The Running Ape

There is something strange about humans if you line us up against the rest of the animal kingdom. We are not fast. A house cat can outrun us. We cannot fly, we cannot swim particularly well, we have no claws, no venom, no armour. What we can do — better than any other animal on Earth — is keep going.

Daniel Lieberman and Dennis Bramble laid out the case in a landmark 2004 paper in *Nature*. The argument: humans did not evolve primarily as walkers. We evolved as runners. Specifically, as endurance runners — animals built to run long distances at moderate speeds in the heat, chasing prey until the prey collapsed from hyperthermia. This is the persistence hunting hypothesis.

The evidence is anatomical and it is persuasive. The human Achilles tendon stores and returns elastic energy during running but serves almost no function during walking. The nuchal ligament — a band of connective tissue running from the base of the skull to the spine — stabilises the head during running and exists in dogs and horses but not in chimpanzees. Our gluteus maximus, the largest muscle in the body, barely fires during walking but contracts powerfully during running. Our relatively long legs, short toes, and wide shoulders (decoupling the arm swing from the trunk) are all running adaptations. None of them make sense as walking adaptations.

But the most remarkable feature is our skin. Humans have between 2 and 4 million eccrine sweat glands distributed across the body surface. This is the highest density of any mammal. Most mammals cool themselves by panting — a method that is incompatible with sustained galloping because the respiratory cycle locks to the stride cycle. A horse running at full speed cannot pant independently of its gait. A human can sweat freely at any speed. This gives us an extraordinary thermoregulatory advantage. On a hot day, a human can maintain a moderate running speed for hours while a quadruped must stop or die of heat stroke.

Lieberman expanded this into a broader framework in *The Story of the Human Body* (2013), introducing the concept of evolutionary mismatch. The bodies we inhabit were shaped by the demands of the Pleistocene — walking 12 to 20 kilometres a day, carrying loads, climbing, digging, running in bursts and sometimes for hours. The modern environment, where a person might walk 2 kilometres in an entire day and spend 10 hours seated, is not what these bodies were built for. The consequences of that mismatch, Lieberman argues,

are visible in the diseases we now treat as normal: lower back pain, osteoporosis, type 2 diabetes, cardiovascular disease.

This is a hypothesis, not a settled fact. Pickering and Bunn (2007) have questioned how common persistence hunting actually was, arguing that scavenging and ambush predation may have been more important. The anatomical evidence for running adaptations is strong, but whether persistence hunting was a primary subsistence strategy or an occasional tactic remains debated. What is not debated is that the human body is built for sustained aerobic movement in ways that most mammals are not.

The Paradox of Energy

If humans evolved to move, and modern humans barely move, you might expect a straightforward story: active people burn more calories, sedentary people burn fewer, and the difference explains obesity. Herman Pontzer's work over the past decade has complicated that story considerably.

Pontzer and colleagues measured total daily energy expenditure in the Hadza, a hunter-gatherer population in northern Tanzania. The Hadza walk long distances daily, dig tubers, climb trees for honey, and carry water and firewood. By any measure, they are far more physically active than the average Western adult. And yet, when Pontzer's team measured their total energy expenditure using doubly labelled water — the gold standard method — they found something unexpected. Hadza men and women burned roughly the same total number of calories per day as sedentary adults in the United States and Europe.

This was published in *PLoS ONE* in 2012 and expanded in *Current Biology* in 2016. Pontzer called the framework the "constrained total energy expenditure" model. The idea is that the body has a roughly fixed daily energy budget. When physical activity increases beyond a moderate level, the body compensates by reducing energy expenditure elsewhere — suppressing inflammation, reducing reproductive hormone cycling, dialling down stress responses. The body does not simply add activity calories on top of a fixed basal metabolic rate. It reallocates.

The implications are provocative. If the model is correct, exercise does not primarily cause weight loss through burning extra calories. Its benefits come instead through metabolic reallocation: the body shifts energy away

from chronic inflammation and stress physiology into physical function. Pontzer laid this out for a general audience in *Burn* (2021).

This model is contested and it is important to say so clearly. Some researchers argue that the Hadza data has methodological limitations, that doubly labelled water has measurement variability that could mask real differences, and that intervention studies do show exercise-induced weight loss in some populations. The constrained model may describe a real phenomenon at population scale without being the whole story. It should be treated as an important and provocative hypothesis, not as established fact.

What is less contested is the core observation: the relationship between physical activity and total energy expenditure is not linear. Moving more does not proportionally increase the calories you burn in a day. Something more complex is happening, and Pontzer's work has forced the field to take that seriously.

The Blue Zones: Movement Without Exercise

Dan Buettner's Blue Zones research approaches the question from the other end — not from physiology but from demography. Where do people live the longest? And what do those places have in common?

Buettner identified five regions with unusually high concentrations of centenarians: Okinawa (Japan), Sardinia (Italy), Nicoya (Costa Rica), Ikaria (Greece), and Loma Linda (California — specifically the Seventh-day Adventist community). Across these populations, he found a set of shared lifestyle patterns. Diet was important (largely plant-based, moderate caloric intake). Social connection was important. Sense of purpose was important.

But the movement pattern was perhaps the most striking finding. None of these populations "exercised" in the way a modern Westerner understands the word. Nobody ran on treadmills or lifted weights in gyms. Instead, they walked. They gardened. They kneaded bread. They climbed stairs and hills as part of daily life. Their movement was constant, low-level, and integrated into every waking hour.

This aligns with Pontzer's metabolic data and Lieberman's evolutionary framework in an interesting way. The human body may not need intense exercise to function well. What it needs is what it evolved with: near-constant low-level physical activity spread across the day. Not 30 minutes of cardio followed by 15 hours of sitting. Movement as a background state, not an event.

Buettner's work is popular science and should be read with that caveat. The epidemiological data behind individual Blue Zones varies in quality, and the concept has attracted criticism for oversimplifying complex demographic patterns. But the core observation — that longevity correlates with habitual daily movement rather than formal exercise — is supported by a broader evidence base than Buettner's work alone.

Sitting and Dying: The Dose-Response

If constant movement is the natural state and prolonged sitting is the mismatch, how dangerous is sitting? The phrase "sitting is the new smoking" became a public health slogan in the 2010s. The evidence behind it is real, though the slogan overstates it.

Ulf Ekelund and colleagues published a major meta-analysis in *The Lancet* in 2016, pooling data from over one million adults across 16 studies. They found a clear dose-response relationship between sedentary time and all-cause mortality. People who sat for more than 8 hours a day had significantly higher mortality risk than those who sat for less than 4 hours. But — and this is the important nuance — 60 to 75 minutes of moderate-intensity physical activity per day eliminated the excess mortality risk associated with high sitting time.

This means sitting is not an independent death sentence. It is a risk that can be offset by sufficient movement. The problem is that most people who sit for 8 or more hours a day do not also move for 60 to 75 minutes. The combination of high sitting and low activity is what kills, and that combination describes a very large fraction of the modern population.

The physiological mechanisms are increasingly well understood. When muscles are inactive for extended periods, lipoprotein lipase activity drops sharply. Lipoprotein lipase is the enzyme that breaks down circulating triglycerides so they can be taken up by tissues. When it falls, triglycerides accumulate in the bloodstream. Glucose transporter activity in muscle tissue also declines, impairing insulin-mediated glucose uptake. Blood pools in the lower extremities, reducing vascular shear stress and impairing endothelial function. These changes begin within hours of sustained sitting, not after weeks or months.

The sedentary physiology literature paints a picture of a body that begins to malfunction when it stops moving — not over years, but within a single day. The human body was not designed to be still.

Movement and the Mind

The evidence on exercise and mental health has strengthened to the point where it is difficult to ignore clinically. A 2023 umbrella review published in the *British Journal of Sports Medicine* by Singh and colleagues examined the evidence across multiple systematic reviews and meta-analyses. The findings: physical activity interventions significantly reduce symptoms of depression, anxiety, and psychological distress. For mild to moderate depression, the effect sizes were comparable to those of antidepressants and psychotherapy.

Note on citation: the README for this project lists this as Singh, B. et al. (2023) in *British Journal of Sports Medicine* 57(18), 1203-1209. The original book text referenced a "BMJ 2024 meta-analysis." These likely refer to the same body of work — Singh et al. 2023 is in BJSM, which is a BMJ journal. The exact citation requires verification, and the effect sizes and specific comparisons (exercise vs. SSRIs) need to be checked against the paper rather than paraphrased from secondary sources. This is flagged in the source notes.

What is clear from the broader literature is that the relationship between movement and mood is not incidental. It operates through multiple mechanisms: increased BDNF (brain-derived neurotrophic factor) expression, improved hippocampal neurogenesis, reduced systemic inflammation, regulation of the HPA (hypothalamic-pituitary-adrenal) axis, and acute increases in endocannabinoid and monoamine neurotransmitter levels. Exercise is not a lifestyle recommendation that sits politely alongside medication. It is a physiological intervention that acts on many of the same systems.

The Mismatch in Numbers

How far off are we? The human musculoskeletal system, based on hunter-gatherer data, appears to be adapted for something in the range of 12 to 20 kilometres of daily movement — a figure derived from accelerometer and GPS data on contemporary foraging populations including the Hadza, Tsimane, and !Kung San. This translates roughly to 15,000 to 25,000 steps per day.

The average American adult takes approximately 4,800 steps per day. The average British adult is slightly higher at around 5,400. The average Australian sits somewhere between the two. These figures represent a three- to five-fold deficit from the movement baseline our bodies expect.

The WHO recommends 150 minutes of moderate-intensity physical activity per week as a minimum. That is roughly 21 minutes a day. Better than nothing, but a fraction of what the evolutionary evidence suggests our bodies were built for. It is a public health minimum, not a biological optimum.

And this is where Goal 12 (play-based education) (play-based education) — climbing walls on every stairway — stops being eccentric and starts being obvious. The problem is not that people lack willpower or gym memberships. The problem is that the built environment has been systematically engineered to remove movement from daily life. Escalators replace stairs. Cars replace walking. Flat surfaces replace terrain. The body adapted for climbing, carrying, and traversing variable ground now navigates a world of smooth floors and elevator buttons.

You do not fix an environmental mismatch with individual discipline. You fix it by changing the environment. Monkey bars at bus stops. Climbing walls on stairways. Pull-up bars in parks. Movement infrastructure woven into the fabric of public space so that using your body is not a choice you make but a thing that happens because the world is built for moving bodies.

The evidence says we evolved to move. The evidence says we are not moving. The evidence says the consequences are visible in every chronic disease registry in the developed world. The question is not whether movement matters. The question is why we built a world that prevents it.