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Evolutionary *metanoia*

If you never change your mind, why have one? - Edward de Bono

When I was a child, I spoke like a child, I thought like a child, I reasoned like a child; when I became an adult, I put an end to childish ways. - St. Paul (1 Cor. 13: 11)

Christianity is a religion of 'mind changing'. Jesus' opening words in Mark's Gospel were, 'Repent and believe (*metanoeite kai pisteuete*) the good news!' (Mark 1:13) Outside the New Testament, the semantic range of *metanoein* and its cognate noun, *metanoia*, encompasses all 'changes of mind', whether religious or not. Thus, for example, the words *metanoeite kai pisteuete* were used by Josephus the Jewish historian (a younger contemporary of St. Paul), in his capacity as an agent of the occupying Roman authorities, to persuade a rebel leader to abandon armed resistance and trust in Josephus' way of peaceful coexistence.

In this wider sense, scientific research entails continuous *metanoia*. When J. J. Thomson discovered the electron in 1897, he pictured it as a minuscule billiard ball. Subsequent work, including experiments by his son G. P. Thomson, showed that electrons sometimes behaved as waves. The 'father of the electron' had to change his mind about his own discovery quite dramatically. Thomas Kuhn's characterization of such scientific *metanoia* on the grand scale as 'paradigm shift' is well known, but little episodes of mind changing in the laboratory happen daily, triggered by new data and by the continual dialogue between researchers.

This is an autobiographical essay on how one scientist-Christian changed his mind about evolution. It is less a Newmanesque *Apologia* than an Augustinian *Confessions*, less of a justification of why I changed my mind, than an introspective reflection of the process of my Christian-cum-scientific *metanoia* about evolution.

Beginnings

When I was growing up in Hong Kong, neither of my parents were Christians. Nevertheless, they sent me to an Anglican secondary school, and before that, to its feeder primary school and kindergarten, because of their academic excellence. Christianity was a constant, but low-key presence throughout. In secondary school, we learnt the outline of the biblical narrative (Abraham to St. Paul) 'at face value', without ever discussing whether 'it was really so'. There were morning assemblies with hymns, prayers and short homilies. At Easter time, there would be an all-school sung service at St. John's, the Anglican cathedral. No one, staff or pupil, had to be a Christian. I certainly was not when I began secondary school, where I started my formal education in science. The curriculum for public examinations was largely 'classical': mechanics, heat, light and electricity (physics), reactions in test tubes (chemistry), and the physiology of the 'higher' plants and animals (biology), without any study of evolution.

I can't remember why I decided to get baptised and confirmed during my last year in Hong Kong. I think it was precipitated by my decision to move to America or Britain for further studies. Since both were apparently Christian countries, I seem to recall wondering (perhaps prompted by someone else) whether I accepted Christianity for myself or not. The precise conclusion I came to was long lost in the mist of time.

Looking back, I think it was more that Anglican worship had become meaningful to me after prolonged exposure, rather than that I thought Christianity was in some theoretical sense 'true'; and, somehow, I realised that if *this* stuff had become meaningful, it required an act of public commitment. I asked my scripture teacher that year, a practising Christian, what I should do. She pointed me to a baptism and confirmation class at the Cathedral, and later became my baptismal sponsor. Her baptismal gift to me, a copy of C. S. Lewis' *The Problem of Pain*, was prescient.

It turned out that a number of my classmates were already Christians, but they practised their faith outwith the orbit of 'school Anglicanism', which they suspected was mostly nominal. They initially did not quite know how to take the apparent sudden conversion of one of the academically brightest of their peers to the 'establishment' version of the faith. Eventually, one of them came to chat me up, and asked me to explain why I sought baptism. After browsing through some of the material I was given to read, I wrote a long essay in reply. It was clearly convincing – I was invited to join their fellowship meetings.

To survive, faith infants, like biological infants, bond instinctively to those who give them caring attention. While my faith was gestated in the *milieu* of school Anglicanism, it was this group of 'non-establishment' Christian classmates who proffered the hand of fellowship at the starting line. I joined them. So from day one, I was introduced to the idea of a 'church within the church': among the larger body of professing Christians, only few, an in-group, were the 'real McCoy'.

From the start, I knew it was *de rigueur* for ingroupers to sign up to having been 'born again' (John 3:3), and born-again Christians spoke as if they had direct lines to God: 'the Lord guided me to do this.' Matters of belief were settled by quoting chapter and verse, 'The Bible says so here.' Genre, context, plurality of voices, etc. were seldom, if ever, allowed to complicate the literal reading of isolated proof texts. I bought these 'group traits' lock, stock and barrel, although interestingly, I continued to worship on Sundays at the 'establishment' St. John's Cathedral.

Some psychologists suggest that the maturing human person passes through a number of predictable 'stages'. The American theologian James W. Fowler has built on this and constructed a phenomenology of the 'stages of faith', most famously in an eponymous 1981 book (from where all quotes are taken). In Fowler's scheme of seven stages (numbered 0-6), the first year of my Christian journey corresponded to stages 0 and 1. Stage 0, as already intimated, is when the (faith) infant instinctively bonds to its primal carers. Of those developing through Stage 1, Fowler says that '[they] can be powerfully and permanently influenced by examples, moods, actions and stories of the visible faith of primally related adults,' who were my fellowship group. I have indeed been 'powerfully and permanently influenced' by them.

First, I have learnt from them that the end of Christian discipleship is to seek and do God's will: 'Thy kingdom come, thy will be done on earth as it is in heaven.' Though I no longer claim that 'The Lord has guided me' to do this, that or the other on a day-to-day level, the conviction has grown over the same period that God has called me to a vocation in science. Secondly, I have learnt from these friends that scripture is authoritative. It took a while to understand that 'authority' did not abnegate the responsibility to interpret rightly. Nevertheless, scripture has remained authoritative

for me. Finally, and less helpfully, I was socialized into an in-group mentality, which took many years to shake off.

Toddling into creationism

I left for England in 1979 for two years of pre-university studies at a boarding school. I arrived 'ready-biased' against its formal religious apparatus – compulsory chapel run by two Anglican chaplains. So I went looking for an in-group, and found it in the home of a chemistry teacher, who ran an informal Christian union, whose members were also (mostly) born-again Christians guided quite directly by God in their daily actions. This kindly teacher introduced me to homemade thick-cut marmalade, the Isle of Mull, and Christian books, of which he had an attic-ful. Between the rafters of his house, I discover that I could actually *think* about my new-found faith, and started devouring Bible commentaries other theological writings.

At this school, I first encountered vocal opposition to my Christian faith, and was relieved to discover *Evidence that Demands a Verdict* by Josh McDowell in the attic. I was so impressed that I later bought my own copy. Re-reading the preface now for the first time in two decades, it is easy to see why I was impressed: 'The evidence proving the deity of the Lord Jesus Christ is overwhelmingly conclusive to any honest, objective seeker after truth.' Four hundred pages of just such apparently cast-iron evidence follow. I can imagine even now how I must have felt all those years go as I turned the last page: 'game, set, match, Christians'.

In the attic, I also discovered books advocating a 'biblical science' based on a literal reading of the first 11 chapters of the book of Genesis – creation in six 24-hour days and a subsequent global deluge. These books sent me to Genesis 1-11, which up till then I might never have read – my scripture education in Hong Kong had started with Genesis 12 (Abraham). Now, a problem and a solution presented themselves simultaneously. Problem: 6-day creation, which seemed certain to be ridiculed by unbelievers. Solution: creation science! I was instantly captivated, and soon convinced. I don't think my chemistry teacher ever made clear his own position, but neither did he dissuade me from my new-found conviction.

Fowler says of those journeying through Stage 2 that their 'beliefs are appropriated with literal interpretations' and that they 'will insist on demonstration or proof for claims of fact'. My fondness for McDowell and the rapidity with which I was won over by 'biblical science' fit the bill perfectly.

The adolescent creationist

Thus it was that I arrived at Cambridge to read natural sciences in 1981 a convinced 6-day young-earth creationist. I already knew where to find the in-group: the Cambridge Inter-collegiate Christian Union (CICCU, pronounced 'kick-you'), of which I immediately became a member, and later, in my final year, its Bible study secretary. As at school, I combined in-group and 'establishment', attending regular services at college chapel.

I learnt much from my time with CICCU. In particular, its weekly 'Bible readings', where an invited speaker expounded a passage of scripture for an hour, were of very

high quality and theologically mostly mainstream. Nevertheless, CICCU was certainly an in-group. Members and invited speakers had (and have) to sign a 'doctrinal basis'. The basic substance of its 11 clauses is unexceptional in the context of traditional Christian belief. However, in the black-and-white manner in which some of the points are stated and the exclusive tone of some of the claims render it unpalatable to many in mainstream churches. For this essay, clause 3 is worth quoting in full: 'The divine inspiration and infallibility of Holy Scripture as originally given, and its supreme authority in all matters of faith and conduct.' The precise meaning of 'infallibility' caused much internal debate, but as far as I was concerned, a literal interpretation of Genesis 1-11 simplified matters. I was pleased to discover other creationists within CICCU. We formed a sort of 'in-group within the in-group' who prided ourselves on taking clause 3 more seriously than the others.

My creationist reading during these undergraduate years concentrated on the physical implications of interpreting Genesis 1-11 literally. What would be the consequences for paleoclimatology of a 'canopy' (or shell) of water (vapour) around the pre-diluvian earth? This constitutes the 'waters above the firmament' of Genesis 1:7, which rained down in the Noahic flood. Would the dead bodies of the animals and plants destroyed in a violent flood sediment out as the waters receded to generate something like the observed fossil column? Two 500-page technically-worded tomes on such matters survive on my shelves, compared to two slim, popular creationist critiques of biological evolution.

Through such reading, I extended the range of coverage of 'biblical science', collecting more and more phenomena that allegedly could be fitted into a literal reading of Genesis 1-11. I did little to work out for myself whether any of these 'fits' actually stood up to proper scrutiny. I was largely incapable of making such judgements at this stage in any case, partly because of a lack of specialist knowledge, but mostly because I had no idea how to go about making such judgements. My on-going advanced education in physics did not train me to evaluate rival scientific claims, since we were only supposed to be fed the truth, which was our task to assimilate. So I learnt creationism mostly by simply trusting what I was told by the PhD-qualified authors of the books I was reading.

Fowler's Stage 3, which biologically often emerges in the teenage years, represents the adolescence of faith. Adolescence is when youths search for and create personal identities, as they begin to form increasingly accurate impressions of how they look in other people's eyes: 'I see you seeing me/I see the me I think you see' (Fowler's couplet). Peers who function as such 'mirrors' for the formation of self become 'chums'. Although the adolescent may feel otherwise, the locus of authority at this stage is external, and resides in the 'significant others' in whose eyes the teenager sees reflections of himself or herself, or 'in the certified incumbents of leadership roles in institutions'. Importantly, the adolescent begins to form a 'personal myth', or metanarrative – a 'master story' of the stories of his or her past, and learns 'to project the forming myth of self into future roles and relationships.'

After having Stages 0-2 compressed into three short years, my faith started to catch up with my biology at Cambridge. Biologically, I was a late teenager when I arrived. Here, parts of my faith development moved into Fowler's adolescent Stage 3. Most importantly, I was beginning to construct a 'story of stories' about my own Christian

journey. I had been quite sure from the start that my scientific vocation was God-given. But the question was why. Science wasn't exactly on the normal menu of 'Christian callings' amongst any of my in-groups so far, who tended to think of 'vocation' in terms of ordination or missionary work, or failing that, medicine. Now an answer began to emerge: God had led me to a top university for professional training so that I could be a creation science champion! The 'story so far' fitted neatly into this scheme, which also gave me a strong sense of where I was going.

This 'faith self' emerged partly in the mirror of other CICCU creationist 'chums'. I did not know them well socially, but our 'chumship' (Fowler's term) was expressed in public meetings, where we stuck together to argue with speakers (such as the editor of the present volume) who advocated non-literal interpretations of Genesis 1-11. Interestingly, mainstream CICCU members who were not creationists also fulfilled an important 'mirror' function for me as I imagined how they saw me. I seem to remember a creationist 'chum' putting it like this, 'When they see someone as bright as you believing it, it should make them think again.' This I saw as the duty and privilege of 'witnessing', and sought to convert others to this position. Finally, as already noted, the locus of authority for my creationism remained firmly external.

These aspects of my faith fit into Fowler's Stage 3; other aspects remained firmly in Fowler's 'mythic-literal' Stage 2. For a start, I was a keen member of an organisation whose 'doctrinal basis' was couched in the kind of black-and-white language that is a Stage 2 trait. Moreover, Fowler suggests that transition from Stage 2 to 3 is often precipitated by facing up to 'conflicts between authoritative stories', quoting as example 'Genesis on creation versus evolutionary theory'. I certainly perceived this conflict, but did not face up to it, and remained stuck in literalism, another Stage 2 trait. Fondness for literalism is correlated with a third Stage 2 trait, the '[insistence] on demonstration or proof'. I needed some clear-cut thing I could point to and say, 'There, that's why I believe in God.' To my mind, science was the source of definitive proofs. So, if creation science was valid, then I've found something for which 'God' was the only incontrovertible explanation. This was classic McDowell, but only better (because 'scientific'). It was 'game, set, match, Christians' again.

Not dealing with a perceived conflict like 'creation/evolution' meant living with painful 'cognitive dissonance', which the educationalist John M. Hull has reflected on extensively in his exploration of the question 'What prevents Christian adults from learning?' in an eponymous book. Four strategies are particularly interesting: separation, ideological compensation and hardening, and evangelism. I counted myself part of an 'in-group' who had separated out from mainstream CICCU to keep alive an uncompromising 'biblical faith'. Such an in-group compensates for the pain of cognitive dissonance by identifying itself as God's elect, comforting themselves that the elect has always been a minority, or 'remnant'. Under ideological hardening, 'more and more ideas are firmly lodged within the authoritative constellation'. How my reading continually extended the range of coverage of 'biblical science' has already been noted. Finally, Hull suggests that these three strategies 'may become the preparatory step toward a more aggressive form of cognitive dissonance reduction, namely, mission and evangelism.' Again, as noted already, I had a strong sense of being a 'witness' for creationism during this period. Thus, I graduated with a degree in physics and theoretical physics with all four cylinders of cognitive dissonance reduction firing: it was costly being a creationist!

Jonah's gourd

At the end of the book of Jonah, we read about a bush (translated as a 'gourd' in the KJV) that miraculously 'came into being in a night and perished in a night'. My creationism was like Jonah's gourd – it started more or less overnight when I found those books in my chemistry teacher's attic, and then it faded about as fast soon after I started my PhD: I was no longer a creationist by my second year. Why? Looking back, it is clear that I was a creationist not because I was particularly convinced by one or more creationist claims. I swallowed creationism whole when I first encountered it mainly because it made immediate sense in a particular kind of in-group environment. When that environment disappeared, creationism withered.

I had belonged to in-groups from the beginning in Hong Kong until the end of my undergraduate studies. The in-group that nurtured me through Stage 0 of my faith drew me into a literal, context-free hermeneutic – 'the Bible says so,' and taught me to expect direct divine agency – 'the Lord guided me to do this.' Fowler suggests that the 'pre-images of God' formed at this stage exercise powerful, because largely subconscious, influence on later faith development. I looked for, and found, an in-group at boarding school in England that continued to offer me a practically identical faith environment to the one in Hong Kong, but also introduced me to an apologetics of 'overwhelmingly conclusive evidence'. When the seed of creationism was planted in this context, the gourd came up overnight!

CICCU offered basically the same in-group environment again, but also a context in which I and other creationists could feel that we were doing 'just a little better' than the wider in-group in upholding scriptural authority. I needed these layers of ingroupiness (amazingly, this word *is* in the Oxford English Dictionary!) to feel safe in a faith whose validity was still based largely on external loci of authority and black-and-white proofs. On the other hand, creationism, which exacted a high price in cognitive dissonance, needed ingroupiness to survive.

This symbiotic complex imploded when I stopped belonging to in-groups. CICCU was essentially an undergraduate organisation, and I simply dropped out of it after graduation. I could have kept up the ingroupiness, however, had I continued to attend the city-centre church of my undergraduate days, where the majority of term-time worshippers, the curate and the vicar, and many visiting preachers were current or past CICCU members. Soon after the start of my PhD, however, I moved to St. Barnabas, the church attended by a close friend of mine. The congregation 'St. B's' at that time were mostly 'normal townies'.

Interestingly, I had always attended non-in-group congregations like St. B's – St. John's Cathedral in Hong Kong, and chapel at boarding school and college. But in each past instance, I also belonged to an in-group who partly defined itself against precisely such 'others'. Now I kicked the in-group habit for good, and threw myself into the life of a congregation who were secure enough in their own faith that they did not need to define themselves against any 'others'. This is one of the characteristics of Fowler's Stage 4, when 'the self … now claims an identity no longer defined by the composite of one's … meaning to others.'

No longer protected by an in-group where a narrow understanding of divine agency was bolstered by a particular kind of literal biblicism, the gourd of creationism practically withered overnight. There was no renunciation ceremony at which I embraced evolution. I only learnt evolutionary science much later. For now, creationism simply ceased to matter to me, and it was quietly dropped, without anything immediate to replace it with. I simply got on with enjoying the new-found freedom of a non-in-group faith existence: no more thought policing, of myself, of others, and by others. The four cylinders of cognitive dissonance reduction can at last stop firing.

The vicar of St. B's, Douglas Holt, became my mentor *extraordinaire*. He drew me into philosophy, i.e. thinking about thinking, which started a long road of exploration into the philosophy (and in parallel, the history) of science. Both explicitly and by the example of his preaching, Douglas also insisted that I thought about the meaning of 'meaning' (i.e., hermeneutics), an exploration that I had already begun when I was CICCU Bible study secretary. Most importantly, Douglas helped me formulate a theology of creation, which became the theological replacement of my former creationism. This led to a more adequate theology of scientific vocation. With Douglas' help, I realised that, wonderfully, the Christian gospel promised the redemption of *the whole of creation.* Ephesians 1:10 says this prosaically, while Revelation 21:24 gives a pictorial version. In his vision of the heavenly city, St. John saw that 'the kings of the earth will bring their glory into it.' Given clues from the rest of Scripture (especially Isaiah 60-66), I came to understand this as saying that *all* that was good and true and honourable in human culture would be transformed and gathered into the new creation to add to its splendour. For a faithful Creator, this must include all good science (as well as Schubert's Impromptus, thick-cut marmalade, Mull, and a lot more). A vocation in science does not need to mean championing 'creation science'.

The end of my PhD coincided with a painful and turbulent period in my personal relationships: God felt very distant, even absent all together. I thought and read a lot about 'the problem of suffering' (back to the baptismal gift from my Hong Kong scripture teacher!). The cross took on a new depth of meaning. It assured me of God's presence with me in my pain. It took a decade, until well after I started lecturing in Edinburgh University, for me to realise that these experiences had broader implications. I came to see how hankering after 'overwhelmingly conclusive proofs' for God's presence in the world, which was one of the main motivations for my brush with creationism, was wide off the mark. If the Jewish malefactor crucified on a Roman gibbet was the only-begotten son of the creator and sustainer of the universe, then this God is unlikely to have made a universe in which explicit reference to Godself is needed at every explanatory juncture. Indeed, as Julian of Norwich so movingly portrayed in her fourth vision, the Creator giving independent existence to any creature, even a hazel nut, represents an act of divine self emptying. Thus, we may expect an enterprise like modern science to succeed, i.e. humans should be able to give naturalistic explanations of the universe *without* constant recourse to divine agency, if the creator is none other than the God and Father of our Lord Jesus Christ. Much later, someone pointed me to the poetry of R. S. Thomas, which poignantly explores this theme in the context of modern science.

The light of evolution and the weight of evidence

It took 10 years for a theological replacement for creationism to emerge; it took just as long to start sorting out the science. I was woefully ignorant of biology in general, and of evolution in particular, when I started as a lecturer in Edinburgh University in 1990. Soon afterwards, I starting researching 'complex fluids', liquids containing 'mesoscopic' – 'middle-sized' – components such as colloidal particles and long-chain molecules (polymers). Life is 'complex fluids come alive'; so I got seriously interested in biology for the first time in my professional career.

One of the first problems I tackled was protein crystallization. Molecular biologists need to crystallize proteins (a very special kind of polymer) to solve their structures using X ray diffraction. While it had long been known that most proteins crystallize only reluctantly, no one seemed to have asked why. With a colleague in 2004, we realised that proteins had probably evolved to be difficult to crystallize, since the conditions *in vivo* were precisely those that, at first sight, should be quite favourable for crystallization, but crystallization *in vivo* would almost always mean trouble. This was the first time that I had engaged in evolutionary reasoning, and it got me interested in evolution in a big way, so much so that 10 years later, I now find myself studying the evolution of bacterial resistance to antimicrobial agents. In this process, I have learnt two important things.

First, I now understand Dobzhansky's aphorism, 'Nothing in biology makes sense except in the light of evolution.' The answer to practically every 'Why?' question I have asked myself about biology is 'because it has evolved that way by natural selection.' Secondly, evolution gives biology a different texture to physics. In physics, a 'smoking gun' reading of progress is often plausible. Newton predicts that the sun's gravitational field shifts apparent stellar positions by half of what Einstein predicts. Eddington saw the larger value; *ergo*, Einstein one, Newton nil. Historians of science dispute the details of this simplistic account, but its flavour is recognizable to all physicists – we like smoking guns. Making the case for evolution is different, as Darwin's *Origins* amply illustrates. It is more like prosecuting a case where there was no smoking gun, and perhaps even the body was missing. The case ultimately convinces not because of a single knock-down argument, but because of the weight of accumulated evidence. If my formal scientific education had schooled me in evolutionary reasoning, I would have understood both of these things, and might not have succumbed quite so easily to creationism.

Putting an end to childish ways

Such was my journey in and out of creationism, which I have interpreted using Fowler's 'stages of faith'. For Fowler, faith, with a small 'f', is the fundamental human quest for meaning, which develops from birth through predictable stages, though the later stages may become delayed or stunted. This framework is most straightforwardly applied to persons born into (say) Christian homes. Towards the end of *Stages of Faith*, Fowler discusses the interesting, and pertinent, complications that arise with conversion, e.g. when someone with no overt religious beliefs is converted later in life to one of the Faiths such as Christianity. Now, growth in Faith with a big 'F' (my terminology) intrudes into a quest for meaning in a different faith (small 'f') system (say, secularism) that has been on-going since birth.

Fowler describes six conversion scenarios; the sixth applies to me best: 'conversional change that blocks or helps one avoid … faith stage changes.' When I left Hong Kong at the age of 17, I was probably in Stage 3 faith (small 'f') in terms of my overall development, and was poised to move into the young adult Stage 4. Beginning my Christian journey the way I did and meeting creationism at the time that I did caused regression in some respects to Stage 2, and got me stuck straddling Stages 2 and 3 for a decade. I only started moving again after I became a member of St. Barnabas, when I was nearly 30. Creationism, and the ingroupiness that it fed off, led to a serious delay in 'putting an end to childish ways.'

Most of my musings in this chapter have been on the religious aspects of my journey; but in so far as science is a system of meaning, it is also a 'faith system' in Fowler's sense. A conventional degree education in physics seems to leave the apprentice scientist *qua* scientist somewhere in Stage 2. That was one of the reasons why my *metanoia* about creationism was so late in coming. My observation is that training in biology, which seems to rely less on a black-and-white 'one proof per theory' mentality ('smoking gun'), does better – many biologists graduate as Stage 3 scientists. Interestingly, much of the polemics launched on behalf of science against Christianity and other religious Faiths seem to me to have come from secularists whose faith straddles Stages 2 and 3, with the most vocal rants betraying an infantile rage from even earlier Stages.

Our science education system, with its almost complete neglect of the philosophy of science, does almost nothing to help scientists make the transition into Stage 4, which involves critical reflection of one's faith system in the light of other systems. Lord May, in his valedictory address when he retired as President of the Royal Society, named fundamentalism as one of the main 'threats to tomorrow's world' (the title of his address). Creationism is part of this threat. Educators who want to play a part in dealing with this threat need urgently to attend to the 'faith development' of scientists; but that is another story.