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Riding the waves, the surfer displays an amazing ability to balance; the toddler meanwhile takes time fine tuning his balance skills. Of more than 250 species of primates, humans seem uniquely built for balance on two legs. How does our body keep us upright?

Balance is more than bones

Our skeleton is built with two legs containing lockable knee joints [6] and an upright spine [7] providing a column of support, bearing the weight of the head, neck and trunk, allowing us to maintain an upright position. Balance is, however, due to a lot more than your bones. Your ears, eyes, brain, spinal cord, heart and muscles all work together to help you stand in line at the supermarket queue.

Your eyes

They might not be essential for balance (you can still stand upright in a dark room), our eyes help us stay upright by seeing what's around us. You can test this by spinning around for thirty seconds with your eyes wide open. Now close your eyes and spin again: it will take longer to find your sense of balance.

Your ears

The inner ear contains the cochlea [8] for hearing and a remarkable balance (or vestibular [9]) system. The balance system contains fluid-filled canals and small organs containing calcium stones (you really do have 'rocks in your head'). As you move, the fluids slosh around and the stones roll, activating nerves that tell your muscles how to keep you upright.

While toddlers are busy learning this skill, ear infections can interfere with the signals, causing dizziness and vertigo [10].

Your heart

When we stand up, gravity causes blood to pool in our legs, dropping our blood pressure, perhaps causing us to faint. Just as a barometer measures air pressure, we have baroreceptors detecting that drop in blood pressure near our heart. They act very quickly to counter the drop by speeding up the heart and making it beat stronger.

Your muscles

Muscular contraction in the legs upon standing pushes blood back to the heart and brain, preventing us from fainting. What's more, there are pressure detectors [11]within the muscles, sensing movement of muscles and tension in tendons. Put us on a rocking ship or a balance board [12], and these detectors will sense our sway and trigger the stretched leg muscles to contract, pulling us back upright again.

Your brain and spinal cord

Essential in muscle contraction, their importance in balance is most clearly seen in disease or injury. People with Parkinson's [13]find it very difficult to balance on one leg due to an unequal loss of dopamine on either side of the brain; a stroke in the motor cortex of the brain prevents leg muscle control on the opposite side of the body and an inability to balance; spinal cord injury severs communication between the brain and muscles, preventing standing.

Standing in awe

It is remarkable how the different body systems work together to allow us to get out of bed in the morning. Balance becomes even more brilliant when you consider that the different parts can compensate for each other in case of deterioration (a real balancing act). Dr Pasma [14] and his team at Leiden University have shown that older people with reduced sight and hearing rely far more on sensory information from the muscles to help them balance.

Alcohol, meanwhile, can demonstrate what happens when our balance mechanisms are interfered with: tipsy tumbles and wobbly walking remind us just how sensitive these mechanisms are.

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Links
[1] https://www.readersdigest.co.uk/health/health-conditions/how-do-humans-stand-and-balance-without-falling-over [2] https://www.helencowan.co.uk/../tags/brain [3] https://www.helencowan.co.uk/../tags/bones [4]

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