'I WILL DEFINITELY BE DRAWING ON THIS BOOK TO KEEP MYSELF RUNNING WITH JOY FOR YEARS TO COME.'
JASMIN PARIS

RUN FOREVER

THE SECRETS TO BECOMING AN AGELESS ATHLETE

DAMIAN HALL

WITH RENEE McGREGOR & PETE STABLES

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INTRODUCTION
PLAYING THE LONG GAME

'Life's journey is not to arrive at the grave safely, in a well-preserved body, but rather to skid in sideways, totally worn out, shouting, "Holy shit, what a ride!"'

HUNTER S. THOMPSON, GONZO JOURNALIST AND AUTHOR

It's just an average Wednesday morning. But I feel emphatically less than average. I'm breathing like an over-zealous Darth Vader impersonator. My lungs feel like they're tiny Tesco bags. My legs feel like they belong to RoboCop. I'm not doing 400-metre intervals or an uphill tempo. It's meant to be just a standard, zone 1, easy run on the flat. Just a jog, really. But everything about it is more effort than it should be. It feels unusually, puzzlingly, worryingly hard. This easy run is making me feel distinctly uneasy. Something's wrong. And then I remember …

I did 5 x 3-minute hills yesterday. A tough workout, but one I've done many times. I couldn't still be fatigued from that, could I? Surely not. I'm a runner in my prime. I'm not a professional athlete, but I can just about say, in that singularly British, awkward way, that I'm an elite one. I've represented Great Britain at trail ultramarathon running. I've trained and trained over years and years. I eat chia seeds, get to bed before 11 p.m. and steer well clear of Stella. I have a coach (though I'm also one myself), run six days a week and have barely missed a training run for seven years. I don't want to sound braggy. I'm just explaining that compared to the average population I'm very fit and I don't get tired easily. But here I am, on an average

Wednesday morning, feeling unmistakably and inexplicably below average. I'm doing exactly what I always do. But I'm clearly more tired than usual. Or perhaps, significantly, more tired than I used to get.

Casting aside my invincibility cloak for a moment, didn't I feel like this last week, on my post-workout day, too? And where has my top-end speed been for the last few weeks? Try as I might, I haven't seemed able to quite hit those 5:30 miles I used to churn out in 400-metre reps. That upper gear has been missing for months, come to think of it … maybe a year. Or maybe more?

I'll tell you what else disturbs me. These shorts. The same company I've been getting my running clobber from for the last decade has definitely started making them tighter at the waist. Yikes! When I look down, for the first time in my running life, despite being careful with cake and biscuits, I've actually got a muffin top. As I (breathlessly) jog past some pensioners, I scream, 'I don't normally look like this – they've changed the sizes!' In my head.

Okay, full confession time: when I say I'm in my prime, that might be a little bit of fairy dust. Though I have the haircut of a seventeen-year-old who's just lost a drunken fight with a lawnmower, technically I'm fifty. But today is the first day in my life that I've categorically felt …

Old.

There. I said it.

Ouch.

A few weeks later I run a local, 12-kilometre trail race called Over The Hills and place fourteenth in 48:30. Second V40 or OG (old git). Not bad, I guess. But I've won that race. Twice. And here's the glaringly significant thing: I used to run it three minutes faster. Albeit that was five years ago.

My age-category placing used to be something I'd look down my nose at, like a bonus Easter egg left over from the main hunt. First V40, too? Nice. But I didn't really care. Now it's all I care about.

I felt uncomfortably grown-up when I found myself in a nightclub on my fortieth birthday and all the music sounded too loud and samey. I also felt like an imposter of an adult when my eldest child graduated from primary to secondary school. When you're twelve years into being a parent, you

can't really claim to be a new one any more. You're no longer an accidental grown-up just muddling through, still believing you're twenty-seven in spirit, still at Glastonbury festival, the numbers beside your age on forms just a silly admin error. And let's not get started on why my unfaithful follicles have decided it's much more fun to grow hair out of my nose, shoulders and ears than on my actual head. I'll never forgive that cruel mutiny.

I guess this is what ageing feels like. I don't like it one bit, but I guess I need to admit that it really is happening. I'm ageing. There's no hiding from the depressing truth that I'm officially past my best. Over The Hills has shown me, with a crushing irony, that I am now over the hill. It's a big moment, realising. Till then, life had felt like it was on an upward trajectory, or at least a flat line, perhaps. Now I'm staring at a downward slope, the void clawing at me. Getting older sucks already. And I've only just got started.

There's some really good news coming, I promise. But in some ways, running, more than most sports, makes ageing a harrowing experience. We have such measurable, standardised performance, at parkrun, at a marathon or even just going out and running a mile on a flat road as fast as we ruddy well can. Our decline is shoved in our face on every run. And while one of the tenets of run coaching is to not read too much into one session, perhaps we do it twice or over a period of those increasingly precious weeks and months. And we can see quite easily and starkly the athletic and human decline. Those exact same data points, calculated by that clever gadget on our wrist, that gave us such motivational joy in those glorious early days of being a runner, now savagely mock our feeble efforts. 'Ha, is that all you've got? Face it. You're slow(er) and old(er).'

Of course, running is about so much more than numbers, but my watch has gone from something I turn to for reassurance of my prowess, confirmation of my potency, to something, frankly, I don't want to look at. I don't need a small piece of technology telling me I'm past my best-before date. Plus, there are probably some GPS blackspots around here anyway.

My body tells me, too. With niggles in my foot and my Achilles tendon that never quite go away. Tightness in my calf that is apathetic towards

foam rolling. A weird discomfort in my shoulder that's been there for two years (probably something to do with working too many hours at a laptop – we'll get on to that – the act of writing this book didn't help). Three-minute hills just feel harder. Fast runs feel like the same effort as ever, but my watch says they're less fast. Easy runs sometimes don't feel easy. I really need my sleep now. I feel tired. I didn't use to be so tired. Or wrinkly.

It's not just athletic performance. Society, too, doesn't need us like it did. *Last of the Summer Wine*, *Dad's Army* – they don't seem funny now. Nor those HILARIOUS birthday cards. Indeed, the UK's advertising standards watchdog recently criticised the use of negative and even offensive portrayals of older people in commercials, stereotyping them as lonely, intolerant and grumpy. Bah!

'Old: it's a withering label, loaded with far more meaning and judgement than the bald [pun unintended] fact you were born long ago,' writes Richard Askwith in the excellent *The Race Against Time*. 'Among much else, it suggests irrelevance, as if the part of your life that mattered had already been lived. Your story is in the past, not the future.'

In truth, my body has been good to me. While I've never had the height, hair or muscles I would have liked, I've run up and down mountains, bimbled for hundreds of miles at a time, and yet haven't had any major physical or health setbacks (though chicken pox was rough). While my body isn't letting me down in a chronic way yet, there is an undeniable decline. It's clear that I'm just not as powerful, fast or durable as I was. I'm a little bit slower, less robust, and a bit more flabby and lumpy in the wrong places. My body is just not as, well, *good* as it once was. I don't like it. But I guess it's time to face up to it and see what can be done to lessen the fade.

Technically, I've been a veteran or masters athlete for almost a decade. Nothing changed at first. Having rediscovered the deep and addictive joy of running aged thirty-six and as a new parent, I'm something of a late starter. Those initial few years were glorious, full of PBs and the joy of accomplishing ouchy but deeply satisfying new distances.

I became one of those annoying running evangelists, thinking everyone should just go for a run and they'd find true enlightenment and running would save the world. After a first marathon, I realised people did the same

thing on trails and often went much, much further, and I got carried away.

It wasn't long before I was running 100-mile mountain races such as UTMB Mont-Blanc, the 200-plus-mile Dragon's Back Race, the 268-mile Winter Spine Race. I became competitive, setting records/Fastest Known Times on National Trails and fell-running rounds, and was once even selected for the GB trail running team, aged forty (I wrote a separate book about all that).

My best objective performance, fifth place at UTMB, the Super Bowl of ultra-trail running, was at the age of forty-two. For my other most notable performance, breaking the record for the Pennine Way, I was forty-four. It was after winning the 2023 Winter Spine Race three years later that I was first officially called a 'veteran' in a write-up, which made me wince. As we'll see, both anecdotally and scientifically, seniority matters less the longer the race and is actually an advantage.

However, in the 2024 Winter Spine Race, I had my wrinkly butt well and truly kicked by Jack Scott, an athlete literally young enough to be my son. He's a good friend and we've met for training runs through the years, but the transfer of power is very much in evidence on those now too. I'm not getting any younger. (I've always hated that phrase. No one is.)

I've thought about those contrasting two years a lot. They felt like they may have represented my peak and the beginning of the end for me as an elite athlete (thankfully, that's turned out to be poppycock). The thing is, with the caveat that the Spine Race is far from a typical running event, it was the 2022 race I should have seen as more noteworthy.

I was also in that year's event and I was in first place after halfway. But my relative inexperience in leading races caused me to misjudge my effort and push unnecessarily hard; a dull ache became a sharp pain and I dropped out of the race, fearing for the long-term implications. So too did the younger runner behind me. This allowed Irishman Eoin Keith to move into pole position and take the win, aged fifty-three, having previously been back in fifteenth place.

When asked about his tactics, Eoin said, 'to run my own race. It was my most comfortable and balanced Spine Race. I don't have gear 5 any more, but I've always said if you run your own race and optimise your own

performance, your best performance will come out.'

A masterful lesson in midlife running for us all. Also, in two out of those three years at the Winter Spine Race, the male winner was in their late forties or early fifties. And while I write this, the extraordinary Anna Troup, aged fifty-five, has just won the Summer Spine Race overall, after three years of injury (more from her on page 134; and more from Eoin on page 91). I hope this book shows runners that in some ways what Anna did shouldn't be that extraordinary. We can all be ageless aces. There are some incredibly inspiring runners and performances in this book, giving us all hope.

However, there will be people reading this with growing annoyance, thinking, *fifty isn't old, matey; just you wait till [insert age here] – you're in for a shock*. And indeed at the 2025 National Running Show, Angela White, aka The Running Granny, the oldest woman to run 875 miles from John o'Groats to Land's End, rightly reprimanded me for calling myself old. 'You're not old,' she said. 'You're just older.' Which feels like an important difference.

This book came about because I wanted to find out what was happening to me as a runner and as a person as I aged. I thought that there must be thousands of runners going through the same thing. I wanted to understand the physiological changes: what exactly is happening to me? But I also wanted to see if any could be slowed, paused or even reversed – and, to my great joy, many can. I found some useful books on the subject, but none that spoke directly to me as a midlife runner.

I really wanted to know how fast my athletic and health decline is forecast to be. What exactly are the physiological changes as we age and how do they affect my athleticism? Which aspects of running fitness might go quickest and which might last longest? Which could be worked on to maintain them? Should I train differently? Do injury-avoidance strategies need to change? Do I need to start pumping iron (yuk), lifting actual barbells instead of half-heartedly swinging a kettlebell about a bit? How about my diet and sleep? Does my mindset matter at all? But as well as all the potential downsides and new things I might need to be doing, are there any advantages to being a mature athlete? Spoiler alert: heck yeah!

The more I read about ageing, the more words like 'longevity' kept

popping up, and the links between running and health. I couldn't help but think and worry about my lifespan and, more importantly, my healthspan. If I can carry on running through middle age and beyond, how concerned should I be about the Four Horsemen of the Apocalypse: cardiovascular disease, diabetes, dementia and cancer? More importantly, is it optimally healthy to continue with my eleven-cups-a-day tea addiction?

In researching this book, I was horrified to discover just how comprehensive ageing is and all the things I'm about to die from. Paradoxically, though, I've been thrilled to find just how much we can stick a middle finger up at time and rage against age. These discoveries are highly motivating. I've learned many things – some alarming, some reassuring, some surprising, some outlandish. But above all, I learned we definitely can claw back some significant control over how we age – as athletes and as people. But most of us need to change some things up. Us old(er) dogs need to learn some new tricks.

I'm going to share how to train to be a kick-ass masters runner, a midlife maestro, an ageless ace. This has huge knock-on health benefits, which should greatly interest most midlife people; with parents well into their seventies, it's doubly interesting.

It may sound dramatic, but some of the information in here could save lives and make those final decades much more enjoyable. We can indeed extend our healthspans. And it doesn't involve taking seventy-two daily supplements, ice barrel submersions or licking toads.

We're at a new frontier of science and practice for both health and performance. The generation before us didn't have the knowledge we have now or the socialised motivations to rage against the dying of the light. Our parents weren't out running 100-milers, sportives and Ironmans into their forties, fifties, sixties and beyond, because they were told it would wreck their knees or kill them. We are. In running and other sports, we've seen extraordinary performances from veteran athletes, which is kicking the science along. Ageing is inevitable. *How we age* isn't.

Other books on the topic are largely written by men for men. As I can only change one of those equations on my own, I've brought in world-renowned sports dietitian, author and kick-ass ultrarunner Renee

McGregor, fifty, to explain how ageing affects female runners, especially around the ironically named menopause. I'm also grateful to record-breaking lifter, strength and conditioning coach, and sub-three-hour-marathoner Pete Stables for sharing his expertise, enthusiasm and wit. I can only apologise to trans people as there just doesn't seem to be any good research on sport and ageing on this demographic yet.

This feels like as good a moment as any to discuss words, their power and what we should we call ourselves. 'Masters athlete', the US version, sounds infinitely better to me than the UK version, 'veteran', which is basically another disparaging word for 'old'. It also implies a lot has happened, when I much prefer a focus on all the things we can do now and all the adventures ahead of us. So the word 'veteran' is banned from this book and I've limited use of the word 'old', too. Language has power, it makes a difference. We may be a little bit *older* than some, but not necessarily *old*. We're in our middle age or midlife – our prime, quite frankly. 'Mature' has a whiff of advantage to it too, of reaching a kind of potential or fullness. And I know I'm not alone in still wanting to attempt big things, try new types of running, have fresh adventures. There are some incredible, inspiring, ageless aces interviewed in this book who are doing just that. Plus, as they discuss, age – or perhaps more accurately, *experience* – is a huge advantage.

While we may not be at our fastest, I like to think we're in our very best years, our optimal time. And we value them more because we know how precious they are. We're not running out of time. We're using our time to run. And to properly live.

I've accepted that I used to be faster, but that hasn't affected the simple fact that I still just ruddy love running. For freedom, for adventure, for health, for time with friends old and new, and purely for the sake of the gloriously simple act of running. I love it for the smelly clothes and wet feet, for bramble scratches and grazed knees, for mud up my calves and sweat on my lips. Though I've reluctantly admitted my athletic potential has been realised, I like to think I'm still in it and will do all I can to stay in it. I'm determined to maximise my running till I have to be scraped up off the tarmac or trail by people in white coats.

I'm going to run forever.

PART ONE: THE BAD

'As you get older, three things happen. The first is your memory goes, and I can't remember the other two.'

SIR NORMAN WISDOM

This section is on reflection a bit depressing. If you'd rather not know all the things about to go wrong with you, feel free to jump to *Part Two: The Good*, on page 17, which is much more cheery. But if you insist on knowing, let's look into what happens to us, as runners and as people, as we age. First, let's look at when and why humans age. 'At some point, your body will decide to grow senescent [your cells start dying] and then to die,' sums up Bill Bryson, father-in-law incidentally to an elite ultrarunner, in *The Body: A Guide for Occupants*. Thanks, Bill.

When is that point? Some early ageing starts in our twenties, related to metabolism, but it's barely detectable. Physiologically, we *Homo sapiens* are past our peak at the blissfully naive age of thirty. Youth, eh? Wasted on the young. In the general population, forty-four and sixty may be significant ageing cliffs, according to a 2024 Stanford study of thousands of different molecules and microbiomes in 108 people aged 25–75 – so two 'massive biomolecular shifts', rather than a gradual phasing out.[1] But research on runners suggests a different pattern and we'll get on to what actually happens to us. But first, why does ageing happen?

Ageing is best understood as a trade-off between cell maintenance and

reproduction, says Nobel Prize-winning molecular biologist Venki Ramakrishnan, author of *Why We Die: The New Science of Ageing and the Quest for Immortality*. Evolution selects for growing fast and maturing quickly, so we can get on with reproducing and passing along genes. Initially, our bodies use their resources for growth, health and survival. At sexual maturity, the priority switches to reproducing. After sexual maturity, look out. We've served our purpose. The force of natural selection weakens and the ageing process begins, leading ultimately to death.

The salmon, for example, is able to make the long arduous journey swimming upstream to spawn, then promptly dies afterwards. All its cells work to give it the best chance of getting to the spawning ground and making the most of the opportunity. But the chances of it swimming back downstream, surviving another year at sea, making the same return trip and successfully spawning again are slim and natural selection doesn't favour them. Indeed, most animals die soon after they lose the ability to reproduce. Homo sapiens, thankfully, do not. In fact, women spend around a third of their lives in a postmenopausal state and we're among very few species – joining sheep, chimps and two types of whale – who continue past that key phase.

For most mammals, the larger the animal, the longer the lifespan. Scientist Steven Austad studies the relationship between size and longevity in animals. He invented the longevity quotient, which shows that humans actually live five times longer than expected, only outperformed by eighteen species of bat and the naked mole-rat (technically neither mole nor rat). The naked mole-rat is studied a lot, because it seems to be cancer-resistant and demonstrates negligible senescence. Its mortality does not increase with age. We all want to be more naked mole-rat.

The hydra is another outlier. This small aquatic animal regenerates tissue continuously and doesn't seem to age at all; while one jellyfish species is often labelled immortal because when faced with injury or stress, it metamorphoses into an earlier version and lives its life all over again.

Lifespans of organisms range from a few hours for some unlucky insects to hundreds of years for some whales, giant tortoises (both around 200) and Greenland sharks (400), to 5,000 years for bristlecone pine trees.

So some biologists live in hope that ageing and death for us aren't inevitable. But so far, it has always happened.

Age-old debate

From around the age of thirty, we're in a race against time. But it used to be much worse. For most of human history, life expectancy – the average years a person is likely to live for at their birth – was just thirty, by which age we were usually grandparents and had largely served our evolutionary purpose. We could still be semi-helpful for gathering berries, free babysitting and telling dad/grandad jokes. But we could also be an extra mouth to feed when food was scarce.

Why do we live for so much longer after sexual maturity nowadays? The grandmother hypothesis suggests it's important for older relatives to stay alive because reproduction is a risky business. A grandmother can ensure the survival of some of her own genes by investing in her grandchildren, so longer life could bring an advantage from a natural selection point of view. The good news for women is that they've always outlived men and are ten times more likely to reach 110. That said, women have to contend with myriad complications from the menopause, typically starting from the age of forty-five but it can be much earlier (renowned sports dietitian Renee McGregor writes about mastering menopause on page 48).

A hundred years ago, we could expect to live into our forties in the UK, and even in 1950 it was into our sixties. Improvements in public health, primarily sanitation and sterilisation of water and food, rather than groundbreaking advancements in medicine, have had the biggest impact, dramatically reducing infant mortality rates – though vaccines, antibiotics, blood transfusions and, surprisingly, fertilisers have played significant roles, too. Today, life expectancy is 81, though one in six babies born now can expect to live to 100. Compared to our ancestors, we've essentially been given a second life. So perhaps we shouldn't be too gloomy and ungrateful about sliding further away from that parkrun PB.

The big question that causes big squabbles amongst biologists is whether there's a theoretical maximum lifespan for humans, or – if we dodge the worst diseases, drunk drivers and lightning – can we just carry on

indefinitely? Because of some of the miraculous lifespans of other species, some biologists do not think ageing is inevitable and there's theoretically no evidence for a limit on human lifespan. Some argue the first human to live to 150 is already alive. Some argue that's all codswallop. But the idea is enough to trigger a few tech millionaires to push for immortality (more on page 169).

Tellingly, perhaps, while life expectancy has doubled in a short space of time, maximum human lifespan – the oldest age reached – hasn't grown. The oldest recorded human, Italy's Jeanne Louise Calment, endured to see her 122nd birthday. She was a smoker and ate lots of chocolate. But she also had only one child, never had a job as such or financial worries for most of her life and was active every day, enjoying bike rides. (Ahem, though there are rumours her daughter may have assumed her identity at some point.)

We used to die younger and faster, mostly from infection or trauma. Now we die older and slower, usually from lifestyle diseases. **Two thirds of the world's population die from age-related causes, the Four Horsemen of the Apocalypse**: the ticking time bombs of cardiovascular disease, neurodegenerative disease, diabetes and cancer. Though we live on average twice as long as we did 150 years ago, we spend a much greater percentage of our lives in decline, functioning at less than 50% of our capacity. In the US, **80% of adults will have a chronic health condition by the time they're sixty-five – the early signs of which can be present in our twenties**. In the UK, the average male will spend sixteen years in poor health, the average female twenty years, according to a recent study.[2]

Cellular data

Though it makes good sense evolutionarily, on a biological level, scientists aren't exactly sure why we age. There are lots of ideas – some 300, in fact – and they fall into three main theories: cellular waste accumulation theories (your cells fill up with toxic waste by-products), genetic mutation theories (your genes malfunction and, um, terminate you) and, the one that sounds more realistic to runners, wear-and-tear theories (your body simply wears out). What scientists do feel certain of is that this happens inside us, in our cells.

Over the course of our lives, our genes collect mutations. Some are completely random, others the result of our diets or external factors such as UV light. Very few are useful, most do nothing, but some are harmful. Before sexual maturity, any gene mutation that decreases an organism's likelihood to reproduce is strongly selected against. But once an organism reaches sexual maturity, there's little benefit in continuing the effort required to stay healthy and senescence, or cellular ageing, starts.

Before sexual maturity, stem cells divide to repair and replace parts of our body, such as those gene mutations. But when senescence hits, those same cells turn on us and mutiny. More recently termed 'zombie cells', they're no longer capable of dividing and can negatively impact the cells around them, weakening our tissues, organs and immune system. BRCA gene mutations are a classic example. They are linked to higher fertility in women, but also significantly increase the risk of breast and ovarian cancers. Stem cells protect us against cancer by preventing cells with DNA damage from multiplying, but senescent cells can accumulate in tissues, causing damage and inflammation, precursors to age-related illnesses. Stem cell repair works really well for a time, but deteriorates with age and eventually the cells down tools. (In more positive news, in March 2025 scientists from Dundee University claimed to have discovered a way to identify and eliminate zombie cells.[3])

Telomeres, stretches of specialised DNA at the end of each chromosome, shorten with each cell division, working as a type of tallying device. Eventually, they reach a predetermined length – which varies from one cell type to another – and the cells become inactive or die. The length of our telomeres (not that we can see them) is a key internal sign of our biological ageing. We'll learn more about this later.

What does ageing look like? In biological-speak, the twelve hallmarks of ageing, according to a 2023 study, are:

- cellular senescence
- stem cell exhaustion
- mitochondrial dysfunction
- telomere attrition
- chronic inflammation

- genomic instability
- epigenetic alterations
- loss of proteostasis
- disabled macroautophagy
- deregulated nutrient-sensing
- altered intercellular communication
- dysbiosis.[4]

Some of that may not mean much (to me included, until recently), but you'll probably agree that it doesn't sound particularly promising. The news that ageing is bobbins won't be entirely unexpected, but the full picture could be worse than we imagined. It affects *everything*. There is some good news coming for us runners. But to understand all of that, we first need to understand what's happening to us as runners.

The race against time

Most athletes towards the end of their forties will have probably felt they're just not as fast as they once were. One of the earliest and most upsetting physiological declines is deteriorating lung function as the air sacs that make up our lungs lose their elasticity. The headline is that **our VO2 max**, the maximum oxygen uptake we can manage during physical exertion, **declines by around 7–10% per decade, from as early as thirty**. So a seventy-year-old has lost about 25% of their aerobic horsepower compared to their forty-year-old self. That feels huge. And demoralising. As we'll see, though, the decline can be less for us runners.

In news that may sound like it's good for us joggers but bad for our sedentary friends, nothing dictates our lifespan and healthspan (the quality of our life, not just its length) like our VO2 max does. Essentially, several studies have shown that the fittest people have the lowest mortality rates, and by a surprising margin. Someone in the bottom quartile of VO2 max for their age group is four times more likely to die than an elite-level runner. Even improving VO2 max from the bottom 25% into the 25th–50th percentile cuts the risk of death by half. Poor cardiorespiratory fitness carries a greater relative risk than smoking.

Depressingly, our heart is going to shrink and stiffen. Our cardiac capacity or maximal heart rate – the highest rate we can reach, when running fast – drops off. There is a steady fall in the number of receptors in our heart muscle listening to the nervous system's signals and telling it how fast to beat. As the heart becomes increasingly deaf to these messages, its maximum rate drops. There also appears to be a decline in the heart's intrinsic ability to beat quickly, but it's actually that the heart can't relax – or, in running speak, 'recover' – as quickly as it used to. Most of us can hit 200 beats per minute (bpm) on short intervals in early adulthood, but **from around thirty the heart's peak capacity to pump blood declines by 1 bpm per year or 5–10% per decade**. The heart's vitality doesn't decline as steeply as lung function, but as less oxygen is delivered to the bloodstream and muscles, there's a corresponding decline in our running performance. As overall blood volume is reduced, our organs get less blood, too. We also have less muscle (more anon), fewer mitochondria (the powerhouses of our muscles), perhaps fewer capillaries, and our arteries may become clogged and/or inelastic.

In further bad but not hugely unexpected news, our lactate threshold also decreases, reducing the intensity we can sustain or our speed endurance. These physiological processes – heart, blood, lungs, lactate threshold – are all linked to one another, are all key to athletic performance and are all on the wane. In summary, as we age, we runners simply can't go as fast as we used to. It's both a physical and an existential crisis. And it's really frustrating.

Weakly mileage

Looking at the elite pen at the start of the London Marathon, a non-runner would be forgiven for thinking that muscles and strength weren't high on a runner's priority list. And they'd probably be right (Kenyan runners don't tend to do strength work). But reaching masters status as a runner has big implications for our muscles. Or lack thereof. Around 20% of adults will experience sarcopenia, age-related skeletal muscle atrophy or muscle wastage. 'Like a snowman in a thaw,' writes Richard Askwith in *The Race Against Time*.

Even if we dodge sarcopenia, we will lose individual muscle fibres and – unlike hair, nails and white blood cells – we can't grow new ones. They atrophy and die. **Muscles can start waving their little white flags as early as twenty-five.** We decline more definitely from around forty and it's much clearer after fifty, where men lose 1–2% of muscle mass each year and 3% each year after sixty. By the age of eighty a man can have said goodbye to a whopping 50% of the muscle mass he had at twenty-five. That's huge – or rather, we won't be. Women lose less muscle mass, around 3–5% per decade from the age of thirty (more anon).

Mass, however, is the least important metric here. **We lose muscle *strength* two to three times faster** than we lose mass. **And we lose muscle *power*** – best understood as the speed at which force is produced – earlier and **two to three times faster than we lose strength**. It drops by 2–4% per year.

This muscle wastage places an abnormal load on tendons and ligaments, which can lead to injury. Crucially, we tend to lose fast-twitch muscle fibres more quickly than slow-twitch fibres, leaving us with weaker and less explosive muscles overall. Simply staying fit isn't enough to keep those fast-twitch fibres firing. Power, or the ability to deliver force quickly, is the number-one factor that separates young athletes from older ones, writes Jeff Bercovici in *Play On: The New Science of Elite Performance at Any Age*.

Even if we maintain the same muscle mass, **our muscles fatigue more quickly as we age**. **Our body becomes less efficient at delivering nutrition to muscles** (known as protein synthesis), making it harder to rebuild them through exercise (known as anabolic resistance). The body has to work harder to convert protein into muscle fibres, so a sedentary sixty-year-old will have to do twice the resistance training of a sedentary twenty-year-old to get the same result. DOMS (delayed-onset muscle soreness) can last longer. At some point **our muscles actually start to work against us**. 'Co-activation of the antagonist muscle' means that when we try a bicep curl, the tricep is firing too, resisting the movement. Balance and coordination are also affected.

It's not just athletics and aesthetics. Health-wise, **muscles protect us from disease**. Muscle is the predominant sink for glucose uptake, so the

more skeletal muscle we have, the more easily we can maintain low blood sugar, putting off the Four Horsemen and other unwanted health outcomes. In late midlife, the real problem is the loss of the ability to move well, respond quickly to say a trip or stumble and even remain independent. Everyday lifestyle things such as carrying food shopping, lifting a grandchild or getting up from a chair unaided become difficult or no longer possible. Falls become more likely and can have very serious implications.

One in three people aged sixty-five or older fall each year and **falling is the second leading cause of unintentional injury deaths worldwide**, after road traffic accidents. Falls are responsible for over 38 million DALYs (disability-adjusted life years) and result in more years lived with disability than transport injury, drowning, burns and poisoning combined. Fewer than 50% of patients who suffer hip fractures in older age return to full pre-fall function, and 30% of hip fracture patients die within the first year of their injury.

Even if a fall is less directly impactful health-wise, people lose confidence, become less active and are less likely to do things they enjoy doing, negatively impacting mental health. Poor balance at fifty is a strong indicator of our risk of falls at seventy, found a 2022 study. **Adults aged 51–75 who couldn't stand on one leg for ten seconds had nearly twice the risk of dying over the next seven years.**[5] Though the reasons for falls are multi-factorial and eyesight is certainly up there, lack of strength, balance and bone health (and vitamin D deficiency) are key. That spectre is hopefully a while further down the line for most of us, but it feels like something we should warn our parents about now.

The bones of it

Talking of bone health, **up to 50% of women and 25% of men aged fifty-plus will break a bone**. The calcium-rich white things we rely on as part of our skeleton get weaker as the years tick by, with serious ramifications. We become increasingly susceptible to osteoporosis, which weakens our bones, making them more likely to fracture and break. When hormones plummet around menopause, bone strength declines by 10–20% and fractures rocket up from the late forties onwards. For women, the incidence

of broken bones is greater than that of heart attack, stroke and breast cancer combined. Later, that can be the beginning of the end.

Osteoporosis is an imbalance between how much of our bones is being renewed and how much is being absorbed by the rest of the body. Our bones are continuously transferring minerals into our blood to facilitate key bodily processes, a natural cycle of regeneration. But if there's not enough calcium doing the rounds, the body will simply steal more of it from our bones to fill the gap, leaving them weaker. Broken bones take longer to knit back together the older we get and **people with poor bone health are also more likely to have dementia.**[6] Runners with a lower BMI or who've had REDs (relative energy deficiency in sport), an eating disorder or disordered eating are more at risk of poor bone health.

We reach peak bone mineral density (BMD) at about thirty, depending on diet and lifestyle, when women have about 125 grams of skeletal calcium, men 150 grams. The decline in BMD for men is fairly constant, but for women the decline steepens around menopause and especially at the age of fifty, then levels off around sixty. Sweating and dehydration also negatively affect our bone mineral density, as does our diet if there's not enough calcium or vitamin D going in (more on page 139).

We can easily take our skeleton for granted. It's the strong, silent type, just an overpowered coat hanger for our skin and muscles. But our skeleton isn't just structural, it's our body's 'master communicator', says Dr Vonda Wright, an orthopaedic surgeon and author of *Unbreakable: A Woman's Guide to Ageing with Power*. Our bones release proteins and talk to our brain via hormones such as osteocalcin. Stimulating bones helps build neurons, metabolise glucose and make testosterone.

Hormonally not yours

We get whacked another time by the giant ageing mallet. The endocrine system plays a vital role in keeping us in physiological equilibrium or homeostasis. The endocrine system uses chemical messaging to signal when some biochemical rebalancing is required. For example, in a stressful situation, if a threat is perceived – the obvious example being a sixteen-year-old chasing us down at parkrun – the adrenal glands signal that

adrenaline is required and ask the heart rate and blood pressure to work harder and speed us to the finish faster. Hormones tell us when to eat and sleep, create desire to have sex, make us feel happy or sad, even communicate when to grow. They're really important. But most hormone levels decline as we age, in particular those which help us adapt to training.

Both men and women have the sex hormone oestrogen, but it's more prevalent and powerful in women, whereas men have significantly more testosterone. Oestrogen drops off a cliff during a menopausal state and is more complex and nuanced than testosterone decline in men, which is also more linear. For women this means:

- bone mineral density decline
- loss of anti-inflammatory qualities which aid the immune system
- loss of heart protection, especially during high-level endurance activity
- interrupted and loss of quality sleep
- more visceral and belly fat.

Men in turn lose testosterone, with big implications for athletic performance and health. Both sexes have testosterone and it declines (I don't know about you, but I'm getting fed up of that word) by about 1% per year in men from the age of thirty. By their seventies and eighties, men have only about half the levels they had in their twenties. Diminishing testosterone in men leads to:

- osteopenia and osteoporosis – loss of bone strength
- sarcopenia – age-related muscle loss
- increased lipid stores – i.e. more body fat
- lower libido – declining sex drive
- declining cognitive function – alertness and sharpness both drop.

Levels of testosterone are also the key difference between the sexes, helping to make men stronger and faster (and perhaps more ego-driven and worse at pacing marathons). It's also one of the popular ways to dope, so ageing is effectively the opposite of doping.

A weighting game

Many symptoms of ageing are linked to declining testosterone levels. For example, the less testosterone you have, the harder it is to maintain and build skeletal muscle. That muscle burns a lot of calories. As you lose it, your metabolism slows, meaning those calories are more likely to turn into fat on your waist. Fat secretes oestrogen and proteins that promote chronic inflammation and insulin resistance. 'Ageing makes us fat, and then fat makes us age,' writes Bill Gifford in *Spring Chicken*.

As well as the extra expense of new running shorts in a bigger size and the increasingly displeasing morning appearance in a full-length mirror, excess weight erodes our efforts to maintain optimal VO2 max and primary muscles have to work harder just to maintain the same pace, needing more oxygen to do so. Increased lipoprotein lipase (LPL) fat could also be reducing insulin sensitivity. Testosterone used to help keep stores at bay, but we have less of it now. Added weight brings down our VO2 max too, so we get slower. It's a depressing spiral.

The human growth hormone (HGH) is the third crucial hormone for athleticism and health. It's so influential in our bodies that searching for illicit supplements of it is the number-one target for the World Anti-Doping Agency. HGH is released as we sleep (more about sleep on page 124), signalling growth receptor cells all around the body to reproduce and grow, making us bigger, stronger and physically more capable. HGH peaks during puberty and declines by 1–2% per year after the age of thirty. HGH decline is related to:

- decrease in lean muscle bulk
- increase in both body lipids (fats) and visceral fats
- reduction in aerobic capacity (VO2 max)
- decrease in bone mineral formation
- decrease in natural EPO production in the kidneys
- neural decline – possibly affecting cognition and alertness
- deterioration of the immune system.

Melatonin and insulin are crucial hormones that also deplete as we age and impact our metabolism. Melatonin is related to our sleep and our circadian

rhythms. It's secreted from the pineal gland, which is large in children, but shrinks post-puberty and becomes further compromised as we get older. Essentially, quality sleep is harder to come by in later years.

Insulin, meanwhile, decreases the glucose levels in our blood, but after fifty our body becomes less efficient at metabolising it, meaning greater sensitivity to sugar, higher levels of glucose and increased risk of diabetes. Indeed, the typical age of a type 2 diabetes diagnosis is between forty-five and sixty-four, with men at higher risk, black and southern-Asian men even more so.

Achy breaky parts

Notice how recovery feels slower in your groaning hips and ankles? Ageing also changes the biology, healing capacity and biomechanical function of tendons and ligaments, both somewhat important to runners, with implications for our joints, too. Connective tissue loses its elasticity and muscles get tight, a one–two punch that can cause injury and force a shortened stride, slowing us down and reducing our running economy.

Most runners will have had some sort of tendon issue at some point, with Achilles tendonitis being a popular and tenacious niggle (I can attest to that). Tendons join muscle to bones, while ligaments join bone to bone. Both are fibrous connective tissue that aids joint motion and stability. Tendons and ligaments make joints work and we know range of motion also reduces with age. Think of them losing elasticity, becoming more fragile and a little more disorganised, and the chances of running injury increasing as a result.

Whether it's tendons and fascia, tighter muscles, and/or a bit of something else, we know that **reduced range of motion, flexibility, mobility, balance, proprioception and overall recovery rate are all things that affect the more mature athlete**.

All injuries, from bruises to tendon strains, take longer to heal, which is thought to be something to do with the deteriorating function of the specialised stem cells that carry out repairs and the decreasing production of growth hormones. This also means slower recovery and adaptations from more challenging training.

Nerve function also deteriorates. The pace at which nerve signals travel around the body to create reaction times declines gradually from the age of twenty-four. As motor neurons die, motor units become less efficient, meaning progressive loss of balance and greater risk of injury, both when running and when not running.

As if all of that wasn't enough for the mature runner to contend with, **our immune system becomes less efficient, making colds and worse things more likely**, meaning more interruptions to training. This can speed our decline up just that little bit more.

Wait, there's more. As we get into our latter decades, we'll find our bladders have become less elastic, hence why we find ourselves increasingly pausing our watches on long runs. Skin also loses elasticity, getting more leathery and drier (so it wasn't just another dehydrated run). Blood vessels are less robust, breaking more easily and causing more bruises. We'll get into fat in more detail, but at the latter end of things, the fat close to skin actually thins, making it harder for elderly folk to stay warm. And we technically shrink, up to two inches by the age of eighty, due to compressed spinal discs.

We also experience changes in our brain (cognitive decline and memory loss), kidneys, hearing, eyesight, hair (come back, you gits!) and libido. Osteoarthritis, a painful inflammation of the bones and joints, becomes more common as the cartilage that acts as a shock absorber wears down and the cells that help it grow get worse at their job. I don't know about you, but at the moment it feels like ageing is a highly overrated idea.

The midlife crisis

Not all changes are physical. Have you had your midlife crisis yet? Considering a short trip to Turkey, buying a Tesla or dabbling in CrossFit are all sure signs. The midlife crisis is a relatively new construct – unsurprising perhaps when we only used to live to thirty.

Aristotle believed middle age to be the prime of our life, having reached peak competence and mastery. In the 1960s the idea that midlife was the period from forty to sixty where we pondered our mortality became prevalent, probably stemming from Canadian psychoanalyst Elliott Jaques.

A 2008 paper titled 'Is well-being U-shaped over the life cycle?' suggested that happiness is high in youth, dips significantly in the mid- to late forties, and then ends up high again in older age.

A midlife crisis feels like a real thing. It could well be the rise of FOMO coupled with the panicky idea that we don't have much time left to get on with all these possibilities, suggests Gwendolyn Bounds in *Not Too Late: The Power of Pushing Limits at Any Age*. Essentially, it can feel like there's so much to do and so little time, which makes us anxious. Having so many options is actually making us unhappy. This 'crisis' throws some people into running, and if that's you, welcome. You made a great choice.

In summary

For the runner, if we do nothing to counteract age decline, we get weaker, slower and less powerful. Our bodies whinge, hurt and break more easily. Recovery from workouts (intervals and other high-intensity running), races and injury is just slower. And those injuries are more likely. Interruptions from training accelerate the decline. As a consequence, motivation can take a hit. Concurrently, work and family 'get in the way'. It all doom-spirals together and suddenly we're not just old but prematurely old, speeding towards the race finish line we don't want to reach.

In a summary we all don't want to read, the big initial changes faced by both sexes as we age are decreased cardiac output, stoke volume and maximal heart rate; decreased aerobic (VO2) output; diminishment of the sport-critical sex hormones oestrogen in women and testosterone in men; reduced mitochondrial efficiency (energy production) and arterial stiffness. Muscles waste away from as young as thirty and we could get 8% weaker per decade. This accelerates around sixty (which also means less glycogen storage among other bad things), limiting performance and recovery. Our fast-twitch fibres go first; our bones also get weaker; our tendons, ligaments and joints are all less happy; our balance, coordination and flexibility all decline; our metabolism becomes less effective and we get fatter; and our sleep gets worse.

Outside of running, our hearing and eyesight diminish. We get saggier and wrinklier, with less hair in the places society deems attractive and more

in the places it doesn't. Importantly and frustratingly, these factors all feed off each other in the ultimate doom spiral, accelerating our ageing and leading to further deterioration for both athletic and general health, making us more susceptible to other, much more serious, issues.

In almost every way you think about it, getting older is rubbish physiologically. However, as well as celebrating what all those extra years on Earth gift us and all the accrued wisdom and photos, we do have a surprising level of control over many of these unwanted facets of ageing. We can slow, pause and even reverse them. Ageing is inevitable. *How* we age is a choice.