

palisade and spongy layers allows the leaf to use as much sunlight as possible. The leaves of some plants are also able to adjust their position to follow the sun as it moves across the sky. The thousands of stomata on the underside of the leaf, flanked by the guard cells, allow carbon dioxide to diffuse into the leaf, and oxygen to leave, as long as the plant is well supplied with water. Once the gases reach the palisade cells, together with the water carried to the leaf through the xylem tubes, photosynthesis takes place.

Some plants, such as cacti or the pineapple, have been designed in a very different way. Water loss is minimised by keeping the stomata shut all day and only opening them at night. This means that the leaf has a special chemical carbon dioxide pump, which can suck the gas more efficiently from the air and then release it behind closed stomata during the next day, into the cells where it is needed.

Summary

This article has only touched the surface in exploring the fascinating world of plants. Plants are indeed a witness to the wonders of creation, and yet are often neglected and taken for granted. Their ability to produce oxygen makes them the foundation of life on our planet. They are incredibly complex chemical factories, and have a phenomenal ability to survive in extreme conditions.

Truly, as Scripture records, “the earth brought forth grass, and herb yielding seed after his kind . . . and God saw that it was *good*”.

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The Spirit of God— the basis of all things

Nigel Bernard

THIS ARTICLE concerns the Spirit of God and its relation to the heavens and the earth. The article begins by considering several key Scriptural passages that provide a foundation for our understanding of the Spirit. We then go on to see how the beliefs of the philosophers in Athens contradicted the Biblical view of the Spirit, and how Paul argued against them at Mars Hill. Then, having reflected upon the beliefs of such men as Isaac Newton and Brother Thomas, we consider the way in which the Bible view of the Spirit provides insight and a true perspective in the context of modern scientific theories and discoveries.

In the beginning

The Spirit of God is first mentioned in the very opening words of Genesis: “In the beginning God created the heaven and the earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters” (vv. 1,2). The Hebrew word translated “moved” here occurs in two other places in Scripture. In Deuteronomy 32 it is translated “fluttereth”: “As an

eagle stirreth up her nest, *fluttereth* over her young, spreadeth abroad her wings, taketh them, beareth them on her wings . . .” (v. 11). In Jeremiah 23 it is rendered “shake”: “Mine heart within me is broken because of the prophets; all my bones *shake*” (v. 9).

Strong says that the meaning of the Hebrew word is ‘to brood’. This fits in well with the context of the eagle in Deuteronomy 32. From this it is often remarked that the movement of the Spirit upon the waters was a manifestation of the way God cared for His creation, even as a bird cares for her young. But in Jeremiah 23 the sense of ‘shake’ would seem to fit the context better. When a bird flutters or a bone shakes, the movement is not continuous in one direction, but rather switches rapidly back and forth. So in Genesis 1, perhaps, in addition to the sense of brooding, there is a sense in which the movement of the Spirit of God is depicted as being akin to a vibration or oscillation.

Jeremiah says of God: “He hath made the earth by His power” (10:12). The power of God is His Spirit. The angel Gabriel said to Mary: “The Holy Spirit shall come upon thee, and the power of

the Highest shall overshadow thee" (Lk. 1:35). In these two parallel statements of the angel we see the Spirit being equated with power. Paul tells us that the creation we see around us is evidence of the power of God: "For the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made, even His eternal power and Godhead; so that they are without excuse" (Rom. 1:20). So, as the Spirit of God moved, fluttered and shook upon the face of the waters, it was as a restless sea of power awaiting the command of God.

In Genesis 1:3 it is recorded: "And God said, Let there be light: and there was light". The role of the word of God in creation is pivotal, and was the means by which the work of the Spirit, through the angels, was begun. When John wrote of the beginning he emphasised the word of God: "In the beginning was the Word, and the Word was with God, and the Word was God" (Jno. 1:1). The psalmist too makes a strong link between the Spirit of God and His word at Creation: "By the word of the LORD [Yahweh] were the heavens made; and all the host of them by the breath [spirit] of His mouth" (33:6). The Spirit was the power by which the word of God was carried out.

It is written that, when God had made the light, "God saw the light" (Gen. 1:4). This too was done through His Spirit. David said of God's Spirit: "Whither shall I go from Thy spirit? or whither shall I flee from Thy presence? . . . If I say, Surely the darkness shall cover me; even the night shall be light about me. Yea, the darkness hideth not from Thee; but the night shineth as the day: the darkness and the light are both alike to Thee" (Ps. 139:7,11,12).

Through His Spirit God is able to see everywhere. In 2 Chronicles 16 it is written: "For the eyes of the LORD [Yahweh] run to and fro throughout the whole earth" (v. 9). Zechariah picks up on this theme, and talks, in type, of seven eyes: ". . . those seven; they are the eyes of the LORD [Yahweh], which run to and fro through the whole earth" (4:10). In Revelation the seven eyes are explicitly stated to be manifestations of the Spirit of God: "a Lamb . . . having seven horns and seven eyes, which are the seven Spirits of God sent forth into all the earth" (5:6). The seven eyes or spirits typify the saints at work in the Kingdom. As they go to and fro throughout the earth the saints will manifest the way in which God sees through His Spirit. The way in which the eyes of God are said to go to and fro

perhaps finds an echo in the way in which the Spirit of God fluttered and shook upon the face of the waters.

The Spirit of God is the basis of life of itself. This is shown in Genesis 7:22, where the Spirit is mentioned in conjunction with breath: "all in whose nostrils was the breath of the spirit of life . . ." (AV mg.). Elihu also spoke of this: "If He set His heart upon man, if He gather unto Himself His spirit and His breath; all flesh shall perish together, and man shall turn again unto dust" (Job 34:14,15). The Spirit is the life force of living creatures.¹

Paul on Mars Hill

When Paul spoke to the Epicureans and Stoics in Athens he said:

"[God] hath made of one blood all nations of men for to dwell on all the face of the earth, and hath determined the times before appointed, and the bounds of their habitation; that they should seek the Lord, if haply they might feel after Him, and find Him, though He be not far from every one of us: *for in Him we live, and move, and have our being*; as certain also of your own poets have said, For we are also His offspring" (Acts 17:26-28).

How could Paul and the Athenian philosophers be said to be "in Him"? It cannot be describing a spiritual relationship, for the God of Israel was "unknown" (v. 23) to the Athenian philosophers. Paul must be speaking of the natural. Paul speaks about being "in Him" to show that God is "not far from every one of us". And yet other scriptures show that God Himself *is* far from us. The actual dwelling place of God is the heaven of heavens: "Behold, the heaven and the heaven of heavens is the LORD'S [Yahweh's] thy God, the earth also, with all that therein is" (Deut. 10:14).

In the parable of the pounds, heaven is likened to a "far country" (Lk. 19:12). Yet if God is in a "far country" how can He be "*not* far from every one of us"? This apparent contradiction is resolved by taking account of the Spirit of God. God dwells in "the heaven of heavens" (Deut. 10:14), but in Psalm 139 David says: "Whither shall I go from Thy spirit?" (v. 7). The Spirit of God is everywhere, but God dwells in a specific location. The Spirit of God emanates from God

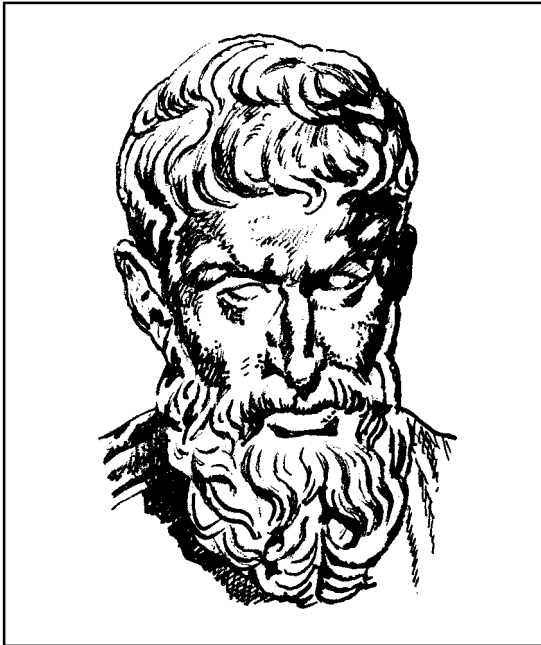
1. See Stephen Palmer, "The spirit of life", *The Testimony*, May 1983, pp. 133-5.

but it is not God Himself. We live and move “in Him” by being within the Spirit of God. In fact Paul goes further and says that, as well as living and moving in him, we also “have our being” in Him. The Greek for “have our being” is literally ‘we are’. To be is to be “in Him”.

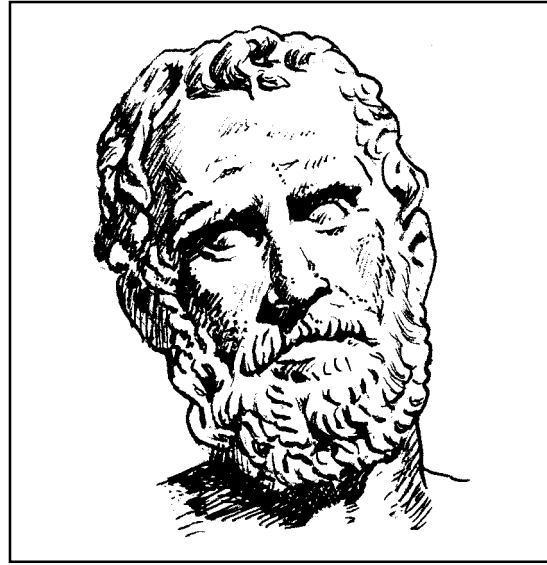
One of the poems to which it is thought Paul was referring was *Hymn to Zeus* by the Stoic Cleanthes. It would be a mistake to think that Paul was trying to establish common ground with the Stoics. On the contrary, Paul is attacking their belief in Zeus because, when he says, “His offspring”, the “His” refers to the God of Israel and not to Zeus.

The beliefs of the Epicureans are also attacked by Paul in his speech. It is particularly relevant to consider this aspect of his speech because it has a direct bearing on the truth concerning the Spirit of God. One of our sources for the beliefs of the Epicureans is the Roman Epicurean Lucretius (c. 100–c. 55 B.C.). We will use his writings to articulate the Epicurean philosophy that Paul opposed.

Epicureans believed in the existence of indivisible atoms. This is a view that can be traced back to the philosopher Democritus. They believed that the world and living things had come about through the random collision of these atoms: “our world has been made by nature



Epicurus (341-270 B.C.), founder of the Epicurean School



Zeno (335-263 B.C.), founder of the Stoic School, named after the Stoa Poikile, ‘Painted Porch’, where he taught his followers

through the spontaneous and casual collision and the multifarious, accidental, random and purposeless congregation and coalescence of atoms”.² Lucretius later says: “the universe was certainly not created for us by divine power: it is so full of imperfections”.³ Paul counters this Epicurean view by saying: “God That made the world and all things therein . . .” (Acts 17:24). Furthermore, Paul uses words such as “determined” and “appointed” (v. 26) to counter the claim that the universe is “random and purposeless”.

The Epicureans believed that the gods did not interfere with the affairs of men: “For it is essential to the very nature of deity that it should enjoy immortal existence in utter tranquillity, aloof and detached from our affairs. It is free from all pain and peril, strong in its own resources, exempt from any need of us, indifferent to our merits and immune from anger”.⁴ But Paul says that men should “seek the Lord, if haply they might feel after Him, and find Him, though He be not far from every one of us” (v. 27). And far from being “indifferent” and “immune from anger”, God has “appointed a day, in the which He will judge the world in righteousness” (v. 31).

2. Lucretius, *On the Nature of the Universe* (translated by R. E. Latham, Penguin Classics, 1951), p. 91.

3. *Ibid.*, p. 177.

4. *Ibid.*, p. 79.

Epicureans believed that the atoms moved in empty space to the exclusion of anything else. Lucretius wrote: "It remains to show that nothing exists that is distinct both from body and vacuity and could be ranked with the others as a third substance".⁵ However, the Bible reveals that, even where there is "nothing", there is nevertheless the Spirit of God. Even when astronauts move in the near-vacuum of space they do so "in Him".

Isaac Newton

When Isaac Newton⁶ published the second edition of his *Principia* he added a section called the *General Scholium*.⁷ In this short but densely reasoned section he analyses the relationship between God and His creation. In the early part he talks about the vacuum of space above the atmosphere, "in which spaces, where there is no air to resist their motions, all bodies will move with the greatest freedom, and the planets and comets will constantly pursue their revolutions in orbits". But this is no Epicurean vacuity. The "beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being". Furthermore, writes Newton, "In him are all things contained and moved; yet neither affects the other: God suffers nothing from the motion of bodies; bodies find no resistance from the omnipresence of God". The beginning of this sentence clearly echoes Paul's words on Mars Hill. Newton draws on Acts 17 to help articulate his view concerning the Spirit.

In the final paragraph of the *Scholium*, Newton discusses a force which he refers to as the "Spirit": "And now we might add something concerning a certain most subtle Spirit which pervades and lies hid in all gross bodies; by the force and action of which Spirit the particles of bodies mutually attract one another at near distances". Newton goes on to claim that this "Spirit" is also involved in the functioning of the nerves of animals. He does not explicitly state that the "Spirit" he is referring to is the "Spirit of God". However, what he says in this last paragraph is an apparent development of what he writes earlier concerning the omnipresence of God. Furthermore, a discussion of the Spirit of God at the end of his argument would seem to complement the antitrinitarian tone which underlies the *Scholium*.

He concludes the *Scholium* by saying: "But these are things that cannot be explained in few

words, nor are we furnished with that sufficiency of experiments which is required to an accurate determination and demonstration of the laws by which this electric and elastic Spirit operates". We might think that describing the Spirit of God as "electric and elastic" is reducing the Spirit too much to the natural level. However, it was this type of description which our pioneering brethren were to adopt when they discussed the Spirit of God in relation to His creation.

Brother Thomas

In *Elpis Israel* Brother Thomas writes of how the Spirit is the basis of matter. Concerning the atmosphere he wrote:

"It is a compound body, consisting, when pure, of nitrogen and oxygen, in the proportion of 79 of the former to 21 of the latter, in 100 parts. These are considered as simple bodies, because they have not yet been decomposed; though it is probable they have a base, which may be the *ruach* [Hebrew for 'Spirit']".⁸

In these words we see that Brother Thomas tentatively suggests two things. Firstly he hints that the atom is not "simple", but that it may be possible for it to be "decomposed" (as he termed it), revealing an underlying base. Secondly, he suggests that this base "may" be the Spirit. In 1903 Brother C. C. Walker, in an editorial note in *The Christadelphian*, commented on the discovery of radioactive radium:

"And the researches of science concerning the newly-discovered substance, Radium, are likewise helpful in that they point to a subtle something underlying all 'matter'".⁹

Brother Walker went on to quote from a report of a talk by a Professor Boys at the British

5. *Ibid.*, p. 40.

6. I am grateful to Brother Stephen Snobelen for his help with regard to the views of Newton, and for allowing me to read a forthcoming research article by him in which he exposes the antitrinitarian thinking present in the *General Scholium*. See Brother Snobelen's article "[The Two Books and the history of Science](#)" in this Special Issue (p. 146) for more on Newton's beliefs.

7. <http://members.tripod.com/~gravitee/genschol.htm>, Isaac Newton's *Principia* (3rd edition, 1726), translated by Andrew Motte in 1729.

8. J. Thomas, *Elpis Israel* (11th edition—revised, 1924), p. 34.

9. C. C. Walker, "'Spirit' the basis of all things", *The Christadelphian*, Oct. 1903, p. 463.

Association. The report said of this discovery: "it means that in one substance at least the disintegration of the molecule is not the final fact, and we cannot tell at what point permanence will be reached". So Brother Thomas's suspicion that atoms were not the ultimate building block had been confirmed. The concept of the indivisible atom held by Democritus and Epicurus was proving to be wrong. Here was an atom giving off a smaller particle. Brother Walker saw this as pointing to the Spirit of God "underlying all 'matter'". Both he and Brother Thomas realised that it was at the level of the Spirit of God that permanence would be reached.

Current thinking

The title of Brother Walker's editorial was, "'Spirit' the basis of all things". The title of this current article has been adapted from this title. In commenting on the title he said: "This is a Bible doctrine. And the scientific world seems to be drifting towards it". Since the time of Brother Walker, more and more subatomic particles have been discovered. Particle accelerators, using large amounts of energy to smash particles apart, have revealed a myriad of further exotic particles. Brother Walker underestimated the complexity and depth of the subatomic world. The scientific world still has a long way to 'drift' if it is to get anywhere near the fundamental basis of all things.

In a recent article in *New Scientist*, Marcus Chown writes of a theory being currently proposed by the British physicist Humphrey Maris, who is suggesting that it is possible to divide the electron. Of the electron, Chown says: "The electron is the lightest subatomic particle and the one with the greatest claim to being absolutely fundamental. In fact, in the 103 years since its discovery, there has been no other evidence whatsoever that the electron is divisible. It is the modern incarnation of Democritus's 'uncuttable' atom".¹⁰ He goes on to say that "the claim that electrons are divisible is therefore nothing short of a bombshell dropped into the world of physics". So the underlying philosophy on which Epicurus partly based his beliefs continues to be questioned.

Whether or not this theory is correct, the lesson of history from the time of Newton onwards is clear. We should not assume that the latest discoveries relating to energy and matter mark the point beyond which lies the Spirit of God. We have seen that Newton described the Spirit

as "electric". Brother Thomas in *Elpis Israel*, in the passage we have already quoted from, goes on to identify the Spirit with electricity: "Uncombined, it is that wonderful fluid, whose explosions are heard in the thunder, whose fiery bolts overthrow the loftiest towers, and rive the sturdy monarchs of the woods; and in less intensity gives polarity to light, the needle, and the brain. These three together, the oxygen, nitrogen, and electricity, constitute 'the breath' and 'spirit' of the lives of all God's living souls".¹¹ We now know that electricity is just one of many forms of energy. But at the time when Brother Thomas was writing, electricity seemed to be the very Spirit itself. But the Spirit of God is an infinite power. Man will never be able to reach anywhere near this ultimate source of energy. We should remember this when considering present discoveries in science.

It will be recalled that Epicurus explained the existence of things by the random and accidental collision of atoms. This view finds an echo in the so-called Uncertainty Principle, originally proposed by the scientist Heisenberg, which claims a fundamental lack of determinacy in quantum physics. In the translation of Lucretius used for this article, the translator in his preface notes this parallel: "But it [the belief that atoms swerve randomly] was the one concession in a dogmatic system to that element of the inexplicable and unpredictable in nature which some modern physicists have been driven to acknowledge by a somewhat similar concession".¹² One scientist who opposed this claim of indeterminacy was David Bohm. He argued that there were infinite levels to matter, which could ultimately explain apparent uncertainty. He wrote:

"But the infinite substructure of matter very probably contains energies that are as far beyond nuclear energies as nuclear energies are beyond chemical energies. Indeed, there is already some evidence in favour of this idea. Thus, if one computes the 'zero point' energy due to quantum-mechanical fluctuations in even one cubic centimetre of space, one comes out with something of the order of 10^{38} ergs, which is equal to that which would be liberated by the fission of about 10^{10} tons of ura-

10. Marcus Chown, "Double or quit", *New Scientist*, 14 Oct. 2000, p. 25.

11. *Op. cit.*, p. 34.

12. *Op. cit.*, p. 12.

nium. Of course, this energy provides a constant background that is not available at our level under present conditions".¹³

Ultimately we know that, at any infinitesimal point in space, the infinite power of the Spirit of God is present. Bohm wrote of a "constant background" of energy that is not currently available. But beyond this energy we know that there is an even more powerful and even more constant background energy. Even so, as Brother Walker might have said, Bohm appears to have been drifting towards the Biblical view of the Spirit.

Conclusion

The vacuity of which Epicurus wrote is increasingly being found to contain many strange phenomena. In writing of the vacuum, one scientist has written: "It is proving to be a wonderland of magical effects: force fields that emerge from nowhere, particles popping in and out of existence and energetic jitters with no apparent power source".¹⁴ It is tempting to say that this power source is the Spirit. However, to say that would perhaps be to make the same mistake as

earlier generations. Nevertheless we can confidently assert that it is a signpost which points to the underlying infinite power of the Spirit of God.

As brethren and sisters in Christ, we are "in Him" not only in a natural sense but also in a spiritual sense. As John wrote: "hereby know we that we are [same Greek as "have our being"] in Him" (1 Jno. 2:5). Unlike the Epicureans and Stoics, "we know him" (v. 3). The Athenian philosophers were always looking for something new to consider. Having been baptized into Christ we now have "a new commandment" (v. 8) to obey, that is, that we should "love one another" (Jno. 13:34). Let us take heed to this instruction. For there is nowhere we can go from God's Spirit. Just as surely as God saw the light on the first day, so God sees us now. Truly, "in Him we live, and move, and have our being".

13. D. Bohm, *Causality and Chance in Modern Physics*, (2nd edition, Routledge and Kegan Paul, 1984), pp. 163-4.

14. R. Mathews, "Nothing like a vacuum", *New Scientist*, 25 Feb. 1995, p. 30.

Order and chaos

Simon Collard

WHEN YOU walk down your street, what do you see? Houses, walls, cars, street lights, etc.? Does it ever occur to you to doubt that these things were actually designed and made by other people? Just imagine the intelligence and effort needed to make even the smallest of cars! Now turn the corner into your local park and consider the grass, shrubs and trees. Are these things any less complex? Each of them can do more than any car. They can grow in size, produce seeds that replicate themselves. They can repair themselves if damaged. In fact, they exist without the need for man to intervene at all.¹ These living things, we are told by evolutionists, have come about by the random forces of chance over enormous periods of time.

The stark reality is that countless intelligent people believe that life is the result of the chance collisions of atoms, that the amazingly detailed and organised phenomenon that we call life has arisen over thousands of millions of years from

disorganised chaos. This belief has been arrived at in the face of our common observation of life, namely, that order and complexity can come from disorder only through the application of thought (intelligence) and effort (energy). A jigsaw puzzle cannot make itself. You need careful observation, thought and manual dexterity to fit the pieces together correctly. If you were to put them into a cement mixer or shake them in the box, you would not expect to assemble the complete picture even if you shake for millions of years.

The Bible account of the Creation is in full accord with our observation. "The earth was without form and void" is a description of the chaotic state of things in the beginning. Then God spoke: "Let there be light". Here is the supreme intelligence, or wisdom of God. Then we read, "and there was light" (Gen. 1:2,3). The will

1. William Paley's *Natural Theology* (1802) has an excellent version of this argument.