

Unravelling Bias in Science

INSPIRATIONAL

stories for

young

SCIENTISTS

Presenting the stories of:

ROSALIND FRANKLIN = WANDA DIAZ-MERCEO = JOHANNA WESTERDIJK
TEMPLE GRANDIN = BART SPEE = RONDA PATRICK = PRIYANKA VERMA
ALEXA IRENE CANDAY = KIZZMEKIA CORBETT = MARY MUNSON RUNGE
PERCY JULIAN = RUTH ELLA MOORE = MARGARITA SALAS FALGUERAS
TIGIST TAMIR = HYUN YOUK = TOMI AKINGBADE = EMERY HALEY



UMC Utrecht



Utrecht University



This e-book is composed by students from Utrecht University, the Netherlands,
as part of the *Unravelling Bias in Science* course, an elective course
hosted by the Biomedical Sciences bachelor program:

SIMON ALKEMA
MADDIE BELNAGER
JOERI BODEWES
NIELS BOERSBROEK
YANNICK BOSBOOM
LINDE VAN DIJKEN
ESMÉE HAENEN
ESTELLE HUNTER
LUDO JANSSEN
JULIA KOOIJ
ELINE KOUWENHOVEN
TOM KROON
SARA MARTIN GARCIA
CARYS PULLES
IRENE ROU
ROMY SCHORNAGEL
BRAM SCHOUTEN

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Janine Geerling
Course coordinator
Unravelling Bias in Science

Gönül Dilaver
Program director
Bachelor Biomedical Sciences

PREFACE

Celebrating diversity within the biomedical research community

Increased diversity within scientific research teams strongly benefits the quality of the teams' scientific output. Among others, diverse teams tend to be more creative, innovative and efficient in their scientific approach. Additionally, having a diverse research team can increase the inclination of study participants from diverse backgrounds to participate in a clinical study. This offers both ethical and health benefits as a greater diversity in the study population, provided that this is relevant for the research question, in its turn increases the generalizability of the study results.

However....

Historically, the scientific community has been dominated by white, cisgender, heterosexual men. As a result, representation of women and under-represented minorities, e.g. in terms of gender, race and ethnicity is low. This is especially the case within the fields of Science, Technology, Engineering and Mathematics (STEM). This gap between majority and minority groups is present at all academic levels but becomes increasingly larger when going higher up the academic ladder. - a phenomenon also known as the 'leaky pipeline'.

One of the factors hypothesized to underlie this leaky pipeline effect is the lack of positive role models for women and people of under-represented minorities within STEM. People from minority groups might feel a lower sense of belonging and/or could implicitly start believing that they do not fit within the academic community as they do not see themselves represented in its members. As a result, students with a minority background tend to drop out of the academic pipeline. To counteract this phenomenon, it is suggested that the promotion of diverse role models within the STEM community could increase the retention of women and under-represented minorities in STEM. Importantly, a recent study within the Utrecht Faculty of Medical Sciences has shown that, at least in the context of medical education, students tend to approach a role model as a 'mosaic' of elements from different people rather than a role model being embodied by one single person. This underscores the need for promoting a broad range of diverse role models within our scientific community.

That is why we created this e-book!

Inspired by the *Good night stories for rebel girls* series by Elena Favilli and Francesca Cavallo, this e-book aims to showcase the (relatively invisible) diversity within our scientific community. By spotlighting researchers with a broad range of diverse backgrounds we hope to inspire *all* young scientists, regardless of their own background, to pave their own path as a biomedical professional - be it here at Utrecht University or anywhere else in the world.

JOHANNA WESTERDIJK

Johanna Westerdijk (1883-1961) made history as the first female professor in the Netherlands, marking a significant step towards greater equality in science. In a time where it was unusual for a woman to pursue a scientific career, she followed her passion for nature and attended the University of Amsterdam to become a biology teacher. After her studies, she became a director at Willie Commelin Scholten, a phytopathological laboratory in the Netherlands. Under Westerdijks supervision, the International Association of Botanists collection grew into the largest collection of living fungi in the world.

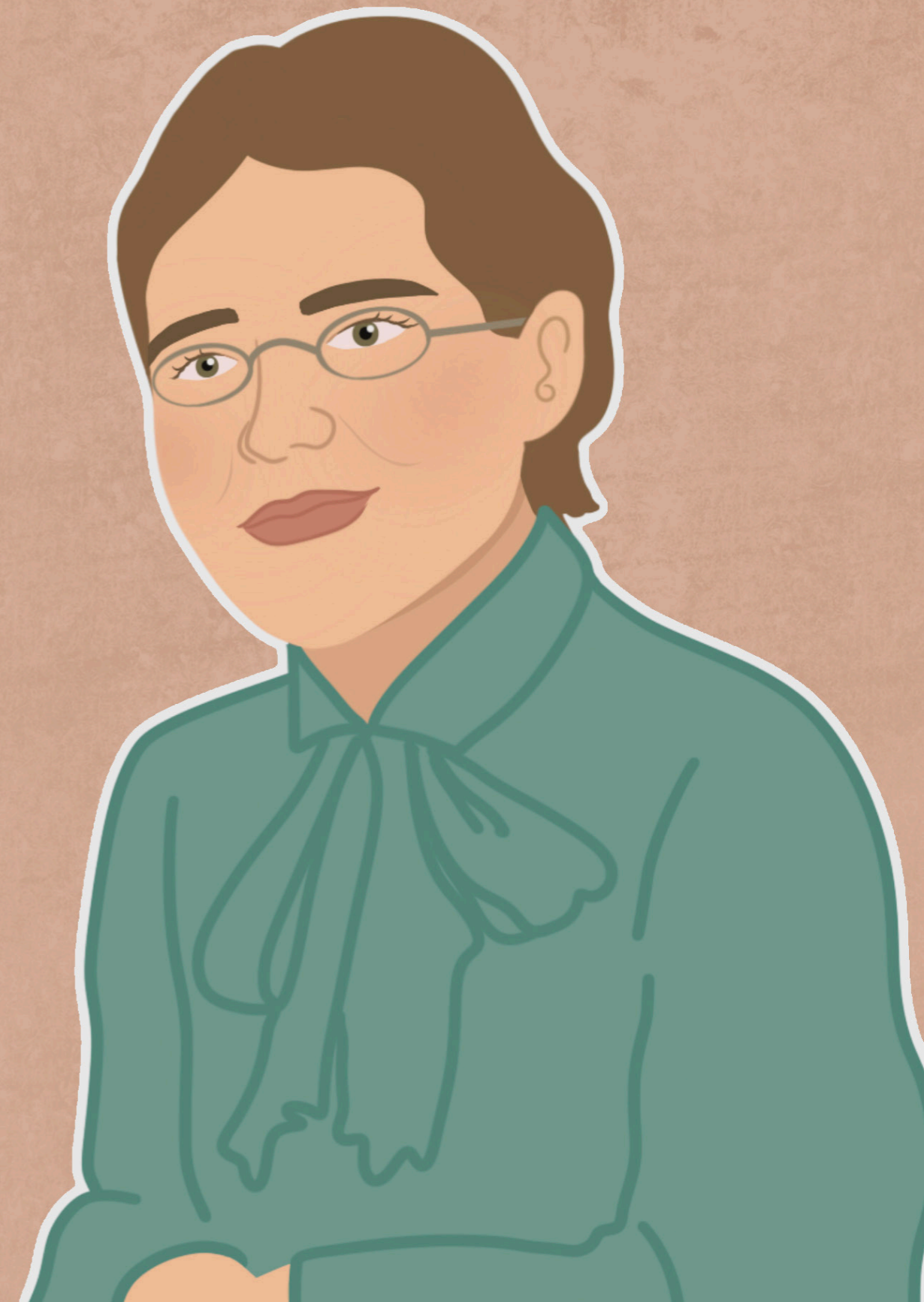
All her hard work in plant pathology and mycology led to her appointment as the first female professor in the Netherlands in 1917. As an associate professor of plant pathology at Utrecht University, she not only made groundbreaking contributions to science but also addressed significant social challenges of her time, such as combating elm and potato diseases.

In addition to her groundbreaking research, Johanna aimed to use her position as an associate professor to improve the role of women in science, mostly by often hiring female students for laboratory positions. She also participated actively in organizations for women in science, both nationally and internationally. Moreover, she sought to make science more accessible by engaging with not only fellow scientists, but also with the general public. She tried to do this by writing articles and hosting open-information days for everybody interested in her research.

Johanna's life was not just about plant pathology and mycology. Johanna loved yodelling and good parties, living by her motto: "working and partying form healthy minds".

"When life gets dull and monotonous,
even a fungus dies off."

= JOHANNA WESTERDIJK =



Text by: Romy Schornagel
Artwork by: Robin Bos

"The greatest challenge I faced in becoming a neurosurgeon was believing it was possible."

= ALEXA IRENE CANADY =



ALEXA IRENE CANADY

Alexa Irene Canady (November 7, 1950) was the first Afro-American woman in the US to become a pediatric neurosurgeon.

Whilst growing up in a white dominated society, she already faced racism: She tested a high score on her intelligence, but her results were swapped with the lower results of a white student. However, her parents encouraged her educational development.

Canady almost dropped out of college due to a 'crisis of confidence'. She decided to continue after she fell in love with medicine during a minority scholarship. In 1975, she graduated cum laude at medical school. After graduating, she found it difficult to convince the chairman that she was the right candidate for neurosurgical residency. However, her biggest obstacle was 'believing it was possible to become a neurosurgeon.' Unfortunately, she still experienced racism during her residency. A colleague once said: 'Oh, you must be our new equal-opportunity package.'

Due to her work as a neurosurgeon, the hospital achieved national recognition as a top pediatric neurosurgery department. After only 4 years she became the chief. She also continued doing research, which led to the invention of a programmable antisiphon shunt to treat hydrocephalus. She became known for her "patient-care first" techniques and received a lot of awards.

It was only later that she realized what an inspiration she was to other women and African-Americans: 'It later became clear to me that it was more significant than I realized'. After retiring, Canady nowadays gives commencement speeches and encourages young women a career in medicine.

EMERY HALEY

Dr. Emery Haley is a nonbinary science communicator with a passion for diversity within the STEM community. They believe that they can combine their passions for writing and science to help address the disconnect between the scientific community and the rest of society. That's why they now work as a scientific writer.

They were born and raised in Huntsville, Alabama. In December of 2016, they received a bachelor's degree in neuroscience from the University of Alabama in Birmingham. In 2022 they finished their PhD and received a doctorate in cell and molecular biology from the Van Andel Institute.

During their PhD, they went into their social and medical transition, which was difficult. It was a big step to communicate with colleges under the right name and pronouns, but now they are proud of their commitment to be their true self no matter the challenges.

Besides their personal growth and transition, they also think it is important to invest and give back to the next generation. That is why they volunteer with several community organizations and events that focus on reaching out to kids. This way they break down stereotypes and inspire kids to pursue science.

Outside of science they also volunteer at the Grand Rapids Pride Center, to stay involved with the 2-SLGBTQ+ community and give support to kids that wasn't available to them when they were a kid.

Text and artwork by:
Estelle Hunter



"As approximately 1 percent of the world population, gender diverse individuals are a minority, but we don't have to be invisible."

= EMERY HALEY =

“A country without investigation
is a country without progress”

= MARGARITA SALAS FALGUERAS =



≡ MARGARITA SALAS FALGUERAS ≡

Born in Asturias, Spain (1938-2019), Margarita Salas Falgueras was a brilliant scientist who pioneered the fields of biochemistry and molecular genetics. She was raised in a supportive family that championed education without succumbing to gender biases. This upbringing fueled her intellectual curiosity, leading her to pursue chemistry at the Complutense University of Madrid, where she earned her Ph.D. in 1961. Mentored by renowned researchers, Salas began under Alberto Sols in Spain and later collaborated with the esteemed Severo Ochoa, even following him to the US.

Her most notable contribution lies in the discovery and characterization of Phi29 phage DNA polymerase, an enzyme that plays a critical role in DNA replication. This invention has proven to have immense value in fields like oncology, forensics, and archaeology.

During her career, Salas not only pioneered groundbreaking research but also occupied esteemed positions. However, her path was full of obstacles, particularly as a woman in science during an era plagued by gender bias. Despite being overshadowed by her husband, Eladio Viñuela, and disregarded due to her gender, she confronted these challenges with courage and ultimately prevailed.

Her achievements were widely recognized. She became the first woman in the Royal Spanish Academy (2001) and received the L'Oréal-UNESCO Science Award (2004). King Juan Carlos I ennobled her in 2008 (Marquesa de Canero).

Margarita Salas's legacy extends far beyond the scientific discoveries she made. She is remembered as a scientific pioneer who shattered stereotypes and inspired future generations of researchers, particularly women, to pursue their passions in science. Her unwavering dedication and fight against gender barriers continue to be a source of inspiration for many.

Text by: Sara Martín García
Artwork by: Robin Bos

BART SPEE

Dr. Bart Spee is a professor and teacher at Utrecht University, with a passion towards hepatocytes and stem cells. The path Dr. Bart Spee walked towards becoming a professor is different than most professors. Becoming a professor was harder, because of his lower and more practical degrees.

Dr. Bart Spee was raised in Gouda and finished his high school with a Mavo degree, which is a lower level of degrees than most professors have achieved. After his Mavo degree he went to a MBO (vocational secondary education in the Netherlands) laboratory in Noord-Rotterdam. Here he opted for the less popular specialization: molecular biology. The course was quite simple for him, what led to the opportunity to start a course at university of applied sciences in Utrecht after he got his propaedeutic degree. He chose to finish his MBO degree to get more practical experience in genetic analysis of different animal species through an internship in Wageningen.

The Bachelor Molecular biology at University of applied sciences in Utrecht was well regarded and gave him an internship in veterinary at Utrecht University with different cell systems for disease modelling. His professor Jan Brokhuizen helped him to start his PhD research without a master's degree into regenerative livers in animal models and became his mentor during his PhD.

During his career, people around him told him to become an analyst, because it suited him better. The criticism motivated him to show people that everything can be done if you really go for it.

Text and artwork by:
Tom Kroon



*"To quote Nelson Mandela:
It always seems to be impossible,
until it's done."*

= BART SPEE =

"I have lived a life of peace and enjoyment,
loving my family, friends, church and all."

= RUTH ELLA MOORE =



RUTH ELLA MOORE

Ruth E. Moore, born in Ohio 1903, made history by becoming the first black woman to achieve a PhD in the natural sciences. She lived in an environment where she faced a lot of discrimination, showing tremendous perseverance and courage.

When Moore was born, the Emancipation happened only 40 years earlier. Despite facing adversity, Moore's mother encouraged her to get an education. Moore attended the Ohio State University where she earned a Bachelor and Master of Science degree and in 1933, she earned a PhD in bacteriology. Her dissertation was on tuberculosis, which was the second largest cause of death in her time. Her work contributed to the eventual control of the disease.

However, racism and sexism were daily obstacles Moore had to endure while achieving her goals. She was allowed to enroll at OSU, but not able to fully participate. OSU handled segregated housing, dining, library, and restroom facilities between black and white people. She was not even allowed to enter some classes, forced to sit outside of lecture rooms and was never assigned a lab partner due to racism.

Despite living in the presence of such segregation and discrimination, Moore persevered and earned 3 degrees. Moore had a successful career, was promoted assistant professor, and became acting department chair of microbiology. However, her work was only honored in 1986 in a black ASM meeting. While Moore did not get the recognition she deserved in her time, Moore's legacy now serves as a symbol for the barriers she endured and overcoming them with utmost resilience.

Text by: Esmée Haenen
Artwork by: Robin Bos

TEMPLE GRANDIN

Dr. Temple Grandin is an academic with autism in the fields of both animal behaviour and autism. She helped gain new insights into the autism spectrum disorder by combining the existing knowledge and her own experiences.

Born in 1947 in Boston, Massachusetts, Grandin was unable to speak until the age of three and showed behavioural problems in her early childhood. Her parents placed her in a private school, ignoring a doctor's advice to place her in an institution. Grandin received her bachelor's degree in psychology in 1970 from the Franklin Pierce College, a master's degree in animal science in 1975 from the Arizona State University and a doctorate in animal science in 1989 from the University of Illinois.

She was not formally diagnosed with autism until her adulthood. People perceived her as 'weird' throughout most of her career, leaving her feeling socially isolated. However, she experiences positive sides of her autism as well. Her extreme visual thinking, a trait of autism, proved beneficial in working with animals.

Grandin addressed parts of autism that had been unnoticed in previous research. Neurologist Oliver Sacks wrote in the foreword of her book *Thinking in Pictures* that her work is 'unprecedented, because there had never before been an inside narrative of autism'.

Besides her work on autism, Grandin is a big spokesperson for animal welfare. She has designed more humane livestock handling processes, reducing stress, panic and injury to animals, motivated by her own experience of anxiety and feeling threatened by her environment.

Text by: Niels Boersbroek
Artwork by: José van Holland



"I am different, not less"

= TEMPLE GRANDIN =

B.J.H.

"I still feel that my own good country, noble as she is, robbed me of the chance for some of the great experiences that I would have liked to live through.

Instead, I had to do like many Americans, I took a job where I could get one, and I tried to make the best of it."

= PERCY JULIAN =



PERCY JULIAN

Dr. Percy Julian was a scientist who became well known for his contributions to the pharmaceutical industry, despite the enormous obstacles he faced during his career because of his black skin color.

Percy Lavon Julian was born in 1899 in Montgomery, Alabama. He grew up in a time where education beyond the eight grade was very rare for African-Americans. He graduated from DePauw university, after which he attended Harvard university, where he finished his master's degree. However, because of his skin color, he didn't get the possibility to pursue his doctorate at this university.

After obtaining his PhD at the university of Vienna in 1931, he returned to DePauw university. At DePauw university, he synthesized physostigmine, the first drug treatment for glaucoma. Even after this discovery, he was still denied the status of professor because of his black skin color.

Julian's determination led him to significant breakthroughs in chemistry. His pioneering work at the Glidden Company, including the synthesis of progesterone, testosterone and cortisone from soybeans, revolutionized the pharmaceutical industry. This last discovery made cortisone production on an big scale possible. Because of this bigger production, the use of cortisone in the treatment of rheumatoid arthritis was finally possible on a commercial scale.

Dr. Percy Julian achieved great results in his career, even with all the obstacles he endured. His story is a great inspiration to many about perseverance and the fight against injustice.

PRIYANKA VERMA

Dr. Priyanka Verma is an award winning researcher in cybersecurity at the Confirm SFI smart manufacturing research center. She became a new mother while working in STEM and applying for the Marie Skłodowska-Curie Actions fellowship. However, she did not let this pregnancy stand in her way to achieve her goals.

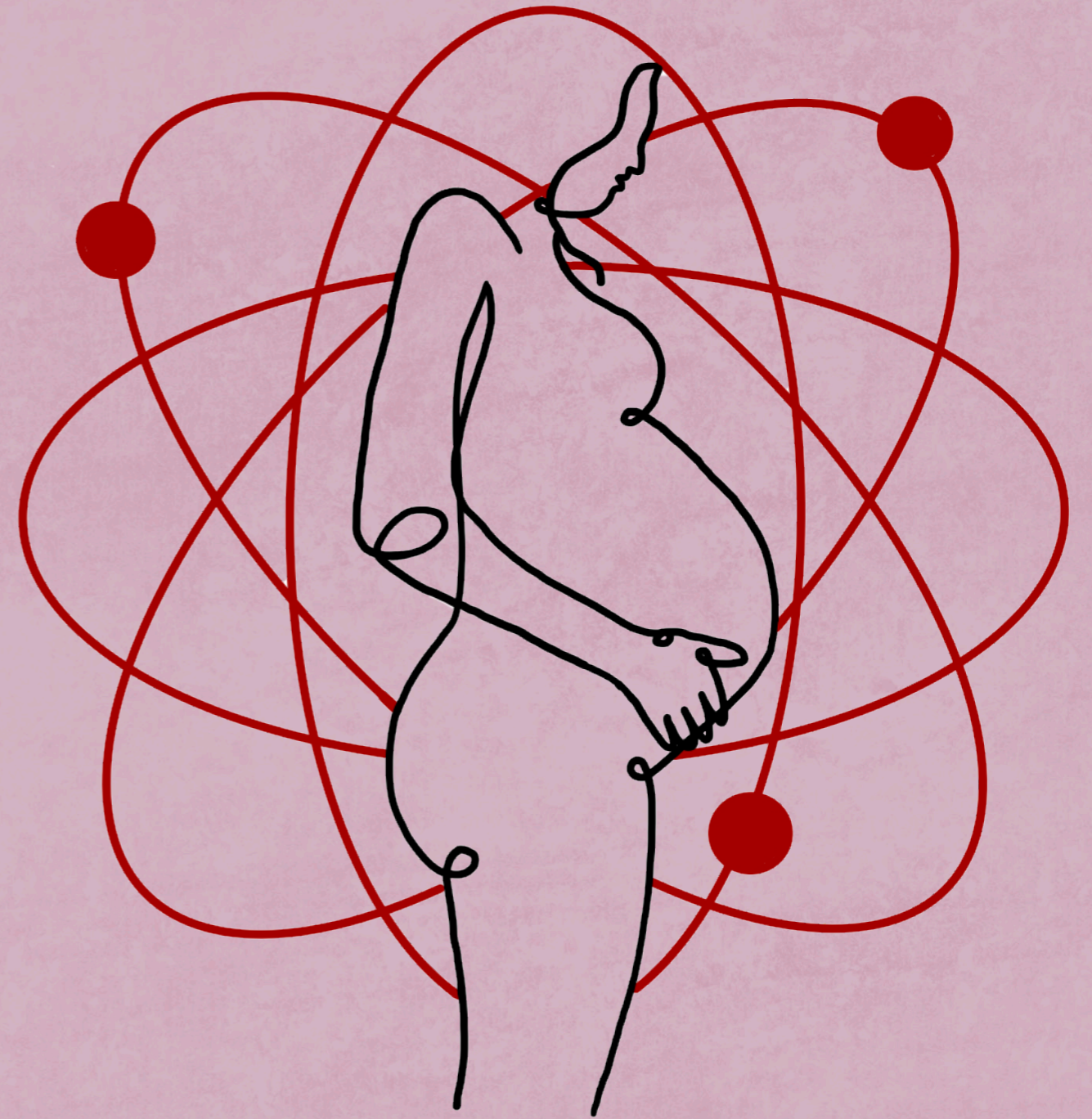
In February 2021, Priyanka started preparing her proposal for her application of the MSCA fellowship and in March she found out she was pregnant. She was advised not to spend more than four hours at a time on the laptop, what was impossible for her if she wanted to achieve her goal. To balance her health, work, family and fellowship proposal, she made a proper timetable which was very difficult and not always possible to follow. This all even during the extra challenges of Covid-19.

She pushed through and submitted her proposal and also completed her PhD on Information Technology and Cloud Security. In June she got the news that she got an interview for the fellowship and she started preparing while being four months pregnant.

Her extreme hard work during her pregnancy paid off, because she got selected for the fellowship. However, due to her pregnancy and Covid-19 she could not travel and could not start her fellowship directly. Luckily, the fellowship could be postponed by three months.

On 8 December she gave birth to a baby boy and only a month later Priyanka and her family moved to Dublin where she started her fellowship. There she works on Security Techniques Against Cyber Threats in Smart Manufacturing Industries projects.

Text and artwork by:
Irene Rou



“Motherhood became the source of motivation and encouragement to achieve my goals, not the hurdle in my life.”

= PRIYANKA VERMA =

“The greatest experience was helping poor African American people who couldn’t even pay for their medicine. The pharmacy gave me an opportunity to help people who needed help.”

= MARY MUNSON RUNGE =



MARY MUNSON RUNGE

Mary Munson Runge, an African American woman, was born in Donaldsonville, Louisiana. Growing up, Mary watched her father, a physician and pharmacist, provide medications to people who could not afford them.

This greatly inspired Mary to become a pharmacist as well and in 1948 she graduated from Xavier University of Louisiana College of Pharmacy. At this time, there were very few female pharmacists and segregation laws were still enacted in some states. After graduating, she became a hospital pharmacist for 21 years in California. During this time she raised a family and she became president of two different hospital pharmacist society’s in California.

After being a hospital pharmacist for so long, Mary became a community pharmacist, serving in areas with African American communities with lower incomes. Helping people with lower incomes, just like her father did, was something she found great fulfillment in. In 1979 Mary became the first female, the first African American and the first employee community pharmacist to be elected president of the American Pharmacist Association (APhA), ending a 126 year history of white male presidents. As president, she was committed to increase minority inclusion in the pharmacy profession.

Mary’s life work serves as an inspiration to many. Three years after her retirement, Mary was inducted into the California Pharmacists Association Hall of Fame. She also served on some federal committees and received the Hugo H. Schaefer Award from the APhA, which recognized her for a lifetime contribution to the APhA and the profession of pharmacy.

Text by: Bram Schouten
Artwork by: Robin Bos

ROSALIND FRANKLIN

Rosalind Franklin, a Jewish woman born in 1920 to a family of Anglo-Jewish scholars, is an influential British physicist renowned for her role in discovering the double helix structure of DNA. Driven by her family, she attended private boarding schools at a young age, to later enroll in Newnham College where she majored in physical chemistry. While the Nazis invaded Europe, Franklin relentlessly continued her degree.

In 1947, Franklin started work in Paris where she studied diffraction techniques. This knowledge paved the way for Franklin to be the first to capture an X-ray image of DNA depicting its density and conformation. This would be called photo 51. Franklin also used crystallography to research viral structure.

Photo 51 helped distinguish the A and B forms of DNA. Her research inspired the double helical model of DNA proposed by Francis Crick and James Watson.

Franklin suffered hardships during her lifetime. She experienced hostility which she believed to be antisemitic and sexist in nature and failed to receive credit for photo 51 until the 1990s. Her diffraction picture was shared without permission by Maurice Wilkins, an adversarial colleague, to Crick and Watson of a competing lab. Crick and Watson were struggling to determine the structure of DNA, but Franklin's photo was the turning point in their research. Without her knowing, Watson published a book on those findings including photo 51.

Today, Franklin is finally recognised for photo 51. Her persistence allowed her to become an undeniably important scientist to the benefit of mankind.

Text and artwork by:
Maddie Belanger

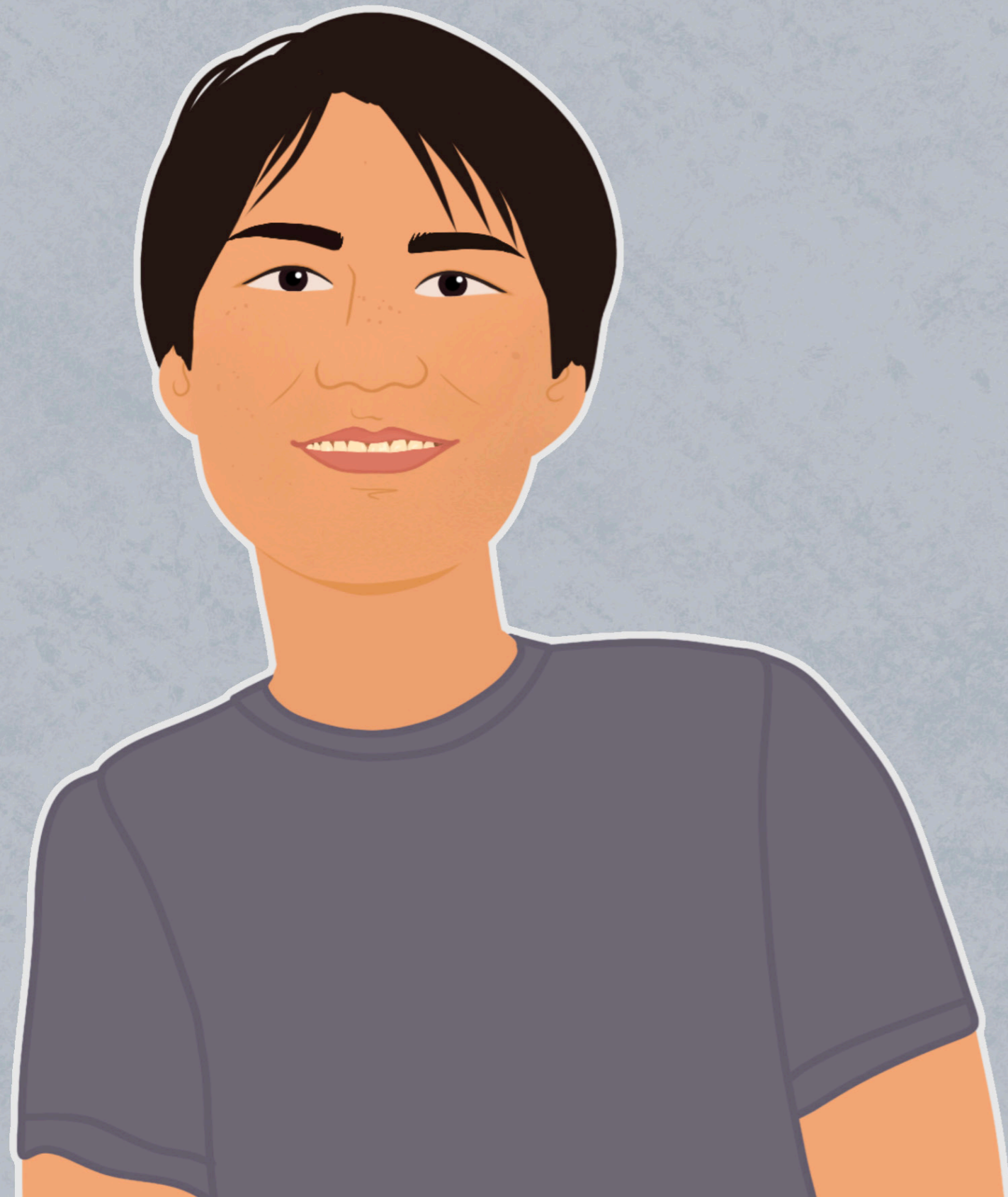


*In my view, all that is necessary for faith
is the belief that by doing our best
we shall succeed in our aims:
the improvement of mankind."*

= ROSALIND FRANKLIN =

"I don't have any magic formula.
I just try my best to be open about
who I am and what I know
and - most importantly -
what I don't know"

= HYUN YOUK =



HYUN YOUK

Dr. Hyun Youk is an Associate Professor of Systems Biology at the University of Massachusetts Chan Medical School. He currently has a lab based in Delft, the Netherlands. Hyun is fascinated by the 'life-death transition' of cells and what it means to be a living or a dead cell.

In his academic career, he faced a lot of mental hurdles. He was the first person in his family to attend university and in some cases he had a challenging time relating to people. For instance, he did not have the same economic background as many of his fellow students.

Because he is gay, some people could think that this was also a hurdle in his academic career. But Dr. Youk argues that coming out as gay gave him some qualities that were very useful to him in his career, such as his self-reflection and grit.

He does acknowledge that being in a minority group in STEM (or in general) can be challenging. According to him, making efforts to promote diversity in STEM are already improving the atmosphere and he is optimistic about where this is going. Being open about each other's values and what you don't know about some people can go a long way.

Text by: Yannick Bosboom
Artwork by: Robin Bos

TIGIST TAMIR

Tigist Tamir is a postdoctoral associate at MIT Koch Institute for Integrative Cancer Research. While doing her postdoctoral she found out that she had ADHD. She finds it important to write about her neurodiversity in the academic world to show people you can face the daily challenges of being a neurodivergent scientist and do what you are passionate about.

Tigist was born and raised in Ethiopia, where she spent her younger years. She started her BSc Biology and Biomathematics at William & Mary in Virginia, Williamsburg. After this she did a PhD Pharmacology at the University of North Carolina at Chapel Hill.

During her time at university she noticed that her studies challenged her a lot. Way more than her peers. In high school, which offered a lot of structure and small classes, she always excelled. However, this changed in university. It put a lot of strain on her executive functions, which made her question her self-confidence. A teaching assistant noticed her interest in research and invited her to work on a project. Everything fell into place. Research created space for novelty, creativity, solving puzzles and many more.

When she got her ADHD diagnosis she felt relief, saying that “sometimes naming something is half the battle”. By educating herself on her neurodiversity and seeking strategies especially for ADHD’ers to excel in research, Tigist found tools to live up to her potential. Her research benefitted by finding people who she related to and could help her to feel more authentic!

Text and artwork by:
Linde van Dijken



“As academics I feel we should strive to create an environment that centers compassion and understanding. We don’t stop being human when we step into the lab, so we shouldn’t shy away from aspects of our humanity either.”

= TIGIST TAMIR =

"I would say that my role as a scientist is really about my passion and purpose for the world and for giving back to the world"

= KIZZMEKIA CORBETT =



KIZZMEKIA CORBETT

Kizzmekia is an African American scientist that has worked on the Moderna COVID-19 vaccine. She grew up in North Carolina in a large family of step-siblings and foster siblings. She realized in high school that she wanted to pursue a scientific career. Kizzmekia received a PhD in microbiology and immunology. For her doctoral work she studied the dengue virus in Sri Lanka. Afterwards she started studying the development of vaccines for coronaviridae, which is a type of virus.

At the start of the COVID-19 pandemic she started working on a vaccine to protect people from coronavirus disease. Her research team partnered with Moderna, a biotechnology company, to manufacture and test the mRNA COVID-19 vaccine. Kizzmekia shared that she cried when the results showed that the vaccine worked.

Kizzmekia is passionate about educating people on health topics. She started educating youth on sexually transmitted diseases at the age of 20. Besides, her opinions have helped gain trust of people within black community in regard to the safety and necessity of vaccinations by visiting black churches and frequently updating her popular twitter page.

During the COVID-19 pandemic, Kizzmekia called for the public to be respectful of each other. She emphasized that we should not stigmatize people who may be from areas where the virus started. Nowadays she is also focused on paving a path to help other black women scientists breaking boundaries. Moreover, she prioritizes hiring individuals from diverse backgrounds to ensure a diverse research group.

Text by: Julia Kooij
Artwork by: Robin Bos

WANDA DÍAZ-MERCED

Dr. Wanda Diaz-Merced is a visually impaired, award winning, coloured women from Puerto Rico. From a young age, Wanda was curious about the stars and galaxies. When participating in a science fair at her middle school, she came in second. This inspired her to pursue a career in STEM.

In her early twenties she started seeing spots in her sight. Later she was diagnosed with degenerative diabetic retinopathy, with a rapidly decreasing eyesight as a result. Even after losing her sight, she still wanted to continue her career in STEM and finish her degree in astronomy.

During an internship at NASA she was able to translate satellite information of the stars, into soundwaves. She used a method called sonification, which turns light waves into sounds, giving her and other visually impaired people access to more information. This allowed her to hear instead of see the stars. Proving anything is possible, if you are creative and think outside of the box!

She went on to finish her studies of physics at the university of Puerto Rico and got her doctorate in computer science from the University of Glasgow, in 2013. She has also won various awards throughout her career.

Nowadays, she travels the world, working on projects and making science more accessible for everyone. She encourages women and disabled people to love science and shares her inspiring story with the world.

Text and artwork by:
Carys Pulles



*"Science is for everyone.
It has to be available for
everyone because we all
are natural explorers.
Even if you can't see."*

= WANDA DÍAZ-MERCED =

“The more brilliant the lightning,
the quicker it disappears.”

= IBN SINA =



IBN SINA

Ibn Sina (980 - 1037 CE) , meaning “ son of Sina” in Arabic, is a man not widely known in the Western world, yet he is perceived as a cornerstone of our current scientific knowledge. With two of his most known works, “The book of healing” and “The canon of Medicine” he set the standard for medicine in medieval and current times by not only incorporating biological but also mental health to improve someones well-being.

Ibn Sina is of Arabic decent and was born in the village of Afshana in Transoxiana(1), this would equate to modern day Uzbekistan. His family later settled in Bukhara, the hometown of his mother(2), and also a significant city that contributed to the advancement of science, philosophy, and the arts in Central Asia. It is here that Ibn Sina would start his road to become an influential figure(3),(4).

Since Ibn Sina was a Muslim, starting out most of his schooling was about the Quran, which was followed by a multitude of tutors coming over to teach him about philosophy, Greek science, theology, arithmetic, the list goes on(4). This resulted in him becoming a physician at the age of 17. Most troubles that Ibn Sina has faced (that we know of) before getting his recognition were mainly due to political reasons such as war(3),(5) causing his research to be halted, since he had to go into hiding.

Despite these challenges, Ibn Sina grew out to become known as the ‘father of early modern medicine’. It is tus important to acknowledge that even though Western scientists often regard the Greeks and Romans as the founders of modern science, a lot of the contributions to the field were originally made by Ibn Sina and other Eastern scientists.

Text by: Joeri Bodewes
Artwork by: Robin Bos

RESOURCES

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Contact:

Janine Geerling

j.j.geerling@umcutrecht.nl