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SPRING 2018 ASIA/PACIFIC – FALL 2018

CONNECTING TO INDUSTRY

THINKING SMALL

The nanoparticle revolution is having a huge impact on fields as far-ranging as manufacturing and medicine, transforming the way we live today ... and tomorrow.

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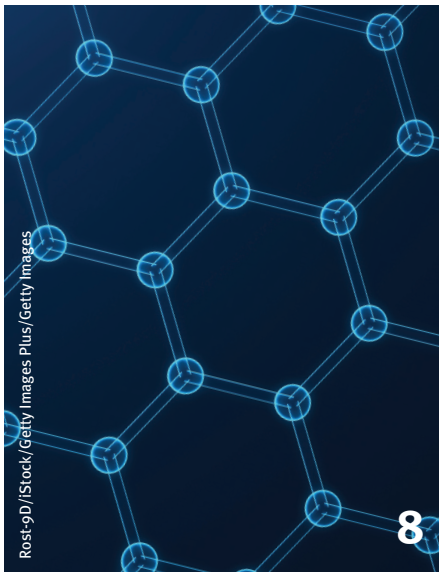
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8


ASSOCIATED PRESS

18


Cliff Welch/Icon Sportswire 357/Cliff Welch/Icon Sportswire/Newscom

24

FEATURES

DEPARTMENTS

READING THE FUTURE

In the 13 years since *BOSS* magazine made its debut with a cover story on bridge building, Dixon has continued the mission outlined in the inaugural Editor's Letter: to keep up with "the many changes in technology and equipment ... and to continually look at ways to make our product offering and our company the best choice for customers."

As Dixon products have evolved to better meet your needs since 2005, so has our magazine: With each issue since that first one, we have strived to provide stories that are increasingly relevant and informative to your life.

From our own experience, and from countless surveys and data about readership habits, we know that people today are increasingly turning to online sources for news and information. And while many of us still value print publications, we have less time for lengthy, in-depth articles and are eager instead for shorter stories accompanied by information-packed graphics and interesting stats.

So that's the direction we're headed with this magazine. Moving forward, we'll be retaining what's best about *BOSS* and "re-imagining" a new version with shorter articles, compelling new departments and increased opportunities for "quick hits." We'll also be providing more of our content via e-books and e-editions in our ongoing effort to make our website your valued resource.

We're excited about this evolution and hope you will be, too! We're also curious to know your own reading habits — including whether you prefer to read *BOSS* in print or online. Please drop us an email: boss@dixonvalve.com.

Thanks for reading,

Dick Goodall
CEO, Dixon

Sue DePasquale
Editor

BOSS

SPRING 2018
ASIA/PACIFIC – FALL 2018

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ON THE COVER
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Youth Sports and the Olympic Games

> IN FEBRUARY 2002, with the Winter Olympics as a backdrop, the Josephson Institute hosted a summit meeting of many of the most influential leaders in youth sports. Their task was to develop standards and strategies to improve the quality of the sports experience for youngsters 12 and under. Before coming up with a document called "Gold Medal Standards for Youth Sports," a lot of time was spent discussing bad sportsmanship, violent and abusive parent behavior, and other negative trends that demean and diminish the reputation and reality of youth sports.

At the same time, the growing gap between Olympic ideals and some ugly realities of modern-day competition did not go unnoticed. In both youth and Olympic sports, the divide between noble rhetoric and nasty reality results from an abandonment of the gallant and uplifting goals of athletic competition in favor of an unrestrained, obsessive and often unprincipled pursuit of personal glory and material gain.

Though the word "competition" is derived from the Latin word *competere*, which embodies the idea of "striving together," competitors are commonly viewed as enemies, even in a youth context.

The solution is easy to articulate, but hard to achieve. We have to take to heart the Olympic Creed: "The most important thing is not to win but to take part, just as the most important thing in life is not the triumph, but the struggle. The essential thing is not to have conquered, but to have fought well."

You see, real sport is not about defeating someone else. It's about having fun and improving yourself. If there are enemies in sports, they are the people who are pillaging its noble traditions.

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Father of the American Navy

John Barry's love for the sea took him from cabin boy to Commodore

Portrait of Commodore John Barry, by V. Zveg.

https://en.wikipedia.org/wiki/John_Barry_(naval_officer)#/media/File:John_Barry_by_Gilbert_Stuart.jpg

> "I HAVE TO REPORT THE SHIP in frightful condition, Sir. The rigging is much cut, damage everywhere great, many men killed and wounded, and we labor under great disadvantage for want of wind. Have I permission to strike our colors?"

That was the report given to an injured Capt. John Barry, who was below deck having his wounds dressed during a fearsome battle against two British warships near Newfoundland on May 29, 1781. Barry's resolute response showed why he had become such a legend among his sea-faring peers. "If this ship cannot be fought without me, I will be brought on deck; to your duty, Sir."

Fortunately, a big wind soon filled the sails of Barry's 32-gun frigate *Alliance*. With renewed energy and Barry back at the helm, the starboard battery blasted its 12-pound cannons, scoring two broadsides in the four-hour battle that ensued. The British lost both its ships (and its captain) that day, and Barry survived to continue his brave leadership on the high seas. A good thing, too: American independence might never have been achieved if not for the naval daring of Barry, an adopted son of the fledgling United States who emerged a hero of the Revolutionary War.

"BIG JOHN"

Born in Ireland in 1745, in the port village of Tacumshane, John Barry was no friend to the British Empire. As a child, he and his family were forcibly evicted from their squat cottage by a British landlord. One of Barry's biographers speculates that this childhood trauma "led to a lifelong enmity of oppression and the British."

The family moved to Rosslare on the coast, where Barry's uncle operated a fishing skiff. Before long, young Barry took to the sea as a cabin boy on a merchant ship to escape the poverty of his Irish homeland. By age 15, he made his way to the American colony, bringing with him a strong knack for navigational skills and ship repairs.

In Philadelphia, John Barry quickly gained a reputation as an expert merchant sailor. At 6 foot 4 inches tall, the ruddy captain cut an imposing figure. He became known far and wide as "Big John."

Barry's usual route was the round trip from Philadelphia to the West Indies. Not a single mishap over dozens of voyages marred his record as he climbed the merchant ranks, commanding the schooner *Barbadoes* in 1766, the *Peg* in 1772, and finally the speedy *Black Prince* just before the signing of the Declaration of Independence. It was on the *Black Prince* that Barry set the 18th century's record for the fastest day of sailing: In a 24-hour period while returning from England on commercial business, Barry logged an astounding 237 miles.

Philadelphia was Barry's preferred base of operations, in part because of its thriving maritime trade industry, but also because of the Pennsylvania colony's comparatively liberal laws addressing religious expression. Barry was, after all, a Catholic in a colony largely dominated by competing strands of Protestantism.

NEVER SURRENDER

In the early 1770s, Colonial anger concerning British injustices grew, as "Taxation Without Representation!" passed from lip to lip. The First Continental Congress convened in Philadelphia to deliberate in June 1774. In an atmosphere of split loyalties between colony and crown, Barry firmly committed to the revolution. He sold the *Black Prince*, oversaw its outfitting into the warship *Alfred*, and was soon named a captain in the newly formed Continental Navy.

John Barry statue, outside Philadelphia's Independence Hall

f11photo/iStock/Getty Images Plus/Getty Images

After a brief stint as a marine, when he saw live action at the battles of Trenton and Princeton, Barry returned to the sea in 1778, quickly gaining fame for his daring naval maneuvers.

Early on in the war, his USS *Raleigh* faced pursuit from two technologically superior British vessels, which chased Barry and his crew all the way up to Maine's Penobscot Bay. The British had the *Raleigh* cornered and its main mast had cracked. But surrender was out of the question for Barry. Instead he ordered the destruction of the ship to save it from British capture and prepared to evacuate his men on a handful of rowboats. Barry safely led 88 crew members, oar stroke by oar stroke, down to Boston.

Two years after his victory over the British on the *Alliance*, near Newfoundland, Barry led that ship in the last naval engagement of the war. In March 1783, he and his crew successfully fended off British attack as they escorted the transport Duc de Lauzane, outfitted with money and supplies for the Continental Congress, safely into port.

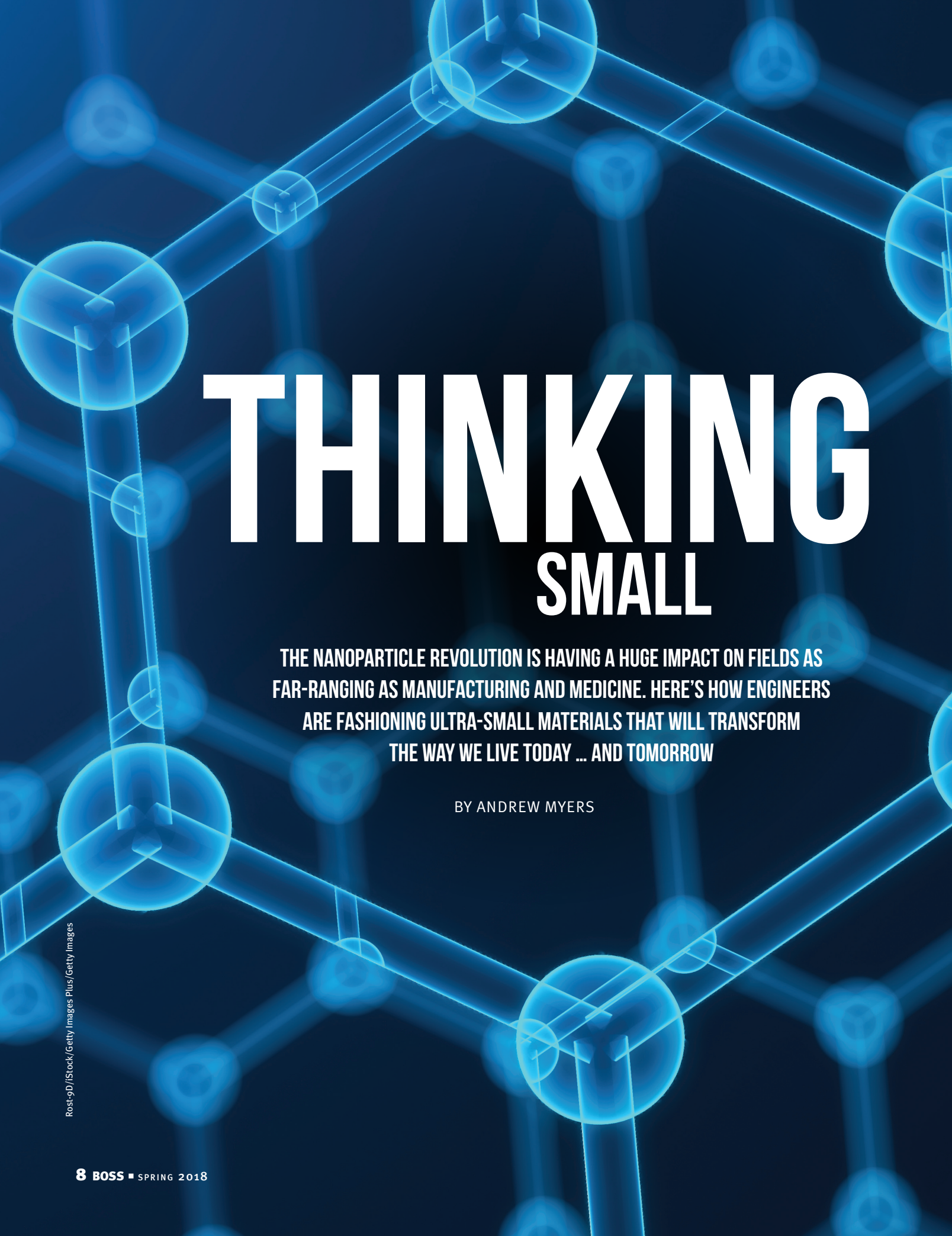
Chief Naval Leader

After the Americans' victory over the mighty British Empire, the Continental Navy disbanded. Barry returned to maritime trade. It took another few years for a permanent U.S. navy to be established.

President George Washington guided its creation, and tapped his trusted comrade, Captain John Barry, as the senior captain of the Federal Navy. On February 22, 1798, Barry received the coveted "Commodore" title, recognizing his status as America's chief naval leader.

Barry was present before, during, and after the moment of creation of the United States. He is one of the nation's first, most prominent success stories: an immigrant who fled oppression, found success in American business, practiced his religion freely, served his country nobly and even found time for family life (he was married twice and happily raised his sister's two orphaned boys).

Barry died in the suburbs of Philadelphia in 1803 at the age of 58, from asthma-related complications. He remained the official head of the United States Navy to his dying breath.



THINKING SMALL

THE NANOPARTICLE REVOLUTION IS HAVING A HUGE IMPACT ON FIELDS AS FAR-RANGING AS MANUFACTURING AND MEDICINE. HERE'S HOW ENGINEERS ARE FASHIONING ULTRA-SMALL MATERIALS THAT WILL TRANSFORM THE WAY WE LIVE TODAY ... AND TOMORROW

BY ANDREW MYERS

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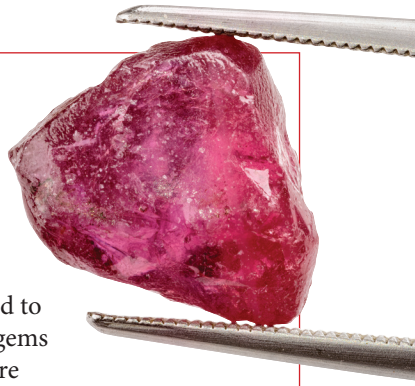


From the rich red of a ruby to the tranquil blue of a sapphire, the mysterious effects of "nanoparticles" are hardly new to the world. Though jewelry shoppers might be surprised to learn it, these two coveted gems are actually the same mineral. Both are aluminum oxide, and both would be transparent if not for nanoparticles — in this case, super-tiny flecks of metal — scattered within aluminum oxide's otherwise orderly crystalline structure. A few microscopic bits of chromium here or there, and aluminum oxide turns into a blood-red ruby. A few tidbits of titanium instead, and it turns the azure blue of a sapphire. Mother Nature, it seems, is the original nanotechnologist.

Today, scientists and engineers are taking their cue from Mother Nature to tap into the power of these natural wonders. Nanoparticles have become the heroes of a new age, in which technologies do their work in an invisible world almost too small to comprehend.

Just how small is a nanometer? A millimeter is about the distance between the two l's in the word "millimeter" printed on this page. Now, imagine that narrow span slivered into 1 million even slices. That's how small "nano" can be.

Empowered by advances in microscopes and manufacturing techniques, a new generation of physicists and engineers has not only managed to see such small particles, but has also learned how to manipulate them to do magical things at human scale.

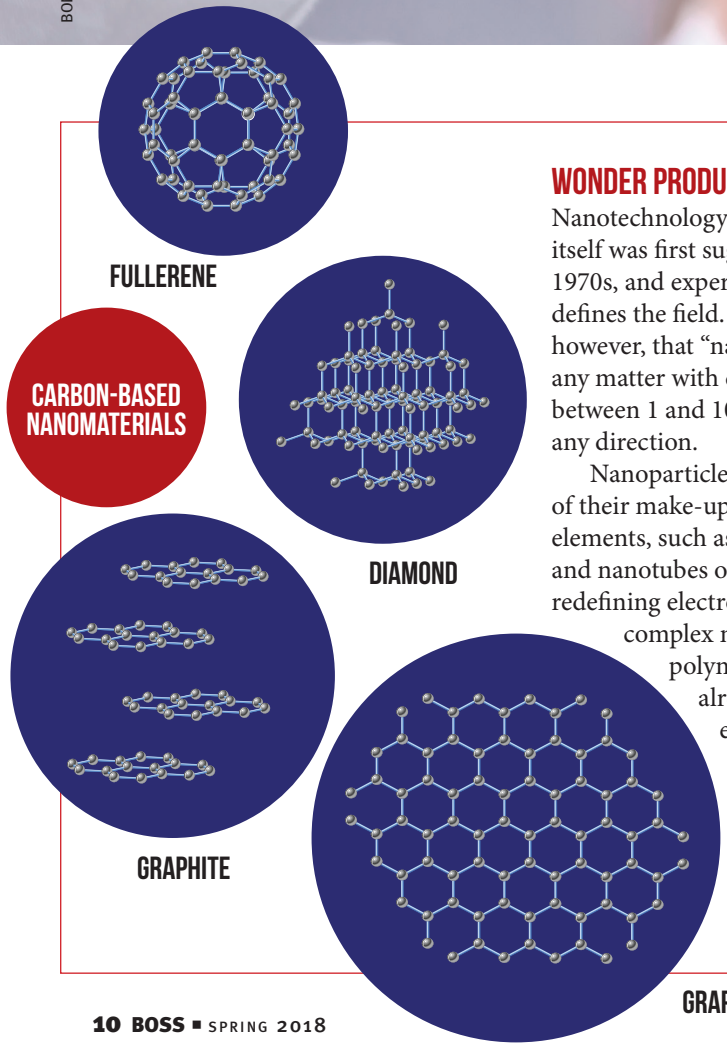
Futurists predict that nanoparticles could hold the key to everything from virtually unlimited solar power to a cure for cancer. Already, nanoparticles have given us smaller electrical circuits, better batteries, ultra-lightweight, super-strong composite materials and ways to see into the human body as never before.

Forget the ages of stone, bronze, iron and steel; we are witnessing the dawn of the Age of the Nanoparticle.

Ruby: Reimphoto/iStock/Getty Images Plus/Getty Images; Sapphire: J-Palys/iStock/Getty Images Plus/Getty Images

BONNINSTUDIO/iStock/Getty Images Plus/Getty Images

A piece of graphene with its single layer of carbon atoms



WONDER PRODUCTS

Nanotechnology is so new that the term itself was first suggested only in the 1970s, and experts still debate what defines the field. All seem to agree, however, that "nanoparticle" includes any matter with dimensions measuring between 1 and 100 nanometers in any direction.

Nanoparticles vary widely in terms of their make-up. Nanoparticles can be elements, such as the nanowires of silver and nanotubes of carbon that are redefining electronics. Others are complex molecules, such as the polymers that are making already strong composites even stronger, and the nanopharmaceuticals that are reshaping modern medicine.

The driving factors in the Nanoparticle Age come down to physics. Nanoparticles simply do not behave in the same ways that their bulky, human-scale brethren do.

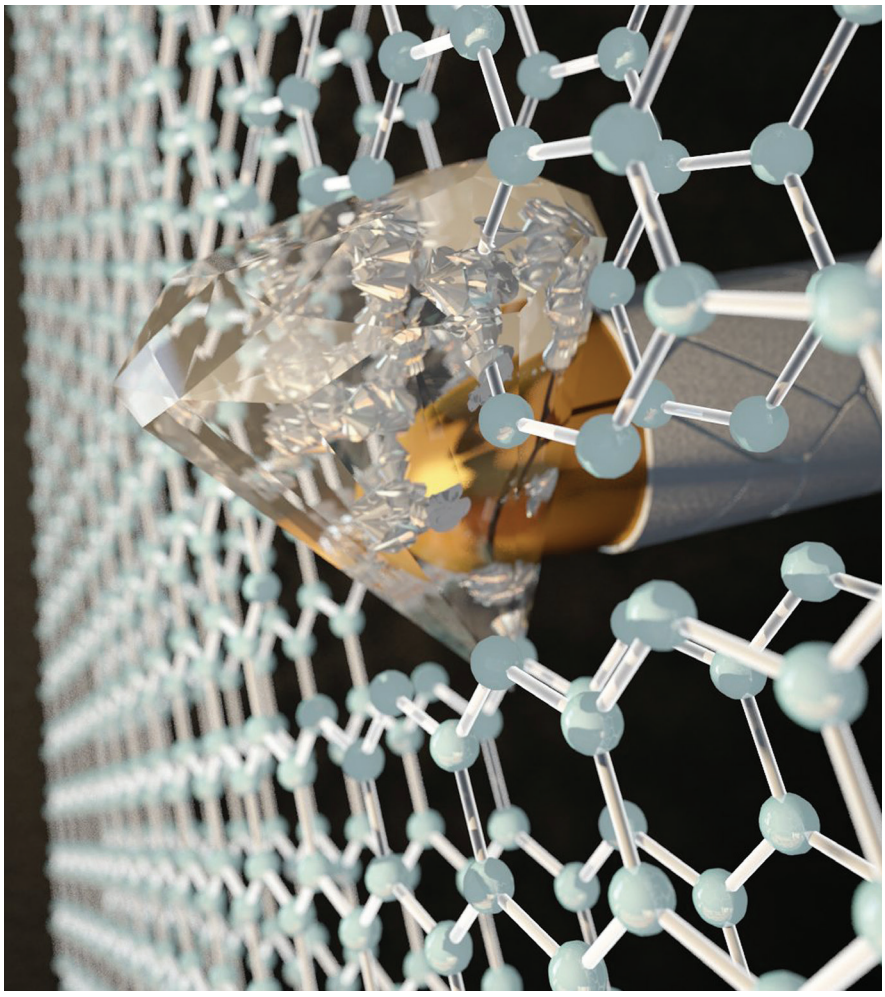
- As we have seen with rubies and sapphires, **nanoparticles react differently to light**. Their optical properties can be exploited to create new medical imaging techniques, advanced lasers and data communication technologies.
- Because they have a **greater surface area**, nanoparticles are exceptional catalysts that could lead to new drugs, better batteries and more efficient petroleum refining.
- Nanoparticles have **different melting temperatures** and can improve the thermal performance of other materials when added in — think polymers and composites that can withstand extremes of hot and cold for space travel.

Carbon-based nanomaterial: nkoly/iStock/Getty Images Plus/Getty Images

- The **exceptional electrical conductivity** of nanoparticles is an area of great interest currently being explored with a view to creating smaller, more efficient electronics.
- Nanoparticles' dramatic **mechanical strength** is being put to use in creating stronger steel, concrete, ceramics and plastics. For instance, bulk copper is thought of as a relatively soft and malleable material that can be easily shaped into pipes and wires. But when shaped into nanoparticles less than 50 nanometers in diameter, copper becomes super-hard and can be used to create high-strength, electrically conductive alloys.
- Last but not least, nanoparticles' **magnetic properties** are being exploited for everything from improving magnetic resonance imaging (MRI) to data storage.

Every one of these physical differences holds engineering promise. Like the armies of polymer scientists a half-century ago who dreamed of discovering the next nylon, countless researchers today are busy working to find the next big nanoparticle.

One of the most touted of all the nanomaterials today is graphene. It is made up entirely of carbon atoms arranged in a single layer. The carbon atoms form a hexagonal, or honeycomb-like pattern, like a flat sheet of chicken wire. In what may be hyperbole, graphene is said to be so thin as to have no thickness at all: a two-dimensional material.



Ferrari/ZUMA Press/Newscom

Scientists have determined that two layers of graphene can harden to a diamond-like consistency and be impenetrable by a bullet upon impact. The potential result? Body armor made of a material as lightweight as tinfoil.

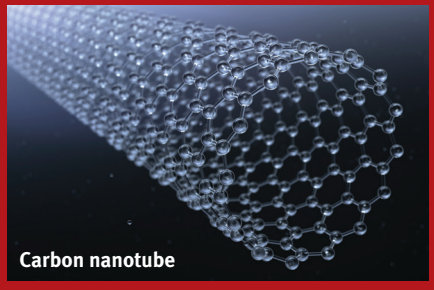
Graphene is nothing less than a wonder product — "the scientific find of the century," as one writer put it. It is highly conductive, electrically and thermally; impossibly strong, yet elastic and bendable; incredibly lightweight and transparent, too. If these descriptions bring to mind thin, foldable touchscreens and electronics, you are on the right track. Engineers are already working on such applications using graphene.

Graphene can be rolled into nanotubes. It can be kneaded into spheres, affectionately dubbed "bucky balls," for the way they resemble the

DID YOU KNOW?

Silkworms produce super-tough silk when fed carbon nanotubes and graphene.

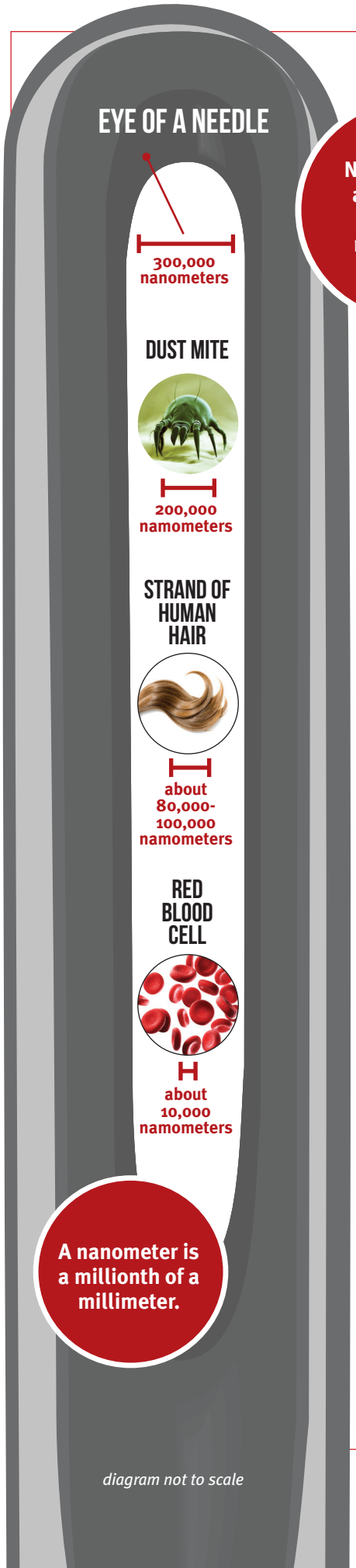
Source: https://www.smithsonianmag.com/smart-news/feeding-caterpillars-carbon-nanotubes-makes-super-tough-silk-180960752/#SbUwDFpdttdaOHV



Carbon nanotube

Silk cocoons

Carbon nanotube: enot-poloskun/iStock/Getty Images Plus/Getty Image; Silk Cocoons: fotohunter/iStock/Getty Images Plus/Getty Images



Needle: S-e-v-e-re/iStock/Getty Images Plus/Getty Images; Dust mite: Eraxion/iStock/Getty Images Plus/Getty Images; Hair: Artem Makovskyi/iStock/Getty Images Plus/Getty Images; Red blood cells: Eraxion/iStock/Getty Images Plus/Getty Images

Nanoparticles are between 1 and 100 nanometers in size.

geodesic dome houses made popular by the architect Buckminster Fuller. Engineers can also mix and match their carbon-based nanoparticles. In one example, researchers have been able to roll up bucky balls inside nanotubes to produce something they call a nanopeapod.

Nanopeapods have promising heat conductance properties that engineers believe could make possible devices that generate electrical power from excess heat. The heat from a smartphone might be channeled into a nanopeapod-based generator to send electricity back to the phone. This sort of self-renewing circuit might produce devices that could even harness the heat from a living creature. Someday, the warmth of a jogger's own skin might power the music player providing the soundtrack for her morning jog.

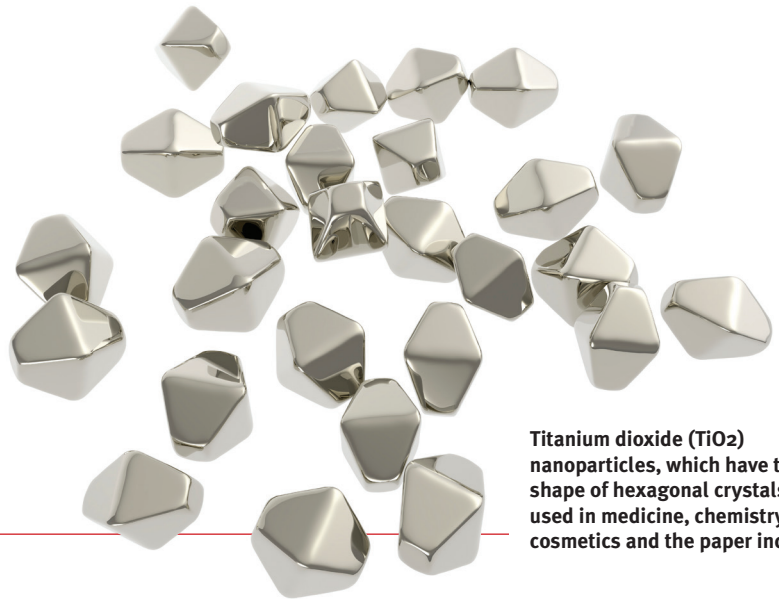
Inspiration for nanoparticles can come from anywhere, at any time. Often, it comes out of the blue. Graphene was first created in 2004, when researchers in Manchester, England, used a piece of Scotch tape to peel back a layer of graphene from a large chunk of graphite, the same material found in your pencil. Little did they suspect the impact their discovery would have. Just six years later, in 2010, Andre Geim and Konstantin Novoselov would share the Nobel Prize in physics for "groundbreaking experiments" using graphene.

The uses of graphene nanoparticles are only beginning to emerge. Its porous nature lends itself to use as a filter to purify water. Carbon nanotubes are a leading contender to replace silicon in new-age computer chips. Nanoparticles of graphene are used in quick-charging batteries and mixed into plastics to produce advanced fire retardants.

MANUFACTURING REVOLUTION

Perhaps nowhere is the nanoparticle effect being felt more acutely than in the manufacturing of traditional materials such as concrete, steel and ceramics. Nanoparticles are now commonly used in ultra-high-performance concretes to improve the concrete's ability to withstand twisting, pulling and compression of construction applications. Particles commonly found in today's concrete include silica and titanium dioxide, but increasingly, super-strong carbon nanotubes and nanofibers have been making their way into the mix.

These tiny nanoparticles fill the fine gaps that occur naturally within concrete. Such gaps are often the weakest points in the material and can lead to failure under high stress. Like steel rebar in reinforced concrete, nanoparticles act like tiny tendrils



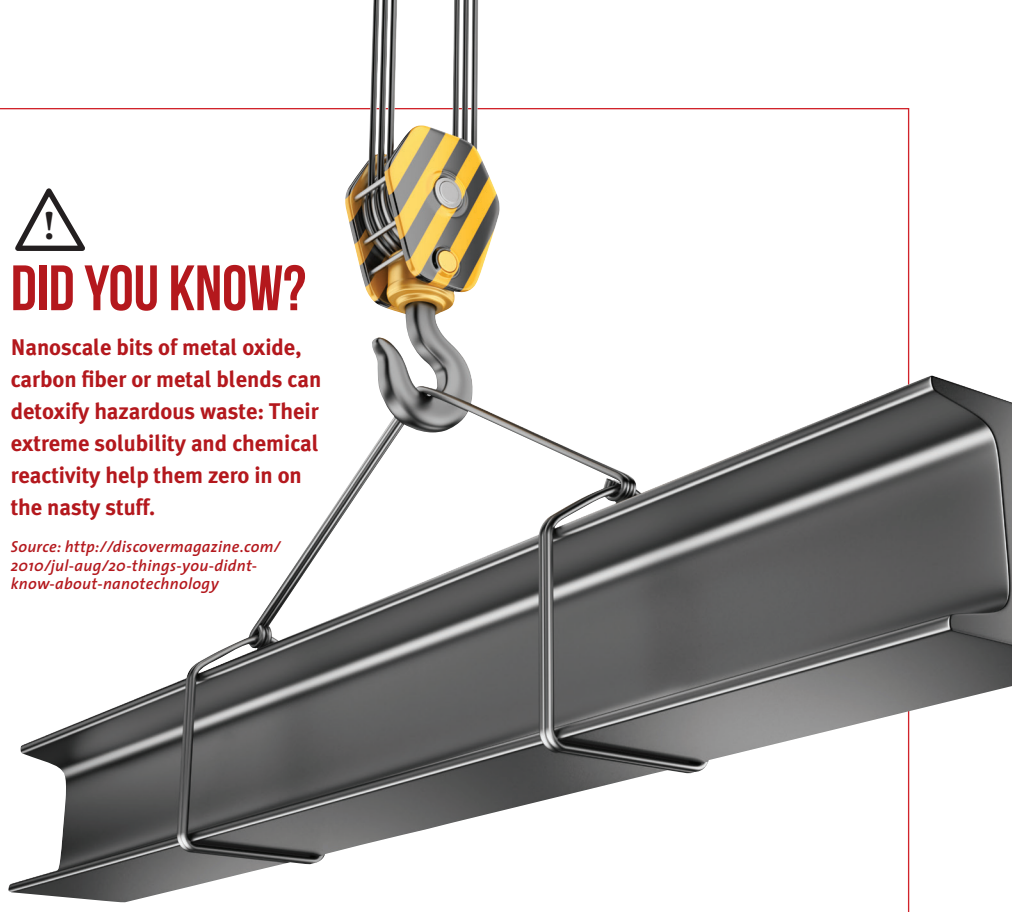
Titanium dioxide (TiO_2) nanoparticles, which have the shape of hexagonal crystals, are used in medicine, chemistry, cosmetics and the paper industry.

Dr_Microbe/iStock/Getty Images Plus/Getty Images

bridging spaces and binding the concrete together to make it stronger. By filling pores, they also reduce permeability and prevent water damage, which is especially important in cold climates, where water can freeze and expand, causing micro-fractures in the concrete.

Another industry being transformed by nanotechnology is transportation. From the rubber that meets the road, to more efficient electronics, to corrosion-resistant steel, virtually no system in today's vehicles — or the roads, bridges and rails that support them— is left untouched by nanotech.

Nanotechnology development offers the promise of multifunctional materials that will contribute to building lighter, safer, smarter and more efficient cars, aircraft, spacecraft and ships. Such advances already include stronger, more durable paints and scratch-resistant automotive coatings imbued with cross-linked nanoparticles. There are new classes of nanoparticle-infused structural metals and plastics, powerful quick-charging batteries, friction-resistant tires, nanoparticle-based solar panel roofs, innovative fuel additives and better catalytic converters to improve efficiency and reduce pollution.



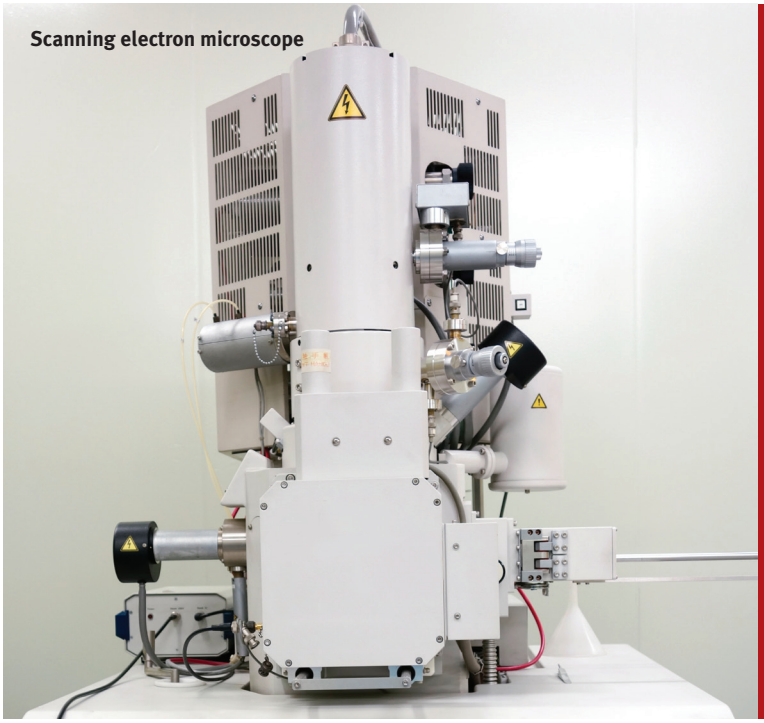
DID YOU KNOW?

Nanoscale bits of metal oxide, carbon fiber or metal blends can detoxify hazardous waste: Their extreme solubility and chemical reactivity help them zero in on the nasty stuff.

Source: http://discovermagazine.com/2010/jul-aug/20-things-you-didnt-know-about-nanotechnology

A BOON FOR MEDICINE

Not to be outdone, the world of medicine is an area of tremendous promise for nanotechnology. These ultra-small bits can roam freely throughout the circulatory system,



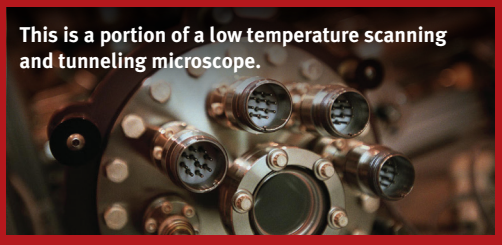
Scanning electron microscope

HOW TO SEE THE NANOSCALE

A conventional light microscope that is typically used in high school and college won't do the job. Nanoscientists use high-powered microscopes that use unique methods to allow them to see the surface features on the atomic scale.

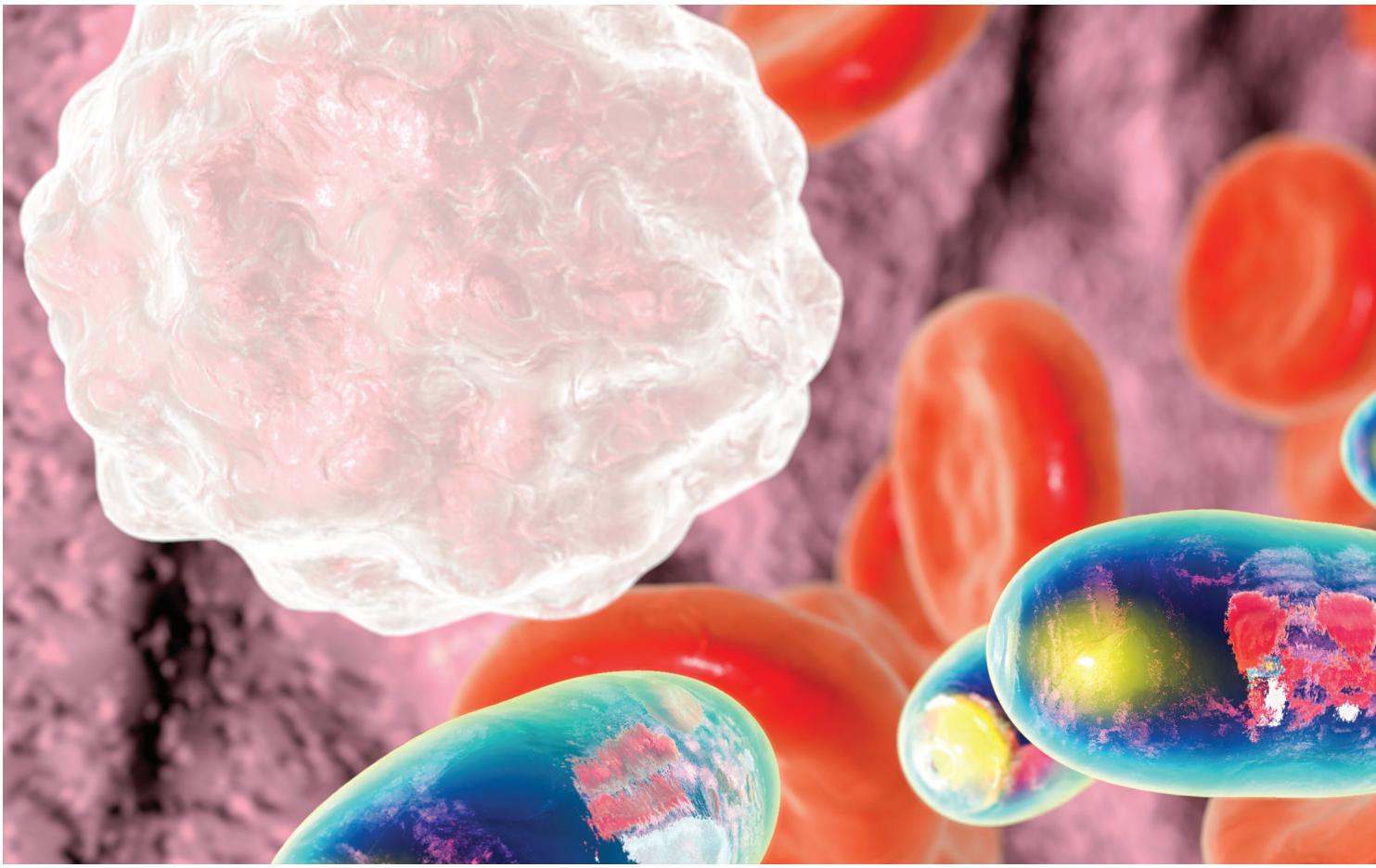
A scanning electron microscope, the transmission electron microscope, the field ion microscope, the scanning tunneling microscope and the atomic force microscope can be used to see at the nanoscale.

Source: https://www.nano.gov/nanotech-101/what/seeing-nano



This is a portion of a low temperature scanning and tunneling microscope.

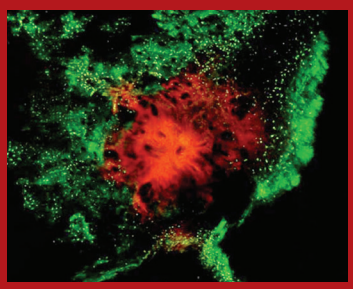
Steel beam: Bedrin-Alexander/iStock/Getty Images Plus/Getty Images; Electron microscope: David_Ahn/iStock/Getty Images Plus/Getty Images; Tunneling microscope: The Washington Times/ZUMAPRESS/Newscom



DID YOU KNOW?

Scientists at University of California San Diego have designed a fluorescent nanoparticle that glows inside the body, making it easier to image tumors and organ damage.

Source: http://discovermagazine.com/2010/jul-aug/20-things-you-didnt-know-about-nanotechnology



This fluorescence microscopy image shows the distribution of two nanoparticles pumped gently into the brain. One particle (red) bound to brain tissue near the site of infusion while the other particle penetrated outwards several millimeters (green).

Microscopy: BSIP/Newscom

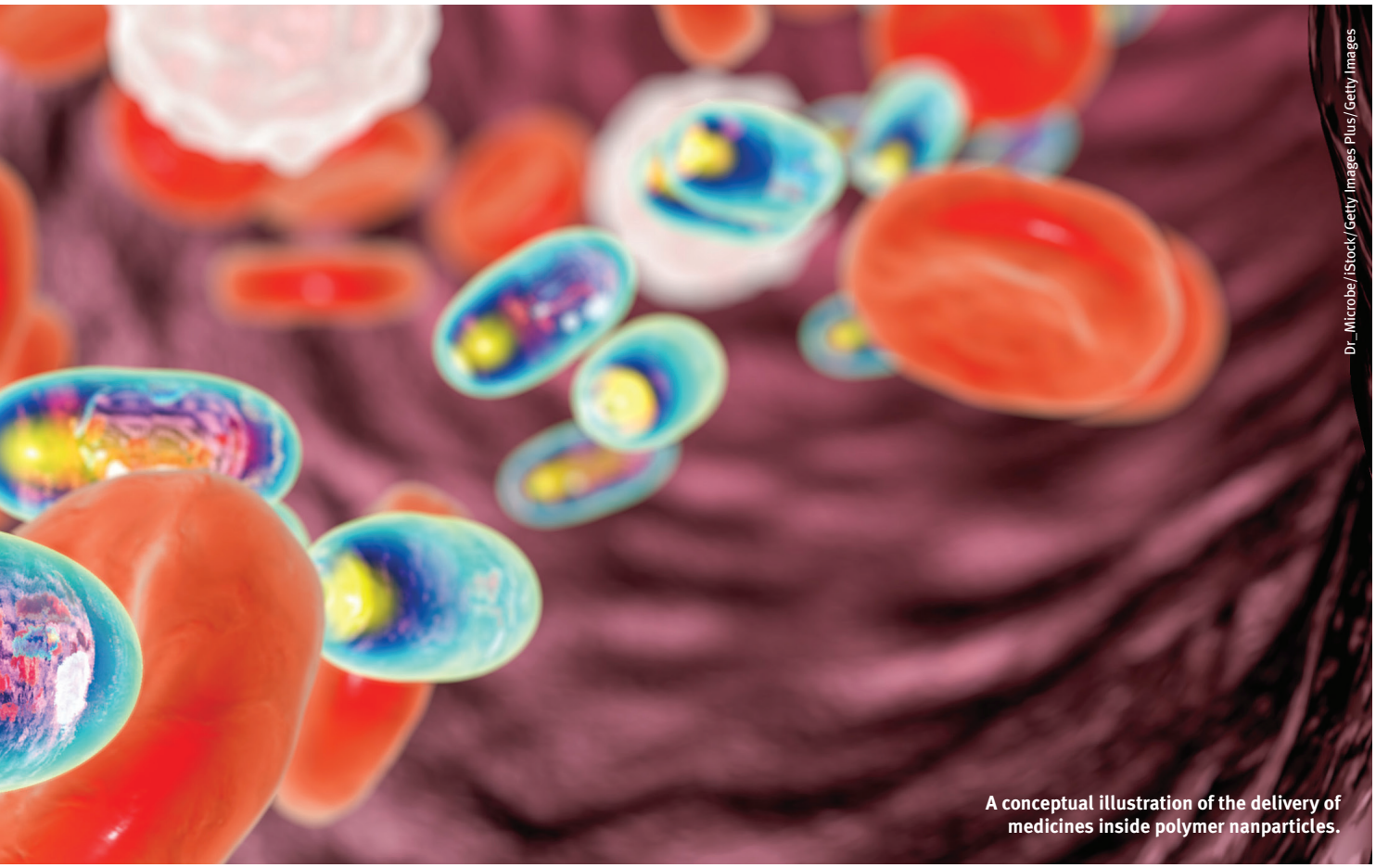
and some are able to penetrate cellular membranes that normally keep larger particles out of cells. With nanoparticles, researchers can get into healthy cells to study how they work. Alternatively, they can penetrate unhealthy ones to learn why they don't.

Nanoparticles have transformed medical imaging, too. Coated with the right antibodies, the particles become like heat-seeking missiles locked on their target. They roam until they meet specific cell types — a tumor in the lymph nodes, or certain nerve cells deep within the brain. New technologies able to detect magnetic and fluorescent nanoparticles within the body have transformed medical imaging and given doctors an unprecedented ability to peer inside the body without surgery.

Meanwhile, on the pharmaceutical end of medicine, nanoparticle encapsulation methods are enabling drug molecules small enough to breach the once-inviolable barrier between the brain and the bloodstream to deliver individual drugs into pockets of the brain that were once out of reach. Such treatments are already being used to treat brain tumors. In the future, they hold the promise of transforming the available tools to combat neurological disorders such as multiple sclerosis, Parkinson's, Huntington's and Alzheimer's diseases.

One researcher has developed a nanoparticle-based synthetic skin that can sense heat and cold and even the delicate weight of a butterfly. This invention points toward the possibility of advanced prosthetics that would to allow an amputee to touch and feel the cheek of a loved one once again.

Elsewhere in the body, biocompatible nanoparticle-infused gels have become the infrastructure upon which stem cells can take root, raising the real possibility of regenerating human tissue in the near future. Such techniques might one day allow a



Dr_Microbe/iStock/Getty Images Plus/Getty Images

A conceptual illustration of the delivery of medicines inside polymer nanparticles.

severed spinal cord to heal, and a paralyzed person to walk again.

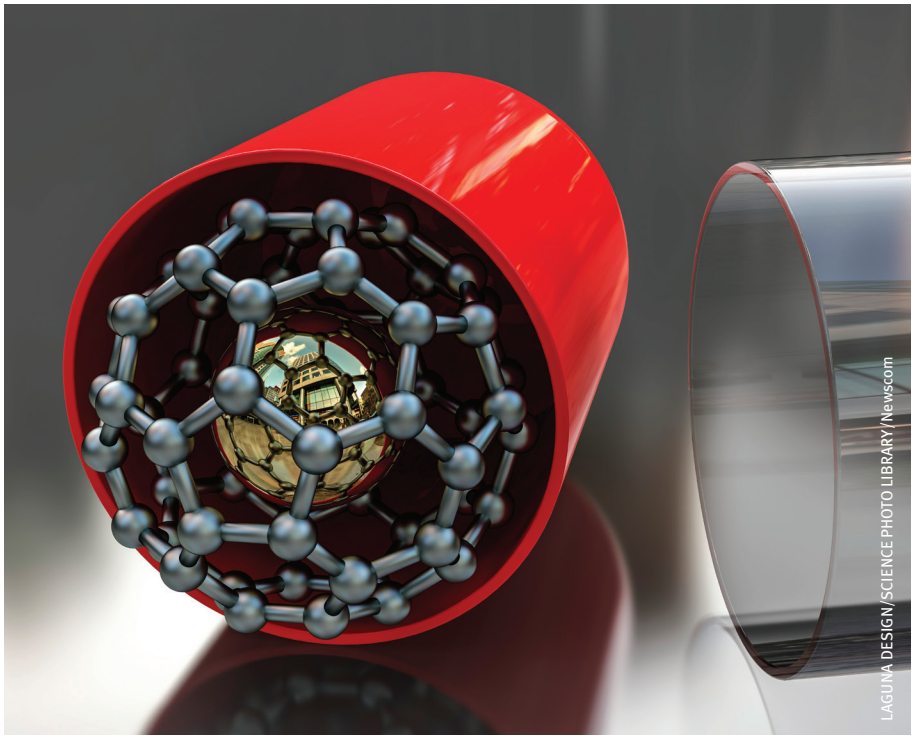
Everywhere you look, it seems nanoparticles are giving hope to patients across the world.

A FUTURE WITH NO LIMITS

Discussion of what scientists and engineers have already achieved raises a natural question: What's next for nanoparticles? The opportunity seems wide open, indeed.

Experts speak of flipping manufacturing on its head. Instead of taking bulk materials and whittling them or combining them into other forms, factories will build new-age materials one atom at a time.

In medicine, there is talk of self-powered nanoscale machines — nanobots — small enough to travel the circulatory system in search of cancers. Having located a cancer, the nanobot will come to rest atop a tumor, like a space capsule landing on the moon, to



LAGUNA DESIGN/SCIENCE PHOTO LIBRARY/Newscom

A conceptual illustration shows a modified-release dosage capsule containing a C60 buckyball (blue) doped with another atom (gold).

Notre-Dame Cathedral

THE SECRET INSIDE THE GLASS

While nanotechnology is a recent phenomenon, nanoparticles have been used by humans for centuries. For proof, one need look no further than the remarkable art glass of Murano, Italy, or the radiant stained glass windows of Notre-Dame Cathedral. Those colors are all made possible by nanoparticles.

The famous glassblowers of Murano were masters at creating glass of many colors, none more desired than red. But the nanoparticles in Murano red are not chromium, as in the ruby; they are gold. True to their shapeshifting optical qualities, nanoparticles of gold do not shine bright yellow, like jewelry — they look red. Chromium produces a green that would make an Irishman proud. Copper produces a glorious aqua blue.

Red:
Ag (~100 nm, Triangle)

Yellow:
Au (~100 nm, Spheres)

Green:
Au (~50 nm, Spheres)

Light blue:
Ag (~90 nm, Spheres)

Blue:
Ag (~40 nm, Spheres)

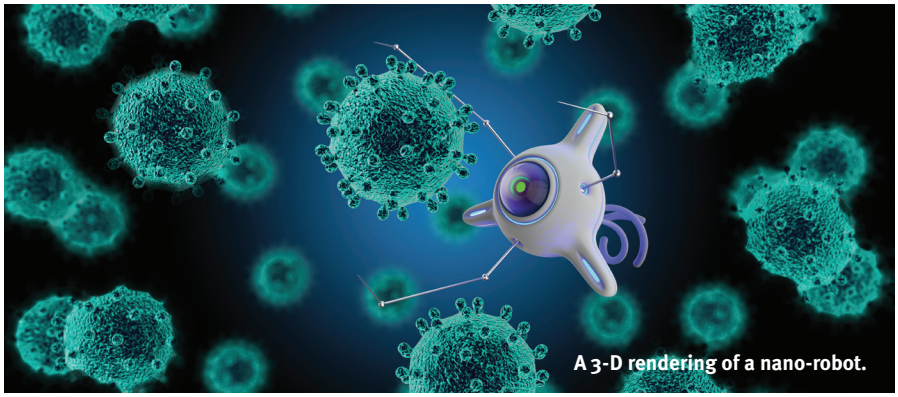
Vases made of Murano glass in a shop, Murano, Venetian Lagoon, Italy

Stained glass: P Deliss / Godong/picture-alliance / Godong/Newscom; Vases: Sabine Lubenow imageBROKER/Newscom

deliver drugs or perform nanosurgeries. Elsewhere, experts have predicted an era of artificial, nanoparticle antibodies able to aid the human immune system to kill harmful microbes and viruses.

On the transportation front, futurists speak of ultra-lightweight, super-strong cars and planes made of nanoparticle-enhanced materials, or roads and rails embedded with nanoscale sensors that register traffic and communicate with cars to reduce jams, avoid accidents and chart more efficient routes.

And these dreams are only of things here on Earth. Space flight, too, stands to benefit from the nanorevolution. New radiation-resistant composite nanomaterials would reduce the weight of space vehicles while helping them endure the extreme heat, cold and radiation-intensive environments of outer space, possibly enabling travel deeper into space than ever attainable before. More realistic predictions include whole-body suits that control body temperature, allowing people to live in extreme environments here on Earth.



A 3-D rendering of a nano-robot.

Volodymyr Horbovyy/iStock/Getty Images Plus/Getty Images

There seems to be no limit to where nanoparticles might take us. From new materials and devices that make it possible to consider travelling to the smallest reaches of the human body, the farthest corners of Earth and the deepest reaches of space, a new age seems just around the corner, if not already underway.

Nanoparticles are a golden ticket to the future. Now, more than ever, if you want to do big things, you've got to think small.

In the *Blink*

How editor Jean-Dominique Bauby wrote his memoir from inside a paralyzed body

BY DAVID HOLZEL

ASSOCIATED PRESS

Friday, Dec. 8, 1995, was a damp, cold day in Paris. The roads leading out of the city were clogged by a transit strike that had everyone taking to their automobiles. As the afternoon rush hour mounted, Jean-Dominique Bauby was stalled behind the wheel of a gunmetal gray BMW he was test driving.

Bauby, 43 years old, was editor-in-chief of the French fashion magazine *Elle*. He was cultured and charming, a lover of the high life, good food and beautiful women.

The BMW importer had given him the car for the day, along with a driver. Now all Bauby wanted was to pick up his 9-year-old son, Theophile, for a father-son evening of dinner and the theater. Bauby had seen less of Theohile and his 8-year old daughter, Celeste, since he had split with his partner Sylvie de la Rouchefoucauld, the mother of his children, and moved out of the family's home 30 miles west of Paris to be with his new lover, Florence Ben Sadoun.

Now, in the muted light, having picked up Theophile and pointed the BMW back toward Paris, Bauby saw the road grow blurry. Cars doubled in his vision, sweat beaded his forehead. Bauby stopped the car on the side of the

Top: Maritime hospital of Berck, where Bauby was sent for long-term care. Left: Undated photo of Jean-Dominique Bauby, a former high-rolling chief editor of France's *Elle* magazine.

# of an Eye

Louis-Michel DESERT/iStock/Getty Images Plus/Getty Images

narrow road and staggered into the back seat. The driver slid into the driver's seat and tore off toward a clinic. Bauby tried to tell him to slow down, but no words came from his mouth. His head bobbed on his neck. His mouth was twisted. They reached the clinic and Bauby sank into a coma.

From that moment on, what is known about Bauby's experience comes from a remarkable book that he dictated in the year after suffering a massive stroke that began on the road to Paris. He called it *The Diving Bell and the Butterfly*. The diving bell was his body, paralyzed and useless except for his left eyelid. The butterfly was his mind, still intact, still fully functioning.

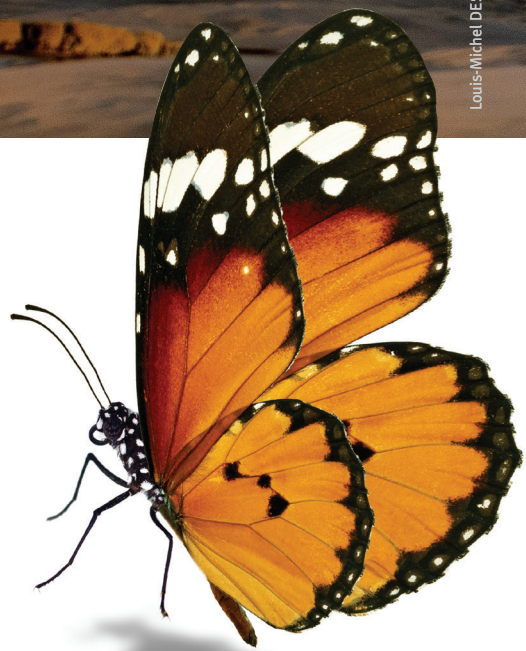
"Other than one eye, two things aren't paralyzed," he wrote. "My imagination and my memory."

Locked-in Syndrome

Bauby awoke after nearly two months of coma and semi-consciousness in Room 119 of the Naval Hospital at Berck-sur-Mer near Normandy. He realized with terror that no one could hear him.

"I can't speak? My God. What happened to me?"

When the neurologist arrived, he explained: Bauby had had a "cerebrovascular accident." It had



thawats/iStock/Getty Images Plus/Getty Images

Etienne George/Sygma via Getty Images

French actors Mathieu Amalric and Emmanuelle Seigner on the set of the movie (directed by American Julian Schnabel), which was based on *The Diving Bell and the Butterfly* by Jean-Dominique Bauby. Seigner played Bauby's former partner, Sylvie.

thawats/iStock/Getty Images Plus/Getty Images

"My diving bell becomes but mind takes flight

damaged his brainstem and severed the links between his brain and spinal cord.

"In the past, it was known as a 'massive stroke' and you simply died," Bauby would later write.

The doctor told him that his case was very rare. He was paralyzed from head to toe.

The doctors called this "locked-in syndrome."

Blink once for yes and twice for no, they told him. From his responses, they understood that his mind was undamaged.

Bauby breathed through tubes, was sustained by drip feed. There was physical therapy and speech therapy. These were aimed at the diving bell. But the butterfly was also affected. On one day, he could be amused at having his bottom wiped like an infant's. "But the

next day, the same procedure seems to me unbearably sad, and a tear runs down … over my cheeks," he wrote.

His friends and Florence kept watch over him. But the hopelessness of his condition seemed to call for divine aid — any divinity would do.

"In every corner of the world, the most diverse deities have been solicited in my name," wrote Bauby, not a believer himself. "A woman I know enlisted a Cameroon holy man to procure me the goodwill of the African gods … " Daughter Celeste prayed for him every night. "So far, the results have been unremarkable," he wrote.

Mastering the Alphabet

"Reflected in the glass I saw the head of a man who seemed to have emerged from a vat of formaldehyde. His mouth was twisted, his nose damaged, his hair tousled, his gaze full of fear. One eye was sewn shut, the other goggled like the doomed eye of Cain. For a moment, I stared at that dilated pupil, before I realized it was only mine."

Bauby dictated that description of how grotesque his body had become using his eyelid.

It was his speech therapist, Sandrine Fichou, who introduced Bauby to her communication code, an alphabet chart in which the letters were arranged not A-B-C, but in descending order of how frequently they are used in French.

ESARINTULOMDPCFB
VHGJQZYXKW

thawats/iStock/Getty Images Plus/Getty Images

Fichou, and soon Bauby's children and friends, learned to recite this alphabet until Bauby blinked on a letter. Then again and again as Bauby spelled words, then sentences.

"In reality, all does not go well for some visitors," he wrote. "Crossword fans and Scrabble players have a head start. Girls manage better than boys. By dint of practice, some of them know the code by heart and no longer even turn to our special notebook — the one containing the order of the letters and in which all my words are set down like the Delphic oracle's."

Six months after arriving at Berck, Bauby began work on *The Diving Bell and the Butterfly*, dictating it blink by blink to Claude Mendibil, a former ghostwriter sent to Bauby by publisher Robert Laffont.

"In my head, I churn out every sentence 10 times … and learn my text by heart, paragraph by paragraph," he wrote.

The two worked three hours a day, seven days a week, for two months to produce the 130-page manuscript. By a different measure, it took about 200,000 blinks to complete.

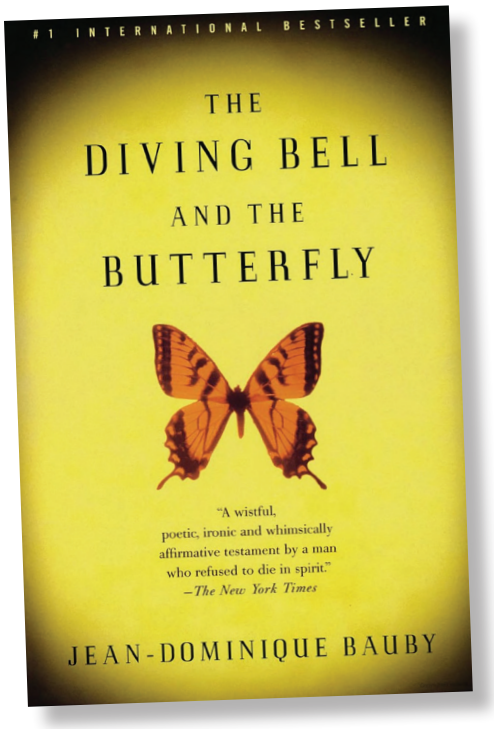
In his memoir, Bauby describes a Father's Day with his children at the nearby seashore, where he's taken by wheelchair. Celeste doing cartwheels on the sand, Theophile dutifully dabbing with a Kleenex a thread of saliva dripping from his "zombie father's" closed lips.

He writes about the letters he sends monthly to a mailing list of 60. So many rumors were swirling around Paris about his condition, he says, that "I would have to rely on myself if I wanted to prove that my IQ was still higher than a turnip's."

His view from a particular hospital terrace is transformed into a movie set by his imagination: "The suburbs of Berck look like a model-train layout. A handful of buildings at the foot of the sand dunes gives the illusion of a Western ghost town. As for the sea, it foams such an incandescent white that it might

less oppressive, and my like a butterfly."

— Jean-Dominique Bauby, *The Diving Bell and the Butterfly*



be the product of the special effects department."

By late summer 1996, Bauby and Mendibil were wrapping up the book.

Bauby seemed to be making progress to some kind of recovery. "I can now grunt the little song about the kangaroo, musical testimony to my progress in speech therapy," he writes toward the book's end.

As the book closes, Bauby is hopeful. "Does the cosmos contain keys for opening up my diving bell? … A currency strong enough to buy my freedom back? We must keep looking. I'll be off now."

The Diving Bell and the Butterfly was published on March 6, 1997, and it would go on to become an international bestseller. Bauby died suddenly on March 8, 1997, of pneumonia. He was 44.

At the time of his death, the man who could write a book in his head was considering new projects. One was a play about a man who suffered from locked-in syndrome.

"All that is left is to write the play," Bauby wrote. "I have the final scene already: The stage is in darkness, except a halo of light around the bed in center stage. Suddenly Mr. L., inert since the curtain first rose, throws aside sheets and blankets, jumps from the bed, and walks around the eerily lit stage. Then it grows dark again, and you hear the voice offstage — Mr. 'L.'s inner voice — one last time: " 'Damn! It was only a dream!' "

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TRIVIA

Did you know that...

Liza Minelli, daughter of Judy Garland (who played Dorothy in the *Wizard of Oz*) married Jack Haley, Jr., son of the actor who played the Tin Man.

In Turkey, it is considered improper and impolite to use silverware to eat chicken.

There are 62 LEGO bricks for every one of the world's seven billion inhabitants.

The Union army bought horses in bulk, but in the Confederacy many soldiers had to bring their own steeds, for which they were paid 40 cents per day.

Nine-banded armadillos have identical quadruplets every time they give birth.

If you could fly across our galaxy from one side to the other at light speed, it would take 100,000 years to make the trip.

Margaret Mitchell's *Gone with the Wind* was almost published as Pansy, the inappropriate name of the main character, now known as Scarlet O'Hara.

Earth is the only planet in our solar system that is not named after a god.

The oldest bird on record was Cocky, a cockatoo, who died in the London Zoo at the age of 82.

On New Year's Eve, people in Cuba and Mexico eat 12 grapes at midnight to ensure 12 happy months ahead.

The Book of Unusual Knowledge

ON THE LIGHTER SIDE

Two Eskimos sitting in a kayak were chilly, but when they lit a fire in the craft it sank, proving once again that you can't have your kayak and heat it, too.

"Uncle John," said little Emily, "did you hear that a baby that was fed on elephant's milk gained 200 pounds in one week?"

"Nonsense! Impossible! Whose baby was it?"

"The elephant's."

A certain farmer was locally famous for the fine crops he raised of potatoes and onions, especially in very dry seasons. Asked how he did it, he replied that it was really very easy: He simply planted the two crops in alternate rows. Then, he said, the onions caused the potatoes' eyes to water, and the consequent moisture kept both crops plentifully irrigated.

Bill Jones, the local athletic "champion," was bragging about his physical prowess at the local bar. None of the regulars challenged him, but a visitor piped up, "I'll bet you 20 dollars that I can wheel something in a wheelbarrow for one block and you can't wheel it back." Bill looked the visitor over and decided that whatever the stranger could do, he could do better. "I'll take you on," he said. The visitor, Bill, and a number of the regulars borrowed a wheelbarrow and took it to the corner. The challenger smiled smugly, rubbed his hands, picked up the handles, and turned to Bill. "OK, Bill," he said. "Get in."

rd.com

Dates in History

1434: On April 14, the foundation stone was laid for the Cathedral of St. Peter and St. Paul of Nantes (or Nantes Cathedral), a Roman Catholic church located in Nantes, Pays de la Loire, France. The cathedral, built in the Gothic architectural tradition, took 457 years to finish.

1619: The Waag's Theatrum Anatomicum opened in Amsterdam on April 19 as a space dedicated to advanced experimenting, observing and learning. Leading surgeons dissected corpses of criminals to expose the anatomy of the human body and help advance this intriguing, taboo-breaking world of medical science.

1782: Friedrich Wilhelm August Fröbel, a German pedagogue who laid the foundation for modern education based on the recognition that children have unique needs and capabilities, created the concept of the "kindergarten" and coined the word on April 21.

1802: April 4 is the birthday of American social reformer Dorothea Dix, born in Hampden, Maine. She founded a home for girls in Boston while only in her teens and later crusaded for humane conditions in jails and insane asylums. During the Civil War, she was superintendent of women nurses.

1860: On April 24, Confederate General Thomas "Stonewall" Jackson was assigned to command Harpers Ferry. With 12,419 Federal troops captured by Jackson, the surrender at Harpers Ferry was the largest surrender of U.S. military personnel until the Battle of Bataan in World War II.

1999: On April 23, Fernando Tatis of the St. Louis Cardinals became the only MLB player to hit two grand slams in the same inning with both grand slams coming off Los Angeles' Chan Ho Park in the third inning. Tatis had never before hit a grand slam in his career.

historyplace.com and worldtimeline.info

Play Ball!

Warm sun, great seats and the chance to snag autographs make spring training a go-to travel destination for die-hard Major League Baseball fans.

BY GREG RIENZI

Let's be clear: The games don't actually count. Dozens of games, in fact, will end in a tie. Your favorite player might exit the contest before you have gobbled down that first hotdog. Who's on first? Who cares! The beer is cold, the air is warm … and baseball is back.

Major League Baseball Spring Training, an institution nearly as old as the game itself, has never been more popular. In 2017, a record 3.4 million hardball enthusiasts descended upon Florida and Arizona during a six-week period in February and March to catch their beloved teams in Grapefruit League and Cactus League action, as both players and coaches worked out the kinks before the marathon of the regular season.

The fans come, in part, for the sun-drenched days and an escape from the final howls of winter. But they also arrive for the unparalleled player access and intimate ballparks — low-slung facilities with one or two tiers of seats typically available from $5 to $100 a ticket.

Spring training offers up-close, unique opportunities to see the stars of today and tomorrow, whether it's a Mike Trout or a Bryce Harper, or the first-round draft pick still a few years away from the Big Show. And, of course, it's spring, so hope bats 1,000 for fans of all 30 MLB teams — who harbor dreams of a deep playoff run or World Series title.

Florida: The Grapefruit League

Since the 1890s, the Grapefruit League has been a popular spring destination for baseball fanatics and the casual fan eager for some beach time. Fifteen Major League teams now train in

Baseball: herreid/iStock / Getty Images Plus/Getty Images; Bat: DNY59/E+/Getty Images

AFLO/Newscom

New York Yankees starting pitcher Masahiro Tanaka delivers the first pitch in the first inning during a spring training baseball game against the Detroit Tigers at George M. Steinbrenner Field in Tampa.

Manny Machado, J.J. Hardy, Ryan Flaherty and Chris Davis of the Orioles during the spring training game between the Philadelphia Phillies and the Baltimore Orioles at Ed Smith Stadium in Sarasota, Florida.

Baseball cleats: devonanne/iStock Unreleased / Getty Images Plus/Getty Images ; Orioles: Cliff Welch/Icon Sportswire 357/Cliff Welch/Icon Sportswire/Newscom

Florida, 12 of them along the East and West coasts and three in the center of the Sunshine State.

If the Grapefruit League has an epicenter, it's Tampa, site of the New York Yankees' **George M. Steinbrenner Field**, a newly renovated 31-acre, 11,026-seat facility with cabana party areas, bar-style seating in two outfield decks and a Monument Park to honor Yankee greats from Babe Ruth to Derek Jeter. Steinbrenner Field, the largest ballpark in the Grapefruit League and the first to feature luxury suites, has the same field dimensions as Yankee Stadium, right down to the inch, and its scalloped grandstand facade resembles that of the team's home stadium in the Bronx.

Stay at a hotel in the Tampa area, and you're within shouting distance of six spring training locations, none farther than a 50-minute drive. "You can follow your team from one stadium to the next, or see a couple of games in one day," says Nick Gandy, a spokesman for the Florida Sports Foundation, which promotes the MLB's Grapefruit League as a tourist destination. He adds that it's not unusual for fans to attend as many as six games in four days.

Got your glove on? Let's go.

Head south to **Ed Smith Stadium** (Baltimore Orioles) in Sarasota and **LECOM Park** (Pittsburgh Pirates) in Bradenton. Dubbed the "crown jewel" of the Grapefruit League, Ed Smith Stadium underwent a $31-million makeover in 2011 and now features Spanish-style architecture with palm tree–lined thoroughfares, a left field lawn, and concessions ranging from the traditional hot dog to crab cakes. LECOM Park, originally opened in 1923, features a new 19,000-square-foot boardwalk spanning the outfield. You can stroll it between innings while chowing down on some barbecue, or take in the view while sitting at a drink rail.

To the west lie **Dunedin Stadium** (Toronto Blue Jays), in Dunedin, and **Spectrum Field** (Philadelphia Phillies), in Clearwater. *Sports Illustrated* ranked Dunedin as one of the Top Five Places to Watch a Spring Training Game, and Spectrum Field, formerly known as Bright House Networks Field, is your archetypal Floridian ballpark, with palm trees galore, a tiki-hut pavilion and mostly single-level seating.

If some folks in your party are less enthusiastic about baseball, or you need

Grapefruit League Breakdown

- Atlanta Braves
- Baltimore Orioles
- Boston Red Sox
- Detroit Tigers
- Houston Astros
- Miami Marlins
- Minnesota Twins
- New York Mets
- New York Yankees
- Philadelphia Phillies
- Pittsburgh Pirates
- St. Louis Cardinals
- Tampa Bay Rays
- Toronto Blue Jays
- Washington Nationals

Kim Klement/USA Today Sports/News.com


csfotoimages/iStock Editorial/Getty Images Plus/Getty Images

Pittsburgh Pirates and New York Yankees fans watch from the outfield on the boardwalk during the third inning at LECOM Park; people enjoy the sunshine on Florida's Clearwater beach.

a break from the action, know that some of the Gulf of Mexico's best beaches are within a short driving distance of both parks. Popular **Clearwater Beach** offers two and a half miles of white sand fun and **Pier 60**, a 1,080-foot fishing pier. Nearby is **Clearwater Marine Aquarium**, home to Hope and Winter, the prosthetic-tailed mammals of the *Dolphin Tale* movies.

Just east of Tampa lies **Publix Field at Joker Marchant Stadium** in Lakeland, home of the Detroit Tigers since 1966 and the second-oldest ballpark in the Grapefruit League. Recently remodeled to resemble Comerica Park in Detroit, Joker Marchant sits on the site of a World War II-era pilot training airbase, and three of the hangars from the old base remain standing. Just a little up the road is the Atlanta Braves' **Champion Stadium** at ESPN Wide World of Sports Complex in Orlando. Watch some ball, and then don mouse ears or hop aboard the Hogwarts Express, as both Walt Disney World and Universal Studios are nearby. (In 2019, the Braves will move into a new $100 million, 8,000-seat stadium in North Point, Florida.)

Two top spots to catch spring training baseball outside the Tampa area reside in Ft. Meyers and West Palm Beach. Each year, hundreds of thousands of Red Sox fans make the trek to Ft. Meyers' **JetBlue Park**, also called Fenway South. The park, which opened in 2012, features the same dimensions as the iconic stadium in Boston and several of its signature elements, including its own "Green Monster" left field wall with seats protected by a net.

Fun Fact

The Florida Grapefruit and Arizona Cactus leagues are a 50-50 split, with 15 teams training in each of the two states.

"It's a very unique vantage point for watching a game," says Katie Haas, the Boston Red Sox' vice president of Florida business operations. "And those seats go fast." JetBlue Park also has a stage for postgame concerts, and its own version of Yawkey Way, called Fenway South Drive — a turnstile-access, two-block area with team stores and concessions stands, including the popular **Rib City Bar-B-Q** and **Mario's Meat Market and Deli**. Before or after a game, be sure to check out nearby **Fort Myers Beach**, or drive across the causeway to **Sanibel Island** or **Captiva Island**.

The newest edition to the Grapefruit League is the 7,700-capacity Ballpark of the Palm Beaches, located in West Palm Beach, home to the Washington Nationals and World Champion Houston Astros. The park features open-air party decks, the Banana Boat Lawn and the Budweiser Sand Bar, with 32 beers on tap

While all the stadiums differ, some constants are fan-friendly views and resort-style amenities. Most parks now feature 360-degree open concourses so you don't have to miss a pitch, and nontraditional seating, such as Adirondack-style rocking chairs and barstools. The small venues ensure that no matter where you sit or stand, you're never far from the action on the field.

No matter which park you choose, get there early, Haas advises.

"One of the coolest things about spring training is that the pregame workouts are open to the public. You can see batting practice up close and

Ken Murray/Icon Sportswire DEL/Ken Murray/Icon Sportswire/Newscom

A huge crowd turned out at The Ballpark of the Palm Beaches on Feb. 28, 2017, for an opening-day spring training game between the Houston Astros and Washington Nationals.

personal, and it's free," says Haas "A spring training game is one big party. Everyone is in a good mood, hoping that this will be the year."

Arizona: The Cactus League

The Cactus League is nothing short of a baseball-lover's paradise. You can see half of the Major League teams play without ever having to drive more than 47 miles, as the league's 10 stadiums — surrounded by mesas, rock formations and cacti — are clustered in a tight radius around the greater Phoenix area, which includes Scottsdale, Mesa and Tempe, as well as Glendale and Peoria to the west.

The Cactus League formed in 1947 with just two teams, the Cleveland Indians and the New York Giants. As the legend goes, then–Giants owner Horace Stoneham learned of a hotel near Mesa that offered mineral baths and massage treatments. Scouting for a new training site for the team, Stoneham thought the hotel sounded an ideal place for players to prepare for the upcoming regular season

Around the same time, Stoneham received a call from Bill Veeck, the owner of the Indians, who had a winter home in Tucson. During that chat, a league was born. Some 70 years later, 15 teams now call Arizona their spring home.

Like the Grapefruit League's, the ballparks in the Cactus League are minor-league sized with a laid-back atmosphere, and the weather remains a top draw. In the past decade, with the relocation of more spring training sites to Arizona, March has become the state's peak tourism period, according to Scott Dunn, a communications director for the Arizona Office of Tourism. "They come for the weather, and they come for the baseball," says Dunn. "And no matter who their team, no road game is more than an hour away."

Angels fans since 1968 have come to the **Tempe Diablo Stadium Complex**, located three miles from Phoenix Sky Harbor International Airport, and at the base of Tempe's Twin Buttes, a rock formation that rises above left field. Fans can enjoy panoramic views of blue skies and desert sunsets while taking in the game.

The Arizona Diamondbacks and Colorado Rockies both play in Scottsdale at the **Salt River Fields at Talking Stick** facility, which includes an 11,000-seat ballpark and 12 practice fields open to the public. Salt River Fields at Talking Stick offers unmatched views of the nearby **Camelback Mountain**, **Four Peaks** and **Red Mountain**. Here, fans can sit in seats or lounge on blankets in the sprawling

MLB Spring Training Tips

PLAYERS' AUTOGRAPHS: Get to the park about 90 minutes before first pitch, or as soon as the gates open. Players will be either taking batting practice, or stretching out on practice fields that are open to the public. Many — not all — will take time out to acknowledge the fans and sign.

TICKETS: Reserve in advance. Tickets to see popular teams such as the Cubs, Yankees, Giants and Red Sox will sell out quickly, as will tickets for any recent World Series winners. "Teams also get a bump when a big-name free agent signs, as everyone wants to see the new guy in your team's uniform," Gandy says. That said, you can often get walk-up tickets on midweek games.

WHEN TO GO: Crowds are relatively thin for the late February and early March games, so there are more seats available. The bloated rosters of these early games also allow you to see the team's top prospects and future stars. But be prepared for longer games, as they'll change pitchers and rotate in new-position players every inning. Later in March you'll get a trimmed-down roster that more approximates the opening day lineup.

Baseball glove: ronniechua/iStock /Getty Images Plus/Getty Images

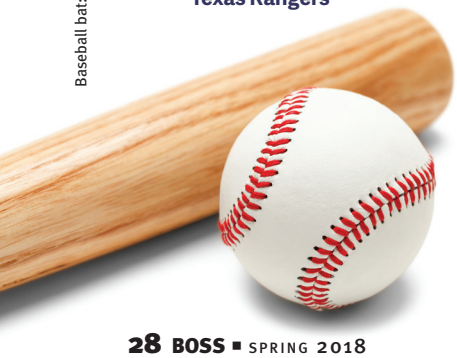
Allan Henry/USA Today Sports/Newscom

Needle: S-e-v-e-r-i-n/iStock/Getty Images Plus/Getty Images

A general view of a spring training game, left, between the Chicago Cubs and the Los Angeles Dodgers at Sloan Park. Chicago Cubs Third Baseman Kris Bryant, right, signs autographs for fans prior to a spring training game between the Chicago Cubs and the Chicago White Sox on March 17, 2017, at Camelback Ranch in Glendale, Arizona.

Cactus League Breakdown

- Arizona Diamondbacks
- Chicago Cubs
- Chicago White Sox
- Cincinnati Reds
- Cleveland Indians
- Colorado Rockies
- Kansas City Royals
- Los Angeles Angels
- Los Angeles Dodgers
- Milwaukee Brewers
- Oakland Athletics
- San Diego Padres
- San Francisco Giants
- Seattle Mariners
- Texas Rangers



Baseball bat: Michael Burrell/iStock/Getty Images Plus/Getty Images

outfield lawn. The first Major League Baseball spring training facility to be built on Indian land, the park has received numerous awards, including Best Spring Training Facility six years running from *Arizona Foothills* magazine. It's also located minutes away from **Talking Stick Resort/Casino**, and a free shuttle can take you back and forth between the resort and the ballpark.

A Cactus League destination not to be missed is the Cubs' 15,000-seat **Sloan Park** in Mesa, the largest venue ever built for spring training. Like several of the parks, Sloan pays homage to the team's home stadium, as the outfield berm resembles Wrigley Field's bleachers and the left-field party deck mimics the rooftop bleachers in Chicago.

Jeff Meyer, president of the Arizona Cactus League Association since 2007, says that the Cubs regularly draw the most fans to Arizona, and downtown Tempe effectively becomes "Wrigleyville West" each spring. The spring after the Cubs won the World Series in 2016, Sloan Park broke all attendance records, and it remains the toughest ticket to secure.

Fun Fact

Pitchers and catchers have to report to spring training a week earlier than the rest of the team.

The Los Angeles Dodgers and Chicago White Sox now both play at the sprawling and scenic 141-acre **Camelback Ranch** complex in the West Phoenix neighborhood of Glendale. The site offers picturesque walking trails, landscaped grounds, an orange grove, water features and a fully stocked lake.

Once mocked for its lack of upscale eateries, Phoenix has recently become a foodie town with a booming restaurant scene. And many of the area's best restaurants can be found in Scottsdale.

J Group Media

Barrio Queen in Scottsdate, Arizona

For some modern Latino cuisine, head to the old town for **The Mission** or **Barrio Queen** (at the latter, don't miss the slow-roasted pork or anything dripping with its signature mole sauce).

Lovers of the arts should plan to spend some time in downtown Phoenix, which now boasts a thriving arts scene. **The Roosevelt Row Arts District**, affectionately referred to as "RoRo" by many locals, is a pedestrian-friendly area with award-winning restaurants, galleries, boutiques and live music. The nearby **Heard Museum** positions itself as the world's preeminent museum for the presentation, interpretation and advancement of American Indian art.

If you're up for a drive, take the two-hour trip to Tucson for its bustling downtown area, and visit Saguaro National Park, home to the nation's largest cacti.

Meyer says the Cactus League has been blessed in recent years with a streak of no rain-outs, but he has seen his share of sunburns. "We have a lot of people coming here after being holed-up all winter back home," he says, "so I strongly advise bringing the sunscreen."

The Manhattan Project

The story behind the creation of the 'destroyer of worlds'

BY EUGENE FINERMAN

Chain reaction: 1. In physics, a self-sustaining reaction in which the splitting of an atomic nucleus creates particles that in turn split more nuclei, creating yet more particles and unleashing nuclear energy.

2. A series of events in which each event is the result of the one preceding and the cause of the one following.

Photo taken nine seconds after the "Trinity" test explosion at Los Alamos, New Mexico, on July 16, 1945. A mushroom cloud billowed 7 miles high.

Everett Collection/Newscom

A letter from Albert Einstein would demand attention. Delivered to the White House on October 11, 1939, its two typewritten pages were read aloud to President Franklin Roosevelt. Einstein's letter began with a summary of recent developments in nuclear physics: experiments on uranium to produce a chain reaction. In the third paragraph, however, Einstein offered his urgent concern: "This new phenomenon would also lead to the construction of bombs, and it is conceivable … that extremely powerful bombs of a new type might thus be constructed." Einstein recommended that the American government accumulate a large supply of uranium and fund further research in nuclear physics. That, he warned, was precisely what Germany was now doing.

The letter, with its arcane science and its frightening implications, required some consideration by President Roosevelt. America was still recovering from the Depression. Beyond the daunting expense of the research, the prevailing political sentiment was for isolationism. But with Germany's invasion of Poland a month earlier, the war had already begun in Europe. After some deliberation, Roosevelt reportedly concluded: "What you are after is to see that the Nazis don't blow us up!"

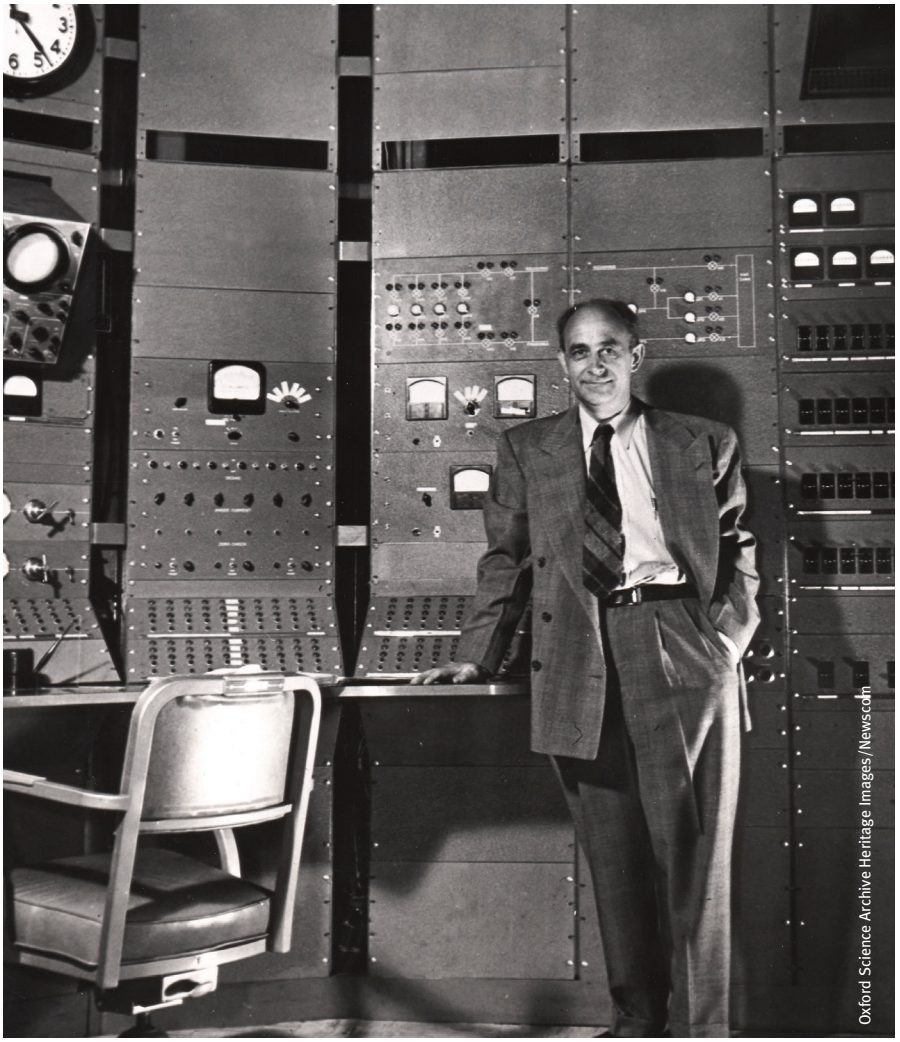
The race had begun. Roosevelt immediately authorized the Advisory Committee on Uranium, comprising government officials and scientists, to organize a program to develop an atomic bomb. The committee's first meeting was on Oct. 21, just 10 days after Roosevelt received Einstein's letter. There was some question as to the feasibility of such a bomb, but not among the scientists, and the bureaucrats did agree that further research was warranted. The government would finance the purchase of 50 tons of uranium.

Uranium had been known to the Romans, who ground the stone for a yellow dye. But it was not until 1896 that its connection to radioactivity became clear, when a scientist incidentally placed uranium salts near a photographic plate — and discovered that the salts emitted radiation without any help from sunlight.

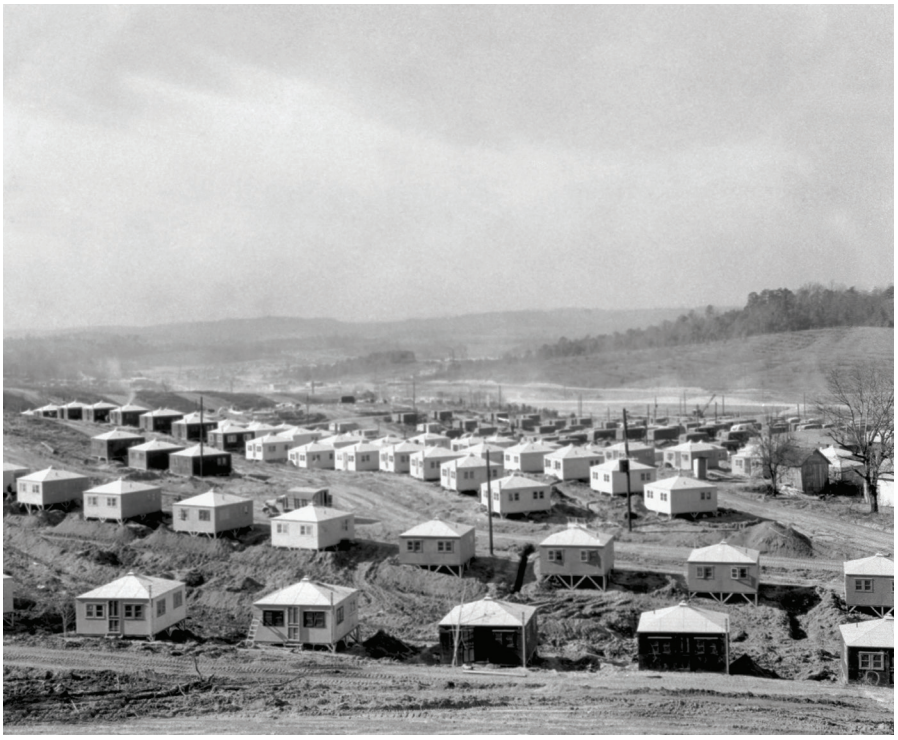
Uranium's volatility was not known until the 1930s, when physicists began experiments in splitting atoms. Some forms of uranium — isotopes — were like bombs, prone to detonating and emitting bursts of energy. Indeed, it was possible for one detonating atom to set off another: a chain reaction. Until the late 1930s, however, creating a chain reaction was still an unpredictable process. To develop a bomb would require novel procedures on a larger scale than ever before undertaken.

The horror of Hitler having the bomb lent urgency, and events were hastening the need for a deterrent. In 1940, Germany attacked Scandinavia, the Netherlands, Belgium and France. All fell. Only Britain withstood the Nazi onslaught. In 1941, Germany conquered Yugoslavia and Greece and had invaded Russia, overrunning Ukraine. Despite the isolationist mood in the United States, President Roosevelt prepared America for war.

American nuclear research was now under the auspices of the renamed Committee of Scientific Research and Development; mention of the word "uranium" was itself a security breach of the top-secret project. The government was funding research around the country. Scientists at Columbia University were working on a nuclear



Enrico Fermi, Italian-born American nuclear physicist



Everett Collection/Newscom

Homes under construction in Oak Ridge, Tennessee, circa 1945.

Lee H Rentz/Avalon/Newscom

An old nuclear reactor building remains along the Columbia River in Hanford Reach National Monument in Washington State.

reactor. At the University of California, researchers had experimented with uranium to create an even more explosive element: plutonium.

By autumn of 1941, America and Germany were waging an undeclared war. American destroyers and German U-boats were dueling in the North Atlantic. Pearl Harbor ended all pretense. Although the country was also at war with Japan, President Roosevelt and his government never veered from the determination that Germany was the greater danger. In June 1942, as the forces of Germany seemed invincible in North Africa and Russia, the U.S. Army Corps of Engineers brought its resources and discipline to the ongoing atomic research. To camouflage their effort to build an atomic bomb, the Corps labeled the operation as "The Manhattan District." History remembers it as the Manhattan Project.

While work originally started at Columbia University, the research on chain reaction was moved to the University of Chicago. It seemed a safer location. U-boats were seen off Long Island, but not in Lake Michigan. An underground squash court at the university was requisitioned for use as the site of a nuclear reactor. Some 45,000 graphite blocks, weighing 360 tons, contained a core of five tons of pure uranium ore and 45 tons of uranium oxides. The goal was to transform the uranium on a massive scale into a volatile isotope. The Atomic Age began December 2, 1942, when the reactor's designer, Enrico Fermi, and an assembly of his fellow scientists witnessed the first controlled nuclear fission chain reaction.

By then the Manhattan Project was no longer constricted to a few college laboratories. In 1942 an entire valley in eastern Tennessee had been purchased as the site of a massive factory complex and self-contained community. Major General Leslie Groves, the military director of the Project, personally selected the location.

It was sparsely populated, isolated by ridges, yet close to the water and power of the Norris Dam. There, three factories were constructed for the refinement of uranium. The scientists, the workers and their families were provided with all the staples that a wartime economy could offer. There were schools, restaurants, supermarkets, theaters, churches and sports facilities to accommodate a population that would grow to 75,000 by 1945. Yet, the town — Oak Ridge — was fenced and guarded. It was a top-secret military installation. So, too, was Hanford, Washington — a newly formed "town"

The Atomic Age began Dec. 2, 1942, when the reactor's designer, Enrico Fermi, and an assembly of his fellow scientists witnessed the first controlled nuclear fission chain reaction.

of some 40,000. Its business was creating plutonium.

For all its achievements, the Manhattan Project had only succeeded in developing the ammunition for a nuclear weapon. The weapon itself did not yet exist. How could the plutonium or the uranium be conveyed to a target and successfully detonated? General Groves trusted J. Robert Oppenheimer with the challenge. A brilliant man known for his self-discipline, who had graduated summa cum laude from Harvard in three years, Oppenheimer could see the poetry in physics but often forgot such banalities as eating. Yet, this genius of theoretical physics was to find a very practical pursuit. He was the director of Los Alamos Laboratory, an isolated desert site in New Mexico where weapons could be developed and tested.

On July 16, 1945, a bomb was ready for testing. Suspended 100 feet in the air was a 6-foot sphere with a core of plutonium. The plutonium itself was only the size of a grapefruit, yet when detonated by layers of high explosives, the chain reaction's blast was the equivalent of 20,000 megatons of TNT. The time was 5:30 a.m. when the New Mexico countryside was swept with a searing light. A shock wave could be felt 100 miles away, and a mushroom cloud billowed 7 miles high. The press and the public would be told an ammunitions dump had exploded. Some of the scientists were elated by their success; others were somber. Oppenheimer later said he recalled a line from Hindu scripture: "Now I am become Death, the destroyer of worlds."

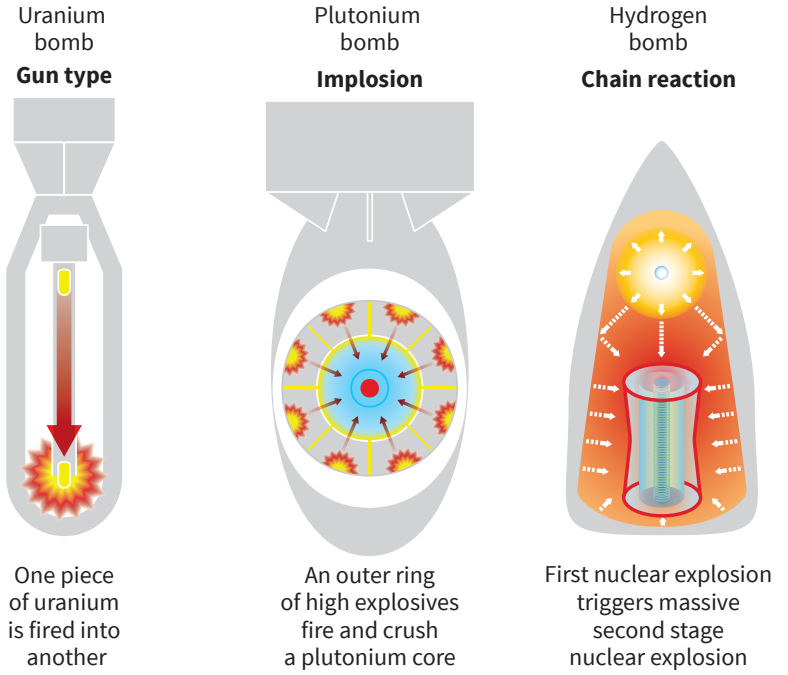
President Harry Truman, who had inherited the project, was immediately informed of the success. At the time, he was in Potsdam, Germany, negotiating with Winston Churchill and Josef Stalin. The war in Europe had ended two months earlier. Hitler was dead, his Reich destroyed. Germany had never seriously pursued the development of nuclear weapons, but had inadvertently contributed to the American efforts: Refugees from Nazi persecution included some of the best physicists of Germany and Central Europe, and the Manhattan Project was eager to have them.

The war continued in the Pacific. Japan refused to surrender; her troops would fight to the death. The invasion and conquest of Japan was likely to cost 800,000 American lives, with the wounded numbering in the millions. Yet, the Los Alamos Laboratory had the components for two more atomic bombs. They might yet serve the purpose of ending the war.

On August 6, 1945, three American planes flew to Hiroshima ….

Nuclear warheads

Examples



Source: Manhattan Project/techinsider.io

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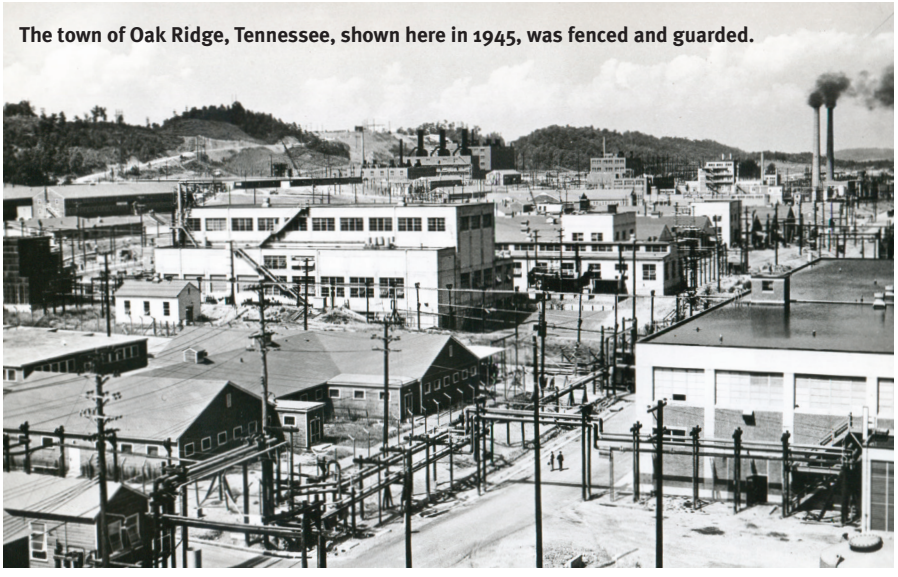

The town of Oak Ridge, Tennessee, shown here in 1945, was fenced and guarded.

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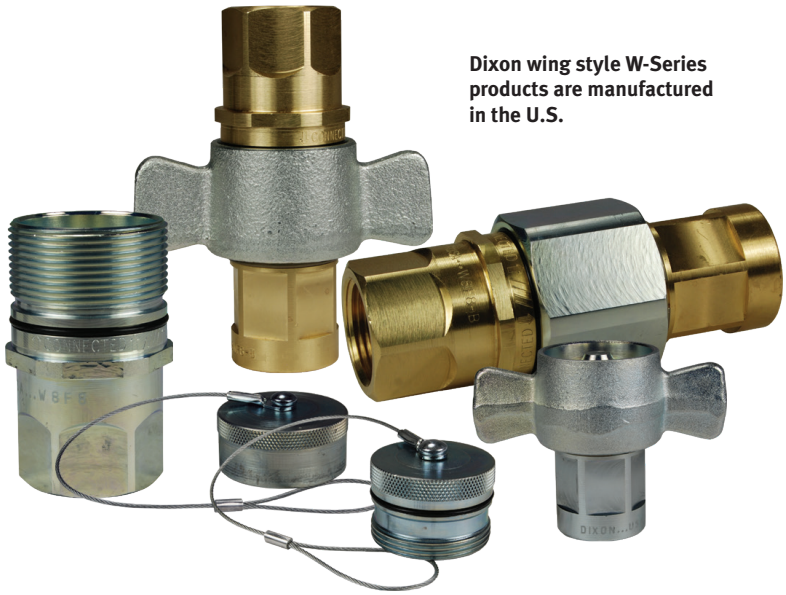
The O-Ring Solution

Dixon's wingstyle quick disconnect (W Series) makes it easy to ensure an open valve, promoting safety and efficiency

Chris Jarman



Dixon wing style W-Series products are manufactured in the U.S.

> IN TODAY'S WORLD, it seems everything needs to be done quickly. Internet speeds are faster than ever, so we can stream videos from YouTube and music from Pandora. Grocery stores are offering curbside pickup, so we can get our food faster. Amazon now has a store, Amazon Go, where customers can grab what they want and leave, without waiting in line. Time is a valuable commodity and there is a finite number of hours, minutes and seconds in a day.

In the world of construction, deadlines are tighter and penalties are increasing when deadlines aren't met. Because each job has a timeframe, efficient and safe work practices can be compromised … just to get the job done, and get it done "quickly."

Consider a specific area of the job site — the hydraulic submersible pump that pumps water out of a hole that's being excavated, and the dump trailer that hauls that dirt away. Both systems, the pump and the dump trailer, play a critical role in the efficiency and time it takes to get the job done "quickly." If either system (or a component of one system) fails, it stalls the process and creates down time.

It's worth noting that both systems share an important component, the wingstyle hydraulic quick disconnect. This threaded connection allows the pump head to be quickly connected to the power unit, and the trailer to be connected to the truck without spilling hydraulic oil.

Dixon Quick Coupling now offers the wingstyle quick disconnect (W Series) in 1/4-inch and 3/8-inch body sizes.

Operators of this equipment frequently run into problems of excess heat, which prematurely wears seals, cylinders and pumps and degrades the hydraulic oil. One cause of excess heat: not connecting the threaded wingstyle quick disconnect fully so that the valve can open all the way. If the valves on the quick disconnects aren't opened fully, this creates restriction and turbulence, which leads to heat in the hydraulic system. A pump manufacturer once told me, "If the customer tells me the power unit and hoses are getting really hot, the first thing I tell them to check is the wingstyle quick disconnects."

It seems simple, but how far *do* you go? Until it's hand-tight? Maybe a little

past hand-tight? Do you need to put a wrench on it … or hit the wings with a hammer? Who knows? Just get it done quickly!

Have you thought about the time it takes to replace those leaking or damaged wingstyle quick disconnects? To do that, there are myriad questions to answer first: What body size do you have? Is the end configuration female pipe thread? Where do you get the disconnects? Do they have your size in stock? How do you put them on correctly? Most important: How long is your pump or trailer out of service, and how much hydraulic oil was spilled? Will you be able to get your job done quickly and meet your project deadline?

As a coupling manufacturer, Dixon Quick Coupling worked to solve this problem with an easy fix: a visual indicating connection O-Ring. It's simple: Thread the wing coupler onto the male plug until you can't see the O-Ring any more. That will open the valve all the way and won't contribute to any more heat for your hydraulic system.

There's an added benefit: When connected, the connection O-Ring protects the threads and coupling from dirt and debris while the pump head is pumping a sewage bypass or the truck driver is having his trailer filled with rock at a dusty quarry.

I recently had a distributor tell me he bought the wingstyle quick disconnect (W Series) from Dixon solely because his end users preferred the Connection O-Ring. "The Connection O-Ring provides the seal necessary to prevent dirt and dust from damaging the threads," he told me. As a result, "Guys aren't having to replace the couplings as often as other models."

So, when it's time to get your next job done "quickly," think about making The Right Connection with Dixon Quick Coupling.

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For Telemedicine, the Future Is Now

Advances are improving access to health care and making it more affordable

-zlaki-/iStock/Getty Images Plus/Getty Images

> ROBOTS DOING HOSPITAL ROUNDS or assisting in complex surgeries. Therapists using online role play to work through traumatic memories with their patients. Kiosks in your workplace where you can instantly (and privately) consult with a doctor via secure and high-quality videoconferencing, and even measure your own vital signs. These scenarios may sound futuristic, but in the world of telemedicine, the future is now.

The word "telemedicine" (often used interchangeably with "telehealth") is most commonly used to describe long-distance therapeutic interactions between healthcare providers and their patients by means of telecommunications technology. But it also encompasses other new possibilities, such as these:

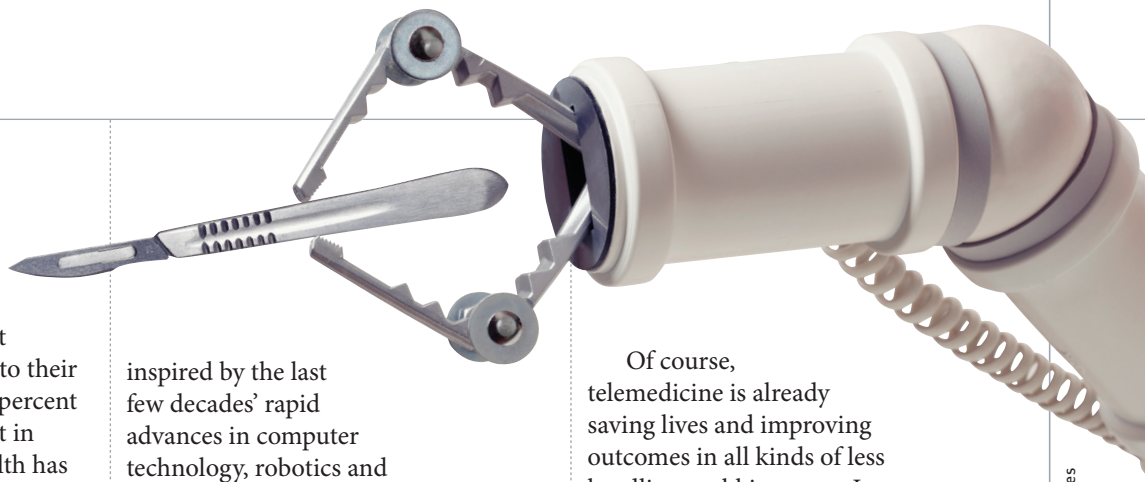
- the potential to securely store and access, from anywhere, a patient's complete medical history.
- the ability of rural doctors to consult quickly with specialists at big-city hospitals.
- the use of videoconferences and online classes to help doctors keep up with developments in their fields.
- the ability to monitor and support people with chronic illnesses in their homes through texting, videoconferencing and new wireless devices that monitor blood sugar, blood pressure, heart function and other vital signs.

THERE'S AN APP FOR THAT

Telemedicine also includes a large — and ever-growing — number of apps that do everything from measure your vital signs to let you consult a doctor or nurse 24/7 through your smartphone, tablet or laptop, often for a fraction of for the cost of urgent care or the emergency department. Some apps guide you to websites they deem reputable for answers to your medical questions, or allow you to text a qualified doctor for free. And some app makers are partnering with hospitals and physicians to make it easier to get quick access to specialists.

Because this approach to doctoring is still relatively new, though, regulators are struggling to catch up, and quality control is an open question. One study last year found that a popular blood pressure app was not terribly accurate. And a current disadvantage of the apps that connect you to a doctor is that your "virtual visit" may not find its way into your permanent medical record, undermining one of telemedicine's big selling points.

Enthusiasts believe these issues will be resolved as telemedicine realizes its seemingly limitless potential. "What is now indisputable," according to the American Telemedicine Association, a major industry group based in Washington, D.C., "is how telemedicine greatly improves the quality, equity and affordability of health care throughout the world."



amphotora/Getty Images Plus/Getty Images

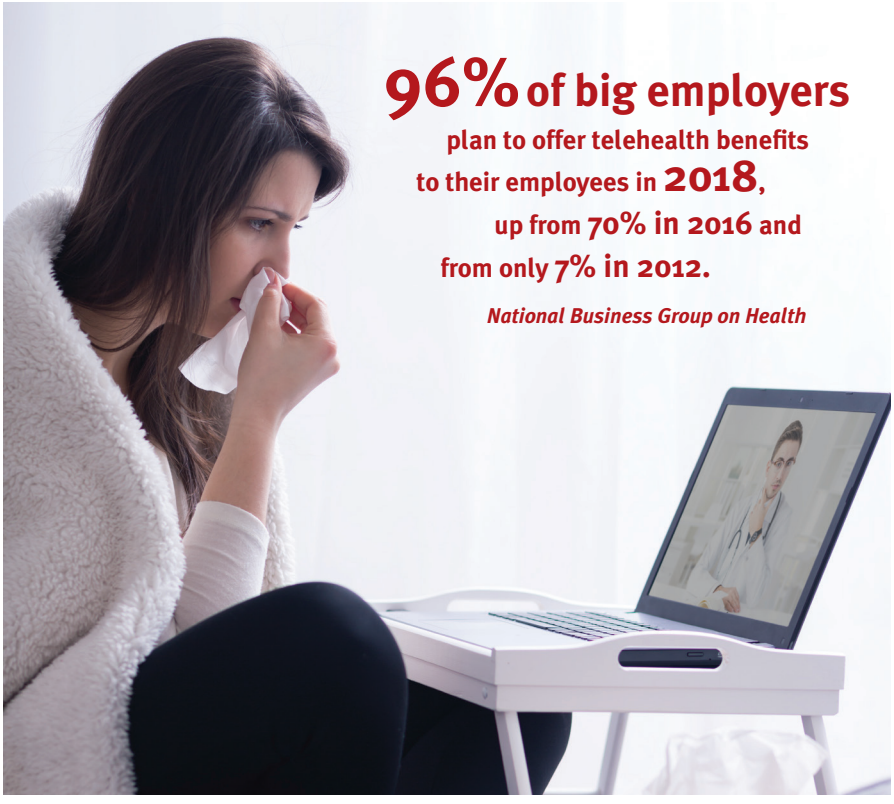
Big employers apparently agree. An annual survey by the National Business Group on Health found that 96 percent plan to offer telehealth benefits to their employees in 2018, up from 70 percent in 2016 and from only 7 percent in 2012. "In just five years, telehealth has gone from a niche program to a service that nearly all employers offer," the study's authors concluded.

And the American Medical Association, after three years of study, in 2016 came up with its first set of ethical guidelines for doctors using these new technologies in patient care.

EXPANDING WORLD-CLASS MEDICAL CARE

Telemedicine is not a new idea. Doctors have been consulting over the telephone since its invention. And NASA has been creating wondrous technologies to keep astronauts healthy in space since the 1960s. But today's revolution was inspired by the last few decades' rapid advances in computer technology, robotics and internet access.

One of the most dramatic demonstrations of this new potential was a successful 2001 gallbladder operation performed by a team of surgeons in New York on a woman in Strasbourg, France, using a high-quality telecommunications circuit and a three-armed robot named Zeus. The dream is that, as computer and telecommunications technologies and robotics continue to improve, similar procedures will become affordable and commonplace on battlefields, in space and in places all over the world that would not otherwise have access to world-class medical care.



96% of big employers
plan to offer telehealth benefits to their employees in 2018, up from 70% in 2016 and from only 7% in 2012.
National Business Group on Health

KatarzynaBialasiewicz/Getty Images Plus/Getty Images

Of course, telemedicine is already saving lives and improving outcomes in all kinds of less headline-grabbing ways. In 2012, for example, doctors at Penn State Hershey Medical Center pioneered a telestroke program. It provides videoconferencing with rural hospitals to deliver a life-saving treatment that must be administered to patients within hours of a stroke. Major stroke centers all over the country have been inspired to follow suit.

Doctors are also using "smart" devices and videoconferencing to monitor pregnant women, post-operative and chronically ill patients, and patients with addictions and other mental health issues. Last November, the Food and Drug Administration approved the first digital pill equipped with sensors, which allows doctors to monitor patient medication compliance. The list keeps growing.

REMOVING BARRIERS

One persistent roadblock for telemedicine efforts is that the practice of medicine is regulated state by state, and there are liability and licensing considerations that prevent doctors from practicing — even virtually — across state lines.

Last August, Veterans Administration Secretary David Shulkin announced a major expansion of that agency's already robust telemedicine program, allowing VA doctors to bypass those state restrictions.

"We're removing geography as a barrier so that we can speed up access to veterans and really honor our commitment to them," Shulkin said.

And that, he added, "is a very big deal."

Easy Cash

The advent of the ATM brought convenience — at a price

> THE SUMMER OF 1967 is remembered by many as the Summer of Love. But the debut of the world's first automated teller machine (ATM) on June 27, 1967, arguably reshaped lives more profoundly than did the tens of thousands of young people who converged on San Francisco's Haight-Ashbury neighborhood.

Numerous legends have grown around the inaugural deployment of a cash machine 51 years ago at a north London branch of Barclays Bank. Its inventor, John Shepherd-Barron, reportedly signed the contract for his machine over a pink gin cocktail with bank officials, and he later claimed the inspiration came to him in the bathtub.

"I hit upon the idea of a chocolate bar dispenser," Shepherd-Barron told the BBC in 2007, "but replacing chocolate with cash."

Inventors had been working on similar devices for decades before the Barclays machine debuted. American inventor Luther Simjian had patented a machine for processing deposits of cash and checks as early as 1939. It was given a trial run in New York and discarded as lacking in utility. Another British inventor, James Goodfellow, patented a teller machine using personal identification numbers (PINs) in 1966.

This near-simultaneous burst of applied ingenuity made possible a more fluid economy, in which consumers obtained increasingly ready access to their funds outside of normal banking hours. By September 1969, a pioneering U.S. company named Docutel saw its first cash machine installed in a branch of Chemical Bank in Nassau County, New York. "On Sept. 2, our bank will open at 9 a.m. and never close again!" bragged an ad touting the newfangled machine. Thousands of banks followed suit over the next decade.

But cash machines had to overcome a variety of problems in their early days. Surprising as it may seem today, the early ATMs were greeted initially by strong resistance from consumers, and even some banks were wary. Many worried that their loss of valuable face time with customers would reduce their opportunity to sell other banking services. And because banks were not yet online, they couldn't determine whether customers had enough money in their accounts to cover their withdrawals.

The situation improved with the advent of personal computers, when ATMs evolved from isolated mechanical machines to electronic devices. By the late 1970s, banks had created a standard in which networked computers were accessible to large numbers of consumers with a combination of plastic card and PIN.

Sensing opportunity, safe and vault maker Diebold jumped on the bandwagon and by the mid-1990s was producing more than 50 percent of all ATMs in the United States.

Of course, banks have always provided a heady temptation to thieves, and ATMs have been no exception. At first, robbers tried simple brute force to yank the machines away from the premises. Criminals have since become more sophisticated, infiltrating ATMs with devices that steal debit card numbers and PINs to "skim" the information required to steal identities and drain accounts.

If time really is money, bank customers have been enriched by the revolution wrought by machines that perform almost every task of a teller. But some might argue that banks themselves have profited too handsomely from it. Fees for accessing cash outside of one's own institution have gone up 55 percent over the past decade. In 2016, the three biggest banks in the United States (JPMorgan Chase, Bank of America and Wells Fargo) made $1.1 billion in ATM fees.

The convenience of cash machines clearly has its costs, as well.

ATM: kvsan/iStock/Getty Images Plus/Getty Images; Money: Tsuji/E+/Getty Images

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