Materials, the millennium and the mind of God.

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EDITORIAL

Materials, the Millennium and the Mind of God

The dawn of the Y2K millennium has arrived! The prospect brings challenges to us, both personally and professionally. As members of a scientific *Academy*, we must appraise where we are heading, our philosophical basis and the values and motivations with which we must mentor others [1] and encourage them to join us. We cannot address all the issues right now. But we shall briefly focus on some critical links with the anniversary that humanity is implicitly celebrating: the 2000th birthday of Jesus Christ.

When Napoleon allegedly asked the mathematical physicist Pierre Simon Laplace 'how God fitted into his (mechanistic) scheme of the cosmos', the latter replied: "Sire, I had no need of that hypothesis" [2]. This outlook is understandable within the one level of a reductionist mind-set, for indeed 'God' does not function merely as *deus ex machina*, such as the sole *immediate* cause of (eg) planetary angular momentum - as even Isaac Newton had suggested. But today, against Laplace, developments especially within physical science itself, such as the anthropic principle [3], chaos and complexity theories, impress upon us the necessity of multiple, complementary levels of explanation. That is to say, *holism* is fashionable. *Exclusive* reductionisms (eg: 'man is *nothing but* a machine') are suspect. Allied to this is the fact that, as we examine and explain systems at higher levels of analysis, then *emergent properties* become apparent. The whole is more than the sum of the parts. As the Hungarian scientist-philosopher Michael Polanyi expressed it: "Life transcends physics and chemistry" [4, 5]. This trend raises the question of the uppermost level of analysis and explanation.

When we come to our subject of Dental Biomaterials, we already differentiate between various levels of analysis, such as: molecular, mesoscale, phenomenological, cellular and clinical levels. The clinician regularly flips mind-set between addressing the whole patient, the oral cavity and the mechanistic reasons for biomaterial failure. The existence of these multiple study levels, each of which is significant in its own terms, can and does lead to some territorial conflicts. Which, if any, are the more ultimate, important and deserving of funding?

Faced with these questions about the focus and essence of scientific explanation, it is time to consider our

historical roots. These include the intellectual richness of the Biblical (or Judeo-Christian, and cognate) understanding of God's relationship to the world. Who is God? He is not less than Anselm's famous 11th - century definition: "God is that than which nothing greater can be thought" [6]. But does God exist? Entailed in this question is the whole issue of whether our lives, including our scientific endeavours and achievements, are ultimately significant and meaningful. Only a transcendent, all powerful, beneficent and purposive Creator can adequately underpin such an outlook.

Modern science operates with key presuppositions that are as axiomatic as those of its Grand Theories, such as Quantum Mechanics [7]. The top Axiom is that: *there is an explanation of everything*. If anything exists for which there is no explanation, physical science would virtually break down. The inexplicable, the irrational, the totally random, puts an end to science. The same happens if one thinks there are many competing gods, or perhaps a god who is not concerned with elegance or rational structure.

Isaac Newton remarked that his search for simple underlying laws of nature was prompted by the belief that a wise Creator would have designed the universe to function on such principles [8]. This means that the whole of space-time, from beginning to end, must depend in every detail on the conscious and purposive act of God. The alternative, non-theistic, origins-hypothesis of 'quantum fluctuations' inherently fails to justify its requisite belief that this universe is bound of *necessity* to be realised sometime. This returns us to the anti-science hypothesis that it does exist just *by chance*; that is, for no reason at all, and *without any possible explanation* [9].

For theists, however, God is the one and only ultimately necessary being. If there are necessary mathematical equations, existing even before this universe comes into being, the obvious place for them to exist is in the mind of God, the supreme cosmic intellect. It is God who can *freely select* a universe from all the available possibilities, and so God's creative choice can explain how a space-time universe comes from a set of ideas, mathematical or otherwise, in the eternal mind of God.

Belief in the intelligibility of nature thus strongly suggests the existence of a creative mind, of vast wisdom and power, able to construct the cosmos in accordance with rational laws [9]. It is no accident that modern, 'western' science really began with the clear realisation in the High Middle Ages that the Christian God was a rational creator, not an arbitrary agent who interferes in unpredictable ways every now and then. If one believes in such a Creator, one will be able to proceed on the assumption that our minds may discover the basic structures of nature, if they work on principles of true reason, seeking some rational explanation for the occurrence of every event. However, if God is not constrained by the world to make it in any particular way, then its secrets cannot be discovered by even rational contemplation or speculation alone, but only by a foundation of observation and experiment. Thus, if the world were not *rational*, science would not be possible: if the world were not *contingent* (i.e. selected out of a set of other possibilities), science would not be necessary.

Explanations in science thus usually function by showing how complex and often seemingly chaotic processes are the result of the operation of general laws, on simpler elements. It is a very remarkable and unexpected fact about the universe that all its ordered complexity results from a cumulative construction out of simpler entities; for example, the manifold diversity of chemical compounds and materials from an 'alphabet' of elements. What is remarkable is that there should be such a relatively simple structure which gives rise, through a cumulative and ordered organisation, to a level of complexity rich enough to generate such things as consciousness and free action. If we suppose that there is a God who creates a universe in order that conscious life should come to exist, then it is much more likely that *this* universe will exist than most other possible, abortive, universes.

As human beings are created in the image of God, and called to shape their lives in the likeness of God, among the greatest values in human existence are also those of free creativity and the recognition of the intrinsic worth of the individual. It is an important task of professional societies, such as the *Academy of Dental Materials*, to nurture such qualities as creativity, community, pastoral care and scholarly integrity. These should equilibrate our attitudes to and relationships with our colleagues, whether our research emphasis is in basic or applied science. As scientists we must also nurture a holistic understanding of human nature if we are to attract the bright minds of a rising generation [10], disenchanted with materialist reductionism. Again we remember

that a major rationale for our research is the health and welfare of our fellow men and women [11]. As we reach this notable Y2K anniversary, and enter the unknown new millennium, we can do so confident in the inherent worth of our task, through the intense involvement of the Creator with humanity, individually and collectively.

David Watts

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