# Surgery for Congenital Heart Defects; science or art?

#### Martin Elliott 37<sup>th</sup> Gresham Professor of Physic

Professor of Cardiothoracic Surgery at UCL Consultant Paediatric Cardiothoracic Surgeon & co-Medical Director

The Great Ormond Street Hospital for Children



## remember the last time?

## remember the last time?

## today, I am going to talk about innovators

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"There is nothing more difficult to take in hand, more perilous to conduct, nor uncertain in its success, than to take the lead in the introduction of a new order of things.

For the innovator has for enemies all of those who have done well under the old, and lukewarm defenders in all of those who may do well under the new."

Niccoló Macchiavelli (1469–1527)

## Theodor Billroth 1829-1894



http://www.aerzteblatt.de/archiv/54013/Medizingeschichte-Herznaht-wider-ethische-Bedenken

## Theodor Billroth 1829-1894



'Ein Chirurg, der versuchte, eine Wunde des Herzens zu nähen, verlöre die Achtung seiner Kollegen.'

'Eine Operation, die nach meiner Auffassung erreicht, was einige Chirurgen Prostitution der chirurgischen Kunst, andere eine chirurgische Frivolität nennen'

http://www.aerzteblatt.de/archiv/54013/Medizingeschichte-Herznaht-wider-ethische-Bedenken

## Theodor Billroth 1829-1894



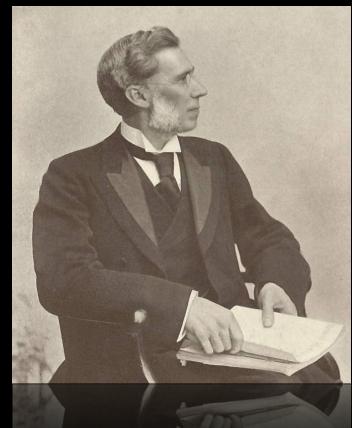
A surgeon who tries to suture a heart wound deserves to lose the esteem of his colleagues

Performing an operation to the heart is tantamount to an act of prostitution in surgery or surgical frivolity.

http://www.aerzteblatt.de/archiv/54013/Medizingeschichte-Herznaht-wider-ethische-Bedenken

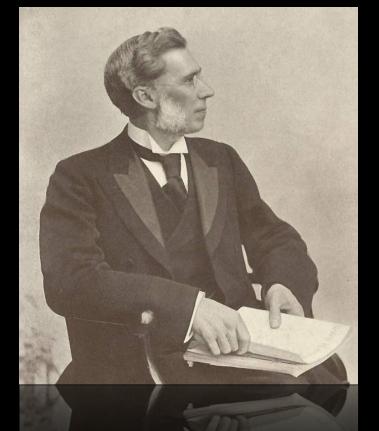
### 1881

€dmund Symes≠Thompson



#### 1881

#### Edmund Symes=Thompson



#### CORRESPONDENCE.

#### DR. SYMES THOMPSON AND THE GREAT NORTHERN RAILWAY COMPANY.

S18,—I feel that an explanation of the circumstances under which I appeared at the Clerkenwell Police Court last week is due to my professional brethren. I therefore forward a statement which I addressed to the President and Council of the Royal Medical and Chirurgical Society.

I have also the pleasure to enclose a resolution which the Council unanimously adopted ; and I confidently trust that the profession in general will receive the explanation in the same generous spirit as was shown at the meeting of the Royal Medical and Chirorgical Society on Tuesday last, I am, etc., E. SYMES THOMPSON,

3, Upper George St., W., Jan. 27, 1874.

#### To the President and Council of the Royal Medical and Chirurgical Society of London.

Mr. President and Gentlemen, - As Honorary Secretary of the Royal Medical and Chirurgical Society, I feel called upon to make a statement with reference to a charge made against me of travelling on the Great Northern Railway without having previously paid my fare, and with intent to defraud the Company, the result of which has been reported in the daily papers.

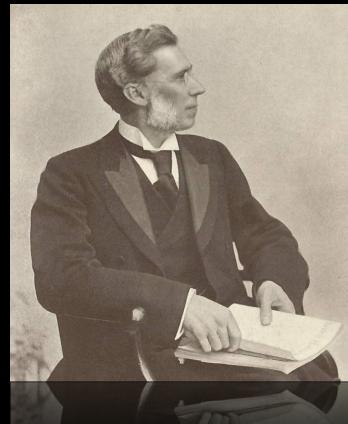
On the morning of December 25th, my wife being ill, and being very much hurried, I reached the Potter's Bar Station too late to take a ticket or speak to the guard. I at once determined, as I was coming back in the evening, to take my return ticket at King's Cross, having failed to do so at Potter's Bar.

When the train stopped at Holloway, I had to change carriages, and, passing a ticket-office, I took a ticket to King's Cross, solely with the purpose of avoiding delay and explanation, and believing that I was too well known on the line to be accused of wishing to avoid the payment of my full fare. The ticket-collector, before whose eyes I had deliberately left the train and taken the ticket, demanded my ticket for the [SIBEI HH] 8[1]IC [DBIDCX- ] then [or the [irst time: realized that I was too the line to be accused of whose eyes I had deliberately left the train and taken the ticket, demanded my ticket for the [SIBEI HH] 8[1]IC [DBIDCX- ] then [or the [irst time: realized that I was too the line to be accused of the line interval.

"The time may possibly come when wounds of the heart itself will be treated by pericardial incision to allow extraction of clots and perhaps to suture the cardiac muscle."

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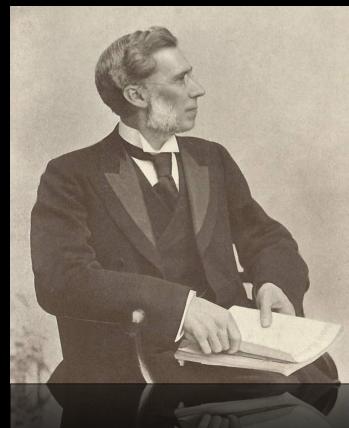


Pericardium

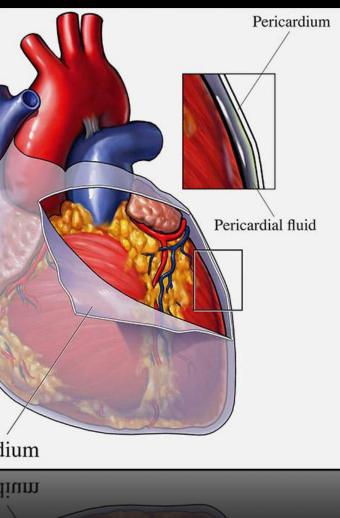
Pericardium

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#### Henry C Dalton (St Louis)



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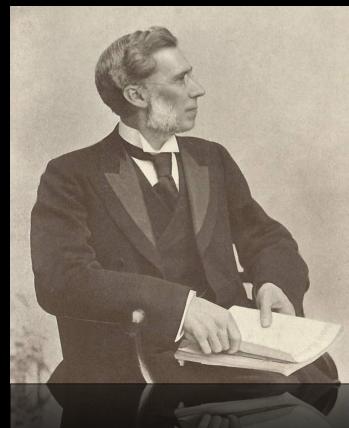


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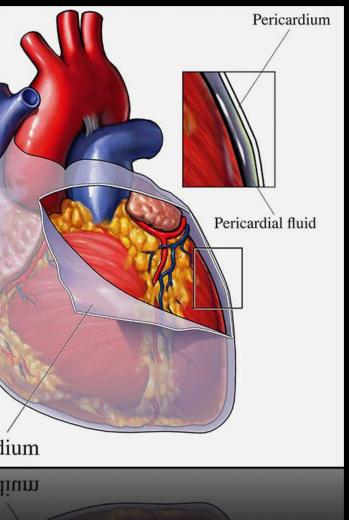
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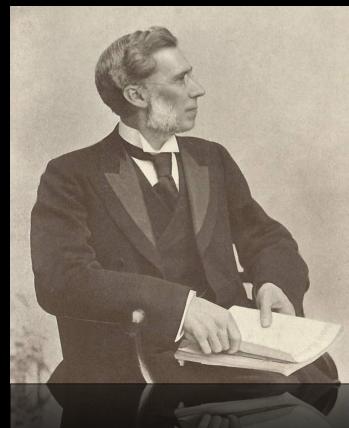


Pericardium

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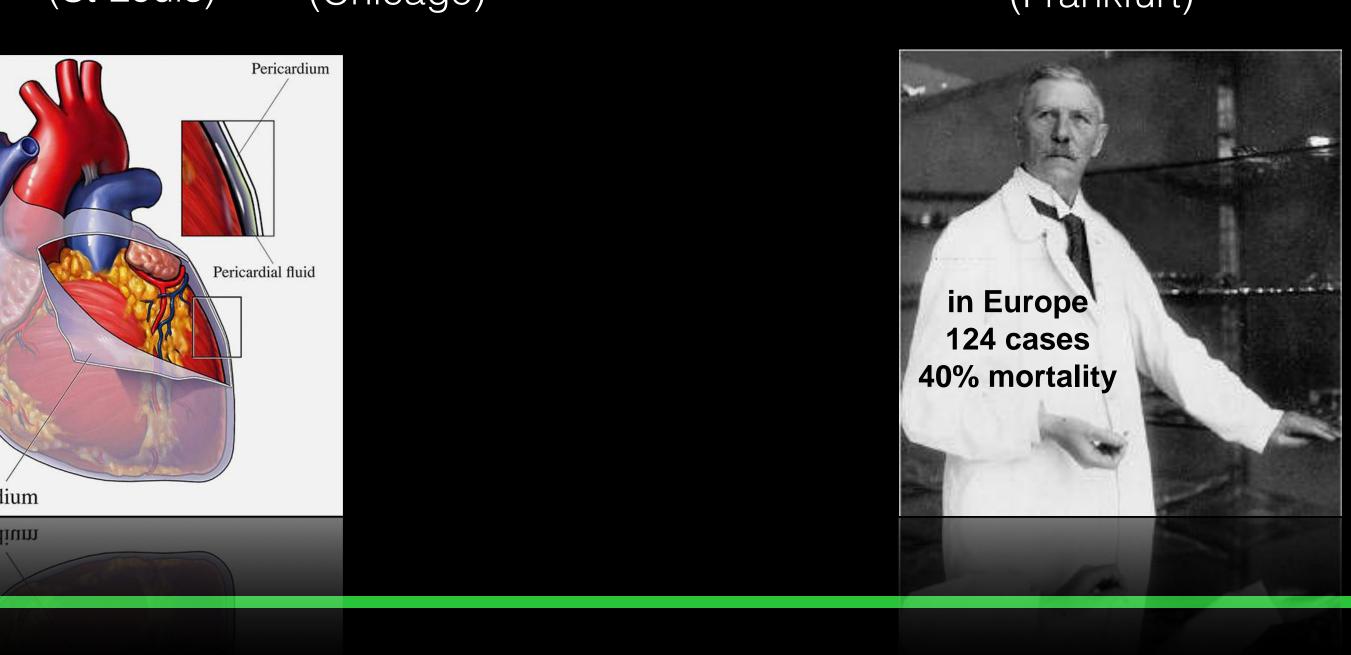
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#### Henry C Dalton Hale Williams (St Louis) (Chicago)

#### Ludwig Rehn (Frankfurt)

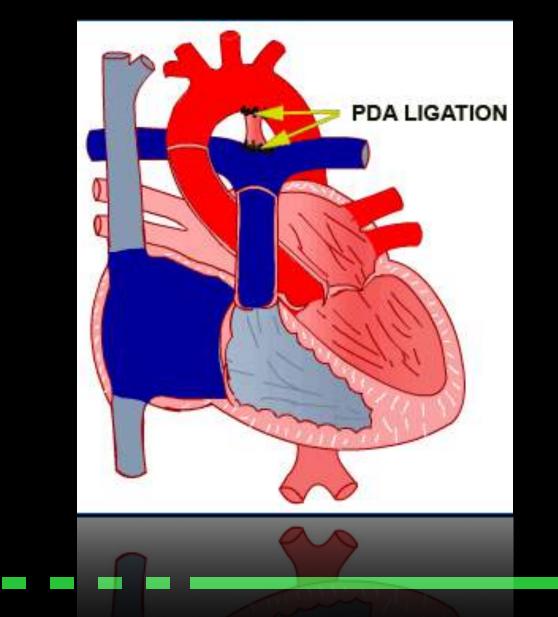




#### 1937

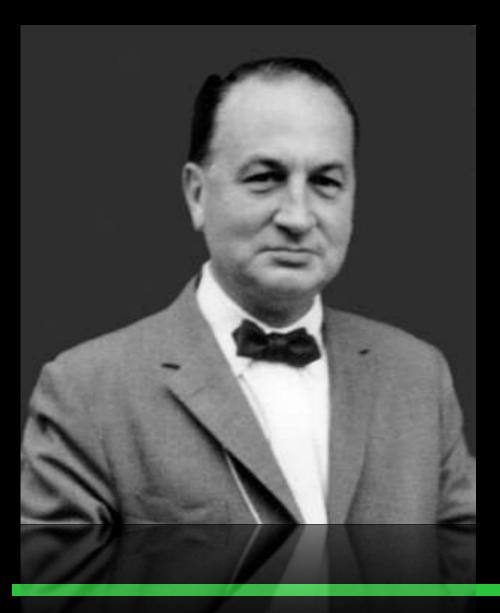
Víncent Sutherland Hodson

#### John Streider (Boston)



#### 1937

Víncent Sutherland Hodson



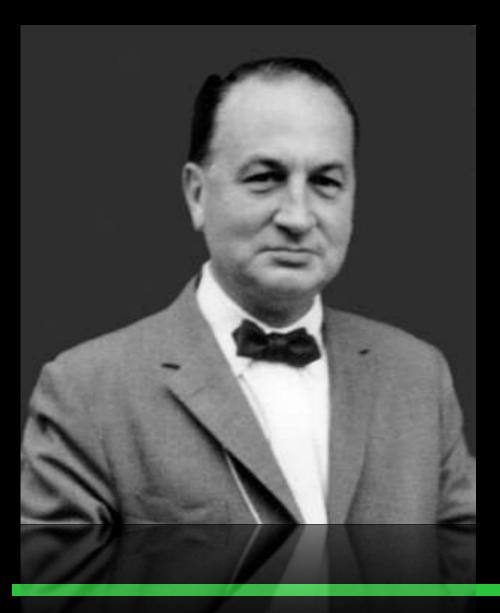
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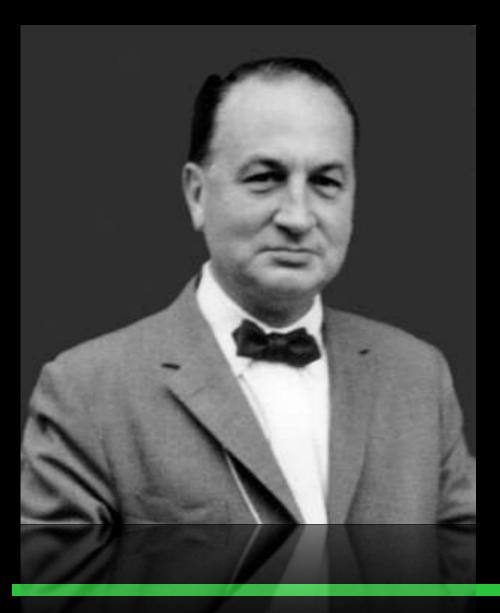
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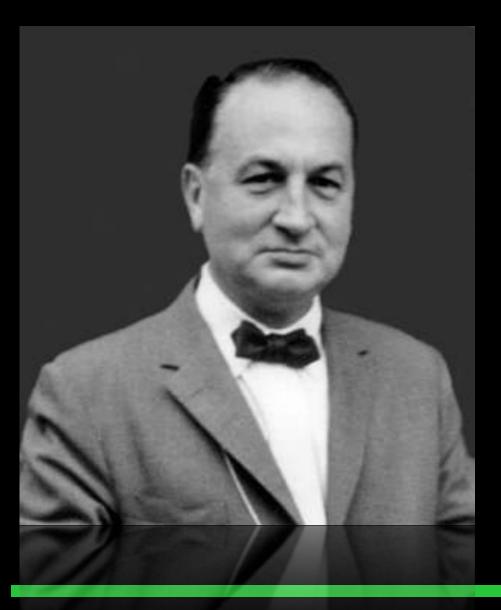
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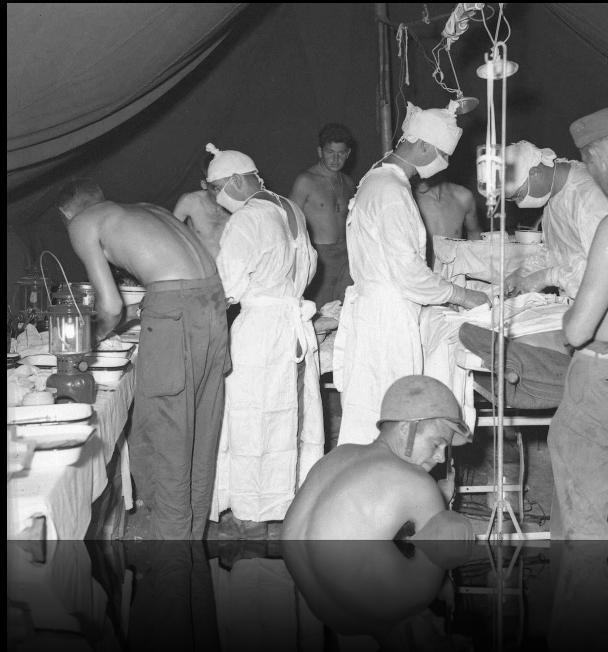
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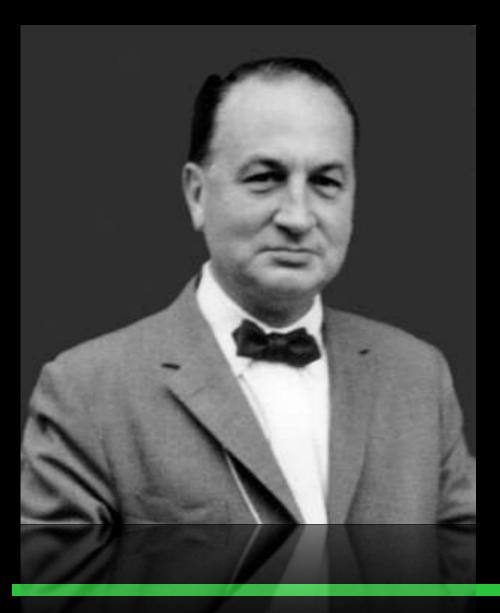
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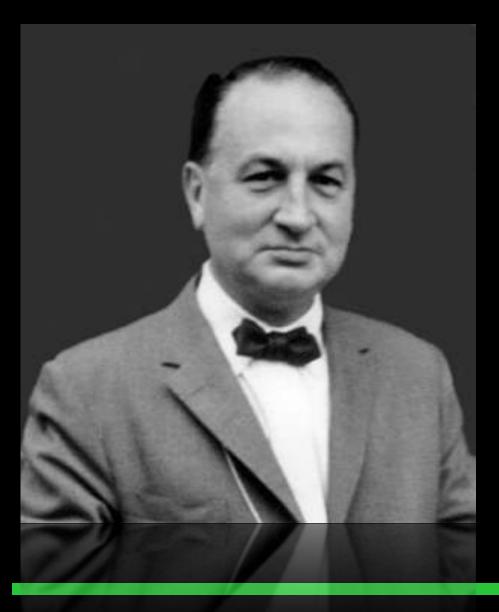
#### **During World War II**

military doctors, facing injury and suffering on a massive scale, pioneered advances in antibiotics, anesthesia, and blood transfusions—advances that would usher in the age of modern surgery.



#### 1937 1938

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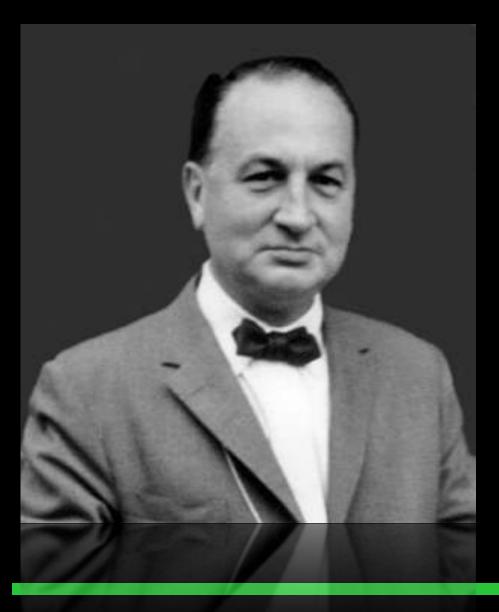


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#### Clarence Craaford (Stockholm)





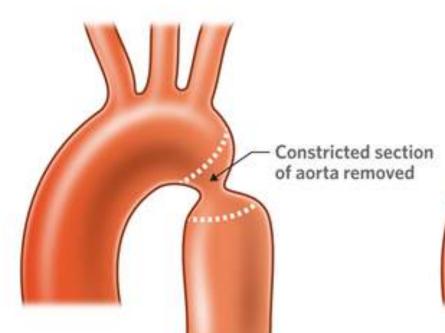
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#### **Coarctation repair**

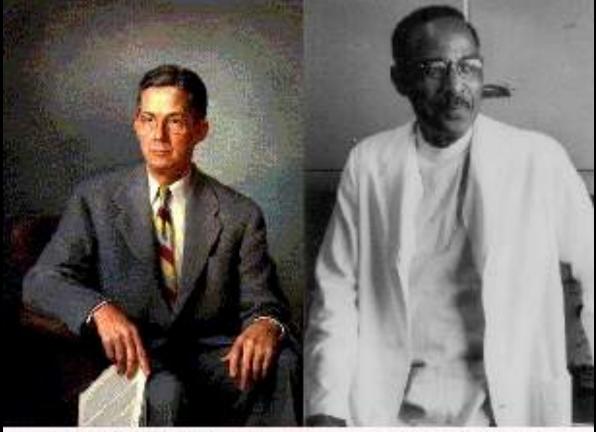




Resection and end-to-end anastamosis

Resection and end-to-end anastamosis





**Vivien Thomas** 

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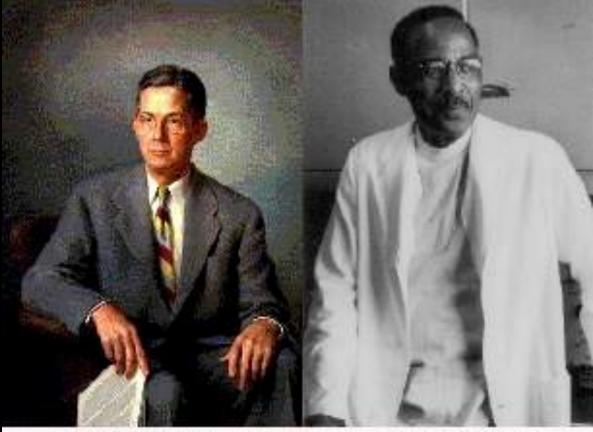


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1941



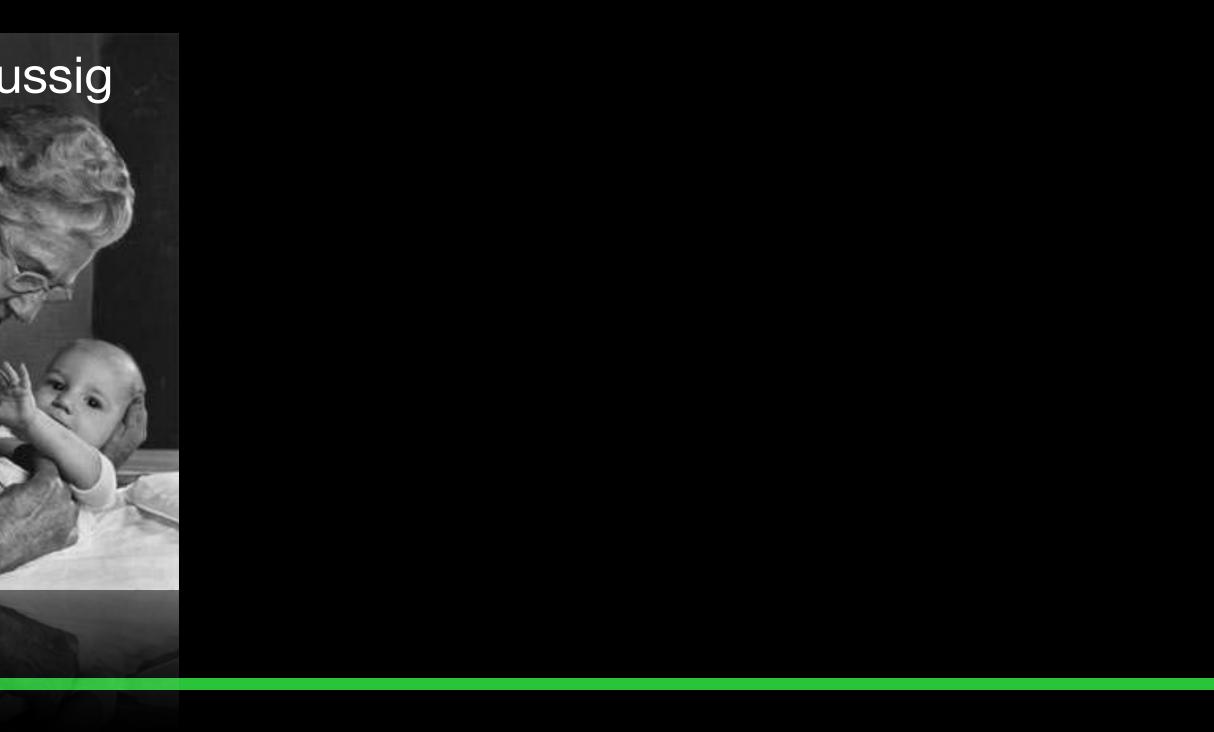
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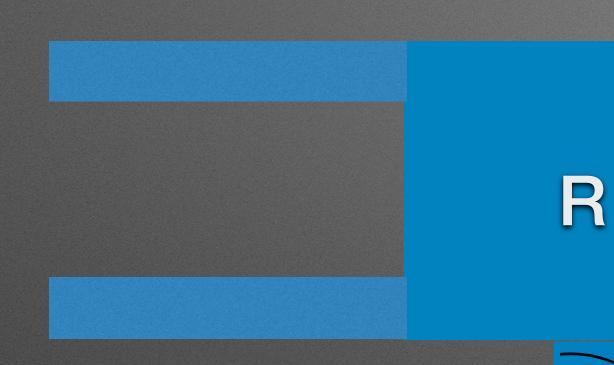
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1941

### Helen Taussig

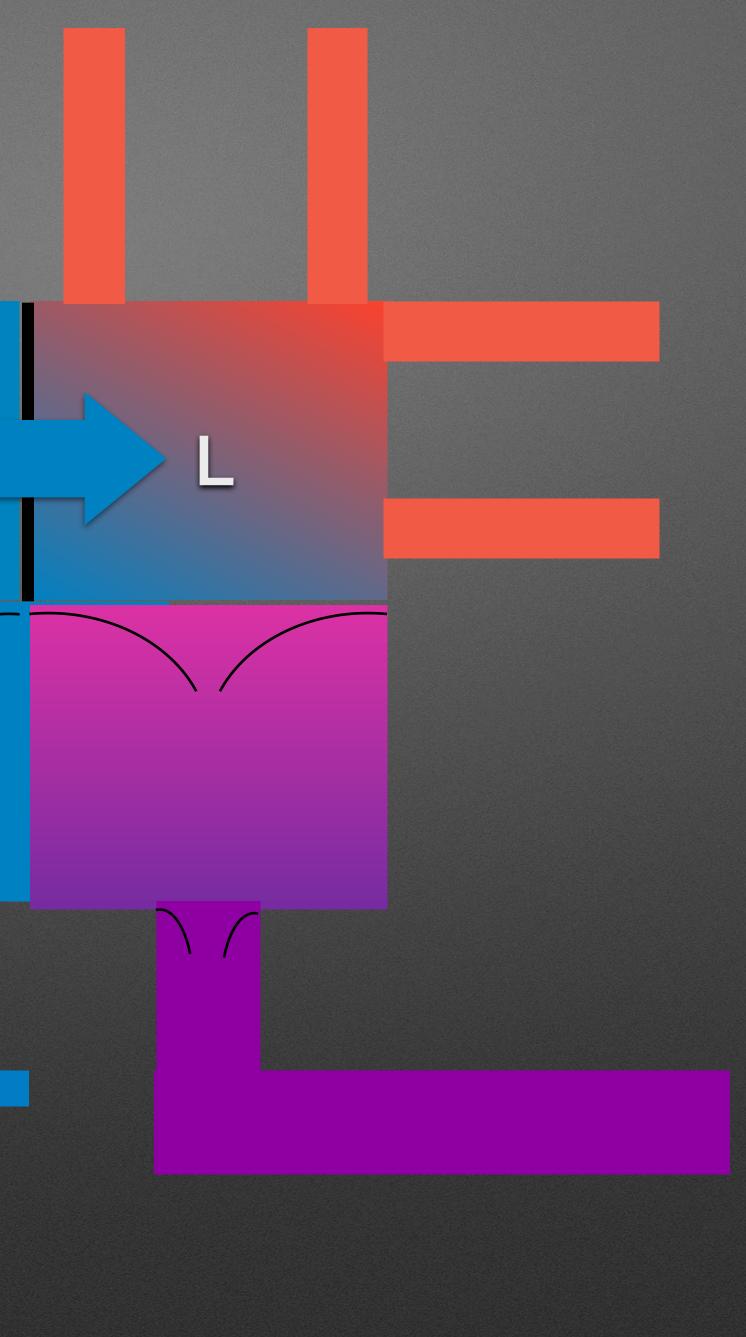


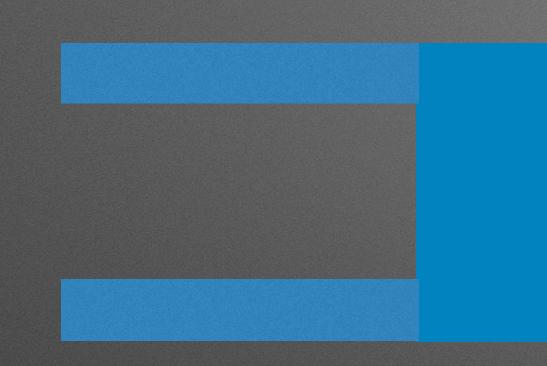




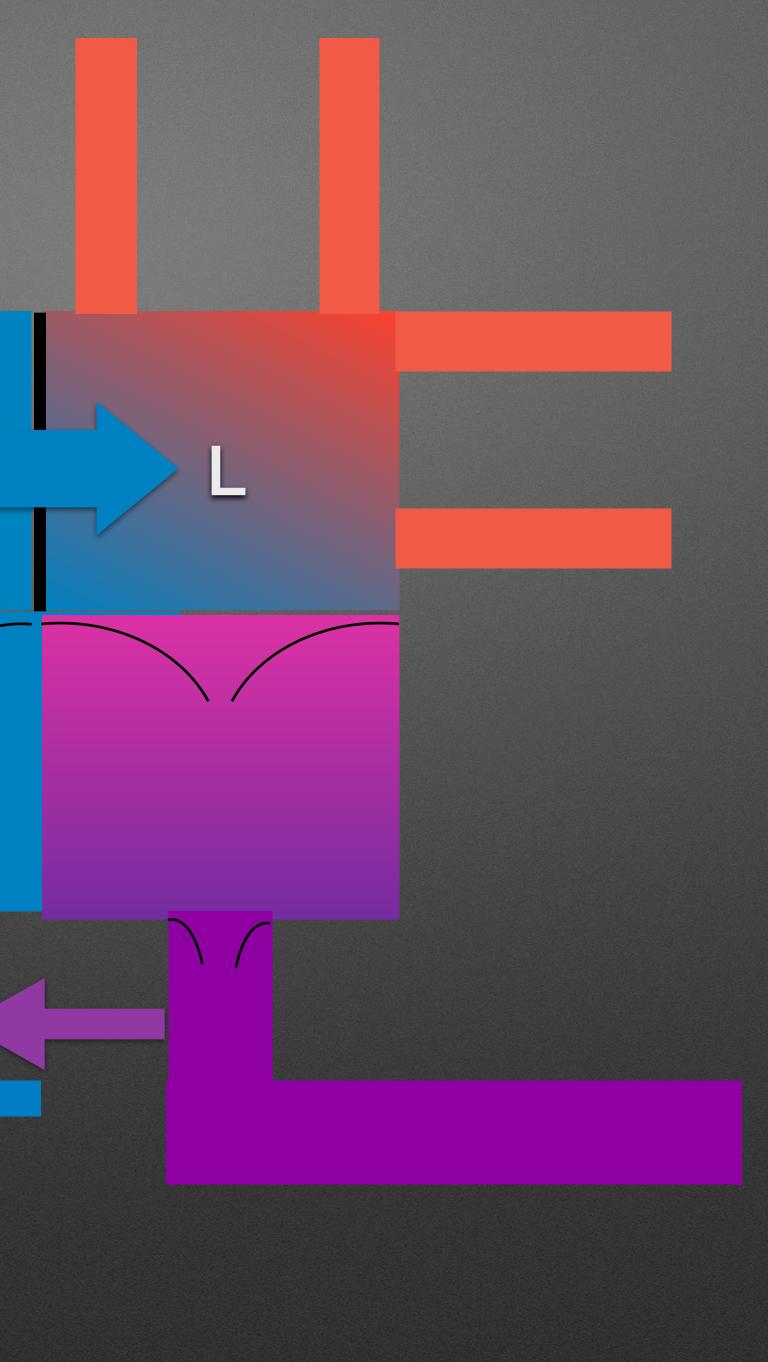


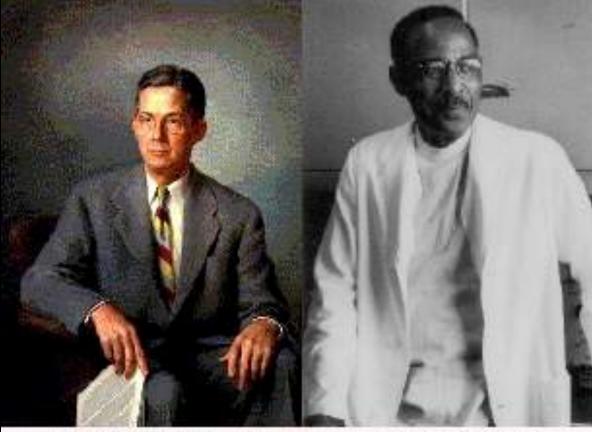












**Vivien Thomas** 

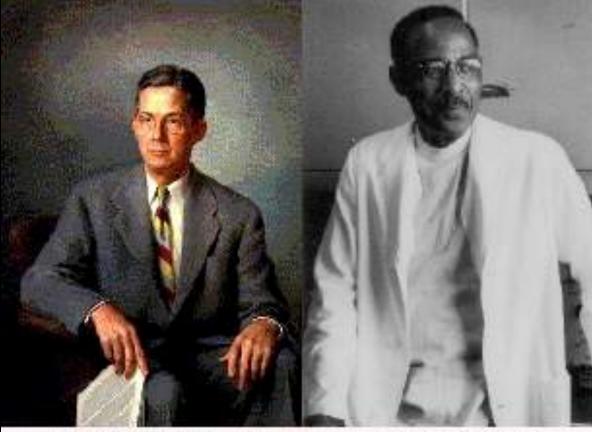
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1941

Images and Movie courtesy of Prof Luca Vricella, Johns Hopkins, Baltimore





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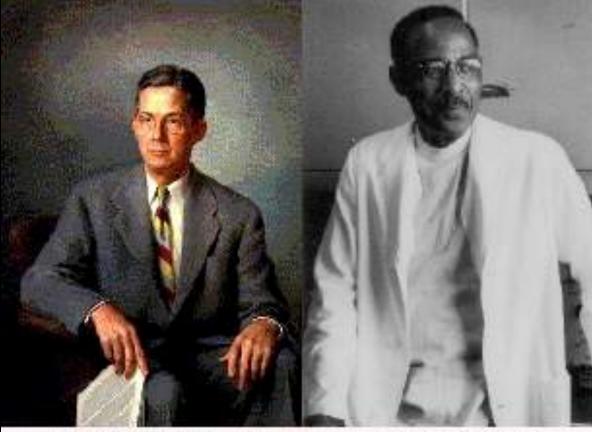
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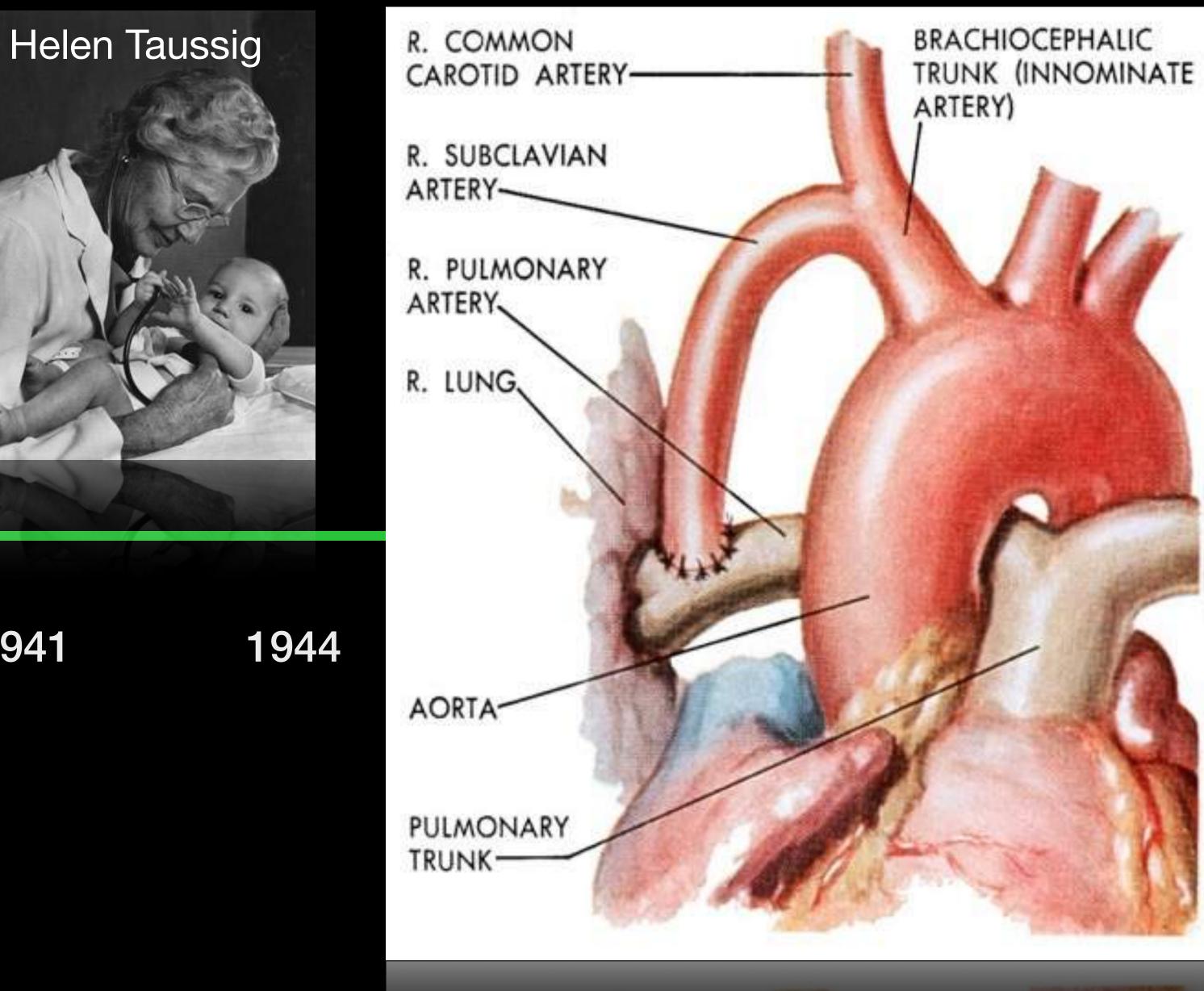
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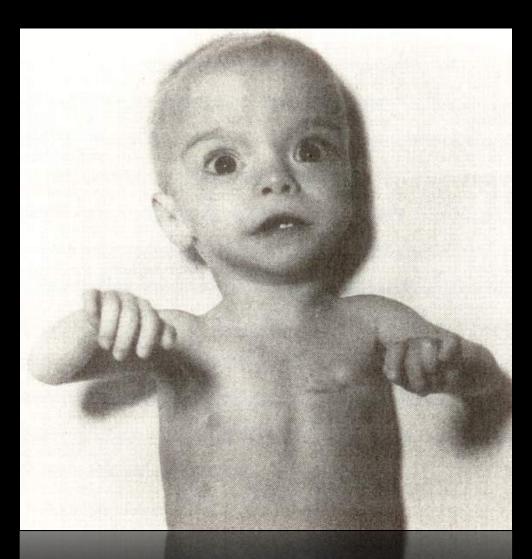
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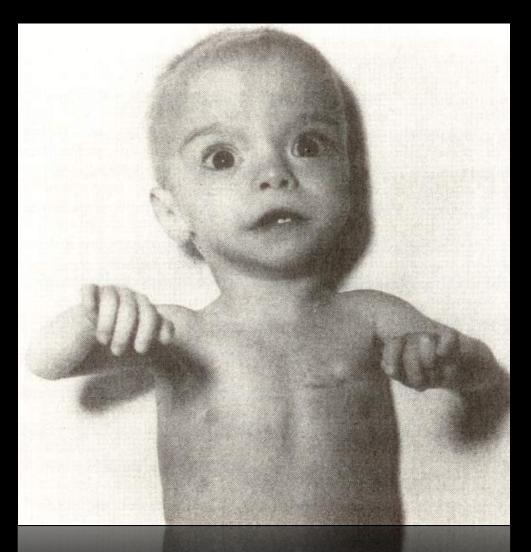






## Eileen Saxon, age 15m





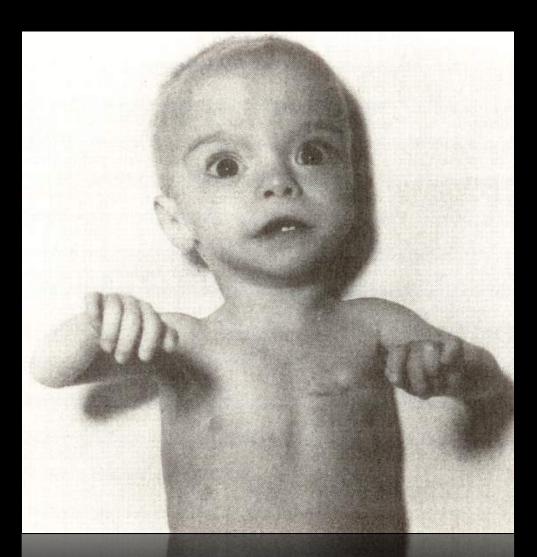
## Eileen Saxon, age 15m



## Bill Longmire

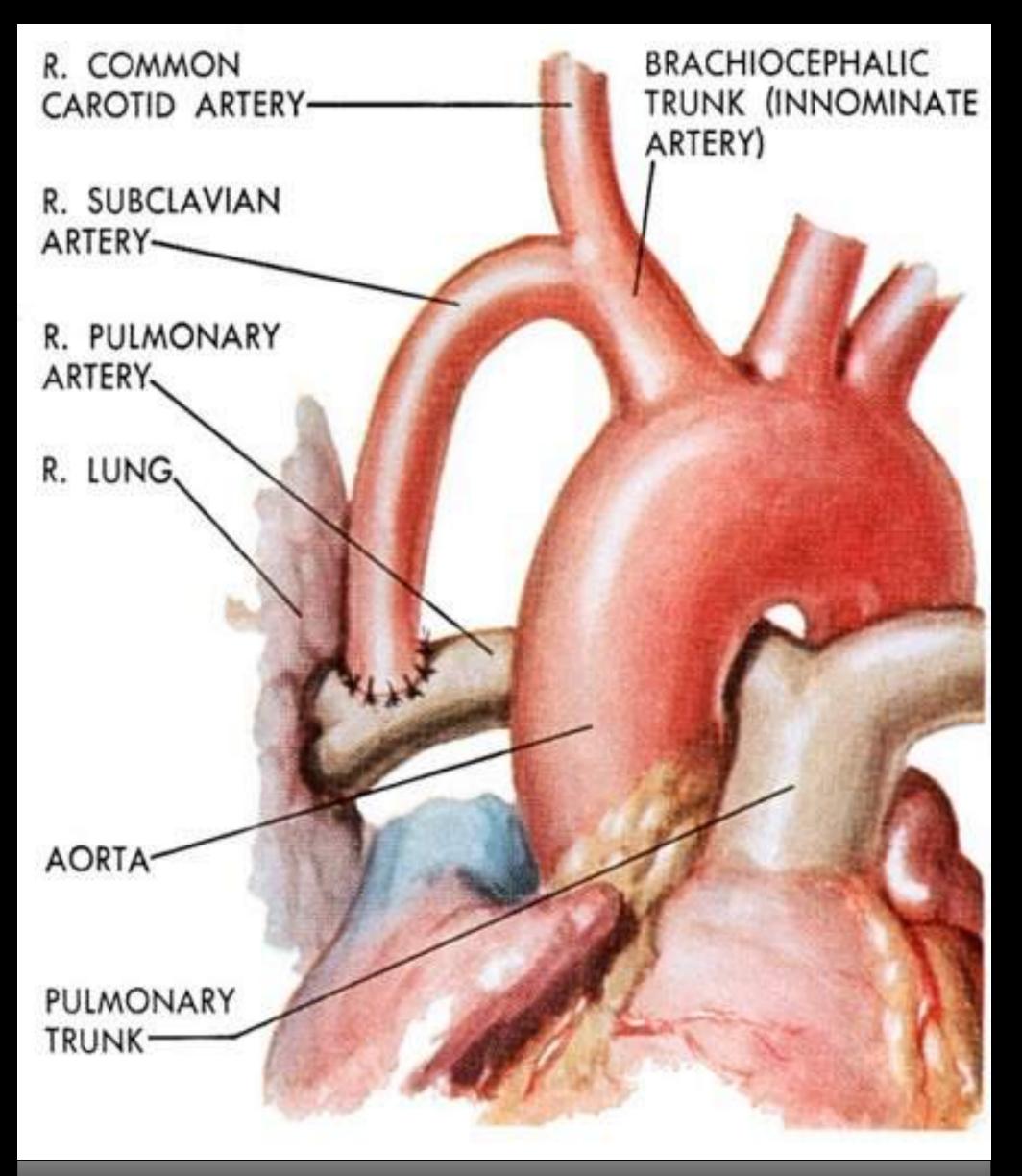
".. On evening rounds, we arrived at the crib of this fifteen-month old baby... I was immediately astounded by the deep cyanotic appearance of the child, much more cyanotic than any patient I had ever seen before: the lips were a deep, dark blue .. The face was suffused with dilated veins, the conjunctiva almost purple."





## Eileen Saxon, age 15m



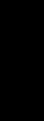


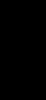
"At operation we lacked all the modern vascular instruments and really had very little but the professor's determination to carry us through the procedure. With the extremely thin wall of an extremely small pulmonary artery I marveled at Dr Blalock's determination in completing this first anastomosis, certainly the most difficult I have ever seen".

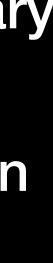




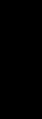








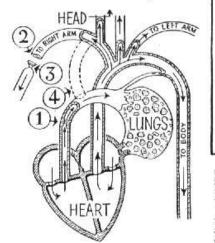




Eileen Saxon became blue again in a few months.

She died shortly after having a Blalock-Taussig shunt on the opposite side

witchin Sidetracks Blood and Oxygen to Otherwise **Starved Lungs** 



The "Blue" Babies' Blood Lacks Vital Dxygen Because the Artery (1) From the Heart to the Lung Is Constricted. By Severing on Artery of the Arm (2), Tying It Off (3) and Attaching to the Lung Artery (4) the Constriction Is By-Passed.

#### By Robert D. Potter Science Editor

WOMAN physician's courageous research and Imagina-tion, and the skill of one of the world's great surgeons have com bined to bring hope that many "blue" babies hitherto considered doomed to early death-may be saved.

These babies are blue because they are suffering from a lack of oxygen in their blood streams, in a condition known as evanosis. The artery from their heart to their lungs is so constricted that their blood never gets oxygen to make cheeks rosy Their lips are blue.

Their toes are blue, they can walk only a few feet without exhaustion Doctors used to give hem only a few tured years to live.

But now medic in give hope . ore . . . for and since Dr. nore Nov. 1944. Blalock, Professor Surgery at Johns Hopkins University in Baltimore, has been conquering the "blue" baby malady by rerouting an artery from the arm and making it carry blood to the ungs where receive its vital oxygen. Nearly 70 operations

have been performed on "blue" babies. In many cases almost miraculous recovery has come.

It is Dr. Blalock's fingers that wield the knife in the delicate operation that exposes the heart and

ransplants its vital arteries. But be and the brilliant operation he has perfected are years of nainstaking research by Dr. Helen B. Taussig. Daughter of the late Prof. F. W

Taussig, world-famous Harvard econ t, Dr. Taussig had watched at Johns Hopkins Hospital.

In many cases she discovered that artery leading to the lung from the heart was narrowed so that an insufficient supply of blood was reaching the lungs to receive its vital oxygen. Dr. Taussig reasoned that a surgical operation might be able to short-circuit the constriction and the sidewalk and rest sidetrack blood into the lungs. On paper, when the diagram of the art-

t blood into the lungs. Of then the diagram of the arr

## Saving <sup>Our</sup> Doomed **Blue Babies**

blood would pick up its life-giv ing oxygen. Then it would go back to the heart again to move outward brough the body.

But could it be done? It is on hing to have a plumber re-arrange a piping system and something quite different to lay bare the human heart, sever one of its main arteries, splice to another main artery and sustain fe in the patient in the process, Dr alock said he would try. Since the pioneer attempt

ration has been largely successful though it is one filled with danger Among the first 70 patients, 14 died The odds are 5 to 1 for success. Now that the news of Dr. Bla

lock's operation is known thr the country the list of patients grows daily. Blue little Bonnie Stewart o Florida, daughter of a daddy killed n Saipan, went to Baltimore with her dmother Today Bonnie walks and plays like other children.

The case of six-ycar-old Mike Schirmer — the boy with the "itchy zipper" - shows what can be done.

Little Bonnie Stewart of Florida I Another of the 70 Children Saved by the New Johns Hopkins Surgery.

Mike's "itchy zipper" is the healing incision over his heart where Dr Blalock went in to do the operation. But let his mother tell his story: "Michael could only walk five feet and then he'd have to squat down on

"I had to wheel him everywhere. Strangers would stop his carriage and not a simple one. It takes from an vessels which take up the blood load

But let his mother tell his story:
"Michael could only walk five feet and then he'd have to squat down on the square dow

was no could that Mike could grow up. But then came new hope, for Dr. Mansderfer told us about the operation of Dr. Blalock. They took him to the operating oom and brought him back two

ours later. It was a miracle. "After only two weeks of convalescence he came home and he has been on the go ever since. If anyone wants anything he'll run and get it. He's up and down stairs 75 times a day. He climbs on bureaus and tables just for the joy of jumping off. He wears me out. But I love it."

branches of the pulmonary artery (to the lungs) are two large blood vessels. One connects the heart and the arm, the other the heart and the head. Dr. Blalock chooses the most con and severs it. One end is clamped off and the other closed permanently

Incision for the Operation

Six-Year-Old Mike Schirmer of Baltimore

Could Walk Only Five Feet Without Resting

Before the Operation. He Shows His "Itchy

The end nearest the heart is then spliced to the nearest branch of the pulmonary artery. The clamps are noved and the blood that would ordinarily flow to the arm goes into the lung. There it becomes enriched with vital oxygen and the baby's blue lips quickly begin to turn red What happens to the arm

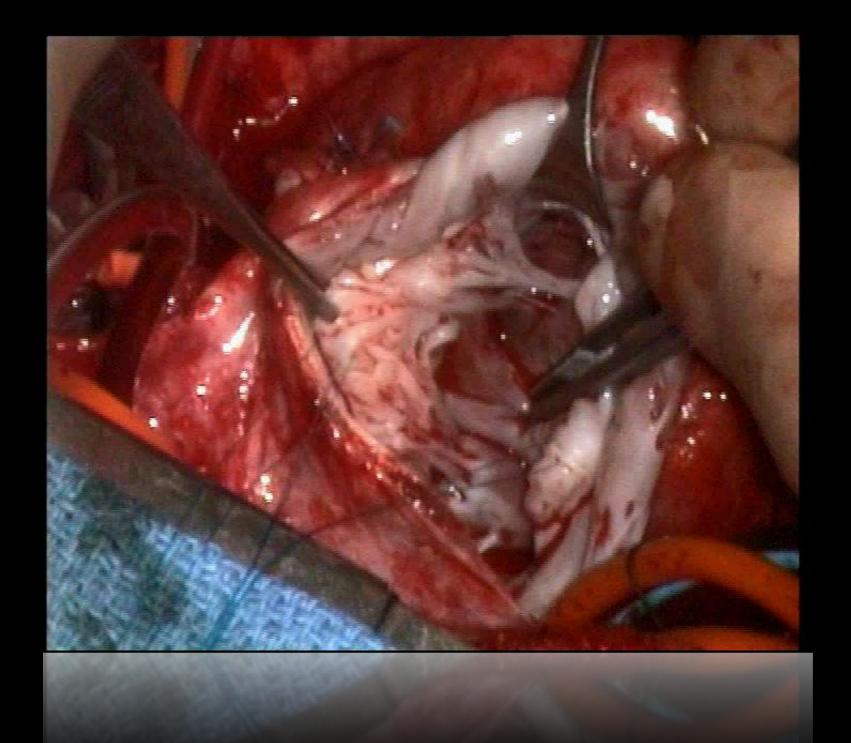
http://www.medicalarchives.jhmi.edu/tausbio.htm

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# getting into the heart safely

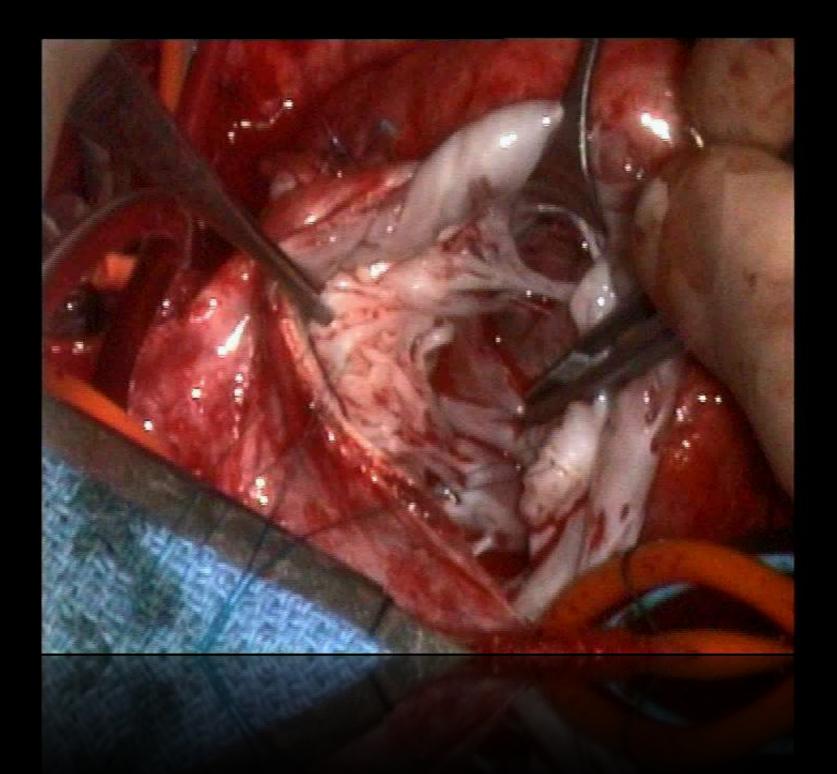




# air, time, movement

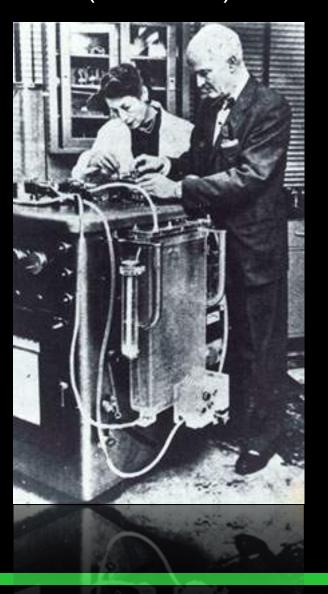
# getting into the heart safely





# air, time, movement

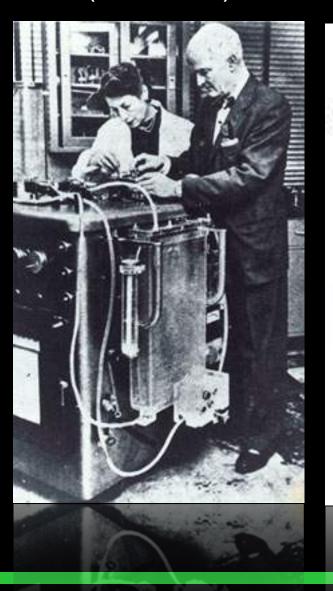
John & Mary Gibbon (Boston)

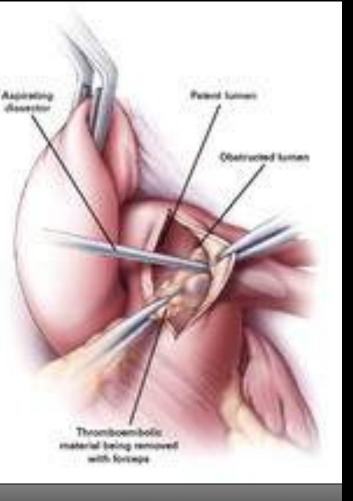


### 1931

Sír George Newman





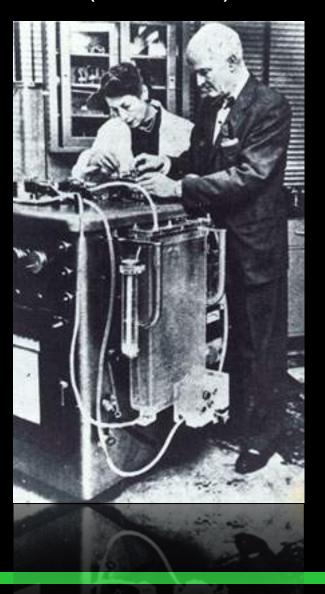


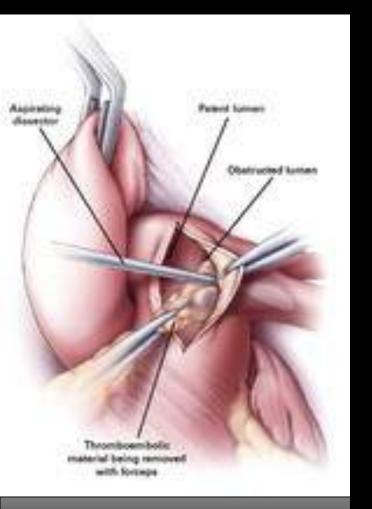
Thromboambole meterial being removed with forcepe

### 1931

Sír George Newman



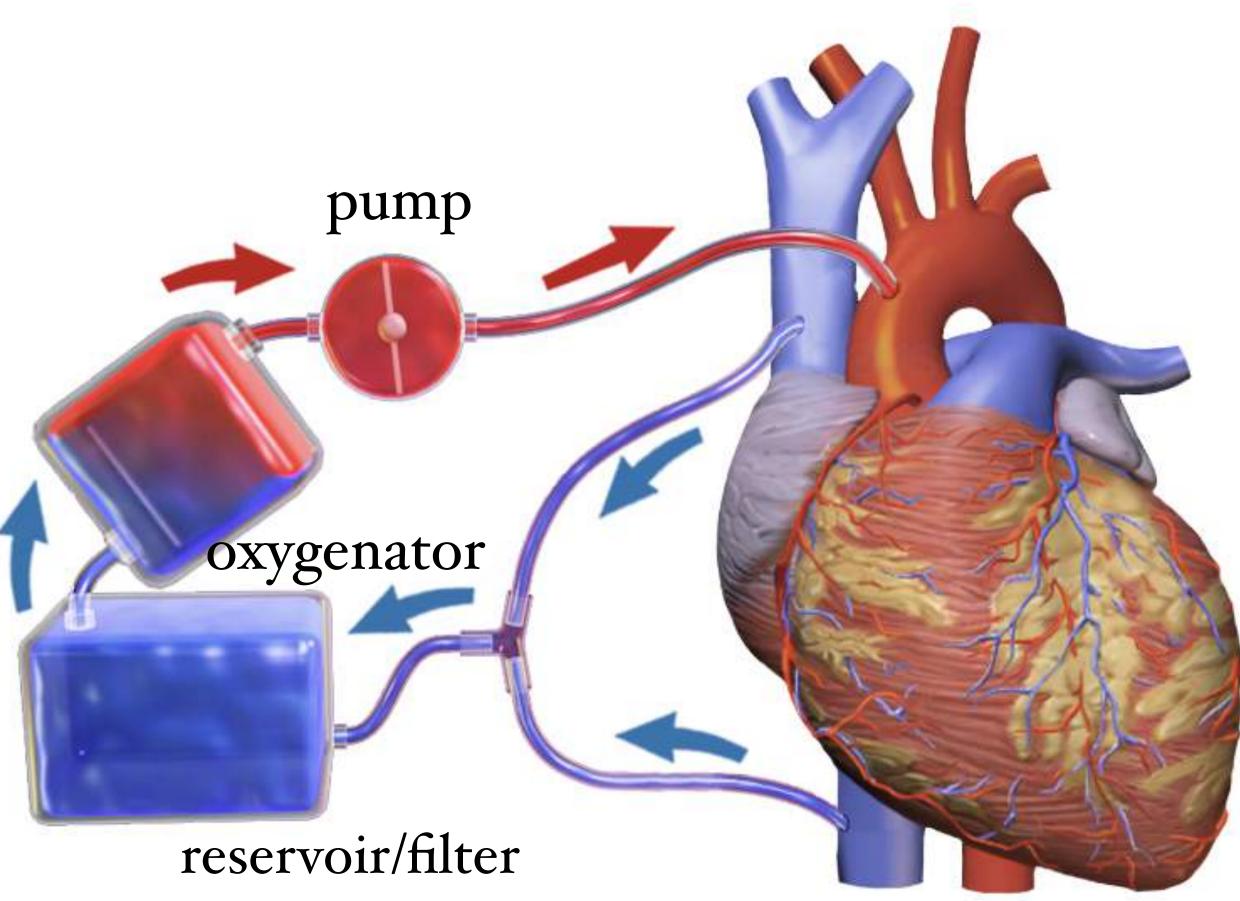


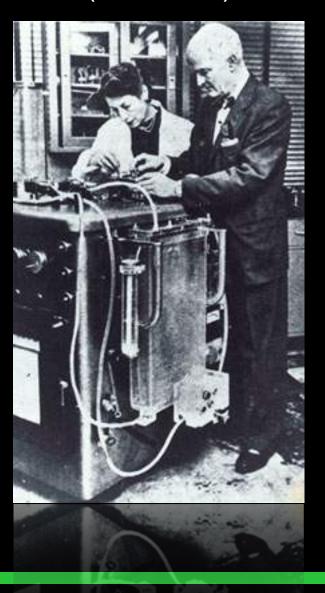


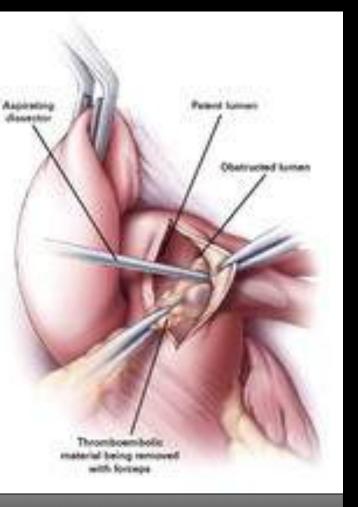
1931

Sír George Mewman







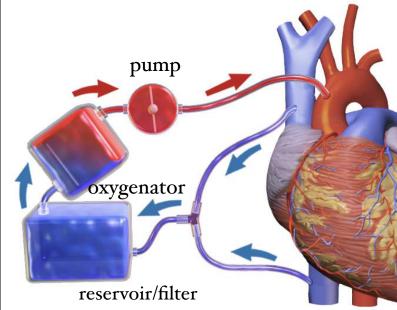


#### 1931

Sír George Newman



# 20 years work





John & Mary Gibbon (Boston)



1931

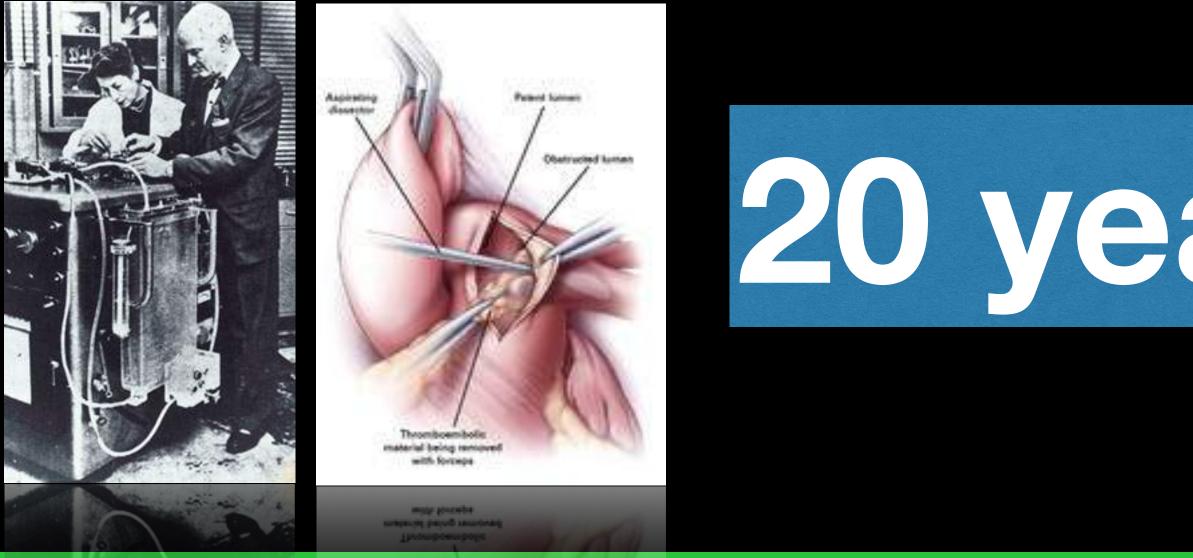
Sír George Newman



"I can recall prowling around Beacon Hill at night with some tuna fish as bait and a gunny sack to catch any of those stray cats which swarmed over Boston in those days. To indicate the number the S.P.C.A. was killing 30,000 a year."



John & Mary Gibbon (Boston)



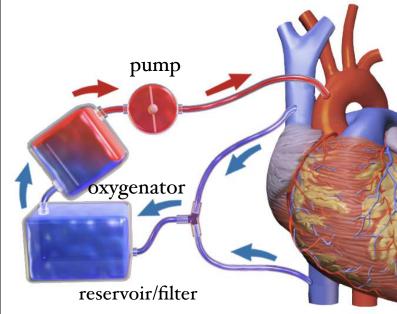
1931

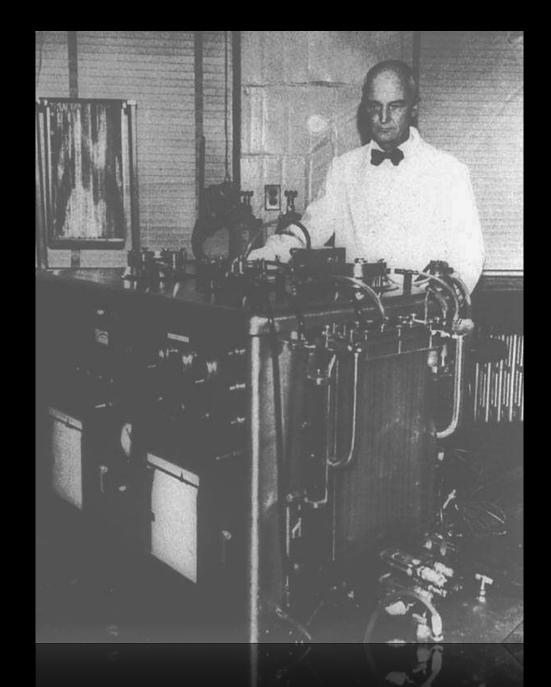
Sír George Newman



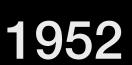
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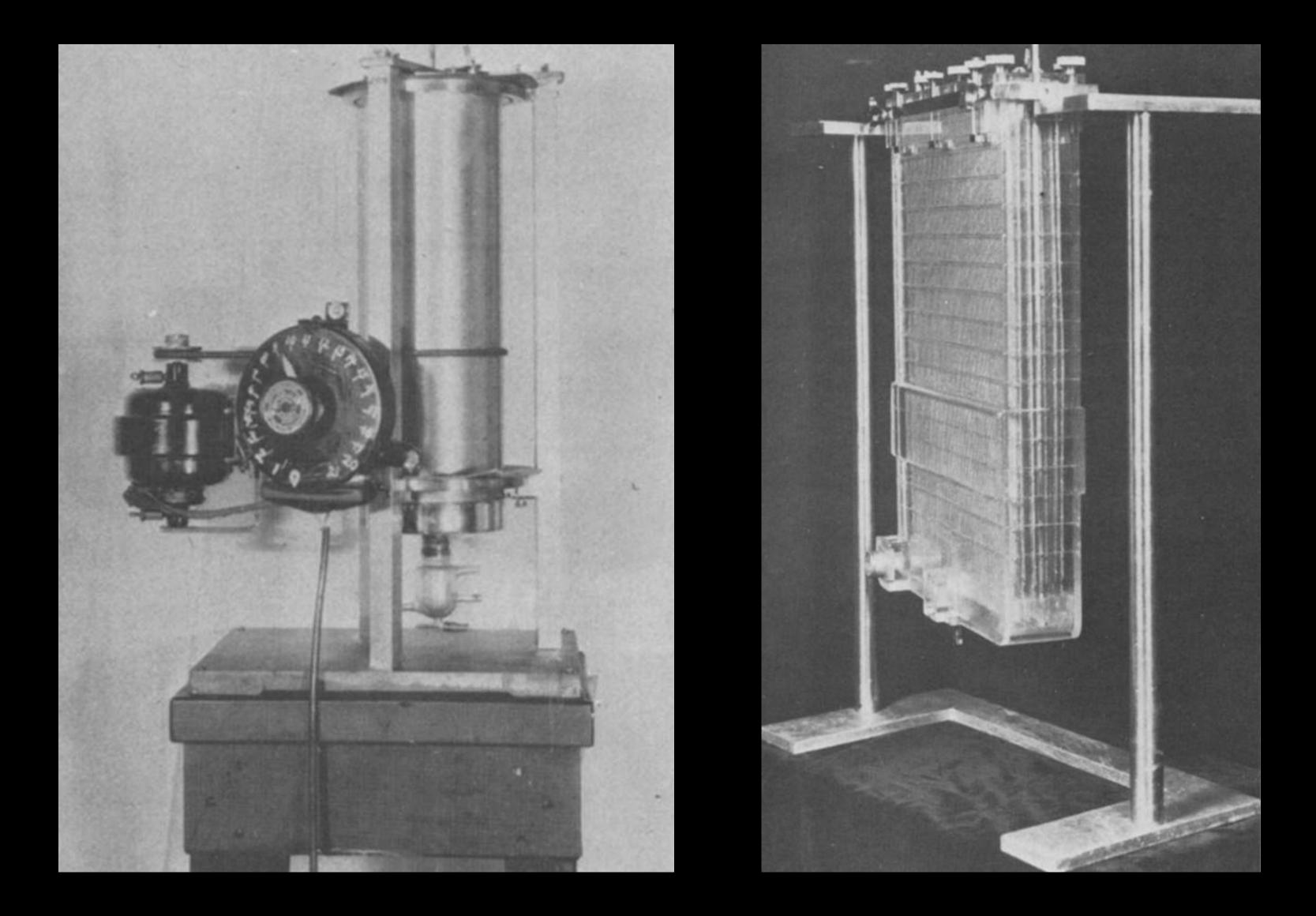
# 20 years work

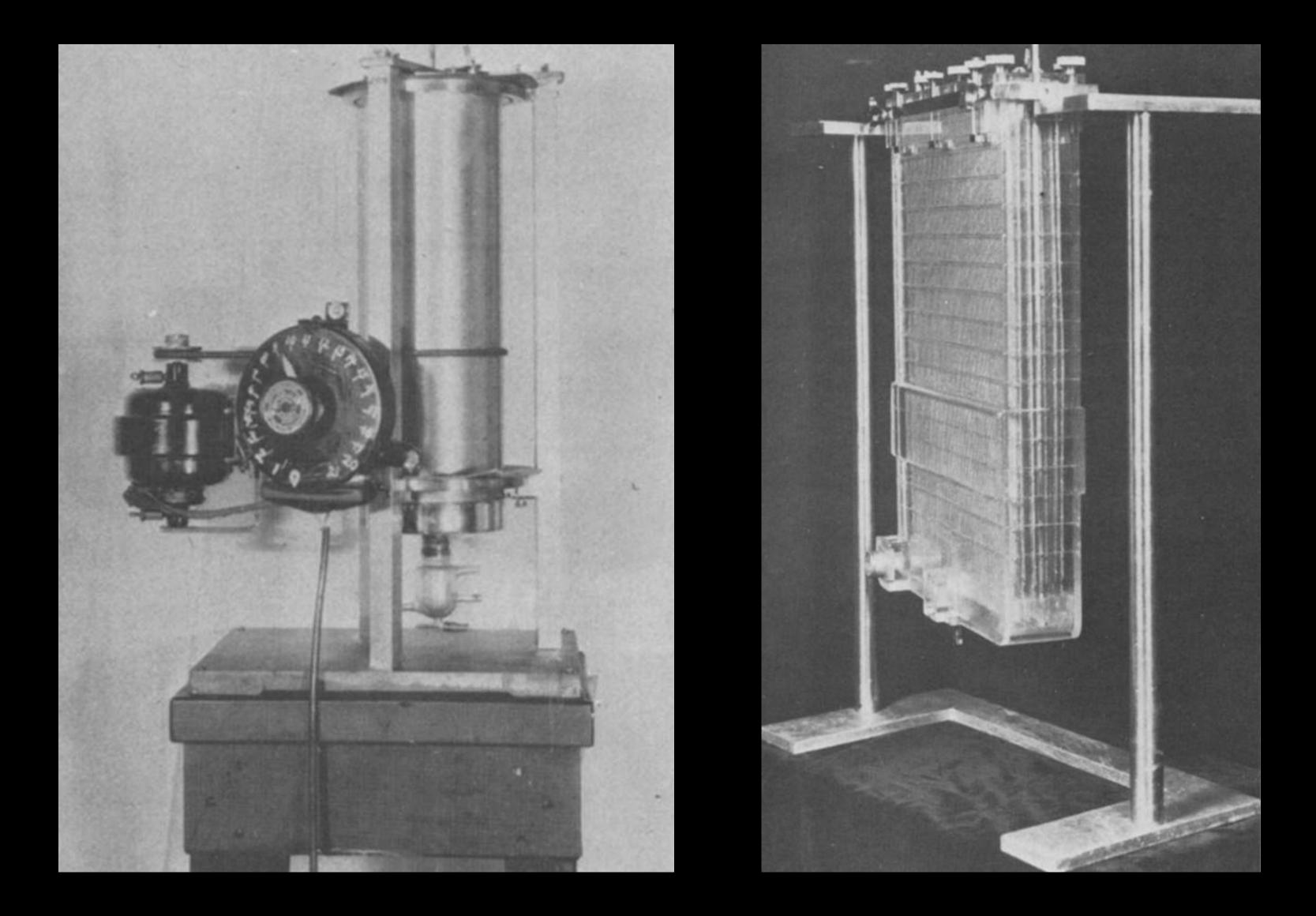






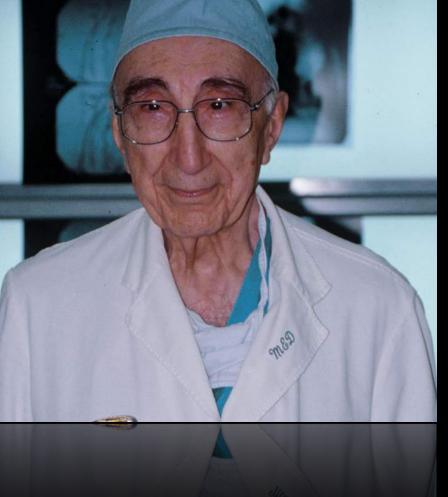




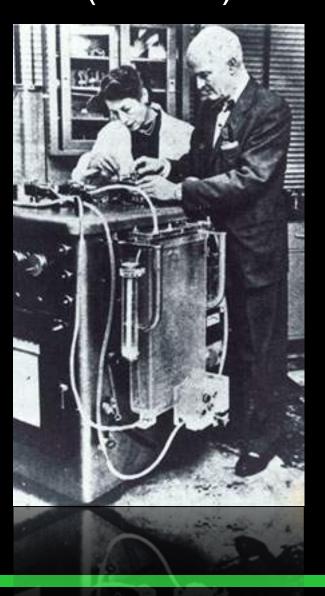


field".

# "He (Gibbon) blasted open the door that had been locked for centuries against any medical therapeutic intrusion in to the cardiovascular



Michael DeBakey



### 1931

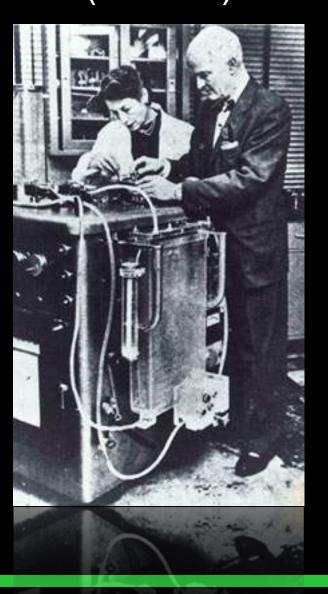
Sír George Newman



1947

Hamílton Hartrídge

### 1955



Wilfred Bigelow (Toronto)



### 1931

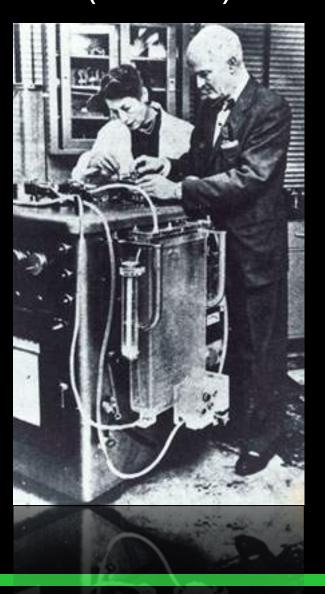
Sír George Newman



**1945 1947** 

Hamílton Hartrídge

### 1955



Wilfred Bigelow (Toronto)



"One night I awoke with a simple solution to the problem, and one that did not require pumps and tubes -- cool the whole body, reduce the oxygen requirements, interrupt the circulation, and open the heart."

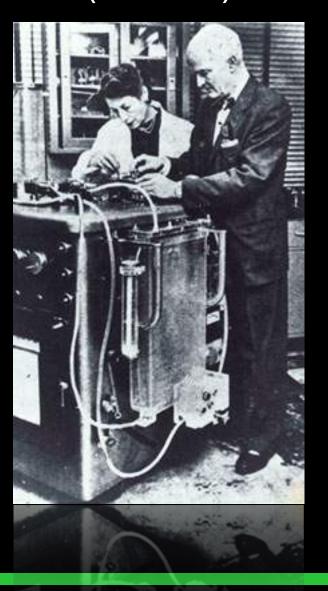
1931

Sír George Newman

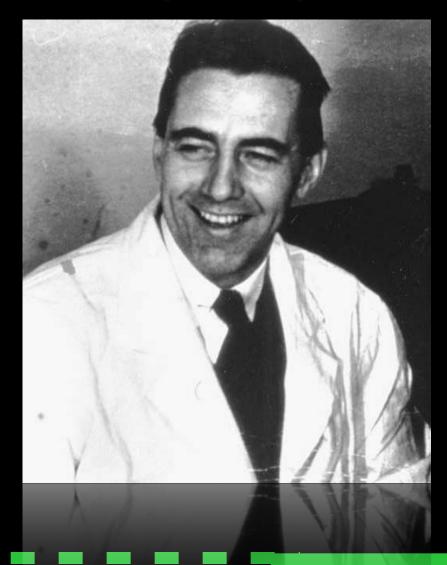


**1**945 **1**947

hamílton hartrídge 1955



Wilfred Bigelow (Toronto)



#### 1931

Sír George Newman

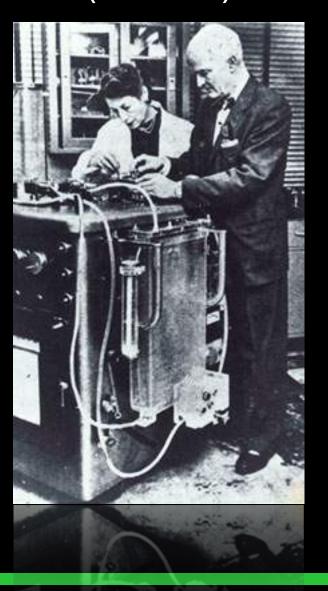


#### **1945 1947**

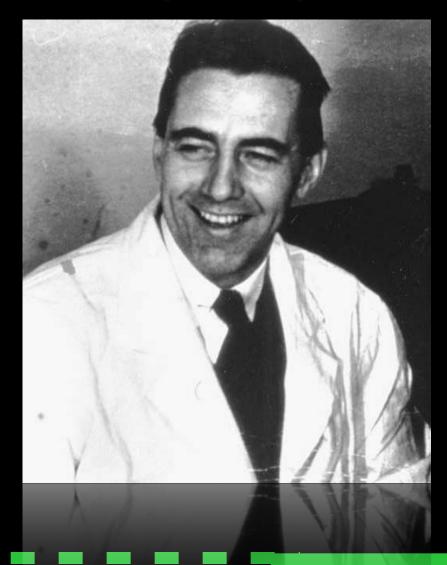


#### 1950

#### 1955



Wilfred Bigelow (Toronto)



#### 1931

Sír George Newman



#### **1945 1947**



#### John Lewis and Richard Varco

(Minnesota)



#### 1950 1952

1955

#### Wilfred Bigelow (Toronto)

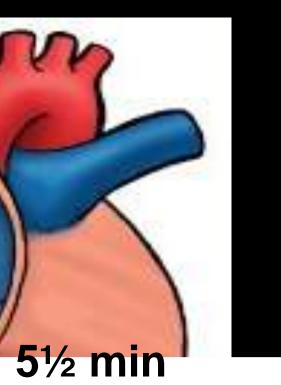




#### John Lewis and Richard Varco

(Minnesota)





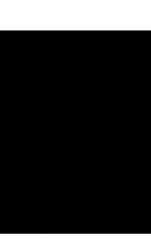
#### **1950 1952**

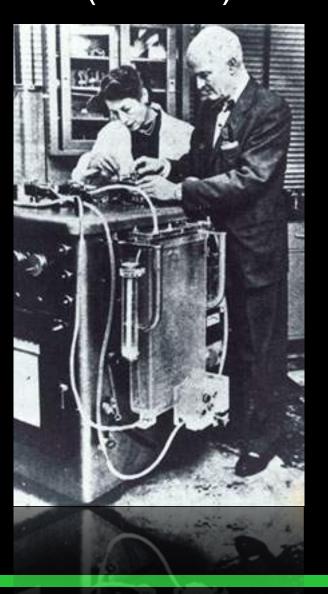




S'Silva







Wilfred Bigelow (Toronto)



1931

Sír George Newman

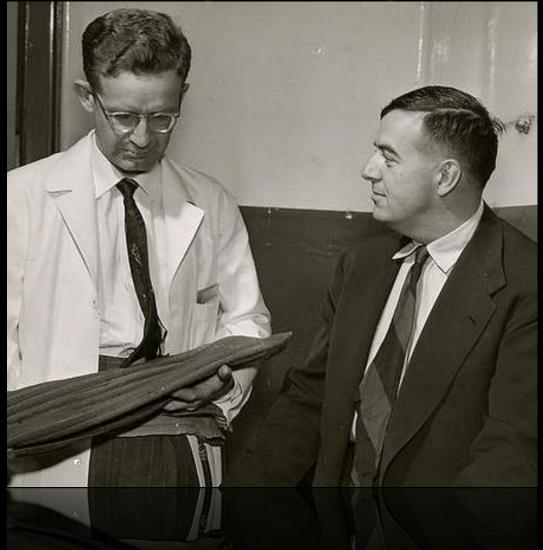


**1945 1947** 

Hamílton Hartrídge

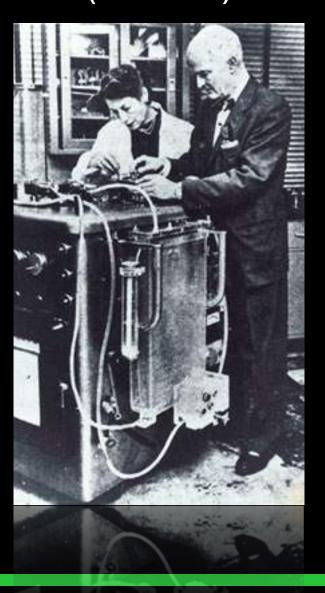
#### John Lewis and Richard Varco

(Minnesota)



1952

#### 1955



#### 1931

Sír George Newman

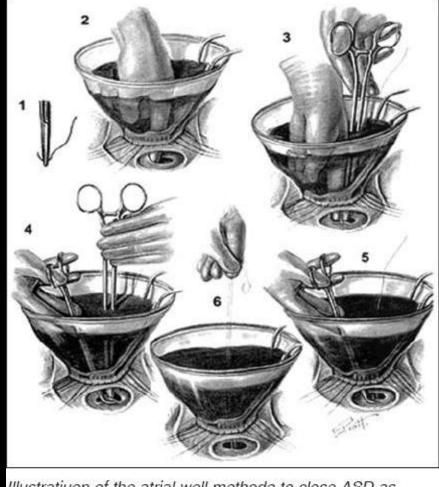


**1**947

Hamílton Hartrídge

#### Robert Gross

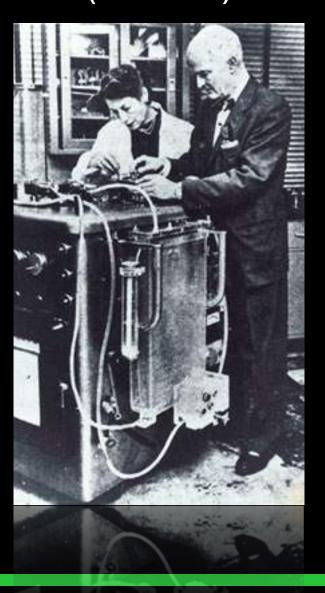
#### (Boston)



Illustratiuon of the atrial well methode to close ASD as described by Robert Gross in 1952.

#### 1952

#### 1955



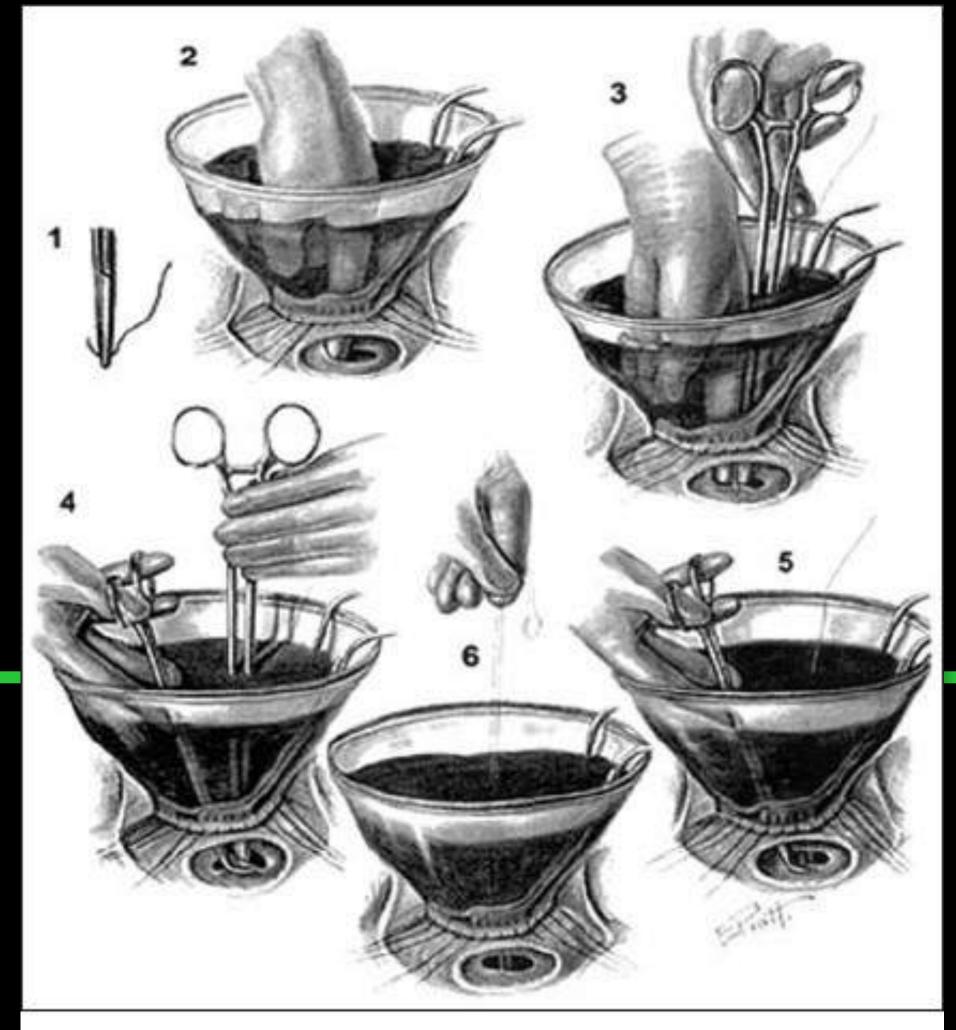
#### 1931

Sír George Newman

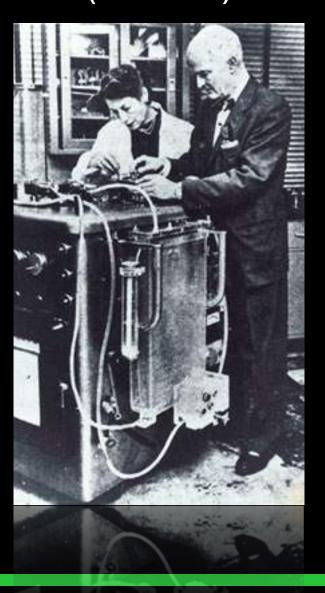


**1**947

Hamílton Hartrídge



Illustratiuon of the atrial well methode to close ASD as described by Robert Gross in 1952.



### 1931

Sír George Newman

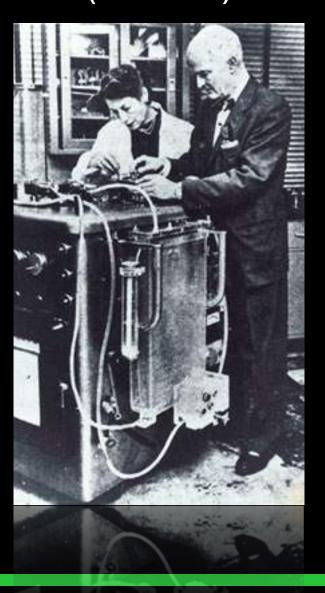


1947

Hamílton Hartrídge

#### 1952

#### 1955



### 1931

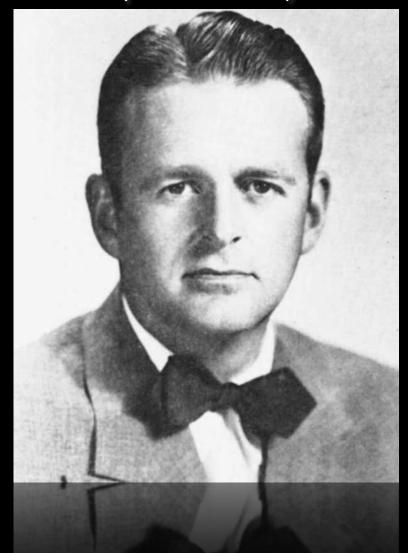
Sír George Newman



1947

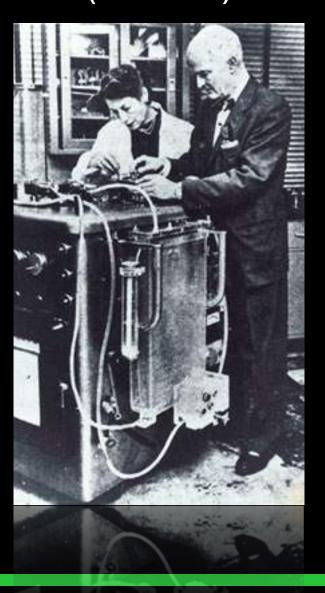
Hamílton Hartrídge Henry Swan

#### (Colorado)



### 1952 1953

1955



### 1931

Sír George Newman

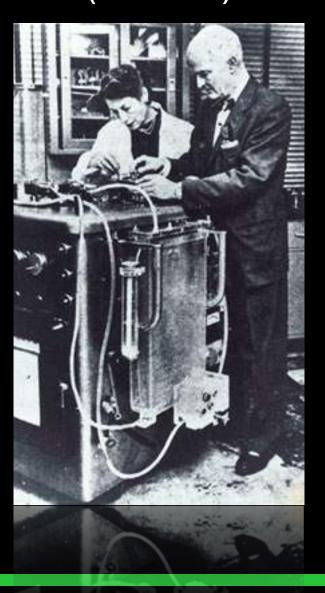


1947

Hamílton Hartrídge

#### 1952

#### 1955



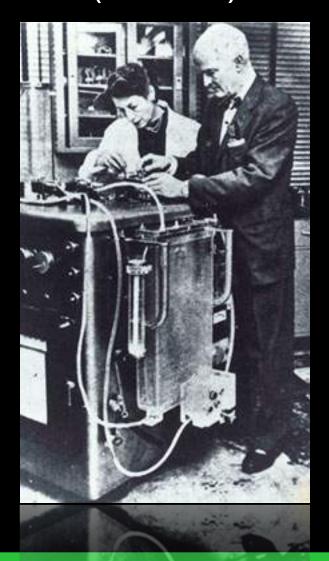
#### 1931

Sír George Newman



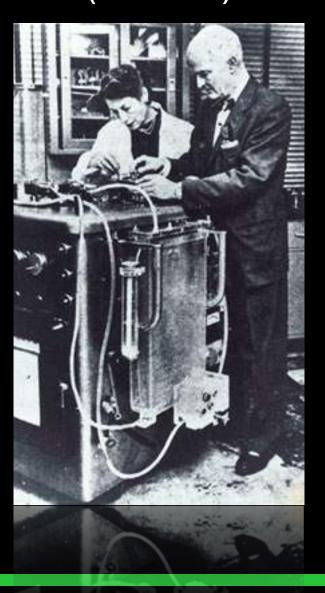
1947

Hamilton Hartridge John & Mary Gibbon (Boston)



1952

1955



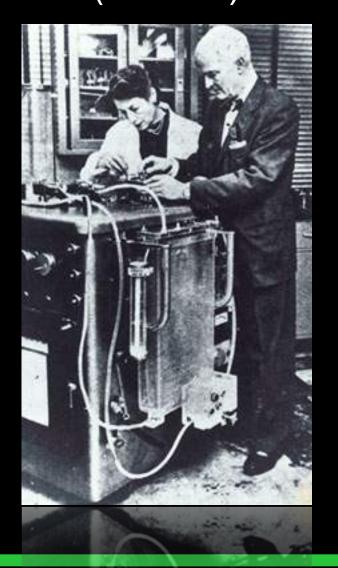
#### 1931

Sír George Newman



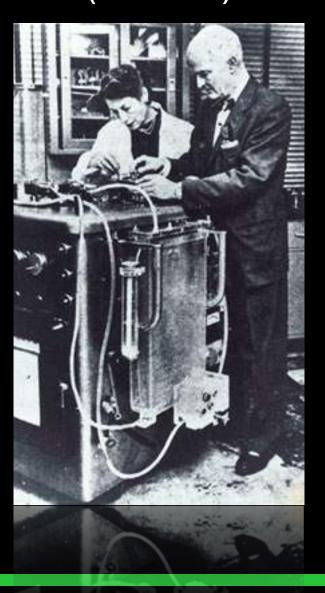
1947

Hamilton Hartridge John & Mary Gibbon (Boston)



#### 1952 1953

1955



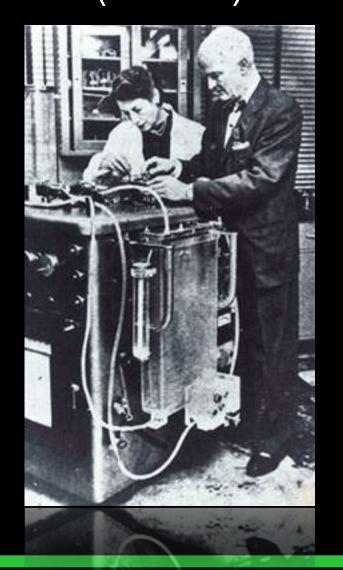
#### 1931

Sír George Newman



**1**947

Hamílton Hartrídge John & Mary Gibbon (Boston)



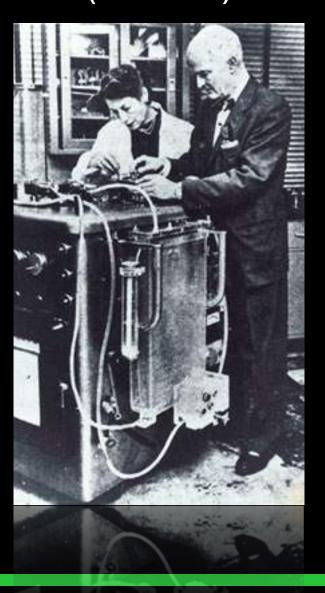
## The next 5 patients died

### 1952 1953

1955

John Leonard S'Sílva

# xt died



### 1931

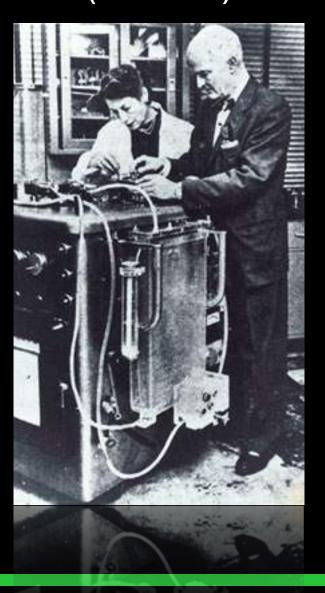
Sír George Newman



1947

Hamilton Hartridge

### **1952 1953 1955**



### 1931

Sír George Newman



1947

Hamilton Hartridge C Walt Lillehei (Minnesota)



#### 1952 1953 1954 1955

## **C** Walt Lillehei The Father of Open-Heart Surgery "The King of Hearts"

1931

Sír George Newman

1947

hamilton hartridge C Walt Lillehei

(Minnesota)



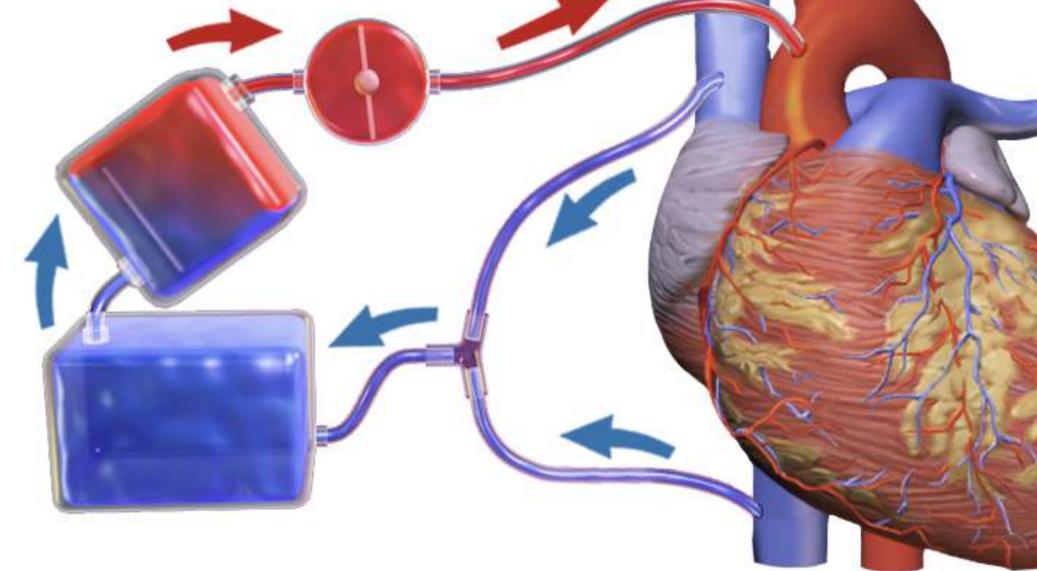
#### 1954

1955



- C. Walt Lillehei

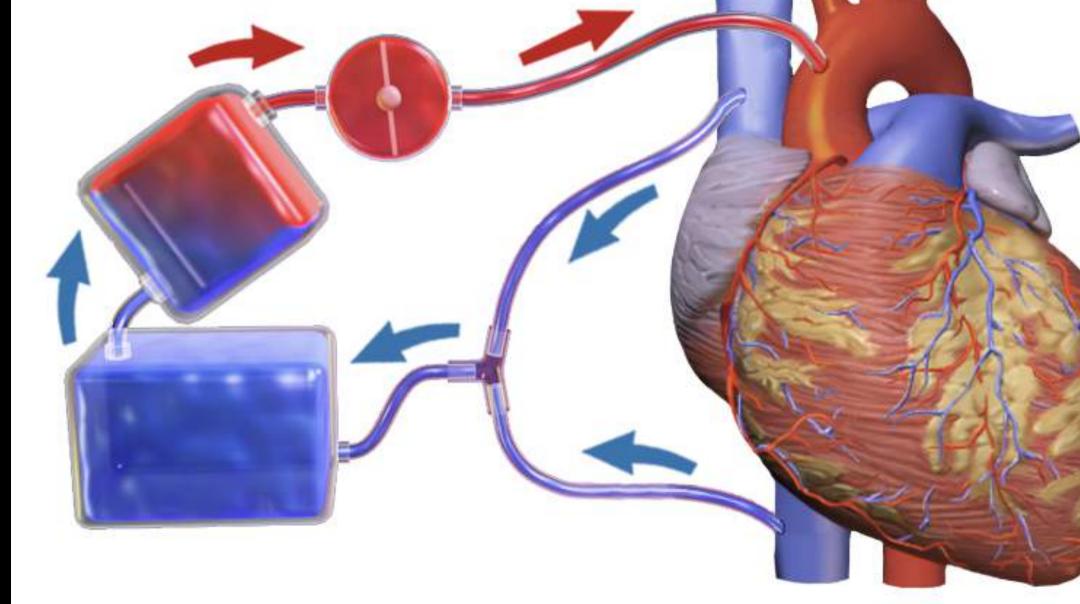
## a moratorium on the use of CPB



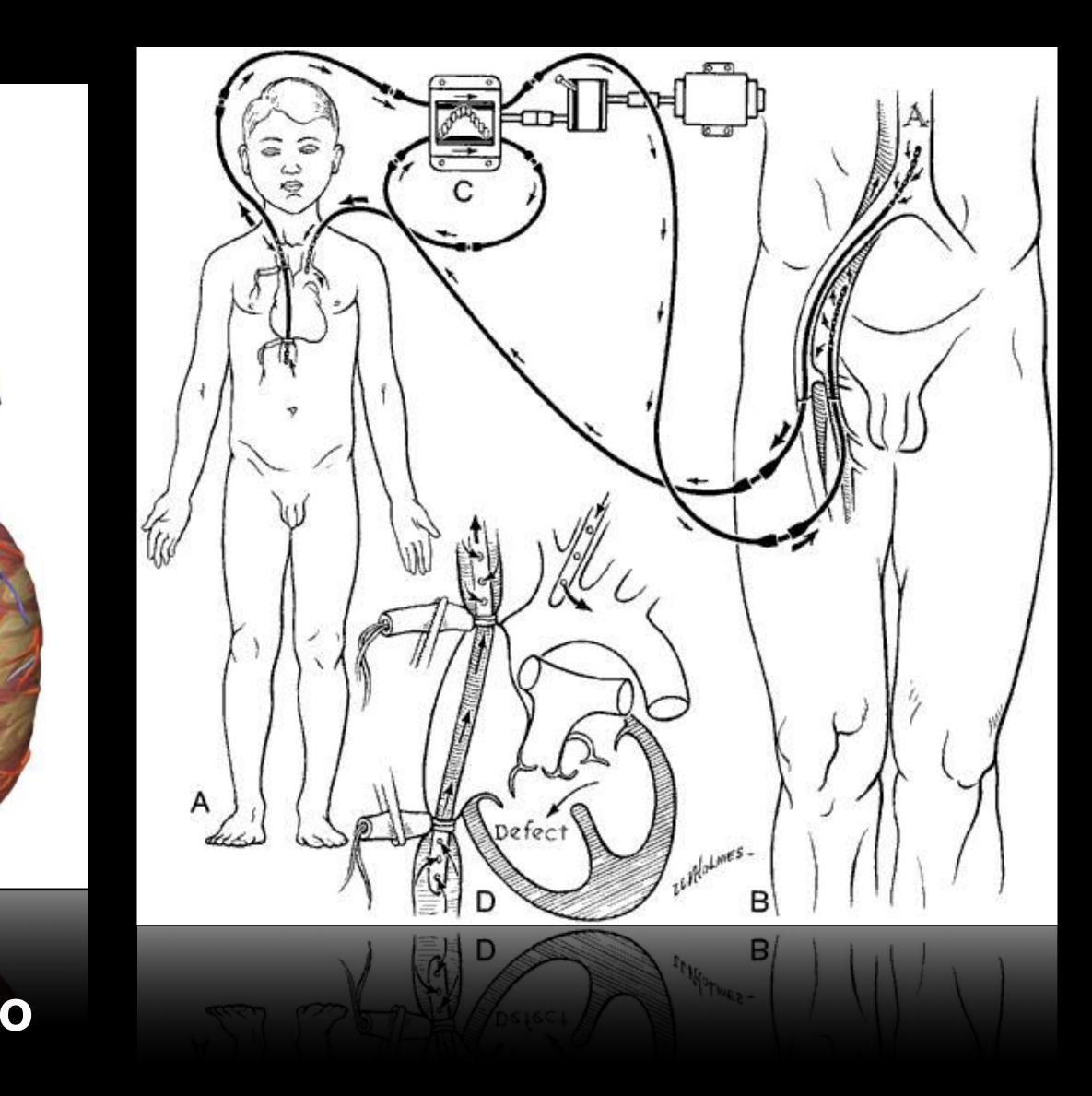
"When going into the wilderness, do not expect to find a paved road" - C. Walt Lillehei



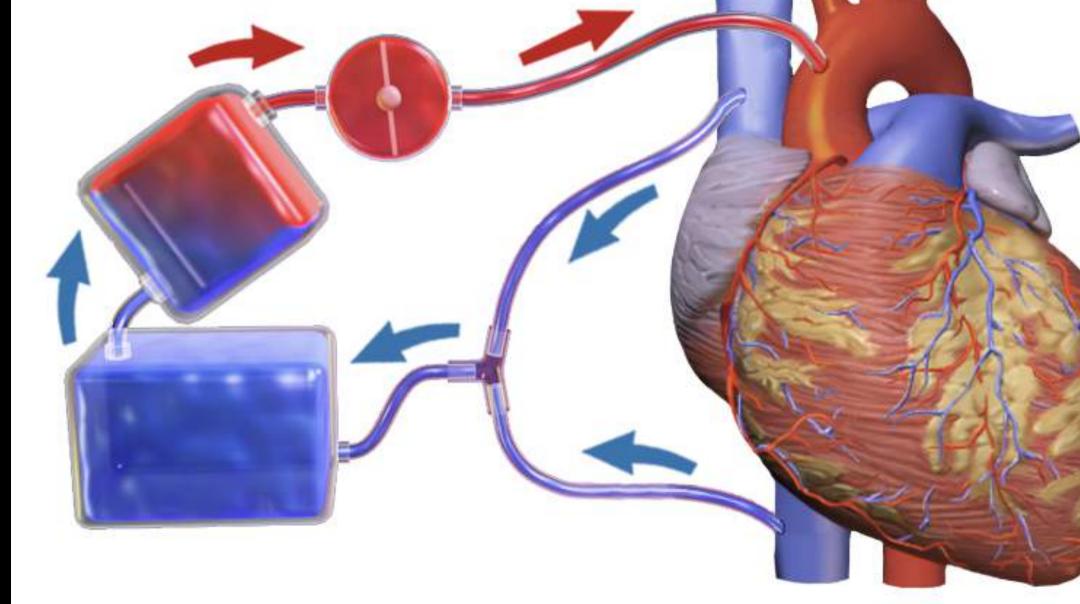
## a moratorium on the use of CPB



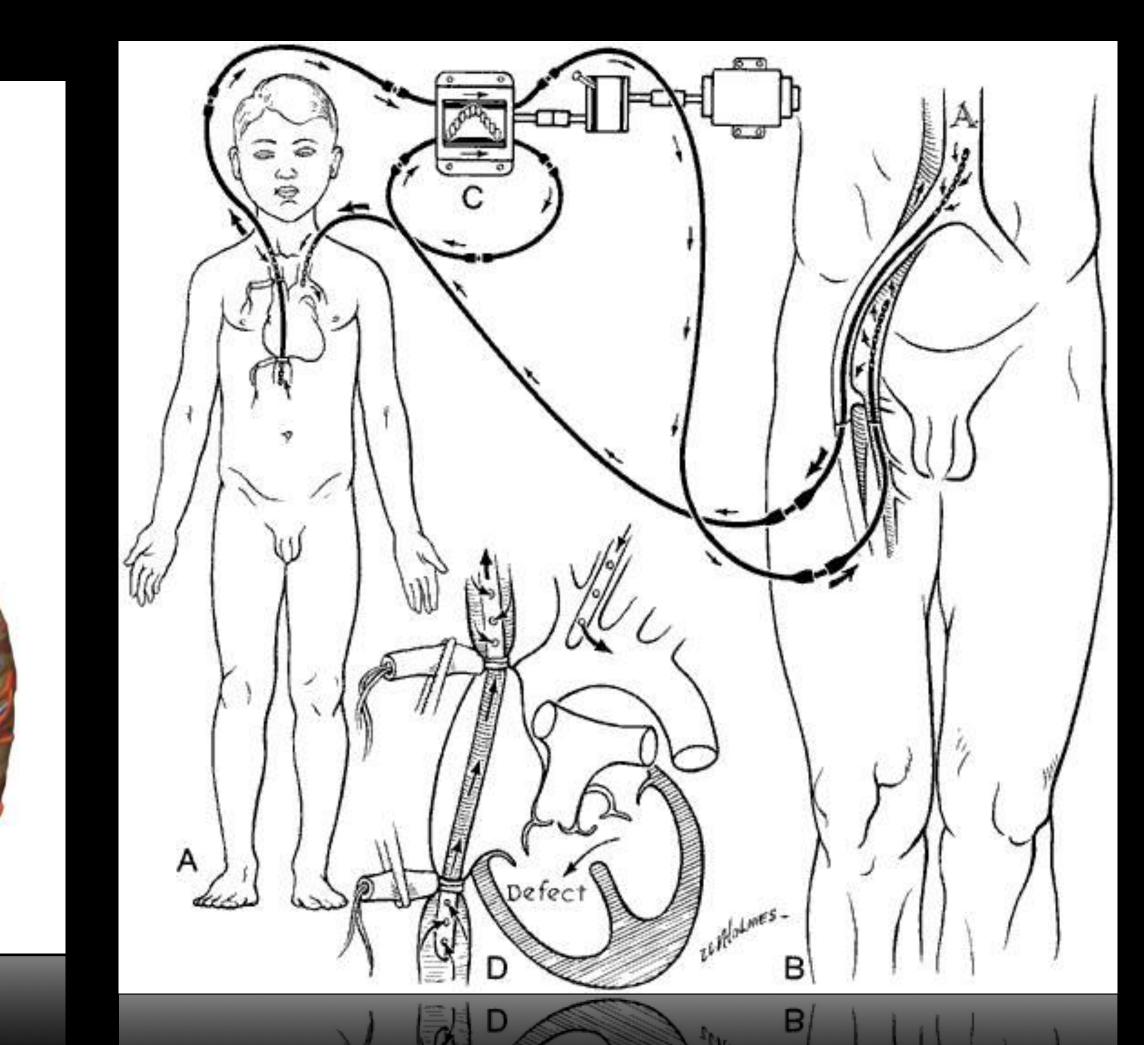
"When going into the wilderness, do not expect to find a paved road" - C. Walt Lillehei



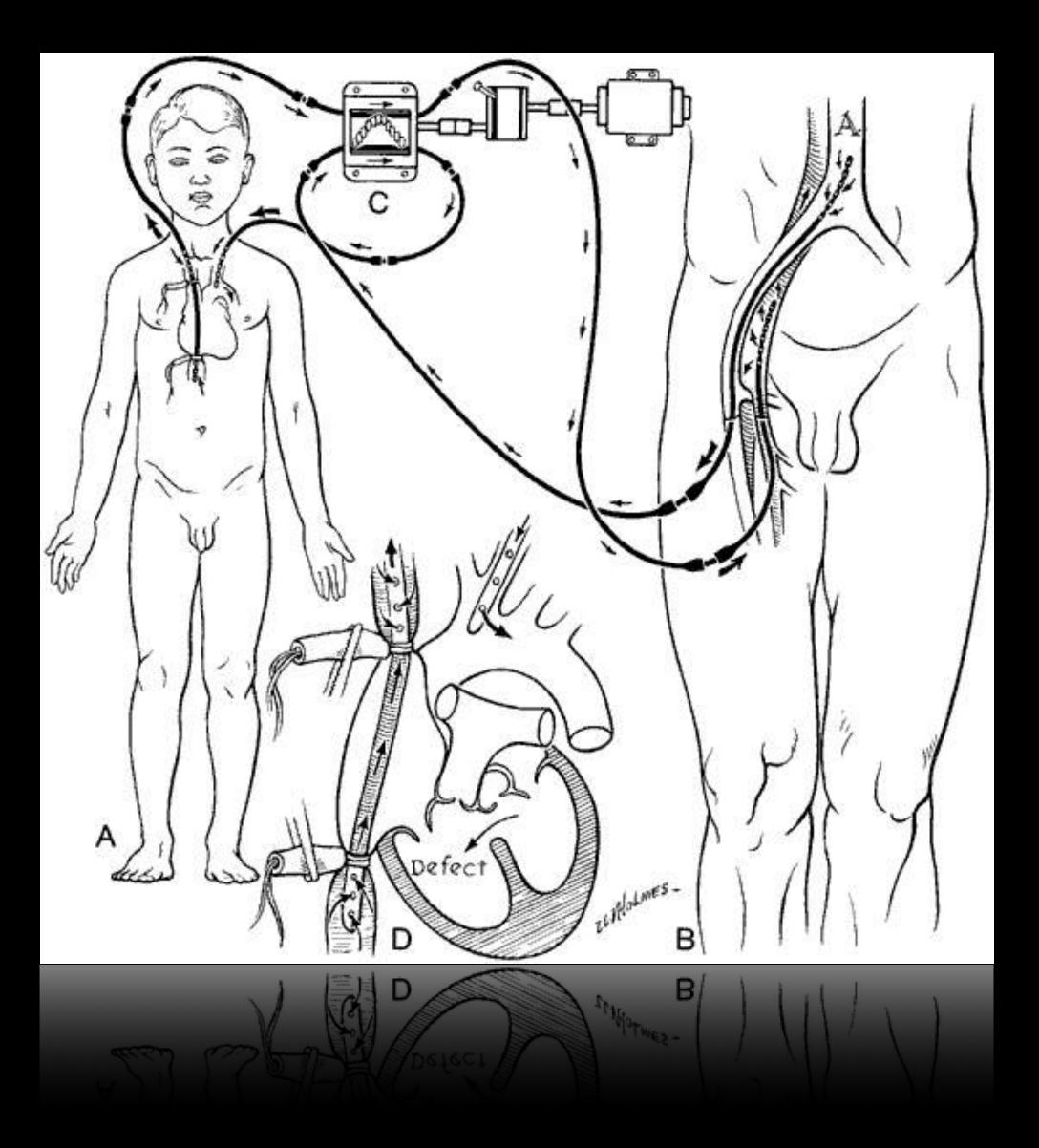
## a moratorium on the use of CPB

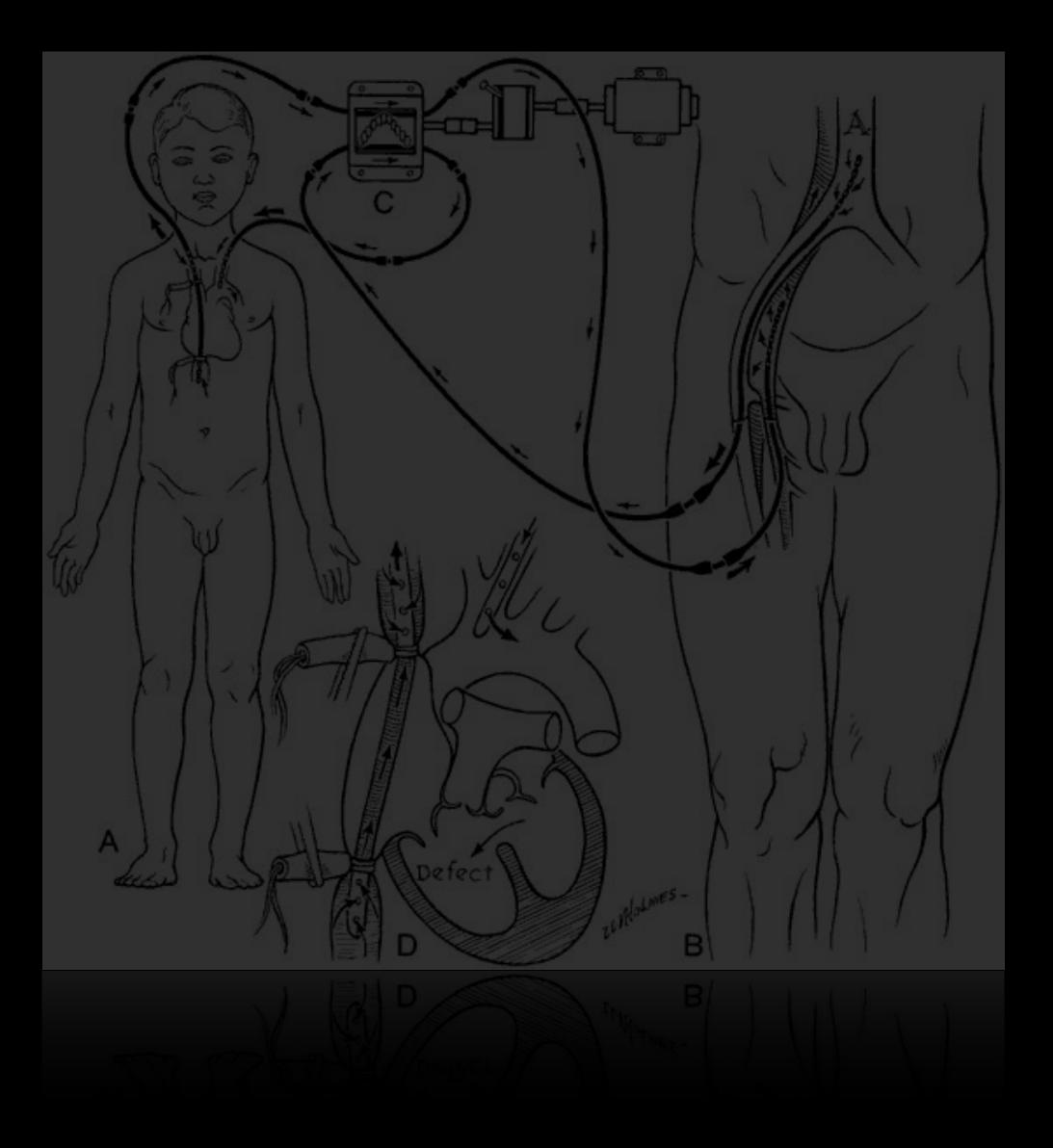


"When going into the wilderness, do not expect to find a paved road" - C. Walt Lillehei

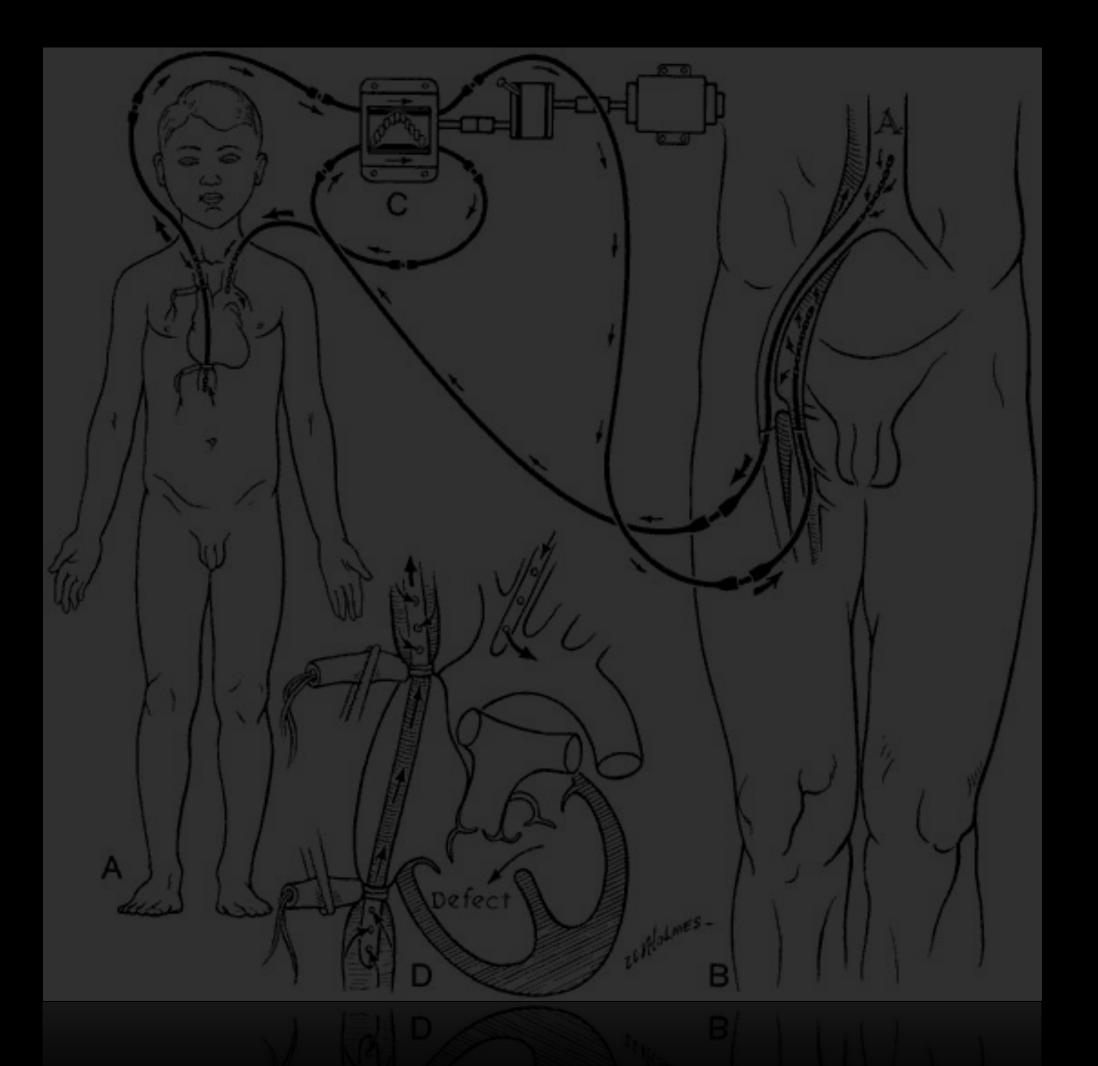


"An operation that could have a 200% mortality." - Unknown critic









# cross circulation was LOUD





# cross circulation was LOUD



# **Cross-Circulation**



### **Cross-Circulation**

First VSD closure March 26, 1954

First AVSD closure August 6, 1954

First Tetralogy of Fallot repair August 31, 1954

45 operations

28 survivors



### **Cross-Circulation**

First VSD closure March 26, 1954

First AVSD closure August 6, 1954

First Tetralogy of Fallot repair August 31, 1954

45 operations

28 survivors



62% survival cross-circulation vs. 6% survival CPB

#### C Walt Lillehei



#### Brash Charismatic Driven Maverick

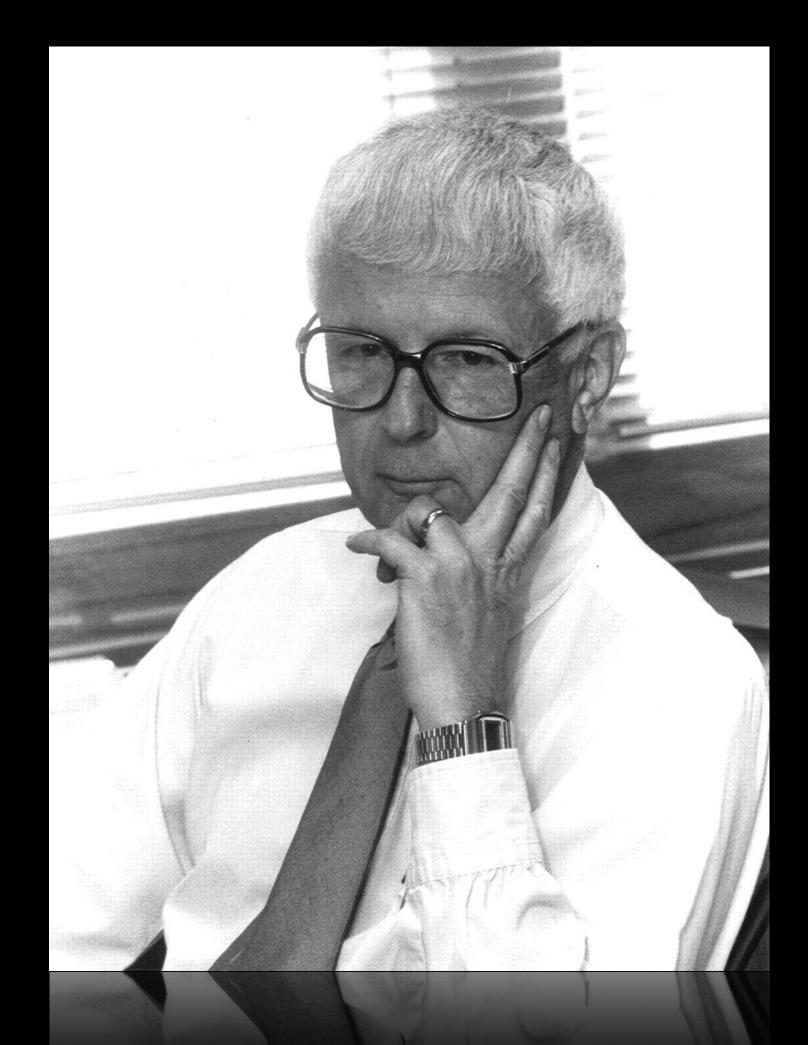
#### **C** Walt Lillehei



#### **Brash Charismatic Driven** Maverick

✓ X-circulation ✓ first operations CHD ✓ first pacemakers mechanical heart valves drove research into transplantation ✓ trained 150 world-leading surgeons Med Director of St Jude Inc ✓ Bravery medal in WW2 (Italy)

#### John W Kirklin



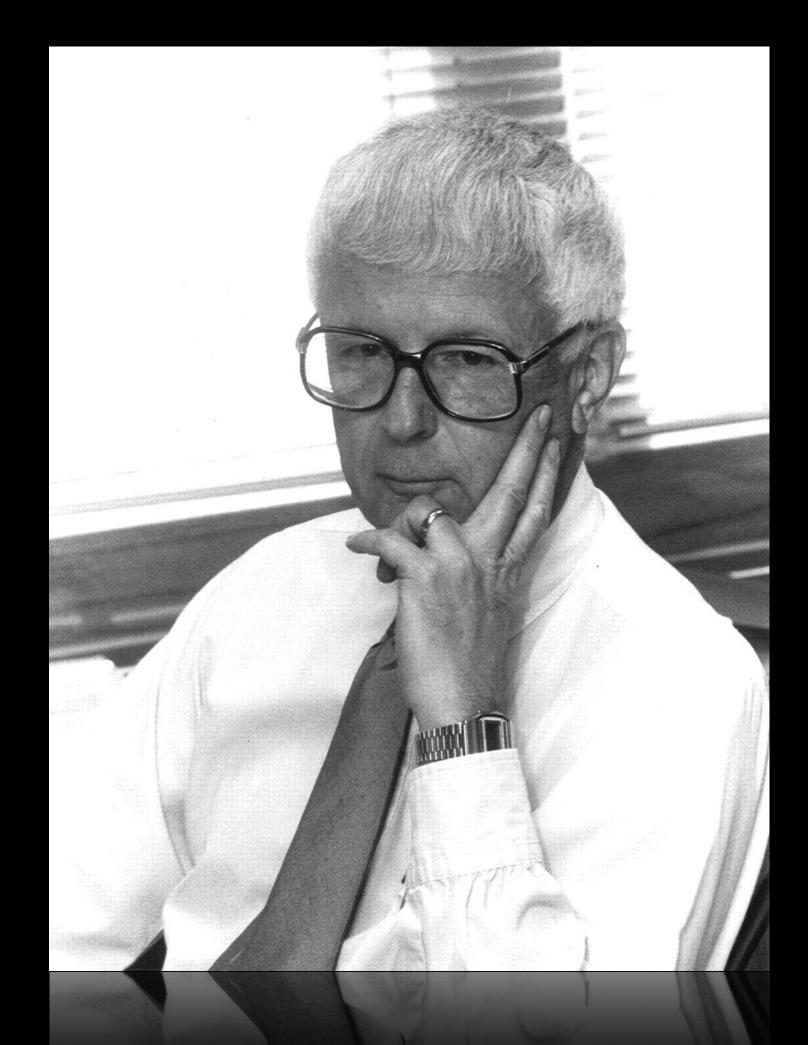
#### Calm



Clear-Thinking Legendary Hard Worker Academic



#### John W Kirklin



#### Calm

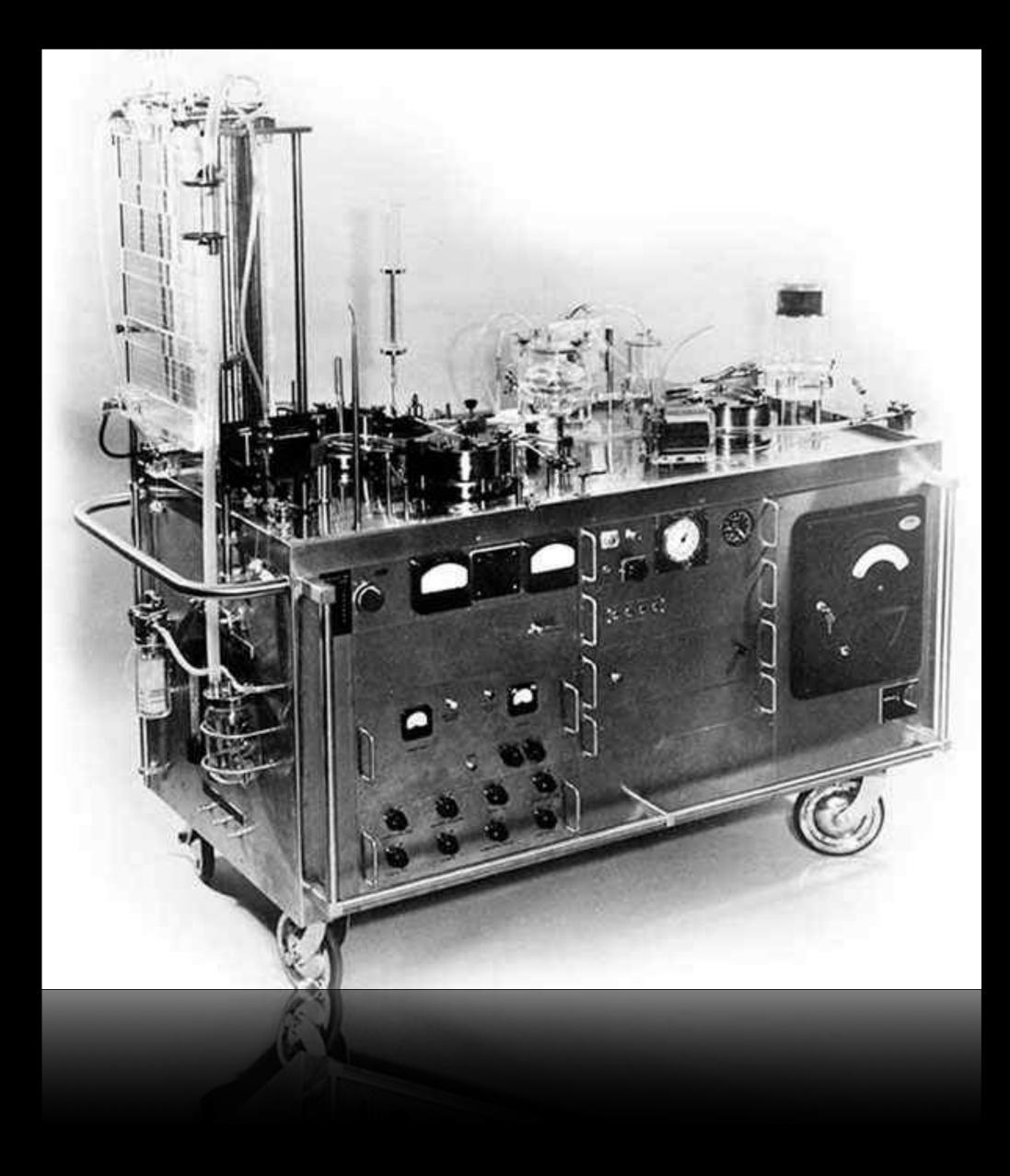


#### $\checkmark$ took CPB to next stage

- ✓ obsessional and scientific
- wrote 'definitive' text book
- ✓ outcome-driven
- ✓ academic leader
- ✓ role model for modern surgery

### Clear-Thinking Legendary Hard Worker

Academic





John W. Kirklin (1917-2004) and colleagues at the Mayo Clinic launched their open heart program on March 5, 1955. They used a heart-lung machine based on the Gibbon-IBM machine.

1955. They used a heart-lung machine based on the Gibbon-IBM machine.





#### De Wall -Lillehei Bubble oxygenator

simple in concept mass producable

brought open-heart surgery to the world

#### **Denis Melrose**



# Stop the Heart Moving!

#### **Denis Melrose**



to **stop**, replace the blood flowing through the coronary arteries with cold, potassium-containing fluid

# **Stop the Heart Moving!**

#### **Denis Melrose**



to **stop**, replace the blood flowing through the coronary arteries with cold, potassium-containing fluid

# Stop the Heart Moving!

to restart, flush out the cold fluid with warm blood

# the underlying need was clear

the underlying need was clear the heart could be bypassed

the underlyin the heart cou the heart be sto

- the beart could be bypassed
  - the heart could be bypassed
- the heart be stopped, and restarted

the underlyin the heart cou the heart be sto people wer

- the underlying need was clear
  - the heart could be bypassed
- the heart be stopped, and restarted
  - people were being trained

- the underlying need was clear
  - the heart could be bypassed
- the heart be stopped, and restarted
  - people were being trained
- all that was needed was the correct operations





what did it take for these pioneers to do the first operations on people like these?





## understand what is wrong, and in 3-D



# understand what is wrong, and in 3-D



### know what to do, and have a back-up plan

explain, orchestrate & lead



- understand what is wrong, and in 3-D
- know what to do, and have a back-up plan

explain, orchestrate & lead



- understand what is wrong, and in 3-D
- know what to do, and have a back-up plan
- have confidence to make the first cut

explain, orchestrate & lead

have technical skill, and speed



- understand what is wrong, and in 3-D
- know what to do, and have a back-up plan
- have confidence to make the first cut

# **Eponymous Operations**

# **Eponymous Operations**

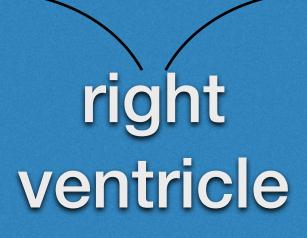
# making a name for yourself

#### abnormal connections

superior vena cava

### right atrium

inferior vena cava



aorta

### transposition of the great arteries (TGA)

pulmonary veins

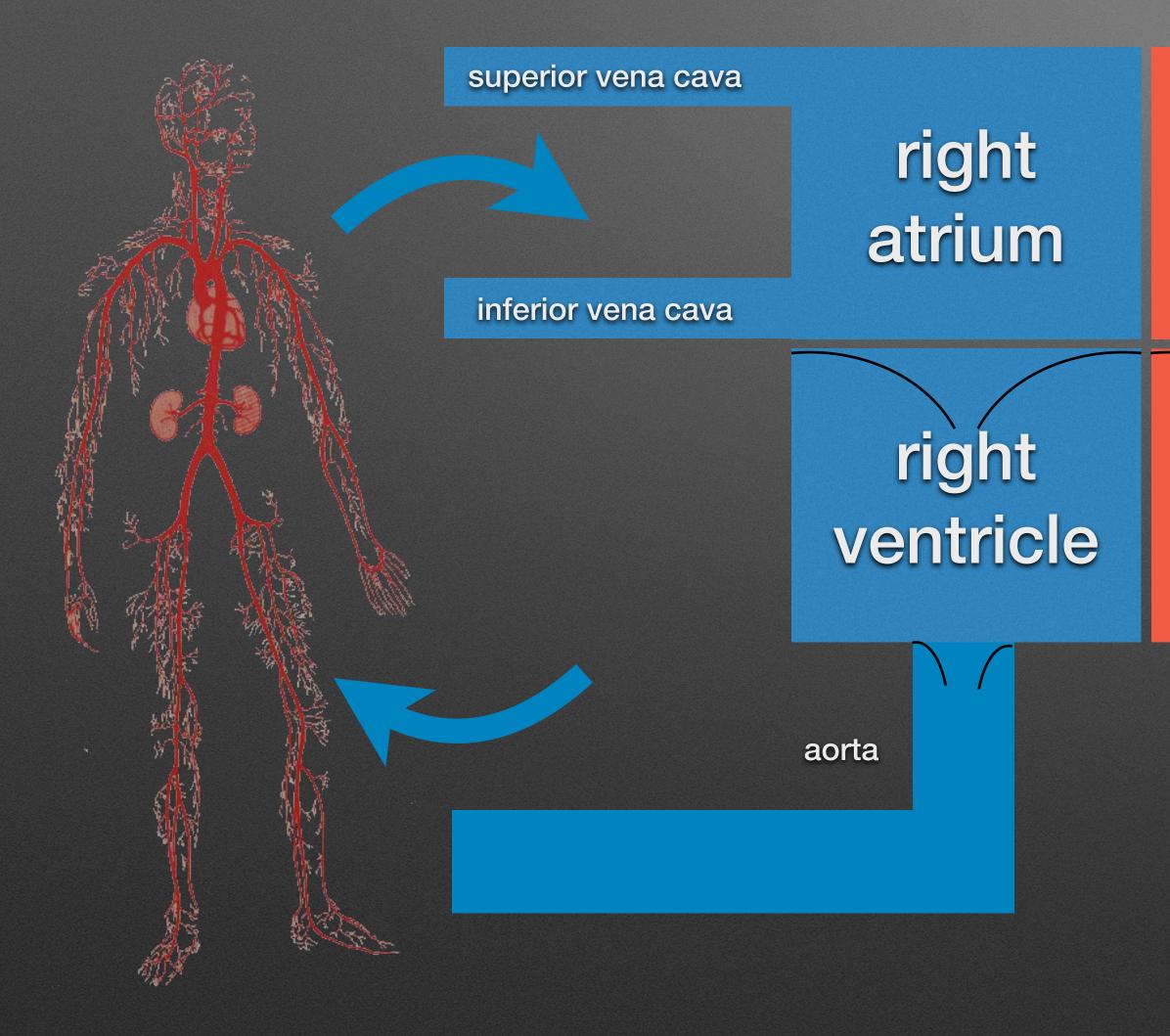
#### left atrium



pulmonary artery



#### abnormal connections



### transposition of the great arteries (TGA)

pulmonary veins

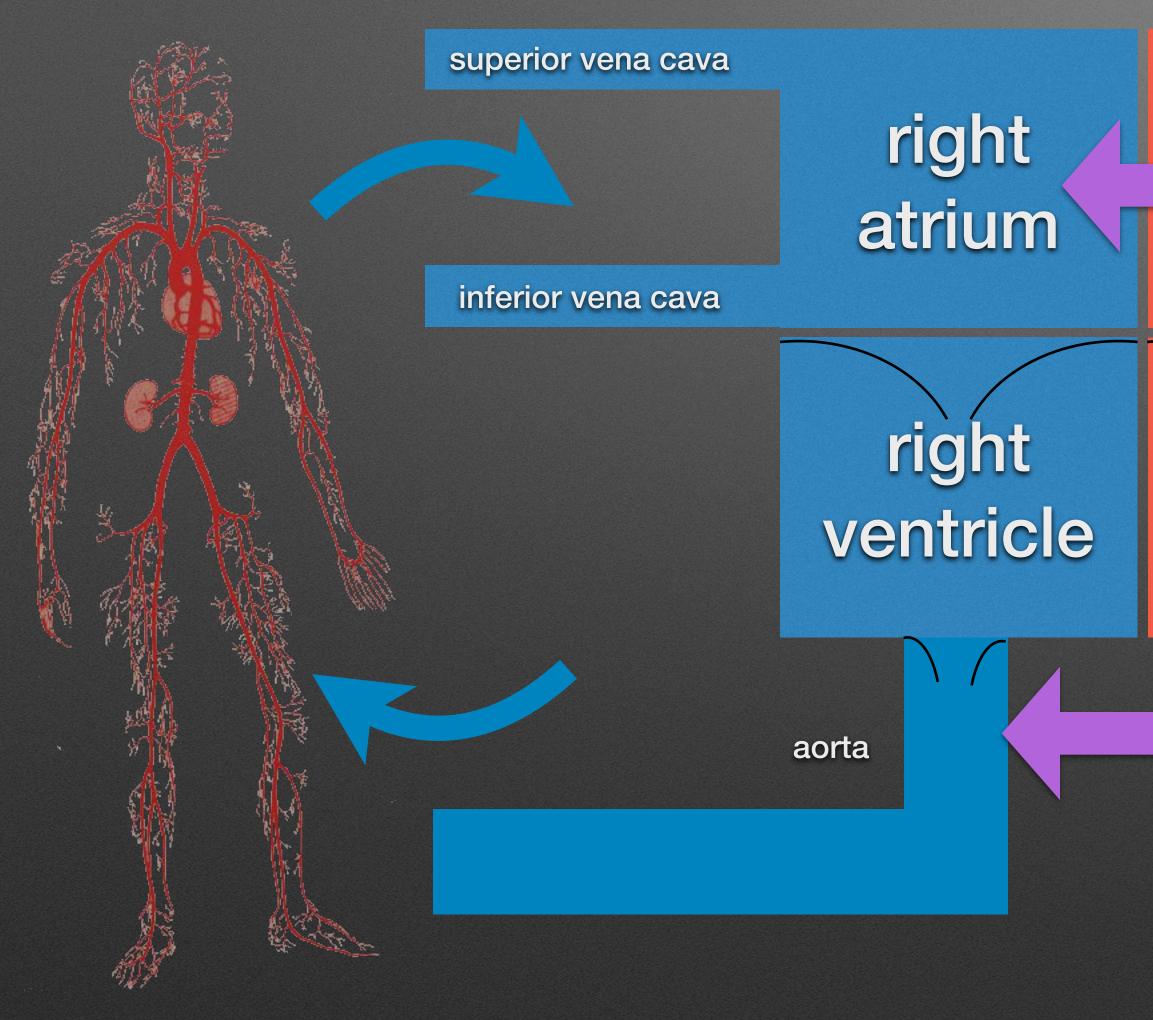
#### left atrium

## left ventricle

pulmonary artery



#### abnormal connections



### transposition of the great arteries (TGA)

pulmonary veins

### left atrium

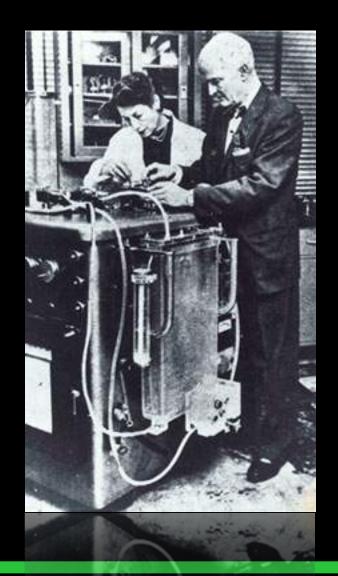
# left ventricle

pulmonary artery



Sír George Newman 1947

Hamílton Hartrídge

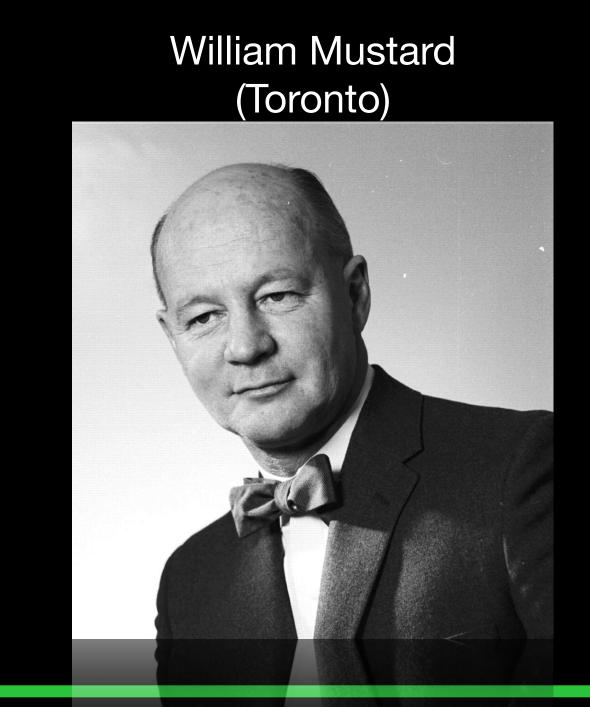


1952

### 1955

Sír George Newman 1947

Hamílton Hartrídge



1952

### 1955

Sír George Newman 1947

Hamílton Hartrídge



1952

### 1955

Sír George Newman 1947

Hamílton Hartrídge



1952

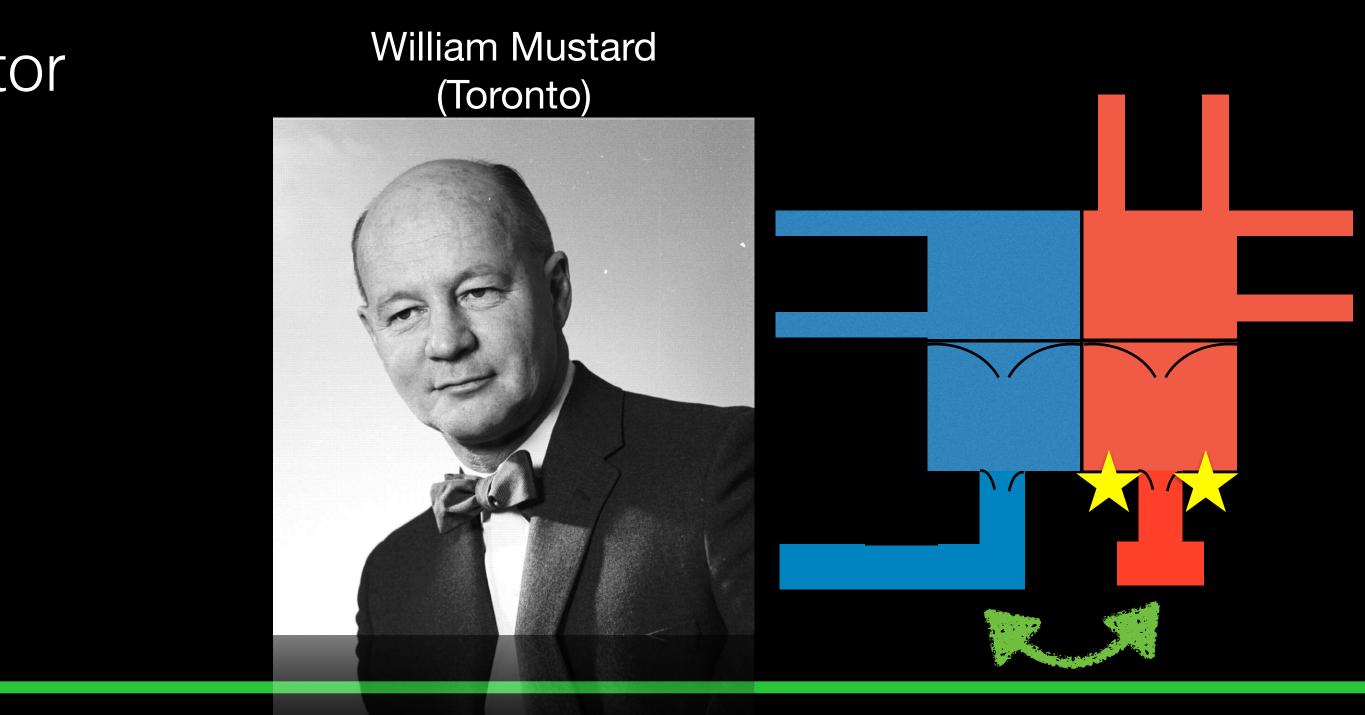
1955

# using a monkey lung as oxygenator

1931

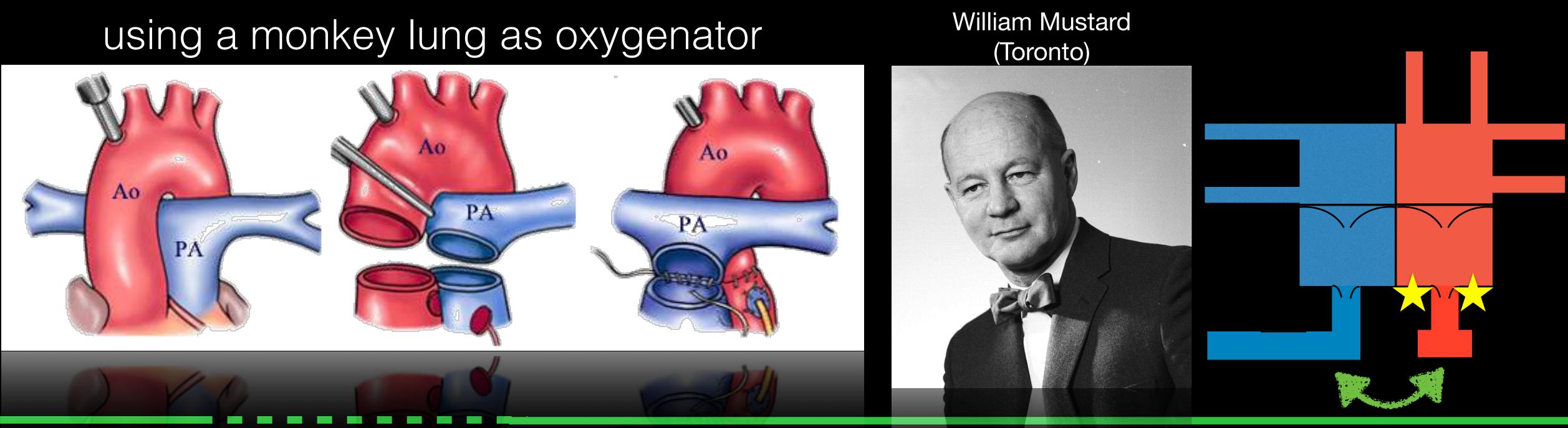
1947

Sír George Newman Hamílton Hartrídge



### 1952

### 1955



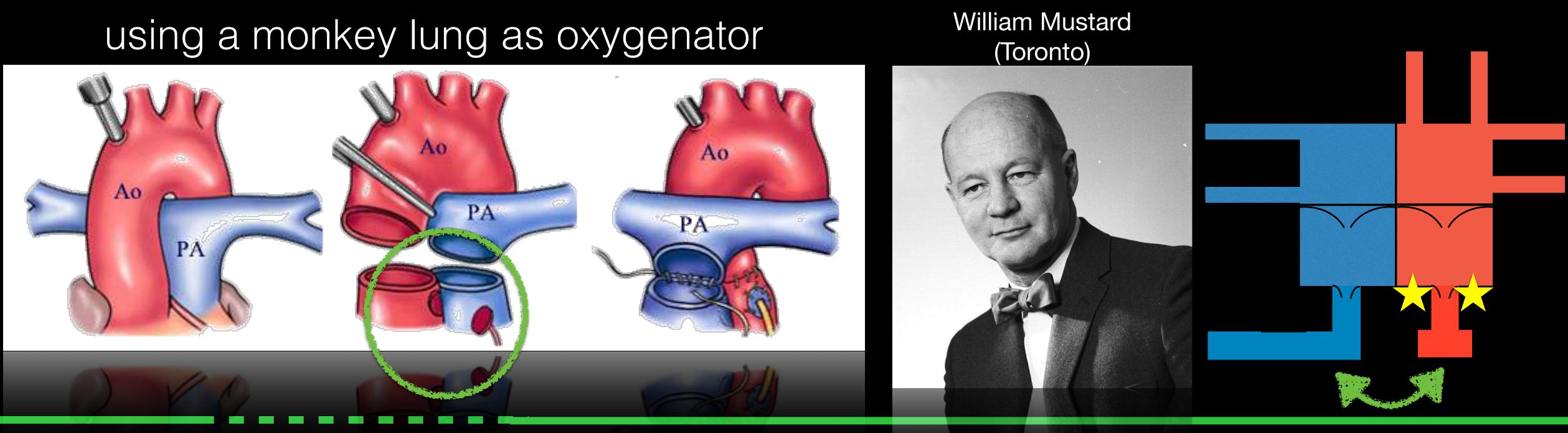
**1**947

Sír George Newman

Hamilton Bartrídge

1952

### 1955



**1**947

Sír George Newman

Hamilton Bartrídge

1952

### 1955

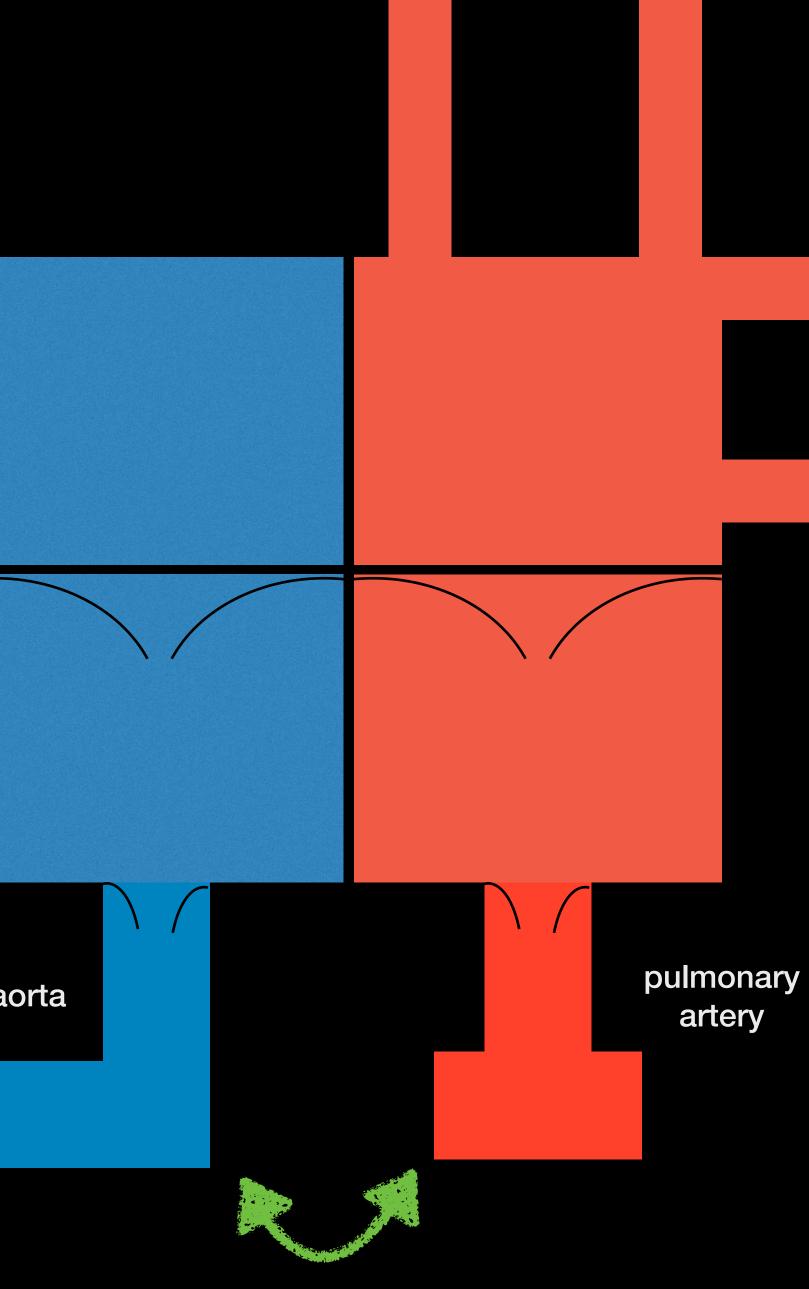
## William Mustard (Toronto)

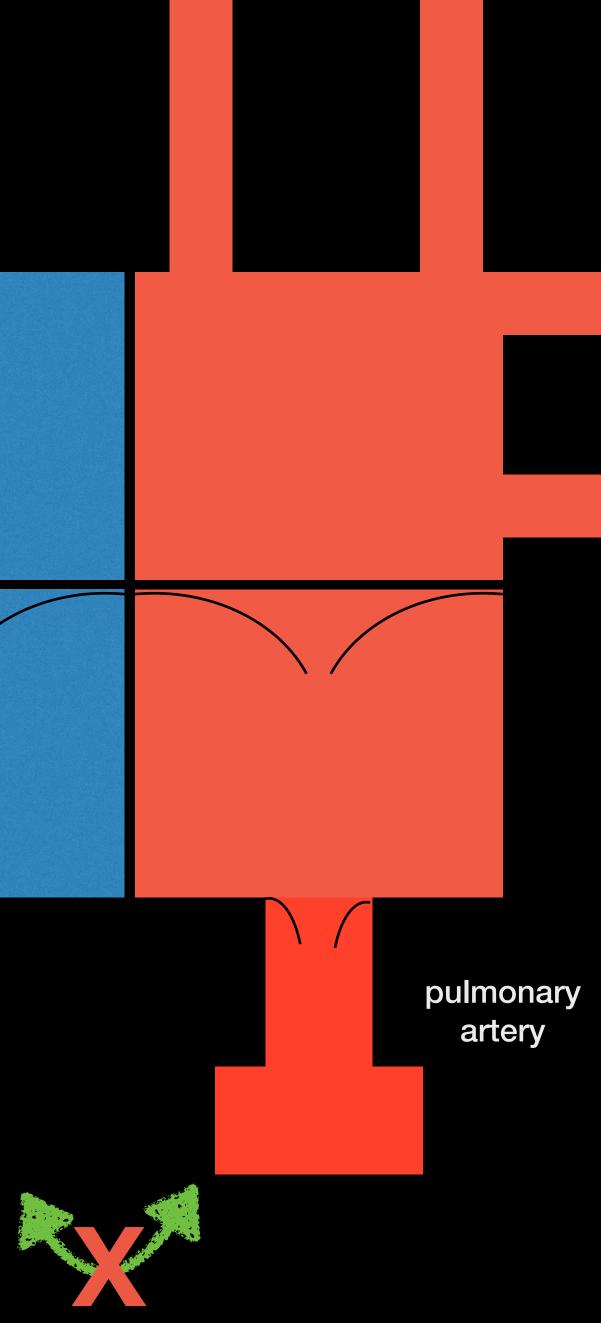


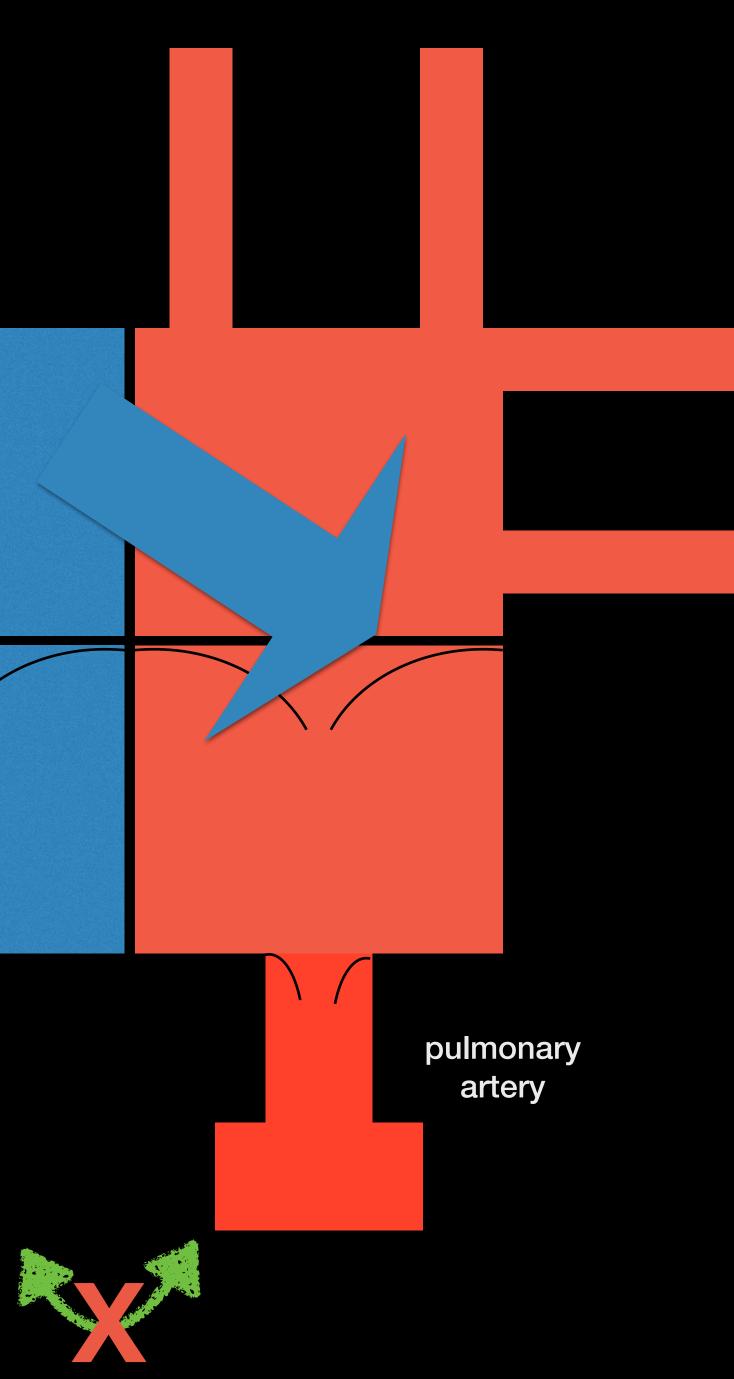


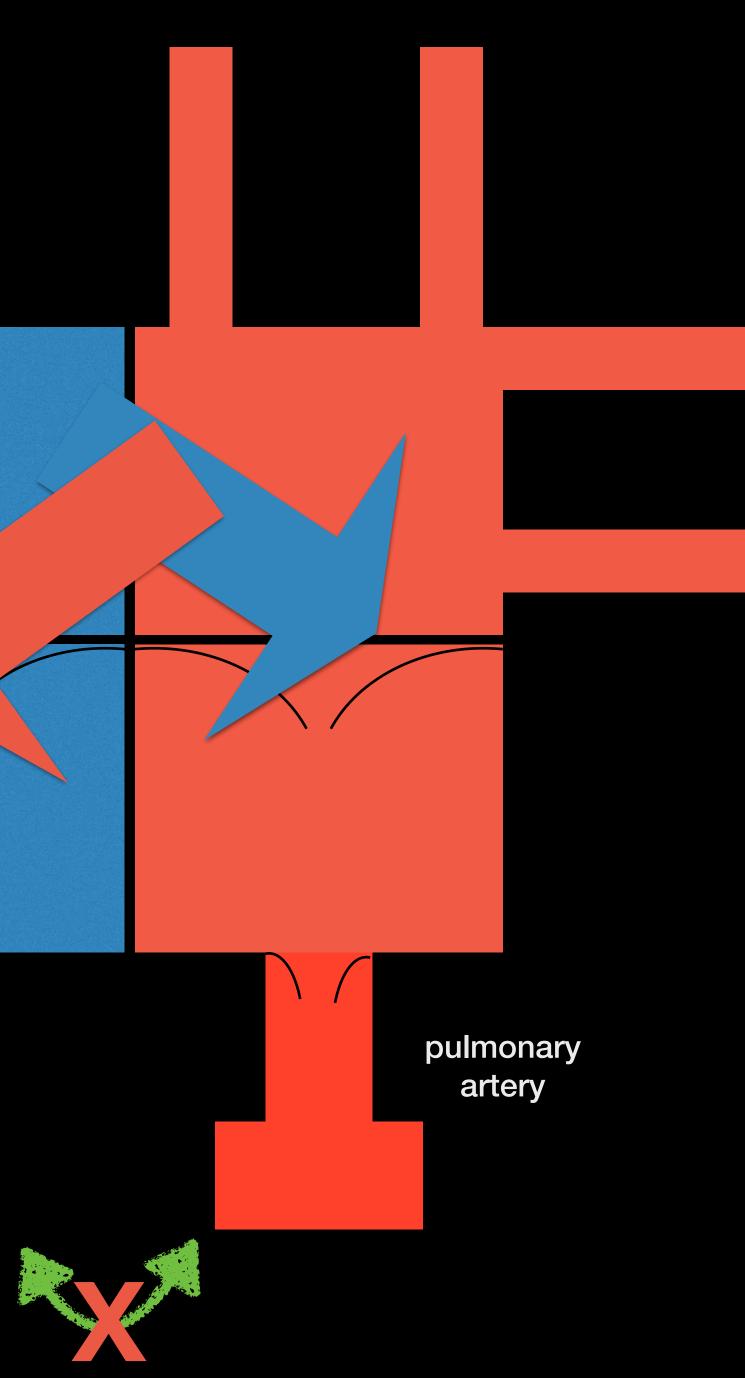
# 7 cases in a year ALL died within a few hours

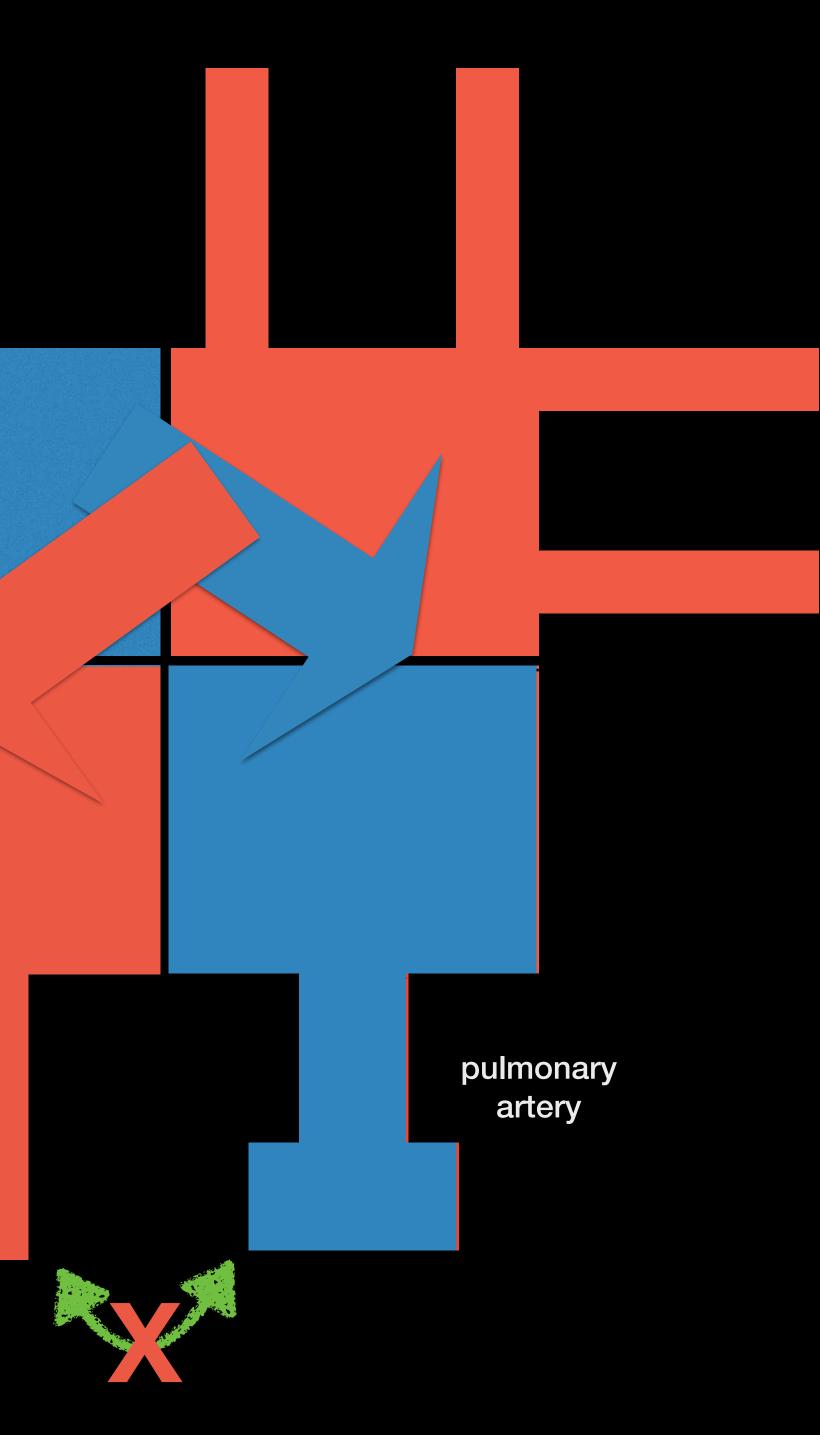
## Bailey (1953), Senning (1954) same result



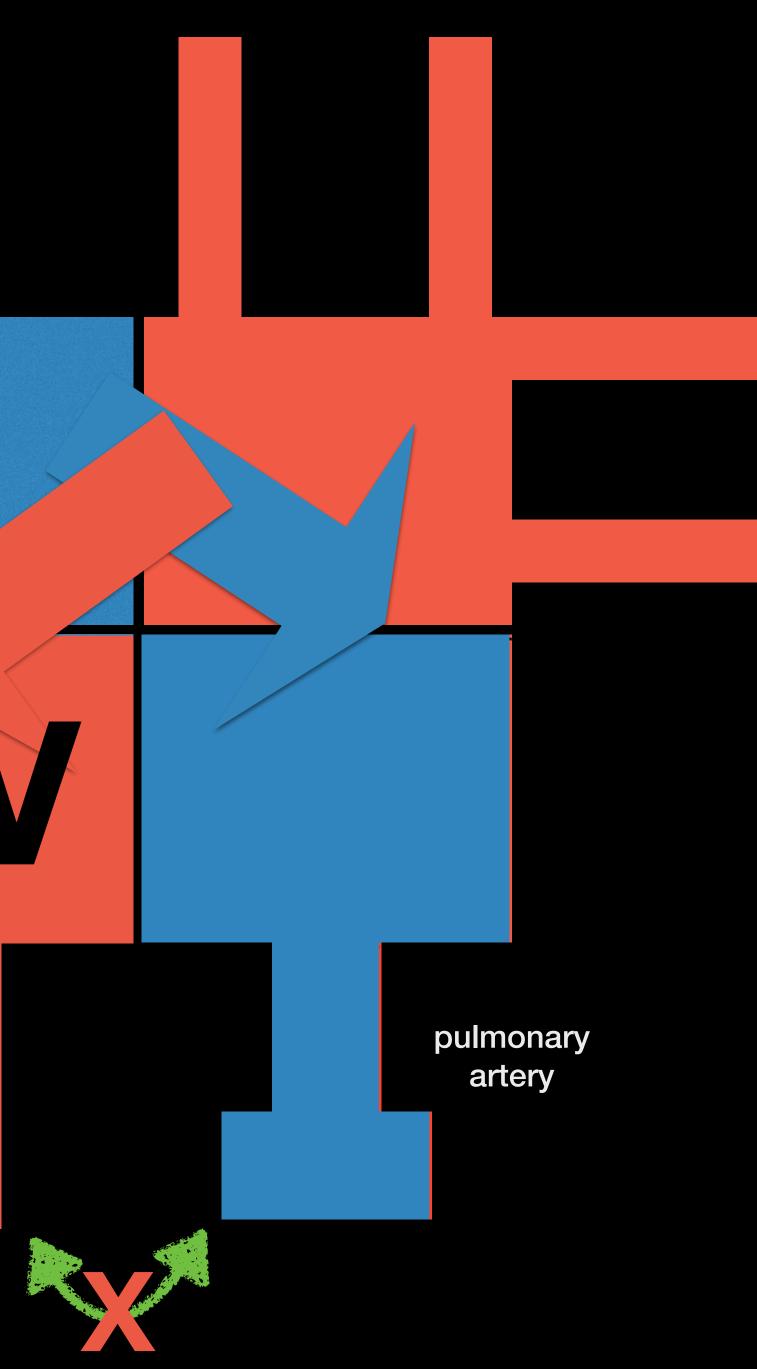




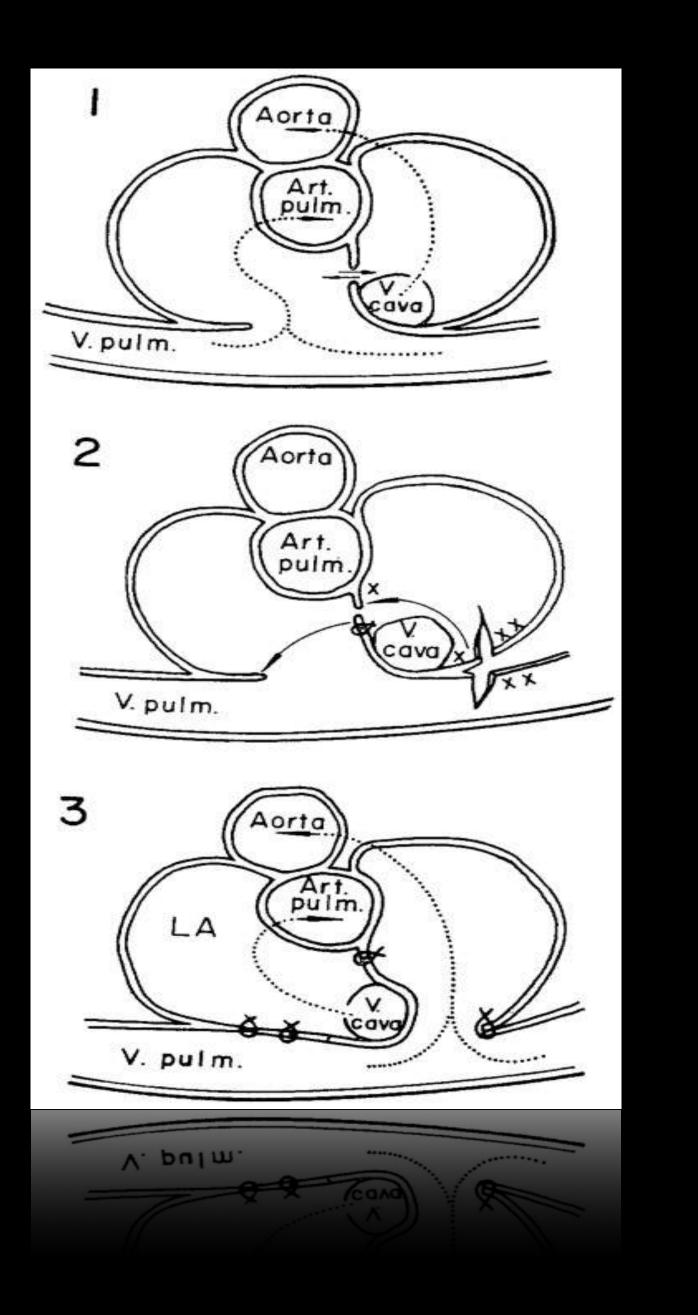


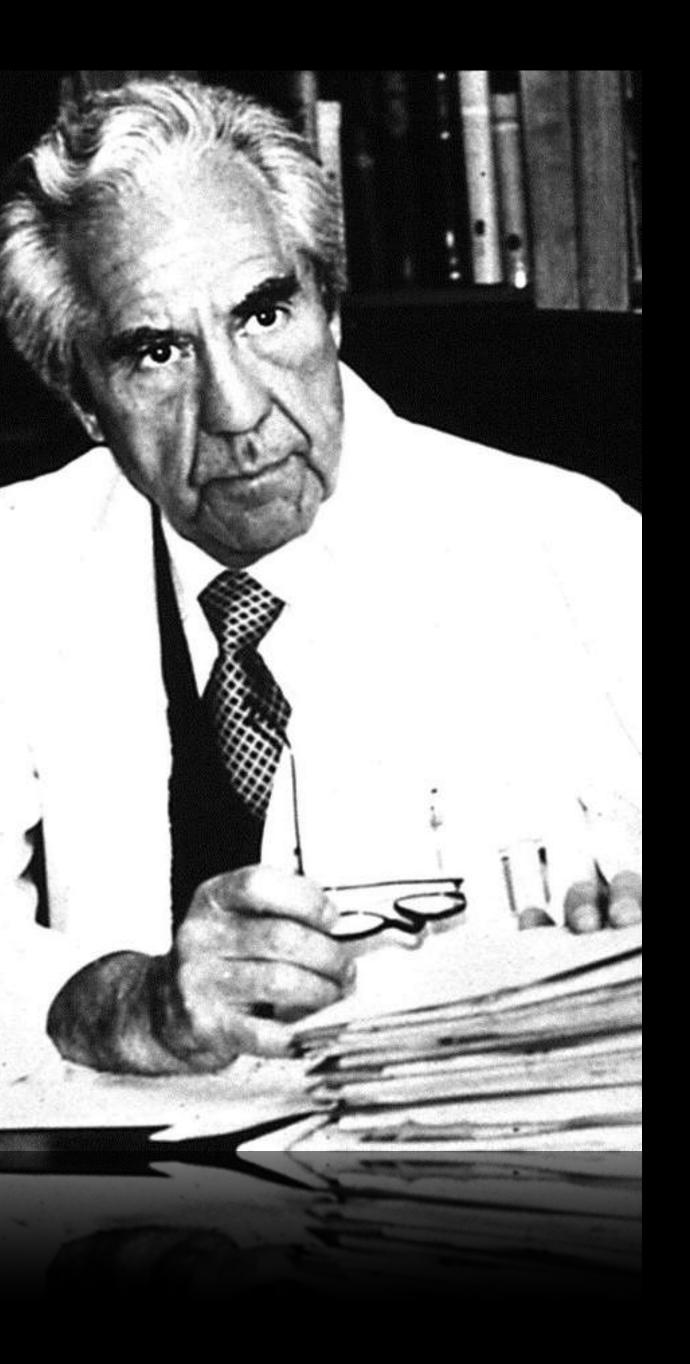


RV



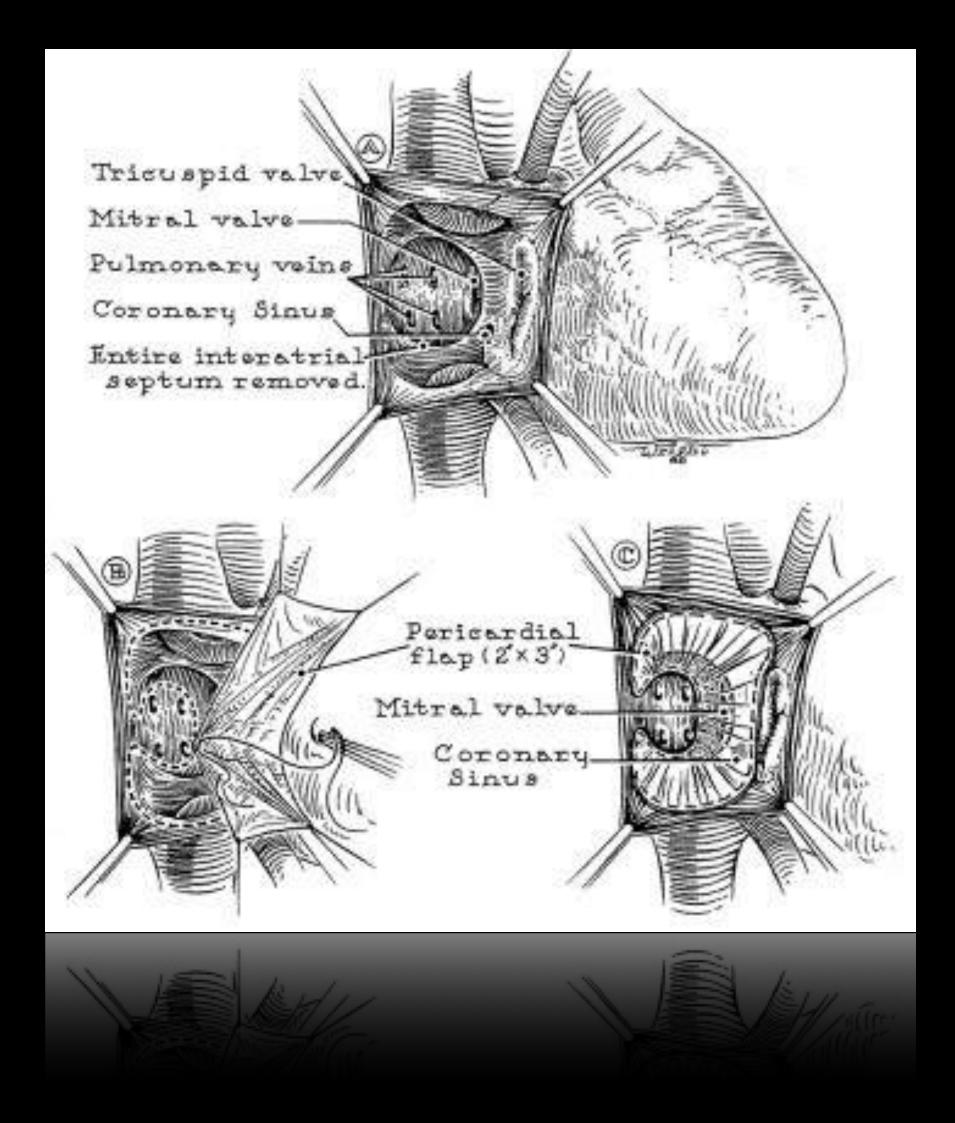
### Senning procedure, Stockholm, 1957





# Ake Senning 1915-2000

### Mustard procedure, Toronto, 1963



### William Mustard 1914-1987









the state of the property of the state of th

LAN BRADY

MYRA HINDLEY





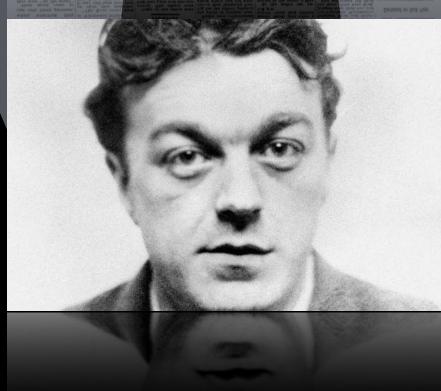












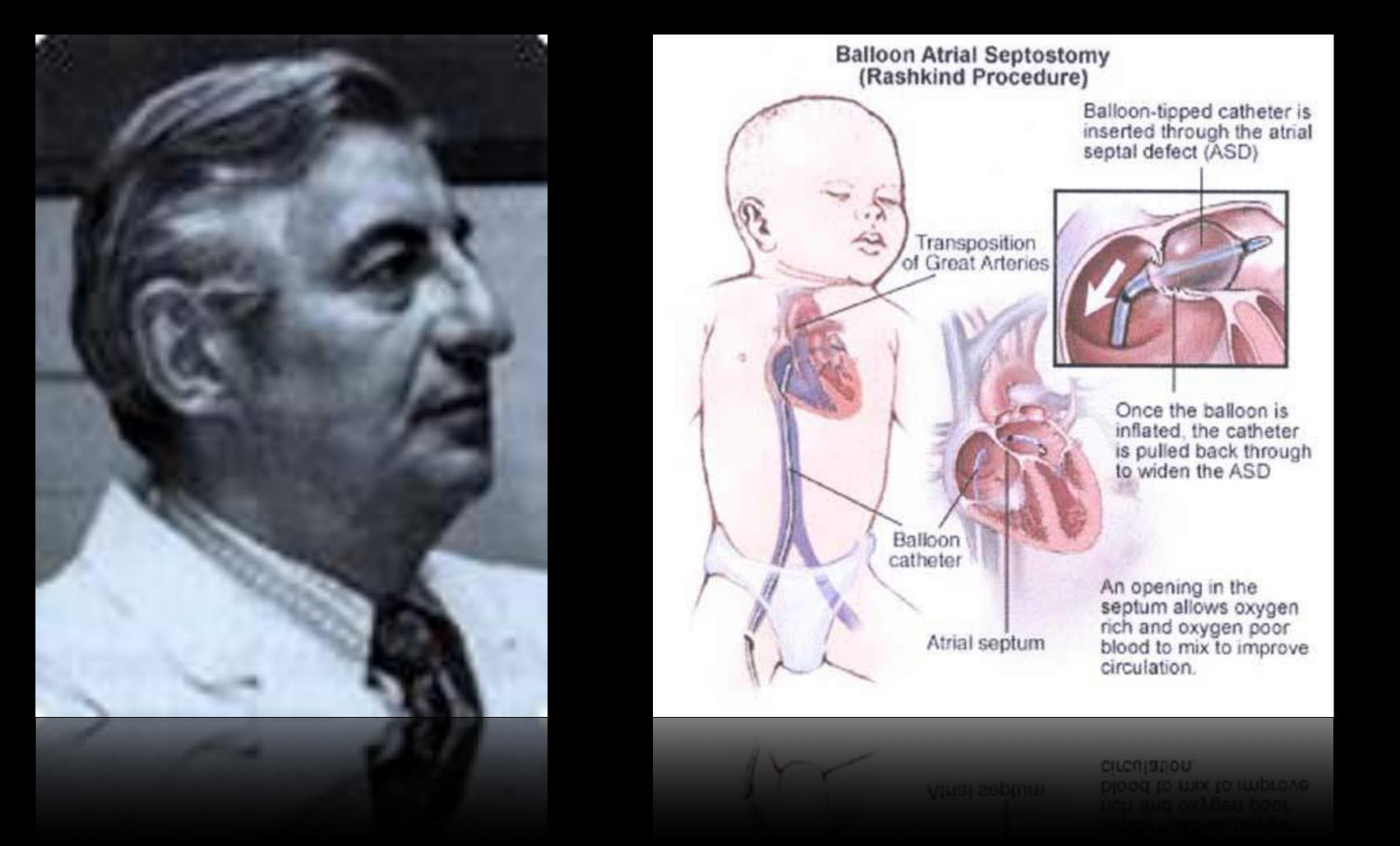
# William Rashkind (Philadelphia)



http://users.skynet.be/bbnc/hartafw/Rashkind.jpg



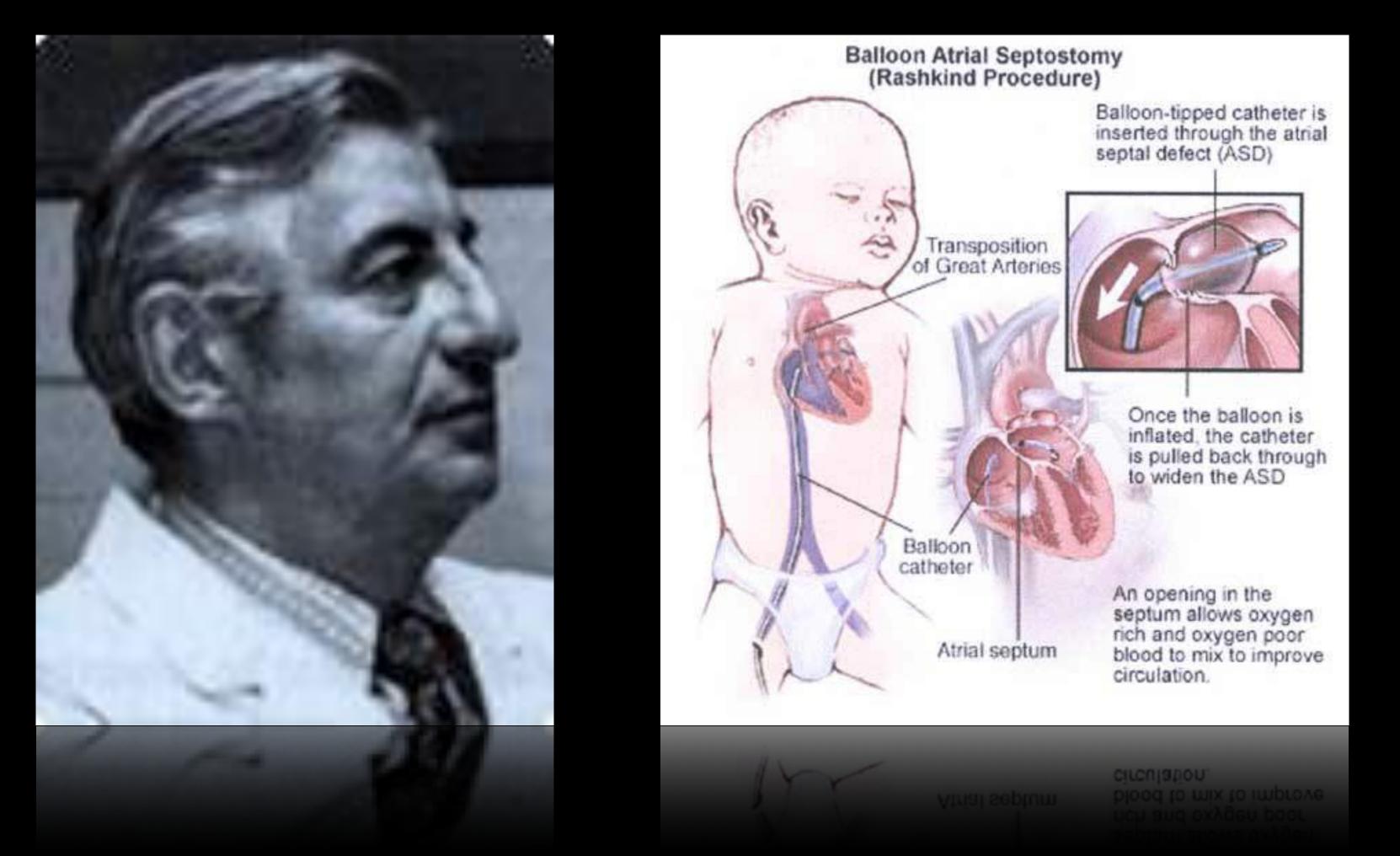
# William Rashkind (Philadelphia)



http://users.skynet.be/bbnc/hartafw/Rashkind.jpg



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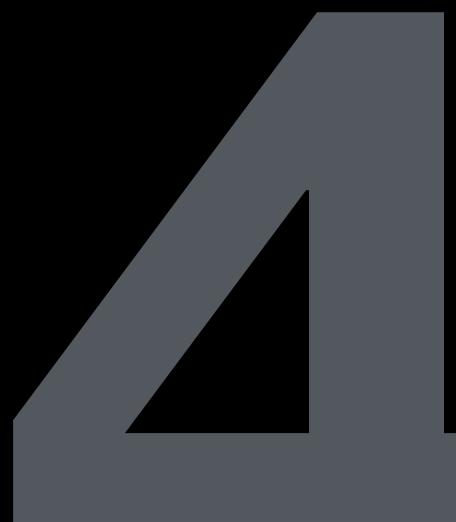
# 1966

# "It's not the science, it's the jerk on the end of the catheter that matters"















e multipline the inter train

### By AVERON'S MILLEY

"All the News

That's Fit to Print\*

The second second

SPECIAL AT 10N RAFE

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### The New York Times

NEW YORK PRIDAY, ADGUST & INM

Aurent, Partie county, wild solver here and read sought. These maps (10% house, First, chance of a life-chances while, of county), They reage that, breach or Pape 8.

LATE CITY EDITION

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### The 37th President Is First to Quit Post

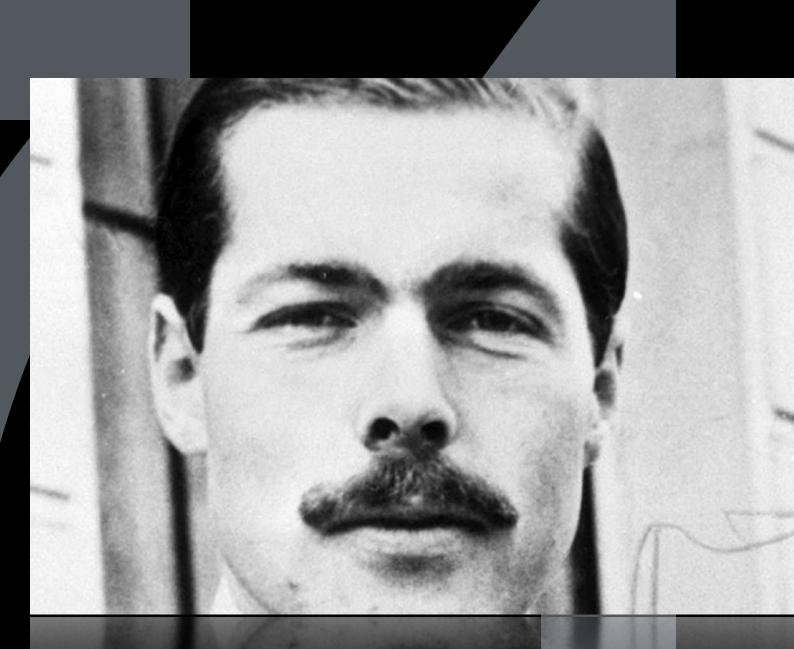
### By KING STREET

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# Prostaglandin E1

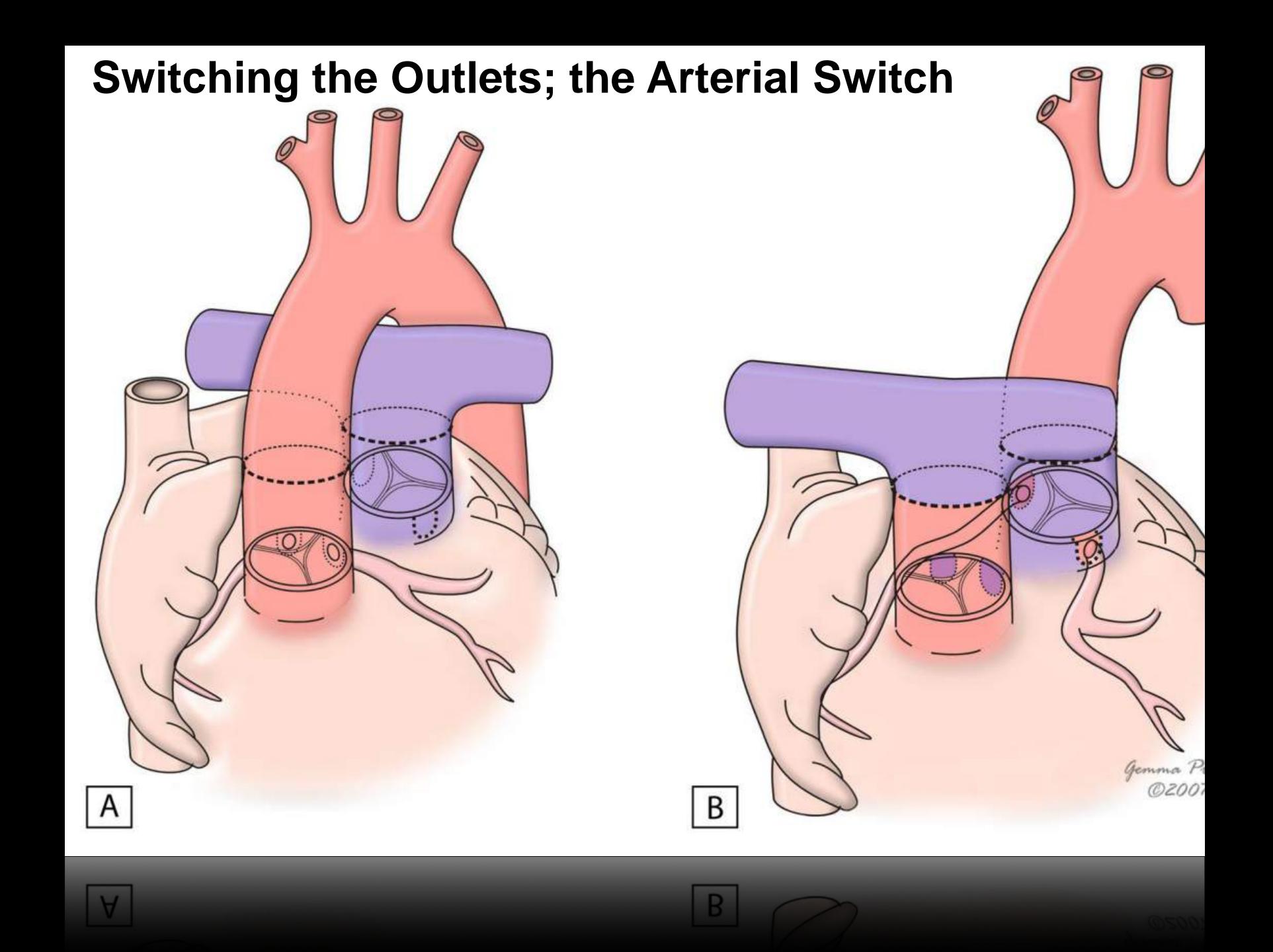
# By the mid-1980's Senning > Mustard Mortality < 5%

# By the mid-1980's Senning > Mustard Mortality < 5%

# By the mid-1980's Senning > Mustard Mortality < 5%

Pre-op (delay)

Late (RV)







### UK trade plunges into deficit

No.62,258

<text><text><text><text><text><text><text><text><text><text><text><text><text><text><text><text><text><text><text><text><text>

And the lot 10

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inquest on muses

High Court refuses Largest oil platform in

High Court refuses BLOCH



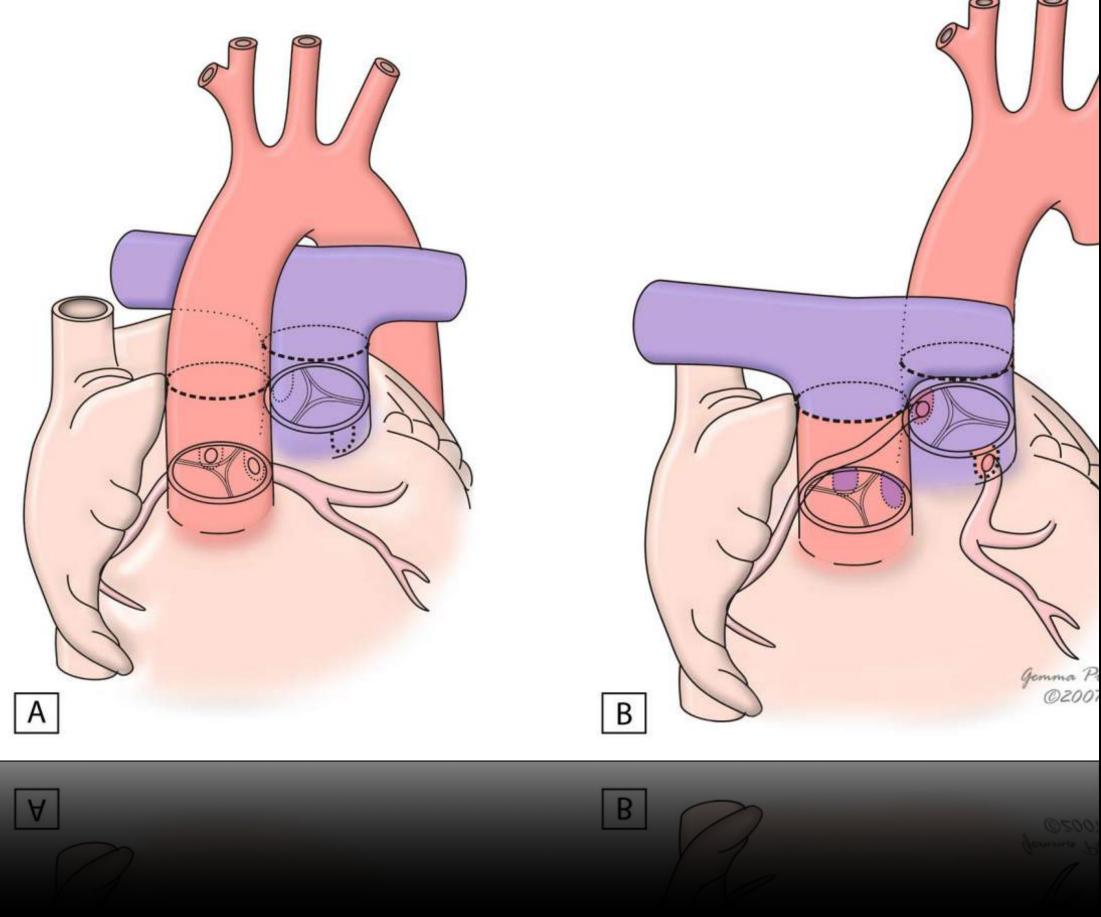


Prus meany peace.



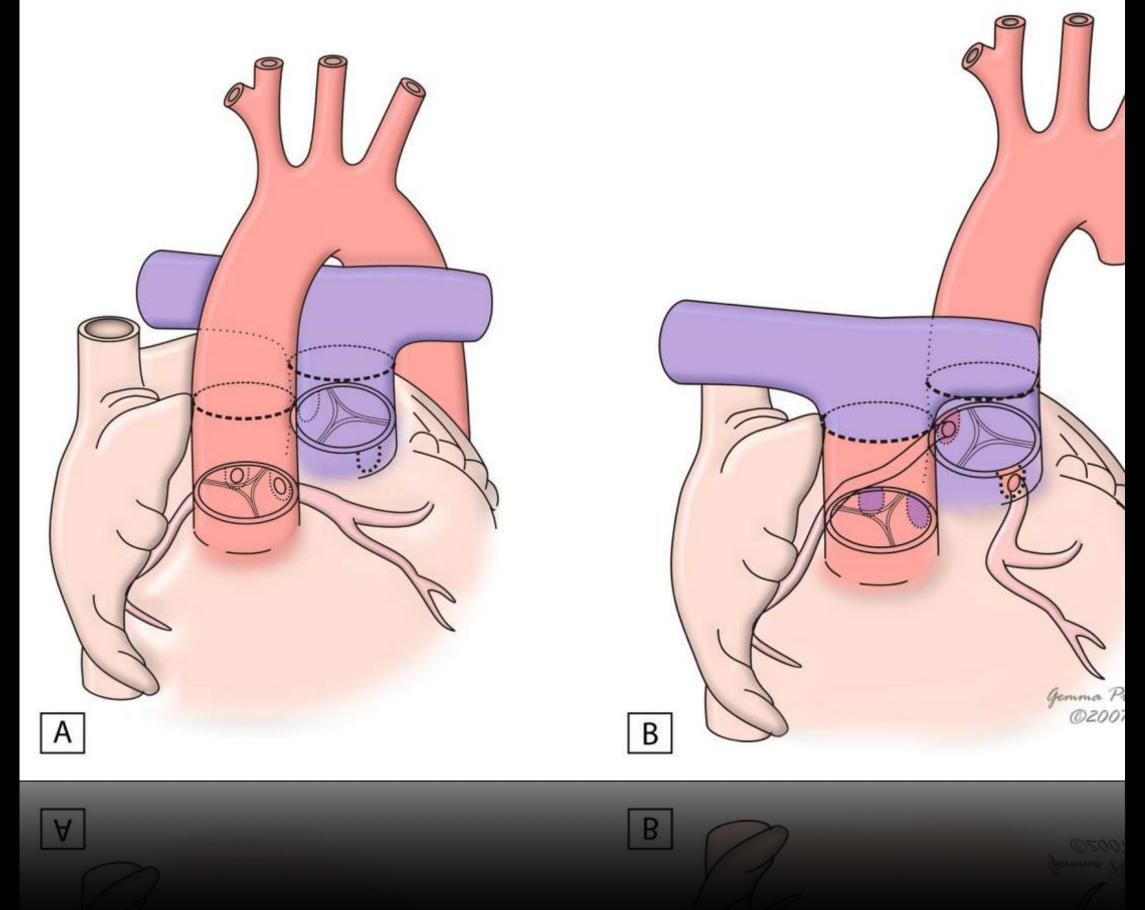
# Adib Jatene (Sao Paolo)





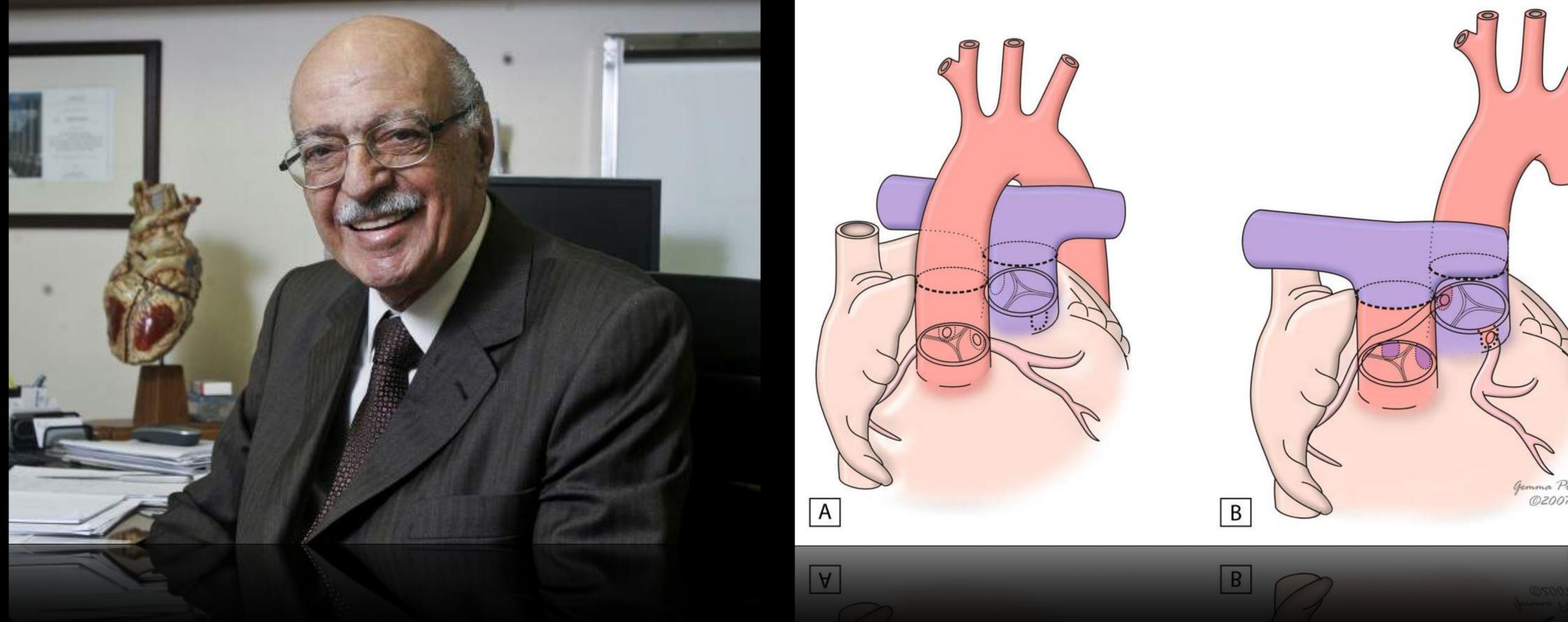
## Adib Jatene (Sao Paolo)





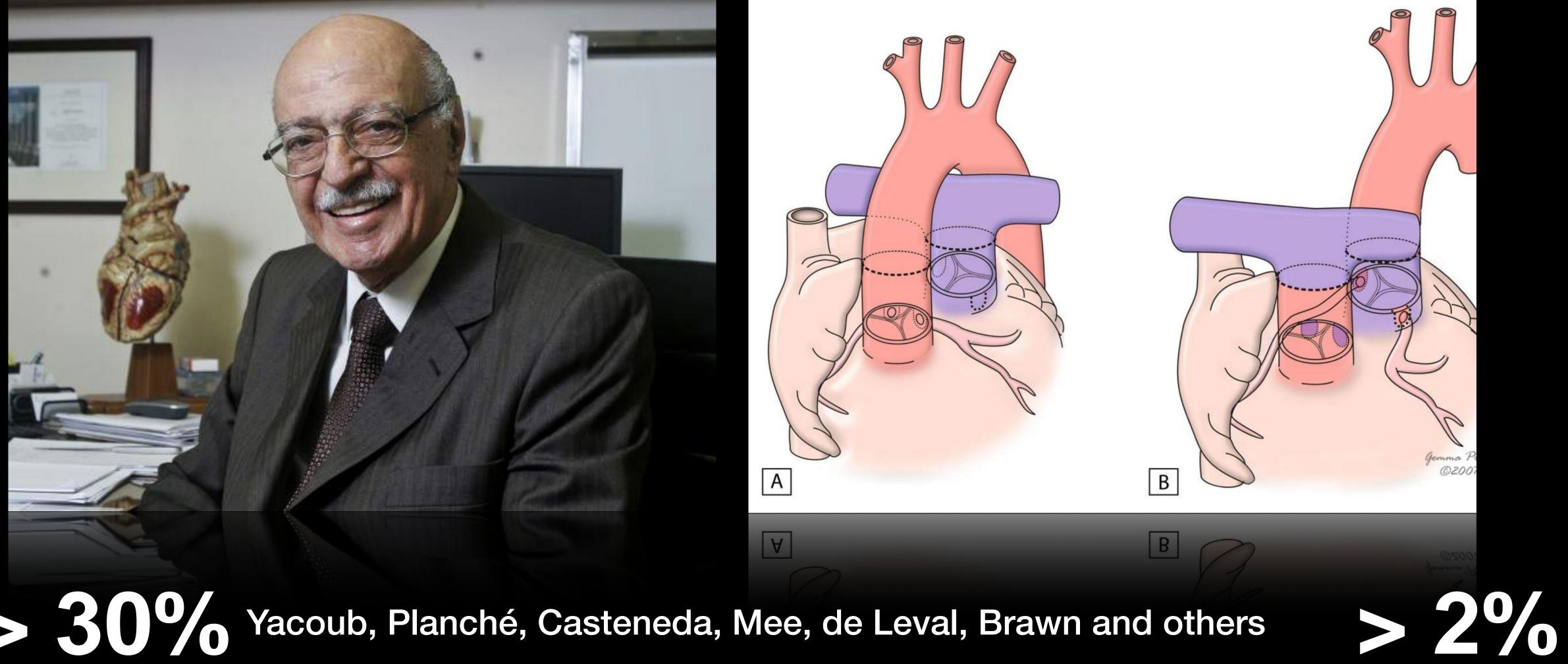
### Yacoub, Planché, Casteneda, Mee, de Leval, Brawn and others

#### Adib Jatene (Sao Paolo)



> 30% Yacoub, Planché, Casteneda, Mee, de Leval, Brawn and others

#### Adib Jatene (Sao Paolo)



> 30% Yacoub, Planché, Casteneda, Mee, de Leval, Brawn and others



#### missing or small components

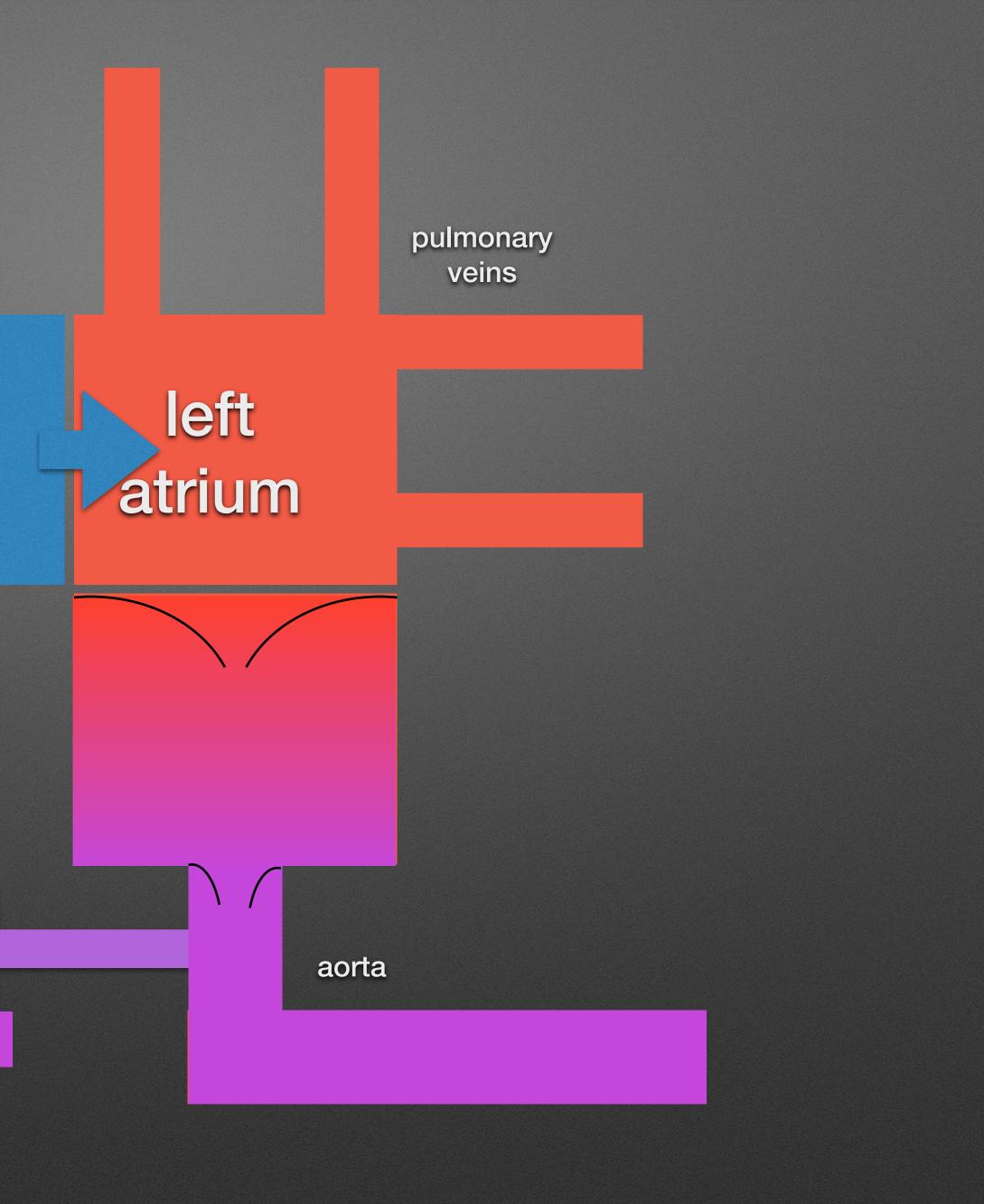
superior vena cava



inferior vena cava

#### univentricular heart absent right ventricle

pulmonary artery



#### missing or small components

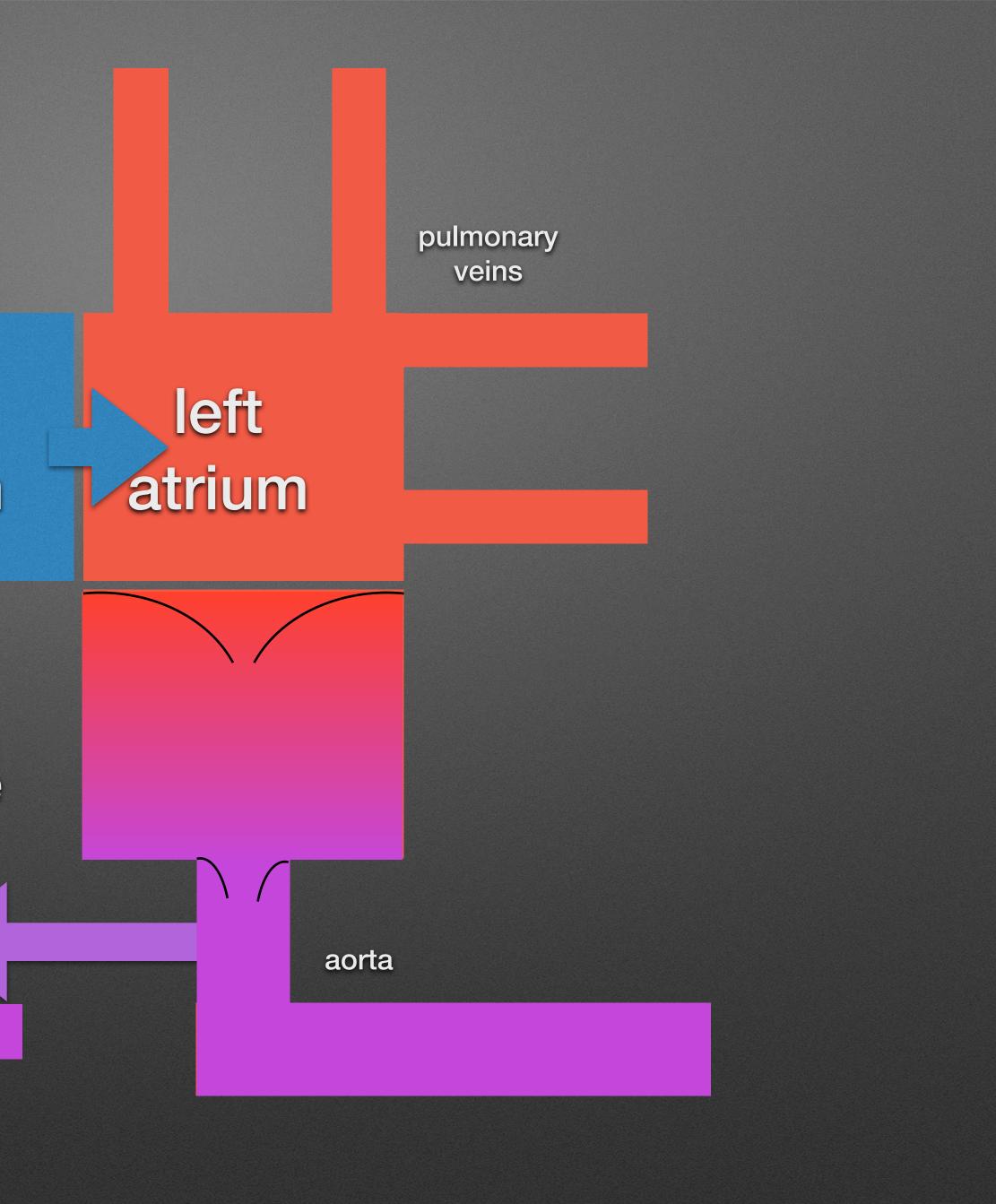
superior vena cava

right strium

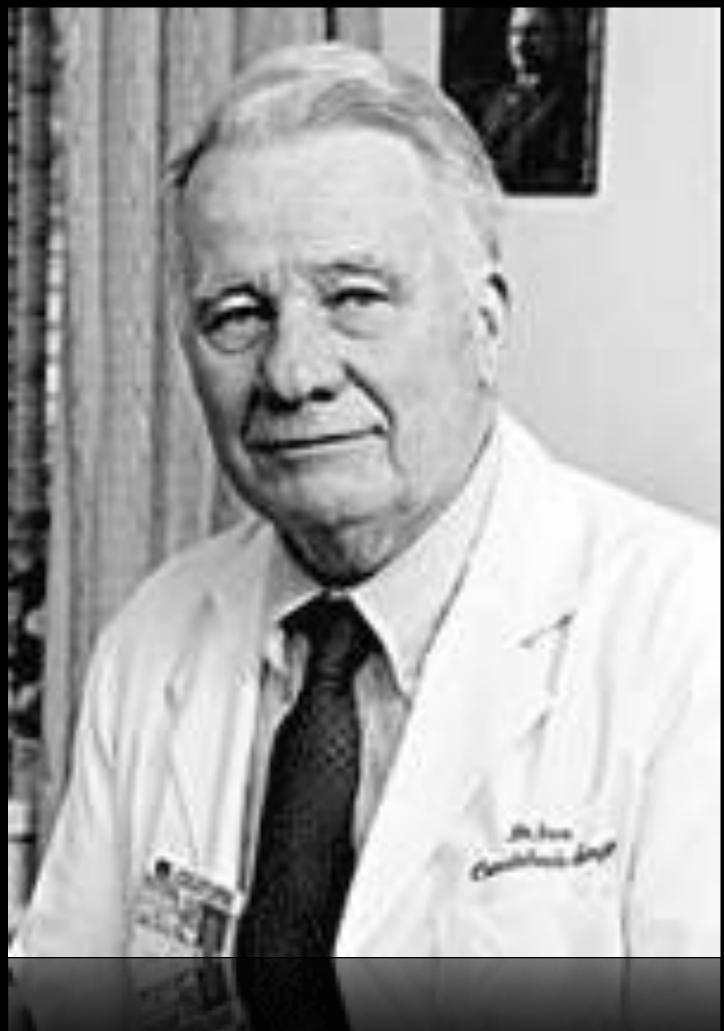
inferior vena cava

#### univentricular heart absent right ventricle

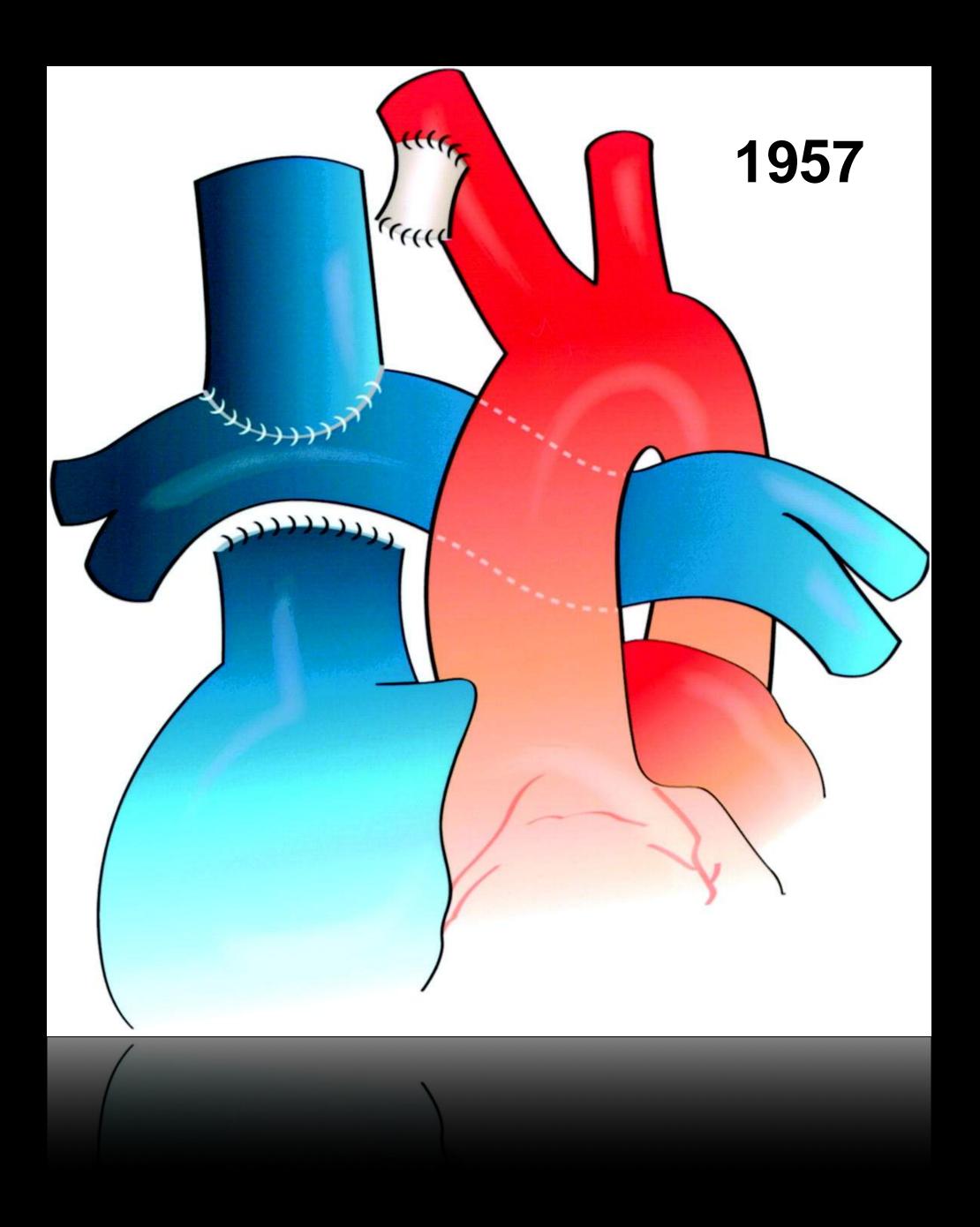
pulmonary artery



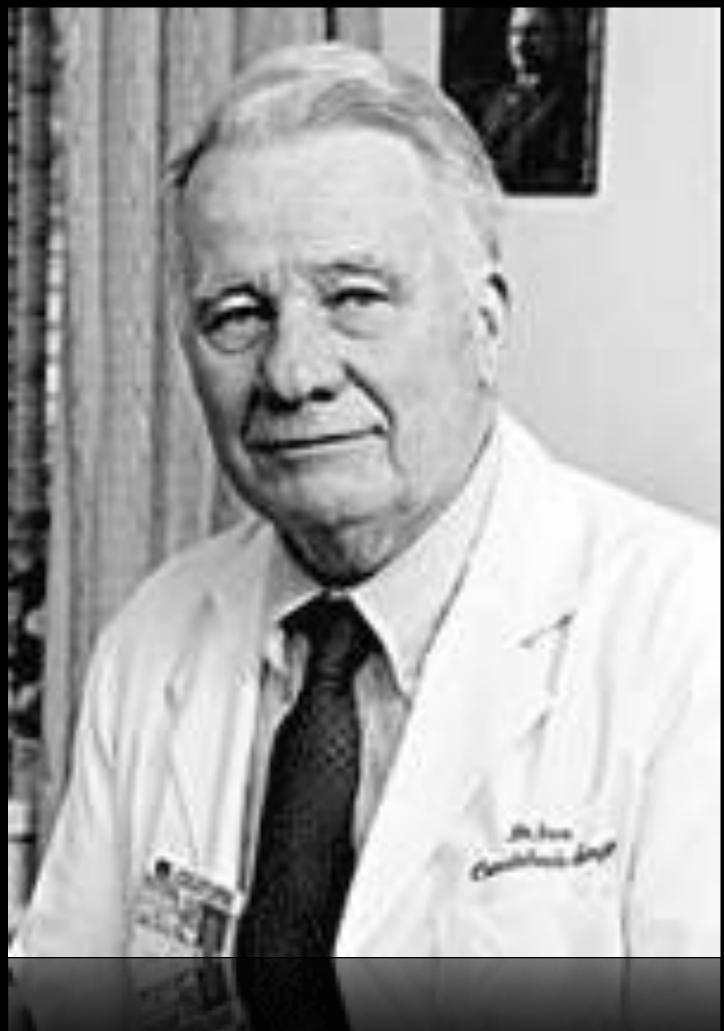
#### William Glenn (Yale)



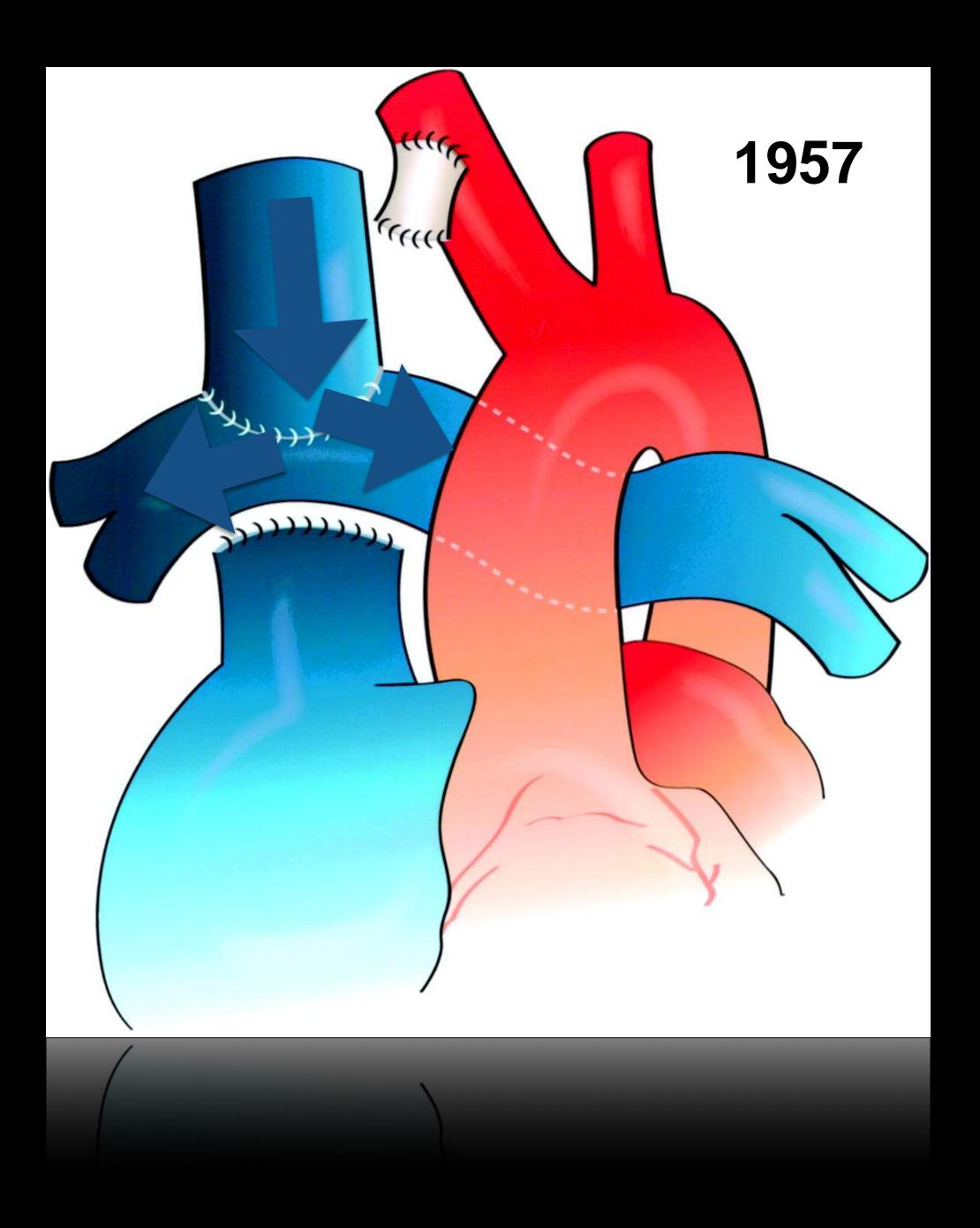
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#### William Glenn (Yale)



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#### DR. KING FATALLY SHOT BY ASSASSIN IN MEMPHIS

#### U.S. Shocked, Saddened by Slaying, Johnson Says

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#### DR. KING FATALLY SHOT **BY ASSASSIN IN MEMPHIS**

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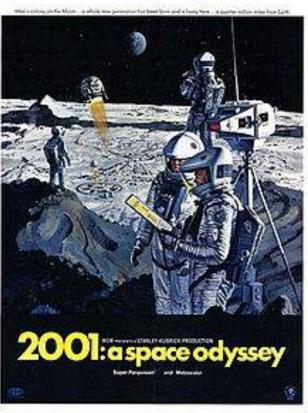
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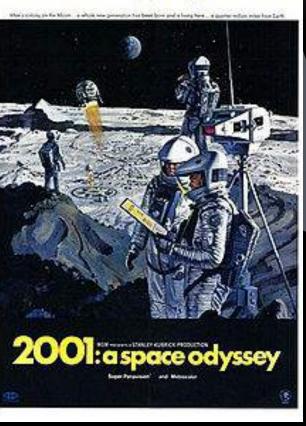
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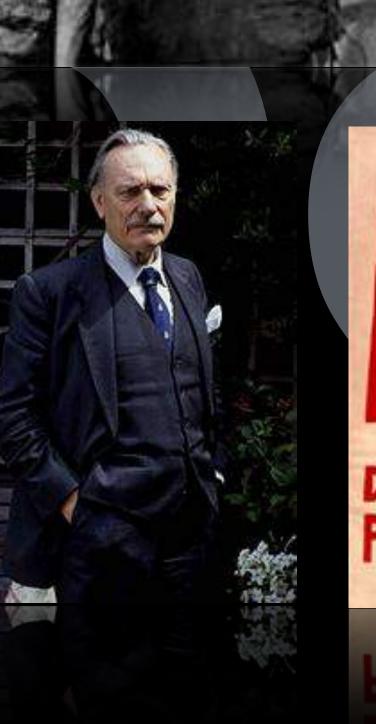
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#### An epic drama of adventure and exploration





# PROLONCEE

**LKOLONCEE** 



#### **Francis Fontan** (Bordeaux)



Superior caval vein anastomosed to right pulmonary artery

Ligated p ulmonary trunk

Aortic homograft in Inferior caval vein

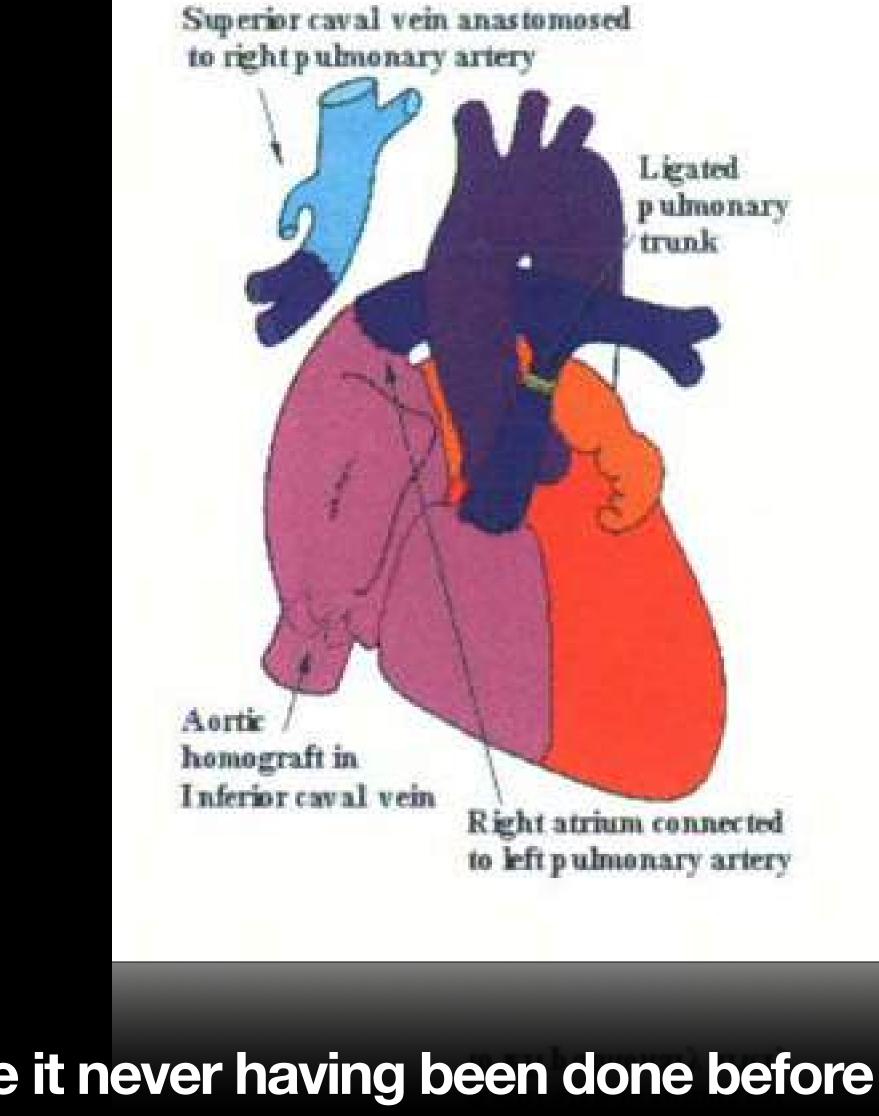
Right atrium connected to left pulmonary artery



#### Francis Fontan (Bordeaux)



He was trusted to do this by his boss, Broustet, despite it never having been done before



#### **Francis Fontan** (Bordeaux)





Superior caval vein anastomosed to right pulmonary artery

Ligated p ulmonary trunk Aertic homograft in Inferior caval vein Right atrium connected to left pulmonary artery

He was trusted to do this by his boss, Broustet, despite it never having been done before



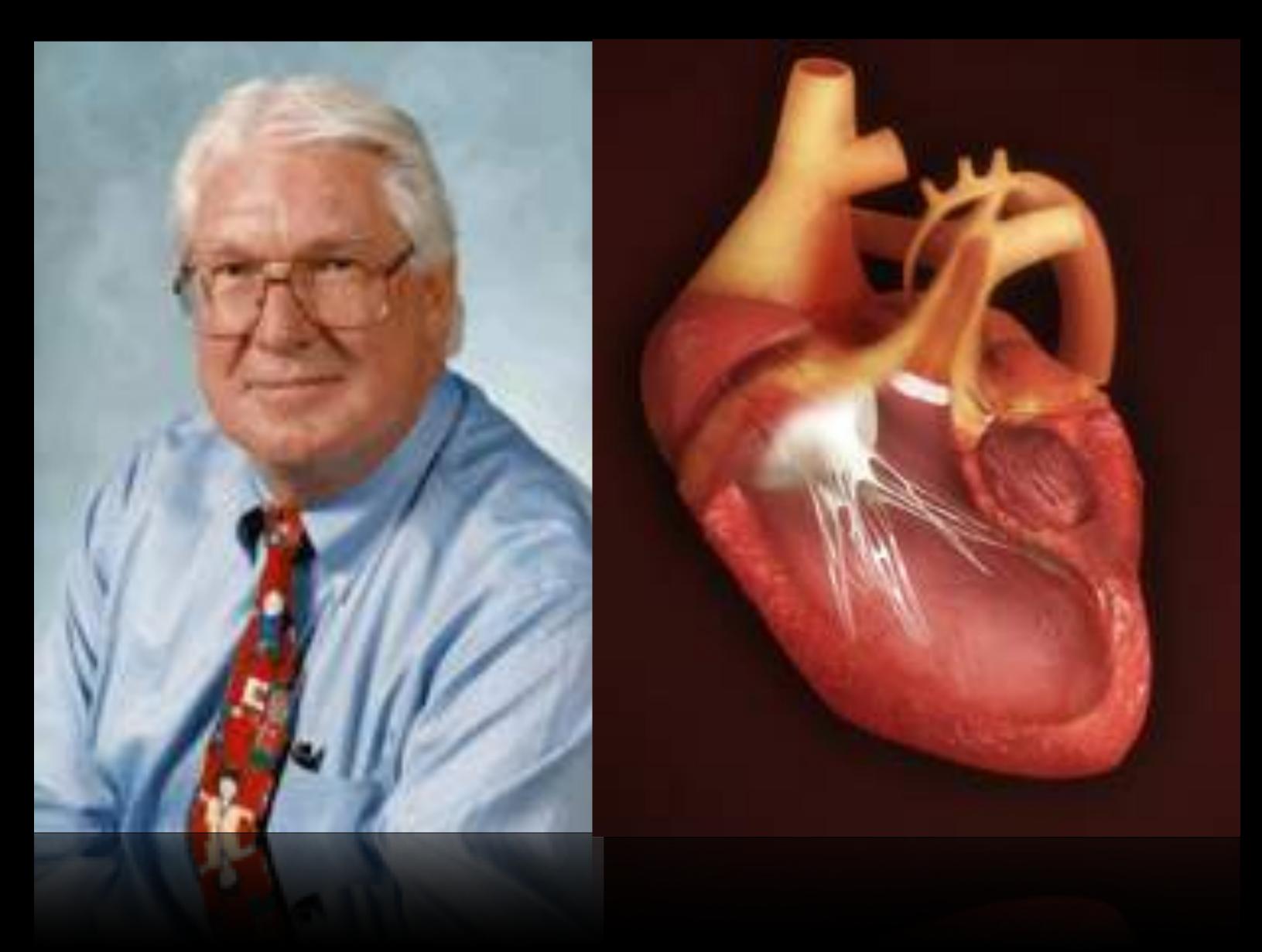


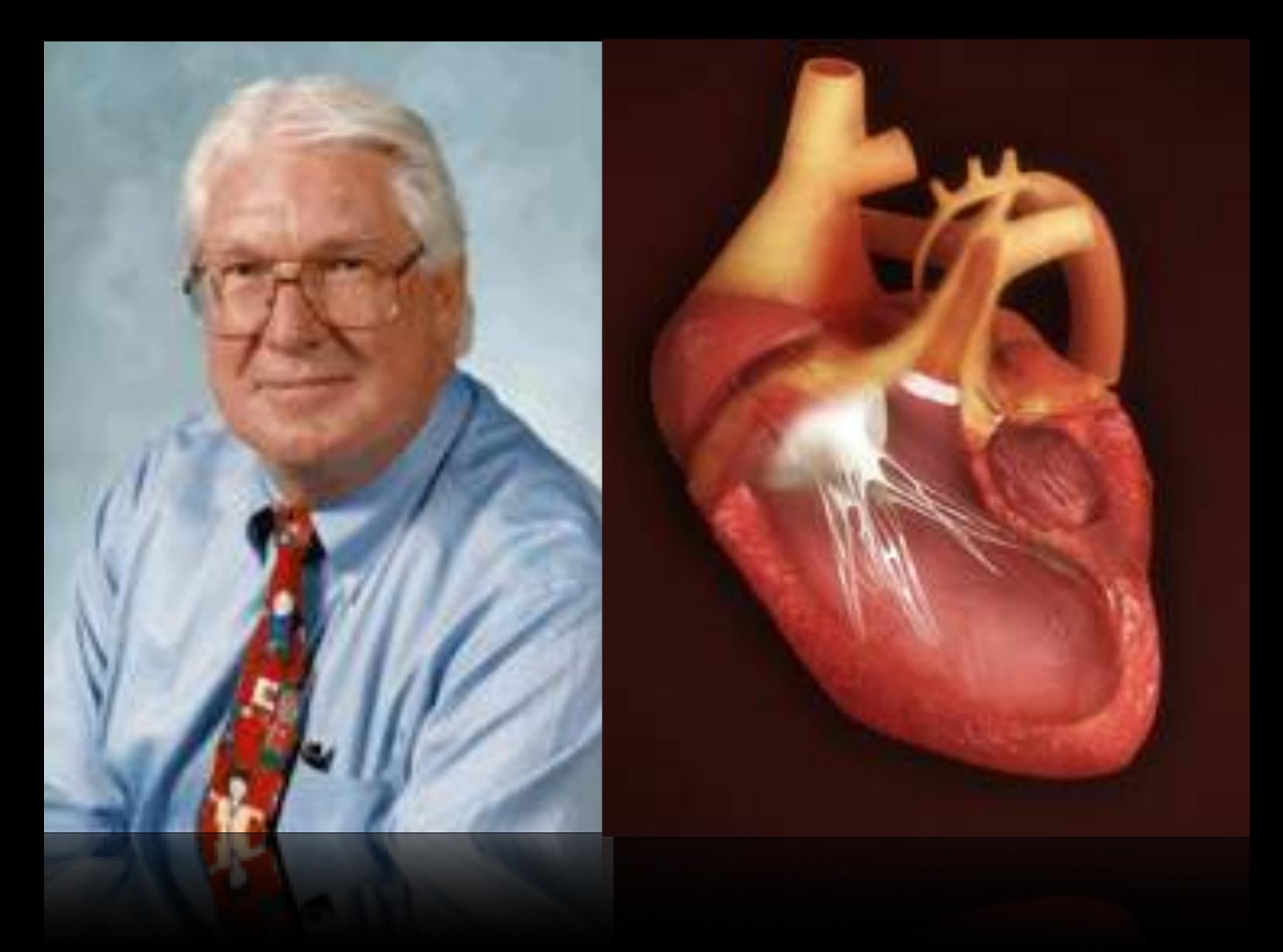






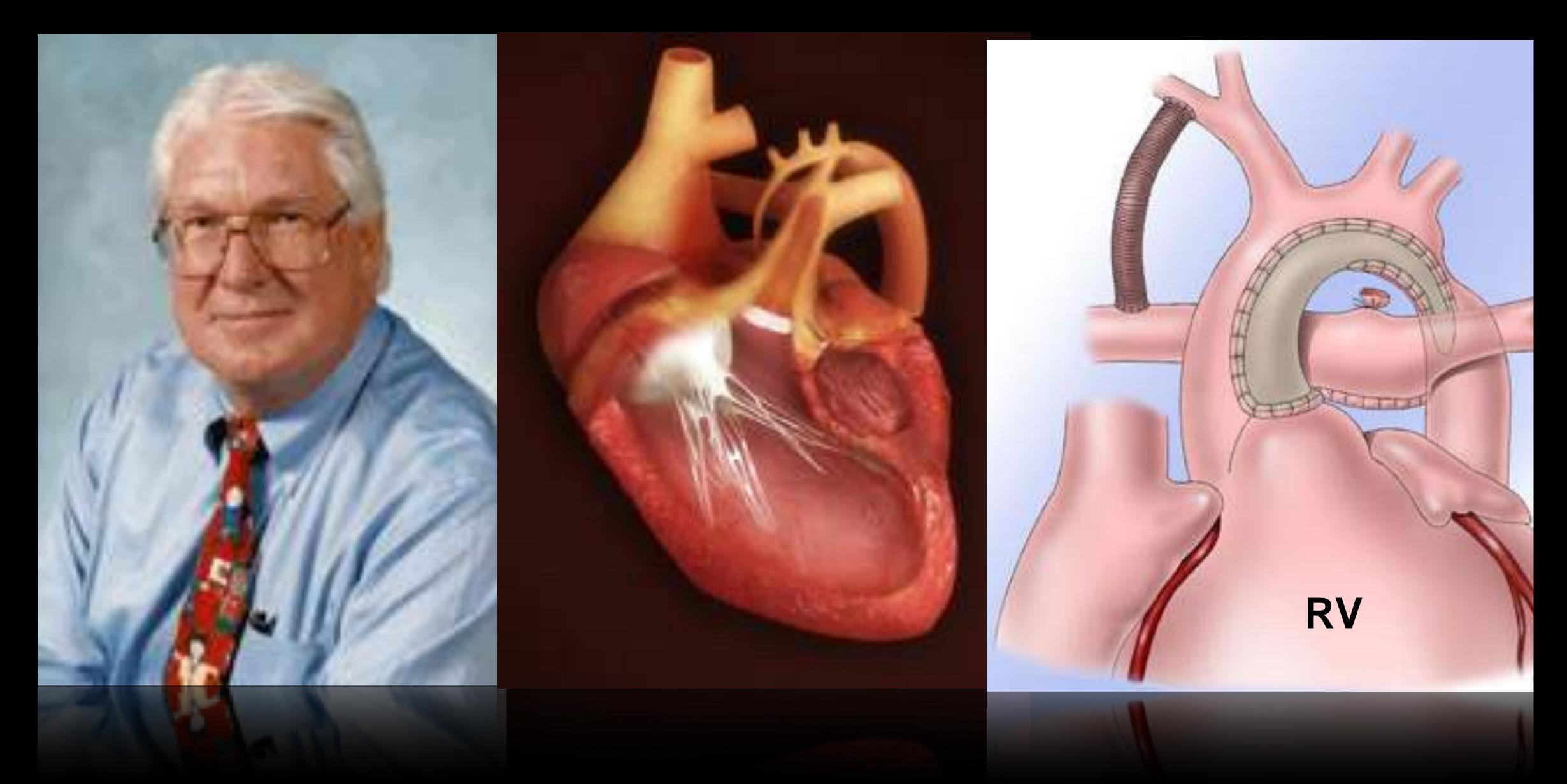






#### untreated, all neonates with HLHS will die in < 4 weeks





#### untreated, all neonates with HLHS will die in < 4 weeks



#### University

#### University







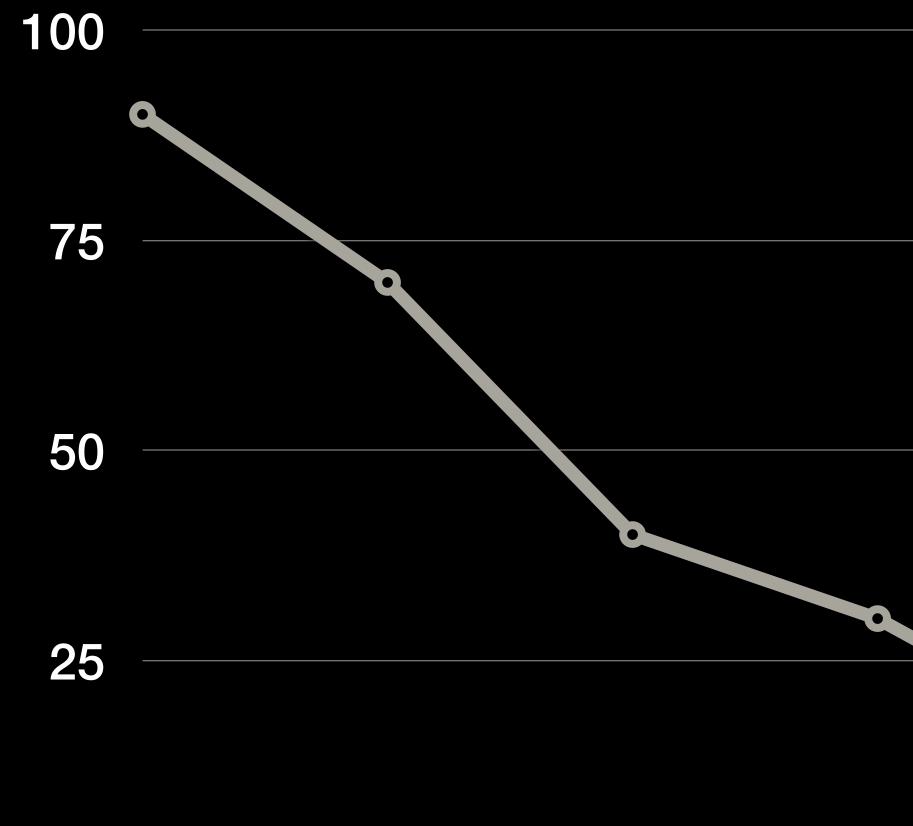


## Symbiosis?

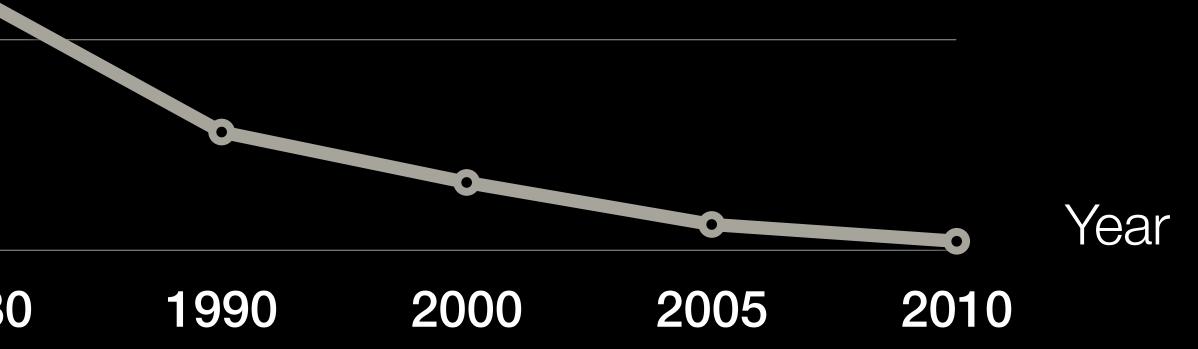
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# mortality of surgery for congenital heart disease

#### • Mortality (%)

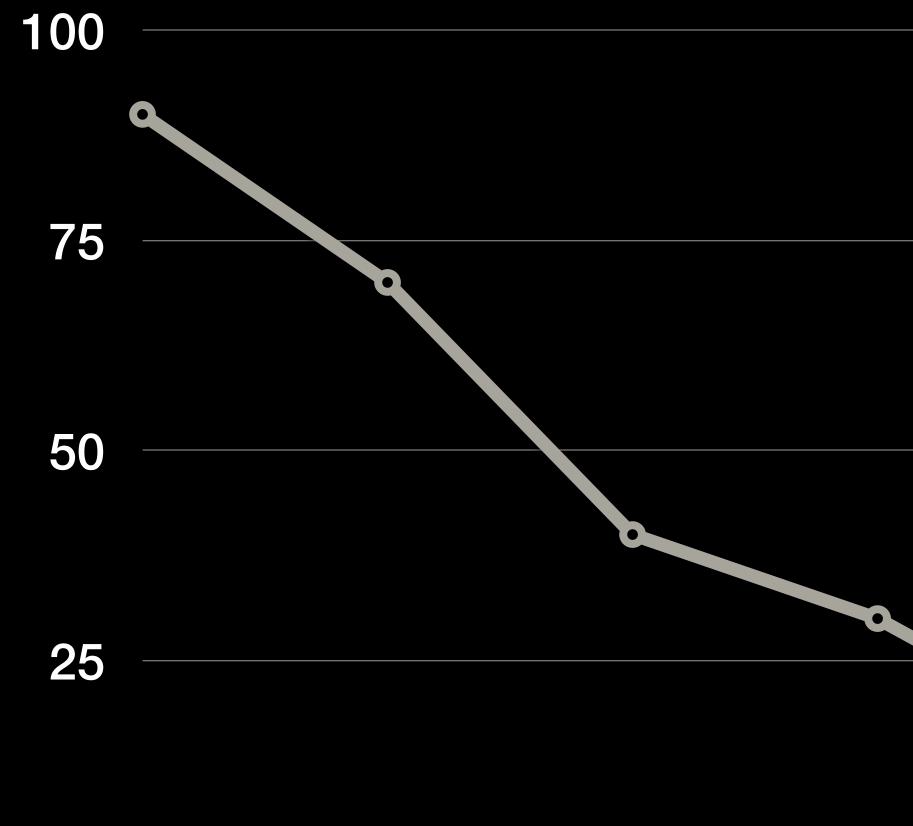


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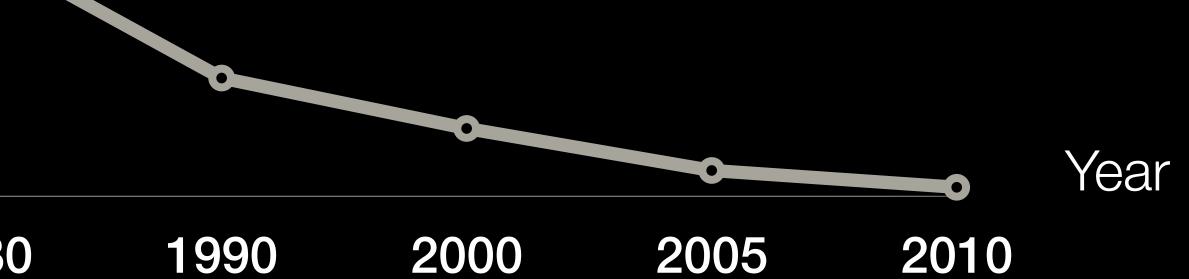
#### mortality of surgery for congenital heart disease

#### • Mortality (%)



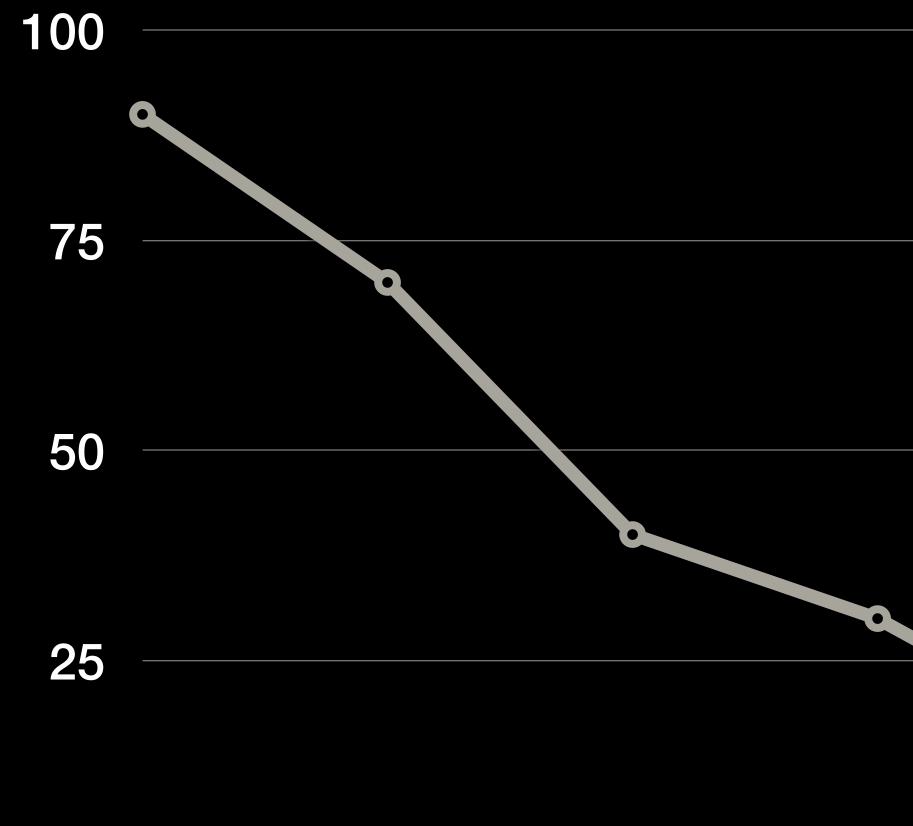
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# **EVERYTHING** has got better

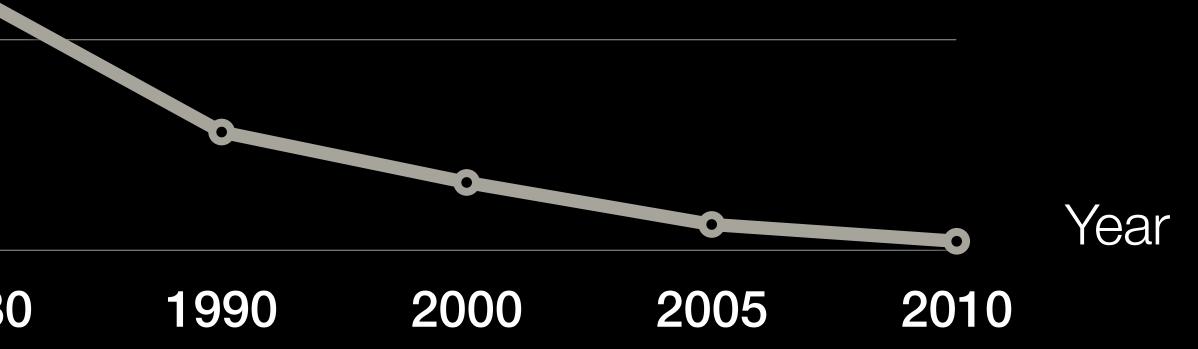


# mortality of surgery for congenital heart disease

#### • Mortality (%)

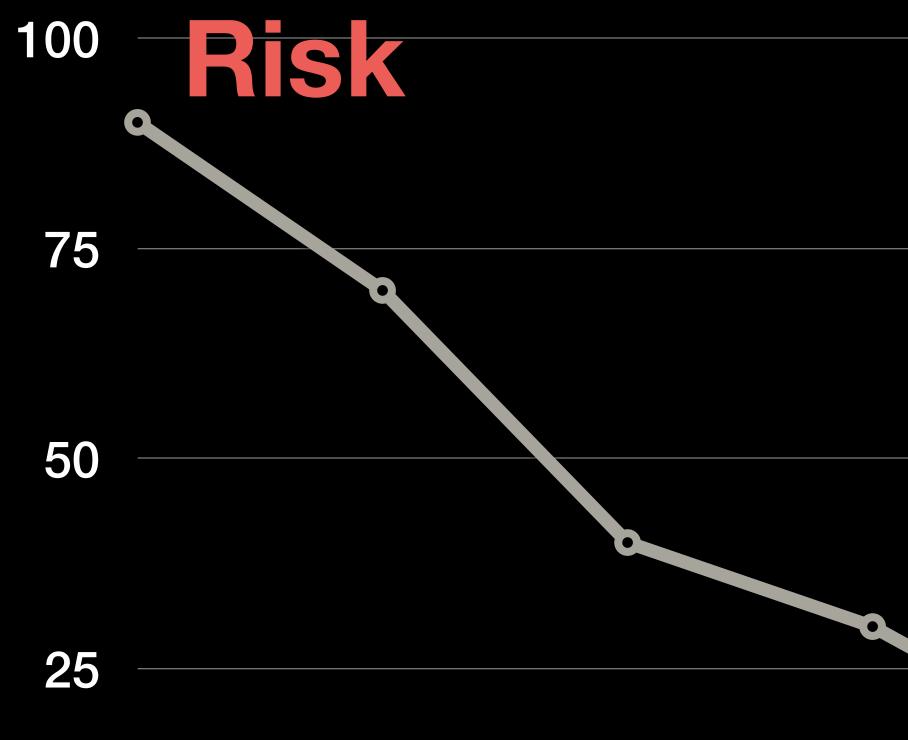


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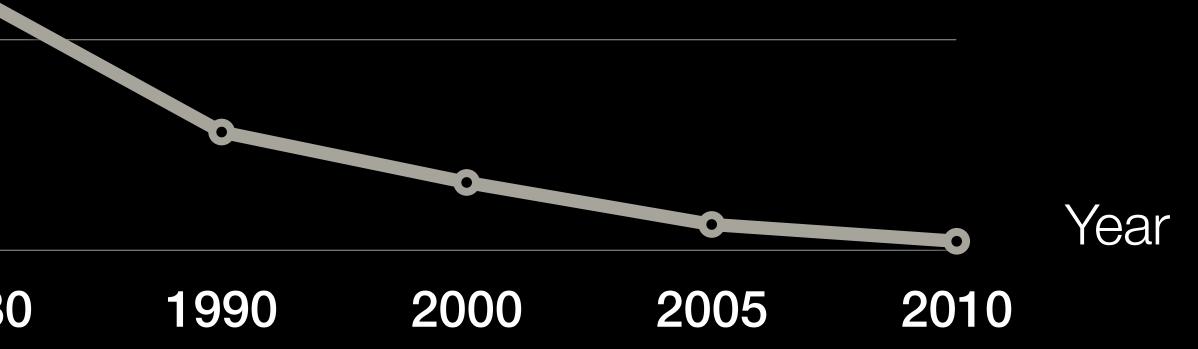


#### mortality of surgery for congenital heart disease

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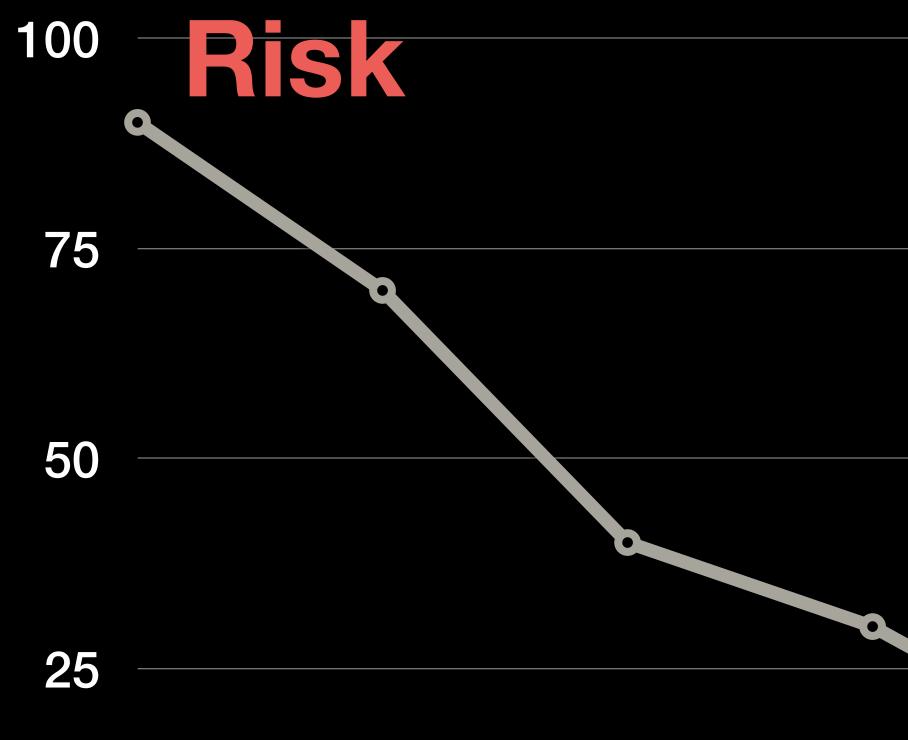


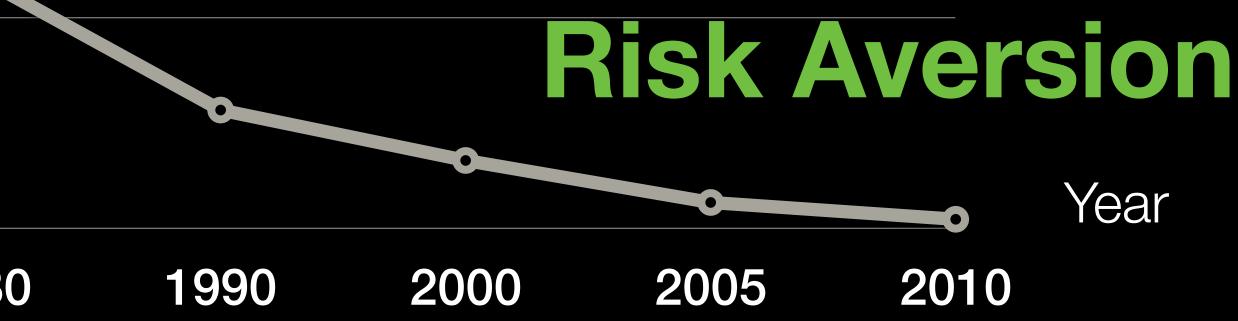
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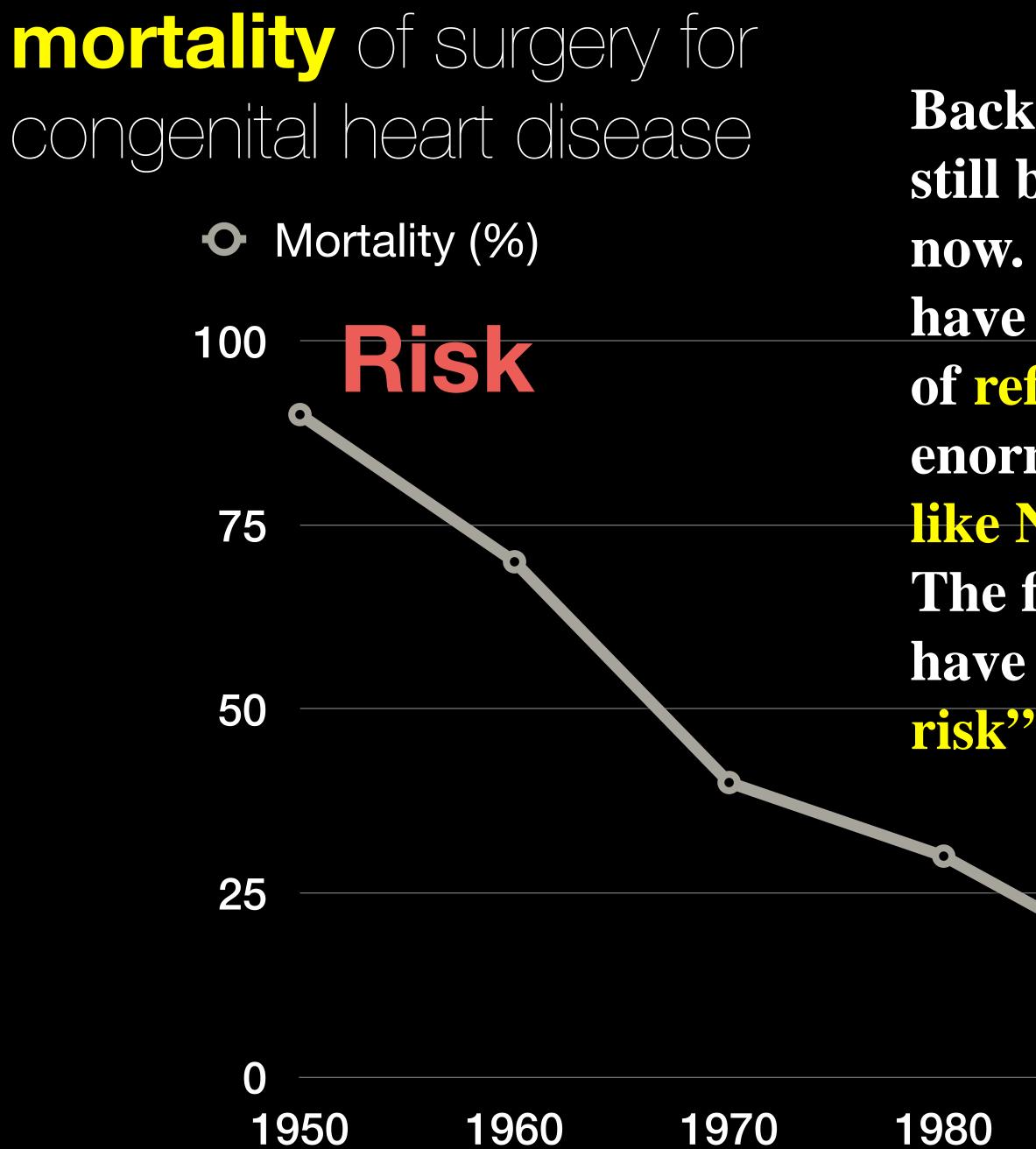


#### mortality of surgery for congenital heart disease

• Mortality (%)







**Back in Norwood's Boston days, there were** still big problems left to solve. It's different now. Today, most heart-defect operations have very good results. "Now, it's a matter of refining the technique ... rather than enormous leaps forward. The mavericks like Norwood have gone by the wayside. The field is full of fastidious surgeons who have had to become expert at managing

Jim Tweddell, Milwaukee

2005

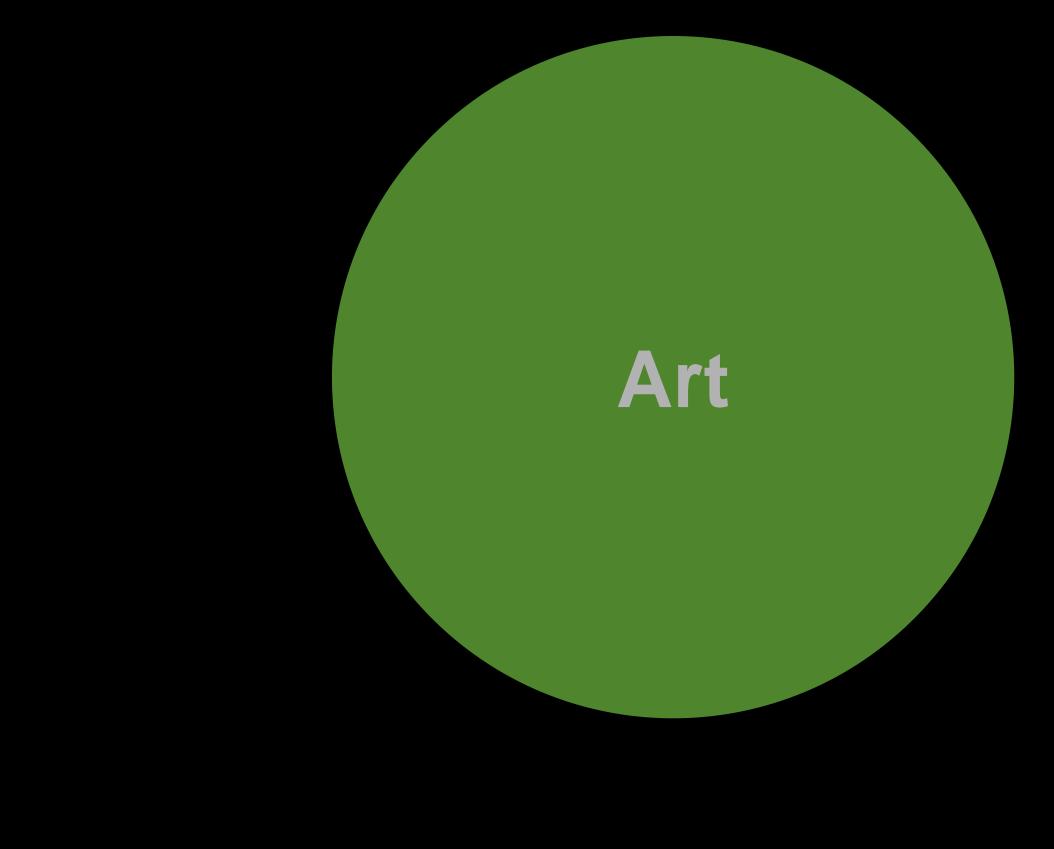
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## **Risk Aversion**

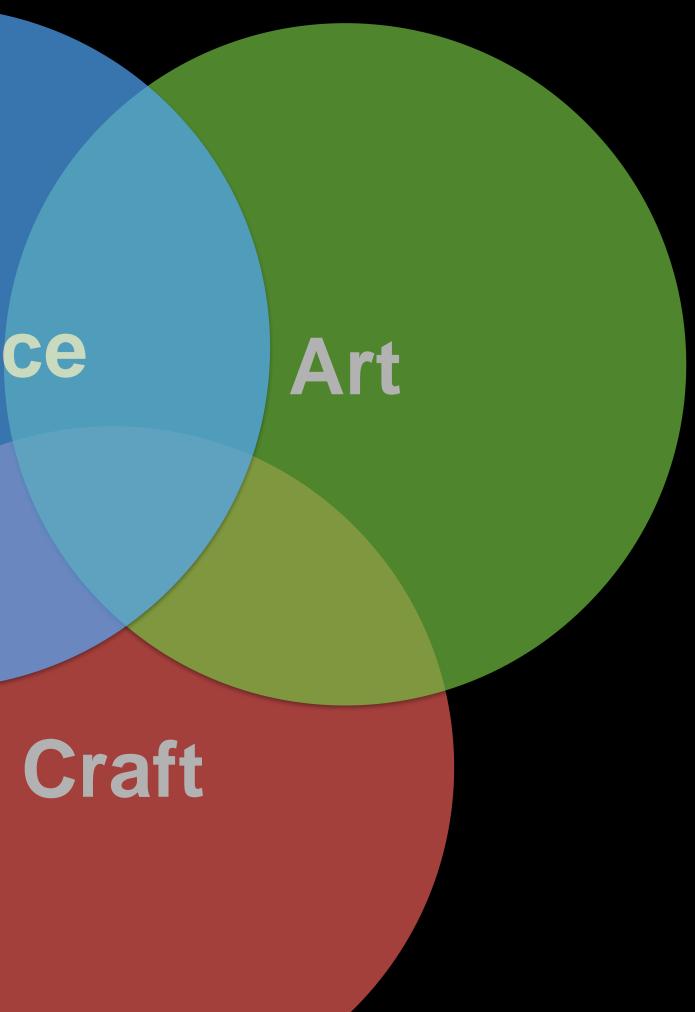
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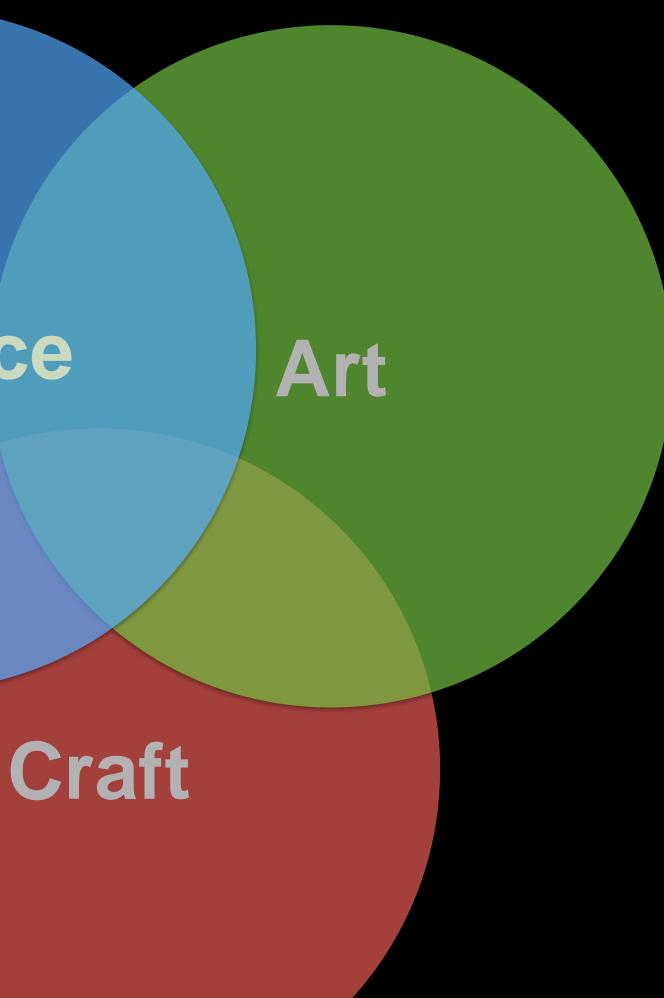








## efficient, gentle, graceful



#### efficient, gentle, graceful & the best cardiologists

#### Science Art

#### Craft

Thank you to all my colleagues, and especially Michiel Vriesendorp





Thank you to all my colleagues, and especially Michiel Vriesendorp

## Could we do now what we did then?

#### 21st January 2015

#### Martin Elliott 37<sup>th</sup> Gresham Professor of Physic

Professor of Cardiothoracic Surgery at UCL Consultant Paediatric Cardiothoracic Surgeon & co-Medical Director

The Great Ormond Street Hospital for Children

