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GOD IN THE COLLEGE SCIENCE CLASSROOM:
CHALLENGES AND OPPORTUNITIES

by

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Emmanuel laughed at my assignment, interrupted the class, rose up and said: "You don't have the right to mingle science with religion! I won't do your assignment." It happened in my Zoology class when I asked my students to choose one phylum and do a survey of the major adaptations of the animals to their environment; they were to evaluate the probability of those adaptations developing by chance or by design.

Since I have faced the same problem on several occasions, it is worthwhile to address the students' complaints on a more general basis. Their reasoning follows: "We have a Philosophy of Science class and you are welcomed to address the philosophical implications of Biology in such a class, but not in a formal 'scientific' class. We don't have time to waste.... We are paying enough to go to school, give us the facts, the hard scientific facts, and the rest we'll pick up outside of class, or later on".

Well, let us look at the facts.

The question:

On what grounds do we have the right to integrate our faith in the Bible with our teaching of Science -- or don't we ?

Before we can even attempt answering such a question, we have to realize that the terms are not always well defined:

Science, then, is to be considered . . . as knowledge of natural regularities that is subjected to some degree of skeptical rigour and explained by rational causes. . . . Thus, scientific knowledge of the world is only partial, and the progress of science follows the ability of humans to make phenomena perceivable.¹

Roth, in a recent review of the subject, lists 8 major concepts implied in the definition of science: organized knowledge, verifiable knowledge, facts about nature, explanations about nature, naturalistic explanations about nature, a system of thought based on

scientific principles, a methodology to discover truth about nature, and a naturalistic philosophy which excludes the supernatural.² Yet, as the New Columbia Encyclopedia puts it,

Although these methods and attitudes are generally shared by scientists, they do not provide a guaranteed means of scientific discovery; other factors, such as intuition, experience, good judgement, and sometimes a little luck, also contribute to new development in science.³

This picture of science is quite remote from the rational and empirical idea that one could have had a few decades ago. More and more, scientists and philosophers alike have come to realize that basic assumptions are involved in the scientific method.^{a, 4 5 6} The assumptions scientists have to make each time they use the scientific method, without weakening it, should remind us of its limitations.

The Bible, on the other hand, deals with more eternal aspects of reality, such as morality, existence, history, even cosmology. Since the Bible claims authority from God, one has first to accept God's existence by faith⁷. Initially, it may seem that science stands on much firmer ground than the Bible; yet we would do well to consider another definition of science:

Si l'on admet que les phénomènes naturels obéissent à des lois et que ces lois sont connaissables, la science est l'ensemble de la connaissance des lois des processus naturels^{b, 8}.

This definition, starting with "if", puts science on the same level as the Bible since one has to believe first that the natural phenomenons are following natural laws before one can study those laws, or as Clark puts it,

... we can formulate a creed for the scientist; it might read something like this:
I believe in the intelligibility of nature. . . . I believe that nature must be taken seriously. . . . I believe that faith--expectation of results as yet unproved--must be exerted if progress is to be made.

^a For a discussion on the scientific method, its basic assumptions and limitations, see Roth (1993); for more details, see Mott Media (1983) and Clark (1972).

^b "If one admits that the natural phenomenons are ruled by laws and that these laws can be known, science is the body of knowledge of the natural processes laws."

The legal setting:

In 1989, the State of California Board of Education adopted a *Policy Statement* on the Teaching of Science in the public schools.

Science's main goal is to gather observable facts and testable hypotheses about the natural world and should not be concerned with divine creation, ultimate purposes, or ultimate causes.

These non-scientific subjects are relegated to the literature and social studies curricula. The *Policy Statement* emphasizes that neither science nor anything else should be taught dogmatically. . . . Science teachers are professionally obligated to stick to science, and should respectfully encourage students to discuss matters outside the domain of science with their families and clergy.¹⁰

Although one could (and should) argue that evolutionism addresses (indirectly) the question of origins and even philosophical and moral questions^c, we have here a case where it will be more and more difficult (if not impossible) for a Christian student to be allowed to integrate his/her faith with his/her learning in state schools. This is another reason why we should support the Christian colleges.

The rational setting:

Even if we are allowed to present science on a Christian approach in private schools, we should be able to justify the rationale of our position. Does scientific rigour allow for metaphysical concepts ?

As we reflect back on the definition of science as a method of understanding the body of natural laws, we realize that scientists are only but discovering laws already existing in nature. After all, apples had always been falling on the ground when they ripen, even before Newton expressed in a mathematical way the reason why they do so.

^c See for instance Racheis, J. 1991. *Created from Animals - The Moral Implications of Darwinism*.

A few years ago, some historians questioned the work of Kekule on the chemical structure of benzene. Their argument went as follows: Kekule late in his life said he had seen in a dream a snake swallowing its tail and that gave him the idea of a circular molecule for benzene, therefore his theory was not valid. Yet no chemist today would be ready to drop the molecular structure of benzene even though the historical origin of the discovery might be under fire.¹¹

What can be learned from that historical case is that the validity of a scientific theory is independent of its origin. It does not matter where a scientist gets his/her idea to develop a working hypothesis. What really determines whether or not the end product will be accepted is the rigour of his/her experimental work and method of reasoning; if the validity of a scientific theory is independent of its origin, then we should be allowed to do scientific work under a biblical paradigm.

The historical setting:

Historically, the ancient philosophers were also the scientists of their time since they were trying to understand the universe and the living beings. But in doing so, they inevitably made reference to religious ideas. Later on, the Western science developed essentially among the Catholic monks since the church was running or controlling most of the schools in Europe. Some historians^d have even suggested that modern physics could never have been developed in the framework of the ancient philosophies of Plato and Aristotle for instance, because it implies the discovery of eternal laws and the recognition of a certain state of perfection in matter which did not fit in the ancients' world view. Nevertheless, one can say that religion has helped the development of modern science especially in the 17th and the 18th centuries, even though not everyone agrees on the importance of that help.¹²

If the religious context of the past centuries has been able to foster the development of science, why couldn't it do so today ?

^d A. Kojève (1964) and R. Hooykaas (1972).

Walsh and Middleton give us a good historical approach to the question.¹³ Little by little, the Western world had been secularized; that is to say, with modernism man has begun seeing the world in a dualistic way. Without completely rejecting God, we have been brought up with the idea that God has nothing essential to say about the natural world. The last step of such a process has been reached at our time when man becomes autonomous (a law unto himself). Being autonomous, modern man has chosen to part from God as source of knowledge, and has replaced Him by science. Today, God is not any more the norm of our knowledge nor the Bible accepted as divine revelation. Scientism has become the new religion.

Instead of the priest of the medieval period, the scientist clad in authoritative white dispenses "knowledge unto salvation". The original sin is no longer disobedience to God; it is ignorance, irrationality or misinformation.¹⁴

The Christian world view:

In contrast with scientism, Christianity is grounded on the belief in God as revealed in the Bible. From that basic assumption, Christians are to take biblical teachings seriously, in order to find guidance for all aspects of their lives: body, soul and mind.¹⁵

Traditionally, science has been portrayed as objective, while religion has been seen as subjective because each person has to make his/her own evaluation of the revelation. Yet are we sure that science does not depend on one's presuppositions? Quantum physics has taught us that each time we observe a particle, we disturb it. Some scientists are even wondering if the same is not true for observations and measurements in other fields, like ecology and sociobiology. In view of that fact, I believe we should not feel ashamed of our framework. The Christian world view is not inferior to the atheistic worldview of scientism; they both have their limitations.

Science, it appeared, is not as objective, nor religion as subjective, as had been claimed. There may be differences of emphasis between the fields, but the distinctions are not as absolute as had been asserted. Scientific data are theory-laden, not theory-free.

Theoretical assumptions enter the selection, reporting, and interpretation of what are taken to be data.¹⁶

Even if the scientific method is rational, the scientific research is not always so. Besides the discovery of the structure of benzene already mentioned, we can think of the serendipitous acts of Flemming when he discovered penicillin, or of Pasteur when he found the vaccine against avian cholera^e.

What can we say about religion ? As does science, religion requires fundamental beliefs, but does that make it irrational ? No, not any more than science^f.¹⁷ One of the advantages of the religious approach to nature is the wholistic view that it employs by integrating the physical, the physiological (biological) and the spiritual (mental) aspects of the phenomena, while the scientific approach is usually reductionist. Yet the more complex a system (such as cells, organs, societies, but also elementary particles), the more difficult it is to explain it, for the behaviour of the whole is not always predictable from the analysis of the components.^{18 19} Forgetting it "is as ridiculous as asserting that a Beethoven symphony is nothing but a collection of notes".²⁰ The same of course can be said about human beings: we are much more than the cells and the molecules that make us; no matter how complex they can be, they cannot fully explain our behaviour nor our thoughts.

Is philosophical neutrality possible in Science ?

Since even the scientific method is theory-laden and not purely empirical, some people have tried to be neutral regarding philosophical issues in science. But as Kuhn has shown, scientific theories do not exist in a vacuum; they are part of a paradigm which unfortunately creates in its users a kind of tunnel vision. It is the paradigm that sets the subjects to be studied and the questions that

^e Fleming did not discard bacterial cultures contaminated by molds but rather checked them under the microscope, while Pasteur re-used chicken that had been previously injected with infected blood. Although their action allowed them to make important discoveries, they were not planned and would even have been criticized as bad techniques by today's microbiological standards.

^f Del Ratzsch (1986) has a good review of the main arguments used by the naturalists against religion, with good answers to each one of them.

have chances to be answered; the other questions should not be answered since the paradigm predicts that they are fruitless and represent only a loss of time and energy⁹. The trouble is, paradigms do change with time during scientific revolutions, and at any point in time we cannot evaluate the absolute value of a given paradigm; we can only say that it is the best we know at that time. In view of this, some philosophers of science do not hesitate to say that

... les empiristes commettent la faute même pour laquelle ils ont à juste titre condamné les autres: il semble qu'il n'existe aucun moyen de tester leurs conceptions. Elles sont aussi infalsifiables que n'importe quelle proposition théologique^h.²¹

Since even the so-called empirical science cannot be free of prejudice and is finally brought back to the same level of theology, why should we be ashamed of studying science within a Christian worldview, especially when, as we shall see, the choice of the paradigm determines the value one attributes to man ?

The moral implications of each paradigm:

Because it is not possible to be philosophically neutral in respect to the origins of the universe and of man, we should explore the moral implications of each paradigm.

The biblical paradigmⁱ implies that:

- God is the Creator of the universe (however He may have done it);
- God created the universe (and the Earth) for a given purpose;
- man has been created differently than animals in that he was made in the image of God with a special mission;

⁹ For instance, scientists working under the evolutionist paradigm accept as their working hypothesis apes as man's ancestor, while other scientists working under the creationist paradigm believe man was created after God's image. The first group of scientists are trying hard to solve the puzzle of the fossil hominids bones because it would strengthen their paradigm, while the second group usually does not see the need for such a study or even fears the results might contradict their paradigm.

^h "the logical empirists make the same mistake for which they have rightfully condemned others: it seems there is no way to test their concepts. These are just as unfalsifiable as any theological proposition."

ⁱ Scientists working under the biblical paradigm acknowledge the existence of God, transcendent to matter and creator of the universe; in this framework the universe is an open system, God being the outside source of energy and design of the whole system.

- creation has been marred by sin, so that what we see today is quite remote from what Adam saw.

From these premises, we can derive some consequences to complete the implications of the biblical paradigm:

- because of his special relation to God, man has the responsibility of caring for God's creation (other human beings, animals, environment) as a steward;
- sin has broken the relationship between God and His creation, and man has to hasten the second coming of Jesus.

At first sight, one could think the naturalistic paradigm^j has no implications on morality and religion, as James Rachels declares in the introduction of his book: "Darwin's theory is about biology, *not* politics or economics or ethics or religion or anything else". Yet two pages later Rachels summarizes his argument by this statement:

Darwinism undermines both the idea that man is made in the image of God and the idea that man is a uniquely rational being. . . . The idea of human dignity turns out, therefore, to be the moral effluvium of a discredited metaphysics²²;

and the remainder of his book is a new approach to morality conceived in order to develop criteria derived from an evolutionary position.

The naturalistic paradigm implies that:

- there is no God to interfere with the universe;
- there is no definite purpose in the universe nor in man;
- man is not fundamentally different from animals;
- sin does not exist, and evil is just a way of life.

Some consequences derived from the naturalistic paradigm:

- man's responsibility toward nature is seen mainly on the basis of his greater mental capacity and of his own survival; he has the right to exploit it;
- death and pain have a heuristic value in being the agent of evolution.

To say that Darwinism has no influence on one's philosophy of life is misleading to say the least. One has only to remember the

^j Scientists working under the naturalistic paradigm believe that the cosmos has always been a closed system of material causes and effects that can never be influenced by anything from outside, like God.

development of social Darwinism in the United States or in France to measure the depth of its influence. During the 19th and the beginning of the 20th century, several geneticists were convinced that some human races were inferior to others, with eugenism as a logical consequence²³. Others used the evolutionist ideas of struggle for life to support the liberal paradigm of free enterprise. This idea was so entrenched in the Western mind that even today one can still notice it in political speeches²⁴. And it was also the Darwinist paradigm that justified the terrible exterminations of Jews and Gypsies under the Nazi regime²⁵.

Today, the situation is not very different. With the development of sociobiology, scientists have begun to view individuals as mere vectors to transfer genes to the next generation. Under such a paradigm, the only finality for human beings is to perpetuate the most advantageous selfish genes, while the whole behaviour is locked into the gene pool of our species. Having said this, sociobiologists are now pushing their theory to other domains, traditionally outside the realm of science, such as ethics and morality; they even suggest that man should use his intellect to develop new forms of religion that go beyond the traditional religions²⁶.

A model for integrating faith and science:

While scientists are preparing to investigate alternative forms of worship, it is urgent for Christians to wake up, less they be overtaken ! We bare the heavy reponsability of presenting them a world view integrating the last scientific discoveries with a philosophical perspective of our origins and destiny anchored on the Bible. If we keep on doing just but "normal science"^k, we may be good scientists, but we will have missed our mission to reveal God to the scientific world. It is therefore our duty to avoid a dualistic approach to the Natural Sciences without offending non-Christians.

^k In the way Kuhn uses the term, that is studying only questions suggested by the leading paradigm (here the naturalistic approach to science).

In order to fulfill our high calling, we should be very tactful especially if we know our partner does not believe in the Bible. It is worth noting that God is not mentioned by name in two books of the Bible, namely Esther and the Song of Songs. Yet those books are in the Bible because they are inspired on the same level as the other 64 books. The immanence of God can be seen in the book of Esther through one of His attributes: Esther finds grace with everyone she meets, from the king and the chiefs, to the common people, and even from eunuchs, while God shows mercy toward His people throughout the book. In the Song of Songs, God is revealed through His perfect love for His creatures.

These two examples should teach us that it is not mandatory to mention the name of God in a science classroom in order to integrate faith and learning. If we can, so much the better, but if we know that some students will be offended or upset, we should find another way of introducing God. In state schools, this is the only way of doing so. I suggest letting the evidences speak for themselves.

Before giving some practical suggestions for carrying out this task, we should recognize the necessity of developing a model for the teaching of science that: 1) allows for scientific research without limiting what can be studied¹, 2) has acceptable social consequences^m, and 3) is wholistic and not reductionist to the point of excluding metaphysical issues (or any other matter)ⁿ.

Practical steps:

The first step would be to survey all (or as many as possible) unanswered questions in a given scientific area under the ruling paradigm (naturalistic). A literature search can be conducted

¹ In the evolutionist paradigm for instance, "solving the mystery of evolution is out of the question because Darwinists have to insist that there is no mystery. The interesting conceptual bit has been settled, and only the details remain to be filled in." (Johnson, P. 1991, p.143). On the other side however, academic freedom in Christian institutions has limits scholars are not always free to bypass: to give but one example, studies on human reproductive behaviour at Loma Linda University were halted several years ago by the General Conference for not being very useful (to them) nor in accordance to the SDA code of morale.

^m To be protected from the pitfalls of social Darwinism for instance.

ⁿ The biblical paradigm should have the advantage of being wholistic, at the condition that we are open enough to accept new ideas.

individually or by groups of students. The number of unanswered questions in such fields as cellular biology, molecular biology, zoology (even systematics), or macro-evolution to name just a few, are amazingly high.

In the second step, one would do the same exercise under the alternative paradigm (biblical). This step may be harder for students to do by themselves due to the lack of Christian scientific books on the topic, and might involve using reflective reasoning more than actual data. Yet it can still be done and could be a stimulating exercise in itself: we can help students to find the questions that cannot be answered due to the limitations of the paradigm.

The third step would analyze the presumed results obtained under both paradigms^o in order to determine which paradigm suggests answers to most of the questions raised in the field under investigation. In this step, we are not so much concerned with the specific mechanisms used to describe the scientific phenomenon as with the philosophy underlying them^p.

The fourth step would be to look at science approached under a biblical paradigm in an attempt to combine the "contingent order and intelligibility that the scientific enterprise presupposes"²⁷ with the revealed data of religion. Along that line, we can bring in the unanswered questions of the two paradigms, and see if they can be answered. For instance,

Evolutionary biology offers many examples of a fantastically complex order, which evokes our wonder. The intricate structures of DNA and protein molecules are dependent on myriads of interatomic forces. Molecular structures, in turn, contribute to higher levels of organization. . . . In nature, information is as important as matter and energy. Perhaps there is some parallel in the theological concept of Word or *logos*,

^o It is important for the reader to remember the goal and the spirit of this method: to bring students to realize one can do good science while believing in God and in the authority of the Bible. In that sense, the results obtained following each paradigm would be different, not because one would use a different method or special techniques, but simply because of using a different working hypothesis according to one's paradigm. In this paper, I am not trying to say that a scientist working under a biblical paradigm is doing a better type of science than a scientist working under a naturalistic one: science is science and results of using the same techniques, no matter the personal philosophy of the scientist. But I am convinced that the Christian scientist because he is using a broader paradigm can suggest different or new paths of research.

^p Most readers will have recognized a form of the multiple working hypotheses developed by T. Chamberlin. (1965) *The Method of Multiple Working Hypotheses*. *Science* 148:754-759.

which can be thought of as a form of information, the communication of meaning and message when correctly interpreted.²⁸

On the other end of the scale, scientists are also wondering at

... the general orderliness of the universe. There are endless ways in which the universe might have been totally chaotic. It might have had no laws at all. . . . But the real universe is not like this. It is highly ordered. There exist well-defined laws of physics and definite cause-effect relationships. There is a dependability in the operation of these laws. . . . This causal order doesn't follow from logical necessity; it is a synthetic property of the world, and one for which we can rightly demand some sort of explanation.²⁹

Moreland (1994)³⁰ gives a list of 25 parameters of the universe that must have been fixed carefully for any life to exist at any time in the history of the universe, and another list of 30 other parameters related to our galaxy-sun-earth-moon system necessary for the support of life on earth. In view of all those constraints, astrophysicist Paul Davies declares

The delicate fine-tuning in the values of the constants, necessary so that the various different branches of physics can dovetail so felicitously, might be attributed to God. It is hard to resist the impression that the present structure of the universe, apparently so sensitive to minor alterations in the numbers, has been rather carefully thought out. . . . Perhaps future developments in science will lead to more direct evidence for other universes, but until then, the seemingly miraculous concurrence of numerical values that nature has assigned to her fundamental constants must remain the most compelling evidence for an element of cosmic design.³¹

Another way of bringing students to approach science on a biblical paradigm is to ask them to draw what they see in nature. The usual assignments of drawing a dissection or a flower at a biology lab session can be extended to nearly all science classes, from ecology to physics or from chemistry to mathematics⁹. Doing so will lead our students to experiment nature through the right side of their brain

⁹ Why not ask the students to sketch out their thoughts even on topics as abstract as a mathematical equation, or a chemical structure or even the structure of the universe? Such an exercise will undoubtedly bring unpredictable results and the teacher will have to guide the students in their search for harmony (or the cause of disharmony) in the universe.

and could help them (especially non-Christian) to see "God's invisible qualities--his eternal power and divine nature--" as they "have been clearly seen, being understood from what has been made"³².

The last step in our work would be to point out to our students the moral and the philosophical consequences of the paradigm of their choice. The outcome of that choice may be a man-centered, terrestrial and limited "pseudoscience, . . . completed with the triumph of the neo-Darwinian synthesis"³³, that could lead to social abuse. The other choice would be a Christ-centered unlimited^f research, helpful not only to the researcher, but also to his fellow men. Such an information might be best transmitted in the setting of a philosophy of science course^s which should ideally be required of all science students even though some of them might think it unnecessary for their specific program. Traditionally classes of philosophy of science have been optional or reserved for senior students when they are given at the College level. Rather than leaving such a course for Graduate School or for some interested senior students, I recommend to make it mandatory to all science students as early as possible, preferably during the first year, to foster the philosophy underlying our science classes. To those who think students must have had enough exposure to scientific reasoning and experimentation before they can really evaluate philosophical issues in science, especially as they relate to biblical statements, to those I suggest to add a second course^t involving even more thinking about questions of existence and requiring strong notions of logics.

^f *Unlimited in time and scope since even eternity will always bring new thoughts to explore and new discoveries to be made.*

^s *Suggested course description for Philosophy of Science: definition and goals of philosophy; definition and goals of science, differences with techniques and technology; the human mind and rational thinking; the scientific method, strengths and limitations; paradigm shifts and scientific revolutions; evolution of the notion of truth through the ages; questions of metaphysics and their relations to science.*

^t *Suggested course description for Science and the Bible: question of transcendence and revelation; questions of origins and destiny, primary and secondary causes, origins of the universe, origins of life, origins of man, evolution versus creation; finality and determinism in nature; order and chaos in the universe.*

Conclusion:

On what grounds do we have the right to integrate our faith in the Bible with our teaching of Science ? We do it because as Christians we believe we are free moral agents responsible for our acts; and to be responsible before God, we have to make a choice: "See, I set before you today life and prosperity, death and destruction."³⁴

Now, Emmanuel was not a bad student, and he did not refuse to do his homework because it was either too boring or too difficult but simply because it did not fit in with the world view he had chosen.

Such an attitude is more likely to be found among non-Christian students, but it can spread quite quickly to all the students of a class, as I have unfortunately experienced more than once in Africa. This is the reason why we as teachers should not leave the problem to the administration by asking them to reduce the number of non-Christian students in our science classes. Such an approach would only solve the problem temporarily. Rather, I suggest that we take a very different approach.

"A major responsibility of the Christian teacher is to help students distinguish between fact and assumption"³⁵. It is the role of religion to provide us with a framework that can help us reshape our world view and correct any false assumption in our paradigm³⁶. If we can do this, we will have achieved our high calling. It might mean retailoring the curriculum and/or changing the sequence of some courses. Such might be the price to pay to have integration of faith and learning; but if we have already gone so far as to have SDA colleges, is it not worthwhile ?

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