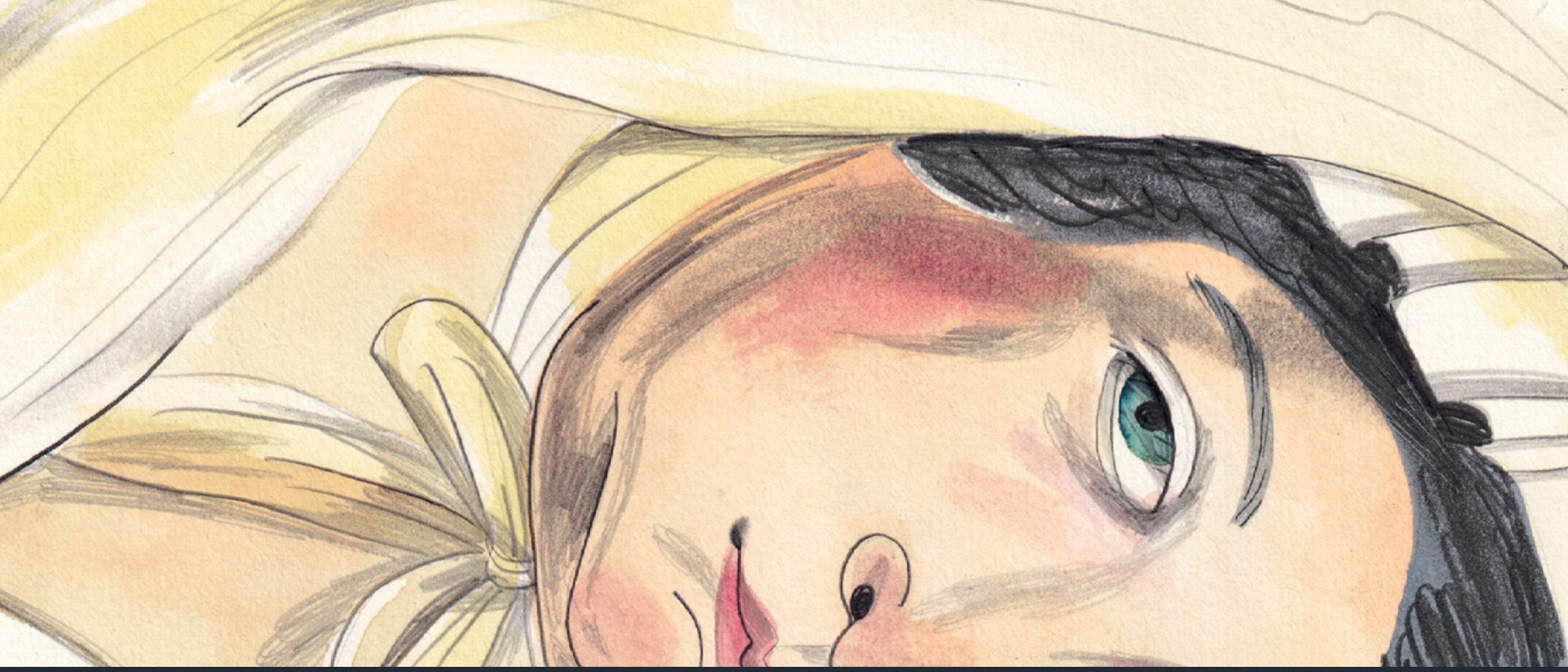


SHE SHAPES SCIENCE

Decoding the Legacy of Women in STEM





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PROLOGUE

At Quibim, we do not believe in highlighting women to fulfill an agenda or trend; instead, we are firmly committed to meritocracy. We recognize and celebrate the talent and contributions of each person based on their real impact, regardless of gender. However, even when we apply this meritocratic criterion, we realize that women have historically been underrepresented in their fields of expertise. This asymmetry does not reflect a lack of ability or achievement but rather the consequence of social and cultural barriers that have limited their participation and, therefore, their visibility. Many pioneering women whose work has transformed our understanding of science and technology have been ignored or overlooked by society. This book pays tribute to 20 extraordinary women, pioneers who have left a profound mark on fundamental areas like medical imaging, mathematics, data science, and biomedical engineering.

Their contributions have been key to developing technologies and knowledge that enable more accurate diagnoses, personalized treatments, and an advanced understanding of the human body. We honor them by highlighting their profound impact on science and technology.

Marie Curie pioneered the research of radioactivity, which laid the foundation for modern radiology. She enabled advancements that have revolutionized medicine and diagnostic imaging. Rosalind Franklin contributed fundamentally to the discovery of DNA's structure through her X-ray diffraction work,

creating a link between biology and medical technology that advanced the field of diagnostic imaging and precision medicine. The area of mathematics had significant progress thanks to women like Hypatia of Alexandria, an ancient Greek mathematician and philosopher. She defended the importance of logical thinking in science, setting a precedent for future intellectual milestones. Maria Gaetana Agnesi was a mathematician who made groundbreaking contributions to mathematical analysis, pushing the boundaries for women in academia. Sophie Germain overcame societal biases to advance number theory and elasticity, demonstrating the depth of female intellectual capacity. Emmy Noether revolutionized theoretical physics and mathematics with her theorem of invariance, a principle linking symmetry and conservation laws that became fundamental in quantum mechanics and relativity.

Applied mathematics and space science owe much to Katherine Johnson. Her precise calculations at NASA were pivotal for space missions, merging mathematics with aerospace technology. Maryam Mirzakhani became the first woman to win the Fields Medal for her innovative work in geometry and the theory of surfaces, showcasing how abstract mathematical thinking can solve complex engineering problems.

Computing and software development were profoundly shaped by Ada Lovelace, often considered the first computer programmer. She envisioned machines capable of executing complex tasks, laying the groundwork for the data science we recognize today. Grace Hopper created the first compiler and popularized the concept of “debugging,” foundational to modern software development. Margaret Hamilton developed the software for the Apollo missions, establishing fundamental principles of modern software engineering, even coining this term and showcasing how programming can drive technological innovation. Barbara Liskov introduced the Liskov substitution principle, solidifying object-oriented programming. Computer science and AI have advanced significantly due to pioneers like Radia Perlman. Known as the “mother of the Internet,” she invented the Spanning Tree Protocol (STP), essential for the functioning of data networks. Fei-Fei Li spearheaded the development of computer vision and artificial intelligence, applying these advances to medical image analysis and contributing to AI-assisted radiology. Jeannette Wing popularized “computational thinking,” influencing how computer science is taught and applied across various disciplines. Manuela Veloso led the field of collaborative robotics, integrating AI and data science into systems that interact seamlessly with humans.

Biomedical science and engineering have been enriched by the work of Dorothy Crowfoot Hodgkin. Her use of X-ray crystallography to map biomolecular structures revolutionized medicine and chemistry. María Vallet-Regí is a leader in biomaterials, developing engineering techniques that enhance medical implants and targeted drug delivery. Ingrid Daubechies made significant contributions with her work in wavelets, which are crucial for signal processing and improving diagnostic imaging.

The legacy of these women demonstrates that interdisciplinary collaboration and dedication to science have driven extraordinary advances in radiology, mathematics, data science, computing, and biomedical engineering. Their combined work shows the power of intellectual diversity and the ability to break barriers to transform our world.

By exploring the lives and contributions of these 20 women, from historical pioneers to current leaders, we aim to highlight their impact and show how each, through their dedication and creativity, has laid the foundations on which we continue to progress today. Their stories remind us that, although technology and methods evolve, human talent drives scientific progress.

CO-FOUNDER & CEO, QUIBIM

Ángel Alberich-Bayarri

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María Vallet-Regí

Born	1946, Las Palmas de Gran Canaria, Spain.
Field of Expertise	Materials Science and Chemistry.
Education	Degree and Ph.D. in Chemistry, Complutense University of Madrid.
Key Contributions	Developed mesoporous ceramics for drug delivery in cancer; created infection-resistant biomaterials.
Awards	Leonardo Torres Quevedo National Research Award (2009). Gold Medal of the Royal Spanish Society of Chemistry (2011). Miguel Catalán Research Award (2013). Spanish Science Selection (2015). King Jaime I Award for Basic Research (2018). Medal of Merit in Research and University Education (2019)



SMART MATERIALS FOR SMARTER MEDICINE

María Vallet-Regí is one of the most influential Spanish scientists in materials science and chemistry, whose groundbreaking work in developing advanced ceramic biomaterials with mesoporous structures has transformed biomaterials and regenerative medicine.

These intelligent materials feature nanoscale pores for controlled drug release, enabling novel cancer treatments. Her research also spans the development of biomaterials for bone regeneration to address osteoporosis and bioceramics aimed at preventing infections in prosthetic implants. Born in 1946 in Las Palmas de Gran Canaria, Spain, Vallet-Regí pursued her passion for chemistry at the Complutense University of Madrid, earning her Ph.D. in 1974. Her visionary approach recognized the immense potential of materials science in medical applications, leading her to explore how synthetic materials could seamlessly integrate with biological systems to foster healing and regeneration. In the late 20th century, Vallet-Regí began pioneering bioceramics research, particularly hydroxyapatite and bioactive glasses. These materials are characterized by nanometric pore structures that serve as carriers for therapeutic agents, enabling their precise and sustained release directly at targeted sites within the body. The materials are called smart because they possess one or more properties that can be controlled by external or internal stimuli, such as variations in temperature, pH levels, or the application of electric or magnetic fields.

In her innovative work on nanoparticles for cancer treatment, Vallet-Regí utilizes chemistry to modify the surface of these particles. These modifications prevent them from aggregating, render them invisible to the immune system, and direct them specifically toward tumor cells. These nanoparticles release their

therapeutic cargo upon reaching their target in response to a specific stimulus, highlighting their 'smart' capabilities. This approach offers a precise and controlled method for delivering drugs directly to cancer cells, minimizing side effects and enhancing treatment efficacy.

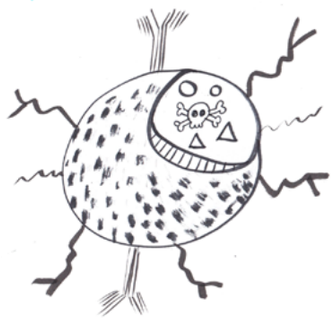
María Vallet-Regí's research has also significantly advanced the development of biomaterials offering transformative solutions for bone tissue regeneration, particularly in treating osteoporosis, a condition that progressively weakens bones and heightens fracture risk. By modifying the porosity and composition of these ceramics, Vallet-Regí has made versatile platforms customizable for various medical applications, blending fundamental science with practical solutions. She has offered hope to millions suffering from bone degeneration by developing materials supporting new bone tissue growth. Furthermore, her work on bioceramic materials to prevent infections in prosthetic implants addresses a critical challenge in orthopedic surgery, enhancing the longevity and safety of joint replacements.

Vallet-Regí's achievements have been recognized with numerous awards and honors. She is a distinguished member of the Royal Spanish Academy of Sciences and has received the prestigious National Research Award in Engineering from the Spanish government. On the international stage, the International Union of Societies for Biomaterials Science and Engineering honored her by naming her a Fellow of Biomaterials Science and Engineering. These honors attest to her exceptional contributions and standing within the global scientific community. Reflecting on her journey, María Vallet-Regí often highlights the power of curiosity and perseverance, believing that her challenges have only strengthened her resolve to make meaningful contributions to society.

She is passionate about inspiring young women in science, firmly asserting that girls should see themselves as equally capable in fields like engineering. She says, "Girls must see that they have the same capabilities as boys in engineering. To know is to want." She advises her female students to think beyond what they want to study and consider what they aspire to work on, encouraging them to follow their passions and contribute meaningfully to their chosen fields. Vallet-Regí actively engages in conferences, public lectures, and scientific committees, where she champions interdisciplinary collaboration and accentuates the societal impact of scientific advancements. Her leadership roles reflect her deep dedication to defining science policy and guiding research efforts toward solving pressing global challenges.

Throughout her distinguished career, Vallet-Regí has authored over 650 scientific publications and several influential books, establishing herself as a leading authority in biomaterials science. Her extensive work, widely cited by the global research community, highlights her impact on the field. She has guided countless students and young researchers as a mentor, fostering a collaborative and intellectually stimulating environment that nurtures curiosity and critical thinking.

Vallet-Regí's work exemplifies the seamless integration of fundamental research with practical applications, demonstrating how scientific inquiry can drive transformative solutions that improve lives. Her legacy is one of innovation, mentorship, and a commitment to advancing science to shape a better, more innovative world.



"EXCELLENCE IS ACHIEVED BY WORKING AND WORKING. AND THROUGH WORK, YOU GET RESULTS, AND WITH RESULTS, PEOPLE RESPECT YOU."

María Vallet-Regí



ABOUT THE ARTIST

Maria Herreros

"I believe in art as a powerful tool for self-knowledge of the individual human being and as an agent of change always at the forefront of social justice."

Maria has been a plastic artist since 2011, and her artistic practice spans various disciplines (painting, editorial, mural, and illustration) without distinction of the medium and with more attention to the message.

She has exhibited her work internationally in Seoul, New York, Berlin, and Helsinki. She has published books with Planeta and Penguin Random House and was selected by Taschen as one of "THE ILLUSTRATOR - 100 BEST AROUND THE WORLD" in 2019, as well as featured in "ILLUSTRATION NOW! 5" in 2014. She has completed artistic residencies in Southampton, New York, and the SI Picture Art Institute in Seoul, South Korea, and has painted murals for non-profit initiatives, including Nepal Sonríe Hetauda in Bastipur, Nepal.

With a distinctive graphic style and a non-academic technique, her interests are centered on feminism and, more recently, social justice and environmentalism. Her emphasis is on portraiture, utilizing her most excellent skill, empathy, and the ability to observe humanity from an existentialist and compassionate perspective.

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HYPATIA OF ALEXANDRIA
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SOPHIE GERMAIN
ADA LOVELACE
MARIE CURIE
EMMY NOETHER
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DOROTHY CROWFOOT HODGKIN
KATHERINE JOHNSON
ROSALIND FRANKLIN
MARGARET HAMILTON
BARBARA LISKOV
KAREN UHLENBECK
MARÍA VALLET-REGÍ
RADIA PERLMAN
INGRID DAUBECHIES
JEANNETTE WING
MANUELA VELOSO
MARYAM MIRZAKHANI
FEI-FEI LI