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Scientific Fraud and Christian Ethics

Fraud in science, though not common, is sufficiently widespread for governments to react. Examples of fraud are given, including the Piltdown skull, the work of Moewus on the genetics of algae and recent deceptions by biological scientists. Manipulation of statistical data, if not outright fraud, was practised by Mendel, the father of modern genetics, also by Sir Cyril Burt in his study of the heritability of intelligence. The motivation of such deceivers is considered and a Christian response to the problem is offered.

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Fraud—an intentional perversion of truth for the purpose of inducing another to part with some valuable thing. How common is that among scientists? Most of us are guilty of minor distortions of the truth. 'A typical result is shown in the Figure above', we write, when in fact it was the best result we ever got. But real scientific fraud has come of age. The United States National Institute of Health now has an Office of Scientific Integrity. Congress modified the Public Health Service Act in 1986 by the addition of Section 493, which says that any organisation applying for a grant to do biomedical research must establish a process to review reports of fraud within its rank.¹ The British Parliament is also aware of the problem. In the 1950s a motion was tabled in the Commons 'That the House has no confidence in the Trustees of the British Museum . . . because of the tardiness of their discovery that the skull of Piltdown man is a partial fake'. The testing of potential new drugs provides opportunities for making exaggerated claims or suppressing data on undesirable side effects. Fraud of this sort by pharmaceutical companies is common enough to require inspection and monitoring by government agencies. In this country for instance, the Department of Health has a Monitoring Unit to ensure compliance with the Principles of Good Laboratory Practice developed by the Organisation for Economic Co-operation and Development.

The Piltdown skull

The Piltdown forgery is perhaps the most famous example of scientific fraud. Ever since Darwin published his *Origin of Species* in 1859, fossils which might be 'missing links' between apes and man have been of great interest. The Piltdown skull, discovered in a quiet corner of the Sussex

¹ Hansen, K. D. and Hansen, B. C. 'Scientific fraud and the Public Health Service Act: a critical analysis', *FASEB. J.* (1991) 5, 2512-2515.

Downs in 1912, was claimed to be one of these. The skull fragments were similar to a modern human but the jaw, except for the wear on its two molar teeth, was ape-like. In fact the jaw was that of an orangutan and the teeth were artificially filed to simulate human wear. All the bones were stained chemically to suggest great age.

There were three main excavators at Piltdown, Charles Dawson, a solicitor and amateur archaeologist, Sir Arthur Smith Woodward, F. R. S., Keeper of the British Museum Geology Department and a friend of Dawson and Pierre Teilhard de Chardin, then a student at the nearby Jesuit College, later to become famous as a palaeontologist and author of *The Phenomenon of Man*, a mixture of evolution and theology which was banned by the Roman Catholic authorities. The planting of the fragments seems to have been an elaborate practical joke, but no-one knows who was really responsible. Dawson found various pieces of skull and took them to Smith Woodward in 1912. The two of them, helped by Teilhard, made further excavations that year, finding the jaw, some flint tools and teeth of elephant, hippopotamus, mastodon and beaver. In December the findings were presented to a meeting of the Geological Society in London and the skull was named *Eoanthropus dawsoni* in honour of its discoverer. The jaw had two molars, but no canine teeth, which was unfortunate since the canines would have indicated whether the jaw was human or ape-like. Ape canines are pointed, while human canines are flatter. Conveniently, Teilhard discovered the missing canine tooth in the same spot in 1913 and it was suitably flattened. This and the further discovery of a molar and some skull fragments, convinced many experts who had been skeptical about the original finds.

In 1953 Weiner, Oakley and Le Gros Clark showed that the Piltdown bones had been stained chemically to mimic age, the teeth filed to simulate human wear, the associated mammalian remains brought in from other places and the flint 'tools' recently carved. The hoax was exposed, but who was responsible? Though gullible, Smith Woodward was innocent, since he knew nothing about Piltdown until Dawson brought him the bones. For a long time Dawson was considered the joker but more recently independent studies by Bowden² and Gould³ point to Teilhard. The evidence is not conclusive but it is significant that Teilhard had lectured in chemistry at the Jesuit school in Cairo from 1906 to 1908, while the other two had no chemical expertise. In addition, one of the teeth planted at Piltdown was from a stegodon and was found to be unusually radioactive for a Western European fossil. However, such stegodon remains are plentiful at Ichkeul in northern Tunisia and are similarly radioactive. Teilhard had stayed near Ichkeul and could easily have brought back the tooth.

If Teilhard was the hoaxer, it seems to have been a youthful prank, not

2 Bowden, M. *Ape-men, Fact or Fallacy?* Bromley: Sovereign Publications (1977).

3 Gould, S. J. *Hen's Teeth and Horse's Toes*. New York: W. W. Norton (1983).

really fraud in the proper sense, since he stood to gain nothing. One thing is certain, the hoaxer was skilful enough to delude the experts for forty years.

Fraud among the algae

The German biologist Franz Moewus published in the 1930s and 1940s a series of fantastic accounts of Mendelian inheritance in various algae. These appear to have been largely fabricated and were certainly too good to be true. For example, a hormone was identified for each step in the production of zygotes and the genetic control of its production was elucidated. No-one has been able to repeat the work. Moreover, the research was reportedly done between 1929 and 1940, but it has been calculated that a man working ten hours a day, six days a week would require over 13 years to complete the microscopic identification of ten morphological characters in 820,816 zygotes. That leaves no time for preparing media, washing dishes and slides or for hundreds of thousands of other tests published in that period, or for years to go by without Moewus being able to germinate zygotes, which he also reported. Incidentally, help from only his wife was acknowledged, that being solely for the inspection of data (!). Concluding an article on this work, Gowans⁴ comments that 'it is considered advisable to discount any and all of the published work of Franz Moewus unless such results have been repeated and confirmed independently'.

The striking perfection and completeness seen in the work are rarely found in biological research. What could have motivated Moewus to labour for so long and presumably so carefully to build such a fabric of deceit? Was it in order to gain a long list of publications? It is interesting that the referees of his papers were not suspicious of such beautiful results. Or was it the perfection itself that led Moewus on, and the impression it would make on his colleagues in Nazi Germany?

Were Mendel's results too good to be true?

The pioneer work of the Augustinian monk, Gregor Mendel, published in 1865 and only rediscovered 35 years later, laid the foundations of modern genetics. Mendel's most famous experiments concerned the cross-breeding of different varieties of peas. He studied seven pairs of characters, for instance tall and short, or seeds with yellow or green cotyledons. Since these varieties bred truly, we should expect in modern terminology that they would have a pair of similar genes (e.g. for size), one from each parent. The tall variety would have, let us say, genes DD and the dwarf variety genes dd. Crossing these would give hybrids which all had genes Dd, but they proved to be tall, showing that the tall gene D was dominant. Crossing the hybrids however, Dd × Dd, would give these possibilities: DD, Dd, dD

⁴ Gowans, C. S. 'Publications by Franz Moewus on the genetics of algae', in Lewin, R. A. (ed.) *The Genetics of Algae*, Oxford: Blackwell Scientific Publications (1976), pp. 310-332.

and dd. Since D was dominant there would be on average three tall peas to every dwarf pea in this generation. Mendel's paper quotes 787 tall and 277 dwarf, a ratio of 3.14 to 1. With yellow and green cotyledons, yellow being dominant, the ratio was 3.01 to 1. Mendel was extremely fortunate in choosing seven pairs of characters which were controlled by separate chromosome pairs, so that there was independent assortment and no crossing over. Even so, the results are too good to be true. Fisher⁵ considered that the ratios approach those expected on theoretical grounds to a surprising extent, with the relatively limited amount of experimental material. It seems that Mendel's figures were not objectively discovered, but were approximated to a segregation ratio already known to him from theoretical considerations. Was this fraud on the part of one who was to become abbot of his monastery? Not really, in my view, but only an acceleration towards the truth. Mendel was convinced that if he did enough crossings the ratio would indeed come out as exactly three to one. The experiments took a long time and life is short, so who can blame him?

Fraud and the inheritance of intelligence

The British psychologist Sir Cyril Burt has been accused by his biographer Leslie Hearnshaw of manufacturing data on intelligence and kinship. There is also doubt about the existence of his co-authors in a study of IQ in identical twins separated early in life and raised apart. Gould⁶ considers this the most spectacular case of outright scientific fraud in our century, claiming that many of the fifty pairs of twins supposedly studied only existed in Burt's head.

Burt's conclusion was that IQ has 80% heritability, but other studies show that intelligence is not inherited to anything like that extent, if at all. One major problem is with the statistical work of Burt. On increasing his sample sizes the correlation coefficients remained unchanged to the third decimal place, which is considered almost impossible.

Unfortunately, theories about the heritability of intelligence have political implications, or so it is claimed. Those of a right-wing disposition who wish to retain the status quo are happy with the idea that IQs are inherited. Burt's supporters, moreover, have suggested that critics of this theory are left-wing environmentalist ideologues.⁶ It is interesting that the government of Singapore, which is not often accused of leftist tendencies, has enacted legislation to encourage graduates to have bigger families. Women with degrees, for instance, get preference in the choice of schools for their children, while the less educated only get such a choice if they are sterilized after the birth of the first or second child. Singapore is clearly basing this legislation on the idea that intelligence is inherited.

Burt has been defended in a recent book by Joynson.⁷ In this it is

5 Fisher, R. A. 'Has Mendel's work been rediscovered?' *Ann. Sci* (1936) 1, 115-137.

6 Gould, S. J. *The Flamingo's Smile*. Harmondsworth: Penguin Books (1985).

7 Joynson, R. B. *The Burt Affair*. London: Routledge (1989).

pointed out that much of the work on identical twins goes back to the days before the second world war and that some of it was misfiled or lost when Burt's department was evacuated to Wales. Joynson thinks it inconceivable that an eminent psychologist who was an expert statistician would invent data to keep correlations constant in spite of larger sample size. He also points out that Hearnshaw's critical biography of Burt has deficiencies in its reporting.

Fossils again and more recent biological deceptions

To return to fossils, Dr. John Talent⁸ accuses Professor V. J. Gupta of the Punjab University at Chandigarh, of inventing fictitious fossils so as to rewrite the geological history of the Himalayas, in about 300 papers published over the last 25 years. If this is true, and Gupta denies it, the Piltdown hoax by comparison will seem a very minor affair.

There have been several accusations of fraud in the biological sciences over the past two decades. One of the best known involves an American immunological paper in the journal *Cell*, of which the senior author was the Nobel laureate David Baltimore. Margot O'Toole, a post-doctoral researcher, complained that the paper's principal claim is not supported by the results. A correction has been published and there have been several enquiries and even congressional hearings. It was concluded that there was no misconduct, though the paper had significant errors of omission and mis-statement. An apology was published by Baltimore⁹ in 1991, together with a chronology of the case. He states that he had no knowledge of the falsification of results by Dr. Thereza Imanishi-Kari and that he trusted her too well. In future, Baltimore says that he must 'temper trust with a healthy dose of scepticism'. However, Dr. O'Toole disagrees with him on several points¹⁰ and considers that he was not open with the investigating panel. Secret Service officers showed that Dr. Imanishi-Kari's notebook of purported supporting data was not authentic and Dr. O'Toole lost her job because she would not comply with Dr. Imanishi-Kari's pressure to misrepresent her own results.

Walter Stewart and Ned Feder of the U.S. National Institute of Diabetes, Digestive and Kidney Diseases at Bethesda took part in the Baltimore investigation and have now developed a computer method of detecting plagiarism. Though paid to do research in neurology and genetics, they are now full-time investigators of scientific misconduct.¹¹ Their first 'fraud busting' was in 1987 when they exposed John Darsee, a young Harvard research physician with an unusually long list of publications. Stewart and Feder showed that some of Darsee's co-authors had no direct part in

8 Talent, J. 'The case of the peripatetic fossils', *Nature* (1989) 338, 623-615.

9 Baltimore, D. 'Dr. Baltimore says sorry', *Nature* (1991) 351, 94-95.

10 O'Toole, M. 'Margot O'Toole's record of events', *Nature* (1991) 351, 180-183.

11 Anderson, C. 'Robocops: Stewart and Feder's mechanised misconduct search', *Nature* (1991) 350, 454-455.

the work and that others were not aware that their names were on the papers. Darsee had been found guilty of fabricating data in a cardiology experiment on dogs.

The issue of *Cell* dated May 19th, 1992, contained a short unambiguous retraction. A 1991 paper from the U.S. National Institute of Health had been 'fabricated by one of the authors . . . without any knowledge by the others'. The responsible author, Mitchell Rosner, was a graduate student. The paper claimed that the protein Oct-3 switches on genes and regulates early development of mouse embryos. When the senior author failed to repeat the experiments, he discovered that Rosner had surreptitiously switched test tubes so that the controls had just buffer solution rather than the correct DNA. An earlier paper by Rosner was entirely trustworthy. This case¹² shows how even close colleagues can be deceived, but it also shows that scientists can police themselves, though the process took 15 months.

In a number of other such cases a young research worker was involved, sometimes working for a Ph.D. The falsified results have usually represented an exciting break-through, confirming the theories of the supervisor even more elegantly than he could have wished. The young deceiver was clearly under pressure to produce good results in a competitive field. Some of the blame must lie with the supervisor.

Motives for deception

Racker¹³ has discussed this type of misconduct with particular reference to Mark Spector, one of his own Ph.D. students in biochemistry at Cornell University. Spector worked on the phosphorylation of an important enzyme and obtained spectacular results by doctoring his samples with radioactive iodine, which readily binds to enzyme protein, rather than the proper radioactive phosphate, ATP. As a result he lost his Ph.D. and his job. Racker believes that most of the young scientists guilty of fraud were like Spector, very intelligent and producing exciting results which they knew would be detected as false. Racker considers therefore that they were unbalanced mentally, 'seeking self-destruction'. His summary of Spector's case is a little disconcerting: 'As far as I am concerned this brilliant young man was ill and there was no cure for his illness'. It might be just to punish a serious crime by taking away a man's Ph.D. and his job. To remove both because of an illness is distinctly unjust, but of course we have only a guess from Racker about the supposed illness. Another interpretation is that Spector was a confident, ambitious and unscrupulous individual who was sure that his fraud would go undetected and bring material rewards sooner or later.

12 Anderson, C. 'NIH laboratory admits to fabricated embryo research, retracts paper, *Nature* (1992) 357, 427.

13 Racker, E. 'A view of misconduct in science', *Nature* (1989) 339, 91-93.

Justice and therapy

At first sight the view that fraud of this sort should be treated as an illness seems liberal and merciful, but it could be just the opposite. If a court decides to impose a penalty such as a fine or imprisonment, its severity will be in proportion to the gravity of the crime. If on the other hand it decides to hand over the offender to the psychiatrists because he is ill, the treatment will bear no relation to the weightiness of the offence. He may be sent to a mental hospital for years. Mere 'antisocial behaviour' by dissidents in the Soviet Union was treated in such hospitals, which were in reality prisons. C. S. Lewis¹⁴ makes the following pungent comment about humanitarian theories of punishment. "To be "cured" against one's will and cured of states which we may not regard as disease is to be put on a level with those who have not yet reached the age of reason or those who never will; to be classed with infants, imbeciles and domestic animals. But to be punished, however severely, because we have deserved it, because we "ought to have known better" is to be treated as a human person made in God's image'.

Some other views on fraud

A recent book¹⁵ deals with the subject of fraud in science but a review of it in *Nature* suggests that the author, Robert Bell, chooses examples in tune with his political beliefs. These examples come from 'big science', corporate support and research involving the U.S. military establishment. This triumvirate excludes many of the examples mentioned above. Bell does not have a satisfactory cure for fraud either. He suggests that those who expose fraud should have encouragement and protection and that the courts should resolve scientific disputes. It seems unlikely that the legal system could mete out justice in such cases and the process would inevitably be lengthy and expensive. Remedies should come from the scientific community itself.

The U.S. National Academy of Sciences published a two-year study on scientific integrity in 1992. Among their recommendations are the following: Scientific misconduct should be defined only as fabrication, falsification or plagiarism. Research institutes and funding agencies should have policies and procedures for handling scientific misconduct. Serious and considered whistleblowing is an act of courage that should be supported by the entire research community.

The panel of 22 often disagreed, and though the final report is mild in tone, two members considered that it exaggerated the problem. Membership included 11 academic scientists, 3 university administrators, a lawyer, a

14 Lewis, C. S. 'The humanitarian theory of punishment', in Hooper, W. (ed) *Undeceptions: Essays on Theology and Ethics* by C. S. Lewis, London; Geoffrey Bles (1971), pp. 238-249.

15 Bell, R. *Impure science: fraud, compromise and political influence in scientific research*. New York: Wiley (1992).

historian, a consultant, a journal editor, 2 public policy and ethics experts and 2 industrial researchers. The report avoids the question of how prevalent scientific misconduct really is. It recommends creating an independent policy board to collect and analyse data on fraud. In his article about the report, David Hamilton¹⁶ comments that it will be read as much for what it does not say as for what it does.

The difficulties experienced by those who expose scientific fraud are well illustrated in an article by E. J. R. Rossiter,¹⁷ chairman of the Deakin University ethics committee in Australia. Rossiter showed that the work of the late Michael Briggs on contraceptive steroids and thrombosis was fraudulent, but the university chancellor refused to accept the evidence. A committee of inquiry was set up, but again its findings were rejected. A further complaint was made and a second committee of inquiry set up, but Briggs then resigned from the university and disappeared overseas. He died in Spain in 1986. During these investigations, Rossiter was subjected to a barrage of attacks, including obscene telephone calls and two threats on his life. A senior psychologist in the university stated that he was 'of unsound mind'. Rossiter expresses surprise that so many academics would not accept the possibility of dishonesty in a senior colleague, yet would attack his own integrity. His closing words are as follows: 'The price of exposing fraud and deceit is high; it is sad, but necessary, that all stages of research must be guarded by vigilant people who must act without fear of the consequences of what they do'.

A Christian view

That deceit is evil is fundamental not only in Christian theology, but also for Jews and Muslims, since the Genesis account of the fall begins with the serpent's deception of Adam and Eve. God has stated that eating the fruit of the tree of the knowledge of good and evil will lead to death. 'You will not surely die' says the serpent (Gen. 3:4), going on to explain that the fruit will give them wisdom, one of its most attractive features for Eve.

Jesus speaks of Satan as the father of lies (John 8:44) and the lie about wisdom is still attractive. Those who fabricate scientific data may be tempted by the appearance of wisdom provided by their fraud. Satan is again referred to as the deceiver of the whole world in the book of Revelation (Rev. 12:9, 20:3) and in the Holy City there will be no place for those who love and practise falsehood (Rev. 22:15).

Genesis provides a picture of scientific activity when God brings the animals to Adam to see what he will name them (Gen. 2:19). Science as we know it grew up in the Christian culture of seventeenth-century Europe. Its early practitioners saw themselves studying the wisdom of the Lord who laid the foundations of the earth (Prov. 3:19). Fabrication and falsification

16 Hamilton, D. P. 'A shaky consensus on misconduct', *Science*, (1992) 256, 604-605.

17 Rossiter, E. J. R. 'Reflections of a whistle-blower', *Nature* (1992) 357, 434-436.

can have no part in our attempts to understand the handiwork of the God of truth (Ps. 96:13).

Scientific fraud is no longer a rarity. As Christians working in science we need first to examine ourselves. Are we guilty of selecting results, of ignoring the ones which do not fit our preconceived ideas? If so, we too are guilty of minor fraud but we will also be poorer scientists. Sometimes the results which do not fit are just the ones which lead to a new discovery.

Having examined ourselves, we shall certainly agree with Jesus that we are in no position to judge others (Matt. 7:1) who may be guilty of fraud. The ten commandments do not deal with truthfulness, apart from the specific injunction not to give false testimony against a neighbour. Long before then however, the Lord inflicted serious diseases on Pharaoh and his household because of the half-truth Abraham told about his wife Sarah (Gen. 12:10–20; see also Gen. 20:1–14). The Old Testament has many references to the God of truth, sometimes translated God of faithfulness in modern versions.

In the New Testament 'truth' usually refers to the gospel message. When Pilate asks Jesus if he is the king of the Jews, he is told that Jesus came into the world for this reason and 'to testify to the truth'. But Pilate is not ready to discuss this. 'What is truth?' he says, but does not wait for an answer (John 18:38).

In his letters, Paul exhorts the believers to put away falsehood and speak the truth with their neighbours (Eph. 4:25; Col. 3:9), presumably using the word in a more general sense.

Many of the early practitioners of science were wealthy men who could afford to study Nature simply for the love of it. Such individuals exist today, but there are not many of them. Most of us probably went into science out of interest and wanting to seek new truths about Nature, but our altruism may fade with the pressure to earn a living and to advance our careers. Out of such pressure comes the temptation to worship mammon, not only money, but worldly success. Such temptations can lead to scientific fraud and none of us is immune. In the end, the words of Jesus in the King James version are the most powerful and poignant: 'What shall it profit a man, if he shall gain the whole world, and lose his own soul?'

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