

Her Science/His Ideology: Hypatia of Alexandria (370-415), daughter of the Greek mathematician and philosopher Theon of Alexandria, was the first woman to make a significant contribution to the field of mathematics.

Theon, professor at the University of Alexandria, raised Hypatia in his world of thought. Father and daughter formed a strong bond and she shared his passion in the search for answers to the unknown. Most historians believe that Hypatia surpassed her father's knowledge at a young age.

Her studies included astronomy and astrology as well as mathematics, but she was known most for her work in mathematics, specifically her work on the ideas of conic sections introduced by Apollonius. She edited his work, *On the Conics of Apollonius*, which divided cones into different parts by a plane. This concept developed the ideas of hyperbolas, parabolas, and ellipses, and her analytical contributions in this important book made the concepts easier to understand

Theon also instructed Hypatia on the different religions of the world and taught her the power of words. He taught her the fundamentals of teaching and Hypatia became a profound orator. History records she was a charismatic teacher and that people came from distant cities to study with and to learn new concepts from her. She taught the accepted philosophical ideas of her time but with a modern scientific emphasis that set her apart from the traditional philosophers.

Early Christians identified her science emphasis with paganism despite that many of her pupils were prominent Christians. One of the most famous is Synesius of Cyrene who later was to become the Bishop of Ptolemais. The letters Synesius wrote to Hypatia that have been preserved represent someone who was filled with admiration and reverence for her learning and scientific abilities. All of Hypatia's work was lost except for its titles and some references to it, and no purely philosophical work of hers is known, only of her work in mathematics and astronomy.

But her proficiency, based on the amount of evidence that is known, argues that Hypatia was an excellent compiler, editor, and preserver of earlier mathematical works. And, in some of the preserved letters of Synesius to Hypatia, such as where he asks her advice on the construction of an astrolabe (a device used in studying astronomy that Synesius believed she invented) and the hydroscope (a device that measures humidity), indicates her knowledge of these instruments. That her ideas survived through the centuries, confirms her status as the first woman to have a profound impact on the survival of early thought on mathematics.

Hypatia lived in Alexandria when Christianity started to dominate over the other religions of the period. Ideological tensions were high and riots broke out frequently between the different religions during the time when church and state vied for control.

Orestes the Roman prefect of Alexandria was a friend to Hypatia. Cyril, patriarch of Alexandria, was a leader among the Christians. He and Orestes, the civil governor, bitterly opposed each other. Hypatia's friendship with Orestes, together with prejudice against her scientific philosophical views seen by Christians to be pagan, situated Hypatia as the focal point of riots between Christians and non-Christians. It is written that Cyril spread extremely harmful rumors about her.

In 415, on the streets of Alexandria, a mob attacked her, stripped off her clothes, scraped her skin off her bones with fish shells, and dragged her through the streets to her death. Her body later was burned. According to one report, Hypatia was brutally murdered by the Nitrian monks, a fanatical sect of Christians and supporters of Cyril. According to another account, she was killed by an Alexandrian mob. What seems indisputable is that she was murdered by Christians who felt threatened by her scholarship, her learning, and her depth of scientific knowledge.



But her scientific knowledge would survive and would be expanded upon by Descartes, Newton, and Leibniz. Albeit her name is not as well known, if at all known, as Descartes, Newton, Leibniz, etc., Hypatia made extraordinary accomplishments for a woman in her time. Philosophers, astronomers, mathematicians, scientists and scholars extraordinaire in academia, consider her a woman of great knowledge and an excellent teacher.

Dr. Carl Sagan, astronomer, cosmologist, astrophysicist, professor, NASA advisor, science communicator in astronomy and natural sciences, etc., recognized Hypatia's genius in his 1980 book *Cosmos* and in his documentary film series *Cosmos: A Personal Voyage*, as seen in this passage which I have edited down in respect of word count. The complete passage can be read in its entirety at:

<http://oregonstate.edu/instruct/phl201/modules/Philosophers/Hypatia/hypatia.html>.

The last scientist who worked in the Library of Alexandria 2,000 years ago was a mathematician astronomer, physicist and the head of the Neoplatonic school of philosophy — an extraordinary range of accomplishments for any individual in any age. Her name was Hypatia. ... At a time when women had few options and were treated as property, Hypatia moved freely and unselfconsciously through traditional male domains. ... The Alexandria of Hypatia's time, by then long under Roman rule, ... was a city under grave strain. ... The growing Christian Church was

consolidating its power and attempting to eradicate pagan influence and culture. ... Hypatia stood at the epicenter of these mighty social forces. Cyril, the Archbishop of Alexandria, despised her because of her close friendship with the Roman governor and because she was a symbol of learning and science, which were largely identified by the early Church with paganism. In great personal danger, she continued to teach and publish, until the year 415, when she was set upon by a fanatical mob of Cyril's parishioners. They dragged her from her chariot tore off her clothes, and armed with abalone shells, flayed her flesh from her bones. Her remains were burned, her works obliterated, her name forgotten. Cyril was made a saint.

Astrophysicist Neil deGrasse Tyson in his 2014 film documentary series, *Cosmos: A Spacetime Odyssey*, a revision of Dr. Sagan's earlier Cosmos documentary series, also reveres Hypatia.

My December 2006 column, "AstroNOMical WOMEN," features a paragraph on Hypatia that follows and my entire column can be read at: <http://aauw-il.aauw.net/counther/>.

Hypatia of Alexandria was a leading scholar in mathematics and astronomy sixteen hundred years ago. Author of *The Astronomical Canon* and a popular university lecturer in philosophy, astronomy, and mathematics, she is credited with geometry and astrometry contributions instrumental in the development of the sky-measuring astrolabe. She interpreted Plato and Aristotle to those in Alexandria who inquired, and the city loved her. But the male rulers envied her and she was singled out by Bishop Cyril. When the university refused his fiat to fire her, he ordered his male monks, to drag her from her chariot into a church where they brutally slashed her to death in the name of God. Bishop Cyril was later elevated to sainthood by the male clergy of the Vatican.

Sources: <http://www-history.mcs.st-and.ac.uk/Biographies/Hypatia.html>;
<https://www.agnesscott.edu/lriddle/women/hypatia.htm>;
<http://oregonstate.edu/instruct/phl201/modules/Philosophers/Hypatia/hypatia.html>.