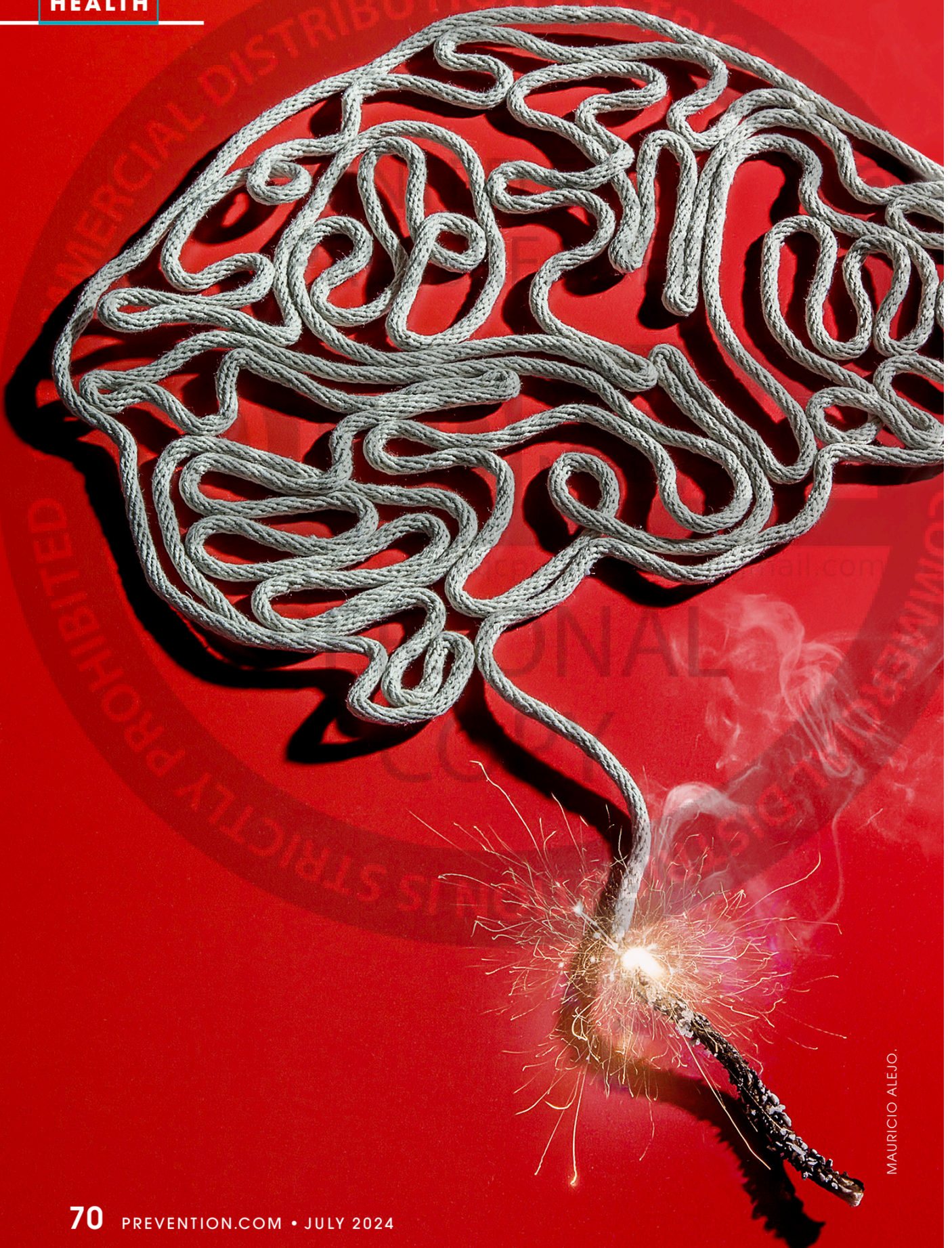



- Climate change / Brain

HEALTH



MAURICIO ALEJO.



THIS IS YOUR BRAIN ON CLIMATE CHANGE

Living on our **HEATING PLANET** doesn't just affect our lungs, hearts, and immune systems but also can **HARM OUR BRAINS' HEALTH**, affecting our moods and behavior. Read on to know **WHAT TO LOOK FOR AND HOW TO COPE.**

BY MERYL DAVIDS LANDAU

HEALTH

You're standing outside your office building on a sweltering summer day when someone passes you a little too closely.

It's not a big deal but, sweating and uncomfortable, you suddenly feel like screaming "Watch where you're going, #%*!" But they're already down the block, so you stand there steaming, literally and figuratively. How unlike you!

Yes, well, what you're like—what we're all like—may be shifting because of climate change. There's been a lot of attention devoted to how a warming world affects our physical health, from additional heart and lung disease to increases in waterborne illnesses, ragweed allergies, and more. But less has been paid to the way climate change alters the mind.

In fact, with temperatures and other climate effects continuing to rise, more people will find themselves suffering psychologically; a growing number of scientific studies underscore the link between climate change and mood disturbances, aggression, learning and productivity loss, and mental illness and infectious disease. Even Alzheimer's disease has a climate connection.

This makes perfect sense when you stop to think about it, says Clayton Page Aldern, author of the new book *The Weight of Nature: How a Changing Climate Changes Our Brains*. "When we say changing climate has a bearing on cognition, behavior, decision-making, and psychological well-being, we're actually describing another physical effect on our bodies. This is brain health," he says.

The change to our psyches, says Aldern, stems mostly from ever hotter average temperatures and longer-lasting heat waves with more extreme temperatures. Other documented culprits include increases in pollution particles in the air, harmful algal blooms, and brain-disease vectors like ticks and mosquitoes traveling farther, all of which are influenced by heat.

WHAT TO EXPECT

As far back as the 1970s, scientists were linking outdoor temperatures with psychological effects. In one study at the time, researchers found that riots were more likely to happen on hotter days. Now that the climate is warming ever faster, a growing body of research in the past decade "really gives us a much more nuanced understanding of how subtle changes in temperature affect human flourishing more broadly," says Jisung Park, Ph.D., an environmental and labor economist at the University of Pennsylvania and the author of the new book *Slow Burn: The Hidden Costs of a*



THE VOORHES/GALLERY/STOCK.

HEALTH

Warming World. Here are some of the ways in which researchers say we are being affected.

AN INCREASE IN AGGRESSION AND IRRITABILITY

More drivers honk their horns and exhibit road rage when the weather is warmer, researchers have found. Crime also spikes, especially gun violence. In fact, researchers have calculated that the rising temperatures from climate change may lead to an additional

5 million assaults and 22,000 more murders in the U.S. by the end of the century.

We see heat-related aggression reflected in social media posts, says Kelton Minor, Ph.D., a research scientist at Columbia University's Data Science Institute. Minor and his colleagues examined more than 8 billion posts on Twitter (now X) over several years and found many more negative tweets on hot days. During the intensive heat wave that struck the Pacific Northwest in June and July of 2021, people posting in the area were a whopping 10 times as negative about many topics as before or after it.



STOCKSY.

Our level of irritability also affects our decisions—even after we get out of the heat. Canadian researchers who studied U.S. asylum judges (who determine whether immigrants may stay in the country) found that the judges were less empathetic on very hot days: Every 10°F increase outside their air-conditioned courtrooms led to a nearly 7% decrease in asylum-granting rates. Other researchers have linked heat with less-than-compassionate behavior: When a baseball pitcher's teammates are hit by throws from the opposing team, the pitcher is more likely on hot days to retaliate by hitting batters. When it's steaming outside, "people are more prone to overinterpreting slights and escalating conflicts," Aldern says.

A FALL IN PRODUCTIVITY, LEARNING, AND INTELLECTUAL RISK-TAKING

Because body temperature always needs to be close to 99°F—having it be just a few degrees higher or lower merits a trip to the emergency room—many internal processes work to cool or heat us when outside temperatures are extreme. On especially hot days, those systems in your brain put out extra effort to keep tissue cool, Aldern says. The brain similarly struggles when too many toxins from pollution in the air assault it. Energy that otherwise might

go toward higher-order thinking and problem-solving gets directed to basic functioning instead.

The result is that work or school tasks become a struggle in the heat. Steel-factory workers are much less productive on hot days, scientists have found, and students don't fare as well either. When Park and his coauthors tracked millions of students as they retook the PSAT exam (to see how much knowledge they'd gained from one year to the next), they found that achievement lagged in communities that had more 80°F or higher days and where schools didn't have AC. Since this scenario is more frequent in poorer communities with more Black and brown students, Park estimates that hot temperatures may account for some 5% of the country's racial achievement gap.

Increased ground-level air pollution, including that from carbon dioxide, also affects our ability to reason and take careful risks. "A wealth of academic evidence suggests that we see decreases in productivity, cognition, and critical thinking when people are exposed to higher levels of CO₂ concentration," Aldern says. Scientists have even tracked air pollution in relation to gains and losses at the New York Stock Exchange over a 15-year period: Each time toxic particles in the city's air increased by one standard deviation, same-day market returns dropped 12%. Investors may become less willing to take risks when they have foggier brains because of toxins, the study authors believe.

BRAIN DISEASES LIKE **ALZHEIMER'S** AND **PARKINSON'S** ARE MORE FREQUENT

Chronic air pollution, which is exacerbated by heat, can enter the brain through the nose and mouth and cause low-grade inflammation in brain tissue. “Air pollution is a literal poison,” Aldern says. If this inflammation continues long enough, issues like dementia and Parkinson’s disease may result. Scientists who recently examined the brains of more than 200 deceased people who had lived around Atlanta found that those in the areas with the highest traffic-related pollution had the highest levels of the brain plaques associated with Alzheimer’s disease.

What’s more, rising temperatures are expanding the range of mosquitoes, including those that carry malaria; one symptom of this devastating disease is severe and lasting changes in the brain.

DEPRESSION, SUICIDE, AND ANXIETY GO UP

Perhaps it’s not surprising that scientists have connected extreme heat with mental illness. On very hot days, more people go to the ER for treatment of anxiety, schizophrenia, and other mood disorders. Deaths by suicide also rise when the temperature does.

Mental illnesses especially strike people whose homes and communities are destroyed by the ravages of climate change such as the floods, wildfires, and stronger hurricanes that last year alone displaced more than 2 million people from their homes. Months after Hurricane Harvey hit Texas in 2017, residents were still reporting higher-than-average levels of depression and post-traumatic stress disorder.

Anxiety about climate change in general is occurring in so many people that psychologists have given it a name: ecoanxiety. “When you read headlines about what has happened or what is to come, you can feel hopeless and fearful. Those feelings are real,” Aldern says.

WHY THIS HAPPENS

The exact mechanisms by which heat changes our brains aren’t yet clear, but scientists have a few theories. One is the impact of extreme heat on the modulation of the mood-regulating hormone serotonin: “One of the things serotonin appears to do is regulate the degree to which you are or are not impulsive,” Aldern says.

Minor observes that heat has a big impact on sleep. “We know from prior sleep studies that restricting sleep increases the same adverse mental health outcomes we’re seeing with higher temperatures,” Minor says. He recently found that higher outdoor nighttime temperatures coincided with

4 WAYS YOU CAN HELP THE PLANET—AND YOUR MENTAL HEALTH

More climate change is inevitable, but the worst can be avoided if we all take steps now, writes Rebecca Solnit in the book *Not Too Late*. In a free downloadable pamphlet from the book (haymarketbooks.org/pdfs/32), Solnit outlines some of the most beneficial actions:

■ Encourage the transition away from fossil fuels.

Prod your state, city, or school district to switch to electric vehicles and rooftop solar and take other actions (such as painting roofs white) to reduce energy use. It's crucial that the world transition away from the fossil fuels that are primarily responsible for warming.

■ Speak out.

Write letters to Congressional representatives insisting that they listen to citizens over oil and gas company lobbyists. You can also protest banks

that continue to invest in climate-harming fossil fuel projects.

■ Vote for the planet.

This applies to the Presidential election and also to elections at the state and local levels. Then hold elected officials accountable for following through on their promises.

■ Connect with others.

Join people in your neighborhood and in national online groups such as Moms Clean Air Force (moms.cleanairforce.org) and Science Moms (sciencemoms.com) in which women are making a difference.

people's getting less sleep. (Humans are generally better able to adapt to cold—by dressing warmly and throwing on extra blankets—than to heat.) This effect was seen even in the U.S., where air conditioners are abundant.

There are no easy ways to avoid these effects, though the most beneficial action is to urge our governments and corporations to minimize the coming changes in our climate (see above). In your daily life, you can temper mood changes by finding ways to stay cool such as spending time in air-conditioned

malls or theaters when the temperature spikes. Employing stress-reduction techniques like slow, deep breathing may counteract increased angst, as can getting professional help if you feel depressed or suffer from extreme anxiety.

Awareness also goes a long way: Connect the dots by checking the thermometer when you feel mentally off. "Most people aren't aware until you point it out, and then they say, 'Of course I'm more aggressive when it's hot out.' We can all recognize these effects if we focus our intention on them," Aldern says.