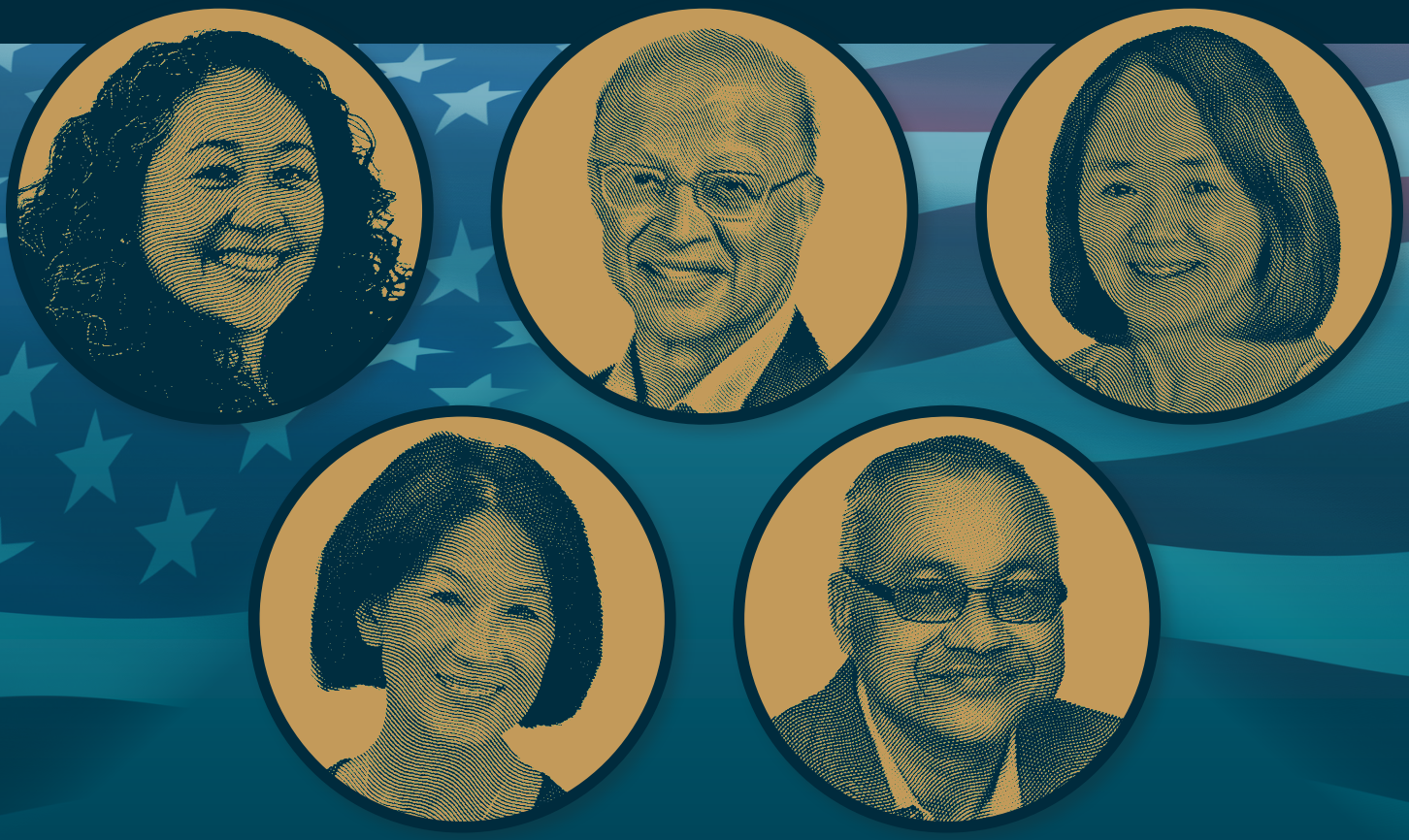

2024 Faces of American Innovation

The Inspiring Triumphs of the Bayh-Dole Act

"Possibly the most inspired piece of legislation to be enacted in America over the past half-century was the Bayh-Dole Act of 1980... More than anything, this single policy measure helped to reverse America's precipitous slide into industrial irrelevance."

– *The Economist Technology Quarterly, 2002*

Bayh-Dole
COALITION

2024 Faces of American Innovation

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A bipartisan miracle that changed the world

Against all odds, the Bayh-Dole Act was passed into law in 1980 — a momentous event that unleashed a wave of innovation.

Indiana Senator Birch Bayh was facing tough times.

He'd been elected to office in 1962, two years into the Kennedy Administration, in one of those rare moments when the party in the White House picks up midterm seats. At just 34, the Democrat became part of a new generation of leaders breathing excitement into national politics.

But by the late 1970s, things were different. Indiana had soured on President Jimmy Carter, dimming Bayh's own hopes of reelection. And vastly worse was the fact that his wife, Marvella, faced a recurrence of cancer. She'd been a dynamic spokeswoman for the American Cancer Society, and she tried to stay optimistic. But doctors told her the disease was inoperable.

Preoccupied as he was, Bayh took a call from Ralph Davis, who was in charge of the technology transfer office at Purdue University. Davis had a problem: Scientists at Purdue were making discoveries with the help of grants from the Department of Energy. With more investments of time and money, these inventions had the potential to become useful products.

But there was a hitch. As a condition of those federal grants, the government took the patent rights on the university's inventions and made them available to anyone who was interested. While well-intended, that destroyed any incentive to invest the time and resources necessary to turn early-stage discoveries into useful products, as rival companies could also get a license from the government and copy their work. As a result, potentially important discoveries just gathered dust on shelves in Washington.

This dilemma resonated with the Bayhs personally. They'd learned that restrictions on patent rights for government-funded research had delayed a tool that could predict how patients would react to chemotherapy. And Marvella was undergoing experimental treatment at the National Institutes of Health. Bayh recognized that while she might benefit from the most cutting-edge research, it would take more time and money to develop that research and share it with the wider public as an approved treatment. He wanted to make sure that happened.

Nevertheless, Bayh and Dole found a common purpose. Together, they crafted a bill that allowed academic institutions, nonprofit laboratories, and small businesses to retain intellectual property rights on discoveries made with government support.

As Bayh soon learned, of some 28,000 patents the government held in the late 1970s, just 5% had ever been licensed for further development. When the government took patent rights away from inventing organizations, not a single drug came to market out of research funded by the National Institutes of Health. Taxpayers were

seeing little benefit from the breakthroughs they'd helped fund.

The backdrop to all this was that the United States, the engine of the global economy after World War II, was losing ground to competitors like Japan and Germany. The industrial heartland became known as the Rust Belt as factories closed. Under the circumstances, it made no sense to let billions of dollars' worth of publicly funded research go to waste.

Bayh was determined to do something — and he learned that Senator Bob Dole, the Kansas Republican, was also interested in the issue. Bayh and Dole were on opposite sides of the political aisle; Dole was working tirelessly to defeat the Democrats in the 1980 election. The country was divided, with Carter facing an uphill battle to stay in office.

Nevertheless, Bayh and Dole found a common purpose. Together, they crafted a bill that allowed academic institutions, nonprofit laboratories, and small businesses to retain intellectual property rights on discoveries made with government support. Royalties universities made from commercialization would be invested back into funding new research and rewarding their inventors. And federal laboratories would be able to effectively license inventions made by their scientists.

Passing the legislation wasn't easy.

The bill faced seemingly insurmountable resistance. The Carter administration opposed the legislation and developed an alternative approach, focused on large government contractors rather than small firms and universities. Russell Long, the powerful Senator from Louisiana, opposed the legislation from the get-go — and threatened to kill it by offering multiple amendments to the bill when it first came to the Senate floor.

Sens. Bayh and Dole worked for months to beat back that opposition and drum up enough support to get the legislation over the finish line. And finally, after countless debates and conversations behind the scenes, the Bayh-Dole Act passed the Senate in April of 1980.

But in the House, lawmakers were throwing their support behind the Carter administration's approach. Before the chambers could align the two bills, the November elections rolled around.

Americans voted both Bayh and Carter out of office, so it looked like Bayh-Dole was doomed. Yet Congress had to reconvene in a lame-duck session to pass a budget, so there was still an outside chance the legislation would survive.

Bayh struck a deal with House leadership as time was running out. The House would include Bayh-Dole in its year-end legislation so long as the Senate passed the bill without any changes. The last hurdle was a unanimous vote in the Senate — a requirement for non-budgetary bills during lame-duck sessions of Congress. And Long was standing in the way.

Long liked the status quo of government patent policies. But apparently, he liked Bayh more. Hours before Congress recessed, Bayh's phone rang. "Birch," Long said, "you can pass your damn patent bill — and I'm sure going to miss working with you!"

In December 1980, the bill became law.

Bayh-Dole doesn't guarantee success. It simply provides the incentives and authorities needed to transform early-stage inventions into useful products. These are the stories of some of the men and women who seized that opportunity — and changed the world.

Ashok Gadgil: The physicist who saved lives with clean drinking water

A road trip revealed stark disparities between the United States and India, changing the course of one physicist's career. Now, his inventions are saving lives across the developing world.

Ashok Gadgil sat on a crowded Greyhound bus, many miles from Berkeley, California, the city he now called home. He listened as his seatmate recounted the details of his life.

Gadgil had had many similar conversations as he zigzagged across the United States. It was 1973, and he was on a mission to understand the real America — not the lavish one portrayed in the movies he'd watched growing up in India. Yet he was beginning to think that those portrayals were more accurate than he'd imagined.

Perhaps most Americans actually did own a telephone and a car. Maybe they really did live in single-family homes, putting more fertilizer on their front lawns than Indian farmers put on their crops. He'd been shocked to learn that even the slums in Oakland were luxurious compared to the slums in Bombay.

To many, the list of disparities between the developed and developing worlds may seem overwhelming and hopeless. But not to Gadgil.

At the time, Gadgil was a graduate student studying theoretical physics at the University of California, Berkeley. After returning from his bus trip, he couldn't stop thinking about the stark inequality between the United States and India. He doubted that his studies in theoretical physics — which had few near-term real-world applications — could help solve the most urgent challenges back home. He shifted his focus to applied physics and finished his doctorate.

He took a job at the Lawrence Berkeley National Laboratory, a lab funded by the U.S. Department of Energy. There, he worked on projects to advance energy efficiency and keep airborne pollutants out of homes. In his spare time, Gadgil read about the latest developments in water sanitation.

Epidemics of waterborne diseases like typhoid, cholera, and dysentery are practically unknown in wealthy nations, but a common fact of life in countries like India.[1] Even by the turn of the twenty-first century, roughly 2.2 million people in the developing world died each year from diseases caused by unsafe drinking water.[2] Most of them were children.[3]

Access to safe drinking water is essential for reducing waterborne illness. Gadgil became intrigued by earlier research demonstrating that UV light could disinfect drinking water. With the help of a mechanical engineering student, he estimated that using UV light, it could cost less than two cents to disinfect one person's drinking water for an entire year. He began to work on the problem.

He soon heard reports of a cholera outbreak in India — which would spread to Bangladesh and Thailand, killing more than 1,000 people.[4] Gadgil was devastated to learn that he was too late to stop the outbreak, but it made him more determined to prevent the next one.

After acquiring initial startup funding from the U.S. Agency for International Development,

Gadgil set to work.[5] He developed the UV Waterworks, a disinfector roughly the size of a microwave oven that was capable of sustaining the drinking water needs of approximately 1,500 people every day.[6] Then, with additional funding from the Department of Energy, he tested the invention in South Africa and refined it further.[7]

Wanting to make his invention as widely available as possible, Gadgil planned to release the blueprint online, allowing anyone to copy it for free. But a conversation with the licensing staff at the National Laboratory changed his mind.

They explained that the impact of giving away the blueprint would be the opposite of what he wanted. The people who really needed the UV Waterworks wouldn't be able to get the blueprint on their own, since they didn't have access to the internet. Nor would they be able to manufacture and distribute it on a large scale. And without a patent and exclusive license, no company would be able to find investors and shoulder the risk of bringing it to market.

He agreed that patenting the invention, which was possible thanks to Bayh-Dole, was the right approach. The University of California filed for the initial patent.[8] Gadgil helped found a company, WaterHealth International, which licensed the technology in 1996. By 2019, Gadgil's invention was serving more than 26 million people across India and Africa.[9]

Gadgil didn't stop there. In the mid-2000s, the Darfur region of Sudan was in the midst of a genocide that had killed approximately 200,000 people and forcibly displaced another two million.[10] When women left their refugee camps to gather firewood for cooking — which could take many hours in the dry and deforested region — they were routinely attacked.[11]

After learning about this ordeal, Gadgil visited Darfur to learn more and collect data. Then, still working at his federally-funded lab, he and his team developed the Berkeley-Darfur Stove, a biomass-based, eco-friendly cookstove that uses much less fuel and thus substantially reduces the need to collect firewood.[12] The University of California, which manages the lab, was assigned the patent for the stove in 2009.[13] As of 2023, more than 61,500 cookstoves had been distributed, primarily in Africa.[14]

Altogether, Gadgil's projects are estimated to have helped more than 100 million people around the world, according to the National Inventors Hall of Fame.[15] They could never have had that big an impact without the Bayh-Dole system to spur and spread innovation.

To many, the list of disparities between the developed and developing worlds may seem overwhelming and hopeless. But not to Gadgil. He counts optimism as one of his core principles because it always keeps him trying.

Hong Hua: Helping people with impaired vision see

One innovator's research caught the eye of a small startup — and changed the lives of thousands of people with low vision.

Hong Hua's mother had one wish for her three children: That they get the best education and help as many people as possible. Hua took her mother's message to heart, and many lives have been changed as a result.

After finishing her doctorate in optical engineering in China, Hua came to the United States as a postdoctoral research associate in 1999. In 2000, as a first-year Beckman Research Fellow at the University of Illinois, Urbana-Champaign, Hua received a prestigious National Science Foundation grant for her research into augmented and virtual reality — AR and VR — which rely on such technologies as physical sensors, imaging systems, human-computer interfaces, and information displays.[16]

Central vision loss prevents people from being able to read, drive, or recognize faces. A device that could correct this type of impaired vision would be nothing short of life-changing.

At the time, it was practically unheard of for the NSF to treat newly minted postdoctoral associates like Hua as principal investigators worthy of their own independent research grants. Yet the NSF saw enormous potential in Hua's work — and decided to place its trust in her. Today, Hua credits her first NSF grant with jump-starting her career as a researcher and innovator, setting her on a path to success.

"I hope more agencies will take risks on today's young scientists," Hua recently said. "Many could be on the cusp of extraordinary breakthroughs."

The NSF's investment soon paid off. In 2004, Hua was hired as an assistant professor at the University of Arizona. There, she continued her exploration into AR and VR. She knew these tools had enormous potential to help people, but she didn't yet know exactly how.

Hua began working with a neurologist who treated people with amyotrophic lateral sclerosis, or ALS, a progressive condition that causes patients to lose the ability to control their muscles. In the later stages of the disease, patients can no longer walk, talk, chew, or perform other basic functions.

At the time, the neurologist was prescribing an eye-tracking device to late-stage ALS patients to help them communicate. The device could trace eye movements back and forth across a screen as a person chose letters to build words and sentences. But the technology was bulky and expensive, requiring a large monitor and a camera to track the patient's eyes. And it wasn't always accurate.

Hua set out to create a more compact, wearable version of the device using VR technology. What if she could integrate the eye-tracking camera into a simple pair of glasses, which could accurately pick up eye movements at closer range?

In collaboration with the neurologist, she developed the technology, built prototypes, and

filed for a patent. But Hua knew that her research would never reach ALS patients without someone to help commercialize it.

She wrote journal articles, traveled to trade shows, and attended conferences in hopes of finding a company that would turn her invention into a real-world product. But none took an interest. The market for her technology was small. This was years before AR and VR would start pulling in hundreds of millions of investment dollars, and before behemoths like Sony and Meta would release VR devices of their own.

As Hua searched for a company to license her research, royalties from licensing agreements on her other federally funded inventions helped keep her University of Arizona laboratory afloat. This was an example of the Bayh-Dole system at work, bringing in income that universities could reinvest into new research.

Eventually, Hua's work caught the attention of a small company called eSight, which had a similar idea for a broader market. The company wanted her help developing a technology that would give eyesight back to people with central vision loss.

Various medical conditions — including diabetic retinopathy, macular degeneration, and Stargardt disease — can cause central vision loss, which prevents people from being able to read, drive, or recognize faces. Many patients can't live independently. A device that could correct this type of impaired vision would be nothing short of life-changing.

Up until that point, Hua had not realized that the impact of her research could be so far-reaching. Remembering her mom's advice, she agreed to partner with eSight. With help from the University of Arizona, Hua entered a sponsored research agreement with eSight, under which the company would directly fund her work in return for the option to license the resulting patents.

The partnership led to a revolutionary pair of electronic glasses. Using a small camera embedded in the frame, the glasses could capture an image, correct the magnification level to meet each user's unique needs, and then project it onto a small screen in front of the wearer's eyes.

In 2017, the company launched the first version of the glasses incorporating Hua's invention — the eSight 3. Less than a year later, more than 1,000 people who had low vision or were legally blind were using the device — which in many cases gave them 20/20 eyesight.[17] One wearer described seeing the details of her mother's face for the first time in her life. Today, thousands of people use eSight glasses. Hua regularly receives letters from users, thanking her for changing their lives.

None of this would have been possible without the federal funds that supported her original research, the patent rights that allowed her to reach an agreement with eSight, or, of course, her dogged perseverance.

These days, Hua runs the university's 3D Visualization and Imaging Systems Laboratory, where she and her team develop tools to power AR and VR for the benefit of humankind. Thanks to the Bayh-Dole system, she can keep finding ways to help as many people as possible — just as her mom would have wanted.

Rachel Dorin: An unlikely career change makes drug production safer

An encouraging word, family support and a U-Haul truck gets an unlikely entrepreneur on her way.

Just over a decade ago, Rachel Dorin told her thesis committee member that after finishing her doctorate, she planned to find a job in management consulting.

"That's disappointing," he replied. "You should be an entrepreneur. And I don't tell a lot of people that."

The casual remark was life-changing for Dorin.

When she'd first enrolled at Cornell University's Department of Materials Science and Engineering, she only knew a little about polymers — chains of small, chemically bonded molecular units. With guidance from her professors and peers, she quickly learned more. She began to explore whether a specific type of polymer, called a block copolymer, could be used to create a new type of porous membrane.[18]

At the time, pharmaceutical companies were using similar membranes to filter impurities out of drugs during the manufacturing process. But the filters were often expensive and inefficient. When one company accidentally let a virus pass through a filter in production, it had to shut down its line, creating a shortage of one of its medicines and leading to a crisis for patients depending on it to protect their health.[19]

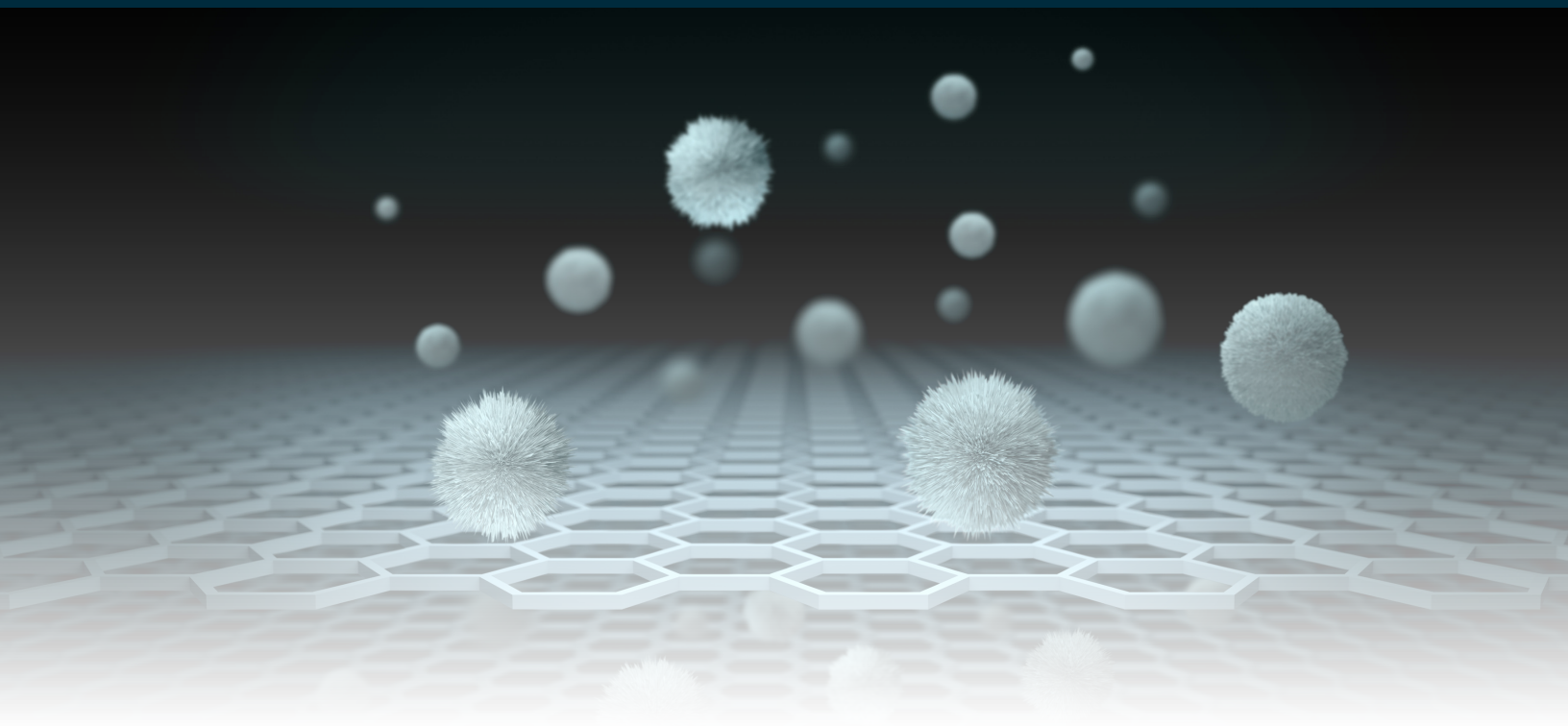
Dorin saw an opportunity to fine-tune and customize filtration membranes based on which particles the manufacturers were trying to keep out. Her lab group began to research and develop such target-specific membranes. She became obsessed with the potential impact they could have on improving the human condition. But there weren't many people doing the same type of research, and Dorin worried that no one would find the answers she was looking for if she didn't find them herself.

She soon made impressive progress. In the third year of her PhD program, she stood with her lab mates and watched in amazement as water slowly dripped through a new, tailored membrane they'd made. They published an academic paper on the invention and sent it to Cornell's technology transfer office. Thanks to the Bayh-Dole Act, Cornell was able to file for patents on the discovery, which had benefited from funding from the National Science Foundation.[20]

In the back of her mind, she'd always known that if she wanted the research to someday bear fruit and change lives, she herself might have to be the one to develop it.

At that point, doctorate in hand, Dorin could have moved on to a secure and lucrative consulting gig.

But the new membrane technology was still in its early stages and existing firms would be reluctant to take on the risk of licensing and trying to develop it. In the back of her mind, she'd always known that if she wanted the research to someday bear fruit and change lives, she herself might have to be the one to develop it. But the entrepreneurial path looked murky and unforgiving.



That conversation with her thesis committee member helped Dorin make up her mind. She decided to start a company, license her research, and do everything she could to get her invention to market.

The only problem was that she had no idea where to begin. That's where family and friends came in.

Her husband, himself an entrepreneur, suggested she apply for a Small Business Innovation Research grant from the National Science Foundation. She did so, and received $150,000 right after she finished her PhD at Cornell.[21] Her sister, a corporate lawyer, offered advice on incorporating her new company. Her father-in-law helped her negotiate a license agreement from Cornell. But she still needed more money — much more — to create a solid foundation for the new venture. She put in her own savings, and friends and family invested too.

It wasn't enough. During the first two years of TeraPore Technologies, her startup was unable to attract the investment capital and employees she needed. She made the hard decision to relocate her company from upstate New York to a highly supportive ecosystem for biotech entrepreneurs, the San Francisco Bay Area.

She and her husband rented a U-Haul and started packing, lab equipment first. She carefully wrapped and tucked her most expensive and breakable lab glassware into her Volkswagen Passat, which sat on a trailer attached to the moving truck, and they made the cross-country journey.

In the roughly nine years since, TeraPore has become a pioneer in the nascent field of nanofiltration. The company has attracted private capital, launched its first products, and established partnerships with multiple drug companies — helping countless patients. And in addition to its pharmaceutical products, TeraPore is developing technology to filter impurities out of chemicals used in making semiconductor chips.

Dorin was right in her expectation that entrepreneurship was going to be difficult. But three key factors helped her overcome the hurdles.

The first was her supportive community. In addition to Dorin's family and friends, professors like David BenDaniel, who recommended she become an entrepreneur, and Uli Wiesner, who co-founded TeraPore, helped convince her that her path — although difficult — was the right one.

The second was federal funding. Government grants allowed her to complete her research and get her company off the ground.

The third was the Bayh-Dole system. It allowed her to license her research from Cornell and gave her the secure patent rights that any tech company needs to attract investment.

Successful entrepreneurship is never easy. But with the right support, breakthroughs can flourish.

Shafiqul Chowdhury: Harnessing a virus for good

Thanks to one veterinary researcher's determination, a revolutionary vaccine could protect cows — and humans.

From avian flu to swine fever, livestock diseases can be devastating. They can wipe out flocks and herds, decimating farmers' income. They reduce the food supply and drive up meat and poultry prices. Water and feed resources go to waste. They cause animals to suffer and to feel emotional distress. And they raise anxiety about potential spread to humans, for which there is alarmingly ample precedent.

One animal ailment, bovine respiratory disease, kills millions of calves each year.[22] The good news is that thanks to virologist and veterinary medicine professor Shafiqul Chowdhury, we may soon have a better vaccine to prevent further outbreaks.

If the vaccine pans out as Chowdhury and RTI expect it to, it would be game-changing for animal and human health alike.

Growing up in Bangladesh, then known as East Pakistan, he was long sure he wanted to pursue a career in veterinary medicine. He hopped on a pre-veterinary track in school, and at age 15, left to continue his studies in Pakistan. But just two years later, the war that led to the independence of Bangladesh forced him to move to Germany, where he worked for several years.

He then returned to Bangladesh and pursued a veterinary medicine degree and a master's degree in microbiology. He taught for a few years and decided to get his PhD. Having received an academic exchange scholarship, he returned to Germany, where he earned a PhD in veterinary virology from the Free University of Berlin.

After immigrating to join family in the United States, he took a job as a post-doc at the dental school at the University of Texas. It took him away from studying animals for a time, but it afforded him the opportunity to begin researching the herpes virus. And that research would shape the rest of his career.

In 1990, Chowdhury joined Kansas State University as a tenure-track faculty member, becoming a full professor in 2002 and winning the Pfizer Award for Research Excellence in 2004. Four years later, an offer of improved facilities drew him to Louisiana State University, where he joined as a tenured professor of veterinary medicine. Using grant funding from the U.S. Department of Agriculture, he began investigating whether the bovine herpes virus could be harnessed into a new vaccine to treat other cattle diseases, and in particular bovine respiratory disease.[23]

Currently available BRD vaccines use live viruses attenuated through genetic modification so that they don't cause disease but do provoke an immune response. Yet even among immunized herds, the infection still kills more than one in five calves.[24]

The live-virus approach has downsides in addition to limited efficacy. For one, it's expensive. It can also cause harmful side effects, including the death of unborn calves. And perhaps most concerningly, live viruses can mutate and regain their ability to cause disease.

Chowdhury had a better approach in mind. He took the bovine herpes virus and stripped it of its ability to cause that disease, whose effects include coughing, fever, nasal lesions, and the death of unborn calves. He then modified the herpes virus to make it produce proteins that exist on the surface of other viruses, including bovine viral diarrhea virus and bovine respiratory syncytial virus.

The idea was that once inoculated with the genetically modified herpes virus, a cow's immune system could be induced to create antibodies to attack not only the herpes virus but also all the other viral proteins. That way, if a cow came into contact with the diarrhea virus or the respiratory virus, its immune system would recognize the proteins and be able to fight them off.

It was a revolutionary approach, one which netted Chowdhury the 2015 Zoetis Award for excellence in veterinary research. And thanks to the Bayh-Dole Act, LSU was able to obtain a patent for the discovery and prepare it for license.[25]

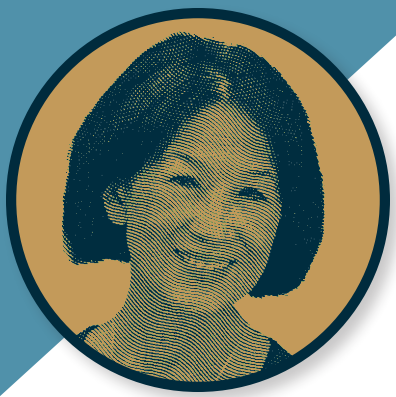
The financial risk in pursuing regulatory approval for a genetically modified vaccine is high. But Chowdhury contacted private-sector partners he had built relationships with throughout his career. More than two decades after he began researching his vaccine platform, he found a small South Dakota-based startup company called RTI to license his invention.

RTI is currently testing the vaccine's safety and efficacy in pregnant cattle. If the vaccine pans out as Chowdhury and RTI expect it to, it would be game-changing for animal and human health alike.

Already, estimates suggest Chowdhury's vaccine could save 8 million calves and $1 billion in costs to the U.S. cattle industry each year.[26] And the fundamental vaccine technology could potentially be adapted for any number of different animals and any number of different diseases.

Preventing disease in animals could help prevent disease in humans, too. The more a virus spreads among animals, the more opportunities it has to mutate. One of those mutations could allow the virus to leap to humans. It's how some of our most formidable viral foes, from HIV to dengue, got their start.

Currently, more research funding goes toward containing outbreaks and treating disease than toward prevention through vaccines like Chowdhury's. But his breakthrough is proof that with hard work and the right public-private partnerships Bayh-Dole enables, we can keep pushing the limits of what's possible.



Katharine Ku: The woman who helped forge the Bayh-Dole system

One young professional's passion and perseverance helped shape the U.S. technology transfer system.

When the Bayh-Dole Act became law in 1980, many could see its enormous potential. But still, few really knew how to implement it. Up until that point, most universities had only very limited experience in managing and licensing patents based on their discoveries.

That was the situation Kathy Ku, a chemical engineer by trade, walked into when she took a job at Stanford University's Office of Technology Licensing (OTL) in 1981. In the new role of licensing associate, she joined a small office and OTL founder Niels Reimers, who would become her mentor. Together, they had to figure out how to effectively move early-stage university innovations into the marketplace — and with most universities still uncertain about how to start licensing their inventions, they had only very limited models to follow.

So OTL developed its own model, built around a recent university breakthrough. Stanford Professor Stanley Cohen and University of California, San Francisco Professor Herbert Boyer had just come up with a process for merging and cloning DNA segments. It would come to be known as recombinant DNA.

After an arduous six-year effort to patent the discovery, the simple path for OTL would have been to license it exclusively to a single company — and they had a lucrative offer on the table to do just that.

But Ku and Reimers understood that recombinant DNA had the potential to deliver a much greater benefit to the public if multiple companies could use it to develop the many new products that relied on this technology. So they took a different approach, licensing it non-exclusively to all interested companies at reasonable rates. The OTL made clear that it considered licensees partners rather than customers, so that they would want to come back and license other inventions. By the time the Cohen-Boyer patent expired in 1997, it had been licensed to over 400 companies.[27]

But she never lost sight of her role as a pioneer of the tech transfer profession — and her ensuing responsibility to ensure that the Bayh-Dole system she helped build would last.

Stanford OTL's foresight helped spark a scientific and economic revolution. Today, recombinant DNA underpins more than 2,400 transformative products.[28] It helped create synthetic insulin, now used by millions of diabetics to regulate their blood sugar levels. It led to a vaccine against hepatitis B and a crucial HIV detection tool. Recombinant DNA has also been foundational to agricultural products such as golden rice — which can prevent childhood blindness and save millions of lives.

Meanwhile, Stanford's trailblazing approach paved the way for other tech transfer offices to license their technologies. Universities like MIT and other government-funded labs began

to emulate the Stanford model of creating win-win licensing agreements.

As partnerships between industry and academia flourished, the U.S. biopharmaceutical sector soon overtook Europe's and Japan's as the undisputed global leader. Now, it supports nearly five million jobs across the country.[29] Even small businesses that receive federal research grants rely on the technology transfer system established by Bayh-Dole and refined by OTL.

In 1991, Ku became OTL's executive director. Under her leadership, the office more than doubled its staff and income.[30] The job wasn't easy, as companies were still cautious about licensing early-stage research. But building on Bayh-Dole's opportunities, Ku was able to shepherd countless new technologies to market.

One of those new technologies was a web-search algorithm developed by two Stanford grad students with funds from the National Science Foundation.[31] The students were Sergey Brin and Larry Page, and their search algorithm launched Google, one of the most globally transformative companies of the last century. Google's success exemplifies how devolving technology transfer to universities can achieve breakthroughs that the government could never plan on its own.

The Stanford OTL's impact goes even further. The university's researchers developed a fiber optic amplifier, which makes computers and phones run much faster than they otherwise would. They created the MINOS optimization software, used to help design the hulls of America's Cup racing yachts. They developed treatments for celiac disease and a technology to accelerate research on electric vehicle batteries.

Ku could have rested on her laurels after bringing these technologies to market. But she never lost sight of her role as a pioneer of the tech transfer profession — and her ensuing responsibility to ensure that the Bayh-Dole system she helped build would last.

As more universities established technology transfer offices, Ku realized that the profession needed to think deeply about its underlying philosophy and principles. So in 2006, she organized a relatively small meeting of tech transfer leaders from around the country, inviting research deans who hadn't traditionally been part of the broader discussion. Their final platform — known today as the Nine Points — has since been adopted by more than 120 universities.[32]

The Nine Points meeting reflected Ku's strong belief that bringing people together to learn from each other was the best way to advance the profession. She lived these beliefs. Her humble nature, willingness to share advice, and uncompromising integrity made her a friend, mentor, and role model to many. Thanks to her leadership, the academic tech transfer industry has governed itself for nearly 45 years without interference from Washington.

U.S. innovation wouldn't be the same today without Ku. She had almost no examples to draw on for how to apply the powers granted by Bayh-Dole — so she helped develop a highly successful model and freely shared it with new generations of tech transfer professionals. That model is predicated upon a core value Ku has long championed for universities and other research institutions: promoting the transfer of technology for society's use and benefit over short-term financial gain.

Ku retired in 2018, after 37 years at Stanford OTL and 27 years as its executive director. For the last five years, she has been an advisor at Wilson Sonsini Goodrich & Rosati, one of the world's leading law firms specializing in representing pioneers and disruptors in the life sciences and technology sectors. At WSGR, she assists start-ups in licensing early-stage research from universities, continuing her mission to facilitate groundbreaking technology transfer between academia and industry.

Her passion, perseverance, and ingenuity — in a profession that hadn't previously existed — helped transform the world.

Not all roads lead straight to success

Some innovations fail despite the best efforts of everyone involved. But "failure" can easily become a stepping stone to a future success.

But not every Bayh-Dole story is a success. After all, getting an invention from the lab to the marketplace is a long, risky, and expensive endeavor. Often, there's a snag in the process. It's entirely possible for researchers, universities, and private partners to do everything right — and still fail.

Cody Friesen: The inventor whose batteries ran out of juice

Cody Friesen had no intention of joining the faculty at his alma mater in 2004. But when he learned that Arizona State University was exploring ways to harness ideas on campus to solve real-world problems, he knew he had to take part.

And he had just the real-world problem to solve.

At the time, there were few cost-effective, reliable, and sustainable ways to store renewable energy, such as solar and wind power. That changed when Friesen discovered a way to make zinc-air batteries rechargeable. He founded Fluidic Energy in 2007 to commercialize the research.

The technology was a raging success. It helped bring electricity to millions of people in the developing world. And it attracted millions of dollars in venture capital.

Despite years of triumph, Friesen's technology failed to catch on in the broader energy storage market. Fluidic tried to keep going by laying off half its workforce. But even that couldn't save the company from shutting down.

Yet Friesen's ingenuity wasn't for naught. In 2020, a new company called Form Energy acquired all of Fluidic's assets and patents. Technology that Fluidic perfected over a decade now underpins an essential component of Form Energy's iron-air battery.

Form Energy's CEO credits Fluidic with saving his own company years of research and unnecessary risk. In other words, one innovation's "failure" can provide just the right amount of juice for another's success.

James Crowe: The antibody hunter missing from history books

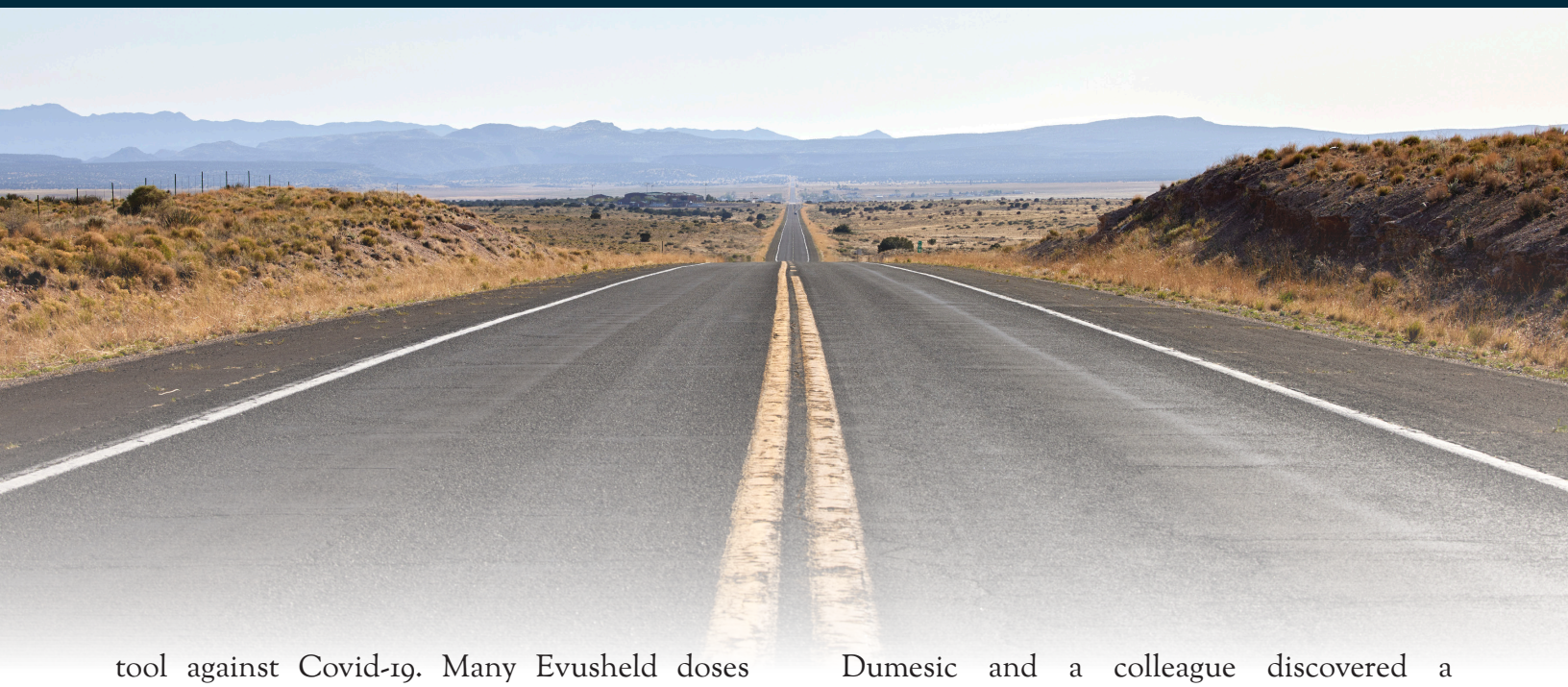
As mysterious cases of a novel coronavirus started popping up in early 2020, the Defense Advanced Research Projects Agency — DARPA, a federal department — came knocking at James Crowe's door. The world needed a treatment to neutralize Covid-19 — and fast.

The Vanderbilt University vaccine researcher knew time wasn't on his side. He had previously discovered antibodies that could fight viruses like Ebola and bird flu, but the process usually took him months. With Covid-19 spreading rapidly, Crowe had just days to find a solution.

So he hunkered down in his lab, working around the clock to sift through survivors' blood and find a needle in a haystack: antibodies that could fight Covid-19.

After just 25 days, Crowe succeeded. He delivered a batch of antibodies to AstraZeneca for further development. In December 2021, some of them were granted Emergency Use Authorization by the U.S. Food and Drug Administration under the name Evusheld.

But as the government worked to get a grip on the pandemic, there was no coordinated effort to educate providers or the public about the new



tool against Covid-19. Many Evusheld doses went unused.

Meanwhile, the virus evolved rapidly, eventually rendering the medication ineffective. In January 2023, the FDA revoked its authorization for Evusheld after data showed the treatment was not effective against more than 90% of the new Covid-19 variants circulating in the United States.[33]

Despite Evusheld's eventual demise, roughly 720,000 courses were administered to U.S. patients. The medication likely saved thousands of lives.[34]

When the story of Covid-19 is written, few will remember the antibodies on the market for little more than a year — let alone the university researcher who holed himself up in a lab and delivered them to patients in record time.

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James Dumesic: The professor with a recipe for success

Former University of Wisconsin-Madison chemist James Dumesic knows what it takes to turn early-stage, federally funded research into a real-world product.

In 2002, he did just that.

Dumesic and a colleague discovered a revolutionary process that could convert plant sugars into the compounds that make up energy sources like gasoline, diesel, coal, and jet fuel. The pair launched a spin-off company called Virent to license and commercialize the research.

With millions of dollars in federal grants, numerous awards, and multiple partnerships with companies ranging from Coca-Cola to Shell, Virent is a huge success. So when Dumesic developed a separate process to turn organic matter into industrial chemicals and founded Glucan Biorenewables in 2012 to license the research, many likely thought it'd be another home run.

But investors weren't biting. In a world running on cheaper, fossil-fuel-based chemicals, attracting interest in the biochemical space was incredibly difficult. Despite raising over a million dollars in funding, the company couldn't stay afloat.

Dumesic had all the right ingredients: a good idea, the right patents, and experience commercializing breakthrough research. But sometimes, even with all those elements, success is still elusive.

Epilogue

The Bayh-Dole system is a national treasure. We must protect it.

When President Carter signed the Bayh-Dole Act into law forty-four years ago, Senators Bayh and Dole couldn't have imagined all the incredible opportunities their legislation would unlock. But they would have been delighted to see how inspired people like Ashok Gadgil, Hong Hua, Rachel Dorin, Shafiqul Chowdhury, and Katharine Ku seized the opportunities their landmark law made possible to make the world a better place.

The Bayh-Dole Act created the possibility that federally funded inventions would be turned into useful products. But that promise is only fulfilled through the dedication of our public sector researchers, our technology management professionals, and most importantly, our private sector entrepreneurs, who commit their time and treasure — despite great risk — to turn research ideas into products that improve our lives and drive our economy.

The Bayh-Dole Act didn't require any new funding or create any new bureaucracy. It simply introduced the authorities and incentives needed to drive commercialization into a system that previously had been dysfunctional. The law's genius was decentralizing technology management out of Washington, D.C. and into the hands of those making new inventions with federal funds. The law works without any fanfare day in and day out, making lives better here and around the world.

Yet despite its manifest successes, there are those who want to repeal Bayh-Dole and others who yearn to restore Washington micromanagement. Either path leads to disaster.

Bayh-Dole is like a goose that lays golden eggs for us every day. All that it asks in return is that we appreciate and protect it.

That doesn't seem like asking too much, does it?

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Bayh-Dole Coalition Executive Director Joseph Allen sitting alongside Senator Birch Bayh as his aide in the Bayh-Dole hearings

About the Bayh-Dole Coalition

The Bayh-Dole Coalition is a diverse group of innovation-oriented organizations and individuals committed to celebrating and protecting the Bayh-Dole Act, as well as informing policymakers and the public of its many benefits.

About Joseph P. Allen

Joe is the executive director of the Bayh-Dole Coalition. As a professional staffer on the Senate Judiciary Committee to Sen. Birch Bayh (D-IN), he played a key role in the successful passage of the Bayh-Dole Act of 1980 and its subsequent amendments.

He later served as the director of the Office of Technology Commercialization at the U.S. Department of Commerce, which oversees the implementation of Bayh-Dole across all federal agencies. Joe chaired the Interagency Committee on Technology Transfer, where he helped agencies implement the Federal Technology Transfer Act and worked to insure that international science and technology agreements conformed to Bayh-Dole. He also served as president of the National Technology Transfer Center.