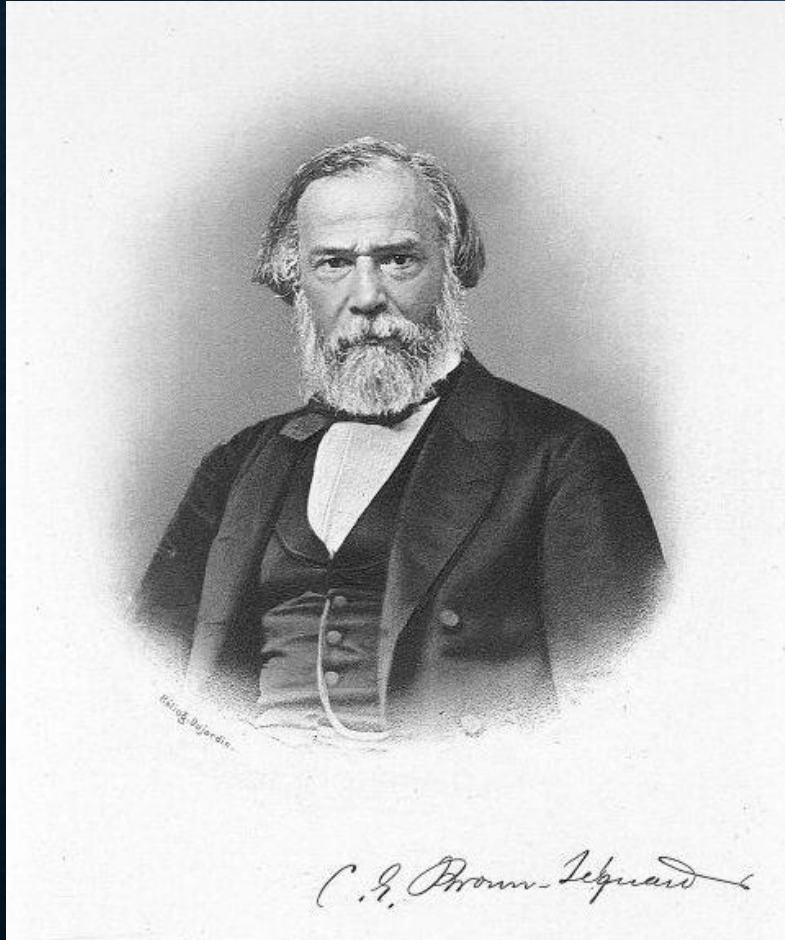


Dale-Shuster Pump 1928



DeBakey Transfusion Procedure

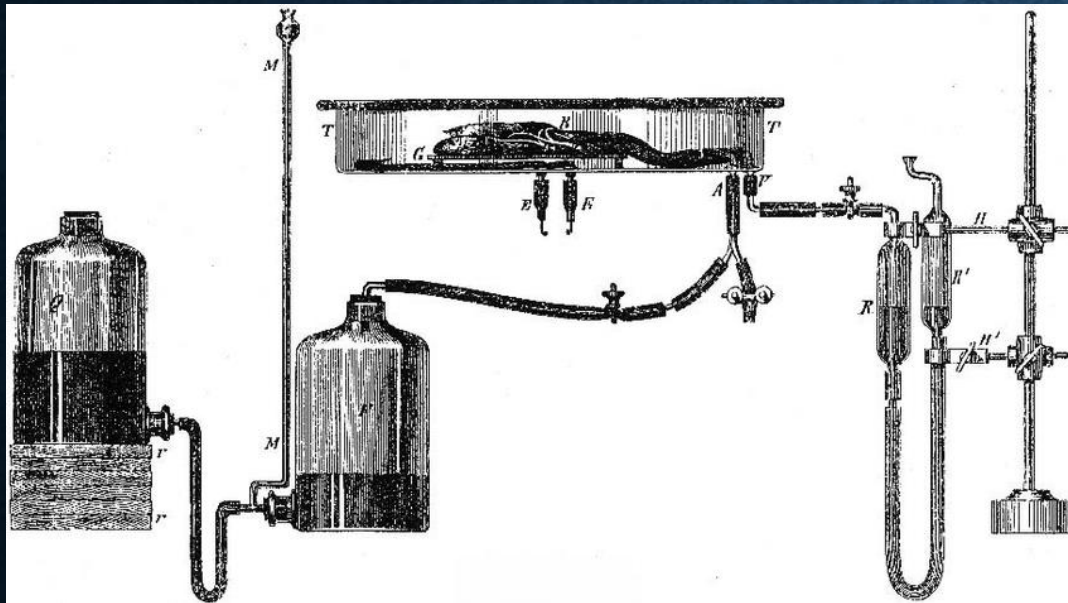
CHARLES-ÉDOUARD BROWN-SÉQUARD



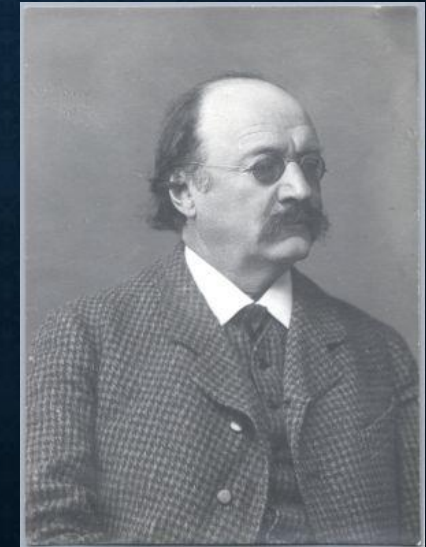
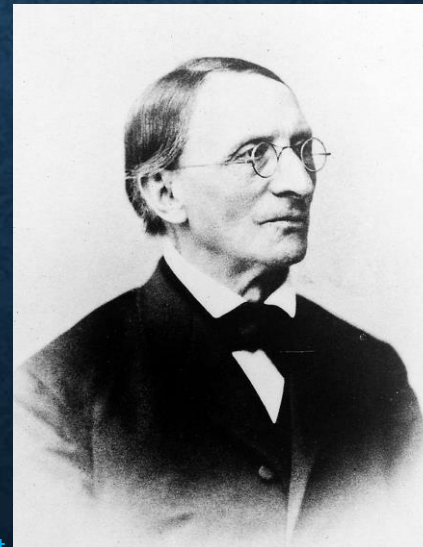
- 1858 Used limbs of guillotined prisoners and demonstrated reflex nervous activity could be preserved if perfusion with oxygenated blood was initiated promptly
- He achieved blood oxygenation by the whipping of “black” blood and forced the oxygenated blood through the arteries by means of a syringe

CARL VON LUDWIG & ALEXANDER SCHMIDT

- 1868 Built a device that could infuse blood under pressure, thus enabling better perfusion of isolated organs for study



Wood engraving of the experimental setup of von Ludwig and Schmidt (1868). The blood stream from the reservoir (F) to the tissue on the glass plate (T) is regulated by the relative height of a reservoir containing mercury (Q) on a variable stack of thin boards (r).



Left: Carl von Ludwig
Right: Alexander Schmidt

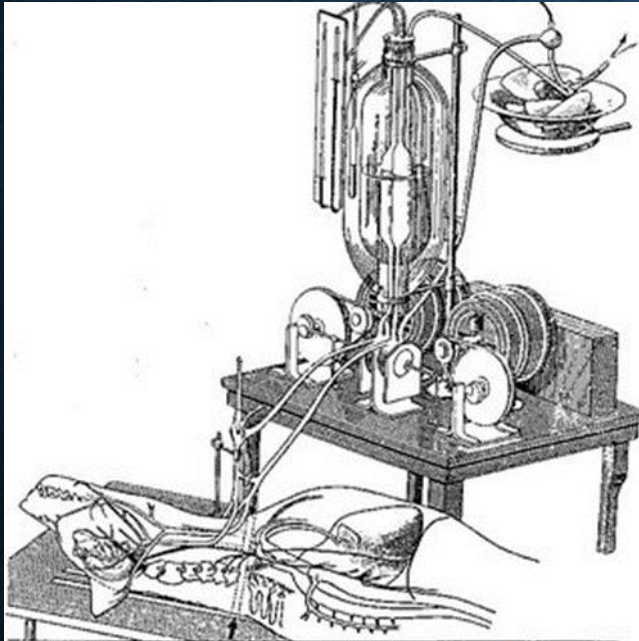
WALDEMAR VON SCHRÖDER STRASBOURG

- 1882 Developed and built the first prototype of a primitive bubble “oxygenator,” which consisted of a chamber containing venous blood; air was bubbled into the chamber and converted the venous blood to arterial blood, later termed a “Hematisator” by Carl Jacobj.

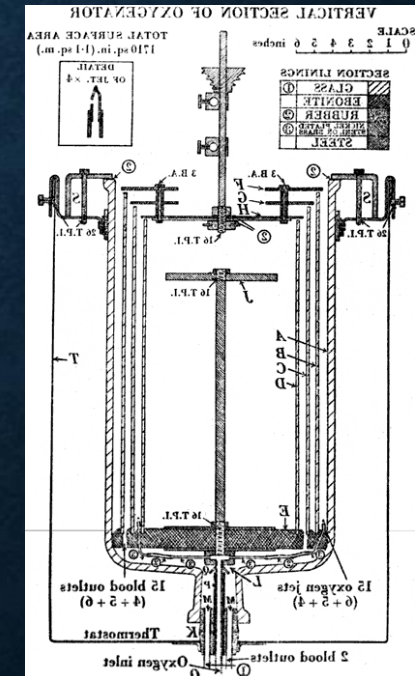
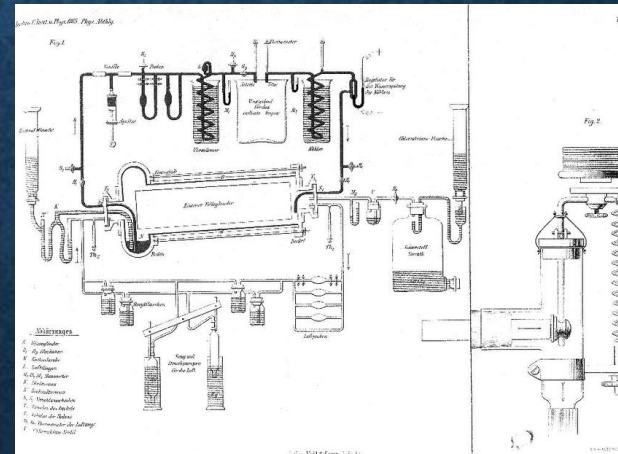
“Because of the rapid air current passing through the blood, foaming often occurs quite heavily.”

THE FIRST HEART-LUNG MACHINE & MAX VON FREY AND MAX GRUBER

- 1885 von Frey and Gruber
First Film Oxygenator



1928 First Heart-Lung Machine by Brukhonenko



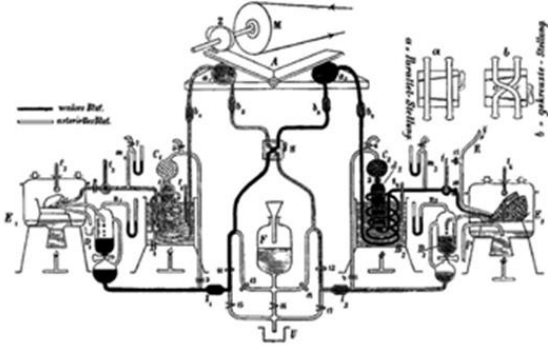
History

- 1895 – Jacoby
 - Use of animal lung as oxygenator for organ perfusion

The diagram illustrates a complex perfusion system. At the top, a motor (M) drives a pump (A) which circulates fluid through a series of tubes. A large central reservoir (B) is connected to the system. To the left, a pump (F) is connected to a series of tubes leading to a pump (G). To the right, a pump (H) is connected to a series of tubes leading to a pump (I). The system includes various valves, reservoirs, and tubes, with labels in German indicating components like 'Flüssigkeit' (liquid), 'Pumpe' (pump), and 'Reservoir'. A legend at the top left indicates that solid lines represent 'wässrige Fl.' (aqueous fluid) and dashed lines represent 'arterielle Fl.' (arterial fluid).

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□ 1895 – Jacobl



- 1890 First cross circulation experiment was performed by Belgian physiologist L. Frederic, who joined the carotid arteries of two dogs. Method widely used by Belgian pharmacologist C. Heymans.
- The method is used in organ and tissue transplantation, chiefly to equalize the immunological systems of the donor and recipient, and in some procedures that involve the heart and major blood vessels of higher, warm-blooded animals.

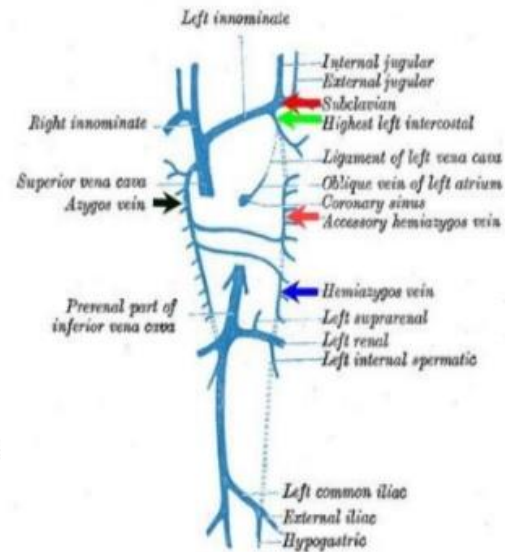
BIOLOGIC OXYGENATORS

- 1895 Jacoby Carl of Strasburg used a perfusion apparatus employing dog lungs or the pulmonary lobes of pigs or calves as oxygenators
- 1954 Lillehei used Controlled Cross-Circulation-Sigmamotor Pump-Adult Donor for oxygenation
- 1955 Mustard used Rhesus Monkey Lungs suspended in glass vats and saline as the oxygenator

AZYGOUS FLOW & ICE WATER IMMERSION

Azygous flow Technique

- A principle based on the observation that animals can survive prolonged vena caval occlusion without sequelae if blood from the azygos vein alone is permitted to enter the heart, patients
- are reperfused during cardiac and pulmonary bypass at flows much less than the normal resting cardiac output
- This is the low flow principle via azygous vein



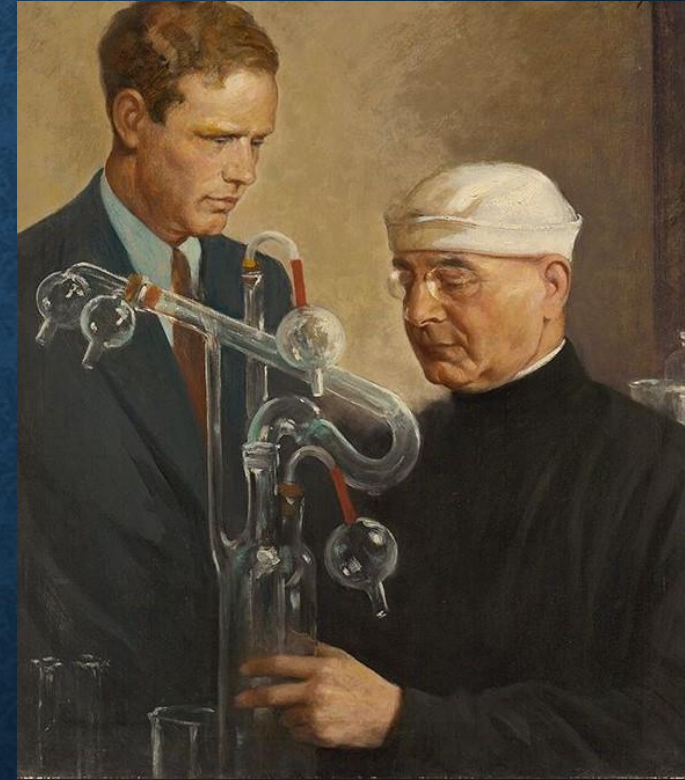
- 1952 F. John Lewis first closure of an ASD in the world on a 5 year old female under direct vision

CHARLES LINDBERGH & ALEXIS CARREL

Alexis Carrel, and engineer/aviator Charles A. Lindbergh—
had attempted to artificially circulate blood through
individual organs with various devices



Charles Lindbergh was the innovator and designer of the perfusion pump.
(National Museum of American History)

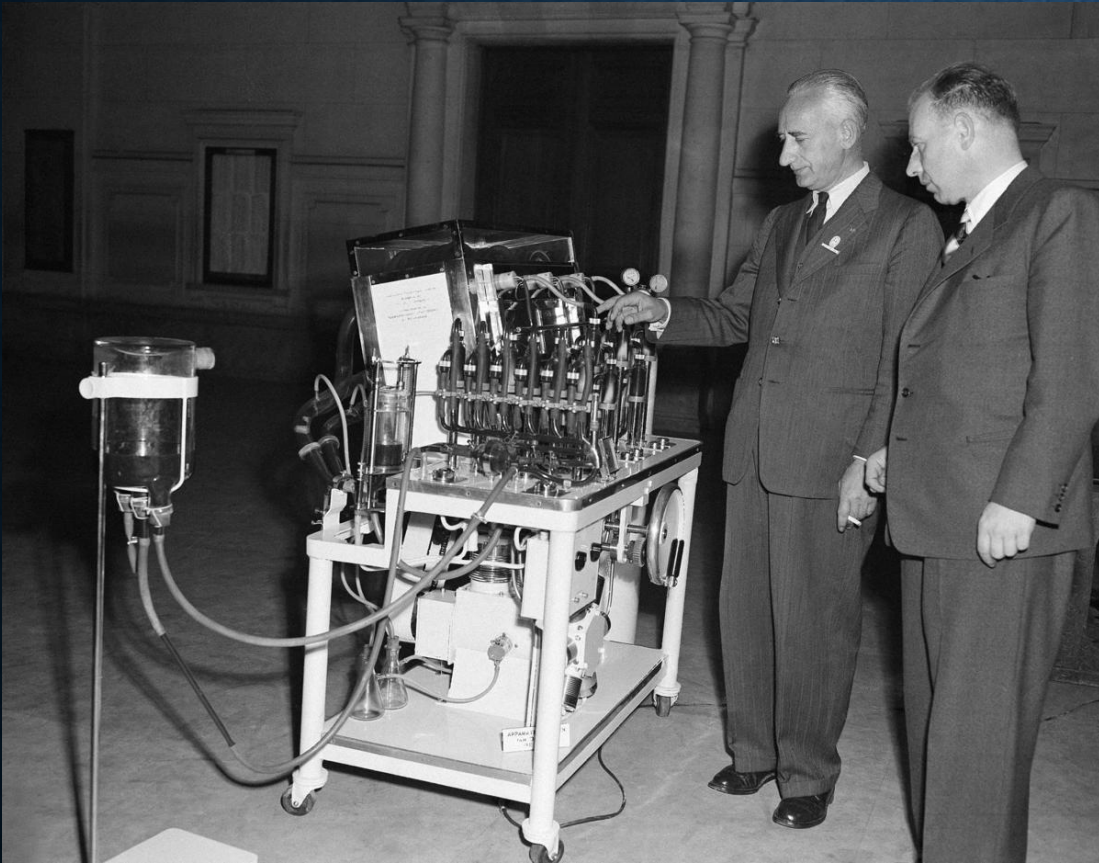


Charles Lindbergh and Alexis Carrel by Samuel Johnson Woolf,
Oil on canvas, 1938 (National Portrait Gallery © Estate of S.J. Woolf)

**The Door Is Opened –
An Urgent Need Arises:
(Perfusionists)**

1947 - 1954

JACOB JONGBLOED PERFUSION SIMULATION 1951



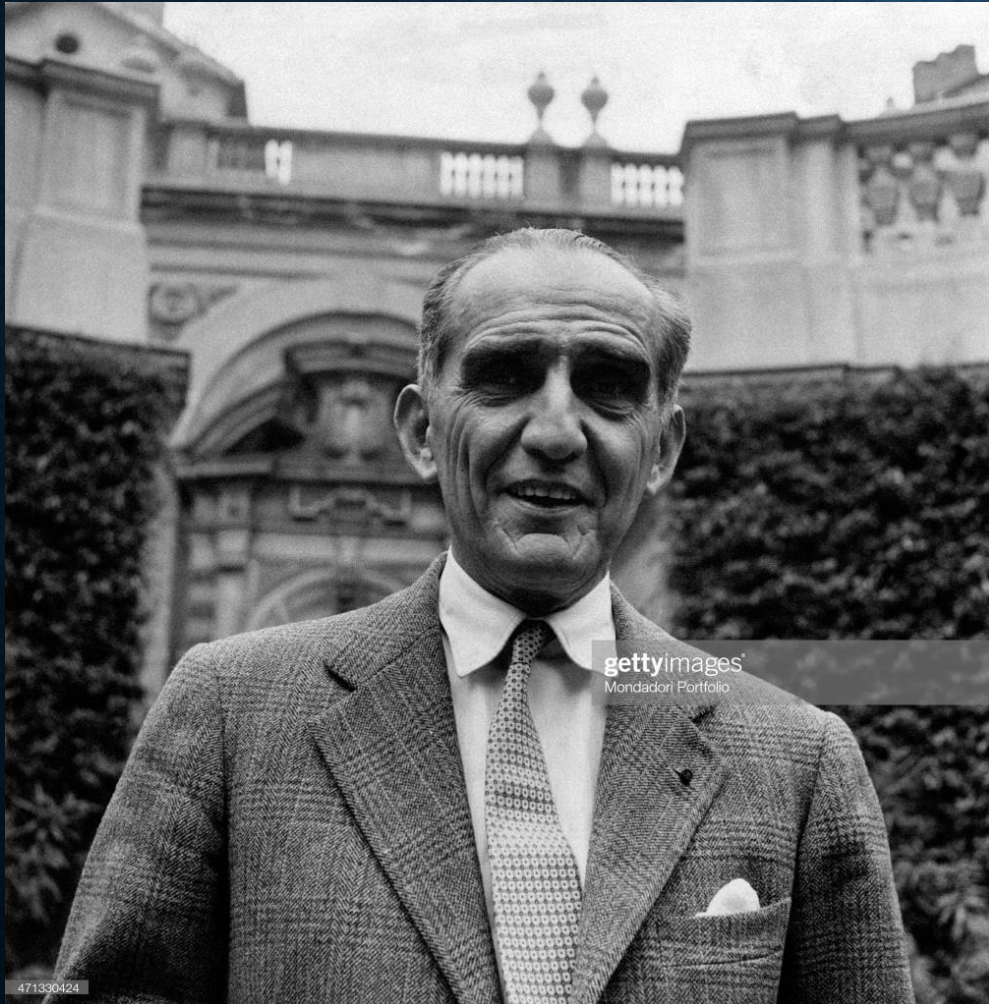
- Jacob Jongbloed, (left) Utrecht, Holland, explains his artificial heart machine at a meeting of the Congress of Surgeons at the Sorbonne University in Paris, France on August 30, 1951
- The bottle (left) takes the place of the body. A tube from a vein carries blood through the pumps on the stand through the artificial lung (in glass case on top) where oxygen is added via a tube to an artery the motor located below the pumps, operates the pumps at the cadence of the normal heart beat

(AP Photo/Gerard Yvon Cheynet)

ACHILLE MARIO DIGLIOTTI

UNIVERSITY OF TURIN, ITALY

AUGUST 7, 1951



- Used a heart-lung machine of his own design to partially support the circulation for 20 minutes at a blood flow rate of 1 L/min while resecting a mediastinal tumor compressing the right side of the heart
- Cannulation Site: right axillary vein and artery
- Patient survived
- First successful clinical use of a heart-lung machine, the machine was not used as an adjunct to heart surgery

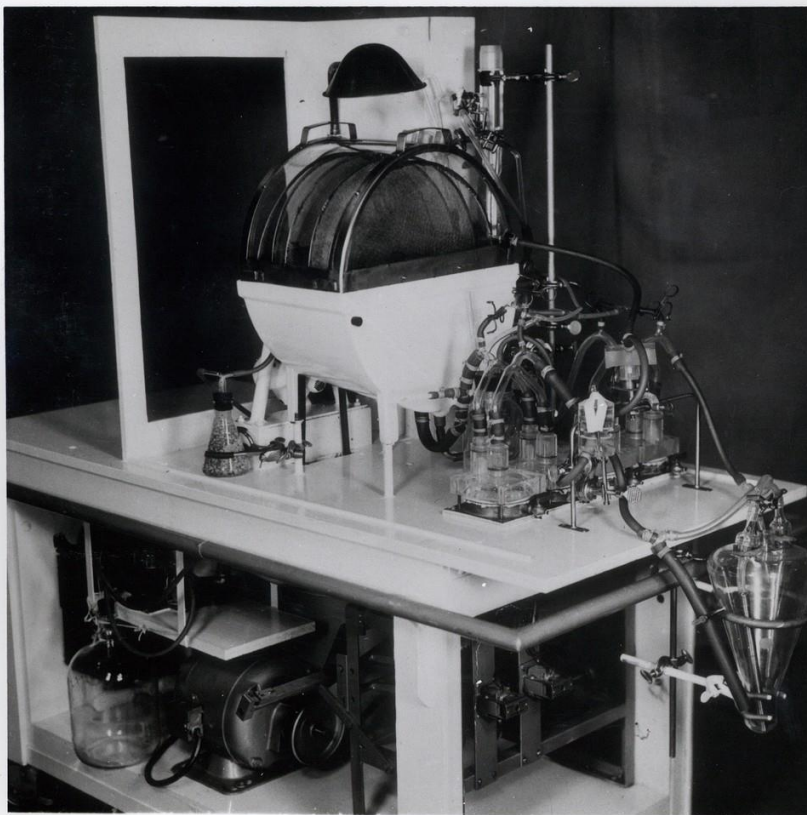
CLARENCE DENNIS



- Rotating Screen Oxygenator was developed by Clarence Dennis (1909-2003) and colleagues in 1947. Blood entered the oxygenator through a low speed jet in the center of the revolving screen disc and a film of blood is laid on the disc by centrifugation and gravity. The rotating screen oxygenator was efficient and relatively easy to clean.

National Museum of American History
Smithsonian Institution

CLARENCE DENNIS APRIL 5, 1951 1946-1951



FIRST MACHINE-SUPPORTED OPEN-HEART OPERATION IN MAN
Apparatus Used at The University of Minnesota, April 5, 1951
American Surgical Association, Apr. 13, 1951. Ann. Surg.134:709,1951

April 6, 1951
ASD
38 Minutes on
Bypass
May 31, 1951
ASD



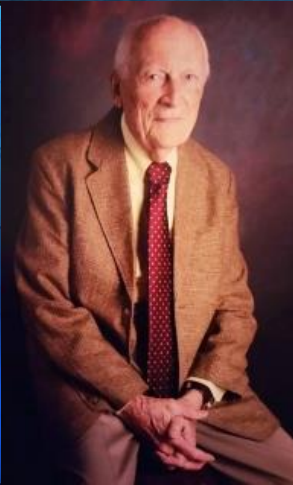
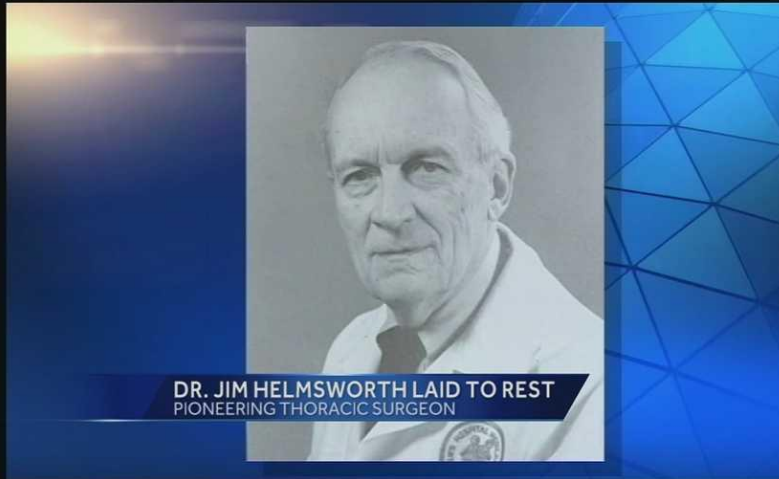
CLARENCE DENNIS

UNIVERSITY OF MINNESOTA HOSPITAL

- 1946 Dennis began work on his pump-oxygenator, first step was to find out who else might be developing such a device.
- John Gibbon, at Jefferson Medical College in Philadelphia, had done substantial work on a heart-lung machine. Prior to World War II, Gibbon had maintained cats on artificial circulation for up to 25 minutes with a prototype machine.
- Dennis visits him, Gibbon welcomed him as "someone else in the world who didn't consider him an impossible dreamer." Gibbon had just returned from military service, and his equipment was still in storage, but he gave Dennis reprints of his work and the two men exchanged ideas and research results during the next few years, as they worked on their parallel projects.
- Dennis, assisted by surgical resident Karl E. Karlson, began his own work at Minnesota in 1947, with funding from the National Institutes of Health (NIH), which would continue to support this and other projects until 1972.

JAMES HELMSWORTH APRIL 3, 1952

“PROVING LIFE SUPPORT & HLM”



- The heart-lung machine, invented by a team of doctors at Cincinnati Children's, was used to perform the first open heart surgery.
- Pediatric cardiologist Samuel Kaplan, MD, cardiac surgeon James Helmsworth, MD, and inventor Leland Clark, PhD, came together at Cincinnati Children's in 1951
- Cincinnati General Hospital, 75 minutes of heart-lung support for temporary relief on 75 y/o patient with end-stage lung disease

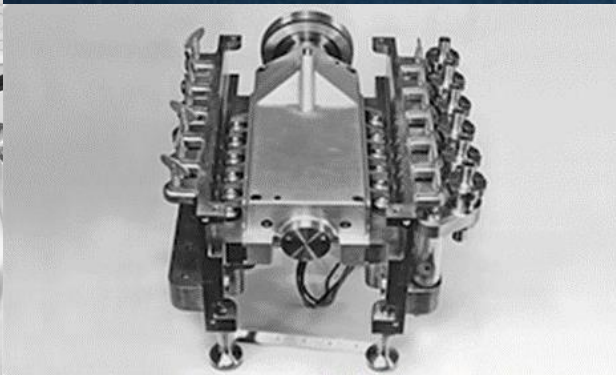
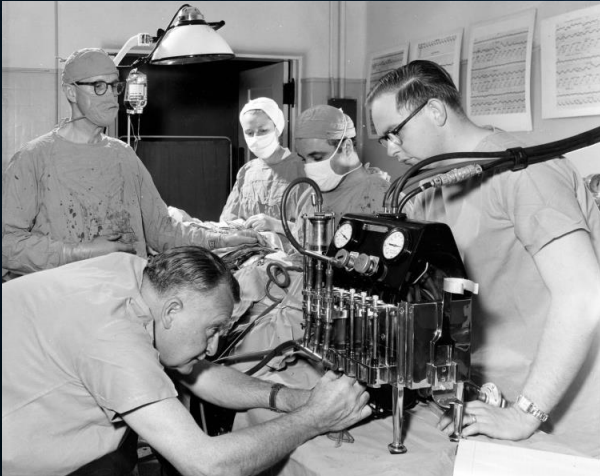


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DEWEY (FOREST) DODRILL JULY 3, 1952 LEFT HEART BYPASS AND 1953 VSD

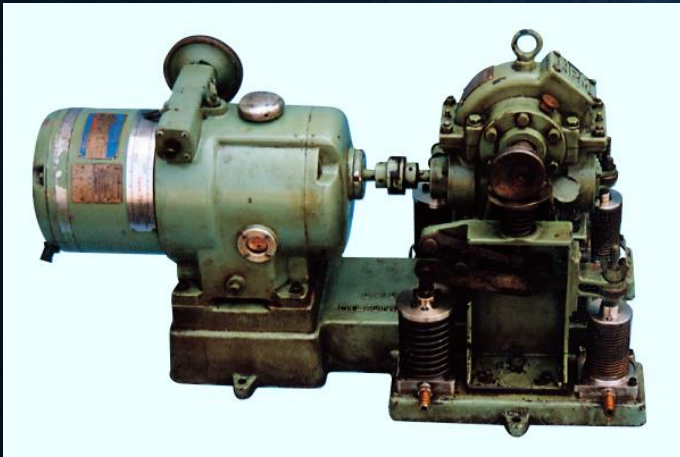
HARPER HOSPITAL DETROIT / WAYNE STATE UNIVERSITY HOSPITAL

- 1952 Left Heart Bypass to successfully treat Mitral Valve Stenosis
- 1952 Right Heart Bypass to successfully treat Pulmonic Valve Stenosis
- 1953 Unsuccessful treatment of Pulmonic Valve Stenosis on a patient who also had a VSD
- He and his medical team enlisted a group of scientists and engineers at the GM Research Laboratories
- Measuring 10 x 12 x 17 inches, the invention resembled a 12-cylinder engine with six separate cylinder-like chambers.
- Made of stainless steel, glass and rubber, it used air pressure and vacuum pumps to circulate blood from the 12 chambers through the patient's body while heart surgery was being performed.

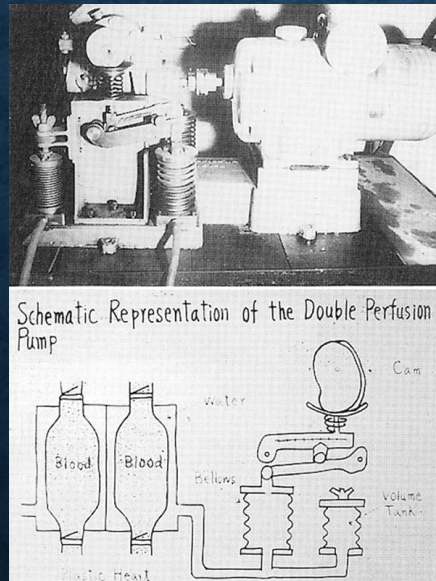


FOREST DEWEY DODRILL

- In true Motor City form, they developed a machine to temporarily replace the heart's blood-pumping function and make open-heart surgery possible.



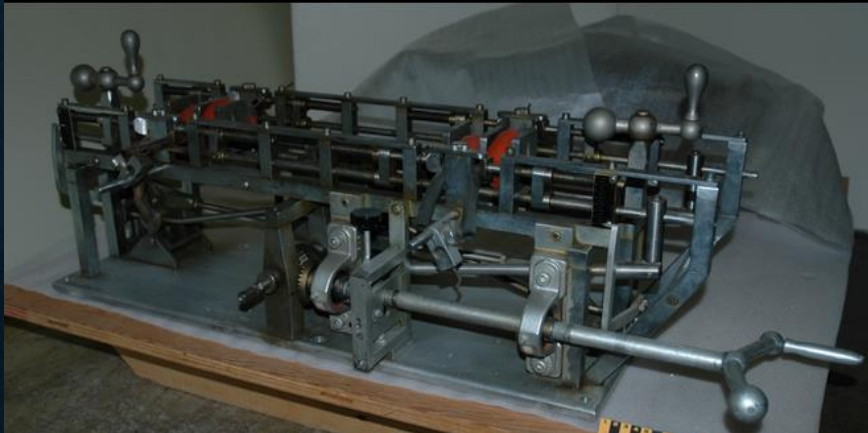
Japan's first artificial heart experimental model in the 1960s and Japan's first artificial heart and its conceptual operation diagram



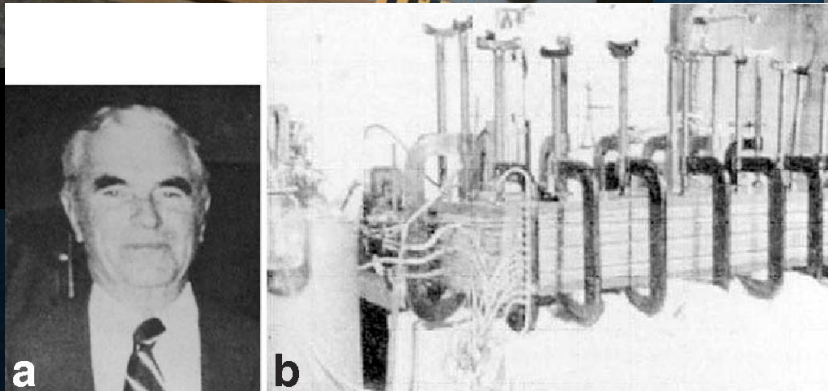
- On July 3, 1952, 41 y/o Henry Opitek made medical history at Harper University Hospital at Wayne State University in Michigan.
- Dodrill used the machine to bypass Opitek's left ventricle for 50 minutes while he opened the left atrium to repair the mitral valve.
- Dr. Dodrill's post operative report he notes, "To our knowledge, this is the first instance of survival of a patient when a mechanical heart mechanism was used to take over the complete body function of maintaining the blood supply of the body while the heart was open and operated on."

GEORGE CLOWES 1951 CLEVELAND METROPOLITAN HOSPITAL HEART-LUNG MACHINE

1951



Before 1950

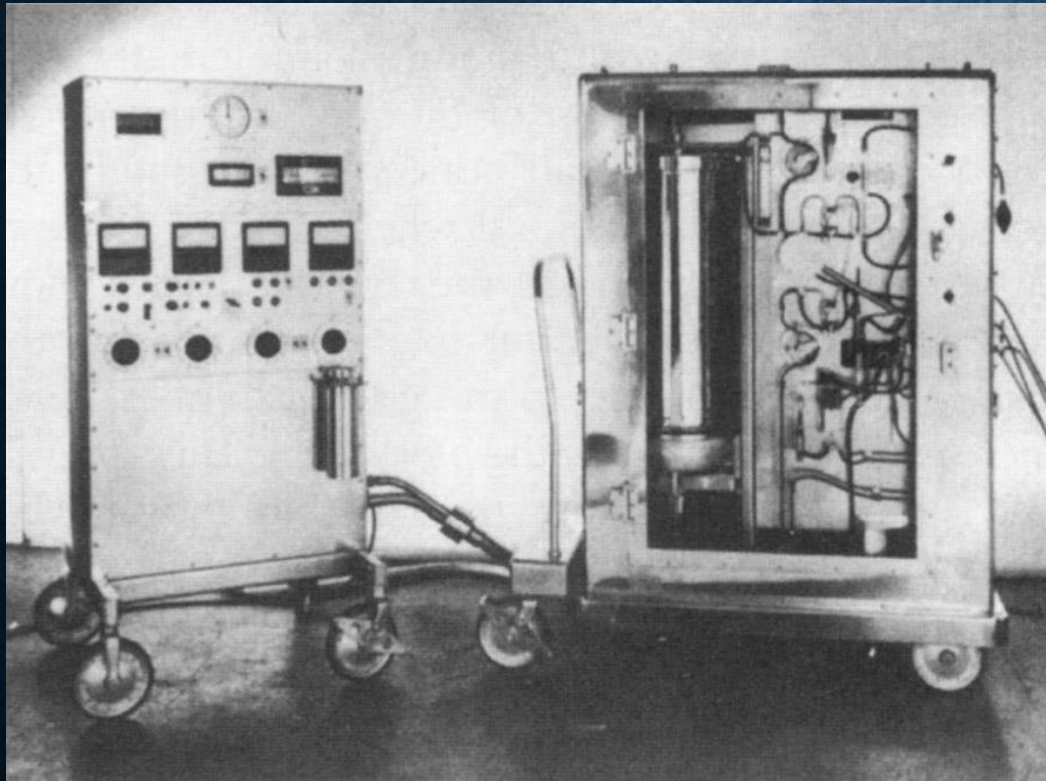


- a. George H.A. Clowes, Jr. in 1956.
- b. Twelve-unit membrane oxygenator used by Clowes used clinically in 1956

The Urgent Need?
Perfusionists!

JOHN GIBBON

THE TRANSITIONAL DEVELOPMENT

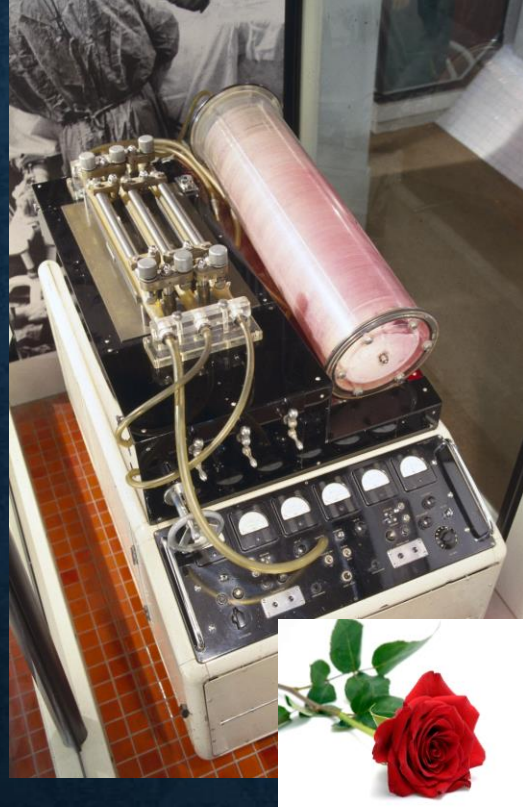
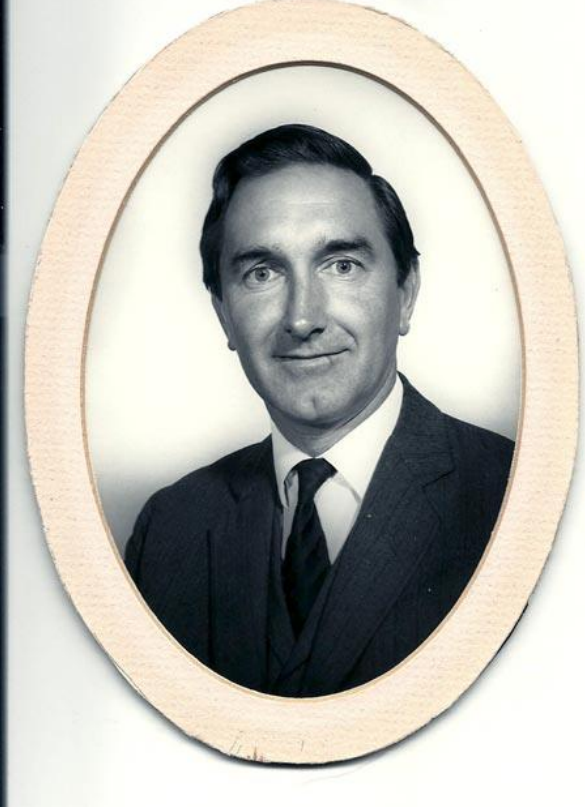


“There is a dual purpose in developing a mechanical heart and lung apparatus. The first is to maintain a part of the cardiorespiratory functions temporarily in patients with a failing heart or lung, or both, in the hope that, with such direct aid for a short time, these organs may be able to resume their entire function. The second purpose is of surgical interest.”

Bernard J. Miller, John H. Gibbon Jr and Mary H. Gibbon,
1951



DENIS MELROSE PERSPEX HLM



- His method of safely stopping the human heart and reducing the leakage of blood - a technique called "cold cardioplegia" - is still routinely used today
- 1955 Melrose and his colleagues, using potassium citrate and then potassium chloride, succeeded in safely stopping the hearts of anesthetized dogs connected to a heart-lung machine.
- He later pursued a second career in sports medicine, inventing a form of leggings which countered the effects of deep vein thrombosis by reducing swelling; this saved hundreds of lives.

Dr Denis Melrose Sister Phylis Bowtle And Sister Hilda Fletcher Of Hammersmith Hospital, Admiring The Rose Which Has Been Named After Dr Melrose Devised The Heart-lung Machine.

WORLD WAR II

- He suffered serious injury when a fellow student, armed with a gun in a college window, fired three bullets at Melrose and two of his friends as they left the refectory. His best friend was killed instantly, and, as he bent down to see what had happened, Melrose himself was shot in the chest, the bullet apparently being deflected from his heart by a pen in his breast pocket; the third student was hit in the hand.
- World War II, he enrolled at University College Hospital, training was disrupted by the constant influx of people injured by bombs. During the midwifery course he followed a nursing sister on her bicycle to visit the homes of expectant mothers; occasionally he had to empty a drawer to make a cradle, while the husband often lay in the same bed throughout the proceedings.



HAMMERSMITH HOSPITAL LONDON, ENGLAND

- 1945 Melrose married, and joined the Royal Navy as an ear, nose and throat doctor, posted to Hong Kong
- Two years later he joined Hammersmith Hospital, determined to pursue his dream of conducting research into open-heart surgery
- Working at the Buxton Brown farm one day a week, he found a way, using chemicals, of sustaining a rabbit's heart so that it would keep beating, a technique which later fascinated Prince Philip during a royal visit

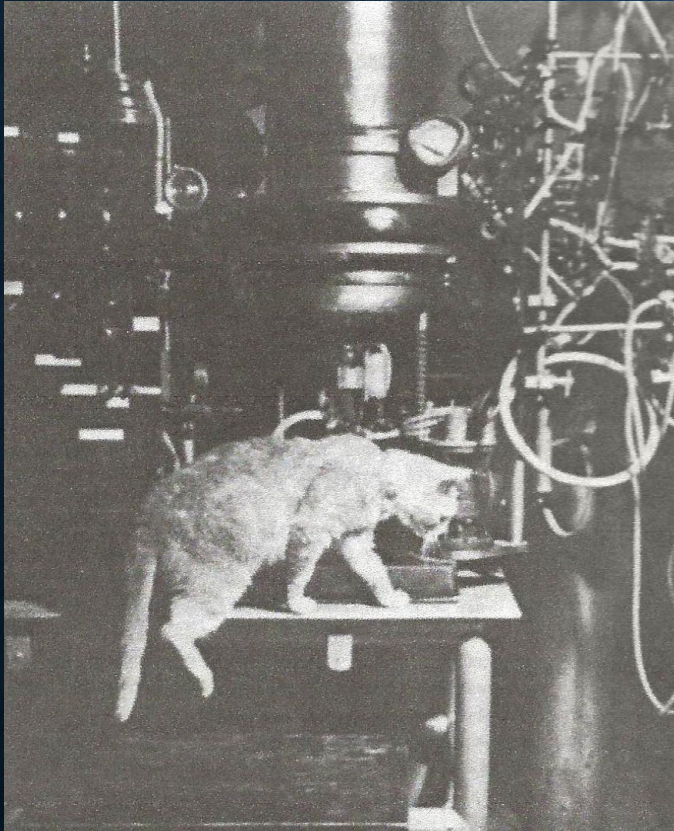


DENIS MELROSE CONT.

- 1957 Melrose applied his technique to human patients, operating to repair congenital defects.
- The Medical Research Council refused to back Melrose in his work, a Hungarian refugee, Francis Kellerman, took out hefty loans to build six prototypes.
- With William (Bill) Cleland, a surgeon, Melrose worked out the technical procedure, while Melrose's wife and other members of the team knitted replacement valves on cotton reels; after it became the custom to attach a rose to the machine's pump, Melrose was delighted when a new strain of rose was named after him.
- Melrose believed in sharing his knowledge with others around the world. He was made a citizen of Bogotá and given a golden key, this and the eponymous rose being the only honors he ever received.

Women In Perfusion:
“YES, They Were There Day One”
Pioneering The Way
Around The Globe!

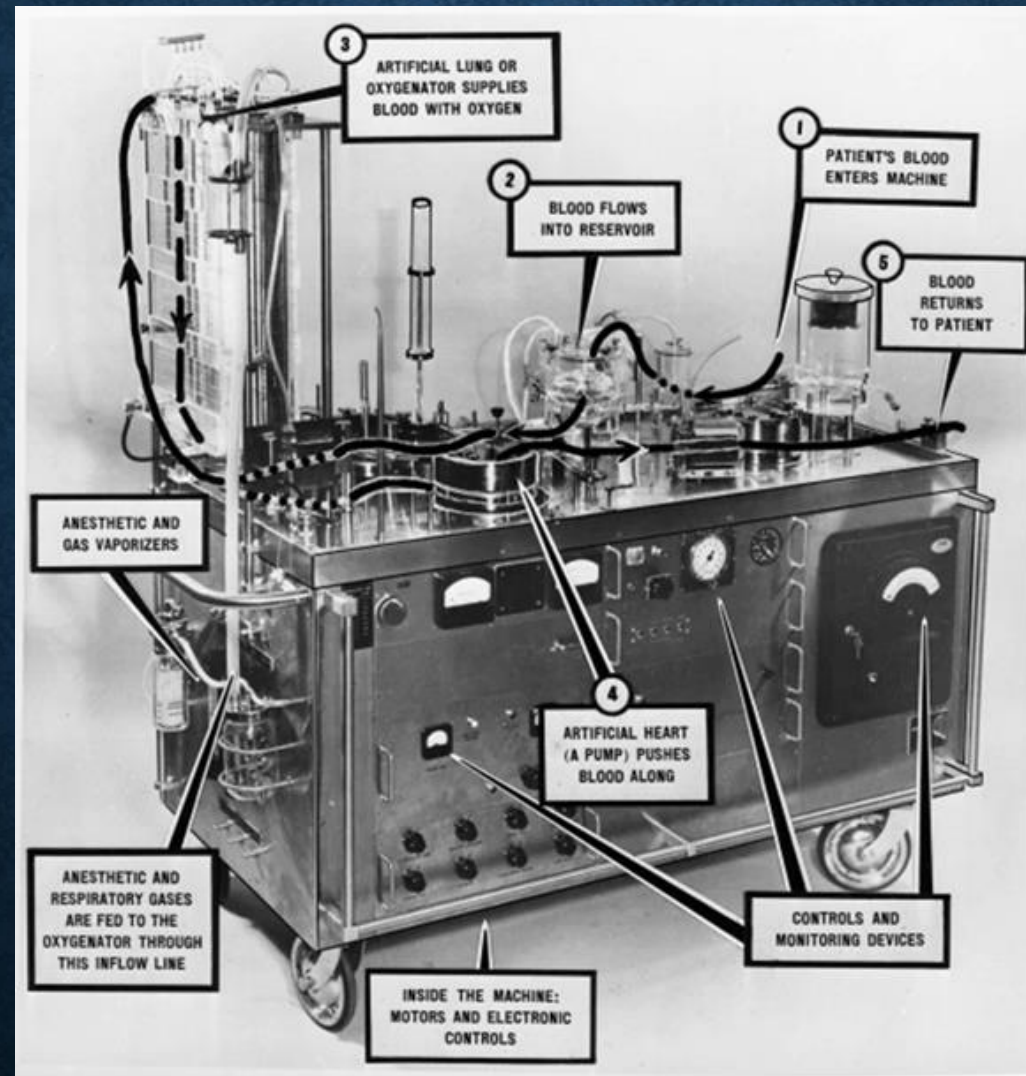
THE BIRTH OF CARDIAC SURGERY & THE HEART-LUNG MACHINE



- His assistant, Mary Hopkinson, was to become one of the most important partners in research – and in real life
- After their March 1931 wedding, they began their experiments, first using cats lured off the street with fish
- They occluded the pulmonary arteries and pumped the blood through a mechanical lung
- On May 10, 1935 the first cat survived It had been without its own heart function and kept alive by extracorporeal circulation, Mary and John danced about the lab, elated

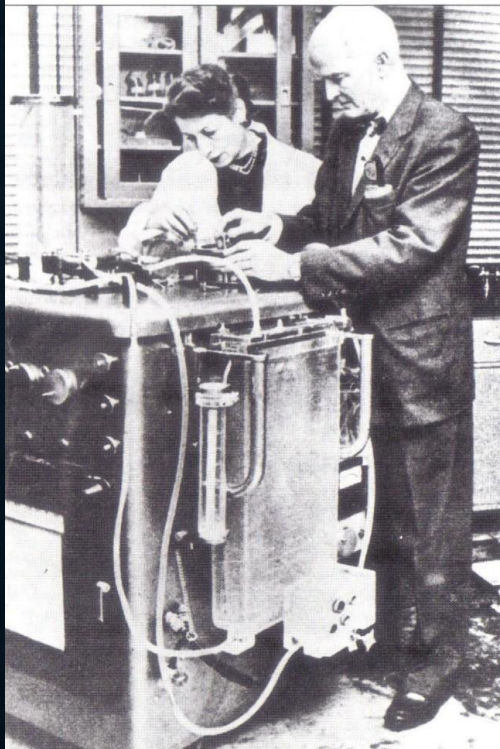
1935, Gibbon's First Heart-Lung Apparatus Survivor:
39 Minutes Extracorporeal Heart and Lung Bypass
The Feline went on to birth a litter of kittens

THE IBM MODEL II

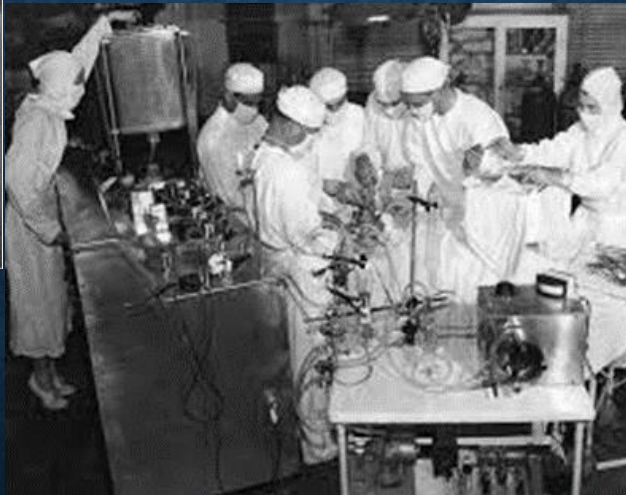
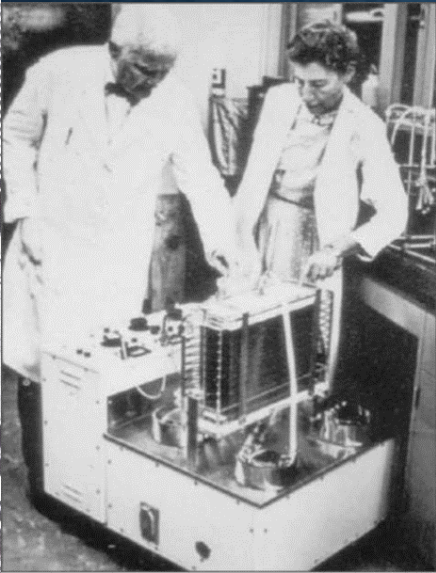


RECORDED HISTORY: MARY “MALY” GIBBON

MAY 6, 1953



1931-1953 John & Mary “Maly” Gibbon



1974 AmSECT International Meeting San Diego, Ca
Leroy Ferries, Mary Gibbon (Honoree), and Charlie Reed

- The First Successful Use of the Heart-Lung Machine
- Undisputed First Lady of Perfusion
- The First Perfusionist



JOANNE CROTHERS DELONE (1929-2021) JOEANN GUTHREY TAYLOR FRASER, RN, CCP

The Pumpists

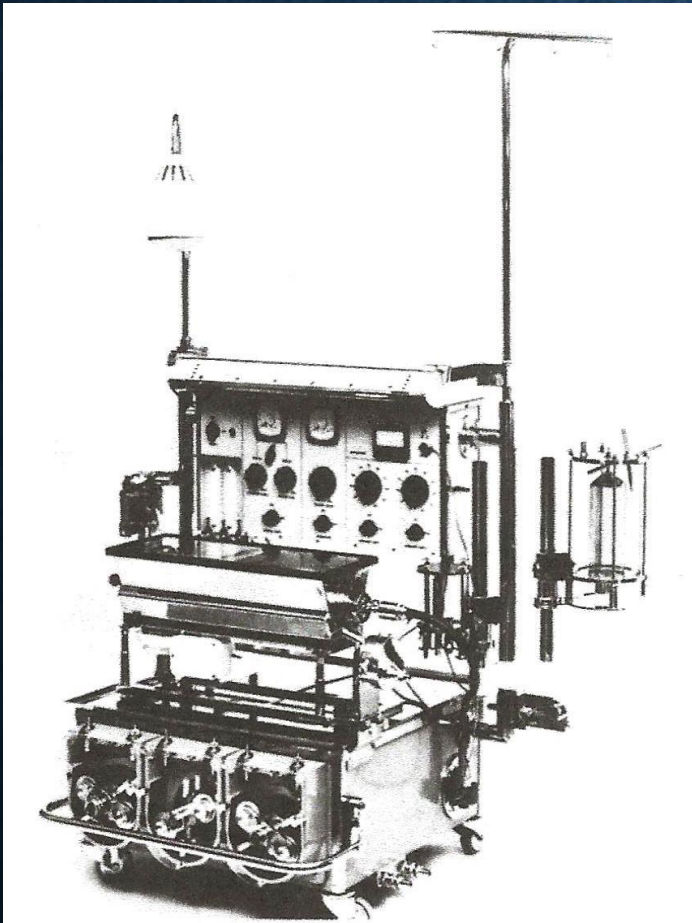
After graduation from nursing school I went straight to the cardiac operating room. While working as a nurse at Jefferson I was also training with Drs Templeton and Bacharach in operating the heart-lung machine. I also learned a great deal about cardiac surgery and nursing from Sylvia. When Sylvia left to get married I became the head nurse/pumpist.

From 1960–1975 I had the honor of working with Dr Gibbon and his young associate, Dr John Young Templeton, first in the operating room as a scrub/circulating nurse, then as head nurse of that operating room, and finally from 1962 on as a nurse “Pumpist” as we were then called. While the work was challenging, historical, and life changing for our patients, I also remember great times on such a close team, especially Christmas parties at Dr Gibbon's farm in Media.

Jo Ann Crother also made history that day as the first-ever perfusionist. The direct suture repair of the secundum defect involved 45 minutes of cardiopulmonary bypass, with 25 minutes of intracardiac repair. Although a pericardial patch had been planned, time was of the essence. According to Dr Miller's account, the patient was under heparinized by today's standards, and thrombi were appearing in the circuit and screen oxygenator, which necessitated quick termination of bypass. Fortunately, the patient made a full recovery.



AKE SENNING, VIKING BJORK, P.A. ÅSTRADSSON HEART-LUNG MACHINE



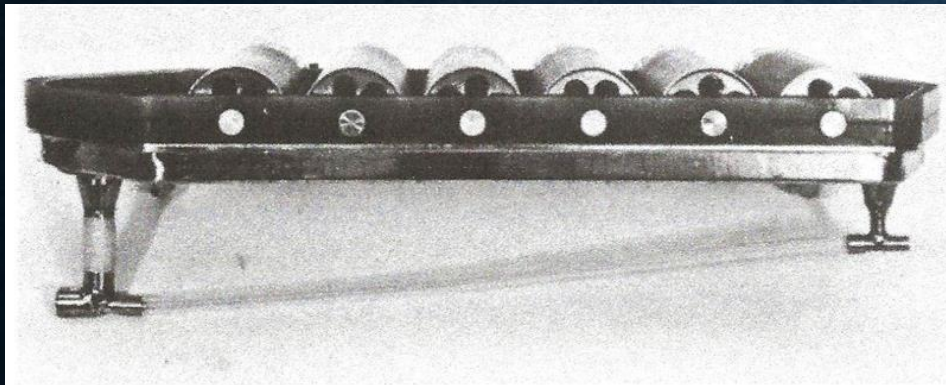
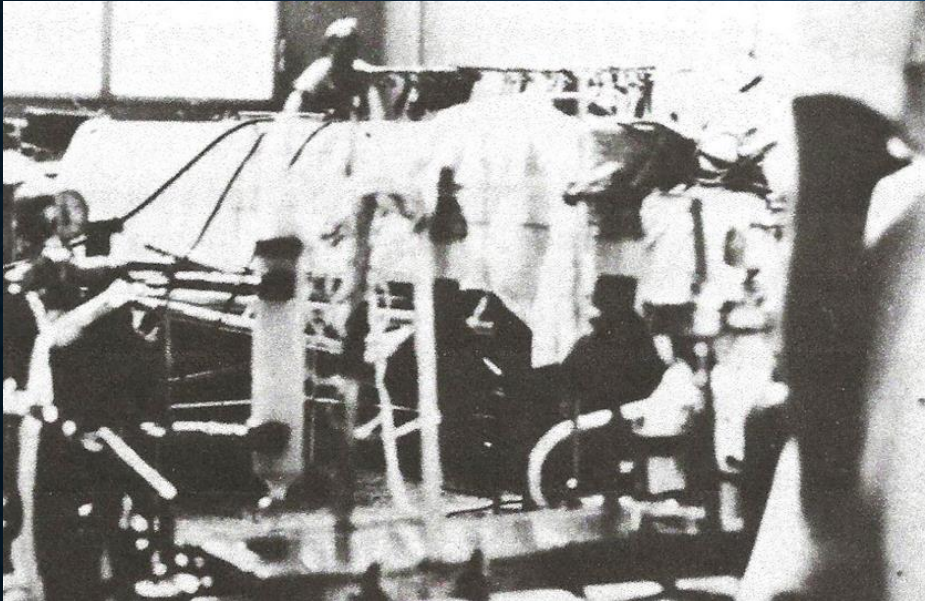
- Clarence Crafoord, a good friend of John Gibbon recognized the importance of the heart-lung machine
- Heart-Lung Machine used July 14, 1954
- The 2nd successful open-heart operation in the world using a heart-lung machine
- Roller Pump / Bjork Disc Oxygenator / Pyrex Glass / Stainless Steel Trough

**2nd Successful open-heart operation,
14 months after John Gibbon**

CLARENCE CRAFOORD, AKE SENNING, BO NORBERG

JULY 14, 1954

STOCKHOLM, SWEDEN



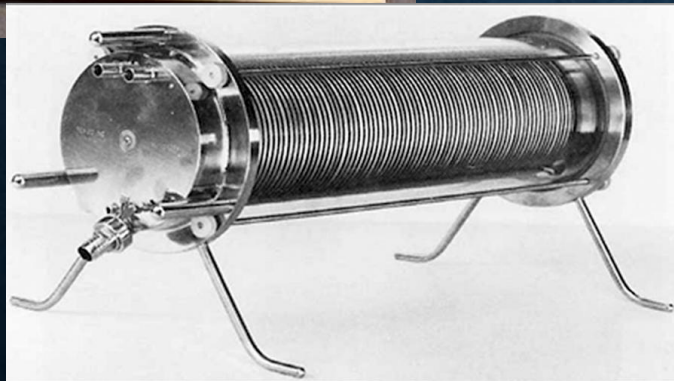
- July 14, 1954 Atypical Mitral Valve Stenosis – Left Atrial Myxoma
- Surface cooled with ice water on operating table heart-lung machine in foreground, image above at left
- Patient survived, 35 years later had a bottle of champagne with Dr. Senning in 1989
- Oxygenator: Rotating Perforated Cylinder Oxygenator

Developments in cardiac surgery in Stockholm during
The mid and late 1950s. Ake Senning.
J Thorac Cardiovasc Surg 1989;98:825-32

EARLY OPEN HEART SURGERY HEART-LUNG MACHINE OUTCOMES

• C. Dennis 1952	2 / 2	Died
• J. Gibbon 1953	5 / 6	Died
• J. Helmsworth 1953	1 / 1	Died
• D. Dodrill 1952	2 / 2	Died
• G. Clowes 1953	2 / 2	Died
• W. Mustard 1953-54	5 / 5	Died
• Results:	17 / 18	Mortality 94.5%

EARL B. KAY AND FREDERICK CROSS 1956



- Pemco Inc. Kay-Cross Disc Oxygenator (Pediatric)
- Designed by Earl B. Kay and Frederick Cross at St. Vincent's charity Hospital, Cleveland.
- Based on a design by Swedish Dr. Viking Bjork. The disc oxygenator required a lot of blood for priming, extensive cleaning, and reassembly before being reused.
- A level detector was added to keep the volume of blood constant so that the patient's blood pressure was controlled.
- This specific instrument did not have a model number, patent number, or heat exchanger.

**Notice The Women In
Perfusion History**

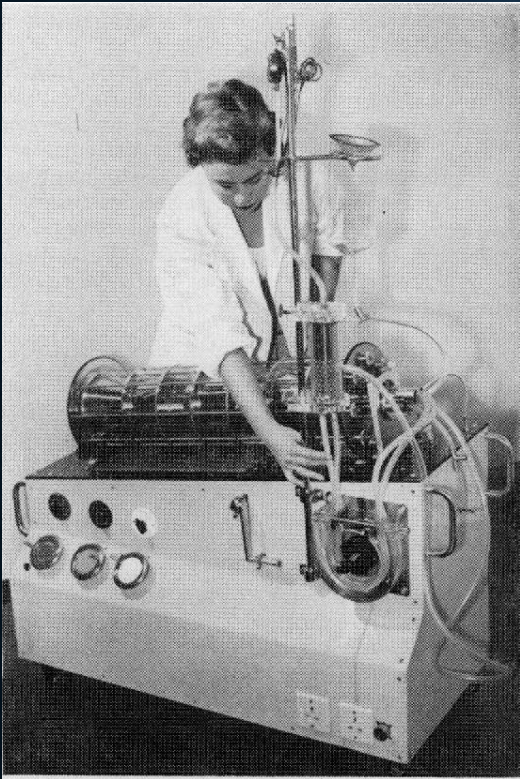
1955 VIDEO: WILLIAM MUSTARD RHESUS MONKEY LUNGS “BIOLOGIC OXYGENATOR”

Artificial heart lung appartus used in
conditions requiring open heart surgery
over ten minutes duration.

1. Ventricular septal defect.
2. Tetralogy of Fallot.
3. A.V. communis.

- Note: Female Perfusionist unknown
- The Dale-Schuster Pump: A double perfusion pump, developed in 1928, and takes its name from researchers Sir Henry Dale (1875-1968) and Edgar Hermann Joseph Schuster (1899-1969)
- Lungs suspended in saline glass vats
- Lungs would last approximately 10 minutes – requiring transition to another pair
- Video: courtesy of Jim MacDonald, retired Perfusionist, Canada

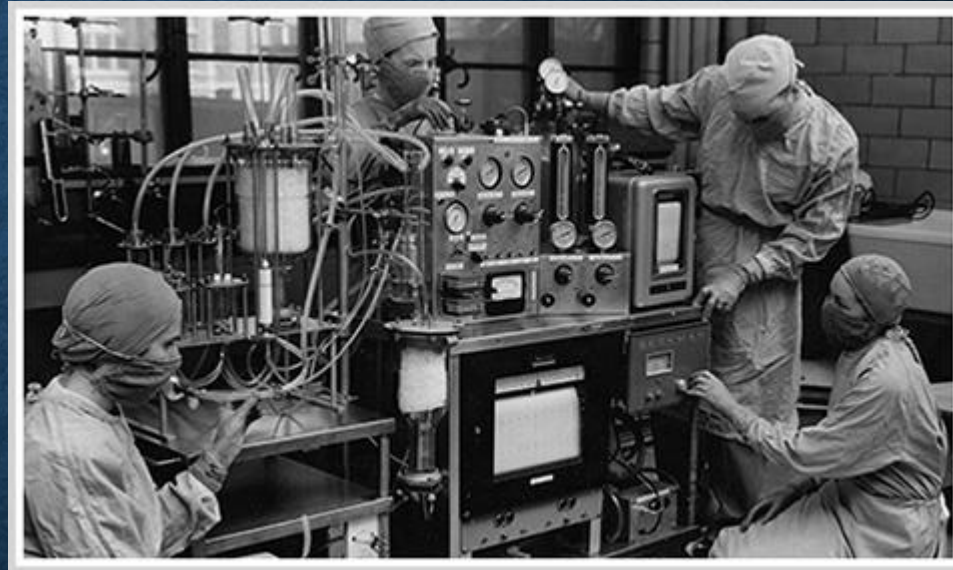
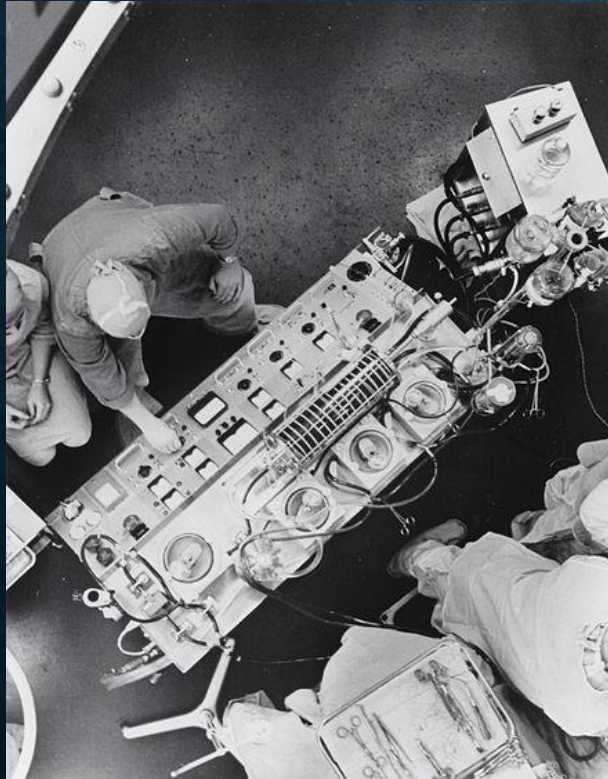
NEW YORK ACROSS NORTH AMERICA TO EUROPE AND AROUND THE GLOBE: “WOMEN TAKING THE LEAD”



1957 Strong Memorial Hospital
acquires its first heart-lung machine.
Rochester, NY

CINCINNATI, OHIO

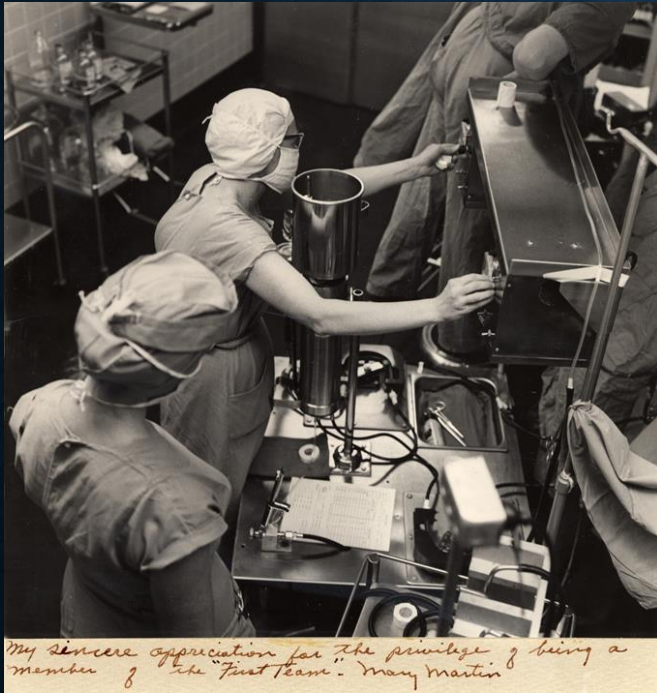
CINCINNATI CHILDREN'S HOSPITAL



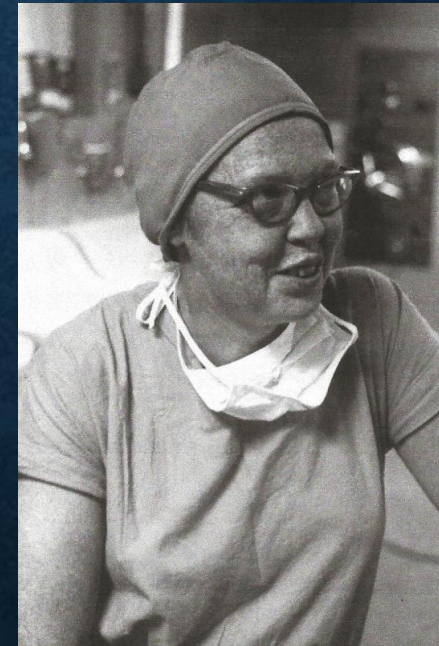
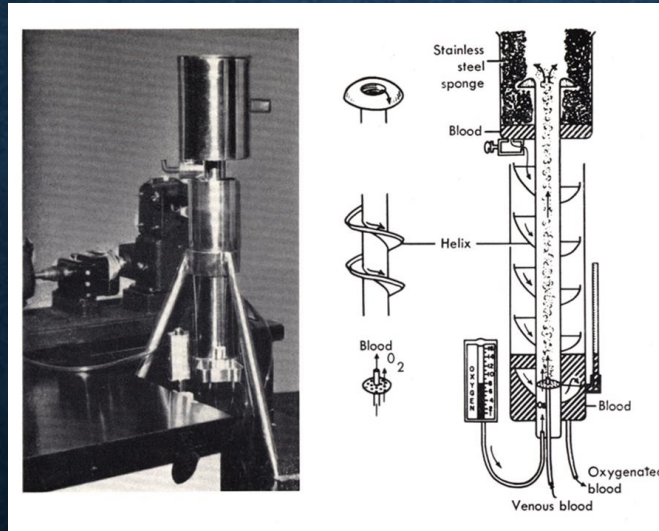
Pediatric cardiologist Samuel Kaplan, MD, cardiac surgeon James Helmsworth, MD, and inventor Leland Clark, PhD, came together at Cincinnati Children's in 1951.

MARY LOIS MARTIN 1927-2010

METHODIST HOSPITAL / TEXAS HEART INSTITUTE
HOUSTON, TEXAS



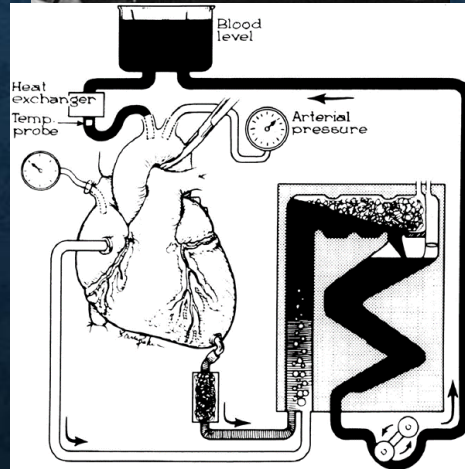
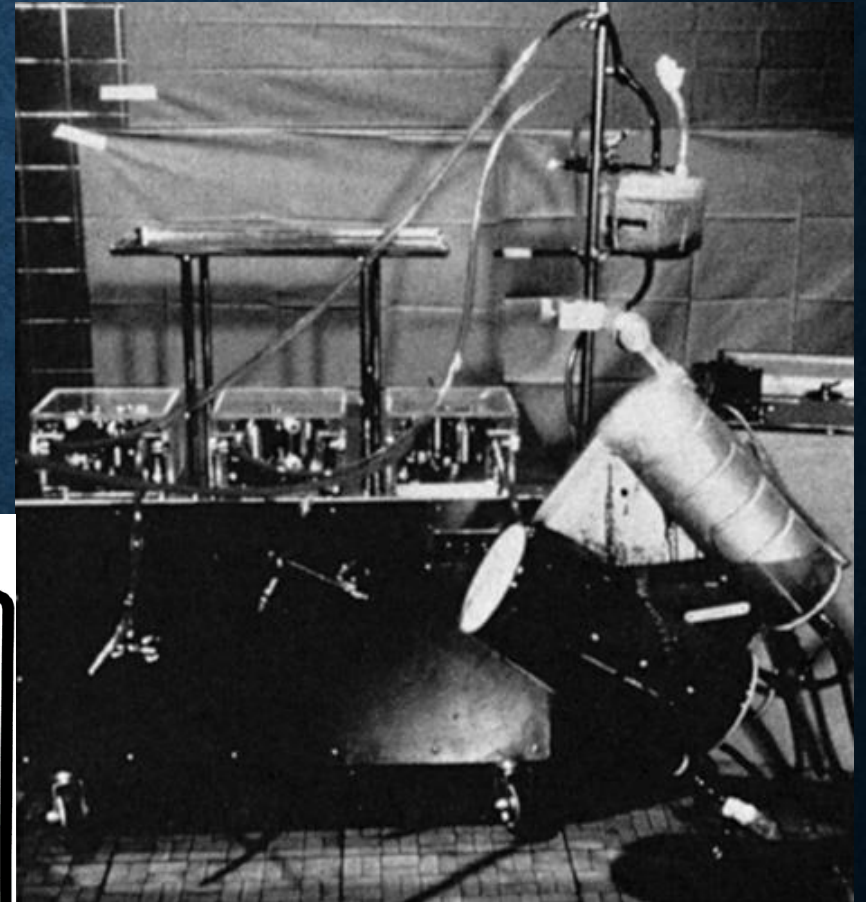
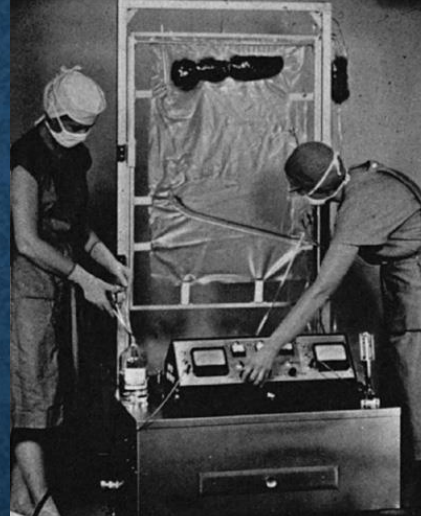
- Perfusionist for Denton Cooley and Michael DeBakey 1957-1969
- Chief Perfusionist until 1981 when she retired



1957, Cooley "Coffee Pot" Bubble Oxygenator
Commercially Produced by: Mark Company; Randolph, Massachusetts

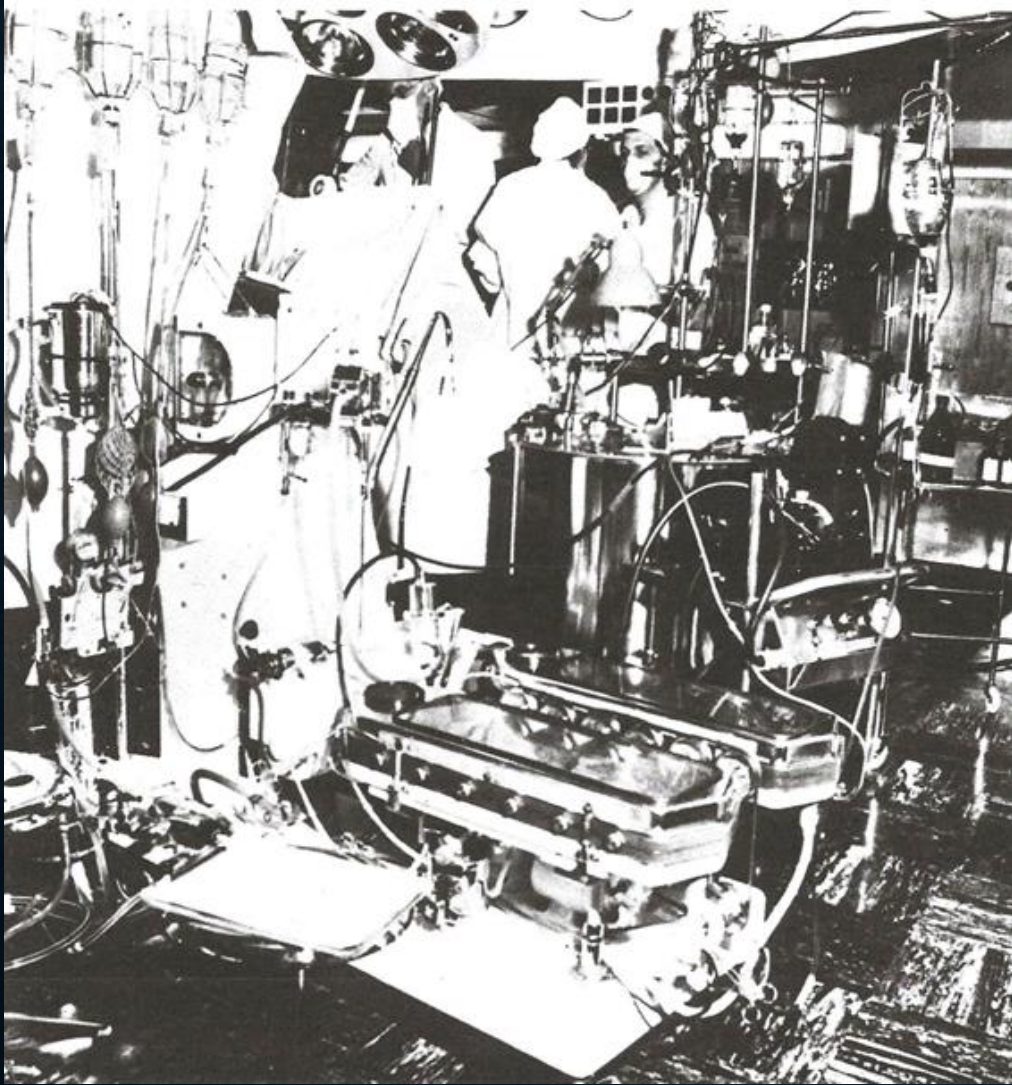
DEWALL-LILLEHEI UNITIZED PLASTIC SHEET OXYGENATOR

COMMERCIALLY SHIPPED STERILE READY FOR USE
(COURTESY OF D. A. COOLEY, TEXAS HEART INSTITUTE, HOUSTON, TX.)



CLARENCE CRAFOORD

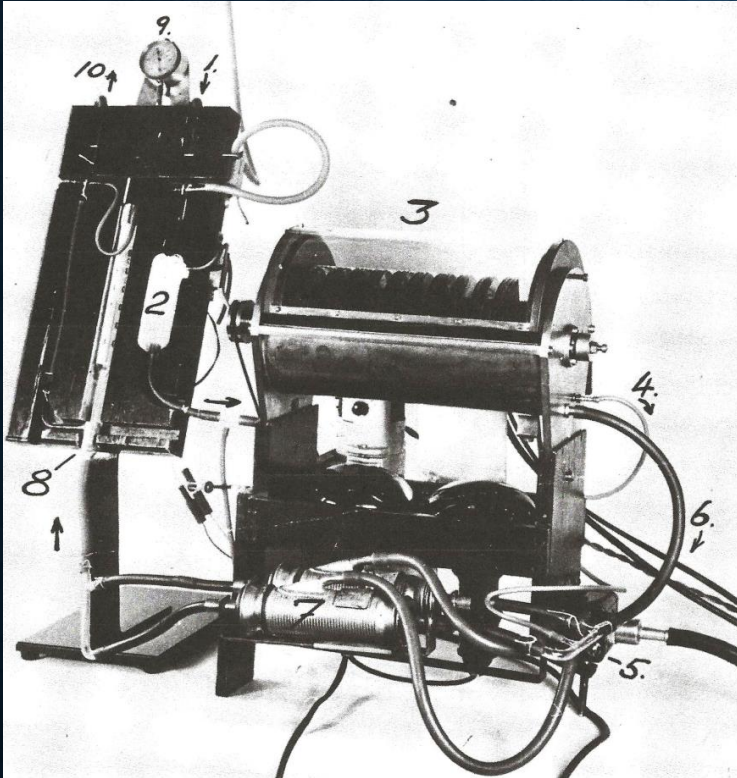
1965



- Karolinska Institute
- Emergency operation with aortic valve replacement
- Crafoord-Senning Heart Lung Machine connected to artificial kidney

Thoracic And Cardiovascular Surgery
At The Karolinska Institute
Published by Members Of The Staff At
The Thoracic Surgical Clinic
Almqvist & Wiksell International
Stockholm, Sweden

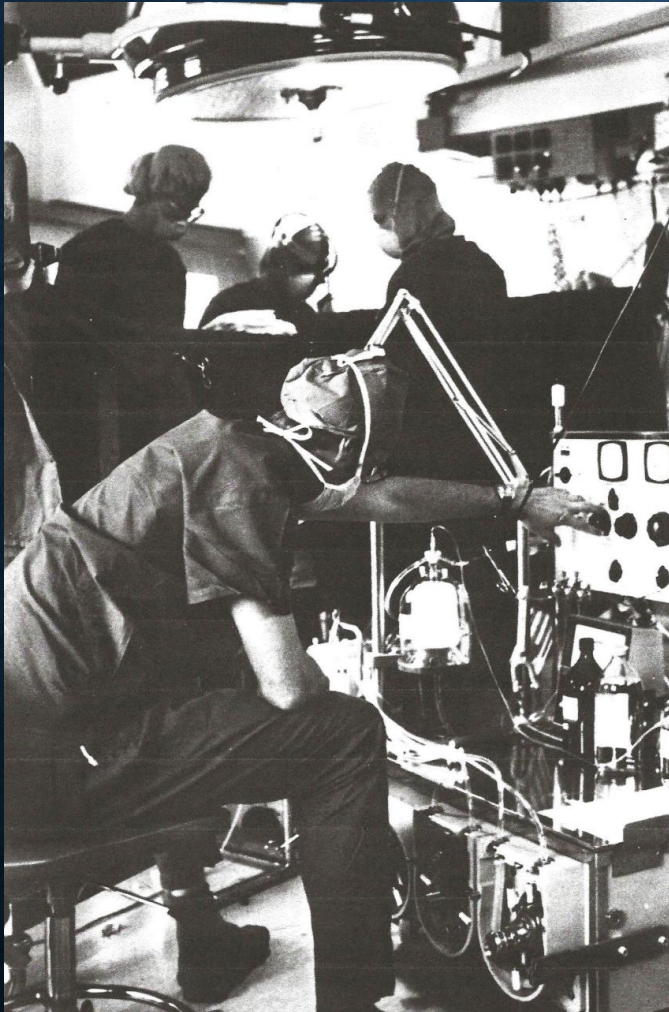
VIKING BJORK DISC OXYGENATOR 1947



Disc oxygenator provided with an automatic blood level control permitting only a maximal variation of ± 2 mm. Through a rubber membrane in the bottom of the outlet portion of the disc oxygenator the weight of the blood column is transmitted to scale connected with an electronic regulation of the voltage to the pump motor. The heat exchanger is built into the oxygenator by using a double-walled trough of stainless steel.

- Originally designed for perfusing the brain
- Supported animal experiments for as much as 33 minutes
- Used on 500 patients by Bjork
- Drum and Rotating Disc Film Oxygenator
- Modified by: Melrose in 1953, Kay and Cross et al in 1956, Osborn-Bramson-Gerbode in 1960

KAROLINSKA INSTITUTE



- Bentley Cardiotomy Reservoir
- Pemco Heart-Lung Machine

SOUTH AMERICA UNIVERSITY HOSPITAL CARACAS, VENEZUELA.



- Maria Cristina Paris, Perfusionist and Denton Cooley, M.D.
- September 12, 1957 ASD Closure, The first Open-Heart Operation with extracorporeal circulation, 14 year old girl

Sigmamotor Pump and DeWall Helical Coil Bubble Oxygenator

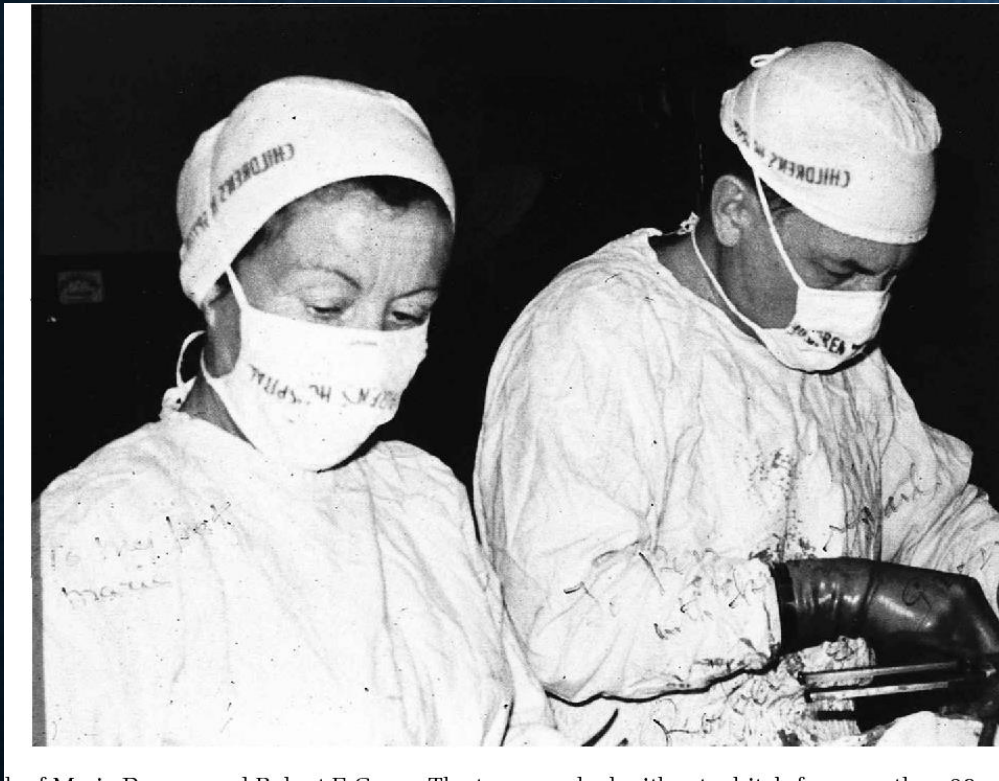
Texas Heart Institute Journal Vol. 14, No.2, June, 1987

Development of the Roller Pump for Use in the Cardiopulmonary Bypass Circuit

Denton A. Cooley

ROBERT GROSS & MARIE DRESSER

PEMCO HLM & SCI-MED MEMBRANE



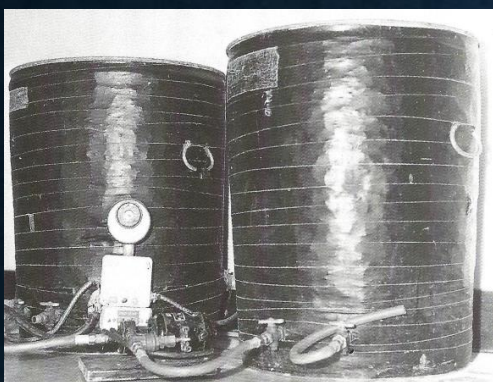
- Worked together more than 30 years
- **Perfusionist: Jean Lutz, R.N.**



DWIGHT HARKEN



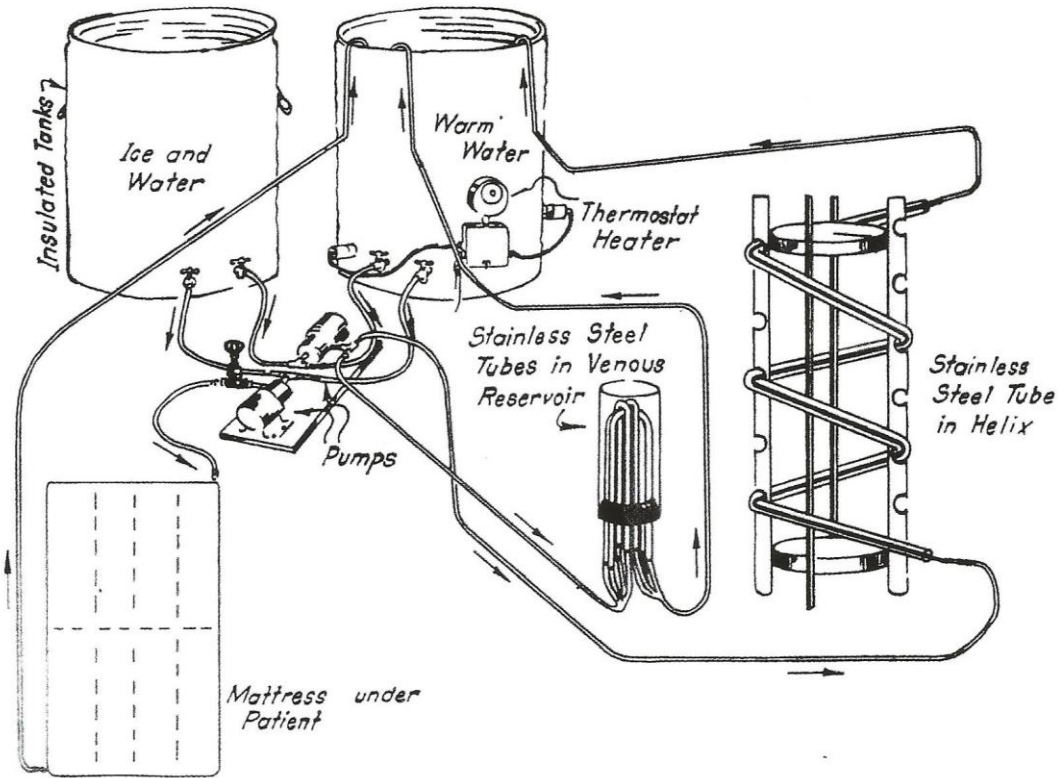
- Disc Oxygenator
- **Perfusionist: Scotty Fosberg, R.N.**



THE WORLD'S FIRST USE OF HEMODILUTION

"A TRIBUTE TO MODINE PIERCE"

1925-2006



Mercy Hospital, Oklahoma City, Oklahoma
 From: The Life of Nazih Zuhdi, Brooks Barr
 Oklahoma Heritage Association



"Things which matter
 most must never be
 at the mercy of things
 which matter least."

Johann Wolfgang
 von Goethe

Heater-Cooler
 Manufactured by
 KimRay, Oklahoma City

MONUMENTAL IMPACT OF “INTENTIONAL HEMODILUTION”

- Children and Adults could undergo cardiac surgery without the requirement to make 9 – 20 Blood Donors available at the time of surgery
- Jehovah's Witness patients could undergo cardiac surgery with “NO Blood Policy” intact
-
- Blood & Blood Product Conservation
- Transfusion reaction incidence reduced
- Disease transmission risk reduced
- Surgical scheduling was uninhibited

BETTY STEPHENS

THE FIRST FEMALE AFRICAN AMERICAN CHIEF OF PERFUSION OREGON HEALTH & SCIENCE UNIVERSITY AND FIRST SUCCESSFUL STARR-EDWARDS MVR

- I've attached two photos of Betty in case you want to use them. We invited her back to the hospital for a luncheon and then presented her with her Emeritus certificate. It was a great moment for us and she so enjoyed being back, memory lapses and all! The surgeon in the pic is Irving Shen, Our Chief of Peds CT Surgery, who also worked with Betty many years ago! He hosted the luncheon for her.

Betty lost her CCP certification effective January 2003, three years after her retirement. Unfortunately, her contact information was lost to the board and she failed to receive her letter offering CCP Emeritus status. Betty was finally presented with her long overdue CCP Emeritus Certificate in Sept 2019!



BETTY STEPHENS

- "Albert Starr's research team", published in the OHSU Historical Image

Collection, is licensed under CC-BY 4.0
circa 1958,

- From left to right, top to bottom:

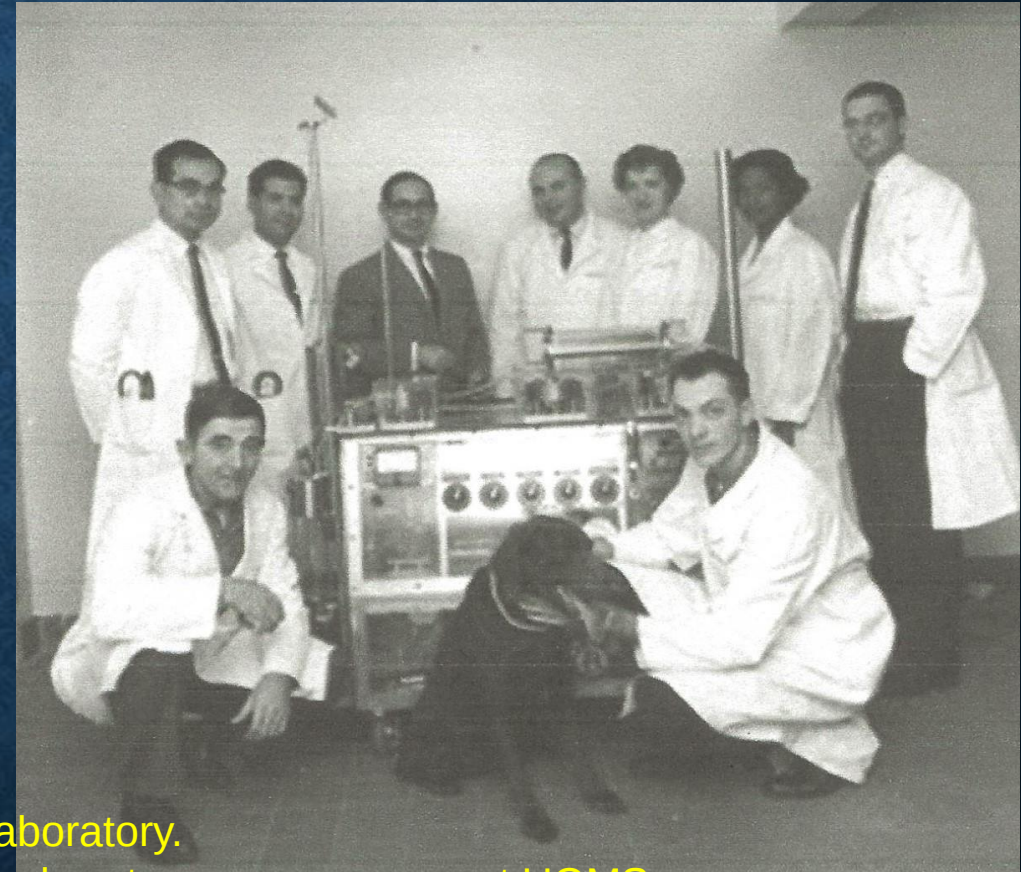
Dr. Alfred Lui, Dr. Fernando Leon, Dr.

Albert Starr, Dr. David Blumen, Mary

Ellen O'Reilly, Betty Stephens, Dr.

Colin McCord, Gary Wiss, "Blacky", and

Otto Hintz

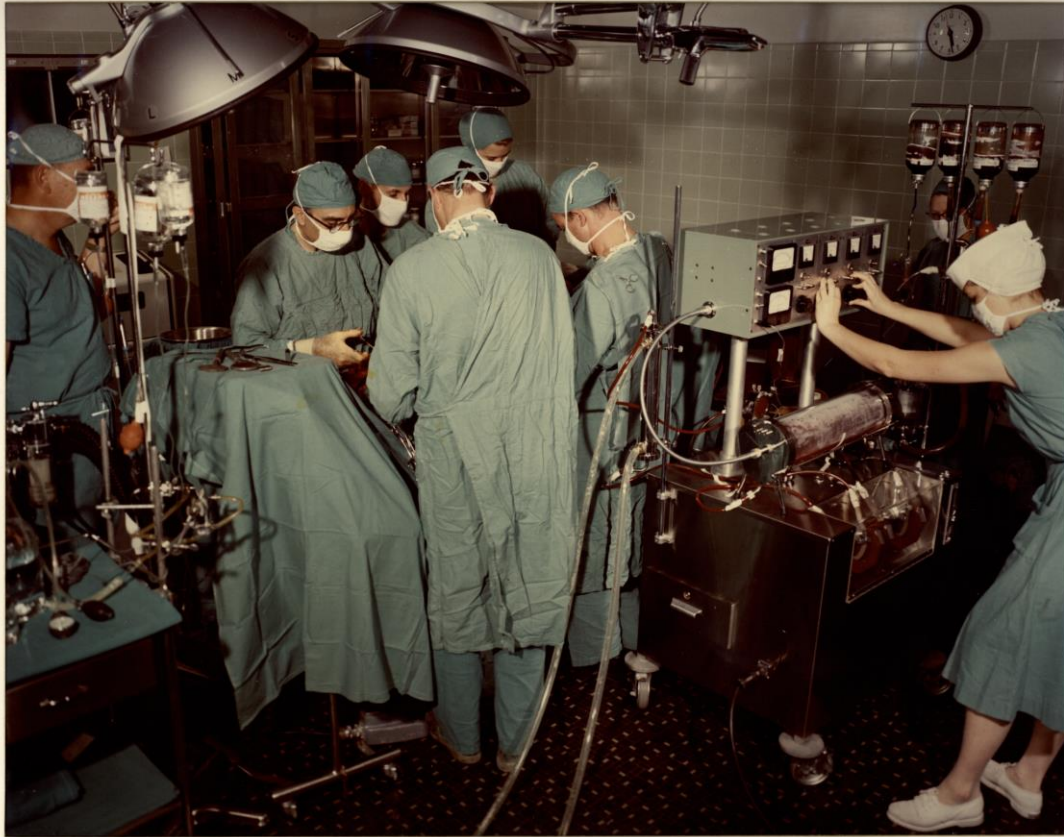


Dr. Starr asked Betty to manage his cardiovascular research laboratory.

During this time, she also worked as a scrub nurse for the open heart surgery program at UOMS.

Betty's contributions in the research lab was instrumental in the development of the first Starr-Edwards mitral prosthetic caged ball valve, which was successfully implanted in a human patient on August 25, 1960. In fact, the stories of Betty hand-sewing the sewing ring to valves after scrubbing in with the patient on the operating room table are true!

MICHAEL DEBAKEY, 1960's



- Not sure who the perfusionist is!

DENE FRIEDMANN, PERFUSIONIST CAPE TOWN, SOUTH AFRICA



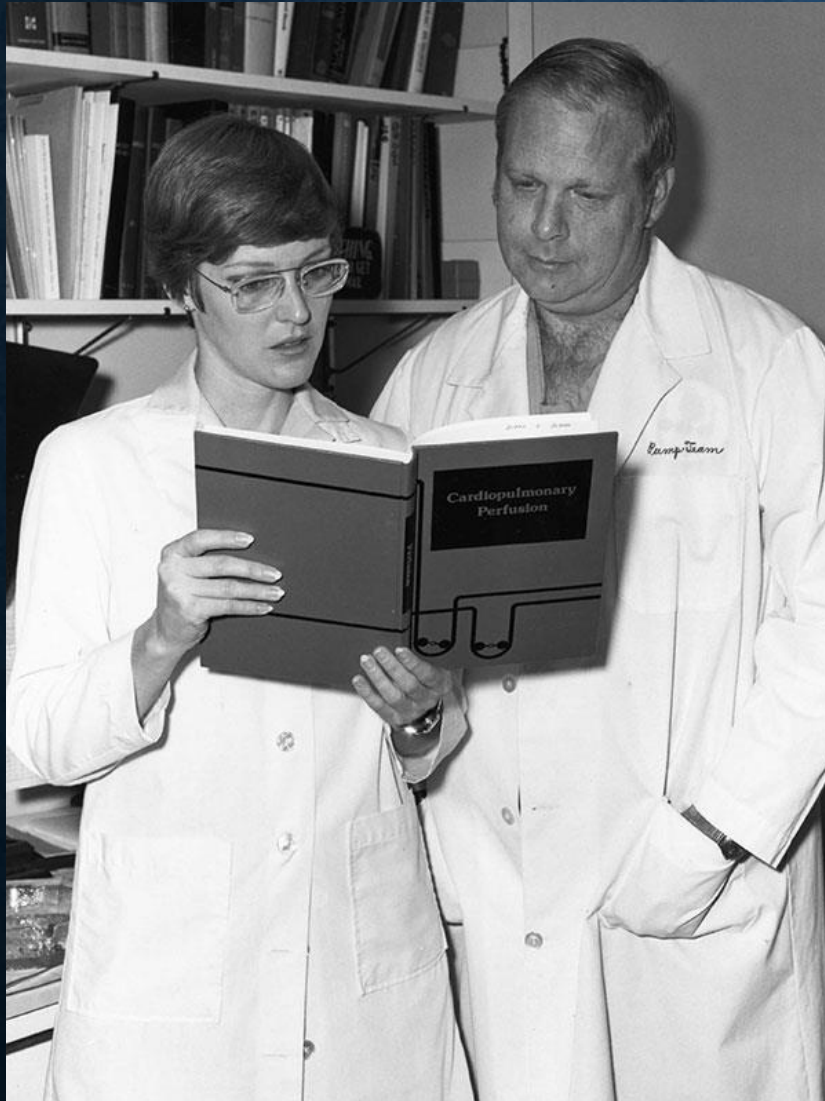
- December 2, 1967 she received a phone call around 10:00 p.m., World's First Heart Transplantation
- Heart Transplant Groote Schuur Hospital

MADELINE MYERS MASSENGALE- BEALL



- A life member of the American Society of Extracorporeal Technology, Inc., Maddie was honored with the first Perfusionist of the Year Award in 1974, the President's Award in 1976, and a Pioneers in Perfusion honoree in 2012. In 1992 Maddie was recognized by the AMA for her contributions to the Committees on Allied Health and Perfusion Education.
- Maddie remained at UCSF until 1970 and then briefly worked at Cedars of Lebanon Hospital in southern California before being recruited to St. Anthony's Hospital in Denver, where she was chief perfusionist until 1983.
- Her last jobs in perfusion were to hold executive positions for three large contract perfusion groups that included PSICOR, Inc. and later Baxter Perfusion Services. She retired in 2000.

DIANE CLARK (1947-2013) PICTURED WITH CHARLES C. REED



- 1971 Texas Heart Institute School of Perfusion Technology
- June 1972 1st Graduating Class
- Appointed Associate Director of Academia
- 1975 Book, Co-Authored with Charles C. Reed "Cardiovascular Perfusion"

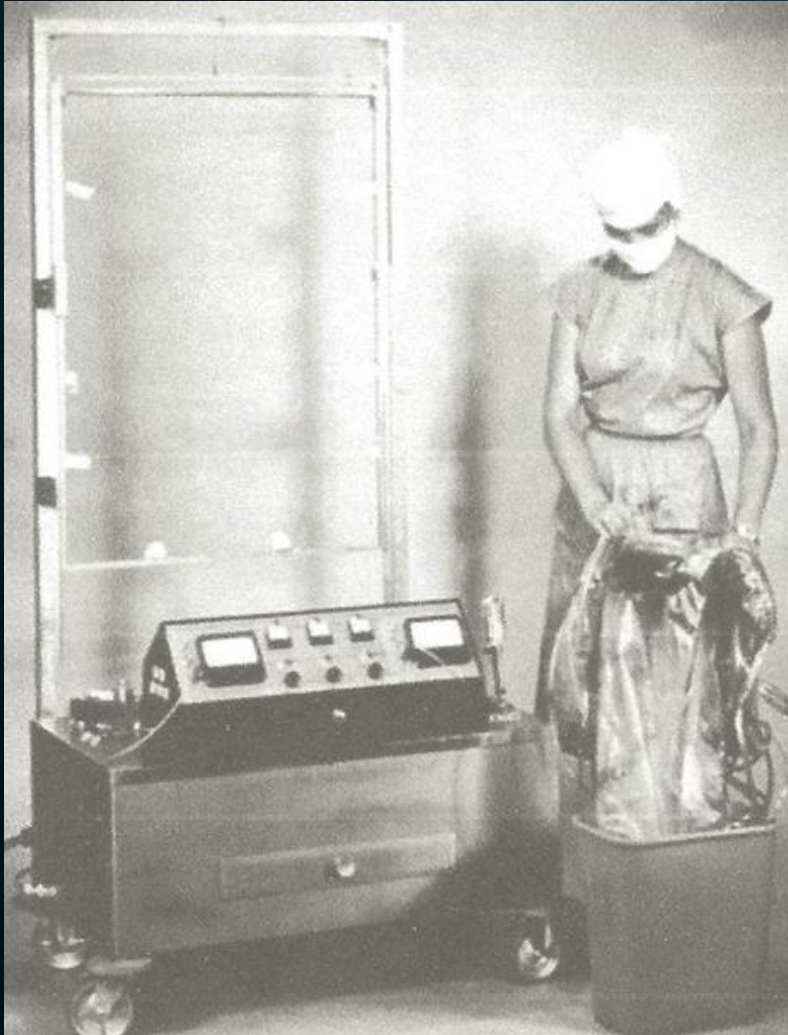
TEXAS HEART INSTITUTE 1960'S

“A BOTTLE OF BLOOD PLEASE”

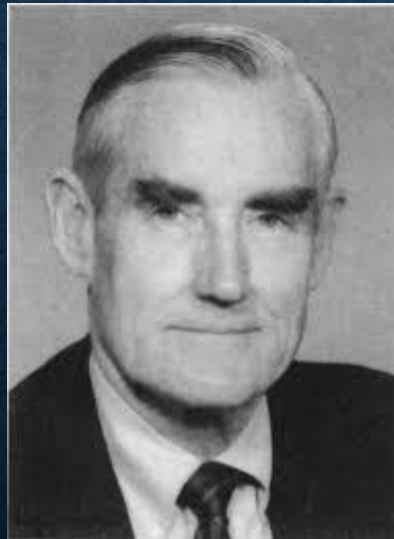


- 1932, The first hospital blood depot Leningrad Hospital, Russia
- 1936, The first vacuum blood bottle was marketed by Hyland
- 1937, Originated the term 'Blood Bank' by Bernard Fantus
- John Elliott develops the first blood container, a vacuum bottle extensively used by the Red Cross
- Glass bottles for blood storage before the Fenwal (Plastic) Bags
- Blood Prime “The Standard of Care”
- 1952, Blood bags were described in literature for the first time
- Manufactured from “polyvinyl resin”
- 1950's to early 1980's, essentially all blood bags were produced from PVC plastics

TEXAS HEART INSTITUTE 1960'S



- Plastic Disposable Oxygenator:
Rygg Bag and "Travenol Bag" 6LF & 2LF
- Developed by I.M. Rygg of Copenhagen
- Modified by Vincent Gott and later
Denton Cooley who added a stainless
steel defoamer



Left: Vince Gott
Right: Collapsible Venous Reservoir



**LEFT: RYGG BAG
RIGHT: RYGG SHEET OXYGENATOR**

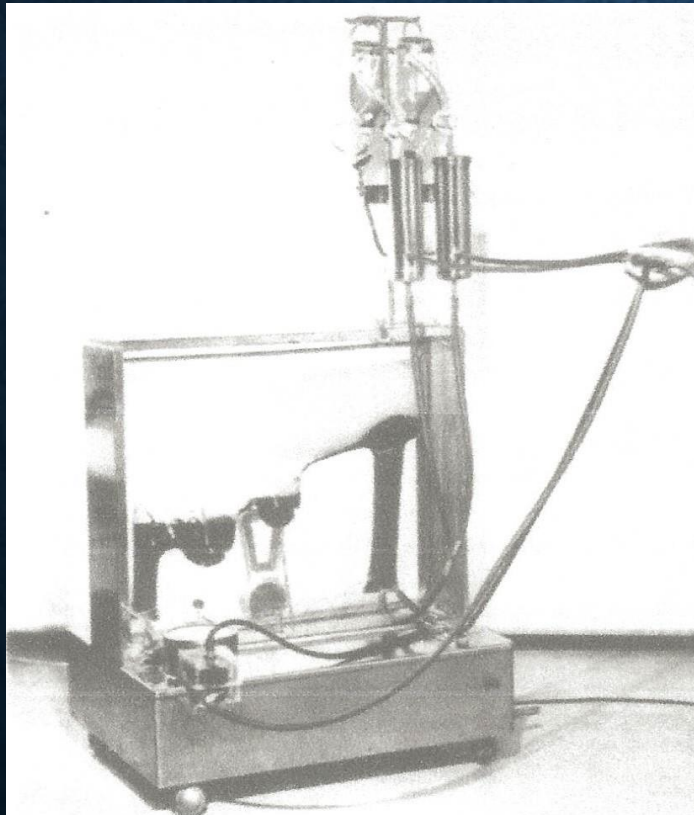


FIG. 1a.—The Rygg-Kyvsgaard III pump oxygenator.

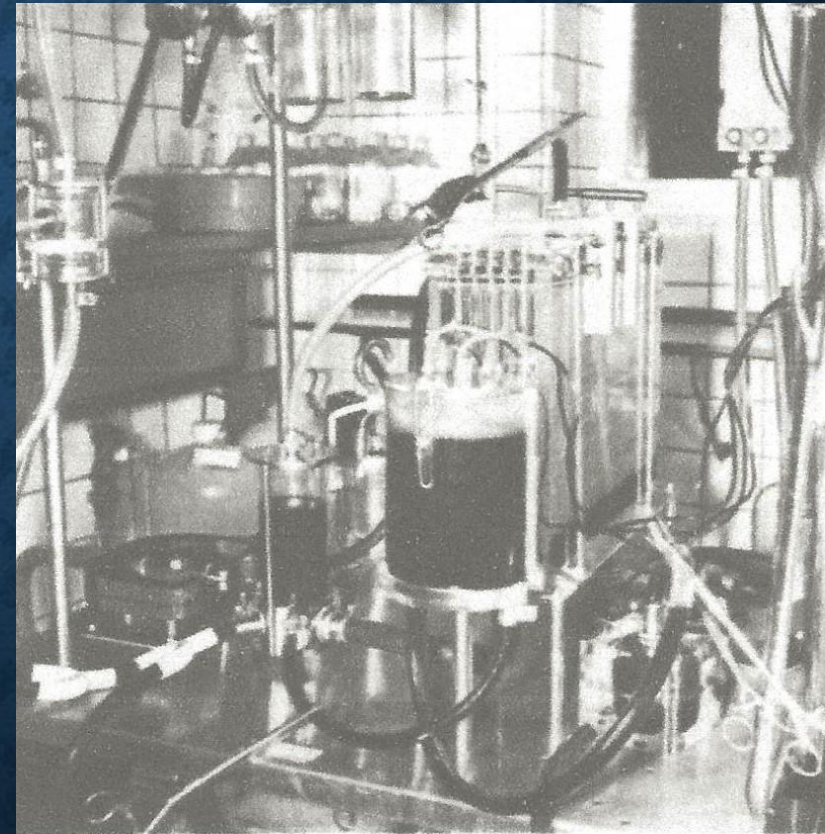


FIG. 2a.—The mark III pump oxygenator.

DENE FRIEDMANN, PERFUSIONIST CAPE TOWN, SOUTH AFRICA



- December 2, 1967 phone call around 10:00 p.m.
- Heart Transplant Groote Schuur Hospital
- A Worldwide Frenzy Ensued



First human heart transplant 1967.
courtesy UCT

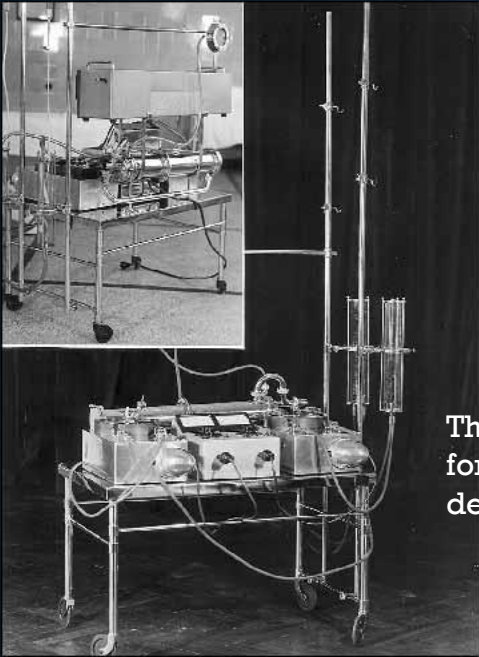


Groote Schuur Hospital 1967.
courtesy UCT



Media frenzy awaiting Dr. Chris Barnard at the
entrance of Groote Schuur Hospital after the
first human heart transplant 1967. courtesy UCT

POLAND 1980

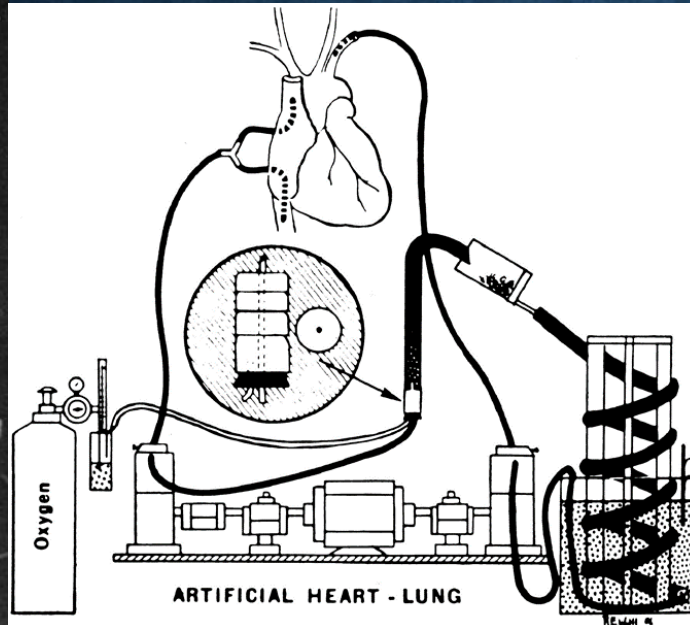


The first Polish Heart Machine with Heat Exchanger for performing open heart operations under deep hypothermia.



- Dr. Wanda Jarosik (maiden name Dziatkowiak) a Perfusionist running the heart-lung machine for open heart operations at the Dept. of Cardiac and Vascular Surgery of the Institute of Cardiology, Jagiellonian University Collegium Medicum, 1980.

CHINA



- The equipment used by Professor Pan Chih and associates for many successful open heart operations at the Shanghai Chest Hospital in China, 1957 to 1958. The first successful cardiac operations using cardiopulmonary bypass in both China and Japan were done with the DeWall-Lillehei bubble oxygenator.

The Present

CHRIS CLAY



“The Greatest Teacher Ever!!!”





**“These Women and
[OH]
so many others Lead!”**





**A Trail Blazed:
“Women In Perfusion”
Career Conditions Today**

2015-2016 SURVEY AMERICAN BOARD OF CARDIOVASCULAR PERFUSION PROFILE & CURRENT TRENDS

- 3,875 eligible, 3,056 (78.9%) respondents
- Gender: 35.7% female
- Age: 4.8% (147) female 20-29 years, 11.6% (351) female 30-39 years, 8.4% (239) female 40-49 years, 8.4% (255) 50-59 years, 3% (90) female 60-69 years
- 1-5 years experience 7.5% (227) female, 6-10 years experience 6.4% (194) female, 11-15 years experience 5.9% (178) female, 16-20 years experience 4.5% (135) female, 21-25 years experience 5.1% (156) female, greater than 25 years experience 6.3% (192) female

A 2015-2016 Survey of American Board of Cardiovascular Perfusion Certified Clinical Perfusionists: Perfusion Profile and Clinical Trends. Casey Turnage, PhD; Edward DeLaney, MBA, CCP; Bradley Kulat, BA, CCP; Ann Guercio, MBA, CCP; David Palmer, EdD, CCP; Carol Ann Rosenberg, MBA, CCP; Kyle Spear, MS, CCP; David Boyne, BS, CCP; Charles Johnson, BS, CCP; William Riley, MS, CCP. JECT. 2017;49:137-149. The Journal of Extracorporeal Technology

TRENDS IN THE WORK PLACE 1970-1999

- Women have increased in participation from 43.3% in 1970 to 60.0% in 1999
- 53.6% of women over the age of 16 years are utilized in the workplace compared to 71.2% of men
- 2009, 71.6% of mothers with children younger than 18 years were in the work force
- 59.8% of married mothers with children 3 years of age and younger were in the labor force
- 81.6% unmarried or separated mothers with children ages 6-17 years
- 39.3% of families rely on mothers as the source for primary financial support
- Women earn 77.5 cents for every dollar men earn with greater disparity in higher education attainment

Source: Women in Perfusion: A Survey of North American Female Perfusionists
Stacey L. Brewer, BS, CCP; Linda Mongero, BS, CCP
JECT. 2013;45:175-177
The Journal of Extracorporeal Technology

TRENDS IN THE WORK PLACE 1970-1999 CONT.

- 53% of employers provide some level of replacement compensation during maternity leave
- Women earn less than men in 99% of all occupations

Source: Women in Perfusion: A Survey of North American Female Perfusionists
Stacey L. Brewer, BS, CCP; Linda Mongero, BS, CCP
JECT. 2013;45:175-177
The Journal of Extracorporeal Technology

SURVEY ISSUES AND CONCERNS

WOMEN IN PERFUSION

- 538 respondents, 45% of all female Certified Perfusionists
- 15.8% age 20-29 years
- 30.1% age 30-39 years
- 25.3% 40-49 years
- 28.8% 50 years or older
- 32.6% had 20 plus years experience
- 90.4% were white females compared to 68.1% in other labor force positions
- The average American earns \$47,000 annually 2011-2012 salary survey
- 87.7% of women in perfusion earn above \$75,000 in salary, 7.6% earn in excess of \$150,000
- 63.8% first professional career, 36.2% had prior medical careers

Source: Women in Perfusion: A Survey of North American Female Perfusionists
Stacey L. Brewer, BS, CCP; Linda Mongero, BS, CCP
JECT. 2013;45:175-177
The Journal of Extracorporeal Technology

BREWER ET AL SURVEY CONT.

- 18.3% attained Master's degrees
- 19.3% identified as Chief Perfusionists
- 41.8% worked < 37 hours per week
- 42% work an average of 37-45 hours per week
- 11.6% work 45-55 hours per week
- 4.7% work > 55 hours per week
- 95.7% take "Call"
- 63.8% were married
- 11% divorced
- 25.3% single
- 7.5% had children
- 87.5% continued working while pregnant
- 28.4% took a 6-week maternity leave, 16.3% a 10-week leave, 3.5% a 1 year leave
- 51.9% held part-time hours to retain their position

Source: Women in Perfusion: A Survey of North American Female Perfusionists

Stacey L. Brewer, BS, CCP; Linda Mongero, BS, CCP
JECT. 2013;45:175-177

The Journal of Extracorporeal Technology

ALARMING & GLARING CONCERNS “MOTHERS & PERFUSION”

- 75.5% Our female colleagues who are also mothers in many instances confront personal family concerns and problems
- Reliance on Day Care or extended family members to “ALWAYS” be available for On-Call situations
- **Unable to be a “Dependable Caregiver” and Absence in Children’s daily lives**, how this upbringing will impact or affect their children into the future
- **45% of those surveyed love their career**
- **0.4% completely dislike their career**

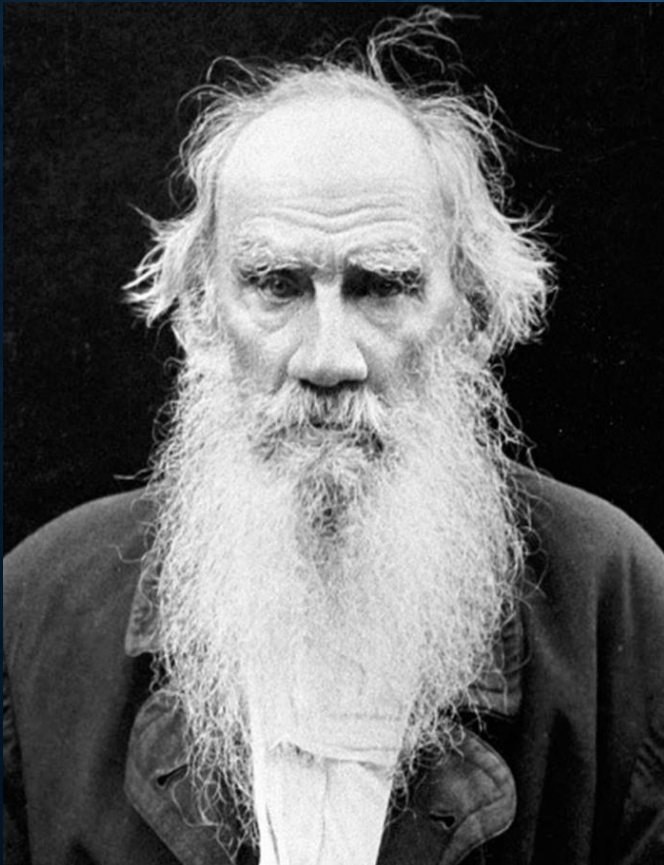
Source: Women in Perfusion: A Survey of North American Female Perfusionists
Stacey L. Brewer, BS, CCP; Linda Mongero, BS, CCP
JECT. 2013;45:175-177
The Journal of Extracorporeal Technology

CONSIDERATIONS FOR IMPROVEMENT WOMEN IN PERFUSION

- Overall Gender Equality: equal treatment regardless of gender – Improves daily workplace experience
- Gender Balance in management – Improves Ability to Establish Female Role Models In The Workplace
- Work / Life Balance – Number of Hours, Flexibility (1/2 days, Sick Leave, Vacation Days, Personal Time Off Days)
- Family Friendly workplace, 50 million mothers in workplace today with children under age 18 years
- Longer paid maternity leave

JOB SATISFACTION MAY MEAN SOMETHING DIFFERENT TO WOMEN

“EXPLORE THE POSSIBILITY”



“All happy families are alike; each unhappy family is unhappy in its own way.”

Leo Tolstoy , Anna Karenina

- The Anna Karenina Principle: states that a deficiency in any one of a number of factors dooms an endeavor to failure. Consequently, a successful endeavor (subject to this principle) is one where every possible deficiency has been avoided.

THE AMERICAN ACADEMY OF CARDIOVASCULAR PERFUSION



Female Charter Members:

- Diane Clark
- Pati Ann Gaich
- Talara J. Hill

The American Academy of Cardiovascular Perfusion
Applauds & Welcomes Women In Perfusion
“From The Beginning”

THE END

**A Special Thanks To Women In Perfusion:
Celebrate Your Success, they were many!**