Chemistry as told by our Scientists

ROYAL SOCIETY OF CHEMISTRY
Queen Mary University of London
IMPERIAL
UNIVERSITY of GREENWICH
HMIC Highlighting Minorities in Chemistry

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Introduction

Students in primary, secondary and higher education in the UK are typically taught that scientists are 'male' and 'white' and the contributions made by women and members of minoritized communities are not given prominence. Lewis Howard Latimer, an African American, the son of slaves who were forcibly brought to America from Africa, invented the carbon filament in 1881 that made the light bulb a useful device, but his contribution is mostly not acknowledged by educators. All credit for the invention of the light bulb is given to his contemporary Thomas Eva Edison. Is it not time almost 150 y after this invention that Lewis Latimer is also given credit for the invention of the light bulb in the curriculum? Inclusion, diversity and wellbeing (KR15 and KR16) have now been made key requirements for the accreditation of degree programmes in chemistry by the Royal Society of Chemistry (RSC) and it is hoped that this will promote the teaching of a chemistry curriculum that is inclusive and cognisant of currently overlooked contributions.

The aim of this booklet is to provide a toolkit to highlight diverse role models in the chemical sciences that may act as an inspiration for a new generation of chemists. The scientific record needs to acknowledge the contributions of those who have been currently overlooked, and this will help inspire future scientists from under-represented communities who currently do not see themselves reflected in the individuals that are the focus of much science teaching. Our goal is to make chemistry curricula more inclusive through the compilation of short biographies of overlooked chemists that showcase their contribution to the subject. These biographies have been co-created with UG students and indexed to modules in the chemistry programmes at QMUL. Academic staff are free to use this material in class. In doing so, we hope to inspire students to aim higher, beyond a 1st degree, and thus address the 'leaky pipeline' that has resulted in the racial and ethnic inequalities that are pervasive especially in senior positions as identified by the *Missing Elements* report produced by the RSC.

If you have any suggestions on how to improve this booklet or ideas for additional biographies that should be included, please email: t.s.sheriff@qmul.ac.uk

Tippu S Sheriff
April 2025

Organic Chemistry

ROYAL SOCIETY OF CHEMISTRY
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Abhik Ghosh

Abhik Ghosh was born in Kolkata, West Bengal, India, in 1964. His academic career began in 1987, Abhik when he earned a B.Sc. (Honours) in chemistry from Jadavpur University, Kolkata, the prestigious University Medal of the Faculty of Science. His pursuit of knowledge led him to the University of Minnesota, where, under the guidance of Regents' Professor Paul G. Gassman and in collaboration with Jan Almlöf, he completed his PhD in 1992. Subsequently, he engaged in postdoctoral research with Lawrence Que Jr. His endeavours during this period laid the groundwork for computational bioinorganic chemistry, marked by pioneering ab initio and density functional theory calculations on bioinorganic systems. Following brief postdoctoral stints at the University of California Riverside and the University of Minnesota, Abhik settled at UiT – The Arctic University of Norway in 1996, where he has since made significant contributions to the field. Alongside his primary role, he held various secondary positions, including Senior Fellow at the San Diego Supercomputer Centre, recipient of the Outstanding Younger Researcher award from the Research Council of Norway, and co-principal investigator at the Centre for Theoretical and Computational Chemistry. Abhik's scholarly endeavours extend beyond academia; he has authored and co-authored numerous scientific publications and edited influential books. His notable contributions encompass diverse areas such as X-ray photoelectron spectroscopy, ligand noninnocence, and the development of heavy element corrole derivatives. Notably, his work in this domain has led to practical applications in oxygen sensing, photodynamic therapy, and solar cell technology.

In recognition of his lifetime achievements, Abhik received the prestigious Hans Fischer Career Award in 2022. His unwavering commitment to advancing the frontiers of chemistry continues to inspire future generations of researchers.

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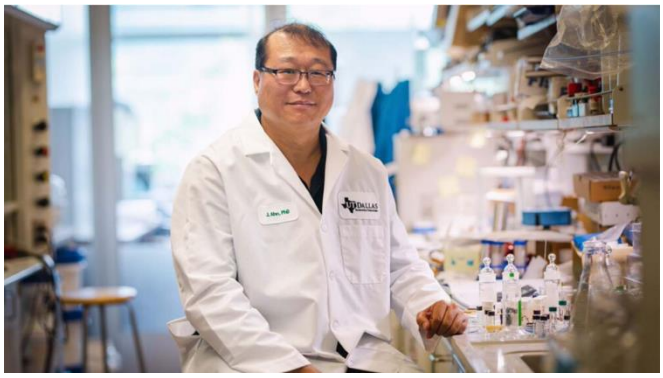
https://en.uit.no/ansatte/person?p_document_id=41027

Ahn Jung-Mo

Ahn Jung-Mo is a bio-organic/medicinal chemist, his academic journey began at Seoul



National University in South Korea, where he earned his bachelor's and master's degrees. Following this, he pursued his passion for peptide chemistry by completing his Ph.D. at the University of Arizona in Tucson. Seeking further expertise, he undertook postdoctoral training in organic synthesis and combinatorial chemistry at the Scripps Research Institute in La Jolla, CA.

Ahn joined the University of Texas at Dallas, where he now serves as faculty in the Department of Chemistry and Biochemistry. Here, he has dedicated himself to independent research, focusing on the design of small molecules to target protein-protein interactions. Unlike conventional screening methods, he advocates for a rational structure-based design approach due to its potential for broad-reaching impact across various target proteins.

Ahn's research has centred on developing novel molecular scaffolds based on oligo benzamide structures. Through experimentation, he has demonstrated their effectiveness in inhibiting specific target proteins, such as androgen and estrogen receptors implicated in prostate and breast cancer, respectively. Notably, Ahn's work uncovered unexpected potency against triple-negative breast cancer cells, which lack estrogen receptors.

After years of investigation, Ahn's team identified a new molecular target, LIPA, which is overexpressed in various tumour cells. One compound, ERX-41, exhibited remarkable potency against breast, ovarian, and brain cancer cells by inducing stress in the endoplasmic reticulum, leading to cell death. This mechanism differs from existing drugs targeting estrogen receptors, making ERX-41 particularly effective against triple-negative breast cancer.

The promising preclinical results have spurred collaboration with EtiraRx, a Dallas-based company, to optimise synthesis, formulation, and delivery of ERX-41 for FDA investigational new drug approval. This partnership represents a crucial step towards advancing ERX-41 into clinical trials, potentially offering a novel therapeutic approach for various cancer types characterized by LIPA overexpression.

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Amir H. Hoveyda

Amir H. Hoveyda, an American organic chemist and former department chair at Boston College, is now a researcher at the Institute of Science and Supramolecular Engineering at the University of Strasbourg. He earned his Ph.D. from Yale University in 1986 under the guidance of Stuart Schreiber and conducted postdoctoral research at Harvard University in David A. Evans' lab. In recognition of his contributions to chemistry, he was honoured with the Cope Scholar award by the American Chemical Society in 1998.

Hoveyda's research primarily focuses on developing catalysts that can selectively promote certain chemical reactions, with a particular emphasis on creating catalysts for olefin metathesis, a process for selectively breaking and reforming carbon-carbon double bonds. His recent work has also delved into using copper-based catalysts for various chemical transformations. One notable achievement is the development of the Hoveyda–Grubbs catalyst, which has been widely adopted in the synthesis of complex organic molecules.

A key aspect of Hoveyda's research is the design of catalysts that facilitate the synthesis of molecules with specific stereochemical properties. By developing catalysts that can precisely control the arrangement of atoms in a molecule, his research aims to streamline the synthesis of important chemical compounds, particularly those with biological or medicinal significance. Recently, he has extensively researched *N*-heterocyclic carbenes as ligands, along with focusing on copper-catalysed allylic **alkylations** and conjugate additions employing these ligands.

Overall, Hoveyda's research underscores the importance of catalysis in modern chemistry and its role in enabling the efficient synthesis of complex molecules with diverse applications. Through his innovative approach and collaborative efforts, he continues to make significant contributions to the field of organic chemistry.

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Asima Chaterjee

Asima Chatterjee (1917-2006), an organic chemist, defied societal norms in Kolkata, India, in becoming the first woman to attain a Doctorate of Science from an Indian university in 1944. As a doctoral student under Prafulla Chandra Ray, the Father of Indian Chemistry, Chatterjee delved into the chemistry of plant-derived products and synthetic organic chemistry. Joining the University College of Science at the University of Calcutta, she faced financial constraints but independently funded her medicinal plant research, yielding significant results, notably Ayush-56, an anti-epileptic drug derived from Marsilia minuta, and an anti-malarial drug sourced from various plants including Alstonia scholaris, Swertia chirata, Picrorhiza kurroa, and Ceasalpinna crista.

Her career spanned nearly six decades, during which she authored over 400 papers in esteemed national and international journals, alongside numerous review articles. Chatterjee's pioneering research extended beyond academia; she advocated for the practical utilisation of phytochemicals from indigenous plants as drugs and drug intermediates, emphasising their potential in pharmacology. Chatterjee's influential work on alkaloids, terpenoids, and coumarins underscored her profound understanding of natural products, contributing significantly to the elucidation of their structures and stereochemistry. Her investigations into the chemistry of indole alkaloids, including ajmalicine and sarpagine, yielded insights into their biosynthesis and therapeutic potential.

Beyond her scientific endeavours, Chatterjee exhibited a profound commitment to education and popularisation of science. Her work, 'Sarai Madhyamic Rasayan,' aimed at simplifying chemistry for secondary school students, exemplifies her dedication to fostering scientific literacy among the masses. Throughout her career, Chatterjee garnered numerous accolades, including the Padma Bhushan, in recognition of her indelible contributions to science. Her tenure as the General President of the Indian Science Congress in 1975 marked a historic milestone, highlighting her stature as a leader in the scientific community. Asima Chatterjee's life and work epitomise the spirit of relentless pursuit of knowledge and service to humanity. Her enduring legacy continues to inspire generations of scientists, reinforcing the transformative power of scientific inquiry and innovation in advancing society.

Reference:
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Darshan Ranganathan

Darshan Ranganathan (1941-2001), a pioneering figure in bio organic chemistry, attained

acclaim as India's most distinguished organic chemist. Pursuing her academic ambitions, Darshan enrolled at Delhi University, where she obtained her PhD in Chemistry in 1967 under the mentorship of Prof. TR Seshadri. Concurrently, she embarked on a teaching career at Miranda College, ascending to the position of Head of the Chemistry Department. Darshan's academic pursuits were further enriched by the prestigious Senior Research Scholarship of the Royal Commission for the Exhibition of 1851, which facilitated her postdoctoral research at Imperial College, London. Here, she delved into work on protein folding and devised protocols for replicating biochemical processes.

Upon her return to India in 1969, Darshan continued to excel in the field of organic chemistry, leading research initiatives at institutions such as the Indian Institute of Technology, Kanpur, and the Regional Research Laboratory, Trivandrum (now known as the National Institute for Interdisciplinary Science and Technology). Despite facing institutional biases and societal barriers, Darshan's unwavering dedication and collaborative spirit propelled her forward, earning her acclaim and recognition both nationally and internationally.

In 1998, Darshan assumed the role of Deputy Director at the Indian Institute of Chemical Technology in Hyderabad, further cementing her reputation in the field of bio-organic chemistry. However, her illustrious career was tragically cut short by metastatic breast cancer, which she battled until her passing on her birthday in 2001.

Despite the adversities she faced, Darshan Ranganathan's legacy continues to inspire generations of scientists, particularly women in STEM fields. Her pioneering research, coupled with her unwavering determination and collaborative ethos, serves as a testament to the transformative power of allyship, resilience, and dedication in advancing scientific knowledge and innovation.

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Dorothy Virginia Nightingale

Dorothy Virginia Nightingale (1902-2000), an esteemed American organic chemist, left an indelible mark with her ground-breaking research on the Friedel-Crafts reaction and chemiluminescence. Her passion for chemistry ignited during a Colorado State University field trip, leading to a BSc in chemistry from the University of Missouri and a subsequent PhD from the University of Chicago.

Nightingale commenced her career as one of the few female instructors at the University of Missouri, where her pioneering work significantly contributed to understanding complex chemical reactions. She published numerous papers delving into the intricacies of chemiluminescence and the Friedel-Crafts reaction.

Beyond academia, Nightingale played a crucial role in advancing production methods for various chemicals, including high-octane gasoline, synthetic rubbers, plastics, and detergents, involving intricate and hazardous reactions. Her remarkable contributions were acknowledged with the prestigious Garvin Medal from the American Chemical Society, recognising her outstanding service to the field. Dorothy Virginia Nightingale's legacy endures as a leader in organic chemistry, a mentor, and a contributor to the safer production of essential chemicals.

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Elizabeth MacGregor Hardy

Elizabeth MacGregor Hardy (1915-2008), a distinguished chemist, is celebrated for her

pivotal role in discovering the Cope rearrangement, a groundbreaking achievement in organic chemistry. Initially, she pursued her academic journey at McGill University, where she obtained a Bachelor of Science degree, followed by a PhD in organic chemistry at Bryn Mawr College. During her doctoral research under the guidance of Arthur Cope, Hardy collaborated with Evelyn Hancock, co-discovering the Cope rearrangement. This [3,3]-sigmatropic rearrangement, now widely used in organic synthesis, represented a significant breakthrough in the field. Beyond this milestone, Hardy made significant contributions to diverse research areas such as molecular rearrangements and the synthesis of various organic compounds, including esters, ketones, and organosulfur compounds.

Hardy's career spanned both academia and industry. After her stint as an assistant professor at Bryn Mawr College, she transitioned to roles in the chemical industry. From 1942 to 1958, she served as a chemist at Calco Chemical Division, followed by a tenure as a literature chemist at Lederle Labs from 1958 to 1975. Subsequently, she joined American Cyanamid Company as a senior resident literature chemist until her retirement.

Throughout her illustrious career, Hardy actively participated in professional organisations such as the American Association for the Advancement of Science, American Chemical Society, and Chemical Institute of Canada. Her extensive research output, comprising numerous publications and patents, underscored her innovative approach and expertise in advancing organic chemistry.

Born in Ottawa, Ontario, Canada, to Thomas Woodburne Hardy and Margaret Ada (Graham) Hardy, Elizabeth MacGregor Hardy displayed a fervent dedication to her education. Her academic pursuits culminated in a Ph.D., which laid the foundation for her remarkable career. Collaborating closely with Arthur Cope and Evelyn Hancock, she left an indelible mark on the field of organic chemistry, with her contributions continuing to inspire scientific exploration and innovation.

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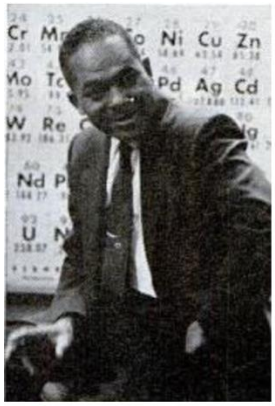
Henry McBay



Born in Mexia, Texas, in 1914, McBay's journey in chemistry began at Wiley College, where he developed a deep fascination with organic chemistry. Graduating cum laude in 1934, he continued his studies at Atlanta University, delving into research on plastics' properties. Following his graduate studies, McBay embarked on a teaching career at Wiley College before moving to Alabama in 1940 to teach high school while conducting research at Tuskegee Institute under George Washington Carver.

In 1942, McBay pursued a Ph.D. in Organic Chemistry at the University of Chicago, where his research focused on synthesising compounds using acetyl peroxide. His ground-breaking work led to the development of a protein useful in treating **prostate cancer**, earning him the prestigious Elizabeth Norton Prize.

Joining the faculty at Morehouse College in 1945, McBay's dedication to teaching and mentorship flourished. Revered for his rigorous academic standards, he earned the nickname "the Little Giant." Over the years, McBay mentored numerous African American chemists, facilitating their entry into doctoral programs and prestigious teaching positions.

In 1951, UNESCO invited McBay to develop a Chemistry program for Liberia, further solidifying his reputation as an esteemed educator. Co-founding NOBCChE in 1972, McBay continued his mission to support African American chemists in achieving their goals.

Returning to Atlanta University in 1982, McBay continued teaching until his retirement in 1986. Despite retiring, he remained dedicated to education, serving as a part-time instructor until his passing in 1995. Throughout his career, McBay's influence helped shape the landscape of African American chemists in the United States, earning him the title "the godfather of African American chemistry."

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Hisashi Yamamoto

Hisashi Yamamoto (1943 – present), a distinguished organic chemist, currently holds the position of professor at Chubu University in Japan and serves as an emeritus professor at the University of Chicago. Born in Kobe, Japan, Yamamoto's academic journey began at Kyoto University, where he earned his BSc in chemistry, and later continued to Harvard University for his PhD.

Over the past three decades, Professor Hisashi Yamamoto has revolutionised organic chemistry. His career, spanning over 450 publications, has significantly expanded the efficiency of organic synthesis, enabling the construction of complex molecular structures with ease. Yamamoto's research has centred on the use of Lewis and Brønsted acid catalysts in selective organic synthesis. He has discovered powerful synthetic reactions, reagents, and catalysts rooted in acid catalysis chemistry. His work in organoaluminum chemistry has been impactful, revealing the influence of organoaluminum compounds on synthetic organic chemistry. Yamamoto's introduction of novel aluminium amide reagents has facilitated advancements in epoxide rearrangement, terpene synthesis, and the Beckmann rearrangement-alkylation reaction sequence.

Moreover, his exploration of carbonyl compound-Lewis acid complexes led to the development of bulky organoaluminum reagents, enabling selective alkylation of cyclic ketones and aldehydes, regioselective Diels-Alder reactions, and epoxide-aldehyde rearrangements. Yamamoto's studies on chiral Lewis acids have advanced asymmetric synthesis, paving the way for the development of highly efficient catalysts for various synthetic transformations. Notably, his discovery of tartaric acid and amino acid-based catalysts has revolutionised enantioselective Diels-Alder reactions and asymmetric aldol/enes reactions, offering simple and environmentally friendly synthetic routes. Furthermore, Yamamoto's research on Lewis acid-catalysed esterification and amidation processes using hafnium and boron catalysts has found widespread applications in the chemical industry.

In recent years, he has pioneered asymmetric oxidation processes based on acid catalysis concepts, offering new avenues for selective organic synthesis. His innovative nitroso chemistry and pyridine-based hetero-Diels-Alder reactions have emerged as powerful tools for asymmetric synthesis. Moreover, his development of 8-hydroxyquinole-based chiral Lewis acid catalysis and metal reagents for SN2 cross-coupling reactions has further expanded the synthetic toolbox, providing highly practical solutions to challenging synthetic problems.

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Jeanette Brown

Jeanette Brown, born in New York in 1934, displayed an early interest in chemistry, which led her to pursue a bachelor's degree at Hunter College in 1956, where she was one of two African Americans in the inaugural chemistry class. She then made history as the first African American woman to earn a Master's Degree in Organic Chemistry from the University of Minnesota.

Beginning her industrial career at CIBA Pharmaceutical Company, Brown specialised in drug development before joining Merck in 1969. There, she made significant contributions, authoring 15 publications and securing a patent for synthesising novel medicinal compounds. She played a pivotal role in the synthesis of cilastatin sodium. This compound, combined with the antibiotic imipenem, resulted in the creation of Primaxin—a vital treatment for severe internal infections, including those caused by flesh-eating bacteria and specific types of pneumonia. In 1993, Brown transitioned to academia, joining the faculty of the New Jersey Institute of Technology. Here, she became a vocal advocate for African American students pursuing STEM careers, dedicating herself to improving diversity in the field. Beyond her scientific achievements, Brown is a staunch advocate for promoting diversity in STEM fields. To support this cause, she established the Freddie and Ada Brown Award, aimed at encouraging young Black students to pursue careers in science. Her dedication has earned her numerous awards, including the prestigious Jeannetta Brown Lectureship established by the University of Minnesota to honor her illustrious career and legacy.

Throughout her career, Brown championed diversity in STEM, serving on committees and authoring books highlighting the contributions of African American women in chemistry. She received numerous accolades, including the 2005 Outstanding Achievement Award from the University of Minnesota and the 2009 Glenn E & Barbara Hodson Ullyot Scholar recognition from the Chemical Heritage Foundation.

Recognising her remarkable contributions, the ACS Division of Professional Relations awarded Brown the prestigious 2020 Henry A. Hill Award. This award, named after the first African American President of the American Chemical Society, honours individuals who have made exceptional contributions to professional relations in the chemical profession.

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Jnan Chandra Ghosh

Jnan Chandra Ghosh, born into a Bengali Kayastha family in Giridih near Purulia District, British India, emerged as a prominent figure in the realms of Indian science and education. His journey began at Giridih High School, where he excelled academically, subsequently enrolling in Presidency College, Kolkata. At Presidency College, Ghosh showcased remarkable aptitude in chemistry.

Graduating with top honours in both B.Sc. and M.Sc. in Chemistry, Ghosh was deeply influenced by Acharya Prafulla Chandra Ray. Calcutta University recognised his potential early, appointing him as a lecturer before his results were even published. Ghosh's academic prowess earned him scholarships, enabling him to pursue doctoral studies in England, where he conducted pioneering research in photochemistry.

Returning to India, Ghosh joined Dacca University as a professor and later became its Provost. His tenure witnessed significant advancements in physical chemistry research, particularly in areas like photochemistry and biochemistry. In 1939, he assumed the directorship of the Indian Institute of Science (IISc) at Bangalore, where he expanded the institute's scope to include engineering studies.

Ghosh's contributions extended beyond academia; he played a pivotal role in India's industrial development. His research on catalytic gas reactions and synthesis mechanisms for liquid fuels and fertilizers proved instrumental. Recognising the dearth of skilled professionals for industrial growth, Ghosh spearheaded the establishment of the Indian Institute of Technology (IIT), Kharagpur.

Despite his numerous achievements, Ghosh remained devoted to his alma mater, Calcutta University. His compassionate leadership earned him widespread respect, evidenced by the emotional response from students when he departed for his new role. As Vice-Chancellor of Calcutta University and later as a member of the Planning Commission, Ghosh continued his tireless efforts to advance education and scientific research in India until his untimely demise in 1959. His legacy endures as a beacon of inspiration for future generations of scientists and educators in India.

Reference:

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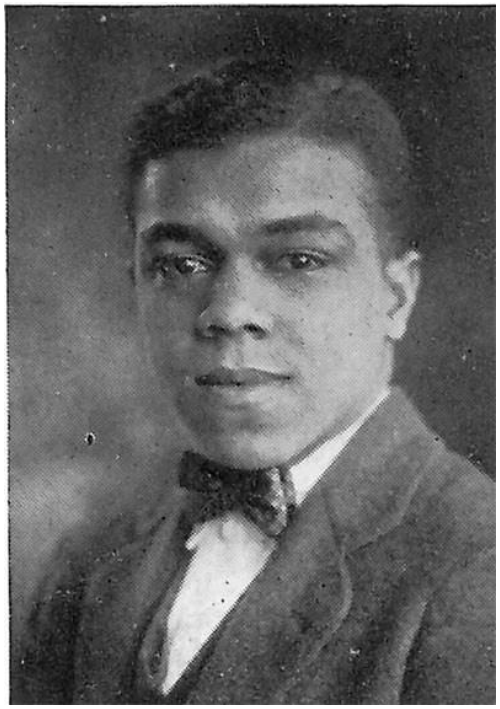
Lawrence Howland Knox

Lawrence Howland Knox (1906-1966), a African-American figure, achieved a ground-breaking feat as one of the earliest recipients of a PhD in chemistry, specializing in organic chemistry, from Harvard University. Raised in a family that highly valued education, Knox's academic journey began with the attainment of a BSc in Chemistry at Bates College in Maine.



Knox's illustrious career transcended diverse scientific realms. His significant contributions to radiation research were notably employed in the Manhattan Project, where he played a crucial role in investigating the effects of atomic bombs. Later, as the resident director at the Hickrill Chemical Research Foundation in New York, Knox, in collaboration with Doering, contributed to experimental support for Huckell's theory by preparing C7h7+. This work proved instrumental in persuading organic chemists to place greater reliance on the theory, marking a transformative moment in the field.

In addition to his impactful research, Knox's legacy includes the credit for at least two U.S. patents. His scientific brilliance and pioneering achievements have left an indelible mark, inspiring future generations and contributing significantly to the advancement of organic chemistry. Lawrence Howland Knox remains a symbol of resilience, excellence, and innovation in the scientific community.

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Lloyd Noel Ferguson

Dr. Lloyd Noel Ferguson (1918-2011) overcome racial barriers becoming the first Black person to earn a Ph.D. in chemistry from the University of California, in 1943, just three years after his undergraduate degree. Despite financial hardships during the Great Depression, he worked diligently to fund his college education, taking on various jobs including working on dock construction projects and as a porter with the Southern Pacific Railway.

During his graduate studies, Ferguson collaborated with Nobel Laureate Melvin Calvin on a project aimed at developing a material to release oxygen for submarines. This pioneering research underscored his commitment to scientific innovation and practical applications. After completing his Ph.D., Ferguson encountered challenges in securing a job in industry due to racial discrimination. Instead, he accepted a teaching position at North Carolina Agriculture & Technology College, where he began his career in academia. He later joined Howard University, where he served as the chair of the chemistry department and established the first Ph.D. program in chemistry at a historically Black college or university.

In 1965, Ferguson moved to California State University Los Angeles, where he continued to inspire and mentor students until his retirement in 1985. Throughout his career, he authored seven textbooks and over fifty journal articles covering a wide range of topics, he left a lasting legacy in academia. His scientific pursuits spanned carbon-based molecules, the organic nature of taste sensations, and cancer-causing agents. Notably, Ferguson contributed to elucidating mechanisms in chemical carcinogenesis and understanding structure-function relationships in anticancer agents. Authoring seven textbooks and over fifty journal articles, he left a lasting legacy in academia. Passionate about diversity in science, Ferguson initiated programs to support minority students in pursuing higher education and science careers, leaving an enduring impact that led to the establishment of a scholarship in his honour.

Ferguson's impact extended beyond his scientific contributions; he was a co-founder of the National Organization for the Professional Advancement of Black Chemists & Chemical Engineers, dedicated to supporting Black professionals in the field. His legacy lives on through the Lloyd N. Ferguson Young Scientist Award for Excellence in Research, which honours his commitment to fostering the next generation of Black chemists.

Reference:

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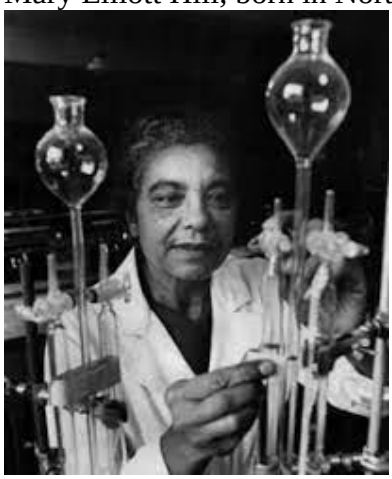
Mary Elliot Hill

Mary Elliott Hill, born in North Carolina in 1907 and raised in the segregated town of South Mills, graduated with a bachelor's degree in chemistry in 1929. Commencing her teaching career in 1930, she made history by becoming the first female chemist to earn her master's degree from the University of Pennsylvania, achieved through summer graduate classes.



Her research specialized in analytical and organic chemistry, focusing on ketenes—hazardous gases consisting of two carbon, one oxygen, and two other monovalent compound molecules. The instability and high reactivity of ketenes posed challenges during her research. Utilizing her expertise in analytical chemistry, Hill employed ultraviolet spectrophotometry to determine solubility, aiding in product quantification and understanding the polymerization and production of plastics, applicable in esters or amides production.

Beyond the laboratory, Hill served as an inspiration globally, encouraging women to pursue STEM careers. As a professor and mentor at various institutions, she supported over 20 students in finding careers in chemistry.

In collaboration with her husband, they co-authored more than 40 scientific papers, although she was never listed as a senior author. Her joy stemmed from observing the increasing interest of women in chemistry, despite the limited number choosing to advance their research careers due to an unsupportive environment.

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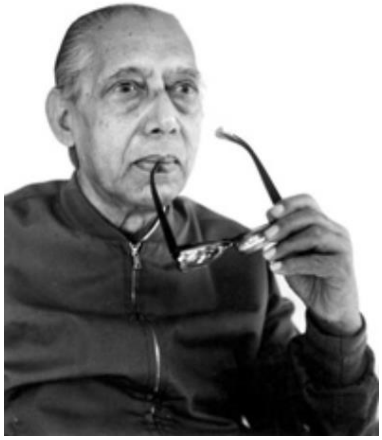
Muhammad Qudrat-i-Khuda

Muhammad Qudrat-i-Khuda (1900-1977) was a distinguished scientist, educator, and author, from the village of Margram in the Birbhum district of West Bengal.



Qudrat-i-Khuda's passed his Matriculation examination with flying colours from Calcutta Madrasa in 1918. He obtained an MSc degree in Chemistry, where he graduated First in First Class from Presidency College, Calcutta, in 1924. This accomplishment was adorned with a gold medal, testament to his exceptional performance. He then pursued higher research in Chemistry, supported by the respected Premchand Roychand Studentship at Calcutta University, and later culminating in a DSc from London University in 1929 for his ground-breaking research on the 'Stainless Configuration of Multiplanet Ring'.

Qudrat-i-Khuda's illustrious career in academia saw him put on various roles, from a lecturer at Presidency College to the Principal of Islamia College in Calcutta. He later returned to Presidency College as its Principal and made significant contributions as a Fellow and Member of the Senate at Calcutta University. His journey took him to East Pakistan (now Bangladesh) after the partition of India, where he served as the first Director of Public Instruction.

His legacy extended beyond academia; Qudrat-i-Khuda made pioneering contributions to organic chemistry, conducting ground-breaking research on various natural resources such as herbs, jute, salt, and charcoal. Notably, he patented 18 scientific inventions, including the innovative manufacturing of Partex from jute-stick, which stands as a testament to his ingenuity. Moreover, his efforts in popularising scientific knowledge in Bengali, through numerous publications and magazines, left an indelible mark on scientific literacy in the region.

Qudrat-i-Khuda's remarkable contributions were duly recognised by both the Governments of Pakistan and Bangladesh, bestowing upon him numerous accolades and awards, including the prestigious 'Tamgha-i-Pakistan', 'Sitara-i-Imtiaz', 'Ekushe Padak', and 'Swadhinata Dibas Puraskar'. His legacy lives on as an inspiring figure in the realms of science, education, and literature, etched in the annals of history for generations to come.

Reference:
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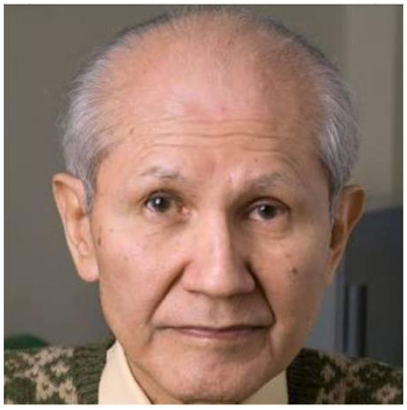
Osamu Shimomura

Born in 1928 in Fukuchiyama, Japan, Shimomura's education was disrupted by war. Following his experiences during World War II, including surviving the atomic bombing of Nagasaki, he pursued higher education against all odds, eventually gaining admission to Nagasaki Pharmacy College.



After graduation, Shimomura embarked on a journey of scientific exploration, initially focusing on the bioluminescence of marine organisms under the guidance of organic chemist Yoshimasa Hirata. His early success in isolating luciferin, a compound responsible for bioluminescence in certain marine life forms, caught the attention of biologist Frank Johnson at Princeton University, leading to Shimomura's relocation to the United States on a Fulbright scholarship.

In collaboration with Johnson, Shimomura investigated the bioluminescent properties of the jellyfish Aequorea, ultimately identifying and characterising **GFP**. Despite scepticism from peers, Shimomura's determination led to significant breakthroughs, including the discovery of GFP's activation by calcium. A breakthrough that revolutionised biomedical research by allowing scientists to observe proteins in living tissues and verify the insertion of genes. This work earned him the Nobel Prize in Chemistry in 2008, alongside neurobiologist Martin Chalfie and the late Roger Tsien. Shimomura's research revealed that GFP possessed its own light-emitting mechanism within its peptide chain, setting the stage for its use as a genetic tool in various organisms.

Throughout his career, Shimomura's generosity and dedication to scientific advancement were evident. He freely shared his research materials with laboratories worldwide, facilitating further exploration in the field. His contributions extended beyond GFP, encompassing extensive studies on bioluminescence in diverse organisms.

Shimomura's legacy endures through his publications, including a seminal textbook on bioluminescence, and his autobiography, which chronicles his remarkable journey from mble beginnings to Nobel laureate. Even in retirement, he continued to pursue scientific inquiry, underscoring his lifelong commitment to advancing knowledge and understanding in the field of chemistry.

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Percy Lavon Julian

Percy Julian (1899-1975) born in Alabama, USA earned one of the first doctorates in chemistry for an African American. He a pioneering steroid chemist and entrepreneur, and revolutionised the synthesis of medicinal compounds by deriving them from abundant plant sources, thereby making them more accessible for mass production.

In the 1930s, chemists recognised the medicinal potential of steroids, yet extracting them from animal tissue was prohibitively expensive. Percy Lavon Julian, born amidst racial prejudice, embarked on a journey to tackle this challenge. He began his academic journey at DePauw University and later earned a master's degree from Harvard University. In 1929, Julian commenced doctoral studies in Vienna, focusing on the chemistry of medicinal plants. He returned to the United States, achieving the first total synthesis of physostigmine, a compound used to treat glaucoma. Concurrently, he explored synthesising steroids from soybeans, a venture that led him to join Glidden Company in Chicago.

At Glidden, Julian discovered a method to produce large quantities of stigmasterol, a key steroid, from soybeans. Leveraging this breakthrough, he developed an industrial process for mass-producing progesterone, a female sex hormone, and other sex hormones. His innovative approach revolutionised the steroid industry, enabling the production of vital hormones like cortisone and hydrocortisone on a large scale. In 1948, when cortisone was discovered to treat rheumatoid arthritis, Julian embarked on synthesising it inexpensively. He developed a new synthesis for a related substance, "Substance S," from which both cortisone and hydrocortisone could be derived. These breakthroughs paved the way for the widespread use of cortisone derivatives in medicine.

Julian's contributions extended beyond science; he founded Julian Laboratories and remained socially active in advocating for African American rights. Despite facing racial discrimination throughout his life, he left an enduring legacy as a ground-breaking scientist, entrepreneur, and advocate for social justice. Julian earned 18 honorary degrees, numerous awards, and became the first African American chemist elected to the USA's National Academy of Sciences.

Reference:

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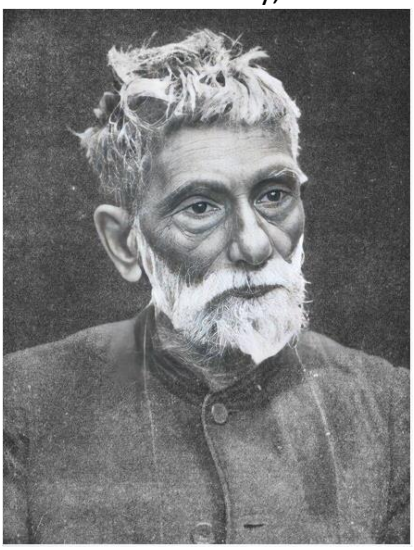
Prafulla Chandra Ray

Prafulla Chandra Ray, born on August 2, 1861, in Raruli Katipara, Bengal Presidency (now Dighalia, Khulna, Bangladesh), was a multifaceted figure in Indian chemistry. He is revered as the Father of Indian Chemistry for establishing the first modern research school in chemistry.



During his undergraduate studies, Ray was deeply influenced by Alexander Pedler, a pioneering chemist in India. Recognising the pivotal role of science in his nation's future, he pursued chemistry passionately. His ambition led him to apply for the prestigious Gilchrist Prize Scholarship. This scholarship enabled him to enrol as a BSc. student at the University of Edinburgh.

In pursuit of his passion, Ray delved into doctoral studies, under the guidance of Crum Brown, focusing on inorganic chemistry despite the prevailing dominance of organic chemistry. His doctoral thesis explored structural affinities in double salts, particularly metal double sulphates, a topic he meticulously researched.

Ray's ground-breaking work extended to the realm of nitrite chemistry. His discovery of mercurous nitrite in 1896 marked a significant milestone, leading to extensive investigations on nitrites and hyponitrites of various metals, as well as nitrites of ammonia and organic amines. He demonstrated the stability of pure ammonium nitrite through meticulous experimentation, earning recognition from eminent chemists like Nobel laureate William Ramsay. His achievements were internationally acclaimed, notably his presentation on ammonium nitrite synthesis at a Chemical Society conference in London. The subsequent publication in Nature magazine in 1912 and the Journal of Chemical Society underscored the significance of his contributions.

Ray's legacy transcended scientific achievements. He founded Bengal Chemicals & Pharmaceuticals, India's first pharmaceutical company, and authored "A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century" in 1902.

Honoured by the Royal Society of Chemistry with the first Chemical Landmark Plaque outside Europe, Prafulla Chandra Ray's life exemplifies the fusion of scientific excellence, entrepreneurial spirit, and scholarly pursuit in shaping the landscape of Indian chemistry.

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Richmond Sarpong

Richmond Sarpong born 1974 completed his B.A. (Chemistry) at Macalester College in 1995.

Following this he received his Ph.D. Organic Chemistry at Princeton University in 2001. And was a UNCF-Pfizer Postdoctoral Fellow at Caltech from 2000 to 2004. He is now a professor in the Department of Chemistry, leads a research group focused on the total synthesis of natural products and the development of innovative synthetic methods. They draw inspiration from nature in selecting their synthetic targets and strategies, often employing bio-mimetic approaches. The compounds synthesised in their laboratory serve as valuable tools for biological studies and potential therapeutics.

Total synthesis presents a unique opportunity to push the boundaries of synthetic methodology and invent new reactions. The formation of carbon-carbon (C-C) bonds is fundamental to their research, and they aim to overcome current limitations in synthetic organic chemistry by pioneering novel approaches to C-C bond formation. Their interests include processes that combine C-C bond formation with energetically favourable events like strain release and aromatisation, as well as the generation of metal vinylidenes for C-H functionalisation and access to reactive intermediates such as metallo-carbenoids and radicals.

Their research interests evolve based on student input and new transformations encountered. Currently, they are engaged in synthesising various natural products, including the teleocidin B family of indole alkaloids, cyathane diterpenoids scabronine A and erinacine E, and trichothecane sesquiterpenoids verrucarin A and satratoxin H. These compounds exhibit diverse biological activities, ranging from tumor promotion to nerve growth factor biosynthesis stimulation and possess cytotoxic properties.

Overall, Richmond Sarpong's research group is dedicated to advancing the field of synthetic organic chemistry through the total synthesis of natural products and the development of innovative synthetic methodologies.

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Ryōji Noyori

Ryoji Noyori, born in Kobe, Japan, in 1938, started his academic journey at Kyoto University, completing his master's degree in 1963. Following this, he commenced his teaching career at the same institution and subsequently pursued his Ph.D., which he attained in 1967 under the guidance of H. Nozaki. Transitioning to Nagoya University, Noyori assumed the role of Associate Professor in 1968 and later ascended to the position of full Professor in 1972. To enrich his knowledge and expertise, he undertook a postdoctoral fellowship at Harvard University under the supervision of E. J. Corey from 1969 to 1970.

Renowned for his pioneering work in molecular catalysis grounded in organometallic chemistry, Noyori's research has notably focused on asymmetric **catalysis**. His discoveries have rivalled the efficiency of enzymes, facilitating the synthesis of essential organic compounds with both theoretical and practical significance. Throughout his career, Noyori has garnered numerous prestigious awards, including the Nobel Prize in Chemistry in 2001.

Beyond his academic achievements, Noyori has actively engaged in various educational and governmental roles. He has served as the President of RIKEN, chaired the Chemical Society of Japan, and been a member of esteemed scientific councils and committees. Noyori's advocacy extends to catalysis and green chemistry, emphasizing their pivotal roles in addressing societal challenges and fostering sustainable development.

Noyori's impactful research in **asymmetric hydrogenation**, particularly utilizing rhodium and ruthenium complexes with the BINAP ligand, has revolutionized pharmaceutical production. Noteworthy applications include the commercial synthesis of enantiomerically pure naproxen and levofloxacin, essential drugs in healthcare. Furthermore, his contributions extend to menthol production, where his methods have significantly enhanced efficiency and yield.

Throughout his career, Noyori has remained committed to advancing scientific knowledge while advocating for its broader societal implications. His leadership and contributions exemplify the transformative potential of scientific research in addressing global challenges and improving human welfare.

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Salimuzzaman Siddiqui

Dr. Salimuzzaman Siddiqui (1897-1994) was a multifaceted individual, embodying the roles of chemist, philosopher, artist, literature critic, and advocate for scientific progress. His pioneering research led to the discovery of biologically active compounds such as alkaloids, glycosides, and steroids, with notable contributions including the isolation of alkaloids and an antiarrhythmic agent from the Rauvolfia serpentina plant, significant in the treatment of mental disorders and cardiovascular conditions like Brugada syndrome. Born on October 19, 1897, in India, Siddiqui embarked on his academic journey with a bachelor's degree in Persian literature and Philosophy. His pursuit of higher education took him to University College London, initially with intentions to study medicine. However, influenced by his brother Chaudhry Khaliquzzaman, he shifted his focus to chemistry, recognizing Germany as a hub for such studies. Consequently, in 1921, Siddiqui enrolled at the University of Frankfurt to pursue chemistry, where alongside his academic pursuits, he nurtured his passion for art, gaining recognition for his sketches displayed alongside renowned painters like Emile Nolde and Muller.

Siddiqui's dedication to chemistry culminated in the award of his doctoral degree under the guidance of distinguished chemist Julius von Braun in 1927. Despite facing financial challenges post-war Germany, he found support from Dr. Hakeem Ajmal Khan, a renowned doctor, and ventured into research on natural products. His investigations on the Rauwolfia Serpentina plant led to the discovery of substances with medicinal potential, some named in honor of Dr. Ajmal Khan. His contributions extended to finding a potent dysentery treatment from the Holarrhena antidysenterica plant, garnering him acclaim in the medical field.

Returning to Pakistan, Siddiqui initiated various scientific endeavors, establishing the Pakistan Council for Scientific and Industrial Research and fostering an environment conducive to innovation. His relentless efforts earned him the moniker of a science pioneer in Pakistan. Even in his later years, Siddiqui continued to inspire, founding the Hussain Ebrahim Jamal Research Institute of Chemistry in Karachi, renowned for its research contributions. His enduring legacy is commemorated through numerous accolades, including a posthumous commemorative stamp and a street named in his honor, symbolizing his profound impact on future generations of scientists.

Reference:
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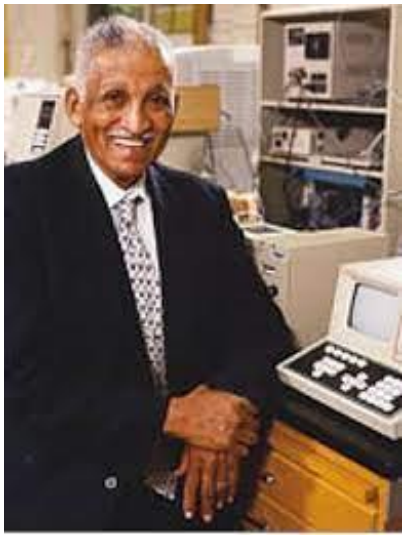
Samuel Proctor Massie

Samuel Proctor Massie (1919-2005 Born in Little Rock, Arkansas,), an esteemed African American chemist, overcame racial adversity to become a prominent figure in the history of chemistry, earning recognition as one of the top 75 distinguished contributors by Chemical and Engineering News.



Graduating high school at thirteen, his academic prowess led him to pursue a degree in Chemistry. Despite being denied admission to the University of Arkansas due to his race, he graduated summa cum laude from Arkansas Agricultural, Mechanical, and Normal College in 1937. Driven by a desire to cure his father's asthma, Massie pursued higher education, earning a master's degree from Fisk University in 1940. Facing discrimination, he was accepted into a Ph.D. program at Iowa State University but was barred from campus facilities for white students.

During his doctoral studies, Massie joined the Manhattan Project at Ames Laboratory, contributing to research on uranium isotopes. However, upon returning home in 1943 to attend his father's funeral, he encountered racial prejudice when denied a draft deferment. Undeterred, Massie dedicated himself to the war effort, working full-time on the Manhattan Project under Dr. Henry Gilman. After the war, he completed his Ph.D. and embarked on a distinguished academic career. Teaching at Langston University and Fisk University, Massie's expertise garnered national recognition. He later joined the National Science Foundation, advocating for improved scientific resources in colleges nationwide. In 1966, President Lyndon Johnson appointed Massie as the first African American professor at the US Naval Academy. Despite his accomplishments, discrimination persisted, exemplified by housing discrimination in Annapolis.

Throughout his tenure at the Naval Academy, Massie's research focused on anti-bacterial agents, leading to a patent for an antibiotic to treat gonorrhea. Upon retirement, his legacy endured through the Dr. Samuel P. Massie Chairs of Excellence, providing opportunities for African American students in environmental studies. Honoured as one of the most distinguished chemists of the 20th century, Massie's contributions transcended racial barriers, leaving an indelible mark on science and academia. He passed away in 2005, leaving behind a legacy of resilience and scientific innovation.

Reference:

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Simone Badal-McCreath

Simone Anne Marie Badal-McCreath is a distinguished Jamaican chemist and cancer researcher, recognised for her ground-breaking work in biochemistry. As the first member of her family to attend university, she achieved a remarkable feat by earning her Ph.D. from the University of the West Indies. Currently serving as a senior lecturer and anticancer researcher at the university, Simone focuses her research on exploring the potential anti-cancer properties of natural products derived from Jamaican plants.

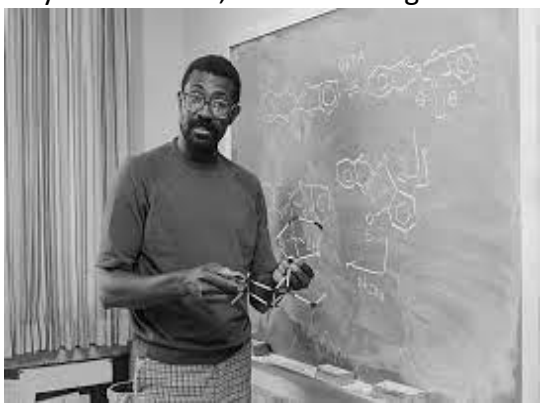
Her innovative approach involves investigating diverse types of prostate cancers, considering variations in ancestry to maximize the benefits of cell-line based drug screening. Notably, Simone recently achieved a significant milestone by developing the first prostate cancer cell line, ACRJ-PC28, derived from a Jamaican man of African ancestry. This achievement underscores her commitment to advancing cancer research and addressing the complexities of diverse genetic backgrounds.

In recognition of her exceptional contributions, Simone has been honoured with the Elsevier Foundation Award for Early Career Scientists in the Developing World, among several other prestigious awards. Her efforts extend beyond research, as she plays a pivotal role in establishing a laboratory at the Natural Products Institute, contributing significantly to the scientific community and fostering advancements in cancer research in Jamaica and beyond.

Reference:
https://www.cancer.gov/about-nci/organization/cgh/blog/2021/grantee-spotlight-badal

Slayton A. Evans Jr.

Slayton Evans Jr., born in Chicago in 1943 but raised in Meridian, Mississippi, encountered



segregation early in life, attending a segregated Catholic school and residing in a segregated public housing project. The launch of the Sputnik satellite sparked his fascination with rocketry. His dreams of becoming an astronaut were hindered by his height, but he secured scholarships to pursue higher education at Tougaloo College, where he encountered The Freedom Riders and became inspired by their non-violent resistance against segregation. Internships at Abbott Laboratories further fuelled his aspiration to become a research chemist, leading him to pursue graduate studies at Case Western Reserve University.

His graduate project, crucial to the Vietnam War effort, deferred his draft notice. Following a postdoctoral position at the University of Notre Dame, he joined Dartmouth College before ultimately accepting a position at UNC Chapel Hill. As the first black chemist in the department's history, he made significant contributions to organophosphorus chemistry, particularly in asymmetric synthesis and conformational analysis. Notably, he explored the use of phosphorus atoms in organophosphate compounds to generate specific stereoisomers.

Evans's dedication to mentoring and promoting diversity in STEM was unparalleled. Known for his high standards and commitment to excellence, he nurtured countless students, earning him prestigious accolades such as the UNC Chancellor's Award for Excellence in Undergraduate Education and the ACS Award for Encouraging Disadvantaged Students into Careers in the Chemical Sciences.

His legacy lives on through the Slayton Evans Jr. Memorial Fund, which supports an annual lecture series highlighting the contributions of diverse chemists and promotes outreach to undergraduate students from underrepresented backgrounds. Professor Evans's enduring influence on science, education, and diversity initiatives continues to shine brightly, honouring his remarkable life and legacy.

Reference:

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St. Elmo Brady

St. Elmo Brady was born in 1884 in Louisville, Kentucky. In 1903 he graduated from Louisville Colored High School. While attending Fisk, an all-black college in Nashville, Tennessee, his chemistry teacher, Thomas W. Talley, encouraged him to study chemistry further. In 1908, St. Elmo Brady graduated with a bachelor's degree from Fisk University and started teaching at Tuskegee Normal and Industrial Institute (now Tuskegee University) in Alabama. After teaching at Tuskegee for four years, the University of Illinois, Urbana-Champaign offered St. Elmo Brady a scholarship for a masters. In 1913, he joined Illinois after taking a leave of absence from Tuskegee. In 1914 he received his master's in chemistry and continued his graduate studies under Professor Clarence G. Derick, with whom St. Elmo Brady published three scholarly abstracts in *Science* between 1914 and 1915.

Derick and the Harvard chemist Arthur Michael disagreed on how the acidity of carboxylic acids was affected by replacing hydrogen atoms on the carbon chain with other functional groups. This was St. Elmo Brady's focus during his PhD; he investigated the acidity of straight- chain carboxylic acids in which a pair of hydrogen atoms were replaced with an oxygen atom to give a keto acid. Due to St. Elmo Brady's research, new methods for preparing and purifying carboxyl groups and clarifying the effect of carbonyl groups on the acidity of carboxylic acids. St. Elmo Brady's and his colleagues concluded that Michael's view was incorrect. In 1916, in just two years, St. Elmo Brady completed his PhD, his dissertation was titled "The Scale of Influence of Substituents in Paraffine Monobasic Acids. The Divalent Oxygen Atom". He was the first African American chemist to earn a doctorate in the US.

In 1914 St. Elmo Brady became the first African American admitted to Phi Lambda Upsilon, the chemistry honour society at the University of Illinois. St. Elmo Brady graduate chemistry program at a historically black college the first established a strong undergraduate curriculum and a fund-raising campaign at all four historically black colleges and universities in the US. He also established. In the University of Illinois, he set up a summer program in infrared spectroscopy, which was open to all colleges and universities. He also started a lecture series that invited recognised chemists to share their research at Fisk University.

Reference:

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Tu Youyou

Tu Youyou, a pharmaceutical chemist, made history as the first female citizen of the People's Republic of China to receive a Nobel Prize, specifically in Physiology or Medicine. Born in 1930 in Ningbo, China, despite facing personal health challenges, including contracting tuberculosis at a young age. Driven by her own experiences with illness, Tu pursued a career in medicine, graduating from Beijing Medical College in 1955. Her expertise in pharmacology and traditional Chinese medicine positioned her uniquely to embark on a journey to combat malaria, a disease wreaking havoc during the Vietnam War due to chloroquine resistance.

Tasked with leading Project 523 in 1969, Tu embarked on rigorous research, immersing herself in malaria-endemic areas like Hainan Island to understand the disease first-hand. Sacrificing personal comforts, including separation from her children, Tu's dedication to her work was unwavering. Drawing inspiration from ancient Chinese medical texts, Tu identified sweet wormwood as a potential solution to malaria. Despite numerous setbacks, including failed extractions and extensive testing, Tu persisted, refining her methods until achieving a breakthrough. Her discovery of artemisinin, a potent antimalarial compound, marked a turning point in the fight against malaria. Tu's selflessness extended to her willingness to test the compound on herself before administering it to patients, demonstrating her commitment to ensuring its safety and efficacy. The subsequent success in treating malaria cases in Hainan Province validated the effectiveness of artemisinin. Despite initial challenges in gaining recognition for her work, Tu's perseverance paid off when her findings were shared globally. The World Health Organization, World Bank, and United Nations acknowledged the significance of artemisinin, paving the way for its widespread adoption as a frontline treatment for malaria.

Tu's humility and dedication to advancing global health were evident when she accepted the Nobel Prize in Physiology or Medicine in 2015. In her lecture, she emphasised the collaborative effort behind her discovery and credited traditional Chinese medicine for its invaluable contributions to modern healthcare.

Tu Youyou's legacy transcends borders, demonstrating the profound impact of harnessing traditional wisdom alongside modern scientific methods. Her ground-breaking research continues to save millions of lives worldwide, underscoring the transformative potential of interdisciplinary innovation in combating infectious diseases.

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Inorganic Chemistry

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Abu Bakr Mohammad Ibn Zakariya Al-Razi

Abu Bakr Mohammad Ibn Zakariya al-Razi, born in Persia (now Iran) in 865 AD, stands as a towering figure in history, revered for his unparalleled contributions to medicine and an array of scientific disciplines. Renowned as a Persian polymath, al-Razi's influence reverberates through time, leaving a mark on human knowledge. Throughout his career, al-Razi's insatiable curiosity led him on a journey, encompassing music, alchemy, medicine, philosophy, and logic. It was within the realm of medicine, however, that al-Razi truly distinguished himself as one of the preeminent physicians of the medieval era. His studies were deeply rooted in the foundational principles of Aristotle's elemental theory, a paradigm that shaped his approach to understanding the intricacies of the human body and the natural world. Central to al-Razi's legacy are his ground-breaking discoveries in chemistry, which laid the groundwork for modern scientific inquiry. Among his most notable achievements was the identification and isolation of sulfuric acid and ethanol, fundamental substances that continue to underpin contemporary chemistry. Through rigorous experimentation and meticulous observation, al-Razi transcended the boundaries of his time, systematically classifying chemical substances and elucidating their properties and interactions.

al-Razi meticulously documented his findings, penning influential treatises that would shape the course of scientific development for centuries to come. His seminal works, including "Kitab al-Asrar" and "Kitab sir al-Asrar," served as compendiums of knowledge, offering invaluable insights into laboratory techniques and the transmutation of common materials into precious ones. Despite his prowess in alchemy, al-Razi's contributions to medicine were equally profound. His keen intellect and empirical approach led to significant advancements in the diagnosis and treatment of diseases, including his pioneering efforts to differentiate between measles and smallpox. However, his relentless pursuit of knowledge exacted a toll, as al-Razi's experimentation ultimately led to blindness at the age of thirty, a tragic consequence of his exposure to hazardous chemicals. Nevertheless, al-Razi's legacy endures, a testament to his unparalleled intellect and unwavering dedication to the pursuit of truth. With a corpus of approximately 200 published works, his influence continues to resonate across disciplines, earning him rightful recognition as one of the most influential scholars of the Islamic Middle Ages and a beacon of enlightenment for generations to come.

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Al-Jildaki

Izz al-Din Aydamir Ibn 'Ali al-Jildaki, a prominent Arab alchemist, resided in both Cairo and Damascus, passing away in Cairo in 743/1342. Revered for his expertise, Al-Jildaki dedicated seventeen years to studying alchemy before authoring his own works. Throughout this period, he travelled extensively, meeting esteemed alchemists across Islamic countries. Al-Jildaki's significant contribution lies in laying the foundation for the "Law of Definite Proportions" in chemical union, a principle later utilized by Kepler, Galileo, and Newton. Notably, he devised a chemical method to separate gold from silver using nitric acid, a technique still in practice today.

Additionally, Al-Jildaki pioneered safety measures against inhaling chemical gases, inventing respirators for chemistry labs. His research extended to the comprehensive study of alkalis and acids, leading to advancements in soap making techniques. Moreover, he elucidated current distillation methods and identified substances' inherent colours when burned. Beyond chemistry and botany, Al-Jildaki explored various disciplines, including mechanics, acoustics, and fluid dynamics, offering valuable insights and corrections to Western chemistry texts authored by his predecessors.

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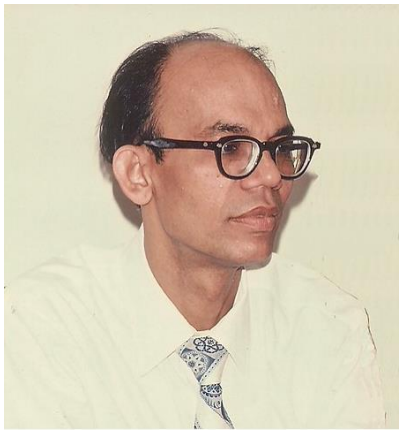
Basudeb DasSarma

Basudeb DasSarma, born in Barisal, East Bengal (now Bangladesh) in early January 1923, comes from a family deeply rooted in education and activism. His father, Ashutosh DasSarma, was not only an ayurvedic physician but also an ardent advocate for India's independence.



At the age of 11, Basudeb entered Jhalokati Government Boys High School, marking the beginning of his formal education. Despite financial constraints, he excelled in his studies, earning entry into Brojomohun College for his Bachelor of Science degree (1940-1944). To support himself, Basudeb took up private tutoring to cover his living expenses.

His academic prowess continued as he pursued a Master of Science (1944-1946) and a Doctor of Philosophy at the University College of Science, Technology & Agriculture under the University of Calcutta. Basudeb emerged as a distinguished chemist and faculty member, contributing significantly to the field.

In 1950, he embarked on his teaching career as a lecturer at the University of Calcutta, later venturing to the University of Illinois at Urbana–Champaign as a research associate alongside Professor John C. Bailar Jr. His research focused on unravelling the complexities of metal complexes' coordination and stereochemistry.

After returning to Calcutta for a brief period, Basudeb transitioned to the role of Chief Chemist at the Geological Survey of India. However, in 1966, seeking new opportunities, he migrated to the United States with his family, joining West Virginia State University as a chemistry professor.

Throughout his tenure, Basudeb made significant contributions to academia and industry, serving as a research chemist for Union Carbide and holding roles such as Certified Research Administrator at Oak Ridge National Laboratory. His ground-breaking work earned him prestigious accolades, including the American Chemical Society Award in 1971.

Despite his professional commitments, Basudeb remained dedicated to teaching and was recognised as the Outstanding Faculty Member of the Year at West Virginia State University in 1973. His legacy as a pioneering chemist, educator, and community leader continues to inspire future generations in the field of chemistry.

Reference:

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Clarice Phelps

Born in Tennessee, USA, Clarice developed a keen interest in chemistry from an early age. She earned her BSc in Chemistry in 2003 from Tennessee State University and, later in 2020, completed her master's degree in mechanical engineering at the University of Texas. Currently, she is pursuing a PhD in Nuclear Engineering at the University of Tennessee.

Facing challenges in securing employment after college, Clarice decided to join the Navy, where she graduated in the top 10% of her class. Subsequently, she transitioned to work at Cole Parmer, a chemical instrument company, before returning to Tennessee in 2009 to join the Oak Ridge National Laboratory. Starting as a technician, she steadily rose through the ranks, achieving positions as a research associate and program manager. One of Clarice's notable achievements includes being part of the team that discovered tennessine, the second heaviest known element. The complex process involved a three-month endeavour to purify 22 mg of berkelium-249, which was then subjected to a fusion reaction with calcium-248. Clarice holds the distinction of being recognised as the first African American woman involved in the discovery of a chemical element.

Beyond her contributions to science, Clarice is engaged in outreach programs to inspire young minds in STEM fields. She initiated a program in Knoxville teaching high school students about robotics, drones, and circuitry. Additionally, she serves as the Vice President of the board of Youth Outreach in Science, Technology, Engineering, and Mathematics (STEM), demonstrating her commitment to fostering interest and diversity in these crucial fields.

Reference:
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Darryl Boyd

Dr. Darryl Boyd (1986-present) is an adept synthetic inorganic and electrochemist with a broad research focus encompassing polymer chemistry, inorganic chemistry, and materials science. His academic journey includes earning a chemistry degree from the University of Michigan, followed by a master's degree in biochemistry and a Ph.D. in inorganic chemistry from Purdue University. Dr. Boyd's current primary research thrust delves into sulphur-based chemistry, particularly exploring inverse vulcanisation and photoinitiated thiol click chemistry. Pioneering the incorporation of selenium into polymer chains, he has developed novel organically modified chalcogenide polymers. These polymers exhibit distinctive optical, thermal, and mechanical properties, making them suitable for applications like night-vision goggles.

Beyond his ground-breaking research, Dr. Boyd is deeply committed to inspiring the next generation in science and technology. He dedicates his time to educational outreach, leveraging YouTube with engaging videos that make science accessible and enjoyable. Dr. Boyd's multifaceted contributions underscore his role as both a cutting-edge researcher and an enthusiastic advocate for science education. Dr. Boyd's website: https://www.drboydthechemist.com/about.html

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Gregory Heagward Robinson

Gregory Heagward Robinson, a synthetic inorganic chemist, and Professor at the University of Georgia, renowned for his research focused on the synthesis, molecular structure, and reactivity of innovative molecules featuring main group elements, including boron, gallium, germanium, phosphorus, magnesium, and silicon.

Growing up during the tail end of the Jim Crow era, Robinson overcame racial segregation, attending a segregated primary school. Excelling both academically and athletically in high school, Robinson pursued higher education at Jacksonville State University on a football scholarship, ultimately earning his Bachelor of Science degree in Chemistry in 1980. His thirst for knowledge led him to pursue doctoral studies at The

University of Alabama, where he delved into the intricacies of organometallic chemistry with a focus on aluminium, earning his Ph.D. in Chemistry in 1984. Robinson joined the faculty of Clemson University in 1985, where he rose to the position of professor. A decade later, he transitioned to The University of Georgia.

His work involves demonstrating aromatic behaviour in gallium under proper constraints, establishing the concept of metalloaromacity, and synthesising the first neutral compound with a boron-boron double bond. Robinson's ongoing research tackles diverse challenges, from catalytic industrial production issues to the synthesis and fabrication of compounds and materials related to nanotechnology. Utilising a strategic combination of sterically demanding stabilising ligands, Robinson and his team have synthesised a host of molecules, including diborene—the diboron analog of ethylene, as well as gallyne—the digallium analog of acetylene. These landmark achievements represent significant milestones in the exploration of multiple bonding between main group elements, expanding the boundaries of chemical knowledge. Furthermore, the Robinson group's innovative approach has led to the preparation of a remarkable collection of soluble diatomic allotropes of main group elements, including disilicon, diarsenic, and diphosphorus. Through meticulous manipulation of steric and electronic properties, Robinson has unlocked a versatile synthetic template for the creation of novel main group molecules and chemical radicals, offering unprecedented insights into their synthetic and catalytic behaviour.

Gregory H. Robinson has gained accolades for his research including the F. Albert Cotton Award in Synthetic Inorganic Chemistry by the American Chemical Society. Additionally, Robinson awarded the Alexander von Humboldt Senior Research Award.

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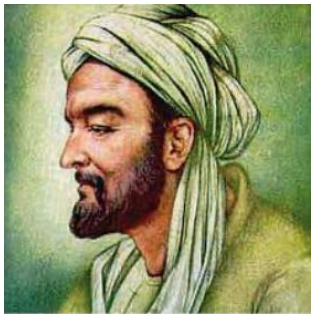
Jabir Ibn Hayyan

Jabir Ibn Hayyan (721 AD – 815 AD), commonly known as the 'Father of Arab Chemistry', was born in Persia, which is now known as Iran, in 721 AD. His contributions to chemistry include the findings of several chemical compounds and techniques which are still widely used today (e.g., distillation). Jabir also looked at other topics which included medicine, pharmacology, zoology, and astronomy.



Jabir Ibn Hayyan helped develop several laboratory processes which are routinely carried out in chemistry laboratories: crystallisation, distillation, filtration, and calcination. When he discovered the technique of distillation, he used an alembic, which originates from the word 'beaker', and is a type of still. Jabir Ibn Hayyan also discovered hydrochloric acid and nitric acid - both are known as strong acids. These were discovered by the distillation of several salts with sulfuric acid. He then went on to combine both hydrochloric and nitric acid to form nitrohydrochloric acid, which is more commonly known as *aqua regia*. *Aqua regia* contains a 3:1 ratio of hydrochloric to nitric acid and can dissolve gold, which is extremely useful for the extraction of gold. Since gold in an inert metal, it will dissolve in *aqua regia*. This method doesn't pollute the environment and can quickly extract the gold.

A further discovery of Jabir Ibn Hayyan included those substances can make water softer, which are called alkali. He also discovered how to prevent rust from forming and improved the production of steel. Throughout chemistry, there are several occasions where the syllable 'Al' is used: alchemy, alkali, alcohol. The syllable 'Al-' originates from Arabic and means 'The'. Several analytical techniques he discovered are still used by scientists today including crystallisation, distillation, filtration, and calcination. An example of how distillation is used on a larger scale is fractional distillation of crude oil.

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Kshitindra Mohan "K.M." Chakravarty

Kshitindra Mohan "K.M." Chakravarty, born on May 1, 1900, in Comilla, Bangladesh, was a prominent Indian chemist, fuel technologist, and educator. His academic journey commenced with a master's degree in chemistry from the University of Dacca in 1925, followed by a Doctor of Science (D.Sc.) degree in 1941, focusing on the catalytic formation of methane from carbon monoxide and hydrogen.

His career flourished as he assumed the role of a professor at the University of Dhaka from 1941 to 1947, where he delved into research on fuel technology and industrial catalysts. In 1945, responding to the Indian government's call, he embarked on a journey to the United States and Great Britain as a member of a technical mission. This mission aimed to understand and select the processes for the Sindri fertilizer plant. Dr. Chakravarty played a pivotal role as the chief chemist in the Sindri fertilizer factory until 1958, ensuring its smooth operation.

Beyond academia, Dr. Chakravarty's contributions extended to various organisations, including the Indian Standard Institution, Indian Science Congress Association, and the American Institute of Chemical Engineers. Notably, he held esteemed positions such as Fellow of the Institute of Fuel (London) and member of the Government of India Board of Studies in Chemical Engineering and Chemical Technology.

His legacy lies not only in his academic achievements but also in his practical endeavours. Dr. Chakravarty was instrumental in the establishment of the first coal-based fertiliser plant in Sindri, Dhanbad, India. This venture, initiated in response to the food crisis witnessed during the Bengal Famine of 1943, aimed to bolster food production in the nation. Recognising the pivotal role of fertilisers in agricultural prosperity, Dr. Chakravarty dedicated himself to this cause, inspiring a wave of scientific involvement in nation-building.

Throughout his career, Dr. Chakravarty authored numerous research papers and held several patents, showcasing his expertise in industrial catalysts. His pioneering work laid the foundation for advancements in chemical engineering and technology in India. Even after retiring from active service, he continued to contribute to technical education and research, leaving an indelible mark on the field of chemistry and industrial development in India.

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Oswaldo Luiz Alves

Oswaldo Luiz Alves, a highly respected figure in the field of inorganic chemistry and a pioneer in nanotechnology research in Brazil, passed away from a heart attack on July 10, at the age of 73. Alves' journey in research began during his time as a public-school student, where he participated in science clubs. He pursued higher education with a scholarship and embarked on a career that led him to become a professor and a researcher of international renown. He held the position of full professor at the Chemistry Institute of the University of Campinas (UNICAMP), where he established the Solid-State Chemistry Laboratory in 1985. Even after his retirement, Alves remained active as a collaborating professor, mentoring over 50 master's and PhD students throughout his four-decade career. At UNICAMP, Alves led the Laboratory of Nano Biosystems and authored more than 250 articles in scientific journals. He also submitted 31 patent applications, including one for a technology aimed at treating effluents from the paper and textile industries, which was subsequently licensed to manufacturing companies.

As part of various research initiatives, Alves contributed to a FAPESP-funded thematic project focusing on complex functional materials and served as the principal investigator for a project supported by FAPESP aimed at establishing the first XAS line at the Brazilian Synchrotron Light National Laboratory in Campinas. He was also a member of the Brazilian Academy of Sciences and chaired it from 1998 to 2000.

Over the course of his career, Alves conducted research spanning various areas. He explored doped glass, a process involving the addition of impurities to alter the properties of the material, employing **quantum dots** for telecommunications and investigating nonlinear optical glasses. Additionally, he delved into synthesis techniques for diverse intercalated two-dimensional materials. Furthermore, Alves investigated chemical systems, focusing on the purification of carbon nanotubes and exploring the interactions of novel carbons with biosystems. He also contributed to the field of drug delivery by studying functionalized silica nanoparticles. These are just a few examples of the broad range of research topics that Alves explored throughout his esteemed career.

Alves received numerous accolades for his work, including the Simão Mathias medal and the Technological Innovation Prize from the Brazilian Chemistry Society. He was also recognized with the Commendation of the National Order of Scientific Merit. Beyond his professional achievements, Alves was noted for his love of music and his commitment to fostering a balanced life. His legacy lives on through his significant contributions to the field of chemistry and nanotechnology in Brazil.

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Priyadaranjan Ray

Priyadaranjan Ray FNA, FIAS, born on January 16, 1888, was a distinguished Indian inorganic chemist and historian of chemistry. He is renowned for his contribution to proposing the Ray Dutt twist mechanism. Ray's journey in academia began in the Chittagong District, Bengal Presidency (now in Bangladesh). After excelling in his early education at the Chittagong Collegiate School, he earned a scholarship to the Chittagong Government College. Subsequently, he pursued undergraduate studies at Presidency College Calcutta, graduating with honours in chemistry and physics in 1908.

Under the mentorship of Prafulla Chandra Ray, Ray completed his master's degree with top honours in 1911. His research career faced a setback in 1912 when an explosion during an experiment left him visually impaired. However, undeterred by the accident, Ray continued his academic pursuits and joined City College, Kolkata, as a chemistry professor after a period of recuperation.

In 1919, Ray became an assistant professor of inorganic chemistry at the University Science College (now Rajabazar Science College), where he dedicated himself to teaching and research until his retirement in 1952. Despite opportunities to work abroad, Ray chose to remain in India, except for a brief research stint in Europe in 1929–1930.

Ray's contributions extended beyond the laboratory; he was a founding fellow of the Indian Chemical Society and served as its president from 1947 to 1948. Additionally, he played a pivotal role in the Indian Association for the Cultivation of Science (IACS) from 1945 to 1958, serving as its Honorary Director and later as its officiating Director.

Ray's humility was evident throughout his life; despite his significant achievements, he never pursued a doctorate. He led a modest life and remained indifferent to academic accolades. In his later years, despite being completely blind and deaf, Ray continued to inspire others until his passing on December 11, 1982, at the age of 94. His legacy endures through his groundbreaking contributions to chemistry and his unwavering dedication to scientific inquiry.

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Ulmas Mirsaidov

Ulmas Mirsaidovich Mirsaidov, a distinguished Tajik chemist and Professor of Chemistry, currently serves as the Director of the Nuclear and Radiation Safety Agency. Renowned for his pioneering research, Mirsaidov has made significant contributions to the field of chemistry, particularly in the study of hydrogen compounds and radiation safety.

Born in Ura-Tube, Tajikistan, in 1945, Mirsaidov's academic journey began with his graduation with distinction from the Moscow Chemical Technological Institute in 1967. He then joined the Tajikistan Technological Institute as an Assistant of Chemical Technologies' Chair. Subsequently, Mirsaidov pursued post-graduate studies at the USSR Academy of Sciences' Institute of General and Inorganic Chemistry after I. S. Kurnakov, earning his Ph.D. in 1973.

Throughout his career, Mirsaidov held various prestigious positions, including Director of the V.I. Nikitin Institute of Chemistry of the Academy of Sciences, Tajikistan, and Director at the Regulatory Authority in Tajikistan. His research interests encompass the chemistry and technology of inorganic hydrides, mineral raw materials, and radioecology. Notably, Mirsaidov conducted practical research on the recovery of materials from wastes of Tajik aluminum and Isfara hydrometallurgical production.

Mirsaidov's scholarly achievements have been widely recognised, earning him numerous awards and accolades, including the Kurnakov Medal, Tajikistan's Lenin Komsomol Prize, and the Abu Ali Ibn Sino State Award. He is also a member of prestigious scientific societies such as the National Academy of Sciences of Tajikistan and the International Academy of Science and Technology in California. Mirsaidov's research has significantly advanced the understanding of energy-intensive substances' chemistry, inorganic materials technology, and radiation safety. His comprehensive scholarly portfolio comprises over 450 scientific publications, 20 monographs, and 70 inventor's certificates and patents. Moreover, Mirsaidov's leadership has facilitated the successful defense of numerous doctoral and candidates' theses, contributing to the development of scientific research in Tajikistan.

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Uma Chowdhry

Born in 1947, the year of India's independence, Chowdhry's fascination with science

blossomed during her high school years in Bombay. She pursued physics at the University of Bombay, earning her bachelor's degree in 1968 before venturing to the U.S. with aspirations of studying nuclear physics in graduate school. Yet, her path took an unexpected turn when she encountered her future husband, chemist Vinay Chowdhry, and Pol Duwez, a materials chemist at Caltech, where she pursued her master's degree in engineering. Completing her studies at Caltech in 1970, she later obtained a Ph.D. in materials science from MIT in 1976.

Joining DuPont's main labs in Delaware in 1977, Chowdhry engaged in diverse research projects. She explored improved methods for synthesising tetrahydrofuran, a key laboratory solvent, and delved into ceramics research, leveraging chemistry to engineer ceramics with exceptional electrical conductivity, surpassing that of metals. Her work paved the way for superconductors, materials vital for various applications in electronics, batteries, and computing. These technologies, integrated into electronic packaging, photovoltaics, and sustainable products, revolutionised everyday utilities.

Despite initially preferring research over management, Chowdhry excelled when promoted into leadership roles at DuPont. Her innate ability to inspire and lead propelled her through management ranks. She lead operations in Terathane, a crucial substance in polymer production, contributing to the development of versatile polyurethane materials used in a plethora of products, from foam cushions to paints.

Chowdhry's legacy extends beyond her scientific achievements; she epitomises a leader who not only innovates but also commercialises novel materials, bridging the gap between laboratory discoveries and consumer products. Her tenure as DuPont's chief science and technology officer until her retirement in 2010 solidified her status as a pioneer in the field. Recognised by prestigious institutions like the National Academy of Engineering and the American Academy of Arts and Sciences, Chowdhry's impact reverberates throughout the realms of polymer science and technological innovation.

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Physical Chemistry

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IMPERIAL
UNIVERSITY of GREENWICH
HMIC Highlighting Minorities in Chemistry

Ahmed Zewail

Ahmed H. Zewail (1946-2016), an Egyptian-born chemist, achieved international recognition

when he was awarded the Nobel Prize for Chemistry in 1999, marking the first Arab to achieve such recognition in a scientific domain. His contributions cantered around the development of femtochemistry, a field that allows scientists to observe the ultrafast processes occurring during chemical reactions. Born on February 26, 1946, in Damanhur, Egypt, Zewail's academic journey began at Alexandria University, where he earned his B.S. and M.S. degrees. He furthered his education in the United States, obtaining his Ph.D. from the University of Pennsylvania in 1974. Zewail's career flourished at the California Institute of Technology, where he joined the faculty in 1976 and later became the Linus Pauling Professor of Chemical Physics. His innovative research laid the foundation for femtochemistry by leveraging advanced laser technology to produce ultrafast pulses of light, lasting only femtoseconds. These brief flashes allowed Zewail and his team to capture the fleeting movements of atoms and molecules during chemical reactions, revolutionising the field of physical chemistry.

The significance of Zewail's work lies in its ability to unravel the mysteries of chemical reactions, previously deemed too rapid to study comprehensively. By employing femtosecond spectroscopy, Zewail illuminated the intricate dynamics of molecular transformations, offering invaluable insights into reaction mechanisms and molecular structures. One of Zewail's most notable achievements was the invention of a 4D electron microscope, capable of visualising atomic-scale processes at unprecedented speeds. This technology enabled researchers to explore the intricate dance of electrons within materials, facilitating advancements in various scientific disciplines.

Beyond his scientific accomplishments, Zewail was a passionate advocate for science education and international collaboration. In 2011, he founded Zewail City of Science and Technology in Cairo, an esteemed institution aimed at fostering scientific excellence in Egypt and the Middle East. Throughout his illustrious career, Ahmed H. Zewail left an indelible mark on the scientific community, revolutionising our understanding of chemical dynamics and paving the way for future discoveries in the realm of ultrafast science. His pioneering contributions earned him recognition as the first Egyptian and Arab Nobel laureate in a scientific field, cementing his legacy as a trailblazer in chemistry and a champion of scientific innovation.

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Al-Haytham

Abu Ali al-Hasan ibn al-Haytham, also known as Alhazen, was a prominent Arab Muslim scholar born in 965 in Basra, Iraq. His education took place in Basra and Baghdad, and he passed away in Cairo, Egypt, in 1040. Alhazen's expertise in mathematics and physics earned him widespread recognition in Iraq, Syria, and Egypt. As a prolific author, Alhazen wrote over 200 works covering various subjects, with at least 96 scientific works known today. Among these, approximately 50 have survived, with nearly half dedicated to mathematics, 23 to astronomy, and 14 to optics, along with other scientific areas.

One significant contribution was his observation, outlined in his book "Kitab Al Manazer," (Book of Optics) where he proposed that eyes receive light reflected from objects rather than emitting light themselves. These contradicted prevailing beliefs of his time, including those of Ptolemy and Euclid. Alhazen's method of combining observations with rational arguments greatly influenced subsequent scholars like Roger Bacon and Johannes Kepler. Alhazen is recognised for developing rigorous experimental methods to verify theoretical hypotheses, akin to the modern scientific method. His approach involved a systematic cycle of observation, hypothesis formation, experimentation, and the importance of independent verification. Gorini credited Alhazen as a pioneer of the modern scientific method, emphasising his reliance on experimental evidence over abstract theories. Alhazen's investigations, particularly in optics, laid the groundwork for future discoveries, including the first practical use of magnification in spectacles.

His seminal work, "Kitab al-Manazer," revolutionized the understanding of light and vision, earning it comparison to Isaac Newton's "Philosophiae Naturalis Principia Mathematica." Alhazen explored various phenomena such as shadows, eclipses, and the dispersion of light, and provided explanations for binocular vision and the apparent size changes of celestial bodies near the horizon. Additionally, he experimented with early forms of cameras, contradicting previous theories on vision.

Alhazen's meticulous descriptions of the eye and his pioneering work on visual perception have led some to consider him the founder of psychophysics and experimental psychology. His legacy continues to inspire scholars in various fields, both in the Islamic world and beyond.

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Alma Levant Hayden

Alma Levant Hayden (1927-1967) stands as a figure in the realm of African

American chemists, achieving distinction as one of the first African American women to secure a scientific position at the U.S Food and Drug Administration (FDA). Her expertise in spectrophotometry and chromatography positioned her as a notable figure, leading to her appointment as the chief of the spectrophotometer research branch within the division of pharmaceutical chemistry at the FDA in 1963. Alma Hayden's most significant contribution to science was when she led a team responsible for exposing the fraudulent anti-cancer drug Krebiozen. Hayden directed them to compare Krebiozen's photo spectrum to the database of 20,000 spectra housed at the FDA. Their examination revealed a match with Creatine, a substance recognised for its ineffectiveness in treating cancer in animals. This revelation sparked a series of three independent studies on Krebiozen, all consistently affirming its fraudulent nature. Alma Levant Hayden played a pivotal role in unveiling this deception, providing invaluable evidence for the FDA. Subsequently, she testified with authority during the criminal trial against the promoters of Krebiozen, emphasising the importance of scientific rigor in drug regulation.

Alma Levant Hayden's legacy transcends her scientific contributions; she becomes a symbol of integrity, resilience, and the vital role of scientists in upholding public trust in the pharmaceutical industry. Her tireless dedication to scientific scrutiny has left an indelible mark, inspiring future generations in the pursuit of truth and ethical standards in drug development and regulation.

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Bettye Washington Greene

Bettye Washington Greene (1935-1995), a pioneering African-American chemist, broke barriers as the first African American woman employed in a professional capacity at the Dow Chemical Company. Born in Fort Worth, Texas, Greene's educational journey began at Tuskegee Institute, where she earned her Bachelor of Science in chemistry in 1955. Subsequently, she pursued her Ph.D. in physical chemistry at Wayne State University in Detroit, focusing on emulsions and particle distribution. Despite facing challenges due to segregation, Greene persevered, completing her Ph.D. just before the civil rights riot in Detroit in 1965. In the same year, Greene made history by joining the Dow Chemical Research Laboratory in Michigan, marking the beginning of a distinguished scientific career. At Dow, she specialised in colloid and latex chemistry, focusing on improving latex products. Her expertise and contributions were widely recognised, and in 1970, she was promoted to the position of senior research chemist. Three years later, she transitioned to the Designed Polymers Research Division, where she continued her work on latex and polymers. By 1975, Greene's exceptional contributions led to her promotion to the position of senior research specialist.

Throughout her tenure at Dow, Greene made significant advancements in polymer research, earning several patents for her innovative work. Among her notable patents were developments related to stable latexes with phosphorus surface groups, composite sheets utilising stable latexes, and latex-based adhesives. These inventions represented advancements in polymer science and cemented Greene's reputation as a pioneer in the field. Greene's legacy extends beyond her scientific achievements; she paved the way for women of colour in the sciences, inspiring future generations with her career. Despite facing systemic barriers, Greene's perseverance, dedication, and contributions to scientific research at Dow Chemical continue to inspire and empower women in STEM fields.

After decades of dedicated service to Dow Chemical, Greene retired in 1990, leaving behind a legacy of excellence and innovation. She passed away on June 16, 1995, leaving an indelible mark on the scientific community. Bettye Washington Greene's pioneering work in polymer science and her unwavering commitment to scientific excellence will forever be remembered, honouring her as a true leader in the field of chemistry.

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Charusita Chakravarty

Charusita Chakravarty was born on May 5, 1964, in Cambridge, Massachusetts, USA. She grew up in Delhi, India. Chakravarty showed early promise in science and was honoured as a National Science Talent Scholar. She successfully cleared the Joint Entrance Exam for the Indian Institutes of Technology (IIT) and pursued her Bachelor of Science in Chemistry from St. Stephen's College, University of Delhi. Graduating with distinction, she then pursued the Natural Science Tripos at Cambridge University, UK.

Subsequently, she embarked on her doctoral journey at Cambridge, mentored by David Clary, focusing her research on the spectra and dynamics of Ar–OH, a complex chemical system. After completing her PhD, she undertook a postdoctoral position at the University of California, Santa Barbara, under Professor Horia Metiu. Returning to Cambridge as a Gulbenkian junior research fellow, she later permanently moved back to India in 1994.

Despite initial challenges in securing a teaching position due to lacking a master's degree, Chakravarty eventually joined the Department of Chemistry at IIT Delhi. She quickly established herself as a prolific researcher, securing funding from the Department of Science and Technology for her projects. Her research primarily delved into atomic and molecular clusters, employing advanced computational techniques like path integral Monte Carlo simulation to explore quantum mechanical phenomena.

Throughout her career, Chakravarty made significant contributions to theoretical chemistry and chemical physics, with a focus on the structure and dynamics of liquids, water, hydration, nucleation, and self-assembly processes. Her work was widely published in prestigious international and national journals, gaining recognition for her single-author papers as well as collaborative efforts. Some notable publications include "Multiple Time-scale Behaviour of the Hydrogen Bond Network in Water" (2004), "Estimating the entropy of liquids from atom atom radial distribution functions: silica, beryllium fluoride and water" (2008), and "Excess entropy scaling of transport properties in network-forming ionic melts" (2011).

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Ching Wan Tang

Ching Wan Tang (1947 – present), a physical chemist born in Hong Kong, has significantly impacted the field through his co-invention of the Organic Light Emitting Diode (OLED). Tang's contributions extend beyond OLED to encompass innovations leading to the commercialisation of advanced flat panel display technologies.

Tang, received his education in Canada and the United States before joining Eastman Kodak in 1975. He later hired Van Slyke and together they applied Tang's invention of the organic heterojunction, a structure consisting of an electron donor and an electron acceptor, to create OLEDs. OLED screens are thinner, lighter, and provide better brightness and colour compared to LCD screens. They also have faster response times. The first OLED product was a car stereo display introduced by Pioneer in 1997. Kodak's EasyShare
Picture credit: Asian Scientist

LS633 digital camera, released in 2003, was the first consumer electronic product to feature a full-colour OLED display. Sony introduced the first OLED television in 2008. Today, companies like Samsung and LG use OLED technology in their smartphones and premium TVs. Other companies, including Apple, Google, and Facebook, also use OLED displays in their products.

Tang has been named on 84 patents and is known for inventing the first heterojunction organic solar cell. He earned his B.S. in chemistry from the University of British Columbia and his Ph.D. in physical chemistry from Cornell University. He has received numerous awards for his work, including the 2011 Wolf Prize in Chemistry and the 2004 American Chemical Society Award for Team Innovation, which he shares with Van Slyke. Tang is currently a professor emeritus at the University of Rochester and is affiliated with the Hong Kong University of Science and Technology. His work on OLED technology has led to its widespread use in various electronic devices, making it a multibillion-dollar industry.

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Elmer Imes

Elmer Samuel Imes (1883-1941), the second African American to earn a Ph.D. in physics in the United States, made significant contributions to the field through his research on infrared spectroscopy. Born in Memphis, Tennessee, Imes attended Fisk University, where he received a Bachelor of Science degree in 1903. He later pursued graduate studies at the University of Michigan, earning his Ph.D. in physics in 1918 under the mentorship of Harrison Randall.

Imes' doctoral research focused on high-resolution infrared spectroscopy, particularly on diatomic gases such as hydrogen chloride, hydrogen bromide, and hydrogen fluoride. His pioneering work, published in 1919 in the Astrophysical Journal and Physical Review, provided the first accurate determination of atomic distances in molecules. Additionally, Imes' research validated the applicability of quantum theory to molecular emission spectra, significantly advancing the understanding of molecular structure.

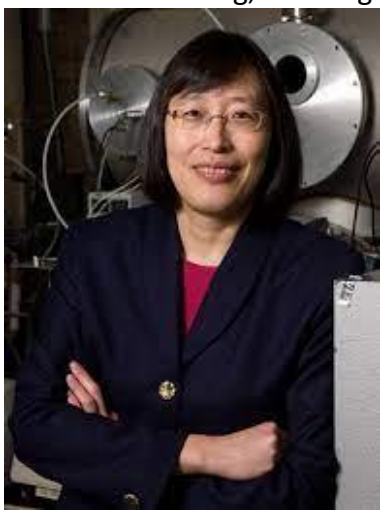
Despite his research, Imes encountered limited opportunities for academic advancement due to racial discrimination. He transitioned to the industry, working as a research physicist at various companies and securing four patents for instruments measuring magnetic and electric properties.

In 1930, Imes returned to academia as the chair of the physics department at Fisk University. He dedicated himself to mentoring students and fostering a research-oriented environment. Imes' research lab at Fisk became a hub for scientific inquiry, where students conducted studies on material properties using x-rays and magnetic techniques. Imes also emphasised the importance of understanding the history of science, developing a course titled "cultural physics" and authoring a book on the subject.

Throughout his career, Imes remained an active member of scientific societies, including the American Physical Society (APS). His contributions to infrared spectroscopy and dedication to scientific education continue to inspire future generations of physicists.

Helen O Leung

Dr. Helen O. Leung, a distinguished physical chemist, earned her PhD in chemistry from Harvard University and currently holds a professorship at Amherst College in Massachusetts. Recognised for her outstanding contributions, Dr. Leung has garnered multiple awards and boasts a rich portfolio of over 100 publications spanning various research domains. Her work not only advances our understanding of intermolecular forces but also establishes her as a prominent figure in the field of physical chemistry.



Her research focuses on comprehending intermolecular interactions driven by van der Waals forces among nonchemically bonded molecules. Despite being weaker than chemical forces, these forces play a pivotal role in shaping the structures and functions of chemical and biological systems due to the vast number of pairwise interactions they facilitate. However, their complete understanding remains elusive, and her group endeavours to bridge this gap. Molecular beam methods are employed for this purpose, generating molecular complexes reliant on van der Waals forces for their existence. These forces dictate the structures and impact the electronic environments of these complexes. Utilising spectroscopic techniques, particularly a high-resolution, pulsed molecular beam, Fourier transform microwave spectrometer, the rotational spectrum of these complexes is analysed to deduce their structure and understand the nature of intermolecular forces.

Her research has focused on nitrous oxide-containing complexes to investigate the effects of van der Waals forces on electronic distribution. She explores how electron density influences complex geometry, focusing on haloethylene-containing complexes. By examining how protic acids bind to these systems, she uncovers the intricate balance between attractive and repulsive forces, shedding light on their nature.

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Irshad Hussain

Irshad Hussain, a Pakistani scientist, has significantly contributed to the field of chemistry, particularly in nanomaterials research within Pakistan. As one of the pioneering figures in this area, his work has had a profound impact on various sectors including biomedical sciences, energy technologies, environmental sciences, and catalysis.

Hussain's academic journey began in a remote village in Jhang, Pakistan. After completing his early education in his hometown, he pursued higher studies, obtaining his MSc degree in chemistry from Quaid-i-Azam University in Islamabad in 1993. Following this, he engaged in research under the mentorship of renowned chemists such as Atta-ur-Rahman and Muhammad Iqbal Choudhary at the Hussain Ebrahim Jamal Research Institute of Chemistry, University of Karachi. In 1997, Hussain joined the National Institute for Biotechnology and Genetic Engineering (NIBGE) in Faisalabad, where he embarked on his journey in scientific research. It was during his tenure at NIBGE that he completed his PhD in Chemistry from the University of Liverpool, UK, under the supervision of Andrew Ian Cooper and Mathias Brust.

Throughout his career, Hussain has held various prestigious positions, including serving as the chair of the Chemistry department at SBA School of Science and Engineering, Lahore University of Management Sciences, from 2010 to 2016. He has also contributed significantly to academia through his roles as a professor of renewable energy engineering and as a foreign professor at institutions in Pakistan and China.

Hussain's research focuses on the synthesis of customised metal and metal oxide nanoparticles for a wide range of applications. He has made notable advancements in developing reproducible methods for synthesising uniform nanoparticles with precise control over size, shape, and surface chemistry. These nanostructures exhibit unique chemical and physical properties that hold promise for diverse applications.

With over 80 research articles published in reputable journals, including Nature Materials and Journal of the American Chemical Society, Hussain has established himself as a leading figure in the field of nanomaterials research, not only in Pakistan but also on the global stage. His contributions continue to drive innovation and progress in the field, making him a key figure in the scientific community.

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Jagadish Chandra Bose

Jagadish Chandra Bose was born in Mymensingh, Bengal Presidency (now part of Bangladesh), during the time when India was under British rule. He completed his early education at Dhaka Collegiate School before joining St. Xavier's College in Calcutta (now Kolkata), where he began his journey into higher education. Initially aspiring to study medicine at the University of London, health issues forced him to abandon this path. Instead, he ventured into research, collaborating with the esteemed Nobel Laureate Lord Rayleigh at the University of Cambridge.

Returning to India, Bose joined the Presidency College of the University of Calcutta as a physics professor. Despite facing racial discrimination and resource shortages, he persisted with his scientific endeavours. Notably, he made significant advancements in the study of radio waves within the microwave spectrum, being the first to employ semiconductor junctions for their detection.

Bose's contributions extended beyond physics; he delved into plant physiology, pioneering the use of his invention, the crescograph, to analyse plant responses to stimuli. His research revealed parallels between the behaviours of animal and plant tissues. While pressured by peers to patent his inventions, Bose maintained scepticism toward the patent system, preferring to prioritize scientific progress over personal gain. Throughout his career, Bose authored notable works such as "Response in the Living and Non-Living" (1902) and "The Nervous Mechanism of Plants" (1926). His scientific papers, including "On polarisation of electric rays by double refracting crystals" and "On a new electro-polariscope," showcased his innovative ideas and experimental prowess.

Bose's ground-breaking experiments, such as demonstrating the passage of microwaves through the human body and his use of semiconductor junctions for radio wave detection, earned him recognition as a pioneer in the field. Although his contributions were occasionally overlooked, with later researchers acknowledging his precedence in certain areas only decades later, Bose's legacy remains integral to the advancement of physics and plant biology.

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Mario Molina

Mario Molina (1943-2020), born in Mexico City, was a distinguished Mexican chemist.

Molina embarked on his academic journey by studying chemical engineering at the National Autonomous University of Mexico, earning his bachelor's degree in 1965. He then pursued further education in West Germany, obtaining an advanced degree from the University of Freiburg in 1967. Returning to Mexico City, Molina briefly served as an associate professor at his alma mater before venturing to the United States to pursue his doctoral studies at the University of California, Berkeley, where he received his Ph.D. in 1972. Following a brief time at Berkeley, Molina joined forces with Sherwood Rowland at the University of California, Irvine. Together, Molina and Rowland conducted experiments focusing on atmospheric pollutants, particularly the behaviour of CFC gases. Their research revealed that these gases ascend into the stratosphere, where they undergo photodissociation under ultraviolet radiation, liberating chlorine, fluorine, and carbon atoms. These liberated chlorine atoms, in turn, catalyse the breakdown of ozone molecules, resulting in ozone depletion. Remarkably, a single chlorine atom is capable of dismantling approximately 100,000 ozone molecules before it becomes inert.

Molina's pivotal role in explaining these mechanisms was highlighted by his authorship of the influential paper detailing their findings, which was published in Nature in 1974. The publication of their research ignited widespread discourse on the environmental ramifications of CFC gases. Subsequently, their theories were validated in the mid-1980s with the discovery of a significant depletion in the stratospheric ozone layer, famously known as the ozone hole, over Antarctica and led them to receive Nobel Prize for Chemistry in 1995.

Throughout his career, Molina held positions at prestigious institutions, including the Jet Propulsion Laboratory at the California Institute of Technology in Pasadena from 1982 to 1989, and later as a professor at the Massachusetts Institute of Technology in Cambridge starting in 1989. In 2004, he transitioned to the University of California, San Diego. Molina's contributions to environmental science and his unwavering advocacy for environmental conservation earned him numerous accolades, including the U.S. Presidential Medal of Freedom in 2013, solidifying his status as a luminary in the field of atmospheric chemistry and environmental activism.

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Moungi G. Bawendi

Born in Paris, France, Moungi Bawendi, the son of Tunisian mathematician Mohammed Salah Baouendi, spent his early years alternating between France and Tunisia before his family settled in the United States during his childhood. Growing up in West Lafayette, Indiana, his father's work at Purdue University led to their residence there. Bawendi completed his schooling at West Lafayette Junior-Senior High School in 1978. He pursued his higher education at Harvard University, obtaining both an A.B. in 1982 and an A.M. in 1983, followed by a Ph.D. in chemistry in 1988 from the University of Chicago, under the guidance of Karl Freed and Takeshi Oka.

During his time at the University of Chicago, Bawendi collaborated with Freed on theoretical polymer physics and with Oka on experiments regarding hot-bands of H3+. These experiments contributed to deciphering Jupiter's emission spectrum observed in 1989. Bawendi's path led him to a summer program at Bell Labs, recommended by Oka, where he was introduced to quantum dots research by Louis E. Brus. Subsequently, Bawendi joined Brus at Bell Labs as a postdoctoral researcher after completing his Ph.D. In 1990, Bawendi became associated with the Massachusetts Institute of Technology (MIT) and attained the position of professor by 1996. In 2024, Bawendi was awarded the Nobel Prize in Chemistry, alongside Louis Brus from Columbia University and Alexei Ekimov from Nanocrystals Technology, for their groundbreaking work on quantum dots.

Quantum dots are minute semiconducting crystals, typically only a few nanometers wide, whose electronic behavior is determined by quantum phenomena due to their size. These dots exhibit tunable properties, including their optical and electronic characteristics, which make them versatile in various technologies. Notably, they have been instrumental in QLED television screens, biotechnology, catalysis, sensors, solar cells, and medical devices. Their fluorescence is particularly useful in mapping biological tissue, aiding surgeons in procedures such as tumor removal.

The laureates' contributions to the field of quantum dots were significant. Ekimov's early experiments on doping glass with copper chloride led to the observation of quantum size effects, while Brus's work on colloidal systems revealed similar effects in cadmium sulfide particles. Bawendi's breakthrough came in 1993 when he developed a method for precisely controlling the size of cadmium selenide crystals, known as the 'hot injection' technique. This advancement paved the way for practical applications of quantum dots across various industries.

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Najat A. Saliba

Najat Aoun Saliba, a Professor of Chemistry at the American University of Beirut, leads vital projects in inhalable and atmospheric aerosol chemistry and climate change, focusing on both local and global significance. Her current efforts emphasise community driven environmental initiatives, fostering collaborative knowledge production to address local challenges. Saliba is notably the co-founder and executive director of Khaddit Beirut and the founder of the Environment Academy.

Saliba received numerous prestigious awards and honours. In 2021, she was named one of the 12 most influential people in climate justice by Apolitical, and one of the 100 most influential people in Gender Policy. In 2019, she was awarded the L'Oreal-UNESCO International Award for Women in Science, the National Order of the Cedar, the Honorary Cedar Shield, and the Paul Harris Fellow Pin. Additionally, BBC voted her among the top 100 most influential women. At the American University of Beirut, Saliba serves as a Full Professor in the Chemistry Department and directs the AUB-Nature Conservation Centre. She has developed innovative methods to analyse water pipe smoke and electronic nicotine delivery systems, contributing valuable data used by local government agencies, the World Health Organisation, and the World Bank. Her research on pollution sources and dust storms has provided crucial insights for environmental management.

Leading initiatives at AUB-NCC, Saliba utilises participatory and citizen science approaches to address rural challenges. Her work has garnered significant attention in both local and international media and resulted in over 75 peer-reviewed articles. Saliba's contributions have earned her prestigious awards such as the Lebanese National Council for Scientific Research Award in Environmental Category and the American Psychological Association Prize for Interdisciplinary Team Research. Saliba's research encompasses atmospheric chemistry, including the mass and chemical speciation of particles indoors and outdoors, as well as the study of air pollutants' diurnal and seasonal variations. She has also developed analytical techniques for detecting toxic components in water pipe smoke and natural food additives. Additionally, her bioprospection research focuses on identifying biologically active compounds from Lebanese endemic plants with medicinal properties, contributing to biodiversity studies in arid regions.

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Satyendra Nath Bose

Satyendra Nath Bose is from Kolkata, India. Bose commenced his academic journey in the intermediate science course at Presidency College, Calcutta, where he learnt from esteemed professors such as Jagadish Chandra Bose, Sarada Prasanna Das, and Prafulla Chandra Ray. In 1913, Bose achieved a Bachelor of Science degree in mixed mathematics from Presidency College, securing the top position. Subsequently, he continued his academic pursuit by joining Sir Ashutosh Mukherjee's newly established Science College, where he once again excelled, ranking first in the MSc mixed mathematics examination in 1915. His outstanding performance in the MSc examination set a new benchmark at the University of Calcutta.

Following his postgraduate studies, Bose embarked on a research journey, delving into theoretical physics. He joined the Science College, Calcutta University, as a research scholar in 1916, focusing his studies on the theory of relativity. During his academic tenure, Bose demonstrated exceptional aptitude, earning accolades at every stage. He served as a lecturer in the physics department of the Rajabazar Science College under the University of Calcutta from 1916 to 1921. Alongside Meghnad Saha, Bose authored the first English book based on translations of Einstein's seminal papers on relativity. In 1921, Bose assumed the position of Reader in the Department of Physics at the University of Dhaka, now located in present-day Bangladesh. Here, he established pioneering departments and laboratories, contributing significantly to the advancement of physics education.

Bose's most notable contribution came in 1924 when he formulated a ground-breaking paper introducing Bose-Einstein statistics. His innovative approach, emphasising the indistinguishability of particles, revolutionised quantum statistics and earned him international recognition. Albert Einstein himself acknowledged the significance of Bose's work by translating and endorsing his paper for publication.

Despite his remarkable achievements, Bose faced challenges in gaining academic recognition, notably missing out on a Nobel Prize nomination. Nevertheless, his contributions to physics, particularly in the field of quantum statistics, remain enduring legacies in the scientific community.

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Sir Chandrasekhara Venkata Raman

Sir Chandrasekhara Venkata Raman (1888-1970), an esteemed Indian physicist, made

significant contributions to the scientific community, earning him the Nobel Prize in Physics in 1930 for his discovery of the "Raman Effect." Born in Tiruchirappalli, Southern India, Raman's early exposure to an academic environment, courtesy of his father, who was a lecturer in mathematics and physics, laid the groundwork for his career. Raman's academic journey began at Presidency College, Madras, where he excelled in physics, earning top honours and a gold medal in 1904. He continued his studies, obtaining his M.A. degree with the highest distinctions in 1907. Despite initially pursuing a career in the Indian Finance Department in 1907, Raman continued his scientific pursuits, conducting research in optics and acoustics while working in the laboratory of the Indian Association for the Cultivation of Science at
Calcutta.

In 1917, Raman was appointed to the newly endowed Palit Chair of Physics at Calcutta University, where he spent 15 years before becoming a Professor at the Indian Institute of Science in Bangalore from 1933 to 1948. Subsequently, he served as the Director of the Raman Institute of Research in Bangalore, a position he held until his passing. Throughout his career, Raman demonstrated a profound commitment to scientific education and research, founding the Indian Journal of Physics in 1926 and the Indian Academy of Sciences in 1934, where he served as its inaugural president. Raman's inspiring work in optics and acoustics led to several discoveries, including the Raman Effect, which fundamentally changed our understanding of light and laid the foundation for Raman spectroscopy—a technique widely used across scientific disciplines. His research extended to various areas, including molecular diffraction of light, effects of X-rays on infrared vibrations in crystals, and the structure and properties of diamond and iridescent substances.

Recognised for his contributions, Raman received numerous honours and awards, including honorary doctorates, memberships in prestigious scientific societies, and a knighthood in 1929. His legacy continues to inspire scientists worldwide, with his research shaping the landscape of modern physics and earning him a place among the most influential figures in scientific history. Sir C. V. Raman's enduring impact on the scientific community remains unparalleled, solidifying his status as an iconic figure in Indian scientific history.

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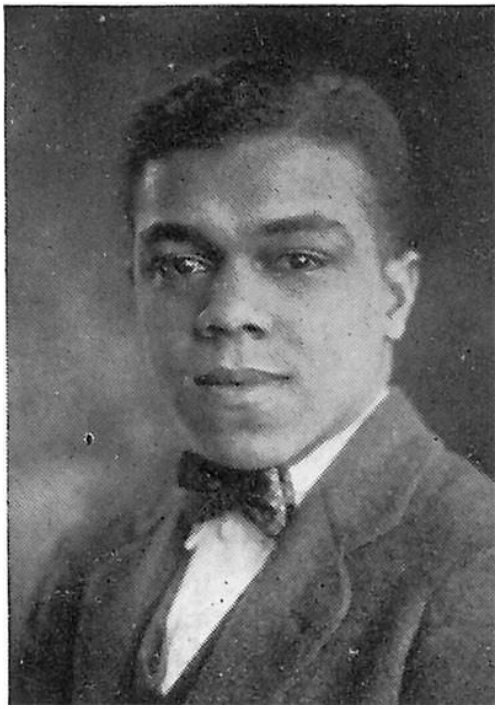
William Jacob Knox

William Jacob Knox, Jr. (1904-1995),, from New Bedford, Massachusetts, was one of the few black scientists involved in the Manhattan Project, which led to the development of the atomic bomb concluding World War II. Following the war, Knox continued to shatter racial barriers at Eastman Kodak, where his contributions to chemical agents significantly enhanced colour photography.



Knox's family history is notable, tracing back to his grandfather Elijah, who emerged from slavery in North Carolina to become a skilled carpenter and eventually purchase his freedom in 1846. Remarkably, Knox and his two brothers would later attend Harvard University, all earning Ph.D.s in chemistry. His journey at Harvard was marked by adversity, as exemplified by the 'Harvard Dormitory Crisis' of 1921, where Knox's exclusion from freshman housing due to his race sparked a campus wide controversy. After teaching in the South, Knox pursued advanced studies at MIT, earning a Master of Science in Chemical Engineering in 1928. Subsequently, he taught at Howard University before returning to MIT for his Ph.D. in Chemistry, focusing on the spectroscopy of the NO2/N2O4 system. Despite prevailing discrimination, Knox's expertise was sought after by Columbia University for the Manhattan Project, where he eventually headed the Corrosion Section.

Post-war, Knox transitioned to civilian industry, securing a position at Eastman Kodak, where he became the second black Ph.D. chemist employed. His work on developing surfactants for film emulsions significantly improved photographic images and manufacturing processes. Over his quarter-century career at Kodak, Knox earned 21 patents and was widely regarded as an expert in surfactant chemistry.

William Jacob Knox, Jr.'s contributions not only advanced the fields of chemistry and photography but also paved the way for future generations of black scientists to overcome racial barriers and make significant contributions to scientific innovation.

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Chemical Biology

ROYAL SOCIETY OF CHEMISTRY
Queen Mary University of London
IMPERIAL
UNIVERSITY of GREENWICH
HMIC Highlighting Minorities in Chemistry

Anirban Basu

Anirban Basu pursued his undergraduate studies, obtaining a BSc Hons degree in 1991, followed by a postgraduate course (MSc) in 1993 at the School of Life Sciences, Viswa Bharati University. He furthered his academic journey by pursuing doctoral studies at the CSIR-Indian Institute of Chemical Biology. Subsequently, he engaged in postdoctoral research at the Penn State Milton S. Hershey Medical Center in Pennsylvania. Returning to India, Basu commenced his tenure at the National Brain Research Centre (NBRC) in 2004 as a scientist and faculty member. Presently, he holds the position of senior scientist and operates an independent laboratory focused on investigating various aspects of neurotropic viral infections in the brain.

Residing within the premises of the National Brain Research Center, Basu's research primarily centers around central nervous system diseases (CNS diseases). He particularly examines the role of microglia and neural stem/progenitor cells in influencing the CNS. Basu's research team concentrates on unraveling the pathogenesis of viruses such as Japanese encephalitis virus (JEV), West Nile Virus (WNV), and Chandipura virus (CHPV), and their mechanisms of causing neuronal damage in hosts.

In 2011, Basu's group identified minocycline, a tetracycline antibiotic, as a potential treatment for Japanese encephalitis. This discovery underwent clinical trials at King George's Medical University, exhibiting beneficial effects on patients surviving initial attacks of the disease.

Apart from his research endeavours, Basu contributes significantly to academia. He has served as a guest editor for Clinical and Developmental Immunology journal and has mentored numerous research scholars at various academic levels.

Basu's contributions have been recognised through several prestigious awards and fellowships, including the National Bioscience Award for Career Development from the Department of Biotechnology, Government of India, and fellowships from esteemed Indian and international science academies. He has also delivered notable orations and lectures in the field of biological sciences, showcasing his expertise and leadership.

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Ibn Sina

Ibn Sina known in the West as Avicenna, a pioneering Muslim figure in the history of science, revolutionised various fields including distillation and aromatherapy. Born in 980 in present-day Uzbekistan, he delved into medicine, pharmacology, and alchemy, leaving an indelible mark on each.

Picture credit: Bayt al-Fann

He wrote the "Canon of Medical Science", one of history's most influential medical compilations, comprising five volumes. Ibn Sina's observations explained the formation of minerals, metals, poisons, dyes, and pigments in nature. Moreover, he introduced concepts like "production time" and "shelf life" into pharmaceuticals, laying the groundwork for modern pharmaceutical practices. "Canon of Medical Science" maintained its status as a standard medical textbook across Europe and the Islamic world for generations. It was translated into Latin, becoming a basis of education in European universities throughout the Middle Ages.

His contributions extended into pharmacology and therapeutics, where he meticulously cataloged numerous drugs, detailing their effects, appropriate dosages, and potential adverse reactions. Ibn Sina's pioneering spirit extended to the realm of medical experimentation, as he introduced the concept of clinical trials to assess treatment efficacy. Furthermore, he contributed to surgical knowledge by describing various techniques and instruments, including procedures for bladder stone extraction, cauterization, and wound suturing. In recognising the significance of mental health, Ibn Sina expounded upon various psychological disorders, elucidating their causes, symptoms, and potential remedies. His insights into disease prevention and public health were ground-breaking for his era, emphasizing the importance of personal hygiene, clean water, adequate nutrition, and environmental factors in preserving well-being. Ibn Sina's awareness of infectious diseases led him to advocate for quarantine and isolation measures to impede their spread.

His enduring impact on Western medicine is evident through the translation of his works into Latin, which played a pivotal role in shaping medical education and practice during the Renaissance. Beyond his medical endeavours, Ibn Sina made significant strides in philosophy, astronomy, and mathematics, solidifying his status as a luminary in both Islamic and European intellectual traditions. His legacy endures as he continues to be venerated as one of the preeminent figures in the annals of Islamic scholarship and scientific inquiry.

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Kamala Sohonie

Kamala Bhagvat (1911-1998), faced daunting odds as a woman aspiring for education and scientific recognition in a society where female literacy was minimal. However, her family defied societal norms, treating her with equal regard as her male counterparts and nurturing her intellectual curiosity. Influenced by her father and uncle's background in chemistry, Kamala was determined to pursue a path in science. She shattered barriers, becoming the first Indian woman to earn a PhD and later, the inaugural female leader of a prominent scientific institution in India.

Arriving at Newnham as a research student in 1937, Kamala had already confronted gender bias in academia back home. Despite topping her class at Bombay University, her application for postgraduate study at the Institute of Science, Bangalore, was initially rejected due to her gender. Undeterred, she resorted to Satyagraha, a nonviolent protest method, staging a sit-in until she gained admission. Despite facing unfavourable conditions, she persevered, earning respect through her dedication and talent, paving the way for more women to enter the institution.

Kamala's early research on proteins in pulses and milk held significant implications for nutrition in India, reflecting her lifelong commitment to improving the welfare of the underprivileged. At Cambridge, she made ground-breaking discoveries in plant tissues, including the identification of Cytochrome C, elucidating the universality of biological oxidation-reduction processes. Returning to India, Kamala continued her scientific pursuits amidst institutional bias and gender discrimination. Despite facing setbacks, she rose to prominence, eventually becoming Professor of Biochemistry and later the first female director of the Royal Institute of Science in Bombay/Mumbai.

Tragically, her illustrious career was cut short when she collapsed during a ceremony honouring her achievements in 1998, leaving behind a legacy of resilience and pioneering contributions to Indian science and gender equality.

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Manju Ray

Manju Ray (1947-2021) graduated from the renowned Science College campus of Calcutta University, earning her M.Sc. in physiology in 1969 and her PhD in biochemistry in 1975. A distinguished Indian scientist, Ray specialised in Molecular Enzymology and Cancer Biochemistry, making significant contributions to both fields. Her research has been instrumental in the development of anticancer drugs and in enhancing our understanding of cell differentiation processes.

Ray's academic pursuits cantered around tumour biochemistry and molecular enzymology, reflecting her profound interest and expertise in these areas. In recognition of her outstanding contributions, she was honoured with the prestigious Shanti Swarup Bhatnagar Prize for Science and Technology in 1989, becoming only the second woman to receive this accolade in the category of Biological Sciences.

Her professional journey commenced in the Department of Biochemistry at the Indian Association of Cultivation of Science. Later in her career, since December 2010, she held the position of Emeritus Scientist at Bose Institute, Kolkata, where she continued her ground breaking research endeavours.

One of Ray's key research focuses revolved around understanding the biological functions of methylglyoxal, a by-product of various metabolic pathways. Throughout her career, Ray and her team meticulously isolated, purified, and characterised a range of enzymes implicated in methylglyoxal metabolism. Furthermore, her investigations delved into the potential anticancer properties of methylglyoxal, yielding promising outcomes during the initial phases of clinical trials.

Ray's legacy extends beyond her scientific achievements; she inspired future generations of scientists, particularly women, to pursue excellence in the field of biochemistry. Her pioneering work continues to shape the landscape of molecular enzymology and cancer research, leaving an indelible mark on the scientific community.

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Marie Maynard Daly

Marie Maynard Daly was born in Queens, New York in 1921. Watching her father study for his bachelor's degree in chemistry at Cornell University sparked her interest in chemistry. However, due to lack of funds, he had to drop out and returned to New York City, where he worked as a postal clerk.

Marie Maynard Daly studied at Hunter College High School. She then went to Queens College, New York, and graduated *magna cum laude* (with great distinction) in 1942 with a bachelor's degree in chemistry. She was offered a fellowship by the college to study for a master's degree in chemistry and completed it in just one year. Whilst studying for her masters, she also worked part-time as a laboratory assistant at Queens College.

After completing her masters, she worked for a year tutoring chemistry students at Queens College. She then started her PhD at Columbia University, where Mary L. Caldwell, who was known for working on the digestive enzyme amylase, instructed her. The title of Marie Maynard Daly's thesis was "A Study of the Products Formed by the Action of Pancreatic Amylase on Corn Starch." She researched how compounds produced in the body affect and participate in digestion. In 1947, in just three years, she completed her PhD. She became the first African American woman to obtain a PhD in chemistry in the United States.

Marie Maynard Daly taught for two years at Howard University in Washington, DC, after she had completed her PhD. The American Cancer Society offered Marie Maynard Daly a grant to join the Rockefeller Institute in New York, where she worked on the composition and metabolism of components of the cell nucleus, among other studies for seven years. She worked alongside Alfred E. Mirsky, a pioneer in molecular biology. In 1960 Marie Maynard Daly became a professor at the Albert Einstein College of Medicine, where she remained until her retirement in 1986. Marie Maynard Daly was passionate about increasing the numbers of minority students in medical school and graduate science programmes. In 1988, to honour her father, she set up a fund for African American science students at Queens College.

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Sunetra Gupta

Sunetra Gupta, an esteemed figure in the field of infectious disease epidemiology, was born in Kolkata, India, on March 15, 1965. She pursued her academic journey with passion, attaining a bachelor's degree in biology from Princeton University. Continuing her pursuit of knowledge, Gupta earned her PhD from Imperial College London in 1992, focusing her research on the transmission dynamics of infectious diseases.

Currently, Gupta serves as a professor of theoretical epidemiology at the University of Oxford's Department of Zoology. Her research delves into the intricate mechanisms of disease transmission, encompassing a wide array of infectious diseases such as malaria, influenza, and COVID-19.

Throughout her career, Gupta has garnered recognition for her scholarly contributions. She has been honoured with prestigious awards including the Scientific Medal of the Zoological Society of London and the Rosalind Franklin Award from the Royal Society.

Gupta's notable involvement in the scientific community extends beyond her academic endeavours. She is an active member of Collateral Global, an organisation dedicated to assessing the global impact of COVID-19 restrictions. Additionally, Gupta has contributed significantly to public discourse on pandemic response strategies.

In 2020, Gupta's research on COVID-19 garnered widespread attention when she and her colleagues proposed a model suggesting broader immunity within the UK population, sparking controversy among fellow experts. Despite criticism, Gupta remained steadfast in her views, advocating against stringent lockdown measures and endorsing the Great Barrington Declaration, which called for a focus on protecting vulnerable populations while allowing lower-risk groups to build immunity through infection.

Gupta's influence extends beyond academia, as evidenced by her affiliations with esteemed institutions and collaborations with industry partners. Her dedication to advancing our understanding of infectious diseases and her commitment to shaping public health policies underscore her significant contributions to the field.

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Tasuku Honjo

Tasuku Honjo, a distinguished figure in cancer research, was born in Kyoto in 1942. His academic journey began with the completion of his M.D. degree in 1966 at Kyoto University's Faculty of Medicine, followed by earning his Ph.D. in Medical Chemistry in 1975 under the mentorship of Yasutomi Nishizuka and Osamu Hayaishi.

Honjo's research career took him across the globe, including a stint as a visiting fellow at the Department of Embryology at the Carnegie Institution of Washington from 1971 to 1973. He then joined the U.S. National Institutes of Health in Bethesda, Maryland, where he delved into the genetic underpinnings of immune responses. Over the years, he held various academic positions, including professorships at universities in Tokyo and Osaka, before settling as a professor at Kyoto University.

Throughout his career, Honjo made significant contributions to immunology. He explained the mechanism of class switch recombination, shedding light on how B cells alter their antibody production in response to different antigens. His discoveries included identifying crucial proteins like activation-induced cytidine deaminase and cloning key cytokines involved in this process.

One of Honjo's most revolutionary achievements was the discovery of programmed death-1 (PD-1), a protein that regulates immune responses. His research showed that PD-1 plays a dual role, dampening autoimmune responses while also aiding tumour cells in evading immune surveillance. This discovery opened new avenues in cancer immunotherapy. Honjo's work didn't stop at discovery; he also demonstrated the effectiveness of blocking PD-1 and its ligands, PD-L1 and PD-L2, in inhibiting tumour growth. These findings revolutionized cancer treatment, leading to the development of PD-1 and PD-L1 inhibitors that are now used to treat various types of cancer.

Overall, Tasuku Honjo's pioneering research has transformed our understanding of cancer immunology and paved the way for innovative cancer therapies. His contributions have sparked renewed interest in harnessing the power of the immune system to combat cancer, promising a brighter future for patients worldwide.

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Walter Lincoln Hawkins -

Walter Lincoln Hawkins was born in Washington, D.C. in 1911. He was an African American

who had a fond interest in mathematics and science. He had to face several obstacles in his life due to his race. As a young child, he was orphaned and was raised by his sister.

After completing a first degree in chemical engineering, he went on to earn a master's in chemistry from Howard University, also in the States, and then a Doctorate in McGill University in Montreal, Canada, with a focus on cellulose (lignin).

After completing his studies, Walter Lincoln Hawkins worked on developing substitutes for rubber during World War ll. He was then recruited by AT&T Bell Laboratories, where he researched plastic and polymers and was the first African American to work in a technical position for Bell Laboratories.

Previously, the cables were made of polyethene which would become brittle once oxidised. During his time at Bell Laboratories, he worked on improving the telephone cable sheath. The coating of the sheath was made of polyethene that was toxic, expensive and was not resistant to harsh weather conditions. Walter Lincoln Hawkins developed a much cheaper and safer alternative. His polymer contained carbon and antioxidants. This discovery improved the quality of telephone cables and ultimately led to their incorporation into the universal telephone service.

In addition to these accomplishments, Walter Lincoln Hawkins became a role model and an inspiration for students from minority ethnic groups. He mentored younger aspiring chemists by becoming the first chairman of the American Chemical Society's project of Summer Educational Experience for the Economically Disadvantaged (SEED). In his career, he published fifty papers, three books and earned 147 patents. To celebrate his achievements, he received the honour of having the Medal of Technology and Innovation from President George H. W. Bush. Walter Lincoln Hawkins' work not only created a huge impact on telephone communications, but also in supporting other minorities in achieving their dreams in chemistry.

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