The Reformation and the birth of modern science

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This talk was given during the celebration of the Reformation which took place in Guildford in the week of 30th October to 2nd November 2017 commemorating the 500th anniversary of Luther's posting his thesis on the door of Wittenberg Castle church on October 31st 1517.

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1. Introduction

At university I trained as a scientist and eventually gained a doctorate in physics. Some of the things I did in my research were to do with what went into the theory behind MRI scans. Since then I have been mostly a working pastor in the church but have always kept up an interest in science and the history of science.

What brought about the birth to modern science? Science and resulting technology have made a huge difference to our world –I think we would agree mostly for good. Where did this great step forward for mankind come from? It's an ongoing question which historians and academics still ponder.

Though previously the Greeks, the Chinese and Muslim scholars had made some headway in mathematics and technology, they had made little progress in understanding the workings of the world. Harnessing nature is a wonderful thing, but it is understanding the internal mechanisms of inorganic and organic matter that we would understand as science itself. It is this which really opens the door to the modern world of electricity, antibiotics, satellite communications and laptops etc.

The turning point

Historically, the turning point in the development of modern science came in Europe between 1500 and 1700 AD. This is significant. Chronologically and geographically, the Scientific Revolution went hand in hand with the rediscovery of Biblical faith and the growth of the Protestant Reformation. So, for example, Luther's 95 theses kick off the Reformation in 1517, and one of the first works of modern science is the work of Copernicus on the workings of the solar system, published in 1543, in which he postulated that the sun was at the centre of the motion of the planets. By the way, the publication of Copernicus's book was delayed until he had died as he was so worried about it falling foul of the Pope. So Luther and Copernicus were contemporaries.

Further, by way of example, the great Puritan theologian William Perkins 1558-1602 was a contemporary of William Harvey 1578-1657 who investigated the circulation of the blood in the body. A little later scientists like Isaac Newton and Robert Hooke in the 17th Century were contemporaries of the theologian John Owen. These men were all writing and discussing their ideas at the same time in England.

The search for causal connections between the Reformation and the rise of modern science has led to much debate between historians with basically two points of view emerging.

The first is that Biblical faith gave decisive encouragement or impetus to science. The second is that both Protestantism and science were spurred on by other factors such as social and economic changes. No doubt both ideas have some truth in them. But whatever the exact connection there is distinct evidence which gives weight to the first option. There are clear links indicating that the Reformation paved the way for modern science to develop. We investigate some of these in this booklet.

2. God and the universe

Firstly, the Biblical worldview gives a solid foundation for scientific endeavour.

The Bible does not contemplate an explanation of the world apart from God. It is aware of atheism, but sees it as both foolish, Psalm 14.1, and indeed only possible through a suppression of the facts, Romans 1.18-20.

Scripture tells us of one God who created all things and is over the whole of reality. The God of the Bible is never thought of by the writers of Scripture as a local 'God' or in some way geographically confined. Although he revealed himself to the nation of Israel he is always declared to be the God of the whole earth, and the God of the whole universe. Indeed what makes it a 'universe' rather than a 'multiverse' is the fact that the one God is the creator and sustainer of it all – not simply some of it. Thus the Bible opens with the words 'In the beginning God created the heavens and the earth,' Genesis 1.1. He made not just the earth, but the sun, moon and stars, Psalm 136.5-9. The book of Job poetically describes God as fixing and guiding the great constellations of the night sky.' Can you bind the beautiful Pleiades? Can you loose the cords of Orion? Can you bring forth the constellations in their seasons or lead out the Bear with its cubs?' Job 38.31,32.

How much greater he is than us humans cannot be measured. The prophet Isaiah speaks for God and puts it like this: 'As the heavens are higher than the earth, so are my ways higher than your ways and my thoughts than your thoughts,' Isaiah 55.9.

Order and law

If we accept that God is the Creator, it means that we can think in terms of a universe where the same principles apply throughout the whole. The Bible tells us that this God is not capricious but a God of order, wisdom, faithfulness and law (as well as grace), who does not change, Psalm 104.5; 1 Corinthians 14.33. However you precisely understand Genesis chapter 1, what we have there is a God constructing the world and bringing order to it. God creates various environments in the first three days then he populates those environments in the last three days of creation.

With this outlook of order and constancy, the idea of universal laws that apply throughout the physical universe and don't change, makes sense. This is

foundational to the whole feasibility of the scientific project. Laws exist and they are the same on Wednesday as they are on Tuesday and the same on the moon as they are on the earth. So it is worth being curious and asking questions about how the world is made, because those questions have definite and durable answers. The verses in Job which are quoted above go on to speak explicitly of 'the laws of the heavens', Job 38.33.

Why can we understand?

Further, the Biblical view of human beings is that we are extraordinarily special. We were originally made in God's image, Genesis 1.26-28, with a mandate to be stewards of his creation. Speaking loosely, we were originally mini versions of God himself. One of the great questions is "Why should we as human beings expect to be able to understand the world?" Atheism provides no satisfactory answer. Such understanding is not necessary for the evolutionary survival or even the thriving of other species. Dogs and cats don't understand physics or solve differential equations. Earwigs and starlings don't research inoculations against diseases or write theses on starlight. Yet they have no difficulty flourishing. But the Biblical truth that human beings are images of God provided the early scientists with reason to think that they could uncover God's laws for the physical world he had made. Because we are made somewhat like God, we can expect, in the words of the astronomer Johan Kepler to be able to "think God's thoughts after him".

This, then is the first link between the Reformation and modern science.

3. Key people in the development of science

Secondly, as we think about how the Reformation helped the birth of today's science, it is simply a fact of history that many of the early scientists were either Protestants or supported by Protestant benefactors, even though initially, Protestants were in a minority. In 1543 a Lutheran nobleman, Duke Albrecht of Prussia, a Lutheran, subsidized the publication of the work by the astronomer Nicolaus Copernicus *De revolutionibus orbium coelestium* which proposed and defended the idea of the sun, rather than the earth, being at the centre of our planetary system. And it was Andreas Osiander, a Lutheran theologian, who arranged for the book's printing and who wrote preface.

The astronomers Tycho Brahe (1546-1601) and Johan Kepler (1571-1630) were both devout followers of Luther. Brahe, a Danish nobleman, was a precise observer who detailed the motions of the planets and the German, Kepler, proposed certain laws of planetary motion rooted in Copernicus' theory of the solar system. His first law was that the planets move in ellipses with the sun at one focus and his second is that the planets move such that a radius from the sun to the planet sweeps out equal areas in equal times. This means that when the planets are closer to the sun they move faster than when they are further away. It wasn't until later, with Isaac Newton and his understanding of gravity in the seventeenth century that the mathematical basis of these laws was established.

We could also think of Johann Frabicius, a Lutheran layman, first observed sun spots and the rotation of the sun and Samuel Dorffel, a Lutheran pastor, first proposed that comets move according to a parabola. We see therefore that Protestants were at the forefront of science in its early days.

Meanwhile in England in 1645 meetings began which in 1661 were formalized as the scientifically prestigious Royal Society. Seven of the ten men who formed the nucleus of these early meetings were Protestants. 62% of the members of the Royal Society in 1663 were clearly Puritan by origin – at a time when Puritans were only a small minority in England after the Restoration of the Monarchy in 1660.

Isaac Newton (1643-1727) was not only a mathematician and member of the Royal Society but also wrote books about the Bible and theology. His book *The Chronology of Ancient Kingdoms Amended*, concerns the great empires of Egypt, Assyria and Babylon which we find in the Old Testament. This indicates that he

tended to work out of a Biblical worldview.

The Puritan interest in science was later encouraged in the Dissenting academies of the seventeenth and eighteenth centuries. This is the background of men like the dissenting clergyman Joseph Priestley FRS (1733-1804), involved in physics and chemistry with a claim to be the discoverer of Oxygen and of the Quaker John Dalton with his atomic theory (1766-1844).

Religion and science

Today it is commonly assumed that there is opposition between science and 'religion' – religion being caricatured something made up based on wishful thinking rather than evidence. But that was not where the Reformers, or the early scientists who followed them, stood at all. They had an understanding of scripture such that God has made the world, which is one 'book' and that God has given another book, the Bible and as the same God has given both books they are not in opposition but harmonise. At the beginning of the Scientific Revolution rather than there being a conflict between science and religion the two went together.

Francis Bacon (1561 – 1626), is regarded by many historians as the 'father of the scientific method.' He wrote in his famous essay *On Atheism*: 'It is true that a little philosophy inclineth man's mind to atheism; but depth in philosophy bringeth men's minds about to religion. For while the mind of man looketh upon second causes scattered, it may sometimes rest in them and go no further; but when it beholdeth the chain of them confederate and linked together, it must needs fly to Providence and Deity...I had rather believe all the fables...than that this universal frame is without mind.'

Again, Robert Hooke (1635 – 1703), the very gifted and overworked experimentalist for the Royal Society, was a man of Christian convictions. One of his friends, Richard Waller describes him as follows: 'He always expressed a great veneration for the eternal and immense Cause of all Beings, as may be seen in very many passages of his writings, and seldom received any remarkable benefit from God without thankfully acknowledging the mercy; never made any considerable discovery of Nature, invented any useful contrivance, or found out any difficult problem, without his acknowledgement to the Omnipotent Providence, as many places in his diaries testify…and was a frequent studier of the Holy Scriptures in the originals…' [1]

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[1] Quoted in *The Curious Life of Robert Hooke: the man who measured London,* by Lisa Jardine, Harper, 2003

Even more recent scientists are careful not to dismiss religion. Though Einstein did not believe in God, yet he was sceptical of atheism. He would speak of the Creator as 'the eternal riddle-setter.' He wrote of his own 'rapturous amazement at the harmony of natural law, which reveals an intelligence of such superiority that, compared with it, all the systematic thinking and acting of human beings is an utterly insignificant reflection.'[2]

The supposed conflict between science and religion is based on a misunderstanding of what religion is, and certainly of what Biblical Christian faith actually stands for. In his great exposition of the gospel, the apostle Paul indicts the human race with sin, precisely because of its suppression of the evidence concerning God. 'For since the creation of the world, God's invisible qualities – his eternal power and divine nature – have been clearly seen, being understood from what has been made, so that men are without excuse,' Romans 1.20. The apostles preached a faith which was based on the evidence and which they called their hearers to investigate, Acts 14.15-17.

[2] *Einstein's Greatest Mistake*, by David Bodanis, Abacus, 2016, page 29

4. Science and human significance

It is said that the pre-Copernican world had the earth at the centre and now it has been shown not to be true, the world has lost its significance and its dignity. Not being at the centre of the universe, it is said, indicates that mankind is simply a meaningless accident in a vast uncaring cosmos.

However, again there is somewhat of a misunderstanding going on. In its historical context, the change to the Copernican view of the solar system did not sideline humanity and belittle us. In fact, in many ways it did the reverse. It elevated the earth and its inhabitants. This may come as a surprise, requiring a rethinking of much mythology which has grown up around the Copernican revolution.

Pre-Copernican cosmology imagined the universe in terms of a number of spheres moving around the earth. The sub-lunar sphere (below the moon), where the earth resided, was seen as the realm of the corruptible, the mutable. Everything else above that was eternal and changeless. But the earth was not part of that elevated existence. In fact, the earth was seen as a sink for all the dregs. It was at the bottom of the universe, a place for all the rubbish on its way to the nine circles beneath the earth on the way to hell.[3]

Rather than demoting the earth as a place of insignificance and filth, people like Copernicus, Kepler and Galileo (1564-1642) saw that the new scheme, with the sun at the centre, actually elevated the earth and therefore its inhabitants.

The starry messenger

Galileo was another champion of the Copernican view. But in his book *Siderius Nuncius* (in English *The Starry Messenger*), he stated "Many arguments will be provided to demonstrate a very strong reflection of the sun's light from the earth – this is for the benefit of those that assert, principally because it has neither motion nor light, that the earth must be excluded from the dance of the stars. I will prove that the earth does have motion, that it surpasses the moon in its brightness, and that it is not the sump where the universe's filth and ephemera collect".[4]

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[3] Dennis Danielson, *The Great Copernican Cliché,* American Journal of Physics 69, 2001, pages 1029-1035

[4] Quoted by Jay W. Richards & Guillermo Gonzalez in their essay *The Pale Blue Dot Revisited*, in *Evidence for God,* Edited by William Demski & Michael Licona, Baker Books,2010, page 53.

When we see the downsides of science, like the oceans polluted by plastic or the horror of the possibility of nuclear warfare, we may be tempted to think that everything about science is wrong. But that is an over-reaction. God told mankind to steward the earth and bring out its potential, Genesis 1.28, 29. Science is part of that God-given project. But mankind in its sin, has misused God's call. Rather than stewarding the earth we have often exploited it. Science does not have in itself the seeds of the denigration of mankind, that only comes with the kind of science which has rejected God and the spiritual side of existence and which sees the material world as a resource for us. That is what denigrates human beings. By complete contrast, in the Bible's view of man, made in God's image, everyone of us is of such immense importance as evidenced by this unique ability to understand and harness something of this world that God has made.

4. Experimentation - the vital ingredient

Third, as we look for the connections between Biblical faith and science we find that the Reformation opened the way for the experimental method.

Immediate observation of nature is important, but a deliberate and carefully planned experiment will give take us further. It will provide less ambiguous results. Greek philosophy guided by Platonic and Pythagorean ideas gave prominence to human thought in such a way as to major on the theoretical and neglect the practical. Dominated by the thought of Thomas Aquinas, the Catholic Church had adopted much of the ancient Greek outlook into its theology. This outlook hindered the cause of true science.

The Scientific Revolution took off with the rise of experimentation. This, in many ways, was the vital key which unlocked everything.

In order to be accepted, scientific experimentation had to receive two things to begin with. 1). it had to receive moral sanction – avoiding suspicion of it being an instrument of illicit curiosity or even sorcery. 2). it had to receive social sanction. It needed to gain acceptance and be considered a respectable and worthy pursuit.

Trades and manual work

Early experimentation was closely linked to the trades. Instruments were made by carpenters, glass blowers and metal-workers. It is arguable that it was because ancient Greek thinkers viewed manual work as beneath them as intellectuals that they made limited progress in science, not engaging directly with the world but merely theorizing about it. They didn't get their hands dirty.

But with the Reformation, came a new understanding of the dignity of manual work. After all, God had created the first man, Adam, to be a gardener and Jesus, the Son of God, was the carpenter of Nazareth, Genesis 2.15; Mark 6.3. Paul's second occupation was that of a tentmaker, Acts 18.3. This understanding dignified manual work and gave both permission and impetus for intellectuals to pursue experimentation.[5]

Thus the experimental method, which is the foundation of modern science was

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[5] See *Religion and the Rise of Modern Science,* by Reijer Hooykaas, Regent College Publishing, 2000

enabled to emerge and be embraced. It is true that the Renaissance brought a greater cooperation between head and hand, theory and practice, but this was limited. This was because the Renaissance being broadly a rediscovery and reinvigoration of the ancient Greek and Roman learning. The Renaissance thinkers still had the same attitude that the intellectual should be above manual labour.

But the new general familiarity with the Bible brought about by the Reformation stimulated the idea of manual skill and clear methodical thinking going together. The Reformation doctrine of the priesthood of all believers – that all our work can be offered to the glory of God whoever we are – underpinned this attitude. The great sixteenth century preacher and theologian William Perkins (1558-1602), often spoken of as the father of English Puritanism, considered a manual trade, performed to the glory of God and the benefit of mankind to be as blessed before God as that of a magistrate or a minister of the gospel. The Reformer Hugh Latimer (1487-1555) told his listeners that nobody should disdain to follow Christ the carpenter in a 'common' calling as all occupations were equally blessed by his example. In the seventeenth century we find George Herbert in his poem *Elixir*, teaching that the clause 'For Thy sake' makes a servant's drudgery divine: "Who sweeps a room as for Thy laws, makes that and the action fine".

By the eighteenth century Charles Wesley is writing hymns for the working man:

"Forth in Thy name oh Lord I go, my daily labour to pursue; The only Thee resolved to know, in all I think or speak or do".

5. Conclusion

So the Reformation seems to provide these three vital building blocks which provide a solid foundation for the pursuit of science as we know it.

- The outlook that God is there and He has given laws and He doesn't change, that we are made in God's image, therefore we can pursue this whole area of finding out how the world works. That framework is rediscovered as people get the bible in their own language and brought to people at the Reformation.
- Then there is the evidence of significant Protestant people who are involved in science including members of the Royal Society.
- Lastly there is the whole matter of the dignifying and the acceptability of experimentation. Put together, these provide some substance for the suggestion that the Reformation gave science a real step forward.

Here is where we find the origins of modern science.

The good news

What was it that ignited the Reformation? What was behind the 95 theses which were the harbinger of the Reformation? It was the rediscovery of the good news of Jesus Christ. It was this which was behind the Reformation which led to modern science.

The great rediscovery of the Reformers was that the creator of this vast universe became the saviour. They rediscovered that the creator of whom we have been talking, in thinking about science, loves the world. He loves men and women. Human beings in particular are so significant that He came Himself, the creator, in the person of Jesus Christ to save us from our sins.

John's gospel begins "In the beginning was the Word, and the Word was with God, and the Word was God. He was with God in the beginning. Through him all things were made; without him nothing was made that has been made. In him was life, and that life was the light of men".

But later John explains: "The Word became flesh and dwelt among us, and we have seen His glory of the One and Only, full of grace and truth". God became man and lived on earth among us. The creator entered his creation as one of us – Jesus, God's Son.

But that phrase, concerning Jesus Christ, 'One and Only' is picked up in that great salvation verse of John chapter 3 "For God so loved the world, that he gave is one and only son that whoever believes on him should not perish but have eternal life". He loved the world so much that he gave his son to atone for all the mess we make of the world and of ourselves in the wrong things that we do.

There is a God of love behind the universe, who made the universe. This marvellous, astonishing God becomes the Saviour. This is what inspired the Reformers. This great truth can not only bring a scientific revolution, it can bring a personal revolution – forgiveness and knowing God.