

Amazing Women Scientists

(that you probably haven't heard of!)



LINDA WINSLOW
OLLI, FALL 2026
WEEK 2

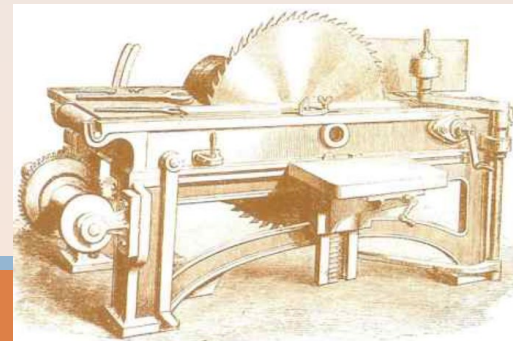
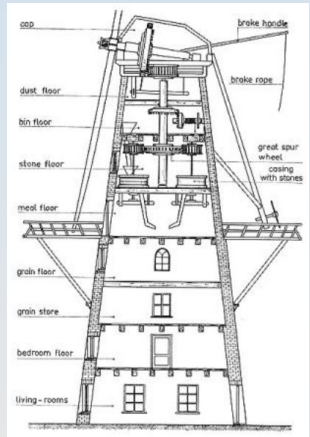


Last Time...

- ✓ 4th Century CE: **Pandrosian & Hypatia** – *1st Documented Women Mathematicians*
- ✓ 12th Century: **Trota of Salerno** – *Famous Physician, Author*
- ✓ Late 1600's: **Elisabeth Koopmann-Hevelius** – *Astronomer, Writer (stars)*
- ✓ Late 1700's: **Wang Zhenyi** - *Astronomer (eclipses, equinoxes)*
- ✓ Late 1700's – early 1800's: **Caroline Herschel** – *Astronomer (meteors, nebulae)*
Sophie Germain – *Mathematician (prime #s, elasticity)*
- ✓ Early 1800's: **Mary Somerville** – *Astronomer, Mathematician, Author*
Ada Lovelace – *Mathematician (first computer programmer)*

Earliest Patents Granted to American Women

- **Sybilla Masters** – In **1715** was first *Colonial Person* to receive a British Patent, for a **corn mill** (*applied in her name but granted in her husband's name*)
 - A second patent was granted for a new process of making ***hats and bonnets using straw and palmetto leaves***
- **Hannah Slater** received a patent in **1793** for a new method of producing ***cotton sewing thread***
 - *The patent was issued in the name of "Mrs. Samuel Slater"*
- **Hazel Irwin** - for a ***cheese press*** in **1808**
- **Mary Kies** - for her technique of ***weaving straw with silk*** to make hats in **1809**
- **Tabitha Babbitt (1810)** for the circular saw blade



Higher Education for Women In the U.S.

- **1700's** – Women could not get degrees (*mostly*) but determined women found ways to learn.
- **1800's**
 - **Women's colleges** (*mostly aimed at teaching or as seminaries*) & “**Sister Colleges**”
 - **Mount Holyoke (1837)**, Georgia Female College (*now Wesleyan*) (1839), **Ohio Wesleyan Female College** (1853), The “**Seven Sisters**”: Vassar (1865), Wellesley (1875), Smith (1875), Radcliffe (1879), Bryn Mawr (1885), Barnard (1889)
 - **First Medical School**: Woman's Medical College of Pennsylvania (**1850**)
 - **Co-Ed Colleges** begin to open
 - **Oberlin (1837)**, Otterbein (1847), Baylor (1847), Antioch (1853), Muskingum (1854), Univ of Iowa (1855), Univ of Wisconsin (1866), Indiana Univ (1867), Oregon St. Univ (1868), Univ of Cal Berkeley (1870), OSU (1873), Stanford (1891) etc. etc. etc.
- **1900's**
 - **Women's colleges admit Men** (*Vassar 1969, Radcliffe merged with Harvard in 1999*)
 - **Men's colleges admit Women** (*Yale 1968, Princeton 1969, Dartmouth 1972*)
- **2000's**
 - Some Women's Colleges still exist (*Barnard, Bryn Mawr, Hollins, Mount Holyoke, Smith, etc.*)

1st State School

What was going on in late 19th Century Science?

1859
**ORIGIN OF
SPECIES**
Darwin

1869
**PERIODIC
TABLE**
Mendeleev

1879
LIGHT BULB
Edison

1896
RADIOACTIVITY
Becquerel

1865
GENETICS
Mendel

1869
**DNA
DISCOVERY**
Miescher

1895
X-RAYS
Roentgen

Before Genetics: What Determines the Gender of a Baby?

Eat Sweets

Eat Fish, Spinach, or Yogurt

Conceive during a Full Moon

Conceive 2-4 days after Ovulation

Conceive on an Even Day of the Month

Place a Wooden Spoon under the bed

Colder Climate

Boxers

Eating Salty food

Eating Bananas or Broccoli

Drink Coffee before Conception

Conceive on the same day as Ovulation

Conceive on an Odd Day of the Month

Conceive when the Woman's head is pointed North

Warmer Climate

Briefs

Nettie Stevens

Geneticist



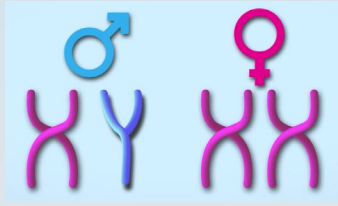
- Discovered sex chromosomes, *later known as X and Y*
- **1861-1912** (*age 51*), U.S. (*Vermont*)
 - She and her sister Emma were 2 of the 3 women who graduated from her high school between 1872 and 1880
- Attended a teacher's college and worked ~20 years to save for further education
- **BA from Stanford** in 1899 (*age 35*) and **MA** in Biology in 1900
 - *Stanford was co-ed since its founding in 1891*
- **PhD in cytology** (*cells*) from Bryn Mawr in 1903 (*age 41*)
 - Spent 1 year in studying Italy and Germany
- **Post-doctoral researcher** at Carnegie Institute of Washington – made her **big discovery** on chromosomes
- **Research Associate** at Bryn Mawr
 - Later offered a Professor position but could not accept due to poor health

Nettie Stevens



[About Nettie Stevens](#)

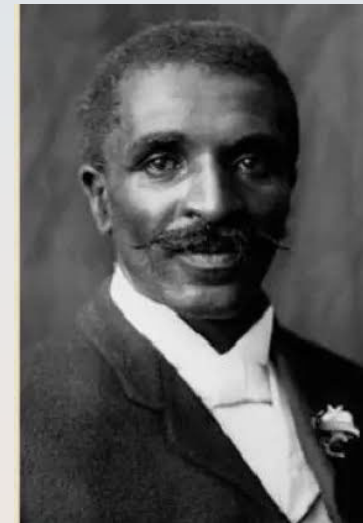
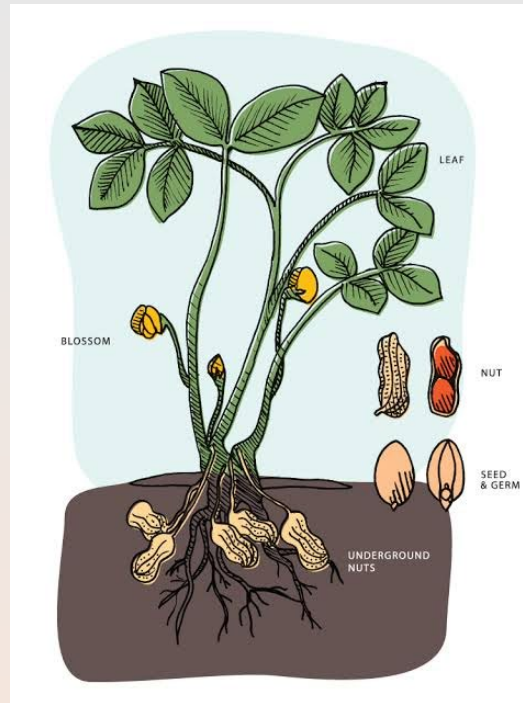
Nettie Stevens



- First time that observable **differences of chromosomes could be linked to differences in physical attributes** (e.g. male/female)
- It was previously (*incorrectly*) thought that the X chromosome determined gender.
- Studied mealworms, and other insects.
- Identified the **Y chromosome** (*smaller and previously unobserved*) and determined that **gender** depended on it. (1905)
 - ***Gender depends on the presence or absence of a Y Chromosome***
 - An egg fertilized with a sperm with the Y chromosome becomes a male
- Cited as an example of the “*Matilda Effect*”, where a woman’s work is attributed to male colleagues, in this case *Edmund Wilson* or *Thomas Hunt Morgan* (who won a Nobel Prize in 1933)
- *Published 38 papers, died before she was given proper credit for her discovery*



Louis Pasteur
1822-1895



George Washington Carver
1864-1943

Anna Wessels Williams

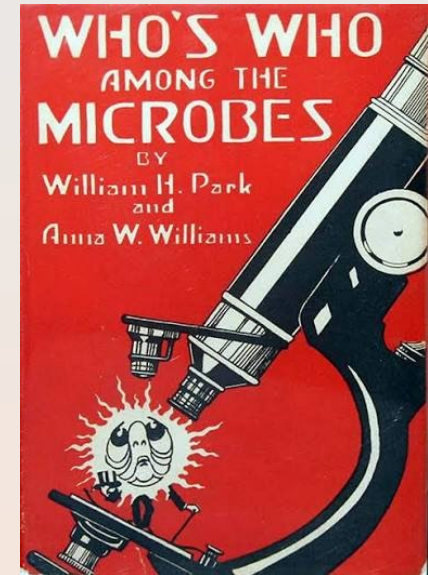
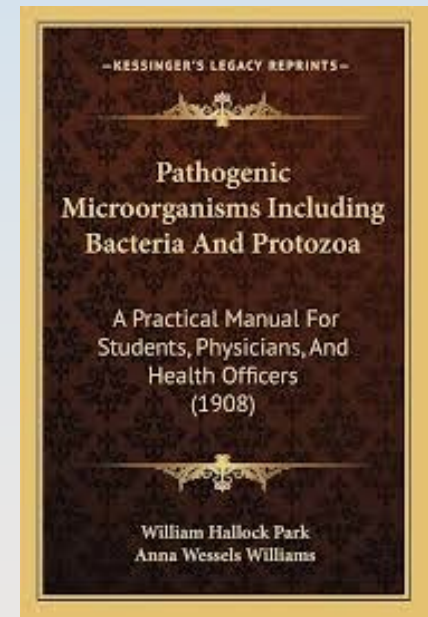
Physician Researcher



- Pioneering immunologist, bacteriologist, Public Health Advocate, and Co-author of Medical Textbooks
- **1863-1954**, American (*New Jersey*)
 - Father was a teacher, who educated her at home (*she later attended Public School*)
 - *Learned to use a microscope at age 12 and was hooked on biology*
- **1887** - She was motivated to study medicine after her *sister almost died during childbirth* to a stillborn child, due to the doctor's incompetency.
- Her mother objected at first, but Anna explained she'd apply medicine to missionary work
- **1891- Medical degree** from Woman's Medical College of the New York Infirmary - ***studied under two woman physician educators***, Elizabeth Blackwell and Mary Putnam Jacobi

Anna Wessels Williams

- Taught a few years then pursued additional medical training in Europe.
- A Speed Demon: She loved riding in Pre WW1 airplanes, especially stunt fliers, received many speeding tickets in NYC!
- She was a **Research Physician**
 - Her first publication was studying *bacteria in a box of cheese*
- **1894** - Volunteered at the NYC Health Department Diagnostic Laboratory – (*which was opened as a response to a cholera outbreak*)
- **1895** - Appointed as full-time staff after a major discovery in Diphtheria treatment
- **1896** – Spent a year in Paris at the Pasteur Institute studying Scarlet Fever & Rabies
- She made critical contributions in the 3 key areas of infectious disease control:
Vaccination, Early-diagnosis, and Treatment



Anna Wessels Williams

➤ Diphtheria Research

- Diphtheria was a major cause of death among children, especially the poor
- *Within a year, she isolated a strain of the bacteria and used it to produce an antitoxin (antidote)*
- It was **issued free of charge to the poor**
- The discovery was made while lab director William Park was away, but still called **Park-Williams No. 8**



➤ Rabies Research

- **1905** - Developed an *improved method for detecting rabies virus cells* in the brain that worked in **minutes**, rather than several days – **speeding up diagnosis and saving lives**
- Was the **standard method until 1939**
- Collaborated on *Trachoma, Strep, Pneumonia, Meningitis, Scarlet Fever, Venereal Disease* diagnosis techniques
- **1932** – Appointed **Chair of the Laboratory Section of the American Public Health Association**
- **1934** - Mandatory retirement at age 70 (*but continued to work for free*), and lived to age 90

What was going on in Early 20th Century Science?

1909
ANTIBIOTICS

1915
**GENERAL
RELATIVITY**
Einstein

1931
**BIG BANG
THEORY**
LeMaitre

1914
**1ST NON-
DIRECT BLOOD
TRANSFUSION**

1928
PENICILLIN
Fleming

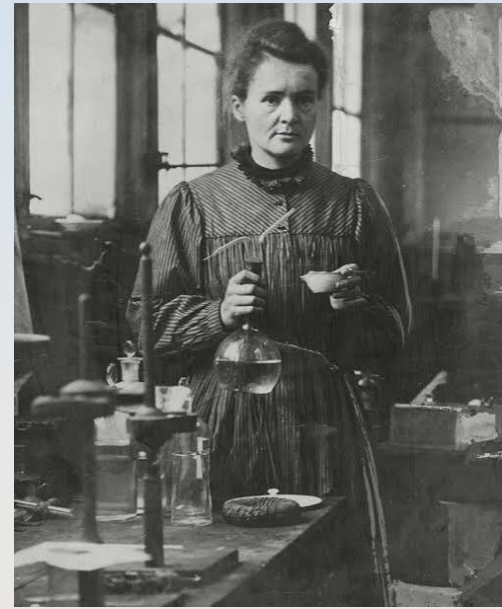
1947
TRANSISTOR
Bell Labs



Marie Curie



Marie Curie

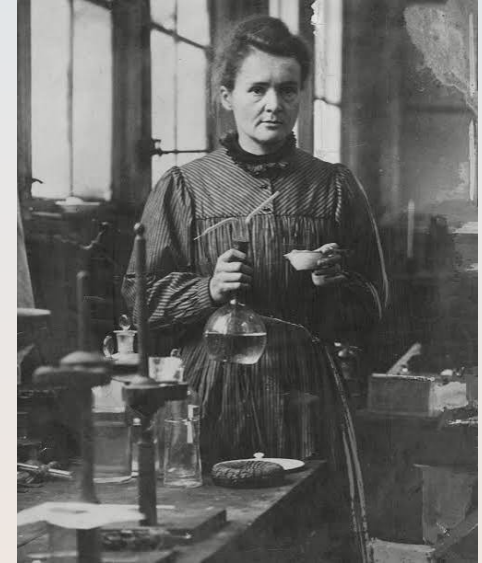


- **Pioneer in Radioactivity, discovered new Elements; 2 Nobel Prizes**
- **1867-1934**, born in Poland as Maria Sklodowska, moved to France in **1891**
 - **Both parents were teachers**, she was the youngest of 5 children
 - *Father supported education for girls and boys equally*
- Was **denied higher education** in Poland because she was a woman, so her parents educated her via the underground “Flying University”
- She *delayed her education for 2 years* to help pay for her sister’s education in France, then they swapped
- **1891 – Moved to Paris** to continue her education; *Many foreign women studied Science in France*
- **1894 – Returned to Poland** but was *denied a position there* because she was a woman. She **returned to Paris** to earn her PhD.
- **1895** – married Pierre (*who died in 1906*); *They later had 2 children, Irene and Eve*

Marie Curie



- **1903 Nobel Prize in Physics** with Pierre and Becquerel for work on **Radioactivity**
 - Used the money to hire their first lab assistant
- **1911 Nobel Prize in Chemistry** for **discovery of Radium and Polonium**
- She was humble and ***Refused*** many awards and medals
- ***Did not patent*** the radium isolation process so that others could use it
- **WWI** – developed **mobile X-ray units** for field hospitals
- **1920** – founded the ***Curie Institute*** in Paris
- **1932** – founded the Curie Institute in Warsaw
- **1934** - Died of aplastic anemia, probably from radiation exposure
- **1944** - Synthetic element Curium (Cm) is *posthumously named after Marie*.
- Name to be added to the Eiffel Tower



Marie Curie

Physicist, Chemist



➤ SO MANY FIRSTS:

- ***first woman*** to win a Nobel Prize (added after a complaint by a Nobel Committee Member)
- **ONLY person** to win a Nobel Prize in ***two different scientific fields***.
- **First person** to win a **Nobel Prize *twice***
- **First *married couple*** to win the Nobel Prize (*now there are 6*)
- First woman to become a ***Professor at the University of Paris*** (1906)
- First woman entombed on her own merits in the ***Paris Pantheon*** (1995)
- Only woman on a French Franc note

Lise Meitner

Physicist

- Instrumental in the discovery of nuclear fission
- **1878-1968**, born in Austria, worked in Germany, then Sweden, died in England
 - *She smoked and worked in Radioactivity, yet lived to age 89*
 - At age 8 she kept a **science notebook** of her 'research'
- Initially trained as a teacher, the only career available to women
- **1906 – PhD** in Physics from the University of Vienna
- Worked in Berlin with **Otto Hahn**, co-authoring many early papers
 - As a woman she was restricted to Hahn's converted wood shop (***not allowed into the university***) and had to use the restroom at a restaurant down the street; These restrictions were lifted after about a year.
 - Her father had to pay her salary until she was well-established



Lise Meitner

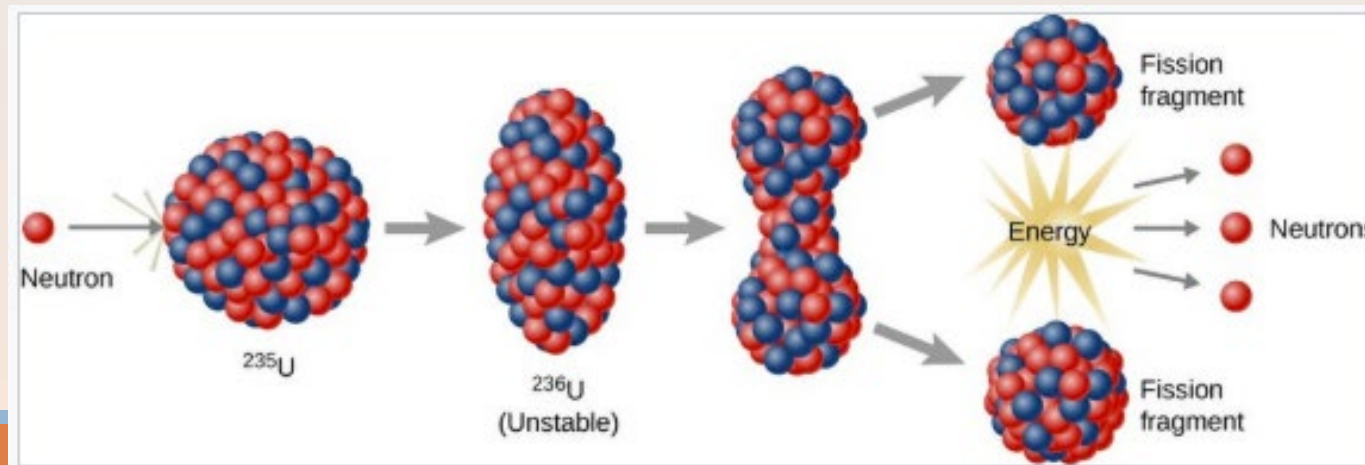
- **1914** – WWI - worked as an x-ray nurse-technician
- **1917** – Appointed **head of her own Laboratories**
 - She had good social skills and was lifelong friends with collaborators (*which also helped her career*)
- **She was well-known to have very exacting lab skills and innovative thinking.**
- **1918** – With Otto Hahn, *discovered a stable isotope* of the rare, highly radioactive element, protactinium. *He did not give her proper credit for her work.*
- **1922** - Studied beta radiation (*fast-moving electrons*) and made the **first discovery** of the *release of electrons from an atom – known for decades as the “Auger Effect” after the French physicist, Pierre-Victor Auger*
But it is now known as the Meitner-Auger Effect.
- **1926** - First woman to become a *University professor* of physics in Germany.



Lise Meitner



- **1935** - *She lost her position* because of the anti-Jewish Nuremberg Laws
- **1938** (age 60) – Snuck out of Germany (*with the help of Neils Bohr*) after all legal ways of leaving were eliminated
 - Emigrated to and worked in **Sweden**
- **1939** - Meitner and her nephew Otto Frisch published a paper in “Nature” that proposed the term **nuclear fission** and explained the physics behind it.
(*Hahn had experimentally observed it but could not explain it.*)
- **1944** Nobel Prize in **Chemistry** awarded to Otto Hahn for nuclear fission



Lise Meitner

- **Nominated 19 times** for the Nobel Prize in Chemistry between 1924 and 1948, and **30 times** for the Nobel Prize in Physics between 1937 and 1967
- *Declined an offer* to work on the Manhattan Project **“I will have nothing to do with a bomb”**
 - Also refused to be a technical consultant on movies after the war
- Traveled extensively and met with Eleanor Roosevelt, Harry Truman, & lectured at major US universities
 - **1946** – Named "Woman of the Year" by the Women's National Press Club in Washington, D.C.
- **1951** – Became a member of the Royal Swedish Academy of Sciences, permitting her to participate in the Nobel Prize process
- Remained lifelong friends with Otto Hahn
- Mostly unrecognized until a Biography published after her death in 1968 raised the awareness of her accomplishments.
- **1997** - Element 109 (*synthetic*) **Meitnerium** was posthumously named after her to raise awareness
- Many, many awards and honors, honorary doctorates; awards, buildings, craters, asteroids, satellites, etc. named after her – *Some while she worked, but most were posthumous.*



Why didn't Lise Meitner win the Nobel Prize?



➤ 3 Theories:

- **Gender bias:** Women were not seriously considered for Nobel Prizes
- **Bias toward Chemistry:** The Nobel Committee had a bias toward Chemistry (*Hahn*) and downplayed Physics (*Meitner*)
- **Effect of being Jewish in 1930's Germany:** Her name was left off of many of Hahn's papers in Berlin;
 - While working in Germany in the 1930's it was dangerous for ***both her and Hahn*** to put her name on papers. *The work is well documented in correspondence.*
 - Her name was not included on papers after she fled Germany.

$$E = mc^2$$



Albert Einstein
1879-1955

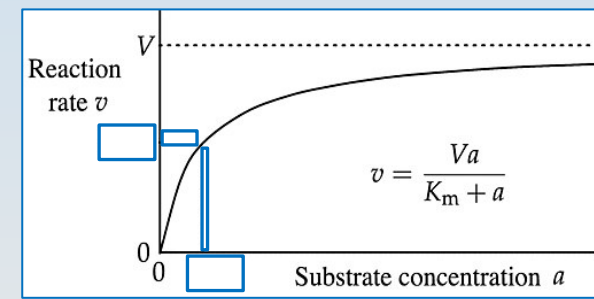
Maud Menten

Biochemist, Physician



- Significant contributions to enzyme kinetics and cell chemistry
- **1879-1960**, Canadian, worked in Germany, U.S.
 - Eldest of 2 children; Father was a river pilot, mother managed hotel/general store
 - Early education was in a 1-room schoolhouse
- **1904** – **BA**, University of Toronto
- **1907** - **Master's**, University of Toronto
- **1911** - **M.D.** University of Toronto – *one of the first Canadian women to do so*
 - **1912** - Moved to Germany because *women were not allowed to participate in Research in Canada*
- **1913** – Published famous paper on enzyme kinetics with Leonor Michaelis: The “**Michaelis-Menten Equation**”
- **1916** - **PhD** in Biochemistry, University of Chicago
- **1923** – Joined faculty of the **University of Pittsburgh School of Medicine** (*nothing for women in Canada*)
- ***Adventurous and Artistic***: clarinet, painter, mountain climbing, Arctic expedition, Astronomy, 5 Foreign Languages

Maud Menten



➤ 1913 - “Michaelis-Menten” Kinetics

- *Calculates how enzymes speed up chemical reactions, based on the concentration of the substrate*
 - Important for studying cell function, developing new pharmaceuticals, etc.
-
- **1943-46** - Invented the “Azo-Dye Coupling Reaction” – still used *to observe enzymes in tissue samples*
 - **1944** - Conducted the first Electrophoresis **separation of proteins** (in hemoglobin) – *(several years before Linus Pauling, and now a standard method)*
 - Areas of Research- hemoglobin, blood sugar regulation, kidney function, childhood cancers
 - Authored or coauthored **>70 publications**
 - **Head of Pathology** at Children’s Hospital of Pittsburgh
 - **1950** – Cancer research at British Columbia Medical Research Institute *(age 71)*
 - **1998** - Canadian Medical Hall of Fame *(posthumously)*

Emily Noether

Mathematician, Mentor



- Leading mathematician who made many important contributions to Mathematical Physics and Abstract Algebra
- **1882-1935**, German
 - Father was a mathematician
 - Unremarkable student
 - Considered being a language teacher because she was a woman, but then became interested in Mathematics
 - 1900- The rules changed at his university to now allow women to AUDIT classes
- **1907 - PhD** at University of Erlangen, summa cum laude
- Barred from teaching and Worked on her own research for 7 years *without pay* at Erlangen (*since women were mostly excluded from Academic positions*)
- **1915-1919** – Recruited to teach at University of Goettingen but after objections from other faculty, she lectured under a male colleague's name
- **1919-1933** – Faculty of the Goettingen Mathematics Department
- **1933** – Dismissed from faculty because she was Jewish, ***Fled to the U.S.***
- **1933** – **Quickly** found a Faculty position at Bryn Mawr College, *a testament to her outstanding reputation*

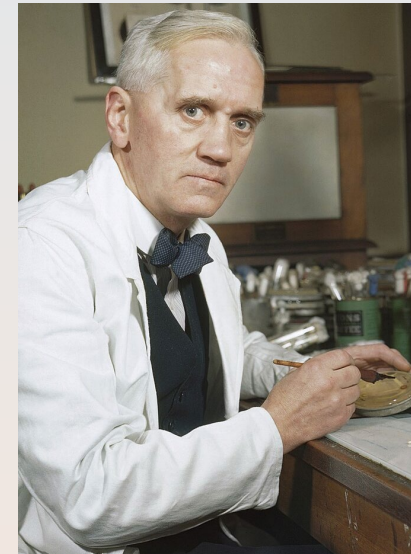
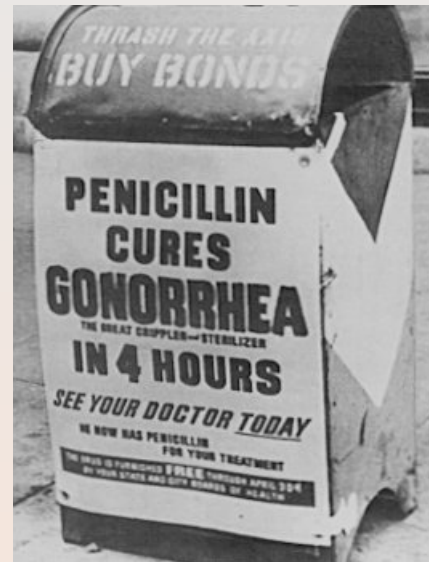
Emily Noether



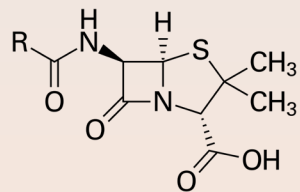
Emily Noether



- Worked in the field known as Higher Algebra, developing the Math to Support General Relativity
- **1918 - Noether's Theorem** (Abstract Algebra)
 - “Explains the connection between symmetry and conservation laws” in Physics
 - Considered *“One of the most important mathematical theorems ever proved in guiding the development of modern physics, possibly on a par with the Pythagorean theorem”*
 - **Re-discovered in the 1950's-60's and used to understand Subatomic Particles**
- **Noether's Second Theorem** – Led to Gauge Theories, which are the *foundation of all Laws of Physics*
 - *Her contribution was not recognized until after her death*
- Once she made her name in Mathematical Physics, she devoted herself to **pure Mathematics**
 - Created the mathematical area of **Ring Theory**
 - Her accomplishments in pure Mathematics were *appreciated immediately* and **she attracted Post-doctoral researchers from around the world**
- She was **very supportive of her students** known as **“Noether Boys”** in Germany and **“Noether Girls”** at Bryn Mawr, several of whom made significant contributions
- **“The Noether School”** – a group of like-minded mathematicians
- Described (by Einstein and others) as the **most important woman in the history of mathematics**
- The classic textbook “Modern Algebra” was based on her work.
- Her work advanced other fields, including **Fluid Mechanics** and **Weather Prediction**



Alexander Fleming
1881 – 1955



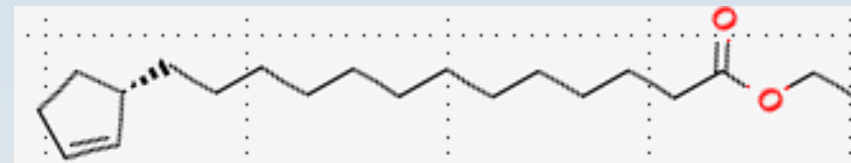
Alice Ball

Chemist



- Produced the first effective treatment for Leprosy (*Hansen's disease*)
- **1892-1916** (*age 24*), U.S. (*Seattle*)
 - Father was a lawyer and newspaper editor, mother and grandfather were photographers (*Photography involved chemistry back then*)
- **1912** – 2-year Degree in Pharmaceutical Chemistry at University of Washington, Seattle
- **1914** – BS in Pharmacy at University of Washington, Seattle
- **1915** – MS in Chemistry, University of Hawaii (***first woman and first black American*** to do so)
- University of Hawaii's first female chemistry instructor
- Recruited to work at the Leprosy Investigation Station in Honolulu

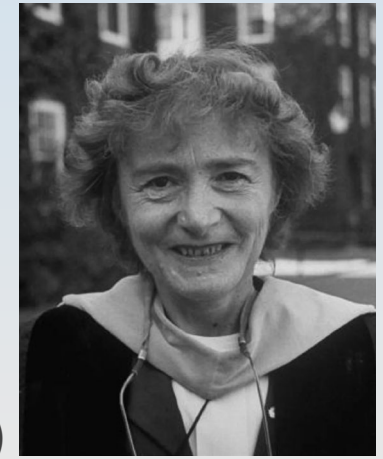
Alice Ball



- Developed a method to chemically modify a known Leprosy treatment (*chaulmoogra oil*) to make it water-soluble to be absorbed into the bloodstream by injection
- She died in 1916 before she could publish her work
- **1920** - Her advisor completed the work and *published without acknowledging her*, called it the “Dean Method”
- By 1920, many patients who received the new method were able to return home, rather than staying quarantined
- **1922** – Dean’s colleague (*Hollmann*) publishes the work, calling it the "**Ball Method**"
- (*Ball method was later replaced with more advanced treatments in 1946.*)
 - **1932 book** “*The Samaritans of Molokai*” that specifically recognized the contributions of a young chemist (Ball)
- **1970’s** – Ball’s research records were found at U Hawaii
- Died at age 24; Cause of death speculated as chlorine poisoning from lab exposure (*tuberculosis?*)
- **2020** – Short film “The Ball Method”, satellite named after her, 2022 National Women’s Hall of Fame
- **2023** – Obituary in the New York Times as part of the “Overlooked Series” of remarkable people whose deaths went unreported in the Times.

Gerty Cori

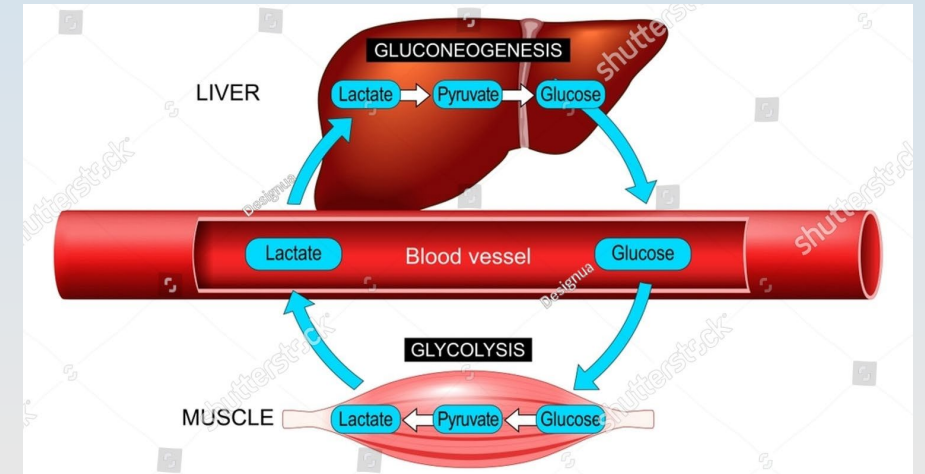
Biochemist



- **1947 Nobel Prize for the "discovery of the course of the catalytic conversion of glycogen"**
 - the *third woman* to win a Nobel Prize in science
 - the *first woman* to be awarded the Nobel Prize in Physiology or Medicine
 - The Coris were the *third ever married couple (after the Curies)* to win the Nobel Prize (*now there are 6*)
- **1896-1957**, Czech, then U.S.
 - Her father was a Chemist (*and her mother was a friend of Franz Kafka*)
 - *Oldest of 3 daughters; Home-schooled until age 10*
 - Her uncle was a Pediatrics Professor, who encouraged her to study medicine
 - Decided she wanted to be a doctor at age 16
- Suffered from malnutrition during WW1 from food shortages
- **1920** – Graduated Medical School (*where she met and married her husband Carl*)
- Moved to Vienna, where Gerty conducted research at a Children's Hospital, publishing papers on blood disorders.



Gerty Cori

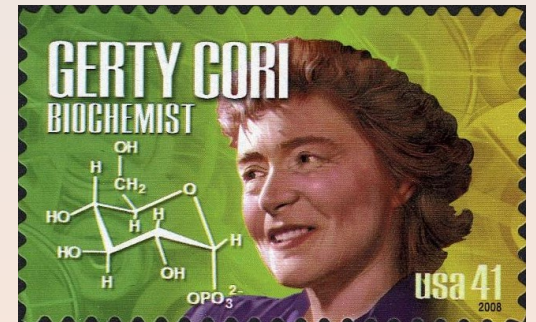


- **1922** – Moved to the U.S. and had difficulties finding a position
- **1922-1930** - Gerty and Carl did research at the *Roswell Park Cancer Institute in Buffalo*
 - Officially, Gerty was Pathology Assistant to Carl but they worked as equals
 - Gerty was threatened to be fired if she continued to collaborate with her husband (*she ignored it and kept working*)
 - They published 50 papers on how glucose is metabolized in the human body and the hormones that regulate this process **including 11 with Gerty as the sole author**
- **1929** – Published the **Cori Cycle**
 - the mechanism where glycogen (*a sugar made from glucose*) is broken down in muscle tissue into lactic acid and then resynthesized in the body and stored as a source of energy
 - **Crucial to the development of diabetic treatments**

Gerty Cori



- **1931** – They moved to **Washington University** (St. Louis), where they both got positions
 - Carl turned down an offer from U. Buffalo because they wouldn't hire Gerty
 - A university job interviewer told her that it was considered "un-American" for a married couple to work together
 - *Gerty's position was much lower than Carl's, as a research associate at a salary one tenth of his salary*
- **1943** – Gerty appointed **Associate Professor**
- **1947** - Promoted to **Full Professor** (*just months before the Nobel Prize*)
- She also pioneered a method of doing biochemical research in a controlled environment outside of living cells
- Many Awards, Medals, and Honors, including National Academy of Science (*4th woman*), *Postage stamp*
- 6 Scientists that the Coris mentored went on to receive Nobel Prizes



Sources

“Women in Science- 50 Fearless Pioneers Who Changed the World” by Rachel Ignotofsky

“Headstrong: 52 Women Who Changed Science– And the World” by Rachel Swaby

“In Our Time” Podcast: <https://www.bbc.co.uk/programmes/b006qykl>

“Science Friday” Podcast: <https://www.sciencefriday.com/science-friday-podcasts/>

Internet sources, including:

- <https://www.nobelprize.org/>
- Wikipedia (*cross-checked with other sources*)
- Smithsonian Magazine <https://www.smithsonianmag.com/science-nature/ten-historic-female-scientists-you-should-know-84028788/>