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wonder [2] bones [3]



From the human leg bone to the gecko's foot, engineers have long been amazed by designs in nature. They even try to copy them in their inventions.

Bodily innovation

The human eye is the best digital camera [4], human bone is stronger than concrete, and even the most powerful computers cannot match the human brain for information storage and retrieval.

The marvels of the human body endlessly inspire engineers and scientists to innovate [5].

Weird and wonderful designs elsewhere in the animal kingdom also underlie inventions: a painkilling drug based on a frog's poison, a lightweight body armour based on the abalone shell—all examples of biomimetics, literally meaning the mimicking of nature to create new materials and devices.

It's easy to see how something as beautiful as a butterfly wing might inspire design (of a paint that never fades [6])—but did you know that even plain old bones have led to some great innovations?

The tower inspired by the thighbone

The thighbone, or femur, is the longest and strongest bone in the body.

The bony head of the femur (where it fits into the pelvis to create the hip), is made up of minute bone fibres, called trabeculae, woven in a criss-cross or lattice arrangement. In 1866, a Swiss engineer called Karl Cullman realised that this internal structure made the bone very strong, and he copied the design to invent a crane.

The world-famous Gustave Eiffel used the same design in 1889 to inspire the strong crisscross metalwork of the Eiffel Tower. What's more, the outward flares at the base of the Eiffel Tower resemble the top of the femur when it

is turned upside down, and give it a strong footing.

The car design inspired by the knee

The knee is the largest and most complex joint in the body.

It consists of four essential parts: two bones (the femur and tibia) and two ligaments, which hold the bones together. Together these parts allow the knee to flex and extend in a ‘four-bar hinge mechanism’, allowing us to run, jump, dance and hop. (Click here to find out how the mechanism works in the knee). [7]

Engineers study this mechanism when designing car suspension; if they require more rotation in their design, they study a gibbon's wrist joint, which allows the hand to rotate in a complete circle.

The prosthetic leg inspired by the deer antler bone

Traditionally, an amputee would place his or her stump inside the top of an artificial leg prosthesis and fasten it with a strap or sleeve. However, the skin at the end of the stump is at risk of becoming sweaty and infected.

Scientists at the Royal National Orthopaedic Hospital are trialling a metal implant [8] into the femur bone that protrudes out of the end of the stump, plugging directly into the prosthesis, freeing the skin at the end of the stump from any abrasion. That's right, the prosthetic plugs directly into the skeleton.

Protruding in a similar way to an antler from the head of a deer, scientists have mimicked the deer antler in their design of the metal implant: it is porous under the skin to allow growth inside it and anchor it in place; it is smooth outside the skin to shield from bacteria.

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