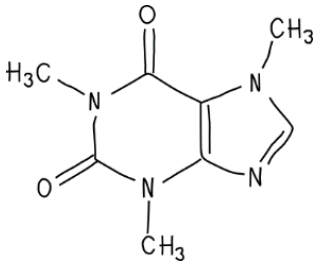

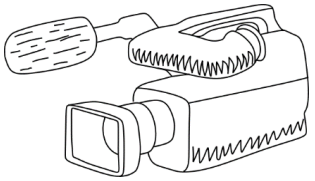

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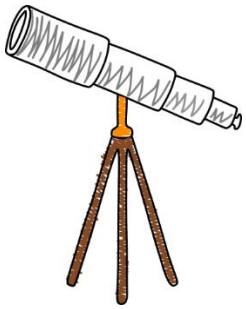

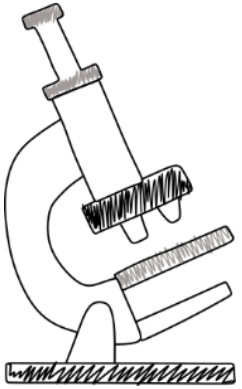

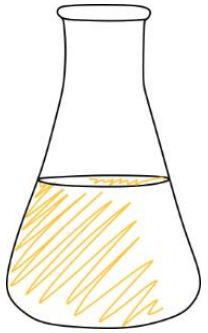

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Ibn al-Haytham

Lived: Iraq / Egypt, 965 – 1040

Mathematician & astronomer

Pioneer of modern optics.

First known person to correctly understand vision as the eyes passively receiving light reflected from objects, rather than light rays emanating from the eyes.

Provided first mathematical analysis of the camera obscura, where an image can be projected through a pinhole into a dark room.

Also known as Alhazen. There were possibly two people called Ibn al-Haytham.

Al-Zahrawi

Lived: Al-Andalus, 936 – 1013

Surgeon

Greatest surgeon of the middle ages: the "father of surgery".

First description of haemophilia (hereditary disorder in which your blood doesn't clot).

Categorised cosmetics as pharmaceuticals and invented moulded lipstick and rub-on perfume.

Al-Andalus is largely modern-day Spain and Portugal.

Ibn an-Nafis

Lived: Syria / Egypt, 1213 – 1288

Physician

First person to correctly describe the pulmonary circulation of the blood between the heart and lungs, stating that the blood must pass from the right ventricle to the left ventricle via the lungs.

Also wrote about eye diseases, diet, astronomy, philosophy, law and theology, among other topics.

Sometimes written as Ibn al-Nafis.

Mary Anning

Lived: UK, 1799-1847

Palaeontologist & fossil hunter

Discovered the first complete plesiosaur skeleton, and excavated the first known ichthyosaur specimen (5.2m long).

Expert on coprolites, and was the first to correctly suggest that these are fossilised faeces.

Self-taught, with no formal scientific training.

Palaeontology is the study of fossils.

Hertha Ayrton

Lived: UK, 1854 – 1923

Engineer, mathematician, physicist, inventor, suffragette

In 1884 she invented a type of line divider for use in technical drawing (drafting).

Re-designed electric arc lamps, which were used as street lamps, so that they didn't hiss and flicker.

Explained the formation of sand ripples through experiments in hydrodynamics.

Alice Ball

Lived: USA, 1892 – 1916

Pharmaceutical chemist

In 1915 (aged 23), developed a treatment for Hansen's disease (leprosy) that was the most effective treatment for 20+ years.

Died aged 24, potentially after accidentally inhaling chlorine gas in the lab.

"Alice Ball Day" is celebrated on 29th February.

Benjamin Banneker

Lived: USA, 1731 – 1806

Mathematician, astronomer & writer

Accurately predicted a solar eclipse that occurred in 1789.

Produced an annual almanac (book) detailing the positions etc. of the sun, moon, planets, tides and more for the year.

Largely self-educated.

Brahmagupta

Lived: India, 598 – 665

Astronomer & Mathematician

The first known person to define zero as a number with mathematical properties.

Laid the foundations of arithmetic and algebra.

His astronomical writings had a major impact on Islamic mathematics and astronomy.

6th century Indian statue of standing male figure, from the Metropolitan Museum of Art, New York

Jocelyn Bell Burnell

Lived: UK, 1943 –

Astronomer

Discovered the first pulsar (rapidly spinning stars that emit pulses of radio waves) while a graduate student. Her professor was awarded the Nobel Prize for the discovery.

First female president of the Institute of Physics (2008).

Awarded the 2018 Special Breakthrough Prize in Fundamental Physics, and donated the £2M+ winnings to a charity to support under-represented groups in physics.

Annie Jump Cannon

Lived: USA, 1863 – 1941

Astronomer

Specialist in classifying stars. Created a new classification scheme based on the spectrum (pattern of light colours) of the star.

Over her lifetime she obtained and classified the spectra for more than 225,000 stars. This work was published in a ten-volume catalogue.

Discovered around 300 variable stars, which are stars that regularly change brightness over time.

Emmett Chappelle

Lived: USA, 1925 – 2019

Chemist

Uncovered the mechanism and chemistry by which living organisms can emit light (bioluminescence).

Patented a method of counting bacteria in water using bioluminescence – the bacterial cells are broken down and mixed with an enzyme that glows when it mixes with molecules from inside the bacteria.

Inducted into the USA's National Inventors Hall of Fame in 2017

Gan De (Kan-Te)

Lived: China, c. 400 BCE – c. 340 BCE

Astronomer

Compiled a star catalogue with two other astronomers, recording the positions of stars. This is believed to be the first such work for which we know the author's name.

Made good predictions of the periods of Jupiter, Venus and Mercury.

May have recorded a sighting by eye of one of the moons of Jupiter, but this is debated.

Standing figure of a nomad, 5th – 3rd century BC, China, from the Metropolitan Museum of Art, New York

Honor Fell

Lived: UK, 1900 – 1986

Tissue biologist

Pioneer in growing organs *in vitro* (i.e. "in glass" – in the lab)

Showed that growth of tissues could be modified by extrinsic (external) factors such as vitamins and hormones

Explained the biological basis of joint destruction in arthritis

Eunice Newton Foote

Lived: USA, 1819 – 1888

Atmospheric scientist

Undertook the first experiments that showed that carbon dioxide traps heat from the sun.

Investigated the connection between changing the pressure of gases and their electrical charge.

Patented an improved paper-making machine and a rubber filling for the soles of boots and shoes.

Rosalind Franklin

Lived: UK, 1920 – 1958

Chemist

Contributed to the discovery of the structure of DNA by taking X-ray diffraction "photographs" of it, which led directly to Watson and Crick's publication.

Studied the physical chemistry of carbon and coal, and the structure of a range of viruses including tobacco mosaic virus and polio.

Credit: Encyclopedia Britannica

Margaret Hamilton

Lived: USA, 1936 –

Computer scientist

One of the first computer software programmers.

Coined the term ‘software engineer’.

Led the team that wrote the computer code for the guidance and control systems for the spacecraft in the NASA Apollo missions to the Moon. Pictured here with the code for the navigation software.

Zhang Heng

Lived: China, 78 – 139

Mathematician & astronomer

Chief astronomer in the court of the Chinese Emperor.

Invented the seismoscope, a device for sensing earthquakes. His seismoscope had dragons which would spit balls into the mouths of sculpted toads if an earthquake was occurring.

Correctly noted that the moon reflected the sun's light, rather than being a light source itself.

Caroline Herschel

Lived: Germany, UK, 1750 – 1848

Astronomer

First discoverer of five comets, and several nebulae (interstellar clouds of dust and gas) and star clusters. Also discovered a periodic comet (35P/Herschel-Rigollet) with an orbital period of 155 years

Catalogued 2,500 nebulae and star clusters

Undertook “extensive and laborious” numerical calculations based on astronomical observations

Dorothy Crowfoot Hodgkin

Lived: UK, 1910 – 1994

Chemist

Discovered the crystal structures of penicillin (antibiotic), vitamin B-12 and insulin using X-ray crystallography (imaging)

Won Nobel Prize in Chemistry in 1964

Developed chronic rheumatoid arthritis aged 28, which left her hands swollen and distorted, but nevertheless continued her delicate work with tiny crystals.

Katherine Johnson

Lived: USA, 1918 – 2020

Mathematician

Calculated and analysed the flight paths of spacecraft for NASA for almost 30 years, including for the first mission to put a US astronaut in space (1961), the first US crewed spacecraft to orbit Earth (1962), and the 1969 Apollo 11 mission, which resulted in the first men on the moon.

One of the "West Computers", a group of African American women who manually did complicated mathematical calculations for aeronautical engineers.

Irène Joliot-Curie

Lived: France, 1897 – 1956

Physical chemist

First to accurately measure mass of neutron. First to photograph paired matter and antimatter. Discovered artificial radioactivity, which paved the way for production of radioisotopes used to treat cancer.

Won Nobel Prize in Chemistry in 1935

One of the first women in French government

Daughter of Pierre & Marie Curie. Worked with husband Frederic Joliot-Curie.

Ernest Everett Just

Lived: USA, 1883 – 1941

Biologist

Made important advances in understanding the biology of the surfaces of cells, the process of fertilisation, cell division, hydration and dehydration in living cells, largely through studying marine invertebrates.

Advocated the study of whole cells under normal conditions, insisting that laboratory experimental conditions closely match those in nature.

Narinder Singh Kapany

Lived: India / USA, 1926 – 2020

Physicist

The “father of fibre optics”. Built one of the first “fibrescopes” – a bundle of flexible glass fibres that could be used to transmit an image. This technology developed into modern fibre endoscopes. Designed an early optical device to measure oxygen saturation in blood.

Designed key components for fibre-optics-based communications systems, used today in e.g. high-speed broadband.

Made pioneering contributions in solar energy.

Sofya Kovalevskaya

Lived: Russia / Germany / Sweden,
1850 – 1891

Mathematician

Proved the Cauchy-Kovalevskaya theorem, which says whether or not you should be able to solve certain equations known as partial differential equations.

Discovered the "Kovalevskaya top", a special configuration of a spinning top precessing (rotating) in a gravitational field, which has particular mathematical properties.

First woman in modern Europe to gain a doctorate in mathematics, and first to be appointed professor of mathematics.

Henrietta Lacks

Lived: USA, 1920 – 1951

Cancer patient

Her cancer cells were taken without her consent. Because they were found to reproduce indefinitely, a huge supply of them was created, called the HeLa cell line.

Her “immortal” cells went on to be mass-produced, for profit, without recognition to her family.

HeLa cells have contributed to many medical breakthroughs, including vaccines for polio and HPV, drugs for HIV/AIDS, leukaemia, and Parkinson’s disease; and breakthroughs in IVF and cancer.

Hedy Lamarr

Lived: Austria / USA, 1913 – 2000

Inventor & Film star

Co-invented frequency-hopping technology during WWII, in which radio communications repeatedly switch frequencies, making them more secure.

This principle is used in present-day satellite and mobile phone technology such as secure WiFi, GPS, and Bluetooth.

Also invented a tablet that dissolved in water to make a fizzy cola drink.

Henrietta Swan Leavitt

Lived: USA, 1868 – 1921

Astronomer

Discovered relationship between period and luminosity for Cepheid variables, a type of variable star (a star that changes its brightness over time). This relationship was later used by Edwin Hubble to show the expansion of the universe.

Discovered 2,400 variable stars

Hearing loss in her 20s lead to deafness

Esther Lederberg

Lived: USA, 1922 – 2006

Microbiologist

Discovered the “lambda phage”, a virus that lives inside the E. coli bacterium. Laid the foundation for understanding bacterial gene transfer.

Developed “replica plating”, a revolutionary technique in which a velvet material is used like a stamp to pick up and then deposit multiple copies of colonies of microorganisms.

Omitted from her husband and colleagues’ Nobel Prize, despite having contributed to the work.

Lise Meitner

Lived: Austria & UK, 1878 – 1968

Nuclear physicist

Discovered uranium fission – the splitting of a uranium nucleus into two parts with a large release of energy.

Refused to work on the Manhattan project (1942-1945, creating the atomic bomb).

Chemical element ‘Meitnerium’ is named after her.

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Cecilia Payne-Gaposhkin

Lived: UK / USA, 1900 – 1979

Astronomer

Discovered that stars, including the sun, are mainly made of hydrogen and helium, overturning the idea that the sun and Earth were essentially made of the same elements

Established that stars could be classified into groups according to their temperature

First and only woman yet to be chair of astronomy at Harvard University

Vera Rubin

Lived: USA, 1928 – 2016

Astronomer

Provided early evidence for the existence of Dark Matter by showing that the stars at the edges of galaxies are moving (orbiting) as fast as those near the centre.

Demonstrated that galaxies are clumped together, not uniformly distributed.

First woman permitted to use the Hale Telescope at the Palomar Observatory at Caltech.

Abdus Salam

Lived: Pakistan / UK / Italy, 1926 – 1996

Theoretical Physicist

Formulated the theory which unites the weak nuclear force and electromagnetism, two of nature's four fundamental forces.

Hypothesised the existence of particles of the weak nuclear force, which were later found through experiments.

Helped set up the International Centre for Theoretical Physics at Trieste, Italy, to provide support for physicists from developing countries.

Received the 1979 Nobel Prize.

Mary Somerville

Lived: UK / Italy, 1780 – 1872

Scientist, Mathematician & Science writer

Translated, rewrote and expanded key scientific texts, selling tens of thousands of copies.

Suggested the existence of a planet beyond Uranus based on the mathematics of its orbit, before Neptune was discovered.

One of the first women to be elected to the Royal Astronomical Society.

Nettie Stevens

Lived: USA, 1861 – 1912

Biologist & Geneticist

Discovered that sex is largely determined by X & Y chromosomes, rather than environment, following work on the embryonic cells (germ cells) of beetles

Began scientific research career at the age of 40

Tapputi-Belatekallim

Lived: Mesopotamia, ~1,200 BCE

Chemist (perfumer)

The earliest recorded chemist: her name is found on a cuneiform tablet dating from 1,200.

She was the mistress of a household and an overseer at the Royal Palace.

She manufactured perfume, which involved extracting essences from natural materials before distilling and filtering to create the perfume.

Egyptian tomb decoration from ~2,500 BCE showing the making of lily perfume

Gladys West

Lived: USA, 1930 –

Mathematician

Laid the foundation for the GPS system through pioneering calculations of the orbits of satellites and “geoid” (imperfect spherical) shape of the Earth.

An early programmer and coder working for the US Navy.

James West

Lived: USA, 1931 –

Inventor & Electrical Engineer

Co-inventor of the foil electret microphone, which is the basis of almost all microphones used today in, e.g. phones, audio recording equipment and hearing aids.

Daniel Hale Williams

Lived: USA, 1858 – 1931

Physician

Said to be the first person to perform successful heart surgery. The patient lived a further 20 years.

African-American who founded America's first interracial hospital, Provident Hospital in Chicago, in 1891.

Chien-Shiung Wu

Lived: China / USA, 1912 – 1997

Nuclear & Particle Physicist

Provided the first experimental proof of parity violation, i.e. a mirror-image of the world would behave slightly differently. (Her colleagues received the Nobel Prize for their work on this problem.)

Was a key member of the Manhattan Project, enabling the isolation of the radioactive uranium isotopes needed for the nuclear bomb.

Tu Youyou

Lived: China, 1930 –

Pharmacologist

Led the team that discovered the important antimalarial drug artemisinin. It came to light through rigorous testing of remedies noted in folk medicine and ancient Chinese medical texts as having activity against malaria. Drugs based on artemisinin have saved millions of lives.

Shared the 2015 Nobel Prize for Physiology or Medicine.