Laura Maria Caterina Bassi Veratti (philosopher, physicist, and mathematician)

October 29,1711-February 20,1778

Laura Bassi Veratti was the first woman in the world to have a doctorate in science and the second woman in the world to earn the Doctor of Philosophy degree after Elena Cornaro Piscopia who received her doctorate in philosophy in 1678. She was the first salaried female teacher at the University of Bologna and the first female member of any scientific establishment when she was elected to the Academy of Sciences of the Institute of Bologna in 1732 at the young age of 21 years old. So why have we not heard of her before? This woman was so known for her intellectual abilities since she was a child that scientists came to her parent's house to talk to her and discuss topics in science and philosophy. Laura was very capable that she was able to continue her research in physics while running a household and having 8 children (only 5 survived to adulthood). From child prodigy to a respected physicist, Laura Bassi never stopped breaking barriers in the 18th century!

Her science journey began when Laura Maria Caterina Bassi was born on October 29, 1711, in Bologna, Italy. She was the daughter of Giuseppe Bassi and Rosa Cesari Bassi. Giuseppe Bassi was a lawyer from Modena who worked as governor and chancellor for estates and houses of several of Bologna's senators and vice-legates. He dealt with the members of the City's aristocracy frequently through his work. Guiseppe and Rosa both came from the town of Scandiano, which is located in the province of Reggio Emilia. Laura's grandfather Giancinto Bassi ran a pharmacist's shop in Bologna where natural-based medicines were prepared and sold. Laura's distant cousin Father Lorenzo Stegani taught her from the time she was 5 years old. She was taught Latin, French, and Arithmetic. Father Stegani taught her how to read and write in Latin, which was important since most books in science were written in Latin. At that time few women were proficient in Latin; thus, from an early age Laura had been trained differently from

other girls. Once again, we see how a supportive father can change the educational opportunities of a young girl. When Laura turned thirteen, her father asked the family doctor, Gaetano Tacconi, to teach her philosophy. Gaetano Tacconi had a degree in philosophy and medicine and was also a lecturer at the University of Bologna on anatomy and medicine. Tacconi was also a member of the Academy of Sciences of Bologna. After observing Laura's intellectual abilities, he began to teach her logic, metaphysics, and some science that included elements of Newton's Opticks. Thus, Laura became interested in Newton's theories at an early age. Soon philosophers from all over Bologna including members of the Bologna Academy of Sciences were going to Laura's parents' house to participate in discussions on science and philosophy. Tacconi had invited them to showcase his prized student's abilities.

Laura's reputation as a prodigy spread all over Italy. In 1731 Cardinal Lambertini (the future Pope Benedict XIV) started attending the discussions at the Bassi's house. He would become one of Laura's biggest supporters and her patron. On April 17, 1732, Laura defended her theses, 49 of them, at the Sala degli Anziani of the Palazzo Pubblico, the residence of the gonfaloniere Filippo Aldrovandi, Head of the Senate, Bologna's governing body. If she was successful, she would earn the degree of Doctor in Philosophy. The 49 theses consisted of six in logic, sixteen on metaphysics, nine on topics related to the nature of Being, Reason, God, and the Angel; and eighteen on physics. The physics theses included such topics as the nature of matter, motion, and meteors. The theses in the 18th century were not the same as the theses we have now. They were not original research but answers and a discussion on a set of questions, which the candidate prepared ahead of time. The candidate would give, in Latin, the written answers to the questions posed by the professors. Then the committee would read these responses, and the candidate would defend them orally. Usually, students defended their thesis at the university, but this particular defense was different because the candidate wasn't a young man; she was a young woman and only 20 years old. Laura also was not of noble birth. Her father was a lawyer of modest means. Because she was a woman, Laura had to perform in the public to get recognition for her intellectual abilities. Even before her thesis defense she was a local celebrity and famous for her intelligence! On March 20, 1732, she was invited to join the Academy of Sciences of Bologna as a member, which made her the only female member and the youngest one.

At the theses defense, Laura was questioned by seven examiners. Five were regular lecturers and two were professors: Dr. Iacopo Bartolomeo Beccari, professor of physics at the Institute of Science and Dr. Gabrielo Manfredi, a mathematician at the Institute. Laura defended her 49 theses successfully and was proclaimed Doctor in Philosophy. The proclamation was issued by the Chancellor of the Studium (University), Alessandro Formagliari and by the President of the College of Philosophy and of the Institute of Sciences of

the University of Bologna, Dr. Mateo Bazzani. When Laura received her degree, it seemed all of Bologna's residents came out to celebrate! Everyone was so excited to see this extraordinary woman receive her doctorate degree! There were public celebrations and collections of poetry were published in her honor.

Laura's fame spread all over Europe. She began corresponding with philosophers, writers, and scientists; and this correspondence lasted all her life. Their correspondence included various topics in science. Why was Laura Bassi given this opportunity a century before women were normally allowed to attend universities? Some people think that Laura Bassi was given all these accolades and gifts because some women were "exceptional" and have abilities beyond that was normally found in other women. Laura was considered extraordinary! This reminds us on how Ellen Swallow Richards was allowed to graduate from MIT but then the school still refused to accept other women. Their reasoning was that Ellen Richards was exceptional and there were no other women who could be as good as her! Elena Cornaro Piscopia had been awarded her doctoral degree in 1678, but after that, the University of Padua enacted a rule that lasted 200 years, refusing to award any more degrees to women. Another reason why Laura was given this opportunity was that Bologna wanted to increase its prestige and renown among the Italian city-states by promoting one of its famous daughters.

MARRIAGE TO GIUSEPPE VERATTI

Many men in Bologna who supported Laura in her intellectual pursuits believed that an "extraordinary woman" like her should remain single and virtuous; and that if she did get married, she should abandon her research and stay at home and take care of her husband and children. There was also the matter of rumors and gossips about her, a single woman, meeting men in the evening, even if the object of the meeting was for intellectual debates and discussions on philosophy and science. So, if she remained single, the rumors would continue while if she gets married, the rumors and gossip would stop. She had to find a husband who would understand and support her commitment to science. She found these qualities in Giuseppe Veratti, a graduate of natural philosophy and medicine. Although his degree was in medicine, he was more interested in physics, a subject Laura was very much interested in.

Giovanni Giuseppe Veratti was the fourth of the nine children of Francesco Veratti and Rosalia Calvoli Veratti. Francesco was also a physician. In 1737, just before his marriage Giuseppe was appointed lecturer in physics at the University of Bologna. He was a member of the Academy of Sciences of Bologna and had presented six dissertations between 1733 and 1735, He had begun to be known in science circles, but much less than his wife who was already famous by the time they were married.

On February 7, 1738, Laura and Giuseppe got married at the Basilica San Petronio in Bologna. The marriage put an end to the

gossip and made it easier for Laura to attend the meetings of the Academy of Sciences of Bologna. Laura would often attend the meetings with her husband.

LAURA'S SLOW SCIENTIFIC DEVELOPMENT

On June 27, 1732, Laura did another defense of a second set of theses about the properties of water. This successful defense of a second set of theses led to her being awarded an honorary post as a lecturer in physics at the University of Bologna with an annual income of 500 lire. If she had been a man, Laura would have been called upon to teach students on a regular basis after receiving her degree and lectureship. But because she was a woman, the university did not expect her to give regular classes to male students. The Academy also did not expect her to present her scientific works at their meetings, publish in their journal, or even attend meetings.

There were three major reasons why her scientific progress was slow. First, the University of Bologna put restrictions on her teaching of science and philosophy. Second, members of the Academy of Science of Bologna opposed her active participation and her attendance at their meetings, even after her marriage. Third, the culture at the time that expected intellectuals especially "exceptional" women to be humanists, to write poetry and sonnets when requested by prominent members of the city. They expected her to be a woman of letters not science. This job she fulfilled grudgingly. In fact, she was hoping all requests would be finished when she got married.

While fulfilling requests for poetry and sonnets, she continued to study science, especially experimental physics and the new mathematics (calculus). She studied physics under Dr. Iacopo Bartolomeo Beccari and mathematics under Dr. Gabrielo Manfredi. In 1737, the University of Bologna announced that despite of her sex, Laura would be allowed to give a lesson in each academic semester. She requested an increase in salary and was given an additional 160 lire per year. She was also given official permission to teach regular classes. Laura was interested in the new science, which was based on performing experiments to demonstrate physical concepts. But the curriculum at the University of Bologna remained theoretical. Then, Spanish troops arrived in ologna and the city became an occupied territory. This resulted in the temporary closure of the university. She also suffered a serious illness around this time. After the military and political interruptions, she returned to teach anatomy in 1749. However, she still wanted to return to her own field, experimental physics.

In order to teach experimental physics, she decided to open her own school at home. Together with her husband they established a school which was well attended. Giuseppe taught experimental physics and Laura taught mathematics. Their course in experimental physics complemented the theoretical physics lectures given at the University of Bologna. Laura and Giuseppe also conducted many research projects on mechanics, electricity, physiology, medicine and eudiometry (a method for analyzing gases). Their collaboration as husband and wife was similar to that of Pierre and Marie Curie who would follow in their footsteps 150 years later. Laura's interest in science covered a broad range but she was mostly interested in researching

solutions to problems that were affecting the city of Bologna. One of the main concerns was water, since most of the industries in Bologna - such as paper, hemp, and silk - depended on the use of water. Giuseppe's research originally focused on medical topics. In 1748 he became interested in electricity and its effect on animals and on the human body. In the 1760's Laura and Giuseppe performed experiments on the possible medicinal applications of electricity. Together they made Bologna a center for experimental research in electricity.

Laura's main contributions were in physics, especially Newtonian physics. Her lectures were designed to teach students Newtonian physics. Of the 28 papers written by Laura and which are held in the Bologna Academy of Sciences, thirteen are on physics, eleven are on hydraulics, two are on mathematics, one is on mechanics, one is on technology, and one is on chemistry. Although many of her papers remain in manuscript, having never been published, one of her papers on mechanics De problemate quodam mechanico (A mechanical problem) and one on hydraulics De problemate quodam hydrometrico (A certain problem in hydraulics) were published in the Commentaries of the Bologna Institute in 1757.

The Bassi-Veratti house was not just a school for teaching and conducting research, it was also a place for scientific meetings and exchanges. Italian and foreign scientists visited the house. Among the famous scientists that went to their house and participated in these scientific meetings were Alessandro Volta, Jean-Antoine Nollet, Lazaro Spallanzani, Leopoldo M. Caldani, Felice Fontana, Giambattista Beccaria, and Luigi Galvani.

MEMBER OF THE ACCADEMIA BENEDETTINA

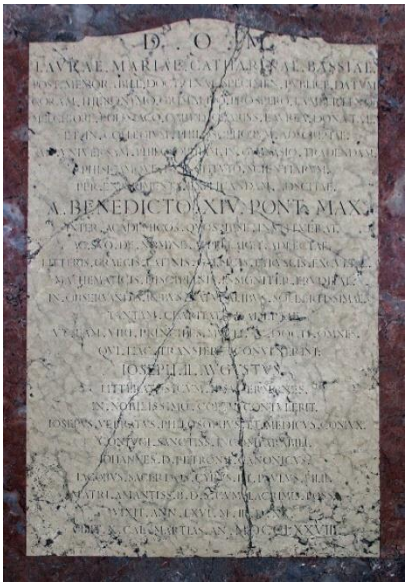
In 1740, Cardinal Lambertini became Pope Benedict XIV. Then in 1745, he decided to create a special group within the Academy and the Institute of Sciences of Bologna. He named the special group "Accademia Benedettina" after himself. His goal was to increase the number and quality of the publications of the Academy, whose output has gone down significantly. He selected the 24 best-known members of the Academy. The members were to be paid 100 lire per year for membership and were expected to present one original work per year. The chosen members were composed of the Heads of Sections at the Institute, their assistants, the President and the Secretary, which amounted to 14 members. Then the next 10 members were supposed to be chosen by these 14 members. When Laura found out that she was not included in the list of 10 members she appealed to Pope Benedict XIV to make her the 25th member so he would not have to remove a male member. For a woman to receive such an honor was controversial! So, Pope Benedict XIV compromised by naming Laura Bassi as a member but with no voting privileges as the other 24. Laura was ecstatic because now she would be able to do her scientific presentations at the academy. As a member she would have to present one original work every year. She would be

able to use the scientific instruments at the Institute for some of her experiments. She would also receive 100 lire annually in addition to her university salary.

ACADEMIC PROMOTION FOR LAURA

When the chair of the physics section of the University of Bologna, Paolo Balbi, died in 1776, the position was split into two. One position was in experimental physics and Laura Bassi was appointed to be the chair and her husband Giuseppe was made her assistant. The other position was in physical mathematics and S. Canterzani, the Secretary of the Institute, was appointed as chair. His assistant was G. Bonaccorsi. Thus, Laura Bassi became the first woman appointed to be chair of physics at a university.

Two years after her promotion, Laura died of a heart attack on February 20,1778 at the age of 66. She had deteriorating health attributed to her many pregnancies and childbirth complications. Her funeral was held at the Church of Corpus Domini in Bologna where silver laurels were put on her head and she was paid tribute to by members of the Accademia Benedettina. She was interred in the church in Via Tagliapietre, in front of the tomb of her fellow scientist Luigi Galvani. Many eulogies were given in her honor by the learned community in Bologna and other cities in Europe and written notices of her accomplishments appeared in the journals serving the Republic of Letters. The Republic of Letters (Res Publica Litterarum or Res Publica Literaria) was the long-distance intellectual community in the late 17th and 18th centuries in Europe and the Americas.



On the right is a photo of Laura Bassi's tombstone.

HER LEGACY

Laura Bassi was a pioneer and trailblazer! She was the first woman to hold a doctorate in science and the first woman to be paid as a faculty member of a university. She was also the first woman to hold a chair in physics in a university.

In 1732, after she defended her 49 Theses, a bronze medal was awarded to Laura Bassi by painter Domenico Maria Fratta and engraver Antonio Lazzari, to celebrate her first series of classes titled "Pubblica Docente e Collegiata". The medal displayed Bassi's image on one side, and on the other, the phrase "Soli cui fas vidisse Minervam" which could roughly be translated to, "Only you can see Minerva". Minerva, the goddess of wisdom, was often associated with Laura Bassi.

After her death, the Institute of Sciences established a commission to judge a competition for a monument to honor their famous female member. The commission chose the marble statue designed by Senator Antonio Bovio Silvestri. After much discussion, it was decided that the marble monument should be placed above the door to the Nautical Room in the Institute where many model ships were housed. When she was alive, Laura always reminded her colleagues that she was not a figurehead but a practicing experimental philosopher who wished to teach and perform research. Now her marble statue positioned above the doors through which the members of the Institute passed made her a scientific muse once again. She was back to her mythological, larger-than-life image as Minerva, the goddess of wisdom!

In 1891, the Scuola Normale Superiore Femminile di Bologna a Laura Bassi, a high school in Bologna was named after her. Now the school is called Liceo Laura Bassi.

A city street, Via Laura Bassi Veratti in Bologna was named after her.

In 1991, a 31-km crater on the planet Venus was named in her honor

The Editing Press offers a Laura Bassi Scholarship thrice in a year since 2018 to junior academics, master's and doctoral candidates. The Laura Bassi Scholarship was established with

the aim of providing editorial assistance to postgraduates and junior academics whose research focuses on neglected topics of study, broadly construed, within their disciplines.

An ice breaker research ship RRS Ernest Shackleton of the British Antartic Survey was acquired by the Instituto Nazionale di Oceanografia e di Geofisica Sperimentale (National Institute of Oceanography and Experimental Geophysics) on May 9, 2019, and was renamed Laura Bassi. In 2024, for the first time, the ship hosted 12 New Zealand researchers as part of an international collaboration for the Programma Nazionale di Ricerche in Antartide (PNRA) (National Antarctic Research Program Programma Nazionale di Ricerche in Antartide (PNRA) (National Antarctic Research Program).

On April 17, 2021, Google created a doodle celebrating Laura Bassi and her many achievements.

The “Laura Bassi” colloquium series was started in 2021 by the Instituto Nazionale Di Astrofisica (INAF) in Italy. The series honors Laura Bassi’s legacy by showcasing the research work of young women astronomers.

The online Bassi-Veratti Collection is a multi-year collaboration of the Stanford University Libraries, the Biblioteca Comunale dell'Archiginnasio, Bologna, Italy, and the Istituto per i Beni Artistici, Culturali e Naturali della Regione Emilia-Romagna, to produce a digital version of the archive Laura Bassi, her husband Giuseppe Veratti, and their children.

HER SCIENCE JOURNEY

1711 - Laura Bassi was born in Bologna, Italy

1716 - Started her lessons with Father Lorenzo Stagani

1724 - Gaetano Tacconi continued tutoring Laura

1732 - Became a member of the Academy of Sciences of Bologna

Received her doctorate degree in science after defending her 49 theses

Bronze medal awarded by painter Domenico Maria Fratta and engraver Antonio Lazzari

1738 - Married Giovanni Giuseppe Veratti

1749 - Started school at their house

1750 - 1760 -Taught experimental physics and conducted her research in different areas of science

1776 - Became the Chair of Experimental Physics section at the University of Bologna

1778 - Died of a heart attack at 66 years old

1781- Marble statue built at Nautical Room in the Academy and Institute of Sciences of Bologna at Palazzo Poggi in Bologna, Italy

1891 - The Scuola Normale Superiore Femminile di Bologna a Laura Bassi, a high school in Bologna was named after her. Now the school is called Liceo Laura Bassi.

1991 - A 31 km crater on Venus was named in her honor

2018 - The Laura Bassi Scholarship was established by the Editing Press

2019 - An ice breaker research ship RRS Ernest Shackleton of the British Antarctic Survey was renamed Laura Bassi

2021 - Laura Bassi Colloquium Series started by Instituto Nazionale Di Astrofisica (INAF) in Italy

Google Doodle honoring the achievements of Laura Bassi

2024- Stanford established the Bassi-Veratti Collection

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The photos and some of the information were taken from these websites:

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