
Facts Are Not Everything in Science

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Questions and interpretation are coloured by the social and conceptual contexts of daily life. The pursuit of hard facts doesn't have to blind science to the big picture.

Science and science education have come a long way since 1952, when I was introduced to both as a boarder in the Marist Brothers Juniorate at Bowral, NSW. Back then, secondary school science comprised physics and chemistry. Biology was not on the menu, especially in boys' schools.

My first introduction to hardcore science outside the classroom was not a happy one. I, along with mainstream Australia, was unaware that scientists had recently identified DNA as the repository of genetic information. They had commenced to unravel its structure and decipher the genetic code. What mattered to me in 1952 was that biologists from CSIRO's Division of Entomology had harmed our favourite weekend pastime of hunting rabbits. Very sick rabbits were my first exposure to scientists, entomology, CSIRO and a virus that caused myxomatosis. I was unimpressed.

Little did I know then, as a trainee Marist brother, that I would spend the bulk of my working life in that same CSIRO division, finishing up as its chief between 1981 and 1995.

In boarding school I lived in a world where heaven, hell, purgatory and limbo were real places populated by angels, devils, and immortal souls – lost or saved. Eternity was an awesome concept. Some retreats (3 days of contemplative silence) really did begin with the Dominican friar painting a picture of a frail moon-based sparrow flying to Earth just once every 1000 years and gently brushing some mountain peak with its

wing. "Imagine how long it would take to rub the Earth till nothing was left," he preached. And, when that time had come and the Earth was no more he would conclude: "Well, eternity is just beginning".

Instead of pondering the enormity of eternity, my thoughts were for the poor bird, its dubious lunar food supply, its long celestial journeys and how its battered wing could survive all that rubbing. It was inevitable that one day we would be spending a lot of time in heaven or hell; hopefully heaven after some cleansing in purgatory.

I commenced Science at Sydney University in 1959 as a Marist brother, residing at its Scholasticate in Dundas, Sydney. Some of us were very lucky to be allowed to study botany in first year, but even luckier to be allowed to continue with botany and genetics in subsequent years. Lucky, because biology, and especially genetics, were still considered inappropriate subjects for boys.

During these years the intellectual challenges came from secular studies in science at university while Thomistic philosophy, ascetics and other religious studies ran in parallel during evenings and weekends at Dundas. Some, such as myself, found intellectual conflict in melding science and religion, and eventually left the Brothers; but others had little difficulty in accommodating the dual cultures.

I will argue that blending science and spirituality is not entirely a matter of being right or

wrong. It's more about providing a satisfying view of life, and the way we like to think the world ticks. To understand this perspective better, we need to appreciate the role of worldviews, conceptual frameworks or belief systems within which we pursue knowledge; and what happens when a particular worldview ceases to be useful under the mounting weight of conflicting evidence. We then think in terms of scientific revolutions, or what the philosopher Thomas Kuhn called "paradigm shifts".

The intellectual and emotional challenge comes when we realise that different groups of people function within different worldviews. Sometimes individuals can manage to accommodate conflicting worldviews. They seem to do so by some neat trick of compartmentalising their thought processes. We see this with, say, some practising geologists and geneticists who still accept a literal interpretation of the

Bible. The rules of engagement for dialogue and debate become complex in these circumstances. We might even wonder about the merit in challenging worldviews that conflict with our own. I once challenged the views of a gentlemanly Catholic, and he became a rather obnoxious atheist. Proselytising should be practised with great care. I'm mindful that some of the most likable and moral biologists I have known include committed atheists and devout Christians.

Accommodating differing worldviews can be illustrated by some events in the life of Dr Robin Tillyard, a distinguished entomologist, palaeontologist and Fellow of the Royal Society of London. Dr Tillyard FRS was appointed in 1927 as the first Chief of the Division of Entomology in the newly formed CSIRO.

John Evans, a former director of the Australian Museum (1954–1965), in his autobiography *Insect Delight: A Life's Journey*, describes a remarkable incident about Dr Tillyard that touches on science and spirituality. In 1928 Dr Tillyard, accompanied by Evans, was on a recruiting mission to Europe via the USA. He had just employed John and believed the trip would benefit his young travelling companion.

In Boston, Tillyard and Evans were hosted by Dr Crandon, a respected surgeon from the Harvard Medical School, and his wife, Margery, a well regarded clairvoyant. After four séances during which Margery conversed with Walter, a recently deceased relative, Tillyard was sufficiently convinced by the "evidence" that he wrote a lengthy paper, published in *Nature* (1928), called "Evidence of survival of a human personality". Tillyard was able to pull rank as an FRS and persuaded the editor, Sir Richard Gregory, to publish the article, but not without a stinging editorial rebuttal by Gregory.

During the same trip, Tillyard gave a lecture in Kansas about some exciting fossil insect discoveries. He proceeded to describe in some detail the mating behaviour of these insects, long extinct over millions of years. One intrepid listener asked how Dr Tillyard could be so confident about the mating behaviour. The story goes that Tillyard, with full conviction, replied "Because I have seen it". Harboring conflicting worldviews is clearly possible, though later I will venture an explanation for Tillyard's confidence in combining science, time travel and spirituality.

Before we begin to explore these ideas further, let me affirm that the most valuable and enjoyable learning time in my life was with the Marist brothers – during the impressionable years between 11 and 20 when every day was an intellectual challenge with dedicated teachers and gifted class mates.

Curiosity, or need, drives most humans to determine if something is true or false. That something might be as simple as "Is the noise in my ceiling caused by a rat, possum or a loose panel?" It might be something very complex, like "Did this God create the universe and all the living things around me; and did He do this by divine intervention or gradually through some evolutionary process involving natural selection?"

The urge to know escapes few mortals. Where we start, how we progress and where we finish depend very much on the culture we are born into. It seems trivially obvious that most Christians fly the same flag from birth, invariably clinging to the same denomination. It is similarly the pattern with Muslims, agnostics and atheists.

Some, like myself, assess the situation and change flags simply because another worldview provides a more satisfying intellectual

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framework for understanding things that matter. Some feel the need to proselytise by sharing their good news. For some, converting others seems little more than a displacement activity to obscure uncertainty.

One difference between the scientist and virtually everyone else is that scientists collect new information, assemble facts and publish their findings as a full-time job. We are usually paid to do this, and we're supposed to be more reliable at getting the right answers. A common criterion, before telling our colleagues and the world which statements are true, is the test of repeatability. Would we, or anyone else, get the same answer if the work was repeated? Would others also find the possum in the ceiling?

If only the above perception of scientists and the scientific process was the full story! Being true or false is not the only thing that counts. Even what "facts" we assemble, let alone how we interpret them, are influenced by the worldview that governs our thinking.

In the living world, the Bible informed us that all species in existence were especially created for man's benefit; and individual members of all plant and animal species reflected some fixed ideal form – the so-called typological species. The biological variation we observe between individuals in space and time was previously regarded as imperfect reflections of the "ideal". Conversely, an individual's development from egg to adult was considered a growing process from a pre-existing complex entity – the homunculus in the case of humans. The possibility of development by differentiation from a less complex entity, the fertilised egg, was unknown. Neither sort of biological variation was worthy of further investigation.

Under our modern worldview of evolution by natural selection, biological variation drives disciplines like genetics and evolutionary biology. Such studies did not exist before Charles Darwin. When I was a secondary student in the 1950s, some 90 years after Darwin published *On the Origin of Species by Means of Natural Selection*, even genetics was an unfamiliar term outside research laboratories.

Despite what some scientists might think, very little biological research is designed to challenge the robustness of a prevailing worldview like evolution. Some biologists would claim that they are validating the theory of evolution on a daily basis. Not true. If something

happens that is consistent with the theory, all well and good. If it doesn't happen, we will likely find a satisfying explanation within our prevailing worldview. I cannot call to mind a credible experiment that would challenge the theory of evolution.

Take the recent work on eye evolution by Prof Trevor Lamb of the Australian National University. For creationists, the origin of the eye is a flagship example of intelligent design (ID). It even worried Darwin. According to Lamb, "Darwin knew that his theory of natural selection would have difficulty in explaining the existence of an organ as specialised as the eye – unless a series of gradual changes could be proved" (*Australasian Science*, Jan/Feb 2008, p.6). Lamb argues that the lamprey's eye undergoes gradual change during its development from a primitive photoreceptor organ similar to the deep-sea hagfish's eye into a structure very similar to the human eye. Lamb's study supports Darwin's evolutionary theory, but it does not prove it. Finding "missing links" is not essential to Darwinism. In the meanwhile, creationists will no doubt ignore Lamb's analysis and cling to other examples of ID.

Before Darwin, the concept of speciation was simply beyond comprehension. The birth of new species, through the accumulation of sufficient genetic differences to reproductively isolate two populations of the same species, was unheard of. Even today, some thinking Christians can accept micro-evolution but balk at speciation, particularly when it comes to the origins of *Homo sapiens* and the "immortal soul".

The modern worldview of biology is far more revolutionary than the origin of species by natural selection. Even more startling have been changes in thinking about how genetic information is passed from one generation to the next. Cytology and chemistry combined forces to establish the theory that each cell arises from the division of a pre-existing cell. I could never understand why my biology teachers viewed the cell theory with such profound respect. Where else could a cell come from? It was only when I got into the minds of biologists before enunciation of the cell theory that I realised other options were indeed conceivable.

The cell theory allowed for novel concepts like cell differentiation during development. It made possible our appreciation that development and differentiation are determined by heritable infor-

mation cryptically encoded in a relatively simple molecule called DNA.

We now accept differentiation as a trivially obvious process, but the concept did not exist until recent centuries. A prior worldview, inadequate microscopy and robust imaginations produced the homunculus – a preformed human inside each sperm. The change from reproductive cells to adult was considered a process of growth, not differentiation. It is easy to appreciate the merits of an earlier abandoned worldview but it would be quite impossible to predict a future one.

Surprisingly, reversion to earlier worldviews can happen. Lysenko, with Stalin's endorsement, took Soviet agriculture back to vital forces, the inheritance of acquired characteristics and a belief that viruses, chromosomal inheritance, spirits and immortality were capitalist inventions. Evolutionists were ostracised, and some liquidated. Hundreds of PhDs were completed under Lysenkoism. Lysenko's worldview has been abandoned, but not before massive damage was done to Soviet society.

Although biologists are largely united in how we perceive some of these fundamental processes, such as change during individual development or changes between individuals and populations over time, other groups in the community still cling to earlier worldviews. In a crude way, the notion of the homunculus is alive and well with those who equate a fertilised egg to an adult human with all the rights that that entails. Much of the energy of the abortion debate is fuelled by differing worldviews on development through differentiation.

Again, it is not so much a matter of right or wrong, but more a case of what provides a helpful framework for explaining things of interest. For some like me it suffices to say, "As individuals we did not exist before our birth, and we will no longer exist after we die". For others that is not satisfying. They are more comfortable in subscribing to immortality.

It is postulated by some that the uncertainty of what lies beyond death fuels much religious conviction. Without trivialising the debate, it was my utter failure, as a social creature, to envisage a heaven where I would be content for moments, let alone eternity, that triggered my journey away from religion. We wouldn't be "us" without human companionship.

It's not surprising that many of the ethical debates we see today derive their energy from

dialogue between adherents holding differing worldviews. If we measure success in the debate in terms of participants shifting their viewpoints, or at least gaining a better appreciation of why others hold differing positions, often little is gained because we are speaking in different tongues. It is like two teams competing when one is following soccer rules and the other rugby. Real engagement is fleeting.

And so it is when we debate topics like the morality of contraception, abortion, euthanasia, stem cell research, genetically modified organisms, ID, or the reality of God, angels, devils or life after death. There certainly is merit in all of these topics being canvassed in a school environment. Many scientists would be hard pressed to talk intelligently on some of these deeper issues that really do impinge on our daily lives. The classroom is a good place to redress this deficiency.

And what about Dr Tillyard's encounter with spirits and mating fossil insects? He graduated in mathematics, oriental languages and theology at Cambridge in 1903. He sailed to Australia in 1904 to a teaching appointment at Sydney Grammar School as second mathematics and science master. In 1910 he resigned his teaching position to pursue biology as a career. Over the next 17 years, Dr Tillyard had a stellar career as an entomologist, naturalist and fossil expert, rising to be chief of CSIRO Entomology in 1927. In 1914 he was seriously injured in a train accident near Hornsby. Throughout life he suffered from chronic back pain and kidney stones. The remedy in those days was strong medication, usually based on opiates.

Many years later, John Evans returned to Boston with his wife, Faith, the second daughter of Robin Tillyard. They visited clairvoyant Margery Crandon's house and met the occupants who had purchased the house from the Crandons. On taking possession they found "electric wiring and bells in unusual places, and all sorts of other devices suggestive of trickery".

It is reasonable to suppose that a cocktail of pain relievers, a strong religious conviction and a touch of gullibility paved the way for journeys back in geological time to personally observe the mating behaviour of fossil insects, and to communicate with spirits like Walter. Possibly today, Robin Tillyard and Walter are conversing in heaven or texting each other between heaven and hell. But, somehow I think not.