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110 Predictions For the Next 110 Years

It's never easy to predict the future. But as PM's 110th anniversary celebration draws to a close, we've decided to try. Here are 110 ambitious ideas for the decades ahead. (For more about PopMech's brain trust and methodology, read [Editor-in-Chief Jim Meigs' introduction](#). And if you want to try your hand at predicting the future, [take our Facebook survey](#), and see when other readers think the most important events of the next 110 years will happen.)

BY THE EDITORS



Christopher Griffith/Megan Caponetto

up or cool you down by sending an electric current across the junction between two different metals. U.S. soldiers have put the lightweight tech to the test. So have soldiers in India. Based on early reviews, it won't be long until others enlist.

- **2012—2022**
- **People will be fluent in every language.** With DARPA and Google racing to perfect instant translation, it won't be long until your cellphone speaks Swahili on your behalf.
- **Software will predict traffic jams before they occur.** Using archived data, roadside sensors, and GPS, IBM has come up with a modeling program that anticipates bumper-to-bumper congestion a full hour before it begins. Better yet, the idea proved successful in early tests—even on the Jersey Turnpike.
- **Climate-controlled jackets will protect soldiers from extreme heat and cold.** The secret to all-weather clothing, according to former MIT student Kranthi Vistakula, is [Peltier plates](#), which can be used to warm you up or cool you down by sending an electric current across the junction between two different metals. U.S. soldiers have put the lightweight tech to the test. So have soldiers in India. Based on early reviews, it won't be long until others enlist.
- **Nanoparticles will make chemotherapy far more effective.** By delivering tiny doses of cisplatin and docetaxel right to cancerous cells, [the mini messengers](#) will significantly reduce the pain and side effects of today's treatments.
- **Electric cars will roam (some) highways.** Who says you can't [road-trip in a Tesla](#)? In a few years, the 1350-mile stretch of Interstate 5 spanning Washington, Oregon, and California will be lined with fast-charging stations—each no more than 60 miles apart. In some areas you will find stations to the east and west too. Don't get any bright ideas, though. If you try to cross the country, you won't get much farther than Tucson.
- **Athletes will employ robotic trainers.** Picture a rotor-propelled drone that tracks a pattern on your T-shirt with an onboard camera. Now imagine it flying in front of you at world-record pace. That's just the start—a simple concept developed by researchers in Australia.
- **Bridges will repair themselves with self-healing concrete.** Invented by University of Michigan engineer Victor Li, the new composite is laced with microfibers that bend without breaking. Hairline fractures mend themselves within days when calcium ions in the mix react with

rainwater and carbon dioxide to create a calcium carbonate patch.

- **Digital "ants" will protect the U.S. power grid from cyber attacks.** Programmed to wander networks in search of threats, the high-tech sleuths in this software, developed by Wake Forest University security expert Errin Fulp, leave behind a digital trail modeled after the scent streams of their real-life cousins. When a digital ant designed to perform a task spots a problem, others rush to the location to do their own analysis. If operators see a swarm, they know there's trouble.
- **Scrolls will replace tablets.** Researchers have already reproduced words and images on thin plastic digital displays. If they want those displays to compete with the iPad, they need to fine-tune the color and refine the screens so you can put your feet up and watch LeBron throw down on YouTube.

Your Car Will Be Truly Connected

- It will communicate with traffic lights to improve traffic flow.
- It will interact with other vehicles to prevent accidents.
- It will let you drag and drop a playlist from your home network.
- It will find the gas station with the deepest discount and handle the payment.
- It will notify you when someone dents your door and supply footage of the incident.

As we branch out as a species, it's quite reasonable to think that we'll send 3D printers to other planets to print habitats for humans prior to our arrival. — **Dave Evans, Chief Technology Officer and Resident Futurist, Cisco Systems**

- **Your genome will be sequenced before you are born.** Researchers led by Jay Shendure of the University of Washington recently reconstructed the genome of a fetus using saliva from the father and a blood sample from the mother (which yielded free-floating DNA from the child). Blood from the umbilical cord later confirmed that the sequencing was 98 percent accurate. Once the price declines, this procedure will allow us to do noninvasive prenatal testing.

10 Things That Will Remain the Same

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- **Radiation sickness will be cured by injection.** Thanks to interest from the Department of Defense, several treatment options are now vying for FDA approval. In clinical trials, one of them, Ex-Rad, has not only prevented long-term cell damage but also promoted bone marrow recovery.
- **That car part you need will be sculpted inside a 3D printer.** Dentists are already using this modern tech wonder to transform laser scans of your mouth into custom-fit appliances for your teeth. But that's a fraction of what the machine can do. When a 3D printer costs the same as, say, an HDTV, you will use one of your own to download all sorts of useful things, marveling as it creates each item layer by layer from plastic, rubber, titanium—you name it. Just imagine your

future self printing a birthday cake, a Rolex, or a catalytic converter for the car. In time you'll even be able to download prescription medicine.

- **Drugs will be tested on "organ chips" that mimic the human body.** Now undergoing trials in 15 research institutions, the new silicon chips feature channels that house living kidney or lung cells, above. Simulated blood and oxygen flow allows them to mirror the actions of real organs, reducing the need for animal testing and speeding up drug development—in the midst of a pandemic, that would be crucial.
- **Passwords will be obsolete.** IBM says it will happen in five years. Who are we to disagree? Apple and Google are designing face-recognition software for cellphones. DARPA is researching the dynamics of keystrokes. Others are looking into retinal scans, voiceprints, and heartbeats. The big question, it seems, is what will you do with all that time you used to spend dreaming up new ways to say JZRulz24/7!
- **Car tires will be brewed by bacteria.** Isoprene—a key ingredient in rubber—is produced naturally by many plants but not at great enough volume to keep pace with the world's demand for tires. It can also be extracted from oil. But biotech firm Genencor has engineered *E. coli* microbes that produce gobs of the stuff as a by-product of metabolizing plant sugars. Goodyear, a partner in the study, is already testing prototypes of these bio-isoprene tires.
- **Self-cleaning buildings will help us fight smog.** When sunlight strikes their aluminum skin, a titanium dioxide coating releases free radicals, which break down the grime and convert toxic nitrogen oxide molecules in the air into a harmless nitrate. Everything washes away in the rain.
- **Your clothes will clean themselves too.** Engineers in China have developed a titanium dioxide coating that helps cotton shed stains and eliminate odor-producing bacteria. To revive your lucky shirt after a night of poker, you need only step into the sun.
- **Drones will protect endangered species.** Guarding at-risk animals from poachers with foot patrols is expensive and dangerous. This summer rangers in Nepal's Chitwan National Park previewed a savvy solution: Hand-launched drones armed with cameras and GPS provided aerial surveillance of threatened Indian rhinos.
- **Data will be measured in zettabytes.** According to the International Data Corporation, the volume of digital content created on the planet in 2010 exceeded a zettabyte for the first time in history. By the end of this year, the annual figure will have reached 2.7 zettabytes. What exactly does a zettabyte look like? Well, if each byte were a grain of sand, the sum total would allow you to build 400 Hoover Dams.
- **Rescuers will use electronic noses to locate disaster victims.** Some devices will use an array of sensors to rapidly detect carbon dioxide, ammonia, and acetone released into the rubble via breath, sweat, and skin. Others sniff out chemical compounds from human remains buried 3 feet underground. All keep working long after the dogs have retired to their kennels.
- **Genetic testing will be used to halt epidemics.** A year ago, investigators at the National Human Genome Research Institute teamed with doctors in Maryland to track the outbreak of a deadly bacterial infection. The big breakthrough? Real-time genome sequencing, which helped them identify minute mutations in the microbe, determine how it spread, and quickly stop it.
- **Vaccines will wipe out drug addiction.** The human immune system is supremely adept at detecting and neutralizing foreign substances. Why not train it to target illicit ones? That's the idea behind addiction vaccines: Persuade the body to produce antibodies that shut down drug molecules before they get to the brain. The concept works in mice. Human trials are under way.
- **Smart homes will itemize electric, water, and gas bills by fixture and appliance.** Shwetak Patel, a 30-year-old MacArthur Fellow, is working on low-cost sensors that monitor electrical variations in power lines to detect each appliance's signature. He has already used pressure changes to do the same for gas lines and water pipes. It's up to you to pinpoint where the savings

lie.

• **Vegetarians and carnivores will dine together on synthetic meats.** We're not talking about tofu. We're talking about nutritious, low-cost substitutes that look and taste just like the real thing. Twitter co-founder Biz Stone has already invested in Beyond Meat, which makes plant-based chicken strips so convincing they almost fooled *New York Times* food writer Mark Bittman.



2023—2062

• **Contact lenses will grant us *Terminator* vision.** When miniaturization reaches its full potential, achieving superhuman eyesight will be as simple as placing a soft lens on your eye. Early prototypes feature wirelessly powered LEDs. But circuits and antennas can also be grafted onto flexible polymer, enabling zooming, night vision, and visible data fields.

• **Checkups will be conducted by cellphone.** The technology is no problem. Scientists are hard at work [trying to perfect apps](#) that can measure your heart and respiration rates, perform blood and saliva tests—even evaluate your cough. Question is

how long will it take the medical industry to embrace them.

• **All 130 million books on the planet will be digitized.** In 2010 Google planned to complete the job by decade's end, but as of March it still had 110 million tomes to go, so we're adding wiggle room. You might use the time to shop for storage, because given today's options and the average size of an e-book (3 MB), you'll need 124 3-terabyte drives to carry the library of humanity with you. It won't fit into a backpack, but it's small enough to schlep in a hockey bag.

• **Nurse Jackie will be a robot.** By 2045, when seniors (60-plus) outnumber the planet's youth (15 and under) for the first time in history, hospitals will use robots to solve chronic staffing issues. Expect to find the new Nightingales lifting patients and pushing food carts. Engineers at Purdue University are thinking even bolder—designing mechanical scrub nurses that respond to hand gestures during surgery.

• **Supersonic jets will return—for good this time.** The limit on [supersonic flight](#) is not one of engineering but of economics. Aircraft that break the speed of sound guzzle fuel, so new jet engines will have to be efficient. One solution—the pulse detonation engine, which uses a fuel—air mixture—was tested at the Mojave Air & Space Port in 2008. By 2030 a successor will power that fabled 2-hour hop from New York to London.

Your Car Will Be Truly Connected

- The refrigerator will place your grocery order.
- The carpet will detect intruders and summon help if you fall.
- Lawn sensors will tell you which part of your yard to fertilize.
- The electric meter will monitor local power consumption and help you make full use of off-peak rates.
- The thermostat will learn your preferences and adjust the climate in each room as soon as you enter.

Within 30 years humans will begin augmenting their brains by plugging the power of tomorrow's cellphones directly into their heads. — **Shawn Carlson, founder of the Society for Amateur Scientists**

- **Highways will handle three times as many cars.** According to researchers at Columbia University, vehicles driven by humans use at best 5 percent of a highway's road surface at any given time. If we let technology take the wheel, we could significantly increase the volume of traffic. In one example, Volvo's semiautonomous road train wirelessly connects a stream of cars to a truck driven by a professional. The self-driving cars mimic the speed and steering of the lead vehicle, safely decreasing the gaps while increasing fuel efficiency.
- **Farmers will grow caffeine-free coffee beans.** Taking caffeine out of coffee is no easy chemical feat, which is why decaf lacks the rich flavor of the high-test stuff. After years of research, Brazilian scientists have discovered a mutant strain of coffee that's naturally low in caffeine. They won't rest until they learn how to remove every last drop of the sleep-retarding stimulant.
- **[Supercomputers](#) will be the size of sugar cubes.** The trick is to redesign the computer chip. Instead of the standard side-by-side model in use today, IBM researchers believe they can stack and link tomorrow's chips via droplets of nanoparticle-infused liquid. This would eliminate wires and draw away heat. What it won't do is help you remember where you left your tiny computer before you went to bed.

10 Things That Will Disappear

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We will find life beyond Earth. There's a horse race going on right now, and one of those horses is going to cross the finish line in the next two decades. — **Seth Shostak, senior astronomer, SETI**

- **A virtual lawyer will help you plan your estate.** "I don't mean avatars," Cisco's Dave Evans says. "I mean virtual people—self-contained, thinking organisms indistinguishable from humans." Sounds crazy, right? But surely you've seen the magic of CGI. What's to say you can't attach a lifelike visage to an interface fronting the crowdsourced wisdom of the Internet? Give it a nice head of hair, teach it how to smile, and you're looking at a brilliant legal eagle with awesome people skills.
- **Vertical farms will feed cities.** There will be 9 billion people on the planet in 2050, seven out of 10 of them in urban areas, and everyone's got to eat. [Future food production](#) will depend on farmscrapers that grow pesticide-free crops year-round—making it much simpler to eat local.
- **Connecticut will feed the world.** To keep up with all the hungry mouths, we may just have to rethink food. The folks at tech startup Pronutria claim to have discovered an industrious single-cell organism that converts sunlight, CO₂ and water into low-cost nutrients. It works in tight quarters too. Instead of a few thousand pounds of crops per acre a year, we'd be looking at 100,000, according to the company's research. In other words, the planet's protein could be produced in an

area half the size of Connecticut.

- **Scientists will discover direct evidence of dark matter.** It may account for 23 percent of the mass in the universe, yet we haven't confirmed that dark matter exists. Why? "It's like a hidden magnet," says Dr. Fred Calef of the Mars Science Laboratory. "You can see what it pulls but can't see the source." Theoretical physicist Michio Kaku believes the proof we seek could arrive within 15 years, helping us to unlock the origins of our universe, and maybe even open the door to another one.
- **[Navy SEALs](#) will be able to hold their breath for 4 hours.** Advances in nanotechnology will help us overcome not only illness but also the limits of being human. For example, robotic red blood cells called respirocytes could each hold 200 times the oxygen of their natural counterparts, enabling a man on a mission to, say, hide out underwater for half a day without a scuba tank.
- **Tuna will be raised on farms.** Ah, the bluefin—powerful, dangerous, graceful ... and delicious served raw. Long reproduction cycles and a migratory lifestyle make it hard to tame, though. Pioneering fish farms in Mexico are now raising the species, fattening tons of fish in massive underwater pens. Similar efforts are underway in the U.S., Japan, and the Mediterranean.



2063—2122

• **Robots will rule the LV games!** China started hosting the International Humanoid Robot Olympic Games in 2010, and inventor Dean Kamen is pushing for high-tech competitors in Rio de Janeiro in the summer of 2016. "The original Olympic skill sets were javelin throws, wrestling, and fighting skills that countries needed for defense," he says. "In the 21st century, sports should require modern skills like programming and mechanical prowess." We say let's get started. By 2100 we hope to design the android version of Michael Phelps.

• **The Pentagon will say goodbye to large submarines.** With the steady improvement in sonar technology, our subs are already hard-

pressed to evade detection. In the future, underwater robots with laser radar or other nonacoustic sensors will make the seas virtually transparent. So how will we deploy our nukes? Hypersonic missiles launched from our own shores will reach any target in the world within 1 hour.

We're all gonna die. — **MythBusters** host **Jamie Hyneman**

• **An [ion engine](#) will reach the stars.** If you're thinking of making the trip to Alpha Centauri, pack plenty of snacks. At 25.8 trillion miles, the voyage requires more than four years of travel at light speed, and you won't be going nearly that fast. To complete the journey, you'll have to rely on a scaled-up version of the engine on the Deep Space 1 probe, launched in 1998. Instead of liquid or solid fuel, the craft was propelled by ions of xenon gas accelerated by an electric field.

Your Body Will Be Truly Connected

- Doctors will check your vital signs around the clock via tiny sensors.
- Stomach chips will monitor your diet to help you lose weight.

- Spinal cord implants will reverse paralysis.
 - Brain chips will let you absorb data while you sleep.
 - Brain interfaces will help you fully inhabit virtual worlds.
- **Scientists will map the quadrillion connections between the brain's neurons.** Quadrillion sounds like a made-up number, but we assure you it's real. Those connections hold the answers to questions about mental illness, learning, and the whole nature versus nurture issue. If every one of them were a penny, you could stack them and build a tower 963 million miles high. It would stretch past Mars, Jupiter, and Saturn and stop roughly halfway to Uranus.
- **One of us will celebrate a 150th birthday.** Our money's on Keith Richards. Given recent advances in health, technology, and medicine and the rise of genome science, it's only a matter of time until someone gets to blow out all those candles—especially if you toss in a breakthrough on the scale of antibiotics, says David Ewing Duncan, author of *When I'm 164*. What are your odds of living to see our predictions come true? There are more than 300,000 centenarians on the globe already—and one hearty soul has reached the age of 122.

THE PM BRAIN TRUST SAYS:

WITHIN 20 YEARS...

[Self-driving cars](#) will hit the mainstream market.

Battles will be waged without direct human participation (think robots or unmanned aerial vehicles).
The first fully functional brain-controlled bionic limb will arrive.

WITHIN 30 YEARS...

All-purpose robots [will help us with household chores](#).

Space travel will become as affordable as a round-the-world plane ticket.

[Soldiers will use exoskeletons](#) to enhance battlefield performance.

WITHIN 40 YEARS...

Nanobots will perform medical procedures inside our bodies.

WITHIN 50 YEARS...

We will have a colony on Mars.

Doctors will successfully transplant a lab-grown human heart.

We will fly the friendly skies without pilots onboard.

And renewable energy sources will surpass fossil fuels in electricity generation.

WITHIN 60 YEARS...

Digital data (texts, songs, etc.) will be zapped directly into our brains.

We will activate the first fusion power plant.

And we will wage the first battle in space.

WITHIN 100 YEARS...

The last gasoline-powered car will come off the assembly line.

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