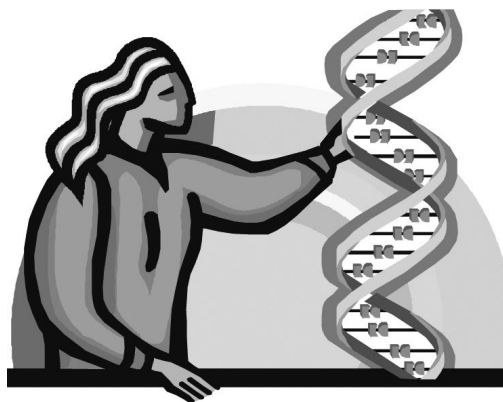


more aware of what is happening at the Christianity/science interface and present alternative viewpoints. Perhaps the proponents of ID themselves need to be extra vigilant in providing a fair summary of different ideas in their articles.

Given the nature of the problem, none of these potential solutions is likely to occur to a great extent, nor is it fair to hold the involved parties responsible to fix the problem (except, perhaps, the editors). Ultimately, it is incumbent on those of us who do have exposure to a broad range of ideas to keep reading, writing, and talking about all the options. For the time being, this vigorous discussion may have to occur only in more specialized venues. However, over time, the best model will slowly emerge, and once generally accepted by our community, it will come to the attention of the broader Christian community. ❁

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## Creation Versus Creationism

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**M**any religious people think that evolutionary science and Christian faith are enemies. In the USA, they expend energy, time, and good will by attacking the teaching of evolution in schools. Recent battles have raged in Louisiana, Kansas, and Ohio.<sup>1</sup>

The issue simmers in New Zealand, too. The *NZ Listener* (in 1995) commented that “God and Darwin are still battling it out in New Zealand schools” and (in 2000) that “the teaching of evolution remains under siege from Creationists.”<sup>2</sup>

We are Christians who work in the sciences, and regard this controversy as a tragedy. We are committed both to the scientific enterprise (including evolutionary science) and to the Good News that God has revealed himself as a person, Jesus of Nazareth. The issue is resolvable by accepting two considerations:

1. We are an evolved species. Unprecedented developments in genetics show beyond reasonable doubt that we and other primates are the descendants of common ancestors. Just as DNA is used in courts to establish paternity, or to identify people involved with crimes, so particular features of DNA sequences establish evolutionary relatedness.
2. The science of evolution and the theology of creation differ in their vocabularies, subject matter, and concerns. Evolutionary science and the biblical concept of creation (regardless of whether someone believes in it) should be seen to address different aspects of human experience. They are not mutually exclusive.

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Today we are witnessing momentous scientific developments. An international consortium has determined the order of (most of) the 3 billion DNA bases (chemical units of information) that comprise the chimpanzee genome. Comparison of the base sequences of chimp and human DNA shows that they are very similar. This indicates that humans should be classified as a species of ape. Our closest relatives (in order) are chimps, gorillas, and orangutans. The differences between chimp and human genetic sequences reflect natural genetic processes. Bases have been changed, and segments of DNA rearranged.

Genetic history is inscribed in DNA sequences. Our DNA sequence includes thousands of derelict genes. These are either ancient relics of once-active genes, or randomly generated copies of genes.<sup>3</sup> It is extraordinary to view large segments of chimp and human DNA, aligned side-by-side, and see the same sequence of genes and derelict genes. Both species are products of the one lineage in which these scrambled genes were generated.<sup>4</sup> Fascinating examples are known. Most mammals make their own ascorbic acid (vitamin C), but higher primates like us need ascorbic acid in their diet. This is because a gene required to make ascorbic acid became inactivated in an ancestor of the higher primates. Chimps, humans (and other higher primates) retain in their DNA derelict copies of this gene.<sup>5</sup>

Most mammals wage war and make love in response to chemical signals (pheromones) that they detect with the vomeronasal organ. But Old World primates (including chimps and humans) lack this structure. The gene for a key signaling protein is defunct, although still present in our DNA (and containing the original inactivating mutation). Pheromone-sensing receptor proteins cannot now signal, and their genes (about 100 of them) have fallen into disrepair.<sup>6</sup>

We have 1,000 "olfactory receptor" genes that encode proteins needed for our sense of smell. About 600 of these can no longer make functional proteins, and many are defunct also in chimps, gorillas, and orangutans—and have the same inactivating mutations in each species. Such mutations occurred in an ancestor of all the species that currently own (by inheritance) the common mutation.<sup>7</sup> Similarly, humans and chimps have 33 genes that make proteins used to sense bitter taste. Some of these genes are derelicts (with the same inactivating mutations) in both humans and chimps, scrambled in a common ancestor.<sup>8</sup>

What compensates for our loss of pheromone and olfactory sensitivity? New World primates have 2-color vision, but Old World primates (including humans) have 3-color vision. This arose when a segment of DNA containing one of the original visual pigment genes was duplicated. Old World primates inherited the same duplicated gene from the one ancestor in which the unique copy-and-paste event happened.<sup>9</sup> Copying-and-pasting has repeatedly produced new genes. Primate genes that control the

immune system<sup>10</sup> and sexual function<sup>11</sup> have arisen by multiple cycles of DNA duplication. Many copied-and-pasted DNA segments occur on the X- and Y- (sex) chromosomes, and have been inherited by humans, chimps, and gorillas. Large-scale changes to DNA continue. Humans differ from chimps by about 200 large duplicated or deleted segments. Any two humans differ by some ten large duplications or deletions of up to 400,000 bases.<sup>12</sup>

We and other primates have emergency patches on our DNA, marking sites where radiation once caused DNA breaks. Many patches are common to chimps and humans. Our DNA has the scars of radiation damage that occurred in reproductive cells of long-extinct ancestors.<sup>13</sup>

Chimps and humans are related genetically. This indicates that we are the products of a common lineage. We marvel in these scientific discoveries, and affirm our conviction that the discoveries of science reveal the work of God.

We regret the efforts of religious groups that seek to debunk evolution. We regret the wastage of resources and good will arising from ongoing confrontations. We fear for generations of children whose minds are being turned against science by anti-"evolution" indoctrination. Does acceptance of human evolution consign the book of *Genesis* to the rubbish bin? We affirm fervently that the *Bible* is our authority in all matters of faith and conduct. But we do urge that it be read responsibly.

The *Bible* describes how God has revealed himself in the history of Israel and supremely in a person called Jesus. It shows us our significance, our responsibilities, and the possibility of a relationship with the Maker of heaven and earth. The early chapters of *Genesis* do not address scientific questions. They are concerned with something more fundamental than science. They introduce in richly figurative language the magnificence of Israel's God.

The *Genesis* creation story has a carefully crafted, semi-poetic structure. It is rich in symbolism and in allusion to religious concepts current in the ancient world. It sets out to undermine the assumptions upon which the religions of Israel's neighbors were based. Its meaning is strikingly illuminated by the socio-religious context in which it was written.<sup>14</sup> Israel was surrounded by mighty empires that worshiped crowds of gods. Israel was almost alone in the ancient world in its vision of a God who was all-powerful, rational, consistent, righteous, faithful, and good. The gods of the ancient empires were nothing like this. As C. S. Lewis said, "'gods' is not the plural of 'God.'"<sup>15</sup>

*Genesis* does not set out to present the age of the universe, the definition of "species," or the biological origins of humanity. But *Genesis* presents a God who makes science possible. Science took root in Europe because the

early scientists recognized the character of God as the guarantee that nature was lawful, intelligible, and consistent.<sup>16</sup> What the Bible says about creation was vital for the development of science.

Remarkably, people at the extreme poles of the science-religion debate are united in their insistence that “evolution” and “creation” are competing concepts. To bedmates like Richard Dawkins and biblical literalists, you have to believe one or the other. This “either-or” dichotomy shows a lack of understanding about what these words mean. Evolution is a process. The concept of creation (wherever or not you believe it) refers to an act of an agent, God.<sup>17</sup> The concerns of evolutionary science are impersonal (interactions between organisms and environment). The concerns of creation are personal (relationships between God and his creatures, and God’s intentions for his world). The language of evolution is about genes, duplications, and base substitutions. The language of creation is about value, purpose, and destiny.

So we reject the claims of Dawkins and biblical literalists that “evolution” and “creation” are mutually exclusive terms. “Evolution” describes dynamic change within the created order. “Evolution” is an aspect of “creation.”<sup>18</sup>

Christians who oppose evolution regard themselves as a part of creation. They accept that they came to exist by the biological processes of conception, birth, and growth, and that God uses his biological processes to create them. Could they not accept that God used another of his biological processes to create their species? When thinking about the astonishing processes involved in the development of the foetus, we can only concur with the author of Ps. 139:13, 14, “You created every part of me ... I praise you.” The same sense of wonder and worship arises from the astonishing biological processes by which our species developed.

Given that human DNA is so similar to that of the chimps, is our status any different from that of other animals? People at both extremes of the debate argue that an evolutionary past denies current value to humanity. *Genesis* does not give the mechanism by which we got here. It simply describes our physical substance as “earth” and ascribes our being to the work of God. It gives our status as creatures in the “image of God.” “Image” means that we should reflect what God is and does.<sup>19</sup> The concept refers not to biological properties but to personal response to God.

The geneticist Ajit Varki has said that genes alone cannot explain the human brain. The human brain owes many of its sophisticated abilities to an intimate synergy between nature (genes) and nurture (environment). The human mind will ultimately be explained only as “Nature via Nurture.”<sup>20</sup> We are human not only because of our genes, which provide the necessary biological framework

for our humanity. We are human also because of our nurture. The Christian believes that vital to this nurture is the call and care of God, who has shown us his goodness, justice, and liberating love. ❁

### Acknowledgment

We are grateful for helpful comments from *Paul Wraight* PhD who lectured in physics at the University of Aberdeen.

### Notes

<sup>1</sup>For comment by scientists, see E. C. Scott and G. Branch, “Evolution: What’s Wrong with ‘teaching the Controversy,’” *Trends in Ecology and Evolution* 18 (2003): 499; R. T. Pennock, “Creationism and Intelligent Design,” *Annual Review of Genomics and Human Genetics* 4 (2004): 143.

<sup>2</sup>NZ Listener July 1–7, 1995, p.42; April 22–28, 2000, p.16.

<sup>3</sup>Z. L. Zhang and M. Gerstein, “Large-Scale Analysis of Pseudogenes in the Human Genome,” *Current Opinion in Genetics and Development* 14 (2004): 328. For an analysis of recently arising pseudogenes, see the update on the human genome: International Human Genome Sequencing Consortium, “Finishing the Euchromatic Sequence of the Human Genome,” *Nature* 431 (2004): 931.

<sup>4</sup>In a genetic region concerned with immunity (1.9 million bases) chimps have 41 genes and 59 scrambled genes, almost the same as humans. The main difference is that a stretch of 95,000 bases has been deleted from chimp DNA. This resulted in the loss of one gene and three scrambled genes that remain in human DNA. Sequencing work on chromosome 21 has ordered 33 million bases. Essentially the same set of genes and fossil genes is found in chimp and human DNA. In many cases, the fossil genes are the same length in the two species. They have hardly changed since the species diverged. See T. Anzai, T. Shiina, N. Kimura, et al., “Comparative Sequencing of Human and Chimpanzee MHC Class I Regions Unveils Insertions/Deletions as the Major Path to Genomic Divergence,” *Proceedings of the National Academy of Science of the USA* 100 (2003): 708; The International Chimpanzee Chromosome 22 Consortium, “DNA Sequence and Comparative Analysis of Chimpanzee Chromosome 22,” *Nature* 429 (2004): 382.

<sup>5</sup>Y. Inai, Y. Ohta and M. Nishikimi, “The Whole Structure of the Human Nonfunctional L-Gulonon- $\gamma$ -Lactone Oxidase Gene—The Gene Responsible for Scurvy—and the Evolution of Repetitive Sequences Thereon,” *Journal of Nutritional Science and Vitaminology* 49 (2003): 315.

<sup>6</sup>E. R. Liman and H. Innan, “Relaxed Selective Pressure on an Essential Component of Pheromone Transduction in Primate Evolution,” *Proceedings of the National Academy of Science of the USA* 100 (2003): 3328; J. Zhang and D. M. Webb, “Evolutionary Deterioration of the Vomeronasal Pheromone Transduction Pathway in Catarrhine Primates,” *Proceedings of the National Academy of Science of the USA* 100 (2003): 8337.

<sup>7</sup>Y. Gilad, O. Man, S. Paabo, and D. Lancet, “Human Specific Loss of Olfactory Receptor Genes,” *Proceedings of the National Academy of Science of the USA* 100 (2003): 3324; Y. Gilad, V. Wiebe, M. Przeworski, et al., “Loss of Olfactory Receptor Genes Coincides with the Acquisition of Full Trichromatic Vision in Primates,” *PLoS Biol* 2 (2004): 120.

<sup>8</sup>C. M. Parry, A. Erkner, and J. le Coutre, “Divergence of T2R Chemoreceptor Receptor Families in Humans, Bonobos, and Chimpanzees,” *Proceedings of the National Academy of Science of the USA* 101 (2004): 14830.

<sup>9</sup>K. S. Dulai, M. von Dornum, J. D. Mollon, and D. M. Hunt, “The Evolution of Trichromatic Color Vision by Opsin Gene Duplication in New World and Old World Primates,” *Genome Res* 9 (1999): 629. And the process of duplicating (and deleting) opsin genes on the X chromosome continues, as evidenced by the abnormal patterns that are found in cases of color blindness. See H. Ueyama, R. Torii,

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S. Tanabe, et al., "An Insertion/Deletion *TEX28* Polymorphism and Its Application to Analysis of Red/Green Visual Pigment Gene Arrays," *Journal of Human Genetics* 49 (2004): 548.

<sup>10</sup>T. Shiina, G. Tamiya, A. Oka, et al., "Molecular Dynamics of MHC Genesis Unraveled by Sequence Analysis of the 1,796,938-bp HLA Class I Region," *Proceedings of the National Academy of Science of the USA* 96 (1999): 13282; H. Sawai, Y. Kawamoto, N. Takahata, and Y. Satta, "Evolutionary Relationships of Major Histocompatibility Complex Class I Genes in Simian Primates," *Genetics* 166 (2004): 1897; J. K. Kulski, T. Anzai, T. Shiina, and H. Inoko, "Rhesus Macaque Class I Duplication Structures, Organization, and Evolution within the Alpha Block of the Major Histocompatibility Complex," *Molecular Biology and Evolution* 21 (2004): 2079.

<sup>11</sup>These duplications have a structure in which the copied segment faces the opposite direction from the original segment, and is separated from it by a spacer segment. S. Rozen, H. Skaletsky, J. D. Marszalek, et al., "Abundant Gene Conversion Between Arms of Palindromes in Human and Ape Y Chromosomes," *Nature* 423 (2003): 873; P. E. Warburton, J. Giordano, F. Cheung, et al., "Inverted Repeat Structure of the Human Genome: the X-chromosome Contains a Preponderance of Large, Highly Homologous Inverted Repeats That Contain Testes Genes," *Genome Research* 14 (2004): 1861.

<sup>12</sup>A. Fortna, Y. Kim, E. Maclaren, et al., "Lineage-Specific Gene Duplication and Loss in Human and Great Ape Evolution," *PLoS Biology* 2 (2004): 937; J. Sebat, B. Lakshmi, J. Troge, et al., "Large-Scale Copy Number Polymorphism in the Human Genome," *Science* 305 (2004): 525; A. J. Iafrate, L. Feuk, M. N. Rivera, et al., "Detection of Large-Scale Variation in the Human Genome," *Nature Genetics* 36 (2004): 949.

<sup>13</sup>The patches in our DNA can be identified as interstitial telomeric repeats, (TTAGGG)<sub>n</sub> possibly put in place by telomerase, and as nuclear mitochondrial pseudogenes. See S. G. Nergadze, M. Rocchi, C. M. Azzalin, et al., "Insertion of Telomeric Repeats at Intrachromosomal Break Sites during Primate Evolution," *Genome Res* 14 (2004): 1704; M. Richetti, F. Tekaiia, B. and Dujon, "Continued colonization of the Human Genome by Mitochondrial DNA," *PLoS Biology* 2 (2004) 1313.

<sup>14</sup>J. Drane, *Old Testament Faith* (Tring: Lion, 1986), 62f; E. Lucas, *Genesis Today* (London: Stirling University, 1989), 89f; A. König, *New and Greater Things* (Pretoria: UNISA, 1988), 9f. The authors were respectively, Lecturer in Religious Studies, Stirling University; research chemist-(University of Oxford)-turned-theologian; and Professor of Theology, University of South Africa.

The genre of the Genesis creation stories is very different from that of the New Testament records that describe the life of Jesus. The New Testament authors emphasized that what they wrote about Jesus—his life, death, and resurrection—was based on direct observation. Paul did not allow that his message could be taken figuratively (1 Cor. 15:1-8); Luke stressed that he wrote as an investigative historian (Luke 1:1-4; Acts 1:1-2) and John, although considered the most "spiritual" of the Gospel writers, emphasized his reliability as an eyewitness (John 19:35; 1 John 1:1-3). The "second generation" believers made it clear that they understood the Good News as describing history (John 21:24; Heb. 2:3). That the earliest Christian preaching about Jesus was to be taken in concrete historical terms was made plain by reports of Roman (Tacitus), Jewish (Josephus, Talmudic writings) and early Church (Ignatius, Clement) writers. See P. Barnett, *Is the New Testament History?* (London: Hodder and Stoughton, 1986); E. M. Blaiklock, *Who Was Jesus?* (Chicago: Moody Press, 1974); F. F. Bruce, *Jesus and Christian Origins Outside the New Testament* (London: Hodder and Stoughton, 1974); M. Staniforth, trans., *Early Christian Writings* (Harmondsworth: Penguin, 1968).

<sup>15</sup>C. S. Lewis, *Reflections on the Psalms* (Glasgow: Collins, 1961), chap. 8.

<sup>16</sup>H. Turner, *The Roots of Science* (Auckland: DeepSight Trust, 1998).

<sup>17</sup>M. Poole, *Science and Belief* (Oxford: Lion, 1990), 110.

<sup>18</sup>A debate between Dawkins and a science educationalist is hugely instructive for understanding the issues. See M. Poole, "A Critique of Aspects of the Philosophy and Theology of Richard Dawkins,"

*Science and Christian Belief* 6 (1994): 41; with the replies in the same journal, vol. 7, pp. 45, 51. Dawkins insists that "I pay religions the compliment of regarding them as scientific theories ... I see God as a competing explanation for facts about the universe and life." Dawkins and Creationists see "God" and "evolution" as competing explanations. This is as illogical as seeing "God" an alternative to "star formation," "plate tectonic movement," "pollination," "fruit set," or "cell division."

<sup>19</sup>J. I. Packer, "Reflected Glory," *Christianity Today* 47 (2003): 56. "Image" means "representative likeness." This requires that, like God, "we should always act with resourceful rationality and wise love, making and executing praiseworthy plans ..." We should generate value by producing what is truly good. "We should be showing love and goodwill towards all other persons ... And in fellowship with God, we should directly honor and obey him by the way we manage and care for that bit of the created order that he has given us to look after."

<sup>20</sup>A. Varki, "How to Make an Ape Brain," *Nature Genetics* 36 (2004): 1034.

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