

Stress: Portrait of a Killer A National Geographic Special

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Transcript

00:00:02 Saplosky: Chronic stress could do something as unobvious and grotesque as kill some of your brain cells.

00:00:08 Narrator: The impact of stress can be found deep within us, shrinking our brains, adding fat to our bellies, even unraveling our chromosomes.

00:00:19 Blackburn: This is real.

00:00:20 This is not just somebody whining.

00:00:22 [Baboon shrieking] Narrator: Stress-- savior, tyrant, plague-- its portrait revealed.

00:01:01 This program was made possible by contributions to your pbs station from viewers like you.

00:01:08 Thank you.

00:01:11 Narrator: All of us have a personal relationship with stress.

00:01:15 But few of us know how it operates within us or understand how the onslaught of the modern world can stress us to the point of death.

00:01:30 Fewer still know what we can do about it.

00:01:42 But over the last three decades, stanford university neurobiologist robert sapolsky has been advancing our understanding of stress-- how it impacts our bodies and how our social standing can make us more or less susceptible.

00:02:00 Most of the time you can find him teaching and researching in the high achieving, high stressed world of brain science.

00:02:13 But that's only part of his story.

00:02:15 For a few weeks every year or so, sapolsky shifts his lab to a place more than 9,000 miles away, on the plains of the masai mara reserve in kenya, east africa.

00:02:37 Robert sapolsky first came to africa over 30 years ago on a hunch.

00:02:42 He suspected he could find out more about humans, stress and disease by looking at non-humans.

00:02:50 And he knew just the non-humans.

00:02:54 Sapolsky: You live in a place like this, you're a baboon, and you only have to spend about three hours a day getting your calories.

00:03:00 And if you only have to work three hours a day, you've got nine hours of free time every day to devote to making somebody else just miserable.

00:03:10 [Baboons shrieking] they're not being stressed by lions chasing them all the time, they're being stressed by each other.

00:03:18 They're being stressed by social and psychological tumult invented by their own species.

00:03:24 They're a perfect model for westernized stress-related disease.

00:03:28 Narrator: To determine just what toll stress was taking on their bodies, sapolsky wanted to look inside these wild baboons-- at the cellular level for the very first time.

00:03:39 ..

00:03:42 In the most unassuming way.

00:03:46 Sapolsky: Basically is what you're trying to do is anesthetize a baboon without him knowing it's coming because you don't want to have any of this anticipatory stress, so you can't just, you know, get in your jeep and chase the baboon up and down the field for three hours, and finally, when he's winded, dart him with an anesthetic.

00:04:07 The big advantages of a blow gun are that it's pretty much silent and hasn't a whole lot in the way of moving parts.

00:04:16 But the big drawback is it doesn't go very far.

00:04:22 So what you spend just a bizarre amount of time doing is trying to figure out how to look nonchalant around a baboon.

00:04:32 [Blows] got him.

00:04:34 Time?

00:04:36 Ok, he is wobbling now.

00:04:38 Whoop, there he goes.

00:04:41 Narrator: From each baboon blood sample, robert measured levels of hormones central to the stress response.

00:04:48 Sapolsky: Well, to make sense of what's happening in your body, you've got these two hormones that are the work horses of the whole stress response.

00:04:55 One of them we all know, adrenaline.

00:04:58 American version, epinephrine.

00:05:00 The other is a less known hormone called glucocorticoids.

00:05:04 It comes out of the adrenal gland along with adrenaline.

00:05:07 And these are the two backbones of the stress response.

00:05:11 Narrator: That stress response and those two hormones are critical to our survival.

00:05:19 Sapolsky: Because what stress is about is somebody is very intent on eating you or you are very intent on eating somebody and there's immediate crisis going on.

00:05:30 Narrator: When you run for your life, basics are all that matter.

00:05:34 Lungs work overtime to pump mammoth quantities of oxygen into the bloodstream.

00:05:40 The heart races to pump that oxygen throughout the body so muscles respond instantly.

00:05:48 Sapolsky: You need your blood pressure up to deliver that energy.

00:05:51 You need to turn off anything that's not essential.

00:05:54 ..

00:05:56 You know, you're running for your life.

00:05:57 This is no time to ovulate.

00:05:59 Tissue repair, all that sort of thing.

00:06:01 Do it later if there is a later.

00:06:03 Narrator: When the zebra escapes, its stress response shuts down.

00:06:08 But human beings can't seem to find their "off" switch.

00:06:13 Sapolsky: We turn on the exact same stress response for purely psychological states.

00:06:17 Thinking about the ozone layer, the taxes coming up, mortality, 30-year mortgages, we turn on the same stress response and the key difference there is we're not doing it for a real physiological reason and we're doing it non-stop.

00:06:34 Narrator: By not turning off the stress response when reacting to life's traffic jams, we wallow in a corrosive bath of hormones.

00:06:43 Even though it's not life or death, we hyperventilate.

00:06:48 Our hearts pound.

00:06:50 Muscles tense.

00:06:52 Sapolsky: Ironically, after a while, the stress response is more damaging than the stressor itself, because the stressor is some psychological nonsense that you're falling for.

00:07:01 No zebra on earth, running for its life, would understand why fear of speaking in public would cause you to secrete the same hormones that it's doing at that point to save its life.

00:07:15 Narrator: Stress is the body's way of rising to a challenge, whether the challenge is life-threatening, trivial or fun.

00:07:24 Sapolsky: You get the right amount of stress and we call it stimulation.

00:07:28 The goal in life isn't to get rid of stress.

00:07:30 The goal in life is to have the right type of stress because when it's the right type, we love it.

00:07:35 [People screaming] we jump out of our seats to experience it, we pay good money to get stressed that way.

00:07:44 It tends to be a moderate stressor, where you've got a stressor that's transient.

00:07:50 It's not for nothing roller coaster rides are not three weeks long.

00:07:52 And most of all what they're about is you relinquish a little bit of control in a setting that overall feels safe.

00:08:03 Narrator: But, in real life, for so many of us primates, including robert's baboons, control is not an option.

00:08:18 Sapolsky: You get some big male who loses a fight, and chases a sub-adult, who bites an adult female, who slaps a juvenile, who knocks an infant out of a tree all in 15 seconds.

00:08:32 Insofar as a huge component of stress is lack of control, lack of predictability, you're sitting there and you're just watching the zebra and somebody else is having a bad day and it's your rear end that's going to get slashed.

00:08:47 So tremendously psychologically stressful for the folks further down on the hierarchy.

00:08:54 Narrator: One of robert's early revelations was identifying the link between stress and hierarchy in baboons.

00:09:03 Some baboon troops are over 100 strong.

00:09:07 Like us, they have evolved large brains to navigate the complexities of large societies.

00:09:13 Survival here requires a kind of political savvy-- with the most cunning and aggressive males gaining top rank and all the perks-- females for the choosing, all the food they can eat, and an endless retinue of willing groomers.

00:09:33 Every male knows where he stands in society-- who can torture him; who he can torture; and who, in turn, the torturee can torture.

00:09:46 Sapolsky: Well, this sounds like a terrible thing to confess after 30 years, but I don't actually like baboons all that much.

00:09:52 I mean, there's been individual guys over the years who I absolutely love, but they're these scheming, back-stabbing machiavellian bastards.

00:10:01 They're awful to each other, so they're great for my science.

00:10:05 I mean, I'm not out here to commune with them.

00:10:07 They're perfect for what I study.

00:10:09 Narrator: 22 Years ago at the age of 30 robert sapolsky's landmark research earned him the MacArthur foundation's genius fellowship.

00:10:21 His early work-- measuring stress hormones from extracted blood-- led to two remarkable discoveries.

00:10:29 A baboon's rank determined the level of stress hormone in his system.

00:10:37 So, if you're a dominant male, you can expect your stress hormones to be low.

00:10:43 And if you're submissive, much higher.

00:10:49 But there was an even more astonishing find in sapolsky's sample: Low rankers--the have-nots-- had increased heart rates and higher blood pressure.

00:10:58 This was the first time anyone had linked stress to the deteriorating health of a primate in the wild.

00:11:05 Sapolsky: Basically, if you're, you know, a stressed, unhealthy baboon in a typical troop, high blood pressure, elevated levels of stress hormones, you have an immune system that doesn't work as well, your reproductive system is more vulnerable of being knocked out of whack.

00:11:20 Your brain chemistry is one that bears some similarity to what you see in clinically depressed humans.

00:11:27 And all that stuff, those are not predictors of a hale and hearty old age.

00:11:37 Narrator: Could this also be true for that other primate?

00:11:41 As robert sapolsky was monitoring stress in baboons, professor sir michael marmot was leading a study in great britain that tracked the health of more than 28,000 people over the course of 40 years.

00:11:57 It was named for whitehall, citadel of the british civil service, where every job is ranked in a precise hierarchy-- the perfect laboratory to determine whether in humans there might be a link between rank and stress.

00:12:14 Man: I mean, that's the thing about stress.

00:12:16 I think you've got to look at it in both acute terms and chronic terms.

00:12:18 And I think I've been under chronic stress in this organization simply because I'm a square peg in a round hole.

00:12:25 Narrator: Kevin Brooks is a government lawyer.

00:12:30 His rank--level seven-- means he has little seniority in his department.

00:12:34 He lives the life of a subordinate.

00:12:38 Brooks: I think what I was most aware of at the time was the workload and how I had most of it under control, but one of my cases wasn't wholly under control, I'd let it slip, and it was a bit like, you know, being in a car and hitting an ice patch and skidding.

00:12:55 But nonetheless I came in Monday morning, and my immediate manager, let's call him Ben-- Ben wants a word with you.

00:13:03 So we find a room, he shuts the door, then he says, you know what you've done, you know what happened while you were away?

00:13:09 We couldn't find one of your files.

00:13:12 Do you know what that meant?

00:13:13 He just gave me a darn good kicking, you know?

00:13:16 Psychologically, he did me over.

00:13:18 And at the end of it, it was more threats, it was, right, this may be a disciplinary matter.

00:13:22 So I left the room, crossed over the corridor to my own room, and I just burst into tears.

00:13:29 ..and wept.

00:13:35 Narrator: Sarah Woodhall also works for the government.

00:13:39 Unlike Kevin, she is a senior civil servant.

00:13:42 Woodhall: There are about 160 people reporting to me ultimately one way or another within the sector.

00:13:49 I do really enjoy working in civil service.

00:13:52 It's quite a dynamic environment, it can be quite exciting.

00:13:58 I like working with lots of people, so, yeah, I do really enjoy my job.

00:14:04 Narrator: Such dramatically different reflections dramatize one of the most astounding scientific findings in the Whitehall study.

00:14:12 Marmot: Firstly, it showed that the lower you were in the hierarchy, the higher your risk of heart

disease and other diseases.

00:14:20 So people second from the top had higher risks than those at the top, people third from the top had a higher risk than those second from the top, and it ran all the way from top to bottom.

00:14:32 We're dealing with people in stable jobs with no industrial exposures.

00:14:36 And yet your position in the hierarchy intimately related to your risk of disease and length of life.

00:14:44 Woodhall: I've been very lucky.

00:14:45 I haven't ever experienced any problems with my health.

00:14:49 Since I've been in the senior civil service I haven't had a day off with ill health.

00:14:54 So I've been very fortunate.

00:14:57 Brooks: In my own situation, I think that my career is pretty much tainted.

00:15:03 It's pretty much arrested.

00:15:05 Because I've had-- for instance, out of the last three years at work, I've been off sick for probably half that time.

00:15:12 Sapolsky: This particular study is sort of the rosetta stone of the whole field, because it's the british civil service system.

00:15:18 Everybody's got the same medical care, everybody's got the same universal health care system, just like the baboons.

00:15:24 All the baboons eat the same thing, they have the same level of activity.

00:15:27 It's not this stuff that, oh, if you're a low-ranking baboon, you smoke too much and you drink too much.

00:15:32 And if you're a low rank in the british civil service you never go to the doctor, you don't get preventive vaccines.

00:15:38 Both of these studies rule out all those confounds, and they produce virtually identical findings.

00:15:44 Narrator: On both sides of the primate divide, there are soul-wrenching stories and life-threatening consequences.

00:15:52 For every subordinate, like kevin, living a life of baboon uncertainty, there is an alpha strutting his stuff, glorying in power-- over someone else, someone unsuspecting, someone low-ranking.

00:16:17 [Blows] Sapolsky: Got him.

00:16:21 12:46.

00:16:23 Sapolsky: Do either of you see where the dart is?

00:16:26 Girl: Yeah, I do.

00:16:27 Sapolsky: Ok, guys, who do you think's higher ranking?

00:16:30 Boy: Our guy.

00:16:31 Sapolsky: Yeah.

00:16:36 Watch carefully, make sure the other guy doesn't hassle him.

00:16:40 Narrator: This year, robert brought his family to africa.

00:16:43 His wife, neuropsychologist lisa share-sapolsky, has also done extensive research with baboons.

00:16:51 And for the first time, they brought along their kids, benjamin and rachel.

00:17:05 Sapolsky: All the baboons are perfectly willing to get very freaked out by a human coming over and touching one of these guys.

00:17:12 But cover him with the burlap and he doesn't exist anymore.

00:17:17 Oh, my god-- he's there, he's there-- oop, not there anymore!

00:17:24 Sapolsky: This is not quite like take your kids to work day.

00:17:26 But this is a pretty central feature of who I am by now, and who my wife and I are, and if our kids want to know where we came from, this is pretty fundamental.

00:17:41 Narrator: As in previous seasons robert measures how individuals at every level of the baboon hierarchy react to and recover from stress.

00:17:51 Sapolsky: So what we're doing, we're now going to challenge the system with increasing doses of epinephrine.

00:18:02 Narrator: The baboon's response is immediately picked up in its blood-- vital signs that can be deep frozen in perpetuity.

00:18:13 Sapolsky: It's this storehouse of potential knowledge, and I got 30 years of those blood samples frozen away at this point because you never know when some new hormone or some new something or other pops up.

00:18:25 And that's the thing to look at and start pulling out those samples back to when, you know, jimmy carter was president.

00:18:32 ..125.

00:18:34 Narrator: Anticipating the long reach of stress is a recent idea, for when robert was rachel's age, scientists believed stress was the cause of only one major problem.

00:18:47 Film narrator: This is a picture of a major american personnel problem-- an ugly sore that doctors call a peptic ulcer, eating away at the wall of a man's stomach.

00:18:59 [Dramatic music playing] those stomach pains that you talk about-- the gnawing, the burning-- those are obvious symptoms of gastric ulcers.

00:19:10 Sapolsky: 30 Years ago what's the disease that comes to everybody's mind when you mention stress?

00:19:14 stress and ulcers, stress and ulcers.

00:19:18 This was the first stress-related disease discovered, in fact, 70 years ago.

00:19:22 What I want you to do is to work on your attitude.

00:19:26 My attitude?

00:19:27 That's right.

00:19:28 Ulcers breed on the wrong kind of feelings.

00:19:30 You've got to be honest with yourself about the way you feel about things.

00:19:33 Finding a new doctor sounds like a better answer to me.

00:19:38 Narrator: The connection between stress and ulcers was mainstream medical gospel until the late 1980s.

00:19:45 Then australian researchers identified a bacteria as the major cause of ulcers.

00:19:51 Sapolsky: And this overthrew the entire field.

00:19:54 This was it's got nothing to do with stress.

00:19:57 It's a bacterial disorder.

00:19:59 And I'm willing to bet half the gastroenterologists on earth, when they heard about this, went out and celebrated that night.

00:20:04 This was like the greatest news.

00:20:05 Never again were they going to have to sit down their patients and make eye contact and ask them how's it going, so anything stressful?

00:20:14 It's got nothing to do with stress, it's a bacterial disorder.

00:20:16 Narrator: So no longer would the solution be stress management.

00:20:19 Now it could be something as simple as a pill.

00:20:24 It was a major breakthrough.

00:20:27 Stress didn't cause ulcers.

00:20:31 Case closed.

00:20:34 But a few years later the research took a new twist.

00:20:40 Scientists discovered that this ulcer-causing bacteria wasn't unique.

00:20:45 In fact, as much as two thirds of the world's population has it.

00:20:50 So why do only a fraction of these people develop ulcers?

00:20:55 Research revealed that when stressed the body begins shutting down all non-essential systems, including the immune system.

00:21:04 And it became clear that if you shut down the immune system, stomach bacteria can run amok.

00:21:11 Sapolsky: Because what the stress does is wipe out the ability of your body to begin to repair your stomach walls when they start rotting away from this bacteria.

00:21:21 Narrator: So stress can cause ulcers-- by disrupting our body's ability to heal itself.

00:21:29 If stress can undermine the immune system, what other havoc can it wreak?

00:21:35 One answer comes from a colony of captive macaque monkeys near Winston-Salem, North Carolina.

00:21:43 Shively: People think of stress as something that keeps them up at night or something that makes them yell at their kids.

00:21:49 But when you ask me what is stress, I say, "look at it, it's this huge plaque in this artery, "
Narrator: Carol Shively has been studying the arteries of macaques.

00:22:06 Like baboons and British civil servants, these primates organize themselves into distinctly hierarchical groups and subject each other to social stress.

00:22:20 Stress hormones can trigger an intense negative cardiovascular response-- a pounding heart and increased blood pressure.

00:22:29 So if stress follows rank, would the cardiovascular system of a high-ranking macaque-- call him a primate CEO-- be different from his subordinate?

00:22:43 When Shively looked at the arteries of a dominant monkey-- one with little history of stress-- its arteries were clean.

00:22:51 But a subordinate monkey's arteries told a grim tale.

00:22:56 Shively: A subordinate artery has lots more atherosclerosis built up inside it than a dominant

artery has.

- 00:23:04 Narrator: Stress and the resulting flood of hormones had increased blood pressure, damaging artery walls, making them repositories for plaque.
- 00:23:15 Shively: So now when you feel threatened, your arteries don't expand and your heart muscle doesn't get more blood and that can lead to a heart attack.
- 00:23:26 This is not an abstract concept, it's not something that maybe someday you should do something about.
- 00:23:31 You need to attend to it today because it's affecting the way your body functions, and stress today will affect your health tomorrow and for years to come.
- 00:23:43 Narrator: Social and psychological stress-- whether macaque, human or baboon-- can clog our arteries, restrict blood flow, jeopardize the health of our heart.
- 00:23:55 And that's just the beginning of stress' deadly curse.
- 00:24:05 Robert's early research demonstrated that stress works on us in an even more frightening way.
- 00:24:12 Sapolsky: Well, back when I was starting in this business, what I wound up focusing on was what seemed an utterly implausible idea at the time, which was chronic stress and chronic exposure to glucocorticoids could do something as unsubtle and grotesque as kill some of your brain cells.
- 00:24:33 Narrator: As a phd candidate at rockefeller university IN THE EARLY 1980s, Sapolsky collaborated with his mentor, dr.
- 00:24:39 bruce McEwen, to follow the path of stress into the brain.
- 00:24:48 They subjected lab rats to chronic stress and then examined their brain cells.
- 00:24:54 The team made an astonishing find: They found that while the cells of normal rat brains have extensive branches, stressed rats' brain cells were dramatically smaller.
- 00:25:07 Sapolsky: And what was most interesting in many ways was the part of the brain where this was happening, hippocampus.
- 00:25:14 You take intro neurobiology any time for the last 5,000 years, and what you learn is hippocampus is learning and memory.
- 00:25:22 Narrator: Stress in these rats shrank the part of their brain responsible for memory.
- 00:25:28 McEwen: Stress affects memory in two ways.
- 00:25:30 Chronic stress can actually change brain circuits so that we lose the capacity to remember things as we need to.
- 00:25:41 Very severe, acute stress can have another effect which is often we refer to as "stress makes you

stupid," which is making it impossible for you, over short periods of time, to remember things you know perfectly well.

00:25:57

Sapolsky: We all know that phenomenon, we all know that one from back when we stressed ourselves by not getting any sleep at all, 00 we couldn't remember a single thing for that final exam.

00:26:09

You take a human and stress them big time, long time, and you're going to have a hippocampus that pays the price as well.

00:26:16

Narrator: So, in addition to undermining our health, stress can make us feel plain miserable.

00:26:22

Carol Shively set out to find out why.

00:26:26

She began not with misery but with pleasure.

00:26:30

Shively suspected that there was a link between stress, pleasure, and where we stand on the social hierarchy.

00:26:37

Just like stress, pleasure is linked to the chemistry of the brain.

00:26:43

When a neurotransmitter called dopamine is released in the brain, it binds to receptors, signaling pleasure.

00:26:53

scanner to explore this process first by looking into the brain of a non-stressed primate, " Shively: What we see is that the brains of dominant monkeys light up bright with lots of dopamine binding in this area that's so important to reward and feeling pleasure about life.

00:27:14

Narrator: Shively then looked at the subordinate's brain.

00:27:18

Shively: What we discovered is that the brains of the subordinate monkeys are very, very dull because there's much less receptor binding going on in this area.

00:27:29

Why is that?

00:27:30

What is it about this area of the brain?

00:27:33

When you have less dopamine, everything around you that you would normally take pleasure in is less pleasurable, so the sun doesn't shine so bright, the grass is not so green, food doesn't taste as good.

00:27:45

It's because of the way your brain is functioning that you're doing that, and your brain is functioning that way because you're low on the social status hierarchy.

00:27:53

Sapolsky: One feature of low rank is being low-ranking, the reality.

00:27:56

An even stronger feature, by the time you get to humans, is not just being low ranking or poor, it's feeling low ranking or poor.

00:28:04

And one of the best ways for society to make you feel like one of the have-nots is to rub your

nose over and over and over again with what you don't have.

00:28:14 Narrator: Richmond, california-- a town where society's extremes can be spotted right from your car.

00:28:20 This is cardiologist jeffrey rittermann's regular commute.

00:28:25 Ritterman: You can learn a lot about the stress and health outcome just from the neighborhoods you visit.

00:28:31 In this neighborhood, the life expectancy is quite good and most of the people are pretty healthy.

00:28:38 And as we reach the top of the hill, it gets to be a little bit less privileged.

00:28:45 And as we make this transition, the social status begins to drop, and correspondingly, in those areas, the health outcome is much worse.

00:28:57 And these people are not going to have the same life expectancy as the people in the middle class area we started in.

00:29:08 People are on guard, people are vigilant, they're living a more stressful life.

00:29:14 This is a community that produces high stress hormones in people, and over time it takes its toll.

00:29:21 Narrator: rittermann's patient is 65-year-old emanuel johnson.

00:29:27 guidance counselor in one of america's most dangerous neighborhoods.

00:29:32 Johnson: Last year I think we had 47 homicides, you know.

00:29:36 In the last 4 days, we had 11 shootings, 3 deaths.

00:29:41 And I just know, nine times out of ten, it's going to be a relative or someone that the kids know.

00:29:48 Narrator: For emanuel johnson, there is a price for chronic exposure to this stress.

00:29:54 Johnson: Five years ago I had a heart attack.

00:29:56 I'm a diabetic, too.

00:29:58 I have to work on it constantly.

00:29:59 I've been in this business 20 years.

00:30:01 So it's just--it's stressful just working the job, so over the years, you know, the cholesterol, the blood pressure, the sugar came on later, but the stress was always there, long before they came on.

00:30:15 Narrator: Emanuel johnson's body may be telling yet another story of stress.

00:30:20 The whitehall study in england found an incredible link between stress, your position in the social hierarchy and how you put on weight.

00:30:30 Marmot: So it may not be just putting on weight, but also the distribution of that weight.

00:30:36 And the distribution of that weight-- putting it on round the center-- is related to position in the hierarchy, and that in turn may be related to chronic stress pathways.

00:30:48 Shively: So we said, does that happen in monkeys because they organize themselves in a hierarchy, too.

00:30:55 And it turns out that it does.

00:30:58 Subordinate monkeys are more likely to have fat in their abdomen than are dominant monkeys.

00:31:05 I think the most amazing observation that I've made in my lab is this idea that stress could actually change the way you deposit fat on your body.

00:31:19 To me, that was a bizarre idea that you could actually alter the way fat is distributed.

00:31:27 Narrator: Sapolsky, shively and others think stress could be a critical factor in the global obesity epidemic.

00:31:35 Even worse, fat brought on by stress is dangerous fat.

00:31:41 Shively: We know that fat carried on the trunk or actually inside the abdomen is much worse for you than fat carried elsewhere on the body.

00:31:50 It behaves differently, it's-- it is, um, it produces different kinds of hormones and chemicals and has different effects on your health.

00:32:00 Whatever it is that works for an individual, they need to value stress reduction.

00:32:07 I think the problem in our society is that we don't value stress reduction, we, in fact, value the opposite.

00:32:13 We admire the person who not only multitasks and does two things at once, but does five things at once.

00:32:19 We kind of admire that person, how they manage that, you know, well, that's--it's-- that's an incredibly stressful way to live.

00:32:27 We have to change our values and value people who understand a balanced and serene life.

00:32:39 Narrator: One heartbreaking moment in history reveals that stress may, in fact, damage us long before we are even aware.

00:32:52 Holland, late 1944.

00:32:55 A brutal winter and a merciless army of occupation conspire to starve a nation.

00:33:02 It is known as the dutch hunger winter.

00:33:04 For those who survive today, these are haunting memories.

00:33:10 [Speaking dutch] Narrator: Dutch researcher tessa roseboom had heard many of those tragic memories.

00:33:43 She and her team wanted to know if there were any lingering effects.

00:33:49 Roseboom knew that our bodies respond to famine in much the same way they respond to other stressors, so she set out to see if the fetuses of women pregnant during these arduous days could possibly be affected by stress.

00:34:06 Because of meticulous record keeping by the dutch, roseboom was able to identify over 2,400 people who could have been impacted.

00:34:17 She and her team analyzed the data from those born during and after the famine and came to a surprising conclusion.

00:34:27 Roseboom: I think that you could say that these babies were exposed to stress in fetal life and they are still suffering the consequences of that now, 60 years later.

00:34:41 Narrator: Most of the dutch hunger winter children live today, all in their sixties.

00:34:47 Many still bear the scars of war.

00:34:51 Roseboom: We found that babies who were conceived during the famine have an increased risk of cardiovascular disease.

00:34:57 They have more hypercholesterolemia, they are more responsive to stress and they generally are in poorer health than people who were born before the famine or conceived after it.

00:35:11 Narrator: Researchers think that stress hormones in a mother's blood triggered a change in the nervous system of the fetus as it struggled with starvation.

00:35:21 This was the fetus' first encounter with stress.

00:35:26 Six decades later, the bodies of these dutch hunger winter children still haven't forgotten.

00:35:33 Sapolsky: What we now know is it's not just your fat cell storage that winds up being vulnerable to events like this.

00:35:40 It's your brain chemistry.

00:35:41 It's your capacity to learn as an adult.

00:35:44 It's your capacity to respond to stress adaptively rather than maladaptively.

00:35:49 How readily you fall into depression, how vulnerable you are to psychiatric disorders-- yet another realm in which early experience and early stress can leave a very bad footprint.

00:36:02 Woman: If I had had an option, I would not have opted to be bipolar, but now that I am bipolar, I'll have to live with it.

00:36:11 [Speaking dutch] Sapolsky: What the dutch hunger winter phenomenon is about is experience, environment starts long before birth.

00:36:27 An adverse, stressful environment can leave imprints, can leave scars lasting a whole lifetime.

00:36:55 Rachel: We're just taking fingerprints 'cause no baboon has the same fingerprint as another one.

00:37:01 So we just took honey bear's, and I'm hoping to go over to riff and get his.

00:37:06 Narrator: During this year's multi-generational research, robert, who has spent his career documenting stress' effects on the individual and on the cell, tracks the trail of stress even deeper into our bodies.

00:37:21 Sapolsky: One of the most interesting new directions of stress research is taking the effects of stress down to a nuts and bolts level of how cells work, how genes work that half a dozen years ago, nobody could have imagined.

00:37:35 Narrator: The once unimaginable-- genetic structures called telomeres, which protect the ends of our chromosomes from fraying.

00:37:44 As we age, our telomeres shorten.

00:37:47 Sapolsky: What's interesting is stress, by way of stress hormones, can accelerate the shortening of telomeres.

00:37:55 So the assumption is for the exact same aged guys, if you're a low-ranking guy who's just marinating in stress hormones, your telomeres are going to be shorter.

00:38:04 Narrator: So how does this formidable finding apply to us?

00:38:10 San rafael, california.

00:38:12 Once a week janet lawson keeps a very important appointment.

00:38:17 She joins other mothers who share circumstances that produce chronic, unremitting stress.

00:38:23 Woman: But she loses her balance, and that's the scary part.

00:38:26 So we just went out, actually last night, and bought a new helmet, storun Woman: We found that as she's getting older and wanting more independence, it's getting harder.

00:38:33 Narrator: Each of these women is mother to a disabled child.

00:38:37 Woman: As my son's only 8 and there's enough I can handle and I don't allow myself to go too much out, I can't.

00:38:43 Woman: I had a friend recently who said to me, you know, I think you really should consider

putting lexie in a home.

00:38:49 And that was really stressful in and of itself ..

00:38:56 ..sorry.

00:38:58 Don't be sorry, hon.

00:39:00 So I was like, wow, how can you even say that?

00:39:03 She's, you know, a little girlfriend.

00:39:06 She's, um, even though she can't really communicate, ..

00:39:14 She loves. she loves.

00:39:19 Narrator: These remarkable women came to the attention of biologist dr. elizabeth blackburn.

00:39:25 Blackburn: I don't directly know the individuals, but I know the stories.

00:39:30 I'm a mother myself.

00:39:31 And so when I heard about this cohort, I really thought it was worthwhile finding out what really is happening at the heart of the cells in these mothers who are doing such a difficult thing for such a long time.

00:39:46 Narrator: blackburn is a leader in the field of telomere research.

00:39:51 Blackburn: We have 46 chromosomes and they're capped off at each end by telomeres.

00:39:57 Nobody knew in humans whether telomeres and their fraying down over life would be affected by chronic stress.

00:40:04 And so we decided we would look at this cohort of chronically stressed mothers, and we decided to ask what's happening to their telomeres and to the maintenance of their telomeres.

00:40:17 What we found was the length of the telomeres directly relates to the amount of stress somebody is under and the number of years that they've been under the stress.

00:40:28 Narrator: Such stressed mothers became the focus of a study blackburn's colleague, psychologist elissa eppel.

00:40:36 Eppel: Mothers of young children are a highly stressed group.

00:40:41 They're often balancing competing demands like work and child rearing and often don't have time to take care of themselves.

00:40:49 So if you add on top of that the extra burden of caring for a child with special needs, it can be overwhelming.

00:40:56 It can tax the very reserves that sustain people, and if they're stressed, if they report stress, they tend to die earlier.

00:41:05 Sapolsky: These women have shortened telomeres-- decreased activity of this enzyme, and very, very rough number-- for every year you were taking care of a chronically ill child, you got roughly six years' worth of aging.

00:41:18 Blackburn: This is real.

00:41:19 This is not just somebody whining.

00:41:21 This is real medically serious aging going on, and we can see that it's actually caused by the chronic stress.

00:41:33 Narrator: But there is hope.

00:41:34 blackburn co-discovered an enzyme, telomerase, that can repair the damage.

00:41:41 Woman: It's what I always call the threat of hope.

00:41:45 [Laughter] Narrator: Preliminary data suggests that a meeting of minds such as this may actually have a health benefit, by stimulating the healing effects of telomerase.

00:41:58 Woman: If you don't laugh, forget it, you can't handle it.

00:42:03 Woman:..

00:42:06 There's a certain level of black humor that we have about our kids that only we appreciate, we are the only ones who get the jokes, in a way we're the only ones ..

00:42:17 Eppel: One of the questions in the stress field is what are the active ingredients that reduce stress and that promote longevity?

00:42:27 And compassion and caring for others may be one of those most important ingredients.

00:42:34 So those may be the factors that promote longevity and increase telomerase and keep our cells rejuvenating and regenerating.

00:42:44 Narrator: So perhaps connecting with and helping others can help us to mend ourselves and maybe even live longer, healthier lives.

00:42:54 20 Years ago sapolsky got a shocking preview of this idea.

00:43:01 The first troop he ever studied-- the baboons he felt closest to and had written books about-- suffered a calamity.

00:43:10 It would have a profound effect on his research.

00:43:14 Sapolsky: The keekorok troop is the one I started with 30 years ago.

00:43:19 And they were your basic old baboon troop at the time, which means males were aggressive and society was highly stratified, and females took a lot of grief, and your basic off-the-rack baboon troop.

00:43:32 And then about-- by now almost 20 years ago, something horrific and scientifically very interesting happened to that troop.

00:43:41 Narrator: The keekorok troop took to foraging for food in the garbage dump of a popular tourist lodge.

00:43:49 It was a fatal move.

00:43:53 The trash included meat tainted with tuberculosis.

00:43:58 The result was that over half the males in the troop died.

00:44:04 Sapolsky: Not unreasonably, I got depressed as hell and pretty damn angry about what happened.

00:44:11 You know, you're 30 years old, you can afford to expend a lot of emotion on a baboon troop, and there was a lot of emotion there.

00:44:19 Narrator: For Robert, a decade of research appeared to have been lost.

00:44:25 But then he made a curious observation about who had died and who had survived.

00:44:32 Sapolsky: It wasn't random who died.

00:44:34 In that troop, if you were aggressive and if you were not particularly socially connected, socially affiliative, you didn't spend your time grooming and hanging out, if you were that kind of male, you died.

00:44:47 Narrator: Every alpha male was gone.

00:44:49 The keekorok troop had been transformed Sapolsky: And what you were left with was twice as many females as males, and the males who were remaining were, you know, just to use scientific jargon, they were good guys.

00:45:03 They were not aggressive jerks.

00:45:05 They were nice to the females.

00:45:06 They were very socially affiliative.

00:45:08 It completely transformed the atmosphere in the troop.

00:45:13 Narrator: When male baboons reach adolescence, they typically leave their home troop and roam, eventually finding a new troop.

00:45:22 Sapolsky: And when the new adolescent males would join the troop, they'd come in just as jerky

as any adolescent males elsewhere on this planet, and it would take 'em about six months to learn, "we're not like that in this troop.

00:45:34 We don't do stuff like that.

00:45:36 We're not that aggressive.

00:45:37 We spend more time grooming each other.

00:45:38 Males are calmer with each other.

00:45:40 You cannot dump on a female if you're in " and it takes these new guys about six months, and they assimilate this style.

00:45:48 And you have baboon culture, and this particular troop has a culture of very low levels of aggression and high levels of social affiliation, and they're doing that 20 years later.

00:46:00 Narrator: And so the tragedy had provided robert with a fundamental lesson-- not just about cells, but how the absence of stress could impact society.

00:46:11 Sapolsky: Do these guys have the same problems with high blood pressure? nope.

00:46:14 Do these guys have the same problems with brain chemistry related to anxiety, stress hormone levels?

00:46:20 Not at all.

00:46:21 It's not just your rank, it's what your rank means in your society.

00:46:26 Narrator: And the same is true for humans, with only a slight variation.

00:46:30 Sapolsky: We belong to multiple hierarchies, and you may have the worst job in your corporation and no autonomy and control and predictability, but you're the captain of the company softball team that year and you'd better bet you are going to have all sorts of psychological means to decide it's just a job, nine to five, that's not what the world is about.

00:46:49 What the world's about is softball.

00:46:52 I'm the head of my team, people look up to me, and you come out of that deciding you are on top of the hierarchy that matters to you.

00:47:06 Sapolsky: Well, that worked.

00:47:09 And lots of baboon poop.

00:47:13 Which under the right circumstances with the right season's experiment is a goldmine.

00:47:21 Unfortunately this time around it's just a cage to have to clean now.

00:47:32 I'm studying stress for 30 years now, and I even tell people how they should live differently, so

presumably I should incorporate all this and the reality is, like, I'm unbelievably stressed and type "a" and poorly coping, and why else would I study this stuff 80 hours a week?

00:47:50 No doubt everything I advise is going to lose all its credibility if I keel over dead from a heart attack IN MY EARLY 50s.

00:47:57 I'm not good at dealing with stress.

00:48:00 One thing that works to my advantage is I love my work, I love every aspect of it, so that's good.

00:48:06 Nonetheless this is pretty clearly a different place than the savannah in east africa.

00:48:13 You can do science here that's very different and more interesting in some ways.

00:48:18 You can have hot showers on a more regular basis.

00:48:21 It's a more interesting, varied world in lots of ways.

00:48:25 But there's a lot out there that you sure miss.

00:48:38 It is a pretty miraculous place, where every meal tastes good and you're 10 times more aware of every sensation.

00:48:49 This is a hard place to come to year after year without getting, I think, a very different metabolism and temperament.

00:48:58 ..

00:49:02 More happy.

00:49:04 This is a hard place not to be happy.

00:49:14 Narrator: So one antidote to stress may be finding a place where we have control.

00:49:20 But how do we reckon with all the time we spend at work?

00:49:23 Marmot: I would say what we've learned from the whitehall study and the study of the non-human primates is the conditions in which people live and work are absolutely vital for their health.

00:49:38 Narrator: Senior civil servant sarah woodhall enjoys the benefits of control.

00:49:44 Woodhall: I don't think I suffer from stress.

00:49:47 I don't work a hundred hours a week.

00:49:49 I control the amount of work that I do to make sure that I can continue to deliver long term.

00:49:57 Marmot: Control, the amount of control is intimately related to where you are in the occupational hierarchy.

00:50:05 And what we have found is in general when people report to us that things have got worse, that the amount of work stress has gone up, their illness rates go up.

00:50:16 When people report to us that they've got more control and they're being treated more fairly at work and there's more justice in their amount of treatment, so things are getting better, the amount of illness goes down.

00:50:30 Woodhall: I've been very lucky.

00:50:30 I haven't ever experienced any problems with my health.

00:50:33 Narrator: But not everyone is so lucky.

00:50:36 So is there a prescription for the vast majority of us who aren't at the top?

00:50:42 Marmot: Give people more involvement in the work, give them more say in what they're doing, give them more reward for the amount of effort they put out, and it might well be you'll have not just a healthier workplace, but a more productive workplace as well.

00:50:58 Brooks: I've managed to achieve a degree of control.

00:51:02 At the moment, I'm in a really good position.

00:51:05 This is the first time where I feel I've had a boss who appreciates me.

00:51:08 He doesn't dominate team meetings, he sits back.

00:51:11 He invites people to contribute.

00:51:14 He lets other people chair.

00:51:15 He's a real manager, and he-- from the start, when I returned after my latest sick leave, just six months ago, he was so positive.

00:51:22 I think I feel sufficiently empowered.

00:51:28 Narrator: Who would have imagined that robert's baboons, roaming the cruel plains of africa, would point us humans toward a stress-free utopia?

00:51:38 Marmot: This may sound a little fanciful, but I think what we're trying to create is a better society.

00:51:47 The implications, both of the baboons and of the british civil servants, is how can we create a society that has the conditions that will allow people to flourish?

00:51:59 And that's where this is heading-- to create a better society that promotes human flourishing.

00:52:08 Sapolsky: So what do baboons teach the average person in there?

00:52:12 Don't bite somebody because you're having a bad day.

00:52:15 Don't displace on them in any sort of matter.

00:52:18 Social affiliation is a remarkably powerful thing.

00:52:22 And that said by somebody who lives in a world where ambition and drive and type-"a"-ness and all of that sort of thing dominates.

00:52:30 Those things are real important and one of the greatest forms of sociality is giving rather than receiving, and all those things make for a better world.

00:52:44 Another one of the things that baboons teach us is if they're able to, in one generation, transform what are supposed to be textbook social systems sort of engraved in stone, we don't have an excuse when we say there's certain inevitabilities about human social systems.

00:53:04 Narrator: And so the haunting question that endures from robert's life work-- are we brave enough to learn from a baboon?

00:53:15 The keekorok troop didn't just survive without stress, they thrived.

00:53:23 Can we?