

THE INTERACTION AND MOVEMENT OF IDEAS, OBJECTS, AND PRACTICES

Note to teacher: Arrange students into small groups of 2-3 (12 groups). Cut up the items below into 12 strips and give one to each group. Ask each group to (a) discuss the innovator or innovations described in their item and consider their utility to current practices, and (b) identify how the item might be presented on a map in such a way as to represent the interaction or movement of ideas, objects, or practices suggested by the description. Students should consult an Almanac to locate unknown cities or regions. After each group discusses their item, ask them to stick the item on a wall map of the world, on or around the origin. Then using colored yarn, have them insert lines to illustrate the interaction or movement of ideas, objects, or practices across geographic regions. Students should refer to all of the information available on their strip, as well as to their own previous knowledge. They should consider the movement of people, as well as influences, in considering how they might represent their item. When all items have been hung, students should have a visual representation of the interaction and movement of ideas to/from MENA and other world regions, illustrative of a shared past. The teacher can then facilitate a discussion. (Alternatively, students can use blank maps and markers for this activity. Maps can be hung on the walls to facilitate a “gallery walk.”)

Mohammed al Khwarizmi (c. 780-850), also known as Algoritmi, is considered the father of Algebra. He was a Persian mathematician whose work was influenced by texts from India. He worked at the House of Wisdom in Baghdad, discovering and re-introducing Indian concepts of numerals, the zero, the decimal, and negative numbers. He has been described as meriting a place of honor on par with Newton, Einstein, and others for revolutionizing the notion of numbers, developing the system of Algebra (which comes from the Arabic word *aljabr*, meaning “restoration”), and developing the algorithm, a formula or set of rules for dealing with large numbers (the word comes from the Latinized version of his name). His works were translated 300 years later by English monks Robert of Chester at Segovia, Spain and Adelard of Bath. Gerard of Cremona emigrated from Italy to Toledo, Spain to translate these texts into Latin, thus introducing the Indo-Arabic numerals that we use today into Europe. Almost 1200 years after al Khwarizmi, the algorithm would become the basis for all computer programming.



[From 1978 USSR postage stamp. Retrieved: http://commons.wikimedia.org/wiki/File:Persian_Khwarazmi.jpg public domain]

Fatima al Fihri (c. 800-880), also known as al Fihriyya, was born in Tunisia and later moved to Morocco, where she founded the world's first academic, degree-granting university in Fez in 859. The University of Qarawiyyin became a major intellectual bridge between MENA and Europe for the discussion of science and innovation, gradually extending its education to other subjects. Its reputation for scholarship attracted important scholars from various regions, including Gerber of Auvergne, who later went on to become Pope Sylvester II. It is here that Gerber was introduced to al Khwarizmi's Indo-Arabic numerals and the zero, which he took to Rome and contributed to the spread of their usage in Europe.



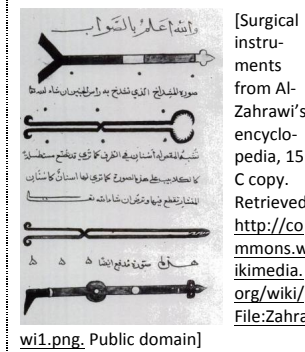
[Author: Nayzak. Retrieved: http://en.wikipedia.org/wiki/File:Fatima_Al-Fihriyya.jpg public domain]

Mariam al Astrulabi (10th C) is one of the first known woman engineers. She designed and handcrafted intricate astrolabes, instruments that are considered early forms of global positioning systems (GPS). Astrolabes determine the position of the sun and planets. They were also used for navigation to locate latitude and longitude. Al Astrulabi was born in Aleppo, Syria, where her astrolabes were well known for their intricacy and innovation to the extent that she was employed by the ruler of Aleppo from 944-967. She learned to make astrolabes from her father, who was an apprentice to a famous astrolabe maker in Baghdad. The astrolabe was brought north by Gerber of Auvergne, who later became Pope Sylvester II. It was integrated into teaching in France before the turn of the 11th C.



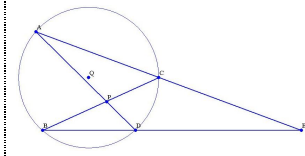
[16th C Moroccan Astrolabe, Paris Naval Museum. Author: Rama. Retrieved: http://commons.wikimedia.org/wiki/File:Planispherical_astrolabe_mg_7095.jpg public domain]

Abul Qasim Al-Zahrawi (936-1013), known in the West as Abulcasis, has been described as the father of modern surgery. His many pioneering contributions include the use of catgut for internal stitches in surgery and surgical tools, such as the scalpel and forceps used in childbirth. He wrote a 30-volume encyclopedia of medical practices, which was translated into Latin by Gerard of Cremona who emigrated from Italy to Spain to translate Arabic texts in the 12th C. It was the primary handbook for European surgeons for 500 years and had tremendous impact on modern medicine. He was born in El-Zahra, near Cordoba where he lived. Many of the 200 surgical instruments he introduced are still in use today.



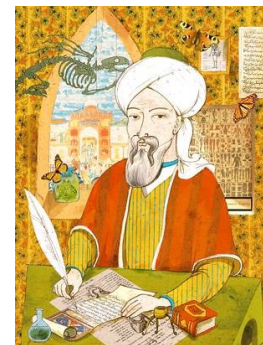
[Surgical instruments from Al-Zahrawi's encyclopedia, 15 C copy. Retrieved <http://commons.wikimedia.org/wiki/File:Zahrawi1.png>, Public domain]

Ibn al Haytham (c. 965-1040), also known by the Latinized name of Alhazen, was nicknamed Ptolomaeus Secundus, or "The Physicist" in Europe. He initiated a revolution in optics, laying the groundwork for many key technologies, such as the modern day camera, eyeglasses, telescopes, and microscopes. He also introduced the earliest version of the modern scientific method. Born in Basra, he lived mainly in Cairo. His *Book of Optics* (1021) was translated into Latin by Gerard of Cremona, who moved from Italy to Toledo, Spain to translate Arabic scientific texts. It was printed by Risner, a German mathematician based in France in 1572 and influenced the later works of Bacon, Da Vinci, Descartes, Kepler, Galileo, and Newton. A crater on the moon is named in his honor.



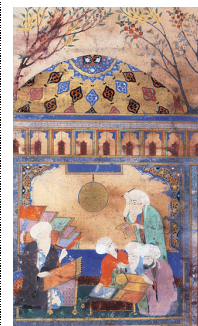
[Author: ジダネ (2008). Retrieved: http://en.wikipedia.org/wiki/File:Theorem_of_al-Haytham.JPG public domain]

Ibn Sina (c. 980-1037) was born and educated in a village near Bukhara. He would come to be known in Europe and Asia as Avicenna. He became a physician at age 16. He studied Greco-Roman, Persian, and Indian texts and learned Indian arithmetic from an Indian grocer. He wrote 450 papers and books in a dozen fields. His *Canon of Medicine* (c. 1025) became a standard medical textbook in Europe, published more than 35 times in the 15th and 16th C, and used in universities in France and Belgium as late as 1650. It introduced Europeans to the contagious nature of infectious disease, the use of quarantine as a medical practice, experimental methods in medicine, rules for testing new drugs, and psychotherapy. Ibn Sina gave the earliest documented account of the use of word associations in psychoanalysis, a method credited to Carl Jung 900 years later.



[Author: Drevnie. Retrieved: <http://commons.wikimedia.org/wiki/File:Avicenna28-02-2010.jpg> free art license]

Nasir Al-Din Al-Tusi (1201-1274) was a Persian astronomer, philosopher, and mathematician, born in Tus. He travelled to places such as Nishapur and Mosul to learn from renowned scholars. Al-Tusi persuaded the Mongol ruler Hulegu Khan to build an observatory in Azerbaijan to establish accurate astrological predictions. Among his many contributions: he developed accurate tables of planetary movements that described the uniform circular motion of all planets and their orbits, leading to the discovery by his student that planets have an elliptical orbit. This was a correction of Roman Ptolemy's model. In the 16th C, Copernicus drew heavily on the work of Al-Tusi and his students, but without acknowledgement. Al-Tusi died in Baghdad.



[Al-Tusi at an observatory. Orig. 1562. Source: Saudi Aramco World 2007. Retrieved: http://commons.wikimedia.org/wiki/File:Nasir_al-Din_al-Tusi_at_observatory.jpg public domain]

Ibn Al Nafis (1213-1288) discovered that blood circulates from the right chamber of the heart to the lungs and then to the left chamber, correcting earlier theories established by Roman physician Galen one thousand years earlier. Ibn Al Nafis was born in Damascus and moved to Egypt in 1236 where he practiced science and medicine as chief physician of Al Mansuri hospital. His work was first translated in Italy in 1547. In 1924, an Egyptian physician discovered Ibn Al Nafis's text on pulmonary circulation in the Prussian State Library in Berlin.



[Opening page of one of Ibn al-Nafis's medical books, most likely a copy made in 17th or 18th C India. Retrieved: http://en.wikipedia.org/wiki/Image:Ibn_al-nafis_page.jpg public domain]

Michael DeBakey (1908-2008), or Dabbaghi in Arabic, was a world-renowned American cardiac surgeon of Lebanese origin whose pioneering heart and blood vessel operations have been performed by surgeons around the world, saving millions of lives. He is considered by many to be the greatest surgeon ever. He was also a leading developer of mechanical devices to support failing hearts. He invented the roller pump, which became a key component of the heart-lung machine, making it possible to conduct open heart surgeries. In 1939, with his mentor Alton Ochsner, he made one of the first connections between smoking and lung cancer. He studied in the US, then France, and then Germany, returning to the US to practice. He also lectured and helped to build cardiovascular centers around the world. In addition to numerous recognitions, he was awarded the US Congressional Gold Medal in 2007.



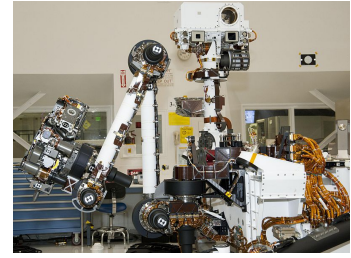
[2007. Author: United States Mint. Design: Don Everhart. Retrieved: http://commons.wikimedia.org/wiki/File:2007_Michael_DeBakey_Congressional_Gold_Medal_front.jpg public domain]

Ahmed Zewail (b.1946-) is the father of Femtochemistry, an area of physical chemistry that studies chemical reactions that take place in a femtosecond (10^{-15} second). The ultra fast laser technique allows scientists to observe intermediate products in chemical reactions. Among numerous international recognitions, he was awarded the Nobel Prize for Chemistry in 1999 for his pioneering work in this field. Zewail was born in Damanhour, Egypt and was raised and studied in Alexandria before moving to the US for his PhD at the University of Pennsylvania. He was nominated to President Obama's Presidential Council of Advisors on Science and Technology.



[2011. Author: Metavid. Retrieved: <http://commons.wikimedia.org/wiki/File:Zewail.jpg>. Creative Commons]

Charles Elachi (b. 1947-) is Director of the Jet Propulsion Laboratory (JPL) in Pasadena, California. JPL put the Mars rover Curiosity on Mars in 2012. The rover is designed to find out if Mars ever had forms of life on it. Elachi was born and studied in Lebanon. He later continued his studies in France and then California where he works today. He has been responsible for a number of NASA-sponsored flight missions and instruments for Earth's observation and planetary exploration. He is the author of more than 230 publications and has lectured about space exploration and Earth observation in more than 20 countries.



[Author: NASA/JPL-Caltech. Retrieved: http://www.nasa.gov/mission_pages/msl/multimedia/gallery/pia13981.html public domain]

Hayat Sindi (b. 1967-) is making important contributions to affordable low cost point-of-care medical diagnostic tools that make healthcare monitoring accessible to people in developing countries. She invented a biochemical sensor with thermoelastic probes that combines the effects of light and ultrasound for use in biotechnology. She also developed the Magnetic Acoustic Resonance Sensor. Sindi was born in Mecca and from a young age was inspired by scientists such as Ibn Sina, al Khwarizmi, Marie Curie, and Einstein. She studied biotechnology in the UK and currently works between Saudi Arabia and the US, where she has major project partnerships. In 2012 she was appointed UNESCO Goodwill Ambassador for promoting science education in MENA.



[Retrieved: http://commons.wikimedia.org/wiki/File:Hayat_Sindi.jpg public domain]