Key Moments in Transfusion Medicine History

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LifeServe BLOOD CENTER

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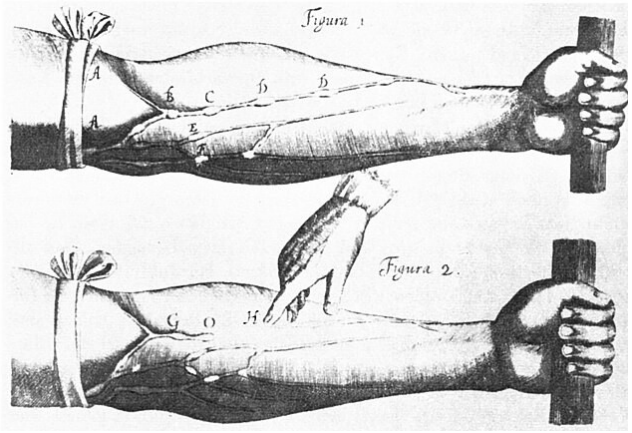
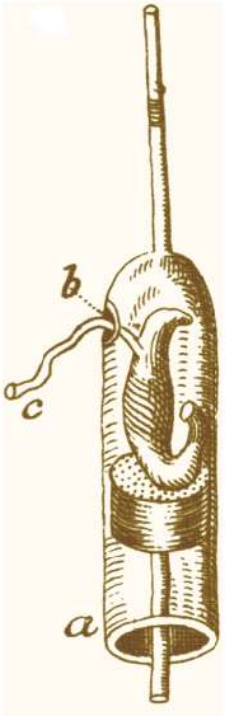
William Harvey

- English physician
- 1616 – first to describe the process of blood being pumped by the heart throughout the body
- An investigator, and skeptic, of witchcraft allegations
  - All women he investigated were acquitted (at least per Wikipedia's references)



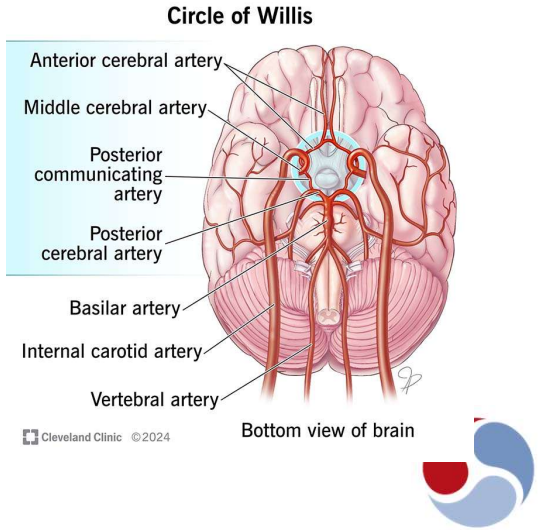
Johannes Swammerdam

- Dutch biologist and microscopist
- 1658 – first person to observe and describe red blood cells (from frogs)
- Key role in debunking the “balloonist theory”
  - Moving spirits are responsible for muscle contractions



Richard Lower

- English physician
- 1665 – performed the first blood transfusion (between two dogs)
- Also well known for his descriptions of the cardiopulmonary system
  - Named the circle of Willis after his teacher, Thomas Willis

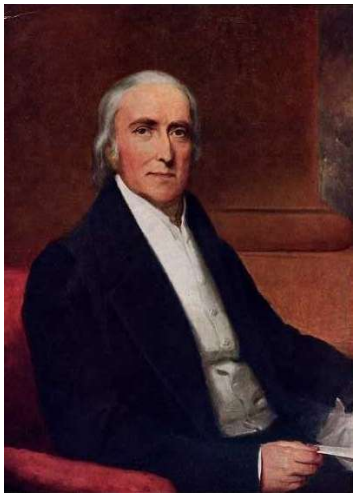


Jean Baptiste Denis

- French physician
- 1667 – performed the first fully documented human blood transfusion
  - Lamb to a 15-year-old boy
  - “Xenotransfusion”
- Less than 10 years later, xenotransfusions were made illegal due to reactions

Philip Syng Physick

- American physician
- 1795 – performed the first human blood transfusion, though he did not publish the information
- Father of American Surgery
- Invented several surgical devices, including the stomach tube and absorbable sutures



James Blundell

- British obstetrician
- Saw many of his patients dying during childbirth
- 1818 – performed the first successful transfusion of human blood to a patient for the treatment of postpartum hemorrhage
  - Four ounces from the patient's husband into a syringe then into the mother
- 1825 to 1830 – ten more transfusions, five of which proved beneficial

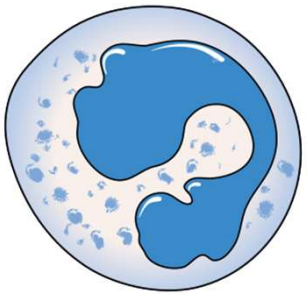
James Blundell (cont.)

- Identified that only human blood could be used for transfusions to another human
- Created various instruments for performing transfusions, including the “gravitator”
- Discovered the importance of removing the air from syringes before transfusion
- Also developed instruments for delivering babies

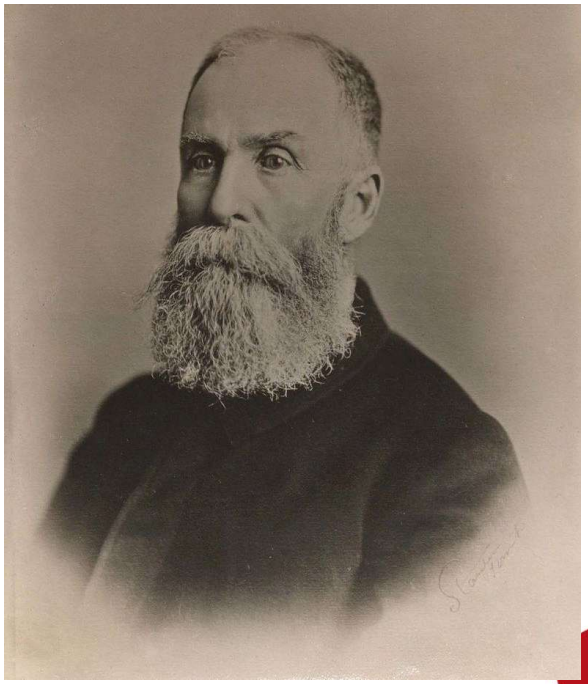
Milk Transfusions

- During the mid-1800s, indiscriminate use of human blood for transfusions was resulting in many reactions
- Transfusions of animal blood began again but were discontinued in the late 1800s due to adverse reactions
- For a brief time, effective substitutes were sought, and milk seemed to be the panacea

Milk Transfusions (cont.)

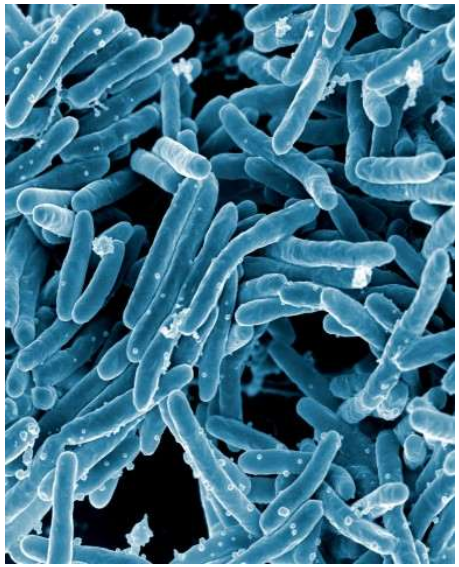


- Previous successful injections of milk into animals led to experiments in humans
  - “Minute oily and fatty particles found in milk… were convertible into the white corpuscles of the blood”, e.g. white blood cells
- 1854 – in Toronto, Canada, James Bovell and Edwin Hodder successfully transfused 12 ounces of cow’s milk into a 40-year-old man with cholera
  - Successfully repeated on a second patient three days later
  - Three more patients were transfused and subsequently died



Milk Transfusions (cont.)

- 1873 – Joseph Howe, a physician in New York City, transfused 1.5 ounces of goat milk to a patient with tuberculosis
  - Patient experienced vertigo, nystagmus, and chest pain
  - Same symptoms after three more ounces transfused
  - “Notwithstanding the fact that the patient thought himself benefitted, I am of the opinion it had no effect.”
  - The patient died the following day
- Tried again on another patient with tuberculosis who also subsequently died
- Tried seven more times on dogs bled to a state of syncope → all died

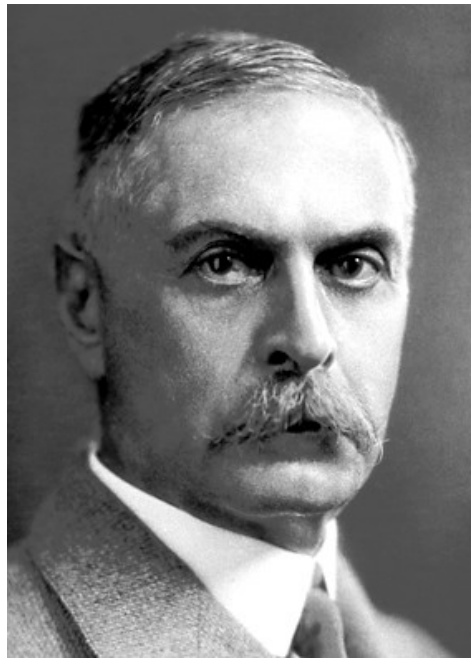


Milk Transfusions (cont.)

- Others continued to try (including with human milk) and had mixed success, but most patients had significant side effects
- Enthusiasm quickly waned after it was decided that milk transfusion were not worth the risks
- Final abandonment came after IV saline infusions become prominent

Karl Landsteiner

- Austrian physician
- 1901 – discovered the first three human blood groups: A, B, and C (later changed to O)
  - Found that blood between two people would sometimes, but not always, agglutinate
  - Won the Nobel Prize in Physiology for Medicine for this in 1930
- Also discovered the polio virus



Ludvig Hektoen

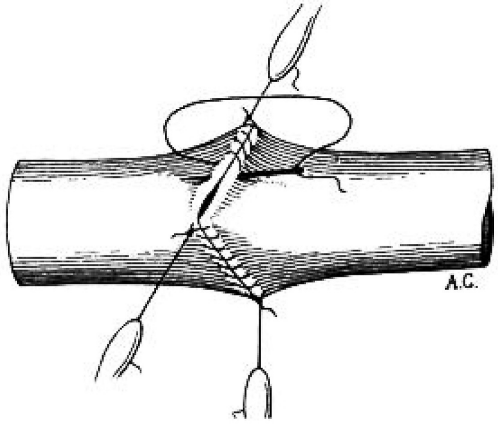
- American pathologist
- Attended Luther College in Iowa
- 1907 – first to suggest “crossmatching” between a blood donor and recipient
- Recognized the mendelian inheritance pattern of blood groups

	A	B
A	AA	AB
O	AO	BO

	A	O
B	AB	BO
O	AO	OO

Alexis Carrel

- French surgeon
- 1908 – devised a way to prevent clotting by sewing the vein of the blood recipient to the artery of the donor – “anastomosis”
- Proved unfeasible for transfusions but paved the way for organ transplants



Carrel Stitch

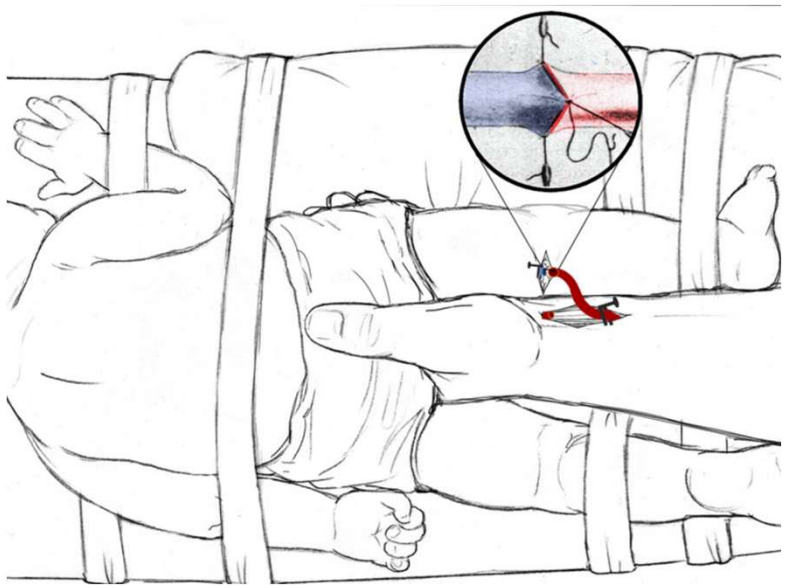
Alexis Carrel (cont.)

- The object of their attention was Dr. Lambert's 5-day-old, nearly comatose daughter, Mary, who had been bleeding since birth from her respiratory and gastrointestinal tracts as well as into a large periorbital hematoma
- The Lambert brothers awakened Carrel early on Sunday morning, asking if he could give Mary some of their blood

- He agreed to try using his anastomotic technique
- Dr. Lambert would be the donor and his partner, George Brewer, would assist

Alexis Carrel (cont.)

- The Lambert dining room at 29 W. 56th Street was the venue. It had a south facing window, providing relatively good lighting.
- Dr Lambert lay supine on the dining table with his left arm extended at a right angle on an ironing board where Mary was secured by loose strapping. No local anesthesia or systemic analgesic was used.



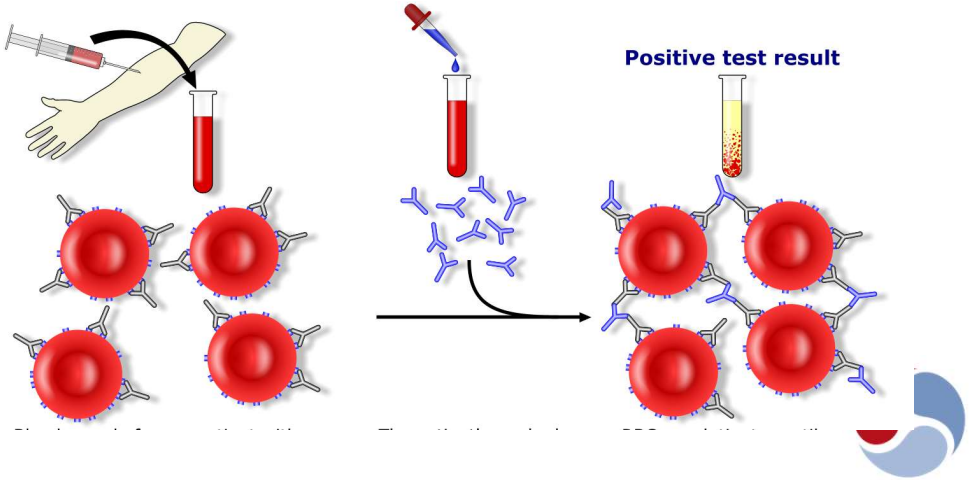
Alexis Carrel (cont.)

- Moments after the anastomosis had been completed, Mary began to stir and cry, as her pallid color gave way to a healthy pink, and bleeding from her incision and nose ceased
- Eldest brother, Samuel Lambert, an internist and the College of Physicians and Surgeons dean thought she might burst and asked Carrel to stop the transfusion
- The vessels were repaired
- Dr. Lambert never experienced hand ischemia

- 1912 – won the Nobel Prize in Physiology or Medicine
- Was honored guest at Mary's 21st birthday party

Carlo Moreschi

- Italian physician
- 1908 – described the antiglobulin reaction
- Rediscovered in 1945 by Robert Coombs, Arthur Mourant, and Robert Russell Rice
  - Coombs test (Moreschi-Coombs test)



Albert Hustin

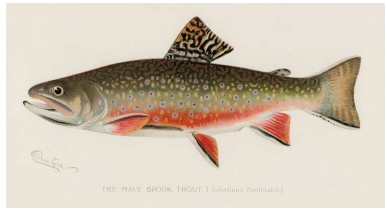
- Belgian physician
- 1914 – performed the first transfusion with sodium citrate added as an anticoagulant
- “One day Hustin examined a person who had been poisoned with CO from lighting gas
  - It occurred to him that his blood could be drawn portion by portion, exposed to pressurized oxygen, and re-injected
- Another day, while bleeding a hypertensive patient, he asked him if he wanted to see how his blood was used to cure another person
  - The opportunity presented itself with an anemic patient after suffering intestinal bleeding
  - Hustin extracted 150 ml of blood from the hypertensive patient, added a glucose solution of sodium citrate, and then infused it.”
- *https://www.historiadelamedicina.org/hustin.html*

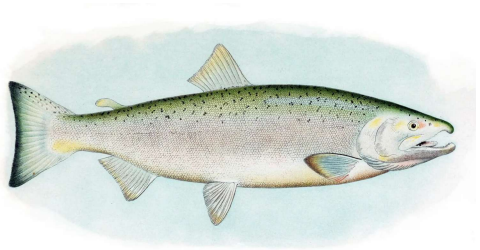
Richard Lewisohn

- German-American surgeon
- Set up detailed experiments using sodium citrate and dog blood
- 1915 – determined the optimal concentration of sodium citrate for preserving blood products without inducing toxicity
  - Additional studies increased storage duration time from two to 14 days
    - Allowed donor and recipient to be geographically separated
  - Coincided with World War I

Oswald Hope Robertson

- English physician
- 1916 – created the first blood depot on the Western Front during World War I
- Considered the developer of the first blood bank and the first blood banker
- Retired to California and built a house next to a stream so he could pursue studying the effects of the endocrine glands on the migration of trout and salmon
- Became a world authority on the endocrinology of fish



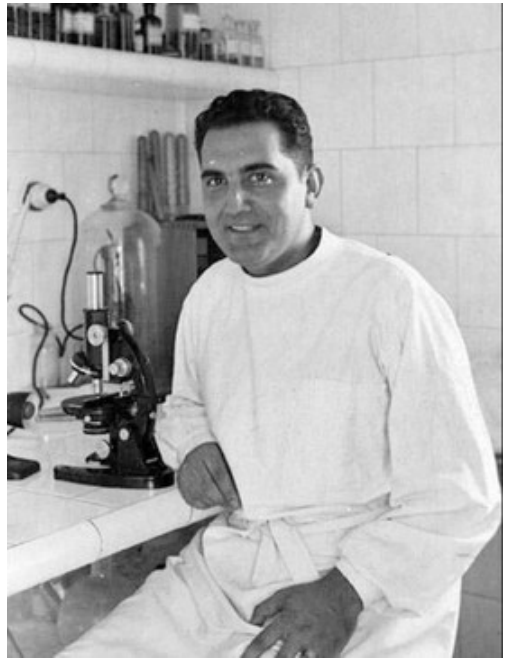


Andrey Bagdarsov (Bagdasaryan)

- Russian hematologist
- 1926 – Deputy Director of the newly created Institute of Blood Transfusion at the 2nd Moscow Institute
- During World War II he was the Chief Transfusiologist of the Soviet Army
- 1932 – developed a number of blood preservation methods, including a way to store donated blood in a bottle for 21 days
- Later focused on Rh factor and the advancement of immunohematology

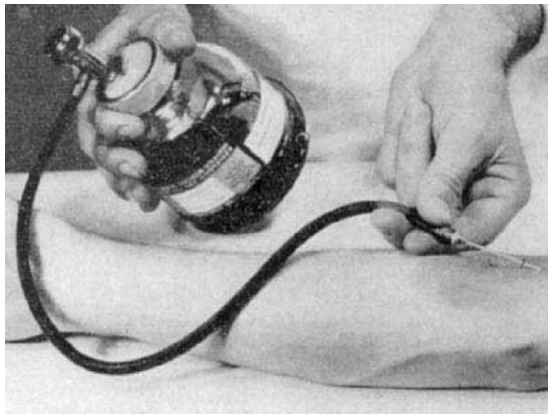
Frederic Duran i Jordà

- Catalan physician
- 1936 – created the first transfusion service in Barcelona, Spain
- A methodology that would serve to collect many blood donations to be transfused at a significant geographic distance, in this case, the front lines of the Spanish Civil War
  - The Duran Method
  - https://essenciabarceloneta.cat/en/dr-frederic-duran-i-jorda-3/



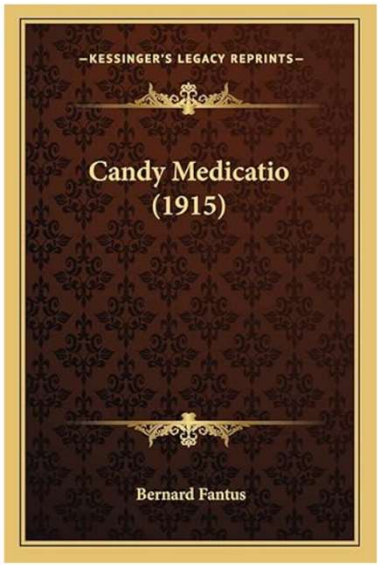
John Elliott

- Naval laboratory technician
- No formal medical training
- 1936 – modified a Winchester bottle resulting in a much smaller vacuum bulb tube than contained citrate, termed the “TransfusoVac”
  - Became an efficient mechanism for blood collection, component separation, and plasma transfusion on the battlefield
  - Eventually replaced open-container blood bottles
- AABB John Elliott Memorial Award
  - For a member who has made outstanding efforts toward the association's goal of providing optimum transfusion services to the nation



Bernard Fantus

- Hungarian-American physician
- 1937 – established the first blood bank in the Unites States at Cook County Hospital in Chicago, Illinois
  - Within a few years, blood banks were established in San Francisco, New York, Miami, and Cincinnati
  - His daughter Ruth coined the term “blood bank”
- Worked with candy makers to develop a method to make medicine more palatable to children
  - Published a book called Candy Medication



Alexander S. Wiener

- American physician
- Began working with Karl Landsteiner in 1930
  - 1937 – co-discovered the Rh factor
    - Named after erythrocytes from Rhesus monkeys used in blood testing
    - Demonstrated its role in Rh sensitization as a cause of hemolytic reactions
    - In conjunction with Philip Levine, identified Rh factor as a major cause of erythroblastosis fetalis

Alexander S. Wiener (cont.)

- Later work examined the genetics of Rh factor
- His theories of how Rh is inherited differed from the CDE-nomenclature that was proposed by Robert Race and Ronald Fisher, the Fisher-Race theory
  - Wiener's theories proved to be closer to the actual DNA structure of genes, although current understanding combines aspects of both

Alexander S. Wiener (cont.)

- Wanted to create a blood “fingerprint” to be used in legal and criminal manners
- Assisted police in numerous investigations by analyzing blood or other fluids
- Written about numerous times for his work in criminology for real life crime stories
- In recognition of his contribution to forensic medicine he was awarded an honorary membership of the Mystery Writers of America

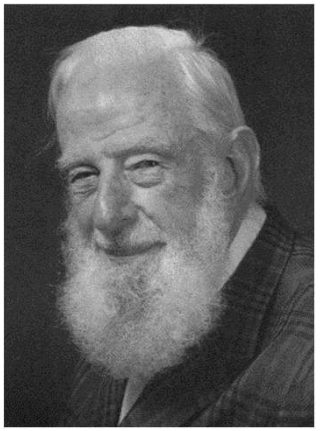
Charles R. Drew

- American surgeon
- The most prominent African American in the field of transfusions at that time
- First African American to earn a Doctor of Science in Medicine
- Developed a process that allowed plasma to be separated from cells and preserved for two months

Charles R. Drew (cont.)

- 1940 – developed the Plasma for Britian program
- 1941 – became the director of the first American Red Cross blood bank
- Protested against the racial segregation of blood products knowing that it lacked scientific evidence

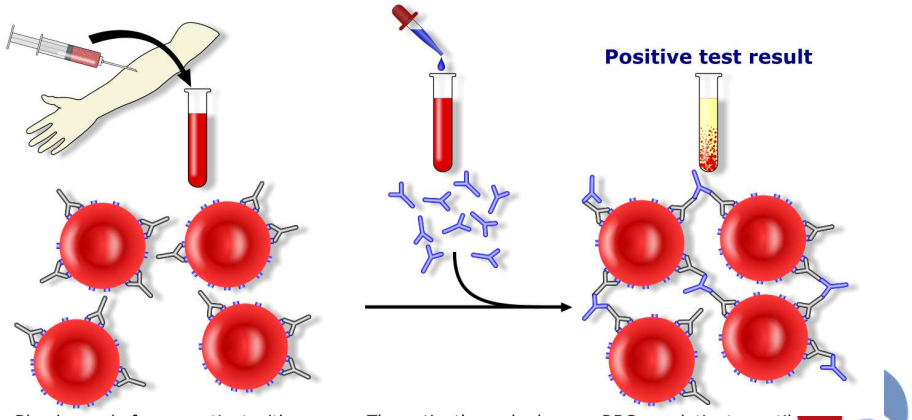
John Freeman Loutit and Patrick Mollison



- Loutit was an Australian hematologist and radiobiologist
  - Director of the London Blood Transfusion Service during World War II
  - Switched fields after the war to research the effects of radiation, including its suppression of immunity
- Mollison was a British hematologist
  - Considered the father of transfusion medicine
  - Sole author the first Blood Transfusion in Clinical Medicine
- 1943 – both contributed to the introduction of acid citrate dextrose → increases storage time

Robin Coombs

- British immunologist
- 1945 – as a doctoral student, he worked with Arthur Mourant and Robert Russell Race to develop a test for detecting antibodies in various clinical situations, including Rh disease and blood transfusions
  - This is the test now referred to as the Coombs test



Robin Coombs (cont.)

- Founded the British Society for Immunology
- “Red blood cells were primarily designed by God as tools for the immunologist and only secondarily as carriers of hemoglobin”

The Texas City Disaster

- On April 16, 1947, the freighter SS *Grandcamp* was docked in Galveston Bay in Texas City, Tx
- Among her cargo was ammonium nitrate and small-arms munition
- The nearby SS *High Flyer* was also loaded with ammonium nitrate

The Texas City Disaster (cont.)

- Around 8 AM, smoke was spotted in her cargo hold
- The fire attracted spectators along the shoreline, who thought they were at a safe distance
- At 9:12 AM, the Grandcamp exploded, subsequently igniting the SS *High Flyer*

The Texas City Disaster (cont.)

- Everything within 2000 feet was completely destroyed with all else in the port extremely damaged
- The explosion caused a 15 ft tsunami and a shockwave that leveled nearly 1000 building
- Among the buildings destroyed was a chemical plant, with 145 workers killed

The Texas City Disaster (cont.)

- Two airplanes flying nearby were blown out of the sky
- Eight miles away in Galveston, half of all windows were blown out
- Official casualties were 567 people, including all those aboard the Grandcamp and all but one of the 28-member Texas City volunteer fire department

The Texas City Disaster (cont.)

- More than 5000 people were injured, with over 1700 admitted to 21 hospitals
- It was the deadliest industrial accident in U.S. history and one of history's largest non-nuclear explosions

The Texas City Disaster (cont.)

- Many victims were brought to John Sealy Hospital and the University of Texas Medical School
- Within four hours of the explosion, almost 1,900 units of plasma were administered
- The supply was adequate until the first shipment of blood products arrived from William Buchanan Blood Center at Baylor University in Dallas, TX

The Texas City Disaster (cont.)

- Blood was sent in refrigerated cases by U.S. Navy planes
- John Sealy's blood bank felt obligated to reject many offers of whole blood from other cities because there were no dependable organized institutions that could draw the blood, group, and Rh type it
- This experience made many realize that blood centers throughout the United States did not understand each other's procedures and what the best standards may be

The Texas City Disaster (cont.)

- Marjorie Saunders, an administrative assistant at William Buchanan Blood Center, had been curious about what people in other blood banks were doing
- She created a survey to blood bankers throughout the United States asking them if they would be interested in joining a national organization

The Texas City Disaster (cont.)

- The vast majority of respondents answered “yes,” so Baylor’s blood bank director, Dr. Joseph Hill, and a hospital administrator, Lawrence R. Payne, agreed to sponsor a meeting to be called the Blood Bank Institute
- At the meeting, 68 people signed an agreement to “seriously consider at the earliest possible moment the formation of an American Association of Blood Banks”

Janet Vaughan

- British hematologist
- 1934 – published *The Anaemias*, one of the first books on the treatment of blood diseases
- 1938 – initiated the creation of London's Emergency Blood Transfusion Service
- Modified a milk bottle for blood collection and storage → Janet Vaughan bottle
- Performed research on starvation
  - Worked at the Bergen-Belsen concentration camp and significantly improved the strategy to feed people suffering from extreme starvation

Winifred Mayer Ashby

- American Pathologist and Immunologist
- Performed research showing that red blood cells live for up to 120 days
  - Previously believed to be two to three weeks
- Created the differential agglutination technique → Ashby technique

Helen Taussig

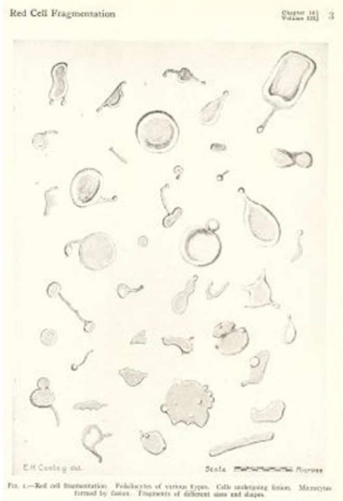
- American cardiologist
- Founder of pediatric cardiology
  - Laid the groundwork for developing safe blood transfusion protocols for pediatric cardiac surgery
- First women to be elected head of the American Heart Association

Judith Graham Pool

- American scientist
- Developed the process to create cryoprecipitate
- Discovered that factor VIII could be made from plasma
- Founding member and co-president of the Association for Women in Science

Emily Cooley

- American medical technologist
- Highly regarded contributor to blood cell morphology
- AABB's Emily Cooley Memorial Award
  - Demonstrated teaching ability and major contribution to the field of transfusion medicine or biotherapies



Sally Frank

- American medical technologist
- AABB's Sally Frank Memorial Award
  - A medical technologist who has demonstrated quality research, teaching, and/or service abilities in the technical aspects of immunohematology

Questions?

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Thank you!

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