

EXHIBIT



TOPIC
OF THE
MONTH:
WOMEN IN
SCIENCE

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Ecofeminism



Ecofeminism is an idea that links ecological and feminist concerns, considering that the need for both originates from patriarchy. The concept aims to identify the connection between women and the environment, and challenges the existence of an oppressive hierarchical power structure. The term '[ecofeminism](#)' was coined by the French writer [Françoise d'Eaubonne](#) in her book *[Le Féminisme ou la Mort](#)* (transl. *Feminism or Death*). In her book, she relates the oppression of marginalised people to the oppression of nature and argues that oppression from the Western patriarchal society is one of the leading causes of environmental degradation. Due to traditional gender roles, women [are 14 times more likely](#) to die from a climate-change-related disaster than men.

The relationship between social and environmental policies is ubiquitous. Ecofeminism is one of the ways to address the link, especially between women empowerment and the environment. Increased access to healthcare and education for women would ultimately empower them to make independent decisions. This could [lead to delayed marriages](#) and fewer but healthier children. Measures like this will have a cascading effect on the environment by reducing the overall fertility rate in the long run.

In addition to population control, this could affect the management of natural resources. In many countries, women tend to manage the natural capital like food, water, fodder, etc. [About 38.7 percent](#) of working wom-

en are employed in agricultural work. Due to their natural-resource-management roles, pollution, and effects of climate change like water scarcity affect them directly.

Social, cultural and legal restrictions mean lower productivity among women, impacting global crop yields. Closing the agricultural gender gap could therefore reduce the negative environmental impacts of agriculture.

One of the pioneers of the ecofeminist movement in India is [Dr. Vandana Shiva](#). She argues that women share a unique, ethical relationship with the environment, and she strongly condemns the Western patriarchal concept of development. The works of Judi Bari, Petra Kelly and Wangari Maathai delve deep into the nuances of this idea.

Ecofeminism has its own set of criticisms. Towards the end of the 20th century, the idea started to get criticised as essentialism. It has been criticised for focusing too much on the *mystical* connection between nature and women rather than on women's actual social conditions. A. E. Kings called the theory out for not adopting an intersectional approach. Most texts are written in a very academic language, making them unavailable to the general audience.

Ecofeminism is one of the first attempts to connect environmental issues with social issues. Fighting global climate change requires multiple holistic approaches since the boundaries between humanity's problems are constantly fading.

-J. Vishwathiga, B'19

Scientist Features

Cecilia Payne



Cecilia Payne-Gaposchkin was an American astronomer and astrophysicist best known for her conclusion that stars were primarily composed of hydrogen and helium.

Born in England, she developed an interest in mathematics and learnt geometry and algebra. Upon moving to London, however, she attended a girls' school whose curriculum was lacking in the sciences. She studied Newton's *Principia* on her own, and was lent physics books by a teacher. At around 14, she undertook studies of calculus and coordinate geometry by herself, and found a tutor to teach her German (vital for scientists at the time). She eventually won a full scholarship to Newnham College, Cambridge University. Her interest in astronomy began after she attended a lecture by Sir Arthur Eddington. While she completed her studies at Cambridge, she was not awarded a degree on the basis of her sex.

She moved to the United States upon realising her career options were severely limited in the UK, and earned a PhD in astronomy from Harvard University at 25 with her thesis entitled *Stellar Atmospheres; A Contribution to the Observational Study of High Temperature in the Reversing Layers of Stars*. Henry Norris Russell, who is often credited with the discovery, initially disagreed with her conclusions upon reading her dissertation but later reached the same results using different methods, and published them four years later. She spent her career at Harvard, where she was initially not allowed to be a professor (again on the basis of sex), and took on low-paid positions and studied the luminosities of stars, variable stars, and stellar evolution. In 1956 she became the first woman promoted to Professor at Harvard.

-Rithika Ganesan, B'19

Esther Miriam Zimmer

Esther Miriam Zimmer Lederberg was an American microbiologist born in 1922. Born as the eldest child during the Great Depression, things hadn't been easy from the start.

At Hunters College, Esther's professors remarked that a woman had no place in the scientific world. However, she ignored their stinging words and chose to study biochemistry. She began her work as a research assistant at the New York Botanical garden and received her Bachelor's degree in genetics at the age of 20. In 1944, Esther was hired to assist George W. Beadle and Edward Tatum at Stanford University. Her work with them played a significant role in them winning the Nobel Prize of 1958 for discovering the part of genes that regulated biochemical events. In 1946, she received her Master's degree and married Joshua Lederberg, a professor at Wisconsin.

Esther went on to pursue her doctoral degree. During her stint as a PhD student, she isolated the lambda bacteriophage for the first time, and after extensive study established that the lambda phage integrates its DNA into the infected bacteria, unlike other viruses. She went on to discover the 'fertility factor-F' that mediated this transfer of viral genetic material. In 1956, Joshua and Esther Lederberg won the Pasteur Award for their "fundamental studies in bacterial genetics." Two years later, Joshua received the Nobel Prize in Physiology. However, Esther's immense role in the field, including lambda phage isolation and her genetic replication process, was largely overlooked. Although Esther's works accelerated microbiology, she struggled to get a permanent academic position at Stanford University. Her husband, on the contrary, won all the recognition by virtue of being a man.

Nonetheless, recognised or not, Esther's enormous contribution to the field stands tall, casting a shadow over the patriarchal scientific landscape.

-Ashley Roby, B'18 | Sources: [\[1\]](#), [\[2\]](#)



Sonajharia Minz



Sonajharia Minz is a professor at JNU's School of Computer and System Sciences, and the president of the university's teachers' association (JNUTA). Her research interests include machine learning, geo-spatial informatics and data mining. She is also the Vice-Chancellor of the Sido Kanhu Murmu University in Dumka, Jharkhand. Hailing from the Oraon tribe of the Gumla district of the state, she is the second tribeswoman to be appointed vice-chancellor in the history of India. Minz is the daughter of Gossner College's founder and *Bhasha Samman* winner Nirmal Minz, who won the award for his contribution to the development of *Kurukh*, the language spoken by the Oraon people. She herself has been on the frontlines of Adivasi activism and has been an active supporter of Dalit rights. She has also been vocal about the bias that she has faced and overcome in her career and life. In an interview with *The Telegraph*, she mentioned how she could not get into an English-medium school because she was Adivasi, and had to enrol in a Hindi-medium school. The discrimination did not stop there. In a recent panel discussion titled *Intersectionality and Privilege in Science Practice in India*, she recalled an incident when her math teacher remarked that she wouldn't be able to do mathematics and how she should choose a different subject, despite having scored a perfect 100. She said that those words determined her to take mathematics up for her graduation at the Women's Christian College in Chennai. After her post-graduation from the Madras Christian College, she joined JNU for an M.Phil, PhD in Computer Science, and has been teaching at the university for the last 28 years. Apart from this, she has also taught at Bhopal's Barkatullah University and the Madurai Kamaraj University.

-Akshita Mittal, B'19 | Illustration- R. Rajesh

Neena Gupta

Although large advancements in mathematics have been made over the centuries, we discover newer questions and problems each year. Some confounding open problems have kept mathematicians restless for years.

An Indian mathematician, Dr. Neena Gupta, who simplified one such problem, was awarded the Shanti Swarup Bhatnagar Prize (SSB) in 2019, one of India's most prestigious awards in science and technology. Dr. Gupta, an associate professor at the Indian Statistical Institute, Kolkata, is the youngest recipient of the SSB Prize at the age of 35, and only the third woman to have received this award in the field of mathematical sciences. This is just one of the countless awards and honors she has received for her innovative work in algebraic geometry.

She had also been awarded the INSA Young Scientist Award in 2014 and the Saraswathi Cowsik Medal in 2013 for proposing a solution to the 70-year-old Zariski Cancellation Problem in positive characteristic, posed by Oscar Zariski in 1949.



Dr. Gupta hopes that her work inspires young researchers who can initiate research in associated conjectures which remain open. As she thanks her parents for letting her pursue higher education, she believes that similar encouragement by parents of girls would resolve the gender disparity in the scientific community.

-Aadhya Krishnakumar, B'19

Women in Science, Women and Science



For centuries, it has been believed that gender inequality is supported and even propounded by science. For most people, science's verdict on gender differences is seen as a possible source of vindication of their beliefs. The scientific method is assumed to be free of biases and prejudice and is meant to be entirely objective. However, the influence of culture and society on scientists' perspectives and the work they produce is evident and also inevitable.

Women are underrepresented in STEM and academia—even Googling 'famous scientists' or looking up faculty members or postdoctoral researchers at any institution yields very few women and fewer transgender or non-binary people. The general trend observed is that girls do exceedingly well in math and sciences at school and undergraduate levels, but their numbers slowly peter out at higher levels of study. This underrepresentation, especially in developing countries, is often attributed to the supposed intellectual and physical inferiority of women, and often, this can seem like a logical conclusion. However, upon further reflection, it is clear that underrepresentation is not a result of some natural order of things—women face many more obstacles. In her book *Invisible Women: Data Bias in a World Designed for Men* [1], author Caroline Criado Perez lists three main reasons for gendered data bias and prejudice favouring men: the female body, women's unpaid care burden (in the form of housework, motherhood, and emotional labour), and [the prevalence and social acceptance of] male violence against women—and it would seem that these factors are the same that prevent more women from being on the tenure track.

A 2014 study [2] by the US Bureau of Labor Statistics shows that only a fifth of men do housework daily, as opposed to half of women. It is also almost always women who end up taking parental leave. The often-cited Yale study (Moss-Racusin et al. 2012) [3] demonstrated that both male and female science faculty were equally likely to exhibit gender bias favouring male students. Women also face sexual harassment (gender harassment, unwanted sexual attention, and sexual coercion) [4] at every point in their education and careers, STEM or otherwise—while this fact is not as disputed as the former three, it comes detached from the harassers, who include the likes of some of the biggest names in science. We tend to uphold the achievements of such scientists, typically men, but dismiss their mistakes, even scientific ones. Women, however, have their achievements diminished—it is no secret that Rosalind Franklin's work was the key to DNA, but the Nobel Prize went to Watson and Crick, and it is their names that are mentioned in every textbook. Nettie Stevens' name is less known, and credit for her work proving that sex is determined by chromosomes and not the environment is still given to Thomas Hunt Morgan. Dame Jocelyn Bell Burnell discovered radio pulsars, but her supervisor received the Nobel Prize, and similarly, Cecilia Payne-Gaposchkin's supervisor is credited for her findings on the sun's composition.

Darwin believed females were less evolved than males, and thus intellectually inferior. Darwin's judgement and scientific ideas were highly influenced by his society and the general treatment of women at the time. Such biases lingered long after his time—C.V. Raman refused to admit Kamala Sohoni on the grounds of her gender, although

two women had previously been admitted to the Indian Institute of Science—and such biases still linger today, but remain unsupported by science.

In her 1894 book *The Evolution of Woman*, Eliza Gamble criticises and highlights contradictions in the theories of many leading (male) scientists at the time. She points out that while Darwin justified the superiority of men with their larger average physical size, he also claimed that gorillas could not become higher social creatures like humans as they were too big and strong.

Scientific studies today support Gamble's critique—male babies are more likely to suffer from complications during birth due to their larger body and head size, and are 60% more likely to be premature. [5] Women tend to survive better at every stage of life than men (when given equal care and not subject to practices such as female infanticide and medical mistreatment). Despite an abundance of evidence [6] that points to women being more robust, the dogma of men's physical strength translating to superiority persists.

It was believed up until very recently [7] that in the human womb, all fetuses start off physically female, i.e. the default blueprint is female. The process of parthenogenesis is well-documented in several species. The offspring in asexual methods of reproduction such as mitosis and meiosis are called 'daughter cells'. It is interesting that though biology suggests that female-ness is the default, society, language, culture, and science suggest otherwise—the cisgender heterosexual male is the norm, and anything other than that is a deviation, referred to as the generic masculine or the male-default in *Invisible Women*. The male-default has, more often than not, led to errors. Male

clinical trials and drug testing have had horrifying consequences [8], [9]. Archaeologists have dogmatically identified female remains as male, despite abundant evidence to the contrary [10]. Piano sizes, phones, office temperatures, shelf sizes all tend to be designed to cater to men [1], albeit unintentionally. Fetuses deviate from the female-default upon exposure to androgens. The discovery of sex hormones was used to further justify the differences in the sexes, i.e. the intrinsic superiority of man and inferiority of woman, and the discovery had an impact on society as well, with fad hormone treatments becoming quite popular. When it was found that both androgens and estrogens were present in both sexes, causing the strongest argument asserting inherent sex differences to collapse, a possibility for a reexamination of what sex meant arose, according to Angela Saini's *Inferior* [6]. The binary gender ideals that society at the time wanted to champion were at odds with the more fluid nature that endocrinology was hinting at.

Anthropologist Margaret Mead put forward the idea that it was cultural expectations that were shaping sex, or rather, our perception of it. Gender and sex are now recognized as distinct, but intersecting, in most circles. According to Perez, sex is not the reason women are excluded from data; gender is—women are treated a certain way because they are perceived to be female. It's clear that working to actively represent gender-minority folks in science leads to not just social justice, but also *better science*. Modern science and academia are social ventures; not one case exists where broader and different perspectives do not benefit the cause. It is vital to ensure that we celebrate and highlight the research and work of gender-minority people every day of the year, and not just their experiences as minorities in the field for a mere 24 hours.

-Rithika Ganesan, B'19

Highlighting Trans Women in Science

Gender is probably one of the most misunderstood classifications in our society. It presents itself to us in every choice we make and every step we take. Science textbooks have taught us that XX means woman and XY means man—implying that one's sex translates into their gender, which is incorrect and outdated. This oversimplified categorisation of sexes is based merely on external genitalia, which is incorrect as J. Vishwathiga has explained in her piece [The Complexity of Biological Sex](#). Gender identity, to begin with, is different from biological sex, and has no lines of separation or division. Outdated biology, which is still taught in schools today, has left generations so narrow-minded that they believe what doesn't conform to one or the other is unnatural.

[Dr. Joan Roughgarden](#), an American ecologist and evolutionary biologist, came out as a transgender woman on her 52nd birthday. This prolific Stanford professor has made seminal contributions to ecology, mathematics and in blurring their boundaries. Her contributions to the field have been far ahead of her time, leaving her peers to trail behind. Meanwhile, Dr. Roughgarden has highlighted how predisposed bias towards sexes and their understanding has corrupted scientific studies. In her book *Evolution's Rainbow*, she discusses how her personal life journey led her through a road not taken in the research field.

[Brigitte Baptiste](#), a biologist and a well-respected

campaigner for biodiversity, identifies as a trans woman. Brigitte has also extended her activism to a cause closer to home, the LGBTQ+ community. In one of her interviews, Brigitte confesses how she fails to understand people who make gender identity a controversial topic. At its heart, this is a reasonably simple human desire—to be who you want to be.

Dr. A Mani is an Indian scientist and a senior elected member of the International Rough Set Society, and a lesbian trans woman. Her [blog](#) documents her transition and describes her struggles with mental health issues. She discusses how her experience with gender dysphoria (a feeling of distress that occurs in people whose gender identity differs from their assigned sex) and depersonalisation were further [aggravated by the discrimination](#) she experienced in academia. Yet, she was able to rise above the odds and set a benchmark for others.



The isolation, ignorance and discrimination that these women face in their respective fields are disheartening. While there have been massive global policies and agendas, like the UN Sustainable Development Goals and campaigns like *#WomeninSTEM*; these efforts and campaigns fail to include non-binary, trans women, or girls of colour, almost abandoning half of the population these campaigns have the responsibility to support. If we were to analyse the situations and problems that trans women run into in the STEM field, one is likely to hit a dead end as reports and studies of gender disparity are almost non-existent.

[The Global Health 50/50 Report](#) decided to undertake the challenge to find out how gender-responsive the world's most influential global health organisations are. The report found that only 10% of the organisations recognised gender diversity and fulfilled transgender and non-binary people's needs. It also revealed that 126 out of 140 global health organisations failed to include

trans people in their policies, programs, or reporting.

This leads us to the reason why there are very few trans women in the research field. Resources and incentives that support trans women in continuing their school education are scarce. Even when they cross such high barriers, what awaits them are the prejudices and workplace inequality that make it further challenging to emerge as members and leaders in STEM professional organisations. Trans women who seek employment are most likely to be turned down due to their gender identity. Some workplaces do not allow trans people to use the bathrooms that align with their gender identity. This is not a trivial issue because if you cannot use the bathroom at work, you cannot work.

STEM organisations have finally begun to wake up to the call of gender-diversity and inclusion and are finally addressing the staggering inequity in their workforces. Here are some steps that an organisation can take to support trans women:

1. Recruit trans students and researchers

Scholarships, funding, internships and mentorships, competitive offers, and recruitment strategies to identify and support transwomen is the first step to gender-inclusive academia.

2. Non-discrimination policies

Explicit educational and workplace policies that affirm all gender identities and punish the violators must be in place.

3. Provision of gender-inclusive culture

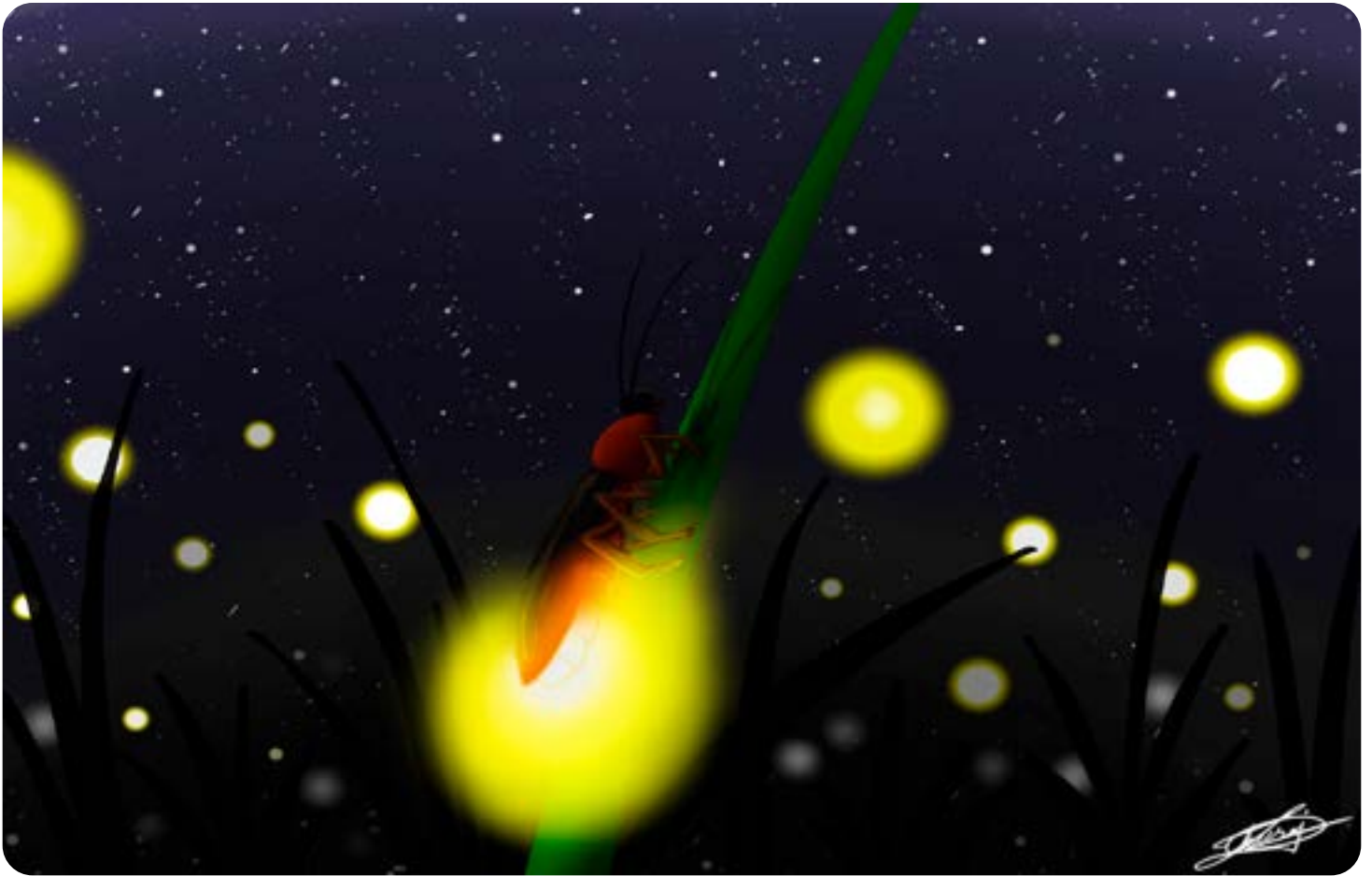
A supportive environment that uses the correct names and pronouns, organises events that cultivate a sense of belonging amongst trans students, and most importantly, a culture that stans their choices.

The internet boasts a few comfortable and healthy niches that support transgender communities in more ways than one, like the [500 Queerscientists](#) and [LGBTQ+ STEM](#).

Meanwhile, let us hope that science one day becomes a level playing field, where anyone curious enough can explore and be rewarded, regardless of their gender or sexual orientation.

-Ashley Roby, B'18

ESI Species of the Month: *Abscondita chinesis*



The Dwindling Lights

Abscondita chinesis, a species of fireflies found in Andhra Pradesh, has become a matter of concern in the past few years—the reason being a drastic decline in their number since 1996. Researchers have stated that their number has fallen from 400 to 500 per sq m. to a mere 10-20 per sq m.

The most prominent reason is the loss of this species to air and light pollution. We have already lost the twinkling stars (thanks to air and light pollution), and accompanying this is the loss of natural beetle torches.

Yes, fireflies are actually beetles! Bioluminescent flashes of lights generated by these beetles are vital to their survival. These flashes determine their mating partners and also protect them from predators. Each species of fireflies has a unique flash pattern; not only this, the patterns are sex-dependent. These flashes of light result from a regulated mechanism at the core of which lie two gases, namely oxygen and nitric oxide. The light organ utilizes oxygen to generate these flashes, and the availability of oxygen to this organ is intricately controlled by nitric oxide presence.

Did you know, though, that not all fireflies emit these characteristic flashes? These flashy developments are found to be a recent adaptation. Researchers have found a few firefly species that use only the ancestral pheromone-based mating approach. These species are said to be a link between the ancient ancestors and the newly found “fireflies”.

The introduction of artificial lights confuses beetles trying to recognise the signals and choose the right and healthy mating partners. This reduces the number of mating events and eventually decreases the beetle count. Also, now that predators have become familiar with artificial lights, they are no longer afraid of these bioluminescent flashes, bringing down their number even more.

Other sources of pollution, like water pollution due to excessive use of insecticides or pesticides, reportedly affect the beetle’s larvae, thus causing a premature death way before they vaunt their beauty. The quest of humanity towards a cleaner and disease-free environment by getting rid of marshy lands and small water lakes is quite a severe

problem for these tiny creatures because they depend significantly on such habitats to lay their eggs. This needs to be taken into account when we talk about cleaner environments.

However, there have been some recent awareness programmes in the form of festivals to celebrate the presence of these beauties. Ironically, these festivals make use of flashes, lights and cameras, which are artificial lights affecting the beetle. This is in addition to human interference in their habitat that might severely jeopardise their survival. Revamping these festivals to let everyone enjoy the twinkles while ensuring the fireflies are not harmed is vital.

If we wish for these beautiful creatures' long life, then we need to find some expeditious measures to restore their numbers so that they can sustain themselves before the light of hope disappears.

-Siddharth Kurne, B'18 | Art- CL Dheeraj, B'17

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Have any science-related questions you'd like answered? Send them to us and we'll get our best minds on it!

