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“Change is the only constant in life,” said Heraclitus, a Greek philosopher. Whether it’s your weight, your bank balance, your sense of wellbeing, or the temperature setting inside your home—it’s true that all things, constantly, are in a state of flux. Deep within our bodies though, it’s a different story—and constancy is key.

Essential equilibrium

No matter what is going on outside our bodies, our hormones and our nervous system strive ceaselessly to maintain sameness inside. To allow deviation from that which is just right could be disastrous—as doomed Icarus discovered in Ovid’s epic, the Metamorphoses [3]. Failing to follow advice not to fly too low in case the moisture weighed down his wings, nor too high in case the sun scorched them, he fell to his death.

“Taking the middle way” and “traveling between the extremes” that are possible within is something which our body does best—without needing wings. Being able to balance its blood pressure and settle its salt levels with breath-taking speed, everything from A to Z lies within its control.

A,B,C,D

Beginning the body’s list of things that it keeps constant is A, for acid. Your body keeps its pH within a very narrow range (7.36-7.44); at a pH of 6.8 or 7.8, you will die. The lungs (through breathing out carbon dioxide) and the kidneys (by excreting acid and reclaiming bicarbonate) are key in keeping this control.

B is for blood pressure, with pressure sensors near the heart detecting any drop in its value. Beat by beat, the heart can change its rate and strength of contraction to counteract any rise or fall in pressure.

Hormones help keep calcium levels constant in the blood, whilst the liver removes and breaks down drugs in the bloodstream, thereby limiting their levels in the body.

E,F,G

It's more difficult to maintain a safe blood alcohol [4] (or ethanol) level; hangovers happen as blood levels soar. Enzymes in the liver do their utmost to claim back control, by breaking down the alcohol into water and carbon dioxide which can be excreted, but they are soon overcome by overdrinking.

A host of hormones hold fat and glucose levels in check. Insulin, glucagon and stress hormones work together to either shut the nutrients away in cellular storage (when blood levels are too high) or bring them back into circulation when called for.

H,I,J,K

Being the chemical boss of the body, the pituitary [5], (a "pea-size nubbin of tissue" hanging on the underside of the brain), commands and controls hormone levels—both sending out orders and receiving feedback to help adjust its instructions. Iron [6] levels themselves are controlled by a hormone called hepcidin.

It's important, meanwhile, that the jugular venous pressure is controlled. High pressures in the pulsating vein seen in your neck can reflect heart disorders.

Ketones are dangerous acids that can build up in the blood when the body burns its own fat. Insulin is the answer in keeping levels low.

L,M,N,O,P

Lymphocytes and neutrophils are white blood cells that lead the body's immune response. Although blood counts may rise during infection, leukaemia or lymphoma (and drop during chemotherapy), numbers otherwise stay near constant. Involving, for example, the manufacture and destruction of around 100 billion neutrophils [7] each day, this balancing act is by no means simple.

Magnesium, Oxygen and Potassium are elements essential to life, and their equilibrium is established for the most part.

Q,R,S,T

Being an important source of energy for cells, the natural antioxidant Coenzyme Q10 is made in your liver in a similar way to cholesterol. Levels do though decrease with age.

There's a fine balance between red blood cell production and destruction, with erythropoietin [8], a kidney hormone, playing a key role.

Sodium levels and body temperature [9] are each regulated by the brain and by our behaviour (drinking water, for example). In the case of sodium, a hormone released by the brain acts on the kidneys to affect how concentrated the urine and how salty the blood become. A portion of the brain called the hypothalamus regulates body temperature through controlling shivering, blood flow and sweating.

U,V,W,X,Y,Z

Your body's got a grip on its levels of urea (broken down proteins), vitamin B12 (a nutrient that keeps nerves and blood cells healthy), water (with humans being 50 per cent water), eXcretory products (such as bile) and neuropeptide Y (an intriguing protein released from nerves and implicated in everything from appetite to heart

failure).

Maintaining a constant state of cellular zinc [10], meanwhile, is essential for survival. Useful in making new cells and wound-healing, its absorption from the gut is balanced by its excretion in faeces, sweat and hair.

Chaos without? Control within.

Variation in your internal environment can come through disease, diet and daily body rhythms but, for the most part, it exists between the extremes, constantly self-adjusting to bring back balance. That's real resilience.



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