

LIVING LONGER

THE NEW AGE OF MUCH OLDER AGE

EVERYONE WANTS TO LIVE LONGER, AND SCIENCE IS STARTING TO MAKE THAT HAPPEN. BUT LIVING BETTER WILL BE THE REAL CHALLENGE—AND OPPORTUNITY

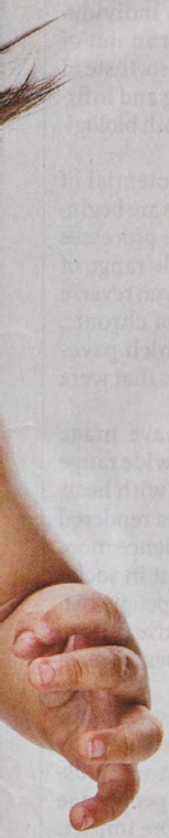
BY LAURA L. CARSTENSEN

WE LIVE IN EXTRAORDINARY TIMES. AND THANKS TO medical and scientific advances that even a generation ago would have sounded like science fiction, our lives are getting longer. An American born today has a projected average lifespan 20 full years longer than one born in 1925, and we are, as a society, growing old. For the first time in U.S. history, the number of people over 60 exceeds those under age 15.

Long life is a remarkable achievement. But our aging society presents challenges every bit as fundamental and pervasive as climate change and globalization. If we address the reality of longevity, we will avoid a crisis—and improve the quality of our lives at all ages.

Even as we look forward to more years ahead, the idea of a long life can also trigger anxiety. The unease we experience has to do with how quickly the age structure in the global population has been reshaped. In less than a century, more years were added to life expectancy than all years added across all prior millennia of evolution combined. Long-lived societies appeared so suddenly that culture—the crucible that holds science and technology along with wide-scale behavioral practices and social norms—has not caught up.

The challenge we face today is converting a world built quite literally by and for the young into a world that supports and engages populations that live to 100



years and beyond. This is no small feat. Consider, for example, that parks, transportation systems, staircases and even hospitals presume that users have both strength and stamina; suburbs across the country are built for two parents and their young children, not single people, multiple generations or elderly people who may be unable to drive. Our education system serves the needs of children and young adults and offers little more than recreation for experienced people.

Indeed, the very conception of work as a full-time endeavor ending in the early 60s is ill suited to long lives. Arguably most troubling is that we fret about ways that older people lack the qualities of younger people rather than exploit a growing new resource right before our eyes: citizens who have deep expertise, emotional balance and the motivation to make a difference.

Science and technology are the reasons for the increase in life expectancy, and looking forward, science and medicine will be responsible for how we extend life even further. But to get a handle on where we're going—the potential for a life longer than any of us can imagine—it helps to think about how we got here.

Prize-winning economist Robert Fogel and his colleague Dora Costa describe a phenomenon called “technophysio-evolution,” that is, biological changes due largely to technologies that ensured a steady food supply. But this explosion wasn't limited to agriculture. Electricity was discovered and made widely available; refrigeration improved the safety of food; pasteurization and water purification contributed further to health; the systematic disposal of waste greatly reduced the spread of contagious disease; and medical science led to dramatic reductions in premature death thanks to vaccination programs that effectively wiped out lethal viruses from large parts of the developed world.

Although we were and remain little different genetically from our ancestors 10,000 years ago, the working capacity of our vital organs has improved greatly. Average body size has increased. We have grown taller, and our brains have come to process information faster.

Longer lives and the fact that we're having fewer kids, in combination, began a global process by which population pyramids—with many at the bottom and a tiny proportion of old people at the top—are being transformed into rectangles. If you're the type of person who can get chills from population statistics, these are the numbers for you. What they mean is that for the first time in history, the majority of babies born in the developed world have the opportunity to grow old.

As much as we may fancy ourselves freethinking, the crux of the longevity challenge is, quite frankly, that humans are creatures of culture. The culture that guides us today—that tells us when to get an education, marry, have children, buy a house, work and retire—is profoundly mismatched to the length of the lives we are

living. Today's culture offers little in the way of cures or even treatments for the chronic diseases that afflict older people, nor does it offer guidance about how to finance decades-long retirements. And so individuals worry they will succumb to dementia, run out of money, lose their relevance. But it needn't be so. Instead of hand-wringing about productivity falling and infirmity rising, we need to change the course, both biologically and socially, of long life.

With sufficient financial support, the potential of scientific advances is breathtaking. Biologists are beginning to understand, at a molecular level, the processes by which aging increases the risk of a whole range of diseases and, importantly, how to slow and even reverse some of these processes. The very nature of chronic, degenerative diseases is being revealed, which paves the way for therapies and possibly even cures that were scarcely imagined a generation ago.

Meanwhile, technological advances have made available devices that can compensate for a wide range of age-related problems, such as difficulties with hearing, balance and mobility, just as eyeglasses rendered presbyopia no more than a minor inconvenience more than a century ago. And with an investment in social science we can develop methods that help people better envision and plan for their futures, improve fitness, remain cognitively sharp and, in some cases, reverse diseases rooted in lifestyles.

We can apply science so that the youngest children among us today live happy and healthy lives as centenarians. In partnerships with businesses and industries, products can be developed that help people age well. Examples include cars that brake before impact, smart homes that improve the safety of occupants, mobile devices that influence behavior and financial products that allow people to effectively finance long lives.

We might also trade retirement for new models of working longer, so that parents spend more time with young children, sabbaticals become commonplace and—imagine this—workers experience periods of leisure before they reach old age.

An essential first step is to change the way we think about our suddenly longer lives.

Thirty or more extra years of life also means we can improve the way we live. To the extent that we can build a world where people arrive at old age mentally sharp, physically fit and financially secure, the problems of individual aging will recede. And finally, we can change the ongoing conversation about a crisis on the horizon to one about long life and new opportunities. ■

LONGEVITY GURU:



Laura L. Carstensen, director of the Stanford Center on Longevity
Age: 61

AGING INTERVENTION

“Oddly enough, I don't think much about chronological age. I do think a lot about physical and psychological health. I keep my priorities clear. Exercise and persistently trying to solve big problems is what keeps people sharp and makes life satisfying.”

Carstensen, professor of psychology and director of the Stanford Center on Longevity, is the author of A Long Bright Future: Happiness, Health and Financial Security in an Age of Increased Longevity

Wellness

LIVING LONGER | PSYCHOLOGY

GET YOUR HEAD IN THE GAME

CUTTING-EDGE RESEARCH IS SHOWING THAT YOUR OUTLOOK CAN CHANGE HOW YOU AGE—AT THE CELLULAR LEVEL. HERE'S HOW

BY JEFFREY KLUGER

WE TEND TO FACE AGING WITH FEEL-GOOD SLOGANS, bringing platitudes to a knife fight. "I'm 70 years young!" we say, ignoring the fact that, going by average U.S. life expectancy, it won't be long before we're 78 years dead. "Fifty is the new 40," we tell ourselves, when the mathematical reality is no, it's not. Fifty will never even be the new 49½.

Then comes a bit of wisdom that, if anything, seems like the most shopworn of all: "You're only as old as you feel." As sentiments go, it has the twin flaws of being both banal and blaming—as if feeling old is your own fault. It turns out, however, that whoever coined that one may have been onto something big.

It's no secret anymore that the familiar mind-body divide, with your head home to the abstract and ethereal and your flesh home to the messy and mechanical, is nonsense. Your moods, feelings and thoughts all influence your physiology. Learn to relax and your blood pressure goes down; emerge from depression and your immune system picks up; take a pharmacologically useless sugar pill that you're told is a powerful drug for your headache or backache or infection and as if by magic, you get better.

The tantalizing question, then, has always been this: If the mind can heal the body, can it also rejuvenate it? Can it make it physically, measurably younger or, at the very least, slow the aging process? The people who research such things already accept that the way we

think and feel can increase the population of disease-fighting white blood cells and lower the level of the hormone that raises blood pressure, so why couldn't it help recalcify bones or reverse heart disease or preserve the brain cells that are lost with age? "You're only as old as you feel" may merely be part of the equation. Perhaps, within reason, you're only as old as you bloody well choose to be—because research is mounting that your outlook, your personality and, frankly, how upbeat you are have a profound impact not just on how you feel but also on how your cells age.

"Let's treat *mind* and *body* as just words," says Ellen Langer, a professor of psychology at Harvard University who has been studying aging, mindfulness, decision-making and health since the late 1970s. "Let's put them together as one thing and say anywhere you put the mind, you also put the body."

Once you make that leap, the medical tool kit becomes a lot larger. It includes not just pharmacology and surgery but also things like meditation, optimism, resilience and social connections—all the stuff that's always been far outside medicine's visible wavelength but suddenly is finding a place comfortably within it.

Consider one study, for instance, showing that even a single day of a mindfulness meditation practice can down-regulate a gene that codes for inflammation—one of the greatest drivers of aging. Or the one showing that reducing stress can reduce the cellular damage from the highly reactive oxygen atoms known as free radicals. Or the research that found, most remarkably, that the telomeres within your cells—the little cuffs that cap chromosomes and erode over your lifespan—can actually be made to grow longer, provided your mind is in the right state to make it happen.

"It comes down to daily behavior and the choices we make," says Elissa Epel, a professor of psychiatry at the University of California, San Francisco (UCSF), who studies stress and aging. "We have a growing set of studies of people from around the world showing that aging is not just an aspect of genetics but of how we live." Deciding to live better, it increasingly seems, is the same as deciding to live younger.

Winding Back the Mind

IT WASN'T UNTIL THE LATE 1970S THAT RESEARCHERS began seriously thinking about using the mind to arrest the aging process, and it was Langer's landmark "counterclockwise" study that really got things started. In 1979, when she was just beginning her Harvard teaching career, she recruited a group of eight men in their 70s for a five-day stay at a retreat in New Hampshire. The men were in neither good nor bad health but what was considered age-appropriate health—which is to say slow, bent and easily fatigued. But Langer was determined to change that.

LONGEVITY GURU:



Ellen Langer, professor of psychology at Harvard University
Age: 67

AGING INTERVENTION:

"I don't get stressed about combatting age, which leads me to take care of myself naturally, without an agenda. I like to play tennis and take walks because it's fun to do so. When we nurture our minds, we're taking care of our bodies."

The retreat, as the men discovered when they arrived, was a former monastery designed to look as the world did to them in 1959. Vintage programs were showing on vintage TVs. Midcentury music played on midcentury radios. The men were treated too as they would have been back then—no one offered to help them with their bags or fetch them a blanket. They kept their conversation to the topics they would have discussed in 1959—the doings in the Eisenhower White House, say, or the Dodgers–White Sox Series face-off. And lest the men get a glimpse of themselves and break the spell, all mirrors were removed from the space.

At the beginning and end of the five-day span, Langer administered a series of physical and cognitive aptitude tests to the men, and the result was as she expected: on virtually every metric, their performance improved dramatically, and in many cases it was closer to what would be expected for men a decade or two younger.

"The study spoke volumes to the potential we have to change our health," Langer says. "At some point people just tell us we can't. If you're 20 and you hurt your wrist, you expect it to get better. When you're 70, you've bought into the mind-set that you're falling apart, and then you do."

Langer went on to test the same premise in other ways. After recruiting a sample group of hotel maids who were battling their weight, she told half the sample that studies showed the work they did every day was actually a vigorous form of calorie-burning exercise. The other women were given no such information. At the end of the study, the women who believed that their work was a workout lost more weight than those in the other group.

Langer's studies, compelling as they are, are not complete. They do a very good job of proving that thinking young appears to make the body young—or at least younger—but they don't say why. Langer herself is more philosophical than empirical on this. "The mechanism is the part that's so hard to get across to people," she says. "But when the mind and body are one, there's no mediator needed."

Maybe. But even if she doesn't need a mediator, other scientists do, and they're looking hard for it—starting inside human cells, at telomeres.

The Levers of Aging

OVER THE COURSE OF A LIFETIME, TELOMERES BURN down like a sort of candle wick, leaving the chromosomes vulnerable to damage and starting the aging process.

Investigators have understood the basics of telomeres since 1978, when then postdoctoral fellow Elizabeth Blackburn, now at UCSF, first mapped their structure and later, with her collaborator Jack Szostak of Harvard, their function. In 1984, Blackburn and her graduate student Carol Greider, now at Johns Hopkins

School of Medicine, discovered the enzyme telomerase, which repairs and maintains telomeres—at least when it's around at sufficient levels. When those levels fall, which happens as we get older, the aging process is kicked off. The discovery won all three of them the 2009 Nobel Prize for Medicine.

"When studies look at which individuals will die in the next three years," Blackburn says, "the chances are higher if your telomeres are shorter. Telomere shortening plays into cardiovascular disease, immune-system problems and maybe diabetes by affecting beta cells in the pancreas—though that one's been shown only in mouse models so far."

The question is, Are there ways to intervene to spare the telomeres and preserve your health? The answer—at least preliminarily—is yes, and stress reduction is one powerful method. In 2014, Epel and her colleague Eli Puterman, also of UCSF, studied 239 healthy, postmenopausal women over the course of a year. Many of the subjects were experiencing at least one of 13 major life stressors, which included unemployment in the family, financial woes, divorce and the illness of a child.

The length of their telomeres was measured at the beginning and end of the year, and the more life stressors these women experienced in that time, the more their telomeres shortened that year. But some of the women also practiced good health behaviors—they exercised, ate well and slept well. Consistently, the women who also practiced good health behaviors maintained their telomere length. "The question had always been whether the telomeres respond to daily lifestyle changes or if the system is chronic and proceeds at its own pace," Epel says. "In our study, it was lifestyle, with damage occurring mostly in people who were sedentary."

Worse, telomere-shortening stress is not confined to older people and does not even have to be experienced firsthand. Epel cites studies showing that when cord blood is drawn from newborns, the babies whose mothers had experienced more stress when they were pregnant showed shorter telomeres than those whose

mothers had easier pregnancies. "We replicated that original finding," she says, "and it suggests healthy telomere maintenance doesn't start when you're born but before you're born."

Some researchers believe that improvements in exercise and other healthy behaviors can increase the output of telomerase, and animal studies in test tubes show that increased telomerase may in turn make telomeres grow. Telomerase supplements, however—either synthetically produced or in the many herbal supplements that claim to include the enzyme—are not the answer. If telomeres never burn down, you get immortal cells—which is another way of saying cancer cells.

"Cancers love telomerase, and a number of cancers up-regulate it like crazy," says Blackburn. "But some cancers are also related to low telomerase because that makes telomeres less stable." Trying to boost telomerase through supplements is a very dangerous game to play—at least given the current state of medical knowledge. "We don't know how to strike some kind of balance. My feeling would be that if I take anything that would push my telomerase up, I'm playing with fire," says Blackburn.

Putting Out Fires

TELOMERES AREN'T THE ONLY BIG, STRESS-RELATED players in the aging game. Another is chronic inflammation. When you're anxious, the sympathetic nervous system—which is not known for thinking things through too clearly—assumes you're about to encounter a predator or some other life-threatening challenge. The brain thus sends a signal to the adrenal gland to start secreting the hormones epinephrine and cortisol; together, these hormones signal the immune system to release proteins known as inflammatory cytokines. These prepare white blood cells and other infection fighters to rush to the site of an anticipated wound.

That works quite well when there really is a wound, or when the danger is fleeting and you escape without injury. Either way, the system, thanks largely to cortisol, dials itself back down. But what if you're always braced for a battle of some kind—with your boss, your kids, your credit-card statements—and the body is always flooded with inflammatory chemicals? In those cases the body suffers from what's known as inflammation—and that's bad.

"There is no invader as there is with a wound, but we're reacting as if there is anyway," says Epel. "That creates a friendly environment for cancer, brain deterioration, cardiovascular disease." In other words, for many of the main killers of aging.

One of the best ways to battle this is with a settled psychic state, through meditation and mindfulness exercises. Increasingly, researchers are finding that a

'THE REGULAR PRACTICE OF [MEDITATION] SEEMS TO BE ABLE TO ALTER THE TRAJECTORY OF AGE-RELATED CHANGES.'

—RICHARD DAVIDSON, NEUROSCIENTIST AT UNIVERSITY OF WISCONSIN, MADISON

particular form of meditation known as Mindfulness Based Stress Reduction (MBSR)—which, as its name suggests, includes paying close attention to feelings, thoughts and other stimuli while meditating—can calm an inflamed immune system in the same way it can calm an inflamed mood.

In 2013, Richard Davidson, a neuroscientist and the founder of the Center for Investigating Healthy Minds at the University of Wisconsin at Madison, conducted a pair of studies showing just how powerful an effect MBSR can have on the body. In one, he and his colleagues compared 40 subjects—21 of whom engaged in eight hours of a combination of guided meditation, meditative walks and lectures on meditation, and 19 of whom engaged in equally relaxing activities but without the meditation. At the end of even so brief a period as eight hours, the meditators showed a decrease in the expression of the very genes that regulate inflammation—meaning a decrease in inflammation itself too.

Another study replicated the findings over the course of eight weeks, and at the end, the experimenters used a suction device to raise a small blister on the arms of the subjects. When fluid was withdrawn, the meditators showed significantly lower levels of inflammatory cytokines—the same cytokines that do so much damage when they circulate in the body chronically.

“The regular practice of certain contemplative methods seems to be able to alter the trajectory of age-related changes,” Davidson says. “Some studies even show that meditation can slow the age-related decline of gray matter in the brain.”

On this last point, Davidson understates things. Exciting research published in February out of UCLA compared two sample groups of 50 people, ranging in age from 24 to 77—a good demographic slice since gray matter actually begins declining when we’re in our 20s. One group was made up of people who did not meditate, the other of people who had been regular meditators for anywhere from four to 46 years. All 100 subjects’ brains were scanned with magnetic resonance imaging, and the results were unmistakable: the meditators showed less gray-matter loss in several regions of the brain compared with the nonmeditators.

“We expected rather small and distinct effects located in some of the regions that had previously been associated with meditating,” said Dr. Florian Kurth, co-author of the study. “Instead, what we actually observed was a widespread effect of meditation that encompassed regions throughout the entire brain.”

The Optimism Effect

ALMOST AS POWERFUL AS MEDITATION—AND CERTAINLY easier for people who would be perfectly happy to set aside time for solitary contemplation in a quiet place if

LONGEVITY GURU:



Steven Austad, researcher on aging at University of Alabama at Birmingham
Age: 68

AGING INTERVENTION:

“I don’t have a great relationship with relaxation. Exercise is one way I relieve stress. I find nothing more satisfying than going to bed at night and being so physically tired I can hardly lift my arms or my legs. If I died in a climbing accident at the age of 90, that would be perfect.”

they could find the hour and the place and the quiet—is simple optimism. Challenges and setbacks and even tragedies are nonnegotiable parts of life, but what is negotiable is how you face them.

Dr. Hilary Tindle, a physician and clinical investigator at Vanderbilt University, has produced a body of work on the connection between attitude and health, and all of it points to the improbable power of just being hopeful. In one massive 2009 study, Tindle analyzed data from 97,253 women who had filled out questionnaires for the National Institutes of Health’s Women’s Health Initiative, trying to correlate hopefulness and mortality. Women who had scored high on optimism—being hopeful about the future—the results showed, had significantly lower rates of heart disease, cancer and mortality than women who scored high on pessimism.

Tindle also studied cynicism, which can be described as feelings of pessimism about other people, expecting them to be untrustworthy and even harmful. Women with lower cynicism, compared with those who viewed most other people with suspicion, had lower risk of death.

In a 2012 study, she compared more than 430 people who had undergone coronary-bypass surgery—284 of whom were diagnosed with at least low-level clinical depression and 146 of whom were not. The subjects all took the same optimism survey that the sample group in the other study had. Within eight months after surgery, the depressed pessimists had more than twice the complication and rehospitalization rate than the optimistic group.

“As a doctor my goal is to help people understand this connection more than they do,” Tindle says. “But they need to do so in a way that makes it actionable. In other words, how do we put all these new findings to work?”

That, ultimately, is the critical question. Researchers are divided on how possible it is for people who have made it to middle age cynical or stressed or sedentary to undo all the damage to their systems through outlook change and meditation alone. But the research is piling up that it can help—and it certainly can’t hurt.

As with most matters involving health, it comes down in large measure to lifestyle—diet, exercise, adequate sleep and positive attitude. That’s not sexy, but when it comes to longevity, take what works over what makes headlines. The fact is that the aging odometer never runs backward. The 70-year-old will always be 10 years older than the 60-year-old. But if you’re talking about how many years both of those people have remaining, put your money on a happy, active 70 over a cynical, sedentary 60.

That, if nothing else, puts a sweet twist on the hard rule that all lives must end: enjoy the time you’ve got, and you just might get more of it. ■

Wellness

HERE'S WHAT THE SCIENCE SAYS:



MORE KINDNESS

Fourth- and fifth-graders who participated in a mindfulness and kindness program showed better social behavior than their peers and were less aggressive and better liked.



BETTER MATH SCORES

The mindful group had math scores 15% higher than their peers'. In a separate study, 41% of meditating middle schoolers gained at least one level in math on a state standardized test.



FEWER ADHD SYMPTOMS

Even third-graders can get Zen. Eight weeks of mindfulness and yoga resulted in fewer ADHD symptoms and less hyperactivity—and the effects lasted for months after the program ended.

Mini Meditators. Mindfulness and meditation exercises are helping kids get an edge in the classroom

By Mandy Oaklander



MORE SELF-CONTROL

Three years after a Transcendental Meditation program was implemented at a troubled middle school, suspension rates dropped from 28% to 4% and teacher turnover plummeted.



LESS DEPRESSION

Just nine lessons of a mindfulness program led to lower depression scores, less stress and better well-being in British kids ages 12 to 16, compared with students who didn't participate in the program.



IMPROVED FOCUS

At an elementary school in Richmond, Calif., teachers reported better focus, self-control, class participation and peer respect in kids who followed a mindfulness program, compared with their levels before.

ANY TEACHER WHO'S EVER PRODDED, begged or bribed a child to sit still and listen knows there aren't a ton of proven ways to get a kid to tune in. But a slew of new research offers a different suggestion: Breathe. Not you—they.

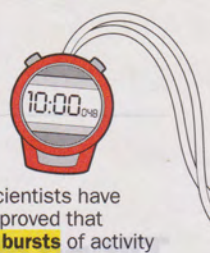
Mindfulness and meditation programs are emerging as powerful ways to calm kids down, sharpen their brains and make them kinder to their classmates. Though

the research looks at many different techniques, the outcomes seem consistently positive—and they appear to work in kids so young, they've yet to meet their first fraction all the way up to high school seniors. Some research even hints that Transcendental Meditation leads to higher graduation rates: 15% higher, one 2013 study found. Seemingly idle time may have a place at school after all.

Sources: *Developmental Psychology*; *Education*; *Journal of Positive Psychology*; David Lynch Foundation; *British Journal of Psychiatry*; *Journal of Child and Family Studies*

ILLUSTRATIONS BY MELINDA BECK FOR TIME

Health



Scientists have proved that **short bursts** of activity truly change and improve the body

Get Fitter (Much) Faster Your workouts don't have to last long—but they have to be hard

BY ALEXANDRA SIFFERLIN

THE TIME-STRAPPED, STRESSED-OUT AND DOWNRIGHT LAZY AMONG US HAVE NO DOUBT caught wind of the latest trend in fitness: micro workouts, which have surprising endorsements not just from personal trainers but from scientists too. And yet they seem to be onto something. "If you only have 15 minutes, many people might blow off traditional exercise and say they can't get a quality workout in a short period of time," says Martin Gibala, a professor of kinesiology at McMaster University in Ontario. "But brief, intense exercise is an effective way to improve your fitness and markers that may reduce risk for chronic diseases." Gibala is researching just how low you can go, time-wise, to get a good workout, but for now he says that to get the full effect, you need to trade in duration for intensity: the shorter the workout, the tougher it should be. "There's no free lunch here," he says. "You really have to get out of your comfort zone and go hard." In his research, Gibala often uses cycling because it's low impact, but you can substitute any type of exercise that gets your heart rate up—be it running, jumping jacks, burpees or barre work.

A Workout for Every Schedule

1 MINUTE:

Go as hard as you can. Gibala's team has shown that you can improve fitness in just 60 seconds.



The workout: Get on a stationary bike or treadmill. Give yourself a short warm-up and then pedal or run as fast as you can for one minute.

The benefit: Men and women who tried the one-minute workout for six weeks improved their endurance and lowered their blood pressure.

7 MINUTES:

Do the seven-minute workout developed by scientists at McMaster University.



The workout: For 30 seconds each, do jumping jacks, a wall sit, push-ups, crunches, chair step-ups, squats, tricep dips, planks, running on the spot, lunges, push-ups with wide rotation and then side planks. Rest for 10 seconds between moves.

The benefit: The diversity of the exercises strengthens muscles throughout the body and improves heart rate.

10 MINUTES:

Try a simple form of high-intensity interval training with the cardio of your choice.

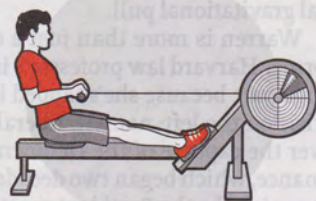


The workout: Hop on a treadmill and run as fast as you can for 30 seconds, then lower the speed and jog for 30 seconds. Repeat 10 times.

The benefit: Even if you're not running to build endurance, research shows, quick spurts of exercise can improve cardiac health.

20 MINUTES:

Gibala's research shows that 20 minutes is enough time to get a serious workout—if you're willing to sweat.



The workout: Choose an exercise like biking, swimming or rowing, and do it at your full capacity for one minute. Back off for one minute and repeat the rotation 10 times.

The benefit: These intervals are shown to improve blood-vessel and heart function.