National Inventors Hall of Fame®

Photo Courtesy of Marian Croak

Marian Croak

VoIP (Voice over Internet Protocol) Technology
U.S. Patent No. 7,599,359
Method and apparatus for monitoring end-to-end performance in a network

Inducted in 2022

Inductee Bio:

Engineer Marian Croak has worked on advancing Voice over Internet Protocol (VoIP) technologies, converting voice data into digital signals that can be easily transmitted over the internet rather than using traditional phone lines. Her work has furthered the capabilities of audio and video conferencing, making it a practical reality in today's world.

In 1982, Croak began her career at Bell Labs (later AT&T) with a position in the Human Factors research division, looking at how technology could be used to positively impact people's lives. She subsequently went on to work on network engineering, where she contemplated the potential of digital telecommunications. Rather than use a traditional phone line for voice communication along with a digital method for internet data, she and her team thought both could be done digitally with the internet. Consequently, they focused on enabling voice traffic that could be both reliable and of high quality. Today, the widespread use of VoIP technology is vital for remote work and conferencing, as well as personal communications.

During her career, Croak and her team created a text-to-donate system for charitable organizations that first saw widespread use after Hurricane Katrina hit New Orleans in 2005, which raised $130,000. After the 2010 earthquake in Haiti, the technology raised $43 million in donations. Croak joined Google in 2014, where she now is vice president of engineering and leads the Research Center for Responsible AI and Human Centered Technology. She also has led a team bringing broadband to developing countries in Asia and Africa.

Croak attended Princeton University for her undergraduate studies and the University of Southern California for her doctorate, focusing on statistical analysis and social psychology. With more than 200 patents to her name, Croak also works on racial justice efforts at Google and continues her goal of encouraging women and young girls in engineering.

Short Description:

Engineer Marian Croak has worked on advancing Voice over Internet Protocol (VoIP) technologies, converting voice data into digital signals that can be easily transmitted over the internet. Her work has allowed VoIP to become a practical reality by enabling reliability and high quality. Today, VoIP technology is vital for remote work and conferencing, as well as personal communications.

National Inventors Hall of Fame®

Lonnie Johnson

Super Soaker®
U.S. Patent No. 4,591,071
Squirt gun

Inducted in 2022

Photo Courtesy of Johnson STEM Activity Center

Inductee Bio:

Engineer and entrepreneur Lonnie Johnson is the inventor of the Super Soaker®, a best-selling toy generating well over $1 billion in sales over its lifetime. Johnson's longtime research focuses on energy technology, and his well-known toy resulted from his work on an environmentally friendly heat pump.

Trained as a nuclear engineer, Johnson worked as a research engineer at Oak Ridge National Laboratory, then joined the U.S. Air Force, heading the Space Nuclear Power Safety Section at the Air Force Weapons Laboratory. In 1979, he left the Air Force to become a systems engineer at NASA's Jet Propulsion Laboratory (JPL) to work on the Galileo mission. Returning to the Air Force in 1982, he served in Space Systems at Strategic Air Command (SAC) and was the first flight test engineer assigned by SAC to the Stealth Bomber (B2) at the SAC Test and Evaluation Squadron at Edwards Air Force Base. In 1987, he returned to JPL to work on the Mars Observer and Saturn Cassini projects.

In 1989, Johnson formed his own engineering firm and licensed his most famous invention, the Super Soaker®, to Larami Corp. Two years later, it generated over $200 million in sales and became the No. 1 selling toy in America. Larami was eventually purchased by Hasbro, and Johnson's patents are also the basis of the Nerf N-Strike line of products.

His current work includes a new generation of rechargeable battery technology and also JTEC, a solid state thermodynamic energy conversion technology to efficiently convert thermal energy to electrical energy.

Johnson, who attended Tuskegee University and holds more than 100 U.S. patents, is president and founder of Johnson Research and Development Co. Inc., an Atlanta-based company that has spun off additional companies, including Excellatron Solid State, Johnson Battery Technologies and Johnson Electro-Mechanical Systems. He has been awarded the Air Force Achievement Medal and the Air Force Commendation Medal on two occasions and has received multiple awards from NASA. One of his ventures is the Johnson STEM Activity Center, which introduces students from diverse and underserved communities to STEM.

Short Description:

Engineer and entrepreneur Lonnie Johnson is the inventor of the Super Soaker®, which became a best-selling toy generating well over $1 billion in sales over its lifetime. Johnson's longtime research focuses on energy technology, and his work today includes advances in rechargeable battery technology and thermodynamic technology to convert thermal energy to electrical energy.

National Inventors Hall of Fame®

Katalin Karikó

Modified mRNA Technology Used in COVID-19 Vaccines
U.S. Patent No. 8,278,036
RNA containing modified nucleosides and methods of use thereof

Inducted in 2022

Photo by Peggy Peterson courtesy of Penn Medicine

Inductee Bio:

The messenger RNA (mRNA) vaccines developed by Pfizer-BioNTech and Moderna for the fight against the COVID-19 pandemic incorporate critical foundational technology that arose from fundamental research and discoveries from biochemist Katalin Karikó and immunologist Drew Weissman at the University of Pennsylvania. Since December 2020, nearly 1 billion mRNA vaccine doses have been administered worldwide to combat the disease caused by SARS-CoV 2, a novel coronavirus discovered in 2019.

The genetic material in the human body that instructs cells to make proteins is called mRNA. At the heart of the COVID-19 vaccines is modified, synthetic mRNA that is delivered into the human body and instructs cells to make copies of the virus' spike protein. Later, the body's immune system will recognize the real virus upon exposure and a rapid immune response will occur to protect against severe disease.

Unmodified mRNA molecules are unable to slip past the body's immune system, but Karikó and Weissman modified mRNA so it could avoid immediate immune detection, remain active longer and efficiently instruct cells to create antigens to protect against severe disease. Karikó and Weissman's discovery in the early 2000s that exchanging one of the four building blocks of mRNA molecules, uridine, with pseudouridine created a modified mRNA with favorable qualities, including reduced adverse reactions. This fundamental discovery paved the way for modified mRNA to be potentially used in a wide array of future vaccines and treatments.

Karikó is a senior vice president at BioNTech and an adjunct professor of neurosurgery at the University of Pennsylvania. At the Perelman School of Medicine at the University of Pennsylvania from 1989 to 2013, her collaboration with Weissman began in 1997. Karikó is also a founding member of the International mRNA Health Conference, started in 2013. Karikó received her bachelor's degree in biology (1978) and her doctorate in biochemistry (1982) from the University of Szeged in her native Hungary. She was with the Hungarian Academy of Sciences before immigrating to the United States in 1985.

Short Description:

Fundamental research by biochemist Katalin Karikó and immunologist Drew Weissman laid a critical piece of the foundation for the mRNA COVID-19 vaccines developed by Pfizer-BioNTech and Moderna. The mRNA vaccines have been crucial in the fight against the COVID-19 respiratory disease caused by SARS-CoV 2, a new coronavirus discovered in 2019. Nearly 1 billion mRNA vaccine doses have been administered worldwide since December 2020.

National Inventors Hall of Fame®

Drew Weissman

Modified mRNA Technology Used in COVID-19 Vaccines
U.S. Patent No. 8,278,036
RNA containing modified nucleosides and methods of use thereof

Inducted in 2022

Photo by Peggy Peterson courtesy of Penn Medicine

Inductee Bio:

Fundamental research and discoveries by immunologist Drew Weissman and biochemist Katalin Karikó laid a critical piece of the foundation for the messenger RNA (mRNA) COVID-19 vaccines developed by Pfizer-BioNTech and Moderna. The mRNA vaccines have been crucial in the fight against the respiratory disease caused by SARS-CoV 2, a coronavirus discovered in 2019. Nearly 1 billion mRNA vaccine doses have been administered worldwide since December 2020.

mRNA is genetic material in the human body that instructs cells to make proteins. The modified, synthetic mRNA in the COVID-19 vaccines is delivered into the human body and instructs cells to make copies of the spike protein of the virus. If someone is later exposed to the real virus, their body's immune system will recognize it and will rapidly trigger an immune response to protect against severe disease.

In the early 2000s at the University of Pennsylvania, Weissman and Karikó discovered that replacing one of the four building blocks of mRNA molecules, uridine, with pseudouridine created a modified mRNA with favorable qualities and reduced adverse reactions. Unmodified mRNA molecules are unable to slip past the body's immune system. Weissman and Karikó's changes allowed the resulting modified mRNA to avoid immediate detection, remain active longer and enter into cells to efficiently instruct them to create antigens or other proteins that fight or treat disease. This fundamental discovery paved the way for modified mRNA to be potentially used in a wide array of future vaccines and treatments.

Weissman serves as the Roberts Family Professor in Vaccine Research at the Perelman School of Medicine at the University of Pennsylvania. He came to Penn in 1997, and his collaboration with Karikó began soon afterward. Prior to 1997, Weissman completed a fellowship at the National Institute of Allergy and Infectious Diseases of the National Institutes of Health. Weissman received his bachelor's and master's degrees from Brandeis University (1981), his M.D./Ph.D. from Boston University (1987) and completed his residency in internal medicine at Beth Israel Hospital in Boston in 1990.

Short Description:

Fundamental research by immunologist Drew Weissman and biochemist Katalin Karikó laid a critical piece of the foundation for the mRNA COVID-19 vaccines developed by Pfizer-BioNTech and Moderna. The mRNA vaccines have been crucial in the fight against SARS-CoV 2, a new coronavirus discovered in 2019. Nearly 1 billion mRNA vaccine doses have been administered worldwide since December 2020.

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Photo Courtesy of Eraka Bath

Patricia Bath

Laserphaco Cataract Surgery
U.S. Patent No. 4,744,360
Apparatus for ablating and removing cataract lenses

Inducted in 2022

Inductee Bio:

Patricia Bath invented laserphaco, a new device and technique to remove cataracts. It performed all steps of cataract removal: making the incision, destroying the lens and vacuuming out the fractured pieces. Bath is recognized as the first Black woman physician to receive a medical patent.

After completing an ophthalmology residency at New York University, Bath completed a corneal transplant surgery fellowship at Columbia University. While a fellow, she was recruited by UCLA Medical Center and Charles R. Drew University to co-found an ophthalmology residency program at Martin Luther King Jr. Hospital. She then began her career at UCLA, becoming the first woman ophthalmologist on the faculty of its prestigious Jules Stein Eye Institute. She was appointed assistant chief of the King-Drew-UCLA Ophthalmology Residency Program in 1974 and chief in 1983. Bath conceived her laserphaco device in 1981, published her first paper in 1987 and had her first U.S. patent issued in 1988. Her minimally invasive device was used in Europe and Asia by 2000.

When Bath interned in ophthalmology, she was one of the first to document that Blacks had double the rate of glaucoma and realized that the high prevalence of blindness among Blacks was due to a lack of access to ophthalmic care. In a seminal paper in 1976, she proposed the discipline of Community Ophthalmology, combining public health, community medicine, and clinical and daycare programs to test vision and screen threatening eye conditions in historically underserved communities. That same year, she co-founded the American Institute for the Prevention of Blindness, designed to protect, preserve and restore sight through education, community service, research and eye care services. She also founded the Ophthalmic Assistant Training Program at UCLA, whose graduates worked on blindness prevention.

Bath received her bachelor of arts degree in chemistry from Hunter College in 1964 and her medical degree from Howard University in 1968. Included among her many achievements, she was the first Black woman to complete a residency in ophthalmology at NYU and the first woman to chair an ophthalmology residency program in the United States at Drew-UCLA. She has been recognized as a laser pioneer, and among her numerous honors she has been recognized by the National Science Foundation, the Lemelson Center, the American Medical Women's Association, the U.S. National Library of Medicine, the American Academy of Ophthalmology Museum of Vision & Ophthalmic Heritage, the Association of Black Women Physicians with its Lifetime Achievement Award for Ophthalmology Contributions, and by Alpha Kappa Alpha with its Presidential Award for Health and Medical Services.

Short Description:

Ophthalmologist Patricia Bath invented a new device and technique to remove cataracts known as laserphaco. Different than phacoemulsification that uses ultrasound, it could perform all steps of cataract removal, including making the surgical incision, destroying the lens and vacuuming out the fractured pieces.

National Inventors Hall of Fame®

Carl Benz

Modern Automobile
U.S. Patent No. 385,087
Self-propelling vehicle

Inducted in 2022

Photo Courtesy of Mercedes-Benz Classic

Inductee Bio:

German engineer Carl Benz was the first to design a car around the internal combustion engine rather than adding an engine to an existing wagon or carriage, a critical insight in auto evolution.

In 1883, Benz partnered with co-investors to establish Benz & Cie. to market a stationary two-stroke engine he had developed. Its success allowed Benz to focus on developing a lighter engine for vehicles. The two-stroke engine was impractical for this purpose, so Benz set to work on increasing the speed of the four-stroke engine by developing the ignition and valve control.

By 1886, Benz had built a gasoline-powered three-wheeled vehicle, the first to combine an internal combustion engine with an integrated chassis. The two rear wheels supported the 0.75 hp strong, single-cylinder engine, and the front wheel was connected to the steering tiller inside the passenger compartment. Debuting on the streets of Mannheim in July 1886, it had all the main components of today's internal combustion engines: a crankshaft, electric ignition and water cooling. It traveled about 10 km on a liter of gasoline (about 23 mpg), reached a top speed of 16 kph (about 10 mph) and is considered by experts as the first practical, gasoline-powered automobile to be commercially available. By using an approach where the integration of the engine, chassis and drive formed a single entity, Benz set the standard for automotive design.

In August 1888, Bertha Benz, Carl's wife, drove their two teenage sons 100 miles from Mannheim to Pforzheim in a Benz Model 3, stirring up publicity with the first long-distance journey in automotive history along the way. A few days later, Carl Benz displayed the Model 3 at the Munich Engineering Exhibition, where he drove between the exhibit hall and the city several times a day, generating detailed press coverage.

In 1893, Benz solved a steering problem that had prevented him from building four-wheeled cars and debuted the Benz Victoria later that year. By 1900, Benz & Cie. was the world's leading automobile manufacturer. Carl Benz retired from an active role in the company in 1903. Benz & Cie. merged with Daimler-Motoren-Gesellschaft in 1926 to form Daimler-Benz AG.

Short Description:

German engineer Carl Benz was the first to design a car around the internal combustion engine rather than adding an engine to an existing wagon or carriage, a critical insight in auto evolution. By integrating the engine, chassis and drive into a single entity, Benz set the standard for all future automotive design and engineering.

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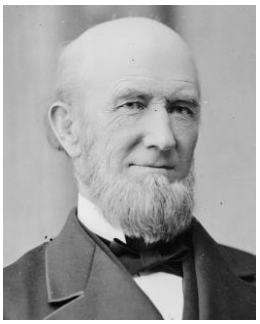

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James Buchanan Eads

American Infrastructure and Defense
U.S. Patent Nos. 83,942 & 170,832
Improvement in bridges/Improvement in mattresses for forming embankments

Inducted in 2022

Inductee Bio:

James Buchanan Eads created a series of inventions during the 1800s that improved transportation, commerce and the military defense of the Mississippi River region. The impact of his innovations in the area, and on the entire country, was immense.

By his late teens, the self-taught Eads was working as a steamboat clerk on a ship that sank. Realizing accidents were common on the Mississippi River, Eads designed salvage ships and an improved diving bell, allowing him to work underwater. He made a fortune in the salvaging business and went on to spend the next several decades addressing challenges in the region.

During the Civil War, Eads constructed a fleet of seven ironclads that the Union used to engage in battle with Confederate forces. He also designed a revolving, steam-powered gun turret for ironclad monitors. His efforts were crucial to Union success.

Following the war, he worked on infrastructure projects to improve transportation and commerce. Construction on the Eads Bridge, the first major bridge to span the Mississippi River, began in 1867 and it opened in 1874. Connecting St. Louis, Missouri, with East St. Louis, Illinois, it was the first bridge to make extensive use of steel and the first bridge in the U.S. to employ pneumatic caissons for deep underwater construction work.

Eads also enabled clear access for large ships from the Mississippi River into the Gulf of Mexico. By constructing a series of jetties at the Southwest Pass, he caused the river to narrow and flow faster. The increased river power scoured a deeper channel. The jetty project, completed in 1879, had a significant impact on the port of New Orleans.

During his lifetime, Eads received many recognitions including election to the National Academy of Sciences, and he was named a fellow of both the American Association for the Advancement of Science and the American Society of Civil Engineers.

Short Description:

James Buchanan Eads created a series of inventions during the 1800s that improved transportation and the military defense of the Mississippi River region. His widespread innovations were crucial to river salvage, the success of the Union Navy during the Civil War, and infrastructure and engineering that enabled major advances in commerce.