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Part IV: Special Relationships

1 Learn the Causes of Things

Explaining the Concept of 'Cause'[1]

The notion of causality is a difficult one. In particular there has been much debate over the question of how we have come to use the language of causality at all. Many have thought that the common observation that one event regularly follows another is all that was needed. However this cannot be right. Regularity and law are not the same as cause. Constant conjunction need not be associated with causal connection (see below). Even if it was, the causal connection would still be invisible:

> We can observe what we call the causes and we can observe what we call the effects, but not the causing (or effecting).[2]

It seems clear that the idea of causality can arise only from our own subjective experience. We purpose in our minds to pull or push, and we experience the effort in our bodies (our muscles). We also experience that our purposive efforts meet with varying degrees of success or failure, *ie* that only sometimes do we produce an effect. Scientists borrow the concept from everyday human experience and apply it, analogously, to non-human things. This is fine, but it does have a significant consequence. If naturalistic science is to provide an adequate explanation of the concept of cause, then it must allow the real existence of purposive agents that are self-aware – aware of making choices and producing effects. If naturalism cannot accommodate effective subjectivity (and with it the existence of mind), then it cannot accommodate causality either. If it cannot explain how scientists function, then it cannot explain science as a human enterprise (see Chapter 2, Part II, Section 5).

Cultural Causes

In seeking to explain phenomena in a scientific way, we are seeking to identify and understand the causes of those phenomena. As with the other areas we have examined, scientific explanation is heavily influenced by those philosophical and religious commitments that are dominant in our culture. Those influences create three areas of concern that we must address in a Christian critique:

(1) Confusing the different kinds of relationship.

(2) Assuming that there is one simple cause of each effect.

(3) For a given effect, scrutinising causes only at the most inanimate and impersonal level possible.

Correlation, Chance, and Cause

The first thing we learn in a good stastistics course is that correlation does not, of itself, mean causation. If two events, circumstances, or states appear to be related, there are at least three possibilities:

- the association is a chance coincidence: they are unrelated;
- there is a real association, but it is indirect: the two have a common causal relation with a third (unidentified) factor;
- there is a direct causal relation between them.

From just an association or correlation, however constant, it cannot be concluded that there is a causal relation. And even if there is a causal connection, the correlation does not, of itself, tell us which factor is cause and which effect. The situation is sometimes very unclear. Yet scientists constantly leap from correlation to causation. The history of science, past and present, is full of salutary examples. Medical science, in particular, provides many examples of the mistakes that can be made.

(1) Hospitalisation and Perinatal Death.[3]

Before the First World War, few British women gave birth in hospitals. By the mid-1980s, however, 99% of women had their babies in hospital, often in large obstetric wards. Between 1964 and 1992, two trends coincided: stillbirths and deaths of newborns declined and so did the number of home births. Governments and the medical profession both consistently assumed that the two were causally linked. The assumption was rarely questioned. However it was probably a chance coincidence:

- The shape of the two declines has been quite different, indicating a weak relationship at best.
- Careful international comparisons support scepticism, *eg* the decline in perinatal deaths was very similar in Denmark and the Netherlands despite the fact that in Denmark home birth was almost completely phased out, whereas in the Netherlands about a third of women continued to give birth at home.
- In one year (1979) that was examined in detail for England and Wales, it was found that about a third of women who delivered at home had intended to give birth in hospital. Either they never made it to the hospital, or they hadn't planned for the birth at all. The latter also accounted for a large proportion of the very small babies.
- With planned home births, perinatal death rates were found to be very low.
- There is good evidence that healthier mothers and better general standards of care are important factors.

(2) Morning sickness and miscarriage.[4]

Women who suffered badly from morning sickness during pregnancy used to be cheered by research that suggested that they were less likely to suffer a miscarriage. It now appears that they were misinformed. Many of the studies used small samples and were not adequately controlled for other factors such as the mother's age. The data shows that morning sickness is less common among older women, whereas the risk of miscarriage is greater. The link of miscarriage is almost certainly with age (a third factor), not with morning sickness.

(3) Melting tarmac and souring milk.

For a third example, we can turn to something much more familiar. It is a common observation that on days when the tarmac melts on the roads, bottled milk left on doorsteps rapidly sours.[5] These two phenomena are constantly associated, but we know that there is no direct causal relation between them. Rather they both relate to a third factor: high temperatures.

So how do we recognise true causation?

This question brings us back to the discussion on the nature of science (section 5 above). A fundamental aim of the natural sciences is to formulate laws which accurately describe the regular workings of the world. But, on their own, law statements - however accurate - do not provide a scientific explanation. Indeed such statements can be perfectly accurate, but scientifically wrong. A statement that describes the constant association of melting tarmac with souring milk is absolutely accurate, but there is no direct causal relation. Despite the law-like quality of many causes, law and cause are different things.

If a regularity is scientifically real, then we expect to develop theories which explain how the phenomena the laws describe are generated. In our second example, we have an empirical generalisation that links the risk of miscarriage with maternal age. The relevant theory explains this in terms of age-related increases in chromosomal abnormalities in a woman's eggs. In the third example, we have a constant relation of tar melting and milk souring to a third factor, namely high temperature. The relevant theories explain the physical processes involved in the melting of tar and the biochemical processes involved in the fermentation of milk. Kinetic theory then explains why raising the temperature brings about the melting of tar, and accelerates the fermentation of milk. *If a credible theoretical underpinning were not available, we could not assume a causal relation*. Yet in the sciences this is constantly being done.

A classic example of correlation being read as causation is the assumption that organisms are caused by genes. The evidence is no more than that gene *differences* correlate with character *differences*, i.e. if you have this gene (allele) you will have brown eyes, but blue eyes if you have a different gene. From this correlation it is assumed that these genes *cause* eye colour and, by extrapolation, that genes *cause* eyes themselves. By 'cause' here it is meant that the genes provide the *blueprint* for eyes, or else the *recipe* (instructions) for making eyes. The correlation of course proves no such thing. The *structuralist* assumption that genes act as triggers in a complex developmental/hereditary system is equally consistent with the evidence.

Despite near universal affirmation, the necessary theoretical underpinning *for any view* does not exist. The reason it does not exist has already been discussed (Part III, Section 4): we do not have any tested theories of development in biology. If a structuralist theory were to become well-confirmed, then the assumption of genic causation would have to be abandoned.

The Ideology of Simple Unitary Causes

It is a powerful prejudice of our culture that there is *the* cause of a given effect, e.g. *the* germ that causes a particular disease, *the* gene that causes a bodily feature. However, real-life situations are often exceedingly complex with many factors interacting to produce a given effect. This is certainly the case when it comes to the functioning of genes in living organisms. Contrary to all the media hype, genes actually can neither make themselves, nor make anything else. They function as part of the exceedingly complex developmental system which is a living animal or plant. The only thing which can 'make' a living organism is another living organism of the same kind. The elevation of the gene (DNA) 'tape' to the supreme status of 'the master molecule of life' and the virtual ignoring of the complex cell system that 'runs' the tape is, as the famous geneticist, Richard Lewontin, charges,

> ... another unconscious ideological commitment, one that places brains above brawn, mental work as superior to mere physical work, information as higher than action.[6]

This particular commitment is one symptom of a Western rationalism that has much wider and more serious implications for us all (Part I above).

Distinguishing the Causes that Differ

Tuberculosis (TB) remains the leading cause of death in the world from a single infectious disease (*c.* 2 million deaths world-wide). It is also one of the major causes of death in AIDS patients. The usual textbook and media accounts tell us that the disease is caused by a specific germ - the tubercle bacillus - that gives us the disease when it infects us. We are told that the reason we no longer die of diseases like TB in the West is because of modern scientific medicine. But there is more to the story than that.

By the time modern medicines for tuberculosis were introduced in the early part of this century, more than 90% of the decrease in the death rate from TB had already occurred. The reality is that TB is primarily a disease of poverty and poor (damp, crowded) living conditions.[7] As far as we can tell, the decrease in death rates in the 19th century was a consequence of the general improvement in nutrition, and was thus related to social and economic improvements. For those people with general good health and a good diet, the disease is very rare. Infection can be common in childhood, but without symptoms, and yet producing a life-long immunity. Given these facts, what should we say 'causes' TB?

In Part II, Section 3 we looked at the many different ways in which things function. Every created thing has all these different aspects, or dimensions, to its existence. This is also true of everything else in everyday life. When we talk about the 'cause' of a real-life phenomenon we are - or ought to be - using the term in a holistic way. If we analyse the causal relation we will discover that it has all the different dimensions to it. That is not to say that they will all be equally important, or even worth noting. Usually there will be a key aspect, but several others are likely to be important. Clearly, in the case of TB, social and economic factors (low real wage, poor living conditions) are key aspects of the 'cause', although the biological (exposure to the tubercle bacillus) is also obviously important (you can't get TB without the bacillus!). Social and economic improvements are never unrelated to the political, moral, and religious commitments of those with the power to promote those improvements. We will want to analyse these deeper relationships, but secular scholars usually avoid them, or perhaps consider them insignificant, or just a cover for the 'real' socio-economic factors. Many others, of course, talk, dismissively, of those who would bring 'politics' or 'religion' into education. The reality is that all these aspects are there from the beginning and we ignore them at our peril.

The TB example points us to another major ideological commitment in our culture. This is a commitment to scrutinising causes at the lowest level possible. Preferably these causes will be impersonal and inanimate, so as to avoid any 'messy' moral, political or philosophical and religious issues. Given a particular problem (effect) in humans we tend to look for a defective gene, or a malfunctioning organ. We will do all we can to avoid any scrutiny of, e.g., lifestyles, for that would raise social, cultural and moral issues of a personal and communal nature. AIDS is another clear example of a problem where key considerations (such as faithful, monogamous relationships) cannot be mentioned. The reality is that AIDS is a preventable disease that can be easily and cheaply avoided by changing behaviour.[8] It could be largely eliminated in one generation.

Religious Causes

Christian interest in science and science teaching is not just a matter of certain topics (e.g. cosmology, evolution, use of natural resources) and of the ethical issues raised by the applications of science (*eg* genetic engineering). Culture and religion are present in science from the beginning and influence it through and through. Christian scrutiny must also be comprehensive. This brief look at causality in science has provided several examples of the significant issues that can easily be refused, sidelined, or overlooked.

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2 On the Whole

Nothing but Wholes and Parts?

Created things show different kinds of internal structure, but modern science tends to reduce these to just one type - that of a *whole and its parts*.

The basic idea of a whole and parts is purely geometrical. In geometry all such relationships involve spatial continuity and relative position. A triangle (a whole), for example, is formed of three sides - three line segments (the parts) joined together to form a plane closed figure (the whole).

In each higher realm of functioning there is a greater variety of kinds of relationship, only one of which will correspond to the spatial relationship of whole and parts. In the physical realm all structural relationships involve physical interactions of some kind, and in the biological realm they all involve various kinds of generative response (i.e. differentiation, development, regeneration or reproduction). Unfortunately, there are no other terms except 'whole' and 'part' available in English, with which to describe the rich variety of structural relationships. The result is considerable confusion. This is just a preliminary attempt to sort out that confusion.[9] There is considerable work to be done, so here we will consider just one distinction which is crucially relevant to matters considered elsewhere in this chapter.

Hidden Riches: Opening Up Through Harnessing

As well as whole and part relationships, there are also various kinds of relationship between different wholes. In particular one whole can *harness* other wholes. The term 'harness' suggests restriction, but these relationships actually reveal an otherwise unknown potential. In living organisms the most important of these harnessing relationships is that between living structures and their chemical components.

If we consider a living cell then we can rightly describe the organelles (nucleus, mitochondria, chloroplasts etc.) as living parts of the whole cell. But protein and nucleic acid (DNA, RNA) molecules are not parts; they are *chemical* (non-living) *wholes* which are harnessed within the *biological* (living) *whole* of the cell.

The chemical realm has a vast potential of functioning, but much of this rich potential is not seen in the non-living world. Harnessing relationships within the biological realm reveal this latent potential. Chemical compounds within living organisms are immensely more varied, more complex and more diversified in their structure and function than in a purely physical environment. These *biochemical* structures and functions neither contradict, nor escape from, the relevant chemical laws and principles. Indeed, *the chemical conditions must be met before biological processes can occur*. Even something as complex as the DNA molecule is non-living; indeed it is one of the most nonreactive, chemically inert molecules in the living world.

DNA has a structure which is completely governed by the principles of physics and chemistry. That structure is linear and can be thought of as being like a string of beads. In DNA these beads are chemical units called 'bases' and there are four different kinds (referred to as A, G, C, and T). Any order of these bases has the same chemical stability (e.g. AGCTTAAA or TCCGTTTC), i.e. there is no chemical reason (or cause) for any particular order of the bases.[10] However, in each living organism, a specific order of bases functions as a *genetic code*. The cell can translate that base order into a specific order of amino acid units in a protein. According to that order of units, the protein will be able to function, e.g., as part of cell structure, as an enzyme, or as a hormone. The DNA base order is left open at the physical level, but is specifically conditioned by the generative law-order that holds for an organism at the biological level. This is such an important matter that it is worth explaining it in different ways. In a living organism the description of the energy relations is exhausted without remainder at the level of the physical (chemical) components and processes, but the physical laws of the behaviour of the components *under*determine (*under*explain) the behaviour of those components in living organisms and also the behaviour of whole organisms.[11] The biological relies for its functioning on the principles of the physical level, even while it cannot be reduced to them, nor derived from them.

The importance of correctly analysing these relationships is that it allows us to affirm the uniqueness of living things, while avoiding both the Scylla of mechanism (that organisms are nothing but chemical machines) and the Charybdis of vitalism (that organisms possess an invisible 'life-force' that makes them alive).

Conclusion: Science in Faith

(1) We must locate and orientate the sciences within a Christian worldview. We must help our children to find their place - and that of science - in a biblically and personally meaningful world. They, with us, must come to know the three stories: the biblical story, the story of their country and community, and their own life story, as comprising one true story that is *all* their story. The great biblical themes of Creation, Fall and Redemption must shape their understanding of themselves and the world. Necessarily this means that Christian schooling will be effective only if the school is part of a community that exemplifies the richness and significance of the Christian worldview. In other words, there must be a distinctively Christian communal and cultural context.

(2) We must ensure that they, with us, learn that there is an unbreakable bond between knowledge, character and use. To know the things of science is to understand our role in relation to them in God's plan, and therefore to know what kind of people we must be to fulfil all that God requires of us as His servant-rulers.

(3) We must practise a science that – in its rich wholeness and integrity – helps us to build Christian culture and community.

(4) In particular, in studying and practising science

- **we must orientate everything within the Christian story**. This is readily achieved by telling the stories of the scientists and their discoveries and inventions.[12]

- **we must not reduce the things and processes of one distinct realm to those of another**. For example, we must not explain away organisms as just (bio-) chemical machines. Rather, we must recognise the diversity of creation and celebrate its richness;

- **we must not divorce things from the many-faceted richness of creational functioning**. Organisms do not just function biologically, nor minerals just chemically. Everything functions in a rich variety of ways. Each way is part of a full and authentic understanding and several will usually be of key importance;

- **we must not separate things from their roles in the world**. For example, we should not try to understand organisms apart from their environment ('museum jar biology'!), or elements apart from the context of their cosmic and planetary roles. In every area of science, we should begin with the largest realm (context) of meaning: in biology, with the world of life as a whole (ecology) not with cells or biochemistry; in chemistry and physics with the non-living world around us (from galaxies to rocks), not with atoms and particles. This kind of 'top-down' approach is essential for meaningful science;

- **we must not treat a thing as nothing more than a sum of separate parts**, e.g. rock, air or seawater as mixtures of chemicals that can be extracted for human use, or organisms as the sum of organs, cells, or even just genes;

- **we must not explain things as the chance outcome of other things that happened or went before**. For example, we should not regard organisms as simply the latest chance products of a purposeless process of evolution. Strictly speaking, of course, an appeal to chance is a denial that there is any explanation at all.

Only within the true context, God's world, can we give everything its proper meaning and discover its significance for us, our families and our communities.

Notes

[1] See Tom Settle, The dressage ring and the ballroom: loci of double agency, in Jitse van der Meer (ed), *Facets of Faith and Science*, Vol. 4: *Interpreting God's Action in the World*, Lanham, MD: University Press of America, 1996, Chapter 2, pp 17-40. Settle provides a fine summary in his Problems naturalism has explaining science, *Pascall Centre Notebook*, **5**, 1997, pp 3-6.

[2] Settle, *ibid*, p 5.

[3] Alison Motluk, Push for hospital births was misguided. *New Scientist*, **150** (2029), 11 May 1996, p 5.

[4] Philip Cohen, Morning sickness link 'misleading'. *New Scientist*, **153** (2071), 1 March 1997, p 11.

[5] A similar example is the correlation between coastal drownings and ice-cream consumption.

[6] R Lewontin, *The Doctrine of DNA: Biology as Ideology*. Harmondsworth: Penguin, 1993, p 48.

[7] 'In other word, TB acts as a barometer of social change; it increases when living conditions deteriorate and decreases as they improve.' (Jo Colston, The return of the Great White Plague, *Biologist*, **44** (4), 1997, pp 392-394 (392).

[8] Not forgetting that some have caught AIDS through no fault of their own, e.g. through receiving contaminated blood products.

[9] See also Roy Clouser, *The Myth of Religious Neutrality*. Notre Dame, USA: University of Notre Dame Press, 1991, Chapter 12.4, *Parts and wholes*, pp 243-249.

[10] An earlier presumption that protein and nucleic acid sequences could be accounted for by inherent self-ordering processes has not been confirmed experimentally. See, e.g., Chapter 10, A chemical code: resolving historical controversies, in Nancy Pearcey and Charles Thaxton, *The Soul of Science: Christian Faith and Natural Philosophy*, Wheaton, ILL: Crossway Books, 1994, pp 221-248. Of course, if self-ordering tendencies were found, then Christian researchers would see God's activity in designing these tendencies. However, evolutionists would seem to *require* such tendencies.

[11] Following Donald Campbell (1974), how wholes affect their parts has been called 'downward causation'. See Tom Settle, The dressage ring and the ballroom: loci of double agency, in Jitse van der Meer (ed), *Facets of Faith and Science*, Vol. 4: *Interpreting God's Action in the World*, Lanham, MD: University Press of America, 1996, Chapter 2, pp 17-40.

[12] See Chapter 3.