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The Validity of Science and Technology

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This symposium on science and technology is possible because in the beginning sinless Adam engaged in scientific activity. His work of naming the animals was analytical in the same sense that the sciences are analytical: he analyzed that which God had created. Perhaps Adam's naming of the animals was the first science project, for this project helped Adam understand the nature of those animals and enabled him to work with those animals better. This was fitting, for God had given Adam, his image-bearer, dominion over the world.

Therefore, the command to carry out scientific work is a creation ordinance. Later the entrance of sin altered how humans would understand and respond to that command, but it did not remove that command.

Perhaps the command concerning scientific work can be compared with commands concerning the family. The family was instituted before Adam fell; therefore, the existence of the family does not depend upon sin. Reformed Christians usually sum this up by suggesting a creation ordinance concerning the family has been given. Distorted modern ideas concerning the family do not change that fact; nor do distorted modern ideas concerning scientific work change the fact that such work was commanded before Adam fell, making this command also a creation ordinance.

With this understanding of why there is scientific work, I want to look at three things. First, I shall describe two important characteristics of the scientific enterprise. I shall emphasize science more than

technology; I do this because several aspects of technology are covered elsewhere in this symposium. Second, using these characteristics, I want to call attention to how humans have responded over the years to the command to do scientific work. This response has brought humankind to a certain place in scientific history. Therefore, given that history, I want to examine in the third part of this talk some modern questions which arise when a Reformed Christian approach to scientific work is used to attempt to answer those questions.

The roots of the scientific enterprise lie in God's command to investigate creation and serve it. That is, Adam was to serve creation when he named the animals. Paradoxically, this service of Adam showed he had dominion over the animals. Also, Adam's naming part of creation reflected the orderliness in creation. An important characteristic—perhaps the most important characteristic—of the scientific enterprise, as witnessed to by virtually all scientists who have recorded their thoughts on the nature of science, is that the world is orderly, and that therefore it is indeed possible for us to have dominion.

By "orderly" I mean that the parts of the world fit together. An analogous situation exists at a busy intersection. As long as the motorists obey the stop-and-go lights, large numbers of vehicles cross paths without collision: there is order, not chaos. One might say that the various streams of traffic fit together. But if the motorists do not obey the law, there is chaos. It is the same in the world which the scientist investigates. His observations fit together just because creation obeys laws. There is no chaos.

This orderliness is implied in the command to investigate creation. Not only does everyone take for granted that science educators will teach future scientists that science cannot exist without the assumption of order; but also, on a deeper level, philosophers of science analyze what has been discovered and deliver a unanimous verdict: order in creation is real and without this order there would be no scientific

activity.

The scientific enterprise possesses a second important characteristic. The existence of order and the consequent scientific activity have made it possible for humans to transform their world, sometimes for the worse, but at other times for the better. I want only to call attention to the existence of this characteristic; other articles in this symposium are concerned with the scientific-technological transformation of the world.

The two outstanding marks of the scientific enterprise, the assumption of orderliness and the use of the resulting technology to transform the world, both reflect pre-fall conditions. The creation ordinance which instructed humans to analyze creation and have dominion over it, was possible only because (1) God did indeed create an orderly world and (2) humans differed from all other creatures in the only way which mattered: they were created in the image of God. Humans will probably not obtain in this life a full appreciation of what being created in the image of God means. But they do know one thing about what his uniqueness, and therefore the image of God, implies: humans can, over the years, from generation to generation, continually learn more about what God has created. The human race can grow in knowledge. The scientific enterprise could grow from extremely small beginnings to what it is today and, presumably, it can grow to something very much larger.

Just because we are creatures who can grow in knowledge, enabling the scientific enterprise to grow, there is a consequence of this creation ordinance (that is, the command to analyze and to have dominion) which might not have been evident to the earliest fallen humans. But it is a consequence now seen rather easily. That is this: scientific and technological activity, human activity, continually gives us more power, the ability to effect changes in the world. The one who had the first hand-held tool had more ability than his predecessor who had none; in a sense, the tool became a human *extension*. Compare this first hand-

held tool with the amazing fifth-generation computer (discussed by W. Tinga in this symposium). As science and therefore technology have grown almost beyond belief, we have become more and more *extended*.

What we can now see, and what the earliest fallen human perhaps could not see, is that humans are capable of doing very

Egypt and Mesopotamia by the end of the fourth millenium B.C.¹ In the second millenium B.C. iron ores were smelted in such a way that a primitive kind of steel was produced, permitting the manufacture of steel plows, weapons, and armor.²

The Ionian philosophers of about 1000 B.C., predecessors of the philosophers of the Golden Age of Greece, were in one sense the

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much. Look beyond our technical achievements to our achievements in the arts, in athletics, and in all kinds of scholarship; you will realize that the human potential is vast. Perhaps it is in principle possible for *one* person to possess all these abilities—in the natural sciences, in the arts, in athletics, etc. Even if there is never such a person, these advances, including those in the natural sciences, demonstrate some of the human potential which exists. Perhaps one can even conclude that these things provide a glimpse of how humans might grow when they have permanent life with the Lord.

The *response* of generation after generation to the part of the creation ordinances relating to the investigation of creation is the development of science. What has that response been like over the years?

According to Genesis 4, the earliest fallen humans learned enough about creation to enable them to make tools. They thus could work metal and build, among other things, musical instruments. Other inventions came slowly. For example, the loom was in use in

fathers of modern science. Their goal was the explanation of the world. They wanted to show that the "creation" of the world took place by natural causes; they thus wanted to unify knowledge without invoking the existence of a god.

Later, in the fifth and fourth centuries B.C., the period of the flowering of Greek culture, thinkers such as Aristotle reflected on the nature of things and influenced thought for more than two millenia. The Greeks emphasized the use of reason in scientific work, but did not think much of experiment. The Romans, who followed the Greeks, were wrong for quite another reason. They were pragmatic and consequently interested primarily in technological results and not in underlying principles. No doubt this was a manifestation of greed. As a result, the Romans did not make a significant contribution to science.

It was a long time before the Gospel had an impact on the scientific enterprise. During the first fifteen hundred years of the Christian era, scientific effort was often mingled with secret formulas linked to paganism (as

was the case with the greedy alchemists who attempted to manufacture gold) and belief in magic. No wonder God did not bless this kind of response to his command. These centuries were the dark ages of the scientific enterprise.

R. Hooykaas, a Christian historian of science, claims with considerable justification that the Reformation brought science out of its dark ages.³ The Reformers rejected several ideas which had permeated the culture of that day, ideas which had for the most part been introduced by the Greeks. Greek philosophers had held that the world is a divine, living organism, the source of all beings, gods included. (This "living organism" concept was, of course, quite different from the modern identification of the biosphere as a living organism.)

The Greeks also said that work with one's hands was of a lower order than other work. Therefore, experimentation was frowned upon for two reasons: it involved (they said) interference in an organism, the world, which has a mysterious life of its own; also, experimentation required the worker to use his hands, that is, it required manual labor. Hooykaas maintains that the Reformers' insistence on the separation between the creature and the Creator was a rejection of the "living organism" idea; in doing so, says Hooykaas, they "de-deified" the world. The Reformers also claimed that all work, including manual labor, has dignity. They were not elitist, as were those who believed that only the lower orders of humankind were to carry out manual labor.

The Reformers believed that we were commanded to investigate the physical or material world, a world that has meaning, using both our head and our hands. As a result of the work of the Reformers, experimentation became and has continued to be extremely important.

But the millenium did not begin in 1517 A.D. The history of the philosophy of natural science since that time is practically a history of distortions of God's command to investigate. The great triumphs of Galileo

and Newton in the seventeenth century, by means of which so much was learned of the world, were used in the eighteenth century not to praise God but to limit him. Thus, the later deists used Newtonian science to limit God to the act of creation at some time in the distant past; after that time, creation functioned on its own, like an unwinding clock. They did not need a God who upheld creation.

In the nineteenth century God was completely removed. N.C. Gillespie shows that the person most responsible for that removal was none other than Charles Darwin.⁴ Gillespie argues that the way in which Darwin defended the theory of biological evolution eventually vanquished those who, like the later deists, wanted to hold at least to a God who created with a purpose. Gillespie claims correctly that as a result of Darwin's debate with his opponents all natural science, not just biology, would henceforth be positivistic science, that is, science which does not need a god.

Auguste Comte, a nineteenth century French philosopher, was the philosopher of positivism. His ideas affected many disciplines, including the natural sciences. Comte taught that humans developed in three stages: the first was the theological, or fictitious, stage in which humans supposed that all phenomena are directly caused by a supernatural being; in the second or abstract stage, humans thought that events are caused by abstract forces. In the third stage, the ultimate or scientific stage, also called the positive stage, humans are finally able to use their mind to discern the scientific laws which determine what happens. Humans are now mature; they no longer need to invoke the existence of a god to account for the unexplainable.

This rejection of a need for a god fit in well with what Darwin was saying. It is no longer important that Darwin actually did believe in a God who created. What is important is that by the time the nineteenth century smoke had cleared, Darwin's argument for purposelessness or randomness in the world

had won out in much of the scientific community.

This is the philosophical mess which the scientific community inherited as the explosion of scientific knowledge began at the beginning of the twentieth century. But God did not leave Himself without witness. Of course, there always have been some of his children working in the sciences. More to the point, however, has been the witness inherent in the results of the scientific work itself. What was discovered as humans investigated did not match the unholy philosophical underpinnings which had been developed. Thus, Christians and non-Christians have always in their scientific work interacted with the same creational structure. But non-Christians have a difficult time explaining why the world seems to have a structure. They are forced to agree that the orderliness inherent in a structure must be assumed for scientific work to be carried out.

Because ideas about the nature of things constantly shifted in the centuries preceding the present one, the twentieth century has not seen a shortage of scientific philosophers. For example, T.S. Kuhn, a scientific philosopher-historian who does not have a Christian approach, states that the question, "What must the world be like in order that man may know it?" is "...as old as science itself, and it remains unanswered."⁵ Surely consistent Christians can answer Kuhn's question. After all, Paul said in Romans 1 that all men know—even though some suppress the knowledge—that there is a God who has all power. This God is faithful to himself—does not contradict himself—and so it should be no surprise to Christians, especially Christian scientists, to learn that the various manifestations of his power are consistent with each other. There is an important corollary to this conclusion. Just because all humans, not only Christians, are created in the image of God, all have the ability to investigate his creation and discover what this consistent power of God means.

But not all Christians have been convinced that everyone can do valid science. Non-Christian scientists have often been eager to mix valid science with pagan philosophy, and consequently Christians can easily come to the conclusion that non-Christians cannot carry out valid scientific work. The same problem has arisen in non-scientific areas of life.

Because of this problem, the first decades of the twentieth century were very confusing ones for Christians. In particular, in the American scene controversy arose in the Christian Reformed Church concerning whether or not God extends grace to all people; is there a "common" grace? There are many aspects to this question; but for the present purpose it is sufficient to note that if there is a common grace, then all persons can do valid, useful scientific work. Then the product of this work, even if the worker is not Christian, can be used to honor God. This is so because the product of the scientific work, whether it is a new chemical compound, a computer chip, or a mathematical relation, is a new manifestation of creation and, like the heavens, declares the glory of God. In this sense the non-Christian can do "good" work.

If much that the non-Christian does is "good" in the common grace sense, then it is wrong to think more highly of a "spiritual" area of life than a "non-spiritual" or "natural" area. Let no one think little of that which honors God. In other words, once people accept the idea of common grace, they will have no use for dualism, which separates the natural from the spiritual. Not just the formal worship services of the church, but also daily work must be sanctified.

The Christian Reformed Church of the 1920's could conceivably have decided against common grace. If that had been the decision, development of what it means to be Reformed in all areas of life would very likely not have gone well. But because common grace was accepted, scholarly work in the Christian Reformed community may

have received not only its biggest boost but also, as will be shown, its worst blow. On the one hand, it was possible to introduce into the Christian Reformed scholarly community the ideas of Abraham Kuyper, working in The Netherlands late in the nineteenth century, concerning Christ's lordship over all of life. Work in the natural sciences and the other sciences was not only valid; it was necessary. The *urgency* of scientific work was demonstrated. There was a call to action.

But acceptance of common grace represented both good news and bad news. Many scholars in the Christian Reformed community of the last half century have uncritically adopted far too much of the positivistic philosophical underpinnings of modern scientific effort. For some, it has been too easy to believe, just because some of the scientific work of the non-Christian is valid, that his philosophical conclusions are also valid.

For example, those who maintain that God created humans by making them descendents of animals miss the whole point concerning the human nature and human dignity. This position is a virtual denial of our creation in the image of God. Anyone who takes this position cannot provide very convincing answers on some of the questions raised in this symposium, such as questions concerning artificial intelligence, robotics, and the information society.

I shall now discuss some of the questions which inevitably arise when one attempts to approach the natural sciences in a Reformed Christian way.

The problem of how to respect all of a subject of investigation while investigating only one of its parts continually arises. Observe what happens when the subject of investigation is humankind. Some non-Christian philosophers hold that an understanding of humans can be reduced to an understanding of mathematics, physics, and chemistry. Certain modern psychologists are guilty of precisely this error. They consider humans nothing more than a bundle of

chemicals, chemicals which can be analyzed using mathematics and physics. Such a "reduction"—in this case, reducing humans to chemicals—violates in many ways the Christian concept of humanity. Thus, were one to describe humans in such a way, the uniqueness of their psyche or of their faith in God would be an impossibility.

But sometimes it is indeed necessary to study a part—even of humans—while recognizing that there is a whole. A scientist might even treat a *part* of humanity in the same way he treats a *part* of an animal. For instance, there is no need to qualify a description of the biochemistry of the human body by saying, "But this biochemistry is different because it is for a *human* body."

Furthermore, for one to make meaningful statements about the biochemistry of humans, one would have to understand the results of extensive, detailed studies; in short, one would have to be a specialist. Specialization is a necessity if the command to investigate has meaning. Specialization should not be confused with reductionism. It makes sense for even the undergraduate student to become a specialist. Just as schools expect certain undergraduate students to be able to read New Testament Greek—certainly a mark of specialization—they quite reasonably expect other undergraduate students to take enough courses in mathematics, physics, biology, and chemistry to be able to discuss knowledgeably the biochemistry of the human body.

But even assuming that the difference between reductionism and specialization is understood, and that specialization is desirable, it is still possible to err. In this case, there is such a thing as overspecialization. In some colleges almost every course a student takes is a course in his specialty. Certain schools of engineering and schools which teach vocational skills are examples of this excess.

One more point must be made concerning the intensive study of one part of the whole. In order to make such a study, the part must

be isolated from the whole; the part is then the "system" which is studied; for convenience, that which is actually the subsystem is called the system. Isolation from the whole is the usual procedure of the physical scientist. But the procedure of defining and isolating a system can seem to be easier than it actually is. In another part of this symposium D. Vander Zee points out that the ecosystem is large and that limiting study to only part of it—because the system has been defined incorrectly—leads to catastrophe.

Perhaps an example of such incorrect definition is the assumption that a forest consists only of trees, not of trees and many other kinds of life. With such an assumption, society can fall into the error of considering only the fate of the trees, not the other kinds of life, when the trees are harvested and replaced with seedlings. There are obviously right and wrong ways to decide on the definition of the system to be analyzed.

Quite often natural scientists need more than system isolation before they can begin their analysis. There are various aspects of creation; and therefore analysis of a system must proceed by analysis of one aspect at a time. For example, the biotic aspect of the ecosystem is not the same as those aspects which, when studied together, constitute physical science. When the biotic aspect is studied, that is, when humans build up the body of knowledge called biological science, they observe that the parts of biological science are harmonious. Here, just as in physical science, is the order I have referred to repeatedly.

Perhaps there is a way to unite the laws of each aspect, so that there is complete organization within an aspect. In the physical sciences, the attempt to obtain such order is the attempt to find a unified field theory. Non-Christians do not deny the possibility of finding a unified field theory in the physical sciences, that is, the possibility of finding order in the physical sciences. But non-Christians do suppress the obvious conclusion. For it is at just this point—that is, when the system is defined, isolated, and

analyzed, and when order is observed—that scientists might attempt to unify knowledge in the wrong way.

Two examples of the wrong kind of unification should be enough to illustrate the danger of attempting to unify without starting out with the assumption that God created the world. Both of these efforts have obviously been carried out for the purpose of denying God and his work. First, consider what has happened as some scientists have attempted to extend the idea of biological evolution so that eventually no creation of any kind is allowed.

After biological evolution was first promulgated, separate creations of plants and animals were not accepted; then, a separate creation of humans was ruled out; then, no separate creation of life, but rather evolution of life from non-life, could be allowed; and finally, belief in a creation of matter was removed and the idea of an eternally-existing universe was accepted instead. Such a system is nicely unified, but its satanic origin is all too evident.

Astronomy provides another example of a non-Christian unification attempt, one closely related to the attempt just described. Some scholars, such as Fred Hoyle, have said that if scientists are going to unify knowledge, then there can be no limit: they must account for everything. To postulate a creation is, for people like Hoyle, a cop-out; after all, humans cannot understand the act of creating from nothing.

Hoyle said, "The aim of the steady-state theory is to dispense with . . . arbitrary starting conditions. Instead of attributing the main features of the Universe to arbitrary fiat, it is proposed that nothing less should be possible than a demonstration that all the main features of the Universe are consequences of the laws of physics, entirely independent of any starting conditions." Those who hold to creation use a procedure which, says Hoyle, ". . . is quite characteristic of the outlook of primitive peoples (who postulated) the existence of gods."⁶

Some cosmological theories have been advanced to "explain" an eternally-existing universe. One of those is the steady-state creation theory, now discredited. Another is the oscillating universe theory, an extension of the "big bang" theory. According to the "big bang" theory, the universe has been expanding from a single point ever since its creation billions of years ago. But the oscillating universe theory says that before the big bang explosion there was an implosion, before that an explosion, and so on indefinitely. The universe does not grow old. In other words, there was no beginning; the God of Psalm 102, who remains the same while his earth and heavens grow old, does not exist. Everything must be explained by known physical laws. The Ionian philosophers would be pleased.

What do all these things mean for the modern scientific enterprise? How should Christians view things?

For science education, they should not ask, "Why not attend a secular school for science education? Isn't science education in a secular school the same as in a Christian school?" I suggest that the history of scientific thought demonstrates that the Christian is correct and that the non-Christian is not. Anyone who investigates in the physical world investigates God's creation. Christian investigators and teachers are then on their own turf. Christians could turn the secular school—Christian school question around: "What right does the secular scientist have to work on our turf? Is he educating properly when he leaves out God? What right have you, Mr. Secular Educator, to go to the classroom and gloss over the fact that science is based on an order you cannot explain?"

Consideration of the modern scientific enterprise provides some conclusions concerning the need to educate all students, not just science majors, in science. Just because Christian schools educate the whole person, and because the student lives in God's creation, the student should learn in Christian schools some of the Christian understanding

of the scientific aspects of that creation. The Christian school can be properly equipped to teach science not only to science majors but also to others.

Following is a summary of the matter: God commanded in the beginning that there should be a scientific enterprise. Humans have done virtually everything they could to distort this effort, but God has held back the forces of evil. Through human scientific activity God continually reveals more of his creation. The first "investigators" could not have visualized how investigation would unfold as the centuries passed, but now we can see more of what is in creation and we are amazed beyond belief. When Christians realize that God has used *humans* in every scientific advance, they also realize that *humans* have unbelievable potential. With the advent of the computer, this potential has suddenly increased in almost every facet of human endeavor. If one could measure such things, perhaps it would be reported that human potential has increased several percent a year for a decade because of the computer. There is a high inflation rate of human potential. God continually shows us more of himself and the world. Perhaps because of our continued disobedience, God will withhold his hand, slowing down or ending the development of human potential in this life. But in the longer view, including our activity in the next life as well as in this one, there is no reason to expect that the development of human potential will not continue.

Endnotes

¹Henry Hodges, *Technology in the Ancient World* (New York: Alfred A. Knopf, 1970), p. 112.

²W.H. McNeill, *The Rise of the West* (Chicago: University of Chicago Press, 1963; Mentor Book pb. edition, 1965), p. 132.

³R. Hooykaas, *Religion and the Rise of Modern Science* (Grand Rapids, MI: Wm. B. Eerdmans, 1972).

⁴N.C. Gillespie, *Charles Darwin and the Problem of Creation* (Chicago: University of Chicago Press, 1979).

⁵T.S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

⁶F. Hoyle, *Frontiers of Astronomy* (New York: Harper and Row, 1955).