These 'useless' quirks of evolution are actually evidence for the theory

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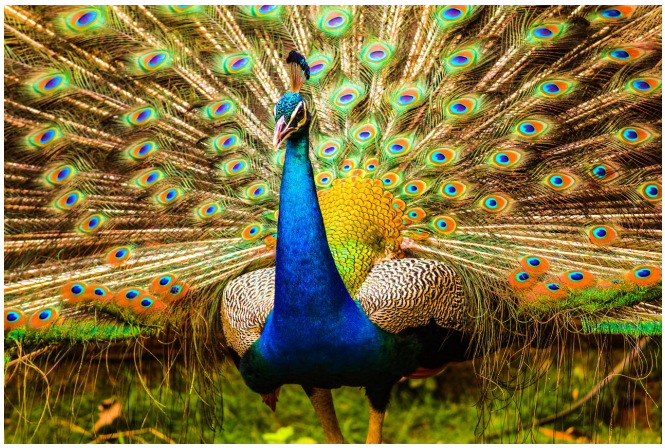

Credit: Chirag Nimavat/Shutterstock

Evolution is a fascinating field but can be rife with misunderstanding. One misconception is that evolution has some innate sense of direction or purpose. In reality, evolution is a mindless, plan-free phenomenon, driven into endless possibilities by random mutations, the most successful of which win out.

People also often think that every aspect of every living creature has a function, that it helps the organism survive in some small way. But there are some areas of evolutionary biology where benefits are murkier and, in some instances, where traits seem to make no sense at all. This is the realm of sexual selection, vestigial traits and evolutionary spandrels.

As important as the concept of survival of the fittest is to evolution, there are many examples that seem to undermine this idea. In fact, various aspects of evolutionary biology may seem counterintuitive and could even be seen as a reason to reject evolution as a whole. In fact, they strengthen our understanding rather than diminish it. Here's how.

Sexual selection

Many species invest heavily in camouflage and other means of blending into the surroundings to avoid predators. So the physically heavy and downright ostentatious plumage of birds of paradise, peacocks and many other birds seems like a clear invitation to be eaten. But crucially they help these birds pass on their genes because they increase their chances of attracting a mate.

This is what's known as sexual selection at its finest. It strengthens the theory of evolution in that these seemingly weaker individuals are actually showing how well they can do in the face of adversity. It's the evolutionary equivalent of using a pretty over-confident dating profile to impress potential partners.

Vestigial traits

When an anatomical structure appears frankly inept, it is probably a vestigial trait. This is a feature that no longer does whatever made it advantageous enough to evolve in the first place. If we could embody evolution as a person, then he or she would be creative but inherently lazy. If something is not being used then why bother maintaining it? It's hard to say why they haven't disappeared altogether but give it another million years and perhaps they will.

Some snakes, for example, still show vestigial traits harking back to their four-legged ancestry. Male pythons have little claw-like structures towards the tail, which, although they aid courtship, are all that remain of their hindlimbs.

Cave fish have lost most of their eyes. Credit: Vladimir Wrangel/Shutterstock

Some cave fish have, over generations, lost most of the components of their eyes because sight uses up a lot of energy and isn't helpful when you live in complete darkness. Many flightless birds, such as penguins and Galapagos flightless cormorants, have wings so small that they are effectively redundant in terms of flying.

Closer to home, the human appendix is a good example of a vestigial trait (although there's now some evidence it may not be useless after all). But there is a weirder one, the plica semilunaris. The next time you look into the eyes of a loved one (it's more awkward with a stranger on the bus), look at that little pink, triangular bit on the inside of each eye.

It's not completely vestigial, as it helps ensure that tears drain properly and gives a slightly greater range of movement, but that's not its original function. Long ago, when we shared a recent ancestry with birds and other reptiles, this little structure would have formed a nictating membrane, or "third eyelid", to provide further protection to our eyes. So, although we have lost this clear, extra eyelid, evolution has upcycled it for another use.

Spandrels

Spandrels are in many ways, the rarest and hardest to see "weird" evolutionary quirks. The word comes from an architectural term for the triangular sections between arches in older, usually fancy, buildings. These zones were often ornately decorated but incidental to the real function of the structure of the building.

An evolutionary spandrel is a physical structure or behavioural characteristic that is a by-product from some other functional adaptation. But despite some apparent examples, truly useless spandrels are hard to find within evolutionary biology.

One well-studied example is seen in an island-dwelling population of Italian wall lizards (*Podarcis sicula*), which spend less time basking in the sun than their mainland cousins. This behaviour can be seen as a spandrel because there's no obvious advantage to it.

Scientists have proposed it's a by-product of the lizards' evolution of increased levels of aggression, sexual activity and food intake. This has also led to more active melanocortin receptors, part of the hormone system that works in response to sunlight, and so the lizards don't need to bask so much.

One genuine exception is something that defines our species as modern human beings: the chin. No other animals, or even extinct human relatives like Neanderthals, have one. As human diets changed, the bones and muscles in our jaws became smaller so we didn't waste energy on them but we were left with a protruding bone at the bottom of the face. And no one has come up with a wholly convincing reason why.

Although the chin throws a spandrel in the works, there is nearly always a reason or, at least, an explanation for the myriad traits we see across biology. A better understanding of these evolutionary obscurities paves the way for a deeper understanding of the complex factors and drivers which influence the natural world around us.

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