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Galileo, Biotechnology, and Epistemological Humility: Moving Stewardship Beyond the Development-Conservation Debate

Charles C. Adams
Dordt College

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Moving stewardship beyond the development-conservation debate

by Charles C. Adams

ABSTRACT

Modern technology—biotechnology in particular—confronts the Christian community with a plethora of complex issues and questions for which there are no simple answers. Some of those issues—stem cell research, for example—are relatively specific and immediate. Others are more hypothetical: genetic therapy for lengthening lifespan is one example. One particular issue that is both theoretical and immediate is the question of stewardship. What does the Lord require of his image-bearing creatures with respect to their relationship to the rest of creation? Some Christians have argued that we are called by God to respect and conserve the created order and that we do so by seeking ecological understanding and promoting actions that minimize human disruption of and/or intervention in those ecological patterns that we discover. Other Christians, hearing God's call to "be fruitful and increase in number, fill the earth and subdue it," understand stewardship more in terms of development. The former group raise many concerns with respect to biotechnology. The latter group are eager to promote biotechnological advancement. Far too often, however, representatives of both groups are influenced by naturalism as much as by careful biblical thinking.

Using a relatively novel interdisciplinary approach, this paper will advocate for the embrace of epistemological humility as a way of avoiding the pitfalls of naturalistic thinking and for remaining faithful to traditional Christian understandings of the nature of creation and of what it means to be human. Starting with basic biblical tenets that have been accepted by Christians for centuries, it will seek to articulate a relationship between the human and non-human creation that encourages careful biotechnological advance within the context of creation care, and that transcends the polarization between unbridled development and stagnating conservation. The approach will incorporate insights from the history of science (e.g., Galileo, Descartes) and the phi-

Dr. Charles C. Adams is Professor of Engineering and Dean of the Natural Sciences at Dordt College.

losophy of technology (e.g., Egbert Schuurman) with basic Christian doctrine (e.g., the Apostle's Creed) to imply a posture of epistemological humility suitable as a common foundation from which to approach specific issues and problems in biotechnology.

INTRODUCTION

> Because of this the land mourns, and all who live in it waste away; the beasts of the field and the birds of the air and the fish of the sea are dying. (Hosea 4:3, *NIV*)

> You will go out in joy and be led forth in peace; the mountains and hills will burst into song before you, and all the trees of the field will clap their hands. (Isaiah 55:10-12, *NIV*)

The words of Hosea and Isaiah bring critical understanding to what we read in the Psalms (e.g., Psalm 8, 19, 24) and in the book of Genesis (Genesis 1 and 2): the earth, all of creation, belongs to God. He loves it and cares for it; but his image-bearing creature has sinned and brought shame and brokenness upon that creation. Nonetheless, by God's grace the whole of creation will be redeemed. Humankind and mountains, the beasts and the trees of the field alike, will share in the eternal reconciliation bought by the suffering of the Redeemer, the one revealed in the New Testament as Jesus, the Word of God in human form, the Creator-Sustainer-Redeemer of all things (Colossians 1:15-20).

In these last days, before the return of Jesus, we humans experience both the brokenness described by Hosea and the shalom foreseen by Isaiah. Moreover, we are called to serve as God's hands in his world: the instruments through which he brings healing and reconciliation to his creation. At the beginning of the twenty-first century, we find ourselves having learned how to transform creation in ways unimagined by the Old Testament prophets. In particular, the most recent advances in biotechnology have enabled humankind to wield unimagined power, power that can bring both great healing and great devastation upon creation, including humankind itself.

Getting in Bed with Frankenstein

Agriculture defines northwest Iowa. Sioux Center, located on the plains of northwest Iowa, is surrounded by fields of corn and soybeans, punctuated by hog and cattle feedlots. However, agriculture is changing. The corn has been genetically modified to resist herbicides, and the reproduction of cattle is gaining assistance from artificial insemination and cloning. Even so, a newcomer has been added to the northwest Iowa landscape: the biotechnology company. By 2002, there were no less than seven biotechnology companies operating in northwest Iowa, and increasingly, Dordt College graduates—with majors in chemistry, biology, and agriculture—were filling their professional ranks.

With this newcomer, it seemed natural and appropriate to some at Dordt College that a program in biotechnology be established. What was envisioned was not a full-blown research and teaching program that would compete with the likes of Iowa State University but rather a modest undergraduate program, one that would more completely prepare students for service in the field of biotechnology, both in terms of technical competence and—more importantly—Christian perspective.

However, what seemed natural and appropriate to some, struck horror in the minds of others. Dordt College has had a program in environmental studies for a decade or more, originating in its Biology Department and eventually becoming a major in its own right. The quarter-century-old Agriculture Program has always held a reputation for promoting sustainability and creation care. As a result, a number of Dordt life scientists (agronomists, biologists, environmental scientists, etc.) raised serious questions about the appropriateness of starting a biotechnology program. To them, it was inconsistent for an institution devoted to "serviceable insight," "care for creation," and "obedient stewardship" to promote a field of inquiry/endeavor that they perceived to be hubris-motivated, unstewardly, dangerous in the extreme, "playing God" (whatever that might mean), and contemptuous of creation. Joining the life scientists were a number of philosophers who believed that before any such program is started, those starting it must demonstrate its expertise with respect to such philosophy-of- biotechnology issues as safety and risk, bioethics, and transgenic manipulation.

Under that directive, a "biotechnology working

group" was formed to investigate the outstanding issues and to propose a program that would assuage the critics and give form to the vision of those who believed that Dordt had a high calling to start a biotechnology program. Before the formal proposal to start the program was adopted in May of 2006, the group had produced a fifty-four page position paper titled *Getting in Bed with Frankenstein: Why a Christian College Should Develop Programs in Biotechnology*,[1] providing a biblically based rationale for the program and addressing some of the most contentious issues. Throughout the process, however, it became clear that the central issue of debate was the tension between a view of stewardship as conserving, caring for, and serving the non-human creation, and a view of stewardship as unfolding, developing, and serving the non-human creation.

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Stewardship as Conserving or Stewardship as Development: An "Either/Or"?

The position paper prepared by the Biotechnology Working Group laid the groundwork for and briefly addressed such issues as sustainable agriculture, safety and risk, distributive justice, genetically modified crops and the developing world, transgenic manipulation and the boundaries of "kinds," the sanctity of life and of human life, cloning, and the nature of human nature. Ultimately, it was found that each of these issues, as well as the question of development versus conservation, is grounded in just a few more fundamental issues. Those turn out to be (1) the definition of biotechnology, (2) humanity's fall into sin and the scope of the consequent curse, and (3) the relation of humanity to the non-human creation.

DEFINING BIOTECHNOLOGY

The first question is whether a narrow or broad definition of biotechnology is appropriate. To some, the word "biotechnology" is synonymous with "genetic engineering" and is irrevocably tied to transgenic manipulation and cloning. Such a definition is unhelpful for a number of reasons. First, it begs the question by defining a human activity in terms of particular forms of that activity—forms that are at the heart of the controversy. Second, and more important, it fails to allow for a careful analysis of the context of meaning of the activity we call biotechnology. Thereby it opens itself up to assumptions it may well want to reject.

The Working Group found that a more general definition of biotechnology allowed for a careful analysis of the various issues. In Stephen V. Monsma's book *Responsible Technology*, a comprehensive definition of technology is offered and carefully explained. That definition views technology as one kind of human response to the "creation mandate," the call given to humankind, in Genesis 1:28 and 2:15, to "be fruitful and increase in number; fill the earth and subdue it….Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground." According to the definition given in *Responsible Technology*, technology involves as its subject "the natural creation."[2] The authors understand this term to mean physical and living things. Thus, it is reasonable to see "technology" as being capable of subdivision into two categories: the technology of physical subjects and the technology of living subjects. This was the approach taken by the Dordt Working Group: Biotechnology, most simply, is the technology of living subjects. Refining the general definition of technology given in *Responsible Technology*, the fol-

lowing was agreed upon:

> Biotechnology is a distinct, cultural activity in which human beings exercise freedom and are held accountable as they respond to God by transforming the biotic creation, with the aid of tools and procedures, for basic research and for practical ends and purposes.

THE FALL AND THE CURSE

While no one at Dordt denied the radical fall into sin and the brokenness that has been its result, the extent of that brokenness became an issue. If, for example, the non-human creation is unaffected by the fall except in terms of its direct (causal) relationships with humankind, then the order and relationships we find within the non-human creation might (and I stress the word "might") be given a kind of *benchmark status* in our biotechnological work. If, on the other hand, the curse is more systemic and creation does indeed "groan" of its own accord—even without causal interaction with sinful humanity—then the order and relationships we observe in the non-human creation cannot with confidence be used as a template for biotechnological work. However, this issue is beyond the scope of this paper and, to at least some extent, overlaps the third issue: the relationship of humanity to the non-human creation.

HUMANKIND'S RELATION TO THE NON-HUMAN CREATION

What is the relationship of humankind to the non-human creation? Are humans simply one more species of living things that, at this point in the history of the universe, is effectuating significant change on planet Earth but that will one day go the way of the dinosaur? Or are humans a unique species unlike any other kind of living creature, a species that has the capacity to radically alter its own environment and possibly its own nature in unpredictable directions? Are humans a developing form of divinity? Or are humans the servants of a deity that created the universe and made humans his representative to serve, care for, and enable that universe to flourish? And particularly in these days of advancing technological capability, how does our understanding of the relationship of humans to the non-human creation inform our understanding of technology?

Thomas Hobbes' famous description of the "natural condition of mankind" as "solitary, poor, nasty, brutish, and short" [3] only slightly exaggerates the experience of most people in pre-modern times. The phrase "over-against" conveys concisely the relationship of humans to the non-human creation. Finding or producing sufficient food and protection against the weather and predators dominated that relationship.

Civilization enabled humankind to reflect on that "over-against" relationship. However, while one might find some appreciation for the non-human creation in the writings of Homer and of the Old Testament,[4] it was Hellenistic thought that most definitely shaped attitudes regarding the relation of humankind and non-humankind. At the center of that thought was Platonic idealism, with its own particular form of "over-against." The non-human creation was viewed as imperfect and temporal matter, lacking substance and permanence, a mere shadow (to use Plato's analogy) of the ideal and eternal forms that could only be approached by thought. The truly *human* part of humankind was that thinking apparatus or *mind.* The human body was separate from that mind, merely part of the insubstantial and impermanent non-human creation.

As an unhappy result, much of Christian thought has been influenced by Hellenistic idealism. Where the New Testament spoke of "spirit" or "soul," the Church understood the immaterial, rational, and eternal essence of humankind. Where the New Testament spoke of "body," the Church understood corrupt, sinful, and impermanent matter. The escape of the Christian's soul from the body and into "heaven" paralleled the escape of the Hellenistic "rational soul" from the prison of the body into the world of forms. Clearly the relationship of humankind to the non-human creation remained one of "over against" in much of Christian thought.

It was a synthesis of Greek and Christian thought that dominated Western culture from the early Middle Ages to the time of the Renaissance and the Enlightenment: biblical theology and Aristotelian cosmology influenced each other and provided the foundation for the Western medieval worldview. On that foundation the Copernican Revolution in

science arose, as did the Protestant Reformation. These and other Renaissance and Enlightenment developments altered the way humankind viewed the non-human creation. The rise of empiricism in science indicates a very different way of looking at the world around us, one that, one might say, gives it more respect than was given during the Middle Ages, when an understanding of the universe was based on what might be derived, in strictly rational manner, from incidental experience and age-old cosmological beliefs. However, even if the non-human creation was respected as a source of valuable data, it was still viewed as "over-against" human thought and understanding. The dualism of soul and body remained pervasive.

Consequently, the age of exploration and the Industrial Revolution built upon an altered foundation: one still grounded in the synthesis of Greek thought and Christian theology but now with the benefit of pilings driven by the Copernican Revolution in science. The sciences of mechanics and thermodynamics made possible the development of new machines and structures, such as the steam engine and the railroad. However, that development came only after considerable human effort. The non-human creation continued to resist humankind's attempt to know her and to bring forth her artifactual children. Thus, both the science and the technology of the period we know as the Industrial Revolution reinforced the "over-against" view of the relationship between the human and the non-human creation.

The seeds of change in this view were planted by Darwin, but they did not begin to sprout until the late twentieth century. The idea that humankind was nothing but another expression of the immutable and inviolable laws of nature—or even more specifically, the laws of mechanics—was expressed by a few, most notably the French mathematician and astronomer Pierre Laplace. However, mechanical reductionism remained too much a violation of common sense to gain significant popularity. Darwin's work replaced mechanical reductionism with biotic reductionism, a view that appealed a bit more to common sense. After all, there are more commonalities between humans and chimpanzees than there are between humans and stars or between humans and water molecules. The late nineteenth century and most of the twentieth century, therefore, witnessed a change in attitude regarding the relationship of the human to the non-human creation. Increasingly, humans were seen as a uniquely evolved part of the natural creation. Then the 1960s occurred, and the notion of humans as simply a natural part of the natural creation was dealt an enigmatic blow. It became clear to more than just professional ecologists that humans were causing all sorts of problems in the non-human environment. The science of ecology arose from obscurity to address one of the chief issues of the day: the environmental crisis. As a result of all these thought-changes, understanding of the relationship between the human and the non-human creation was obscured, with the "over-against" view gaining new strength from the palpably obvious tension between strivings for human development and the concern for a "clean," or even "pristine," environment.

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THE NON-ANSWER OF NATURALISM

In some respects, naturalism may be seen as resulting from the melding of Greek and Christian thought. Naturalism is the view, or system of

thought, holding that all phenomena (things and events) can be explained in terms of "natural" causes and laws, where "natural" is understood as that which is exclusively biotic and physical. In many circles, the melding of Greek and Christian thought led to a kind of deism, wherein the Creator is understood to have brought into being all things and the laws by which all things function, and then simply to have allowed them to function in a seemingly autonomous fashion, with that lawfulness inherent in the things themselves. The Darwinian variety of naturalism asserts that those laws are fundamentally biotic and physical. The Laplacian variety asserts that they are only physical, biotic laws being reducible to physical law.

Of course, one need not be a deist to embrace naturalism; an atheist can embrace naturalism just as well. A theist can also adopt a posture of methodological naturalism; that is, one can do scientific and technological work "as if" all things and events can be explained in terms of natural causes and laws.

A problem with naturalism, however, is incoherence. Naturalism must begin with a belief in the capacity of free human thought to understand and shape the world around itself. However, when the naturalism gets to the point of explaining all things and events in terms of physical causality, it effectively eliminates the possibility for truly *free* human thought. Thought itself becomes explainable—one might even say determined—by the laws of physics. The only escape for the naturalist is to posit a radically dualistic ontology: one where the world of *nature* and the world of *free human thought* are completely separate from each other. That escape is illusory, however, because the basic problem of how humans are to interact with the non-human creation betrays the inseparability of *nature* and *free human thought*.

Nonetheless, a form of naturalism can be attractive to a Christian mind that sees the world in dualistic terms: spirit and matter. It fails, however, to address the tension between conservation and development. A naturalist position can be used, and has been used, to defend either side of the argument. Francis Fukuyama, for example, emphasizes the pole of "free human thought" in his book *Our Posthuman Future*; here he raises deep concern about the ways humans are altering the natural environment. He shows particular concern for the "nature of human nature."[5] Ray Kurzweil [6] and Rodney Brooks,[7] on the other hand, emphasize the "nature pole," explaining everything in terms of the laws of physical causality, and thus predict the day when there will be no difference between humans and what we today call robots. Kurzweil, in fact, predicts human immortality being achieved by downloading our minds into the computer storage devices that will be an integral part of our new and replaceable robotic "bodies."[8]

A more sophisticated form of naturalism, and one that historically has attracted a number of Christian thinkers, is the approach of "natural law." John Locke, Hugo Grotius, and Thomas Aquinas are names associated with the natural law tradition in history. Recent work by Wesley Wildman and by Rolf Bouma, a doctoral student of Wildman's, uses the approach of natural law to develop norms for biotechnological activity. [9] While Wildman and Bouma's approach gives some useful guidelines by pointing to the perceived structure of creation and rightfully insisting that we respect that structure, it tends to identify normativity with structure and either restricts itself to biotic and physical structures or seeks to reduce other evidences of structure (e.g., parents caring for children) to biotic structure (e.g., evolutionary adaptation).

LESSONS FROM THE HISTORY OF SCIENCE[10]

One can gain much insight into the conservation-development debate, as well as into the naturalistic perspective, by studying the history of science. To a physical scientist, there are two key episodes in the history of Western science that stand out as "revolutionary:" the Copernican Revolution in the sixteenth century and the Einsteinian Revolution in the early twentieth century.

Prior to the Copernican Revolution—that is, prior to the discoveries represented by Copernicus and Kepler in Astronomy and Galileo and Newton in mechanics—Western science was dominated by the well-established theories of Aristotle. Astronomy was geocentric; mechanics was understood in terms of the doctrine of "natural place," and what was to become chemistry was guided by the four-element theory of matter. These were the established understandings of the physical creation, basic components

in the Western worldview for close to two-thousand years. However, in a relatively short time during the Sixteenth Century, that would all change. Today we tend to look back on the theories of Aristotle as intuitive but primitive or quaint, and we neglect to appreciate how long those theories stood the test of time.

By the end of the nineteenth century, it seemed that the Newtonian worldview had matured. The revolution had been accomplished, and what was left was to collect the data and tidy up the details. The Industrial Revolution and developments in the thermal-fluid sciences—all based on Newtonian physics—seemed to confirm that we had arrived at a place of scientific understanding of the universe. However, over the course of less than twenty years, at the beginning of the Twentieth Century the work of Planck, Einstein, Bohr, and Heisenberg turned Newtonian mechanics on its head. Today we appreciate Newtonian science as an adequate model and empirical explanation of the phenomena, so long as one does not do anything extreme or look at anything too closely. Still, it is a model that fails to truly explain the lawfulness in the physical creation.

We are much more ready today, than we were in Galileo or Newton's day, to admit that our cosmological world picture is as much a product of our epistemological apparatus as it is a picture of what is "really and truly out there."

What, then, is the cosmological model that dominates science today? What view of the world has privileged—or as Thomas Kuhn describes it, "paradigmatic"—status? Surely it is one that is a revolutionary refinement of the Newtonian worldview, with relativity and quantum mechanics providing that refinement. However, the revolutionary work of Planck, Bohr, Heisenberg, Pauli, Schrödinger, De Broglie, Born, and others—and especially the arguments between Bohr and Einstein—have made it clear that the cosmological picture that we have today is as much an epistemological picture as it is an ontological one. Whereas the Newtonian worldview was a naïve realist worldview, the post-modern cosmological picture, influenced by positivism and linguistic analysis, exists as a tension between realism and idealism. We are much more ready today, than we were in Galileo or Newton's day, to admit that our cosmological world picture is as much a product of our epistemological apparatus as it is a picture of what is "really and truly out there." Einstein resisted that admission, wanting to believe in a much closer relationship among the knower, knowing, and the known subject. Neils Bohr, who was, interestingly, known as a very humble person, embraced the uncertainty and ambiguity that seemed required by the epistemology of quantum mechanics. His theory of complimentarity, as well as Heisenberg's uncertainty principle, arises from a kind of epistemological humility.

Galileo's Epistemology

But epistemological humility has not been a dominant characteristic of Western scientific thought. Consider Galileo, for example. While popular understanding limits his conflict with the Church in Rome to have been primarily with the relative position of the earth and the sun—geocentric versus heliocentric astronomical models—it can be argued that the conflict was actually much deeper, more on the level of biblical hermeneutics and epistemology. Galileo's views regarding Holy Scripture and the relationship of theology to natural science are formulated most carefully in his "Letter to the Grand Duchess Christina." [11] Therein one will find his use of the phrase, "the intention of the Holy Ghost is to teach us how one goes to heaven, not how heaven goes."[12] Galileo's epistemological opinions, however, are nowhere more apparent than in his *Dialogue Concerning the Two Chief World Systems*, the book that caused him the greatest amount of trouble with the Church. Consider the following paragraph on the absolute nature of those particular modes of human understanding associated with

mathematics and natural science:

> Human understanding can be taken in two modes, the intensive or the extensive. Extensively, that is, with regard to the multitude of intelligibles, which are infinite, the human understanding is as nothing even if it understands a thousand propositions; for a thousand in relation to infinity is zero. But taking man's understanding intensively, in so far as this term denotes understanding some proposition perfectly, I say that the human intellect does understand some of them perfectly and thus in these it has as much absolute certainty as Nature itself has. Of such are the mathematical sciences alone; that is, geometry and arithmetic, in which the Divine intellect indeed knows infinitely more propositions, since it knows all. But with regard to those few which the human intellect does understand, I believe that its knowledge equals the Divine in objective certainty, for here it succeeds in understanding necessity, beyond which there can be no greater sureness.[13]

This speech is placed in the mouth of Salviati, Galileo's representative in the *Dialogue*. As if anticipating the coming fury, Galileo has Simplicio, a participant in the *Dialogue*, suggest that Salviati's speech strikes him "as very bold and daring." Salviati replies that such is not the case, that his discussion of absolute certainty is no more bold than saying "God cannot undo what is done," a proposition that had some general acceptance at that time.[14] Then, to clarify his argument, Galileo has Salviati say the following:

> So in order to explain myself better, I say that as to the truth of the knowledge which is given by mathematical proofs, this is the same that Divine wisdom recognizes; but I shall concede to you indeed that the way in which God knows the infinite propositions of which we know some few is exceedingly more excellent than ours. Our method proceeds with reasoning by steps from one conclusion to another, while His is one of simple intuition.[15]

Galileo's caveat notwithstanding, he is asserting that human knowledge can be absolutely certain—just as it is for God—and that certain kinds of human knowledge, e.g., 2 + 2 = 4, are the same for the human creature as they are for the Creator. Galileo is recognized today as a revolutionary experimental physicist but not even as a second-rate philosopher. Nonetheless, his cosmology arises from a philosophical worldview that would dominate Western thought and, it may be argued, remains with us today in refined but essentially unaltered form.

Descartes' Epistemological Dualism

Quoting him as writing, "I wished to give myself entirely to the search after truth," Frederick Copleston describes Descartes' fundamental aim as the attainment of philosophical truth by the use of reason.[16] Likewise, Peter Schouls asserts that for "Descartes, the greatest need which the philosopher can fill is to do away with insecurity, with lack of certainty."[17]

It may be argued that whereas Galileo did battle with the scholasticism of the late medieval Church, Descartes did battle with skepticism. [18] Descartes' famous method of doubt has one chief end, the attainment of certain knowledge. He believes that there is only one kind of knowledge and that it is certain and evident. Unique to Descartes is the notion that there is only one kind of science based on that one kind of knowledge and that there can be only one scientific method. [19] This one kind of knowledge is attained by the "light of reason," and it stands over against uncertainty, falsehood, and *praejudicia*: Descartes' technical term for those opinions and hypothetical statements that have yet to withstand methodological doubt.

Thus for Descartes, knowledge is certain and is grounded in reason. The nature of reason is expressed by intuition and deduction. Quoting from Descartes' *Rules for the Direction of the Mind*, Schouls writes,

> To say that the understanding can acquire knowledge in a way other than through intuition and deduction would be false, for "nothing can be added to the pure light of reason which does not in some way obscure it." Thus it is these "two operations of our understanding, intuition and deduction, on which alone...we must rely in the acquisition of our knowledge." Intuition and deduction express the very nature of reason.[20]

Descartes' epistemological dualism (e.g., certain

knowledge vs. *praejudicia*) is consistent with his ontological dualism (*res cogitans* vs. *res extensa*). His "one kind of science" based on his "one kind of knowledge" meant for him that all the natural sciences could be reduced to physics and that thus the whole material world could be treated as a mechanical system. This is manifest, for example, in his interpretation of animals as machines and in his rejection of the need to consider any but efficient causes in physics. In other words, final causality is a theological concern and has no place in physics.[21] Thus, Descartes' ontological dualism reinforces his epistemological dualism. Further, although Descartes may not have done so himself, those who followed him would begin to classify theological knowledge in one category, with respect to certainty, and scientific knowledge in another category.

In summary, there is an interesting relationship between Galileo and Newton, on the one hand, and between Galileo and Descartes, on the other: where Newton polished and codified Galileo's mechanics, one might say that Descartes polished and codified his epistemology.

Learning from History

What, then, might we learn from this brief exploration of the history of science? It may well be helpful to remind ourselves of the following: (1) the modern scientific worldview has been around for less than five hundred years, in comparison to the two-thousand-year reign of the Aristotelian worldview, and it has experienced significant change in the last hundred years; (2) the absolutization of human knowledge and its equation—at least in some forms—with divine knowledge by Galileo and the codification of that epistemological absolutism by Descartes, ought to raise some questions about the epistemological assumptions we make today.

A BIBLICAL-THEISTIC STARTING POINT[22]

> In the beginning God created the heavens and the earth. (Genesis 1:1, NIV)

> In the beginning was the Word, and the Word was with God, and the Word was God. He was with God in the beginning. Through him all things were made; without him nothing was made that has been made. (John 1:1-3, NIV)

While these verses provide a good place to start discussing a Christian view of the conservation-development debate, the doctrine that God created all things is affirmed and stressed *throughout* Scripture. Given that stress, one may state the central idea in a slightly different form as "the radical distinction between Creator and creation," or, expressed negatively, "Nothing God made is God." [23] Outside of Scripture, the doctrine is confessed by Christian churches everywhere when they recite the Apostle's Creed: "I believe in God the Father almighty, maker of heaven and earth." On the basis of this doctrine one may deduce the non-self-sufficiency and the referential character of creation.

Thus, everything in creation refers back to its Creator, either in accordance with his will or in some distorted and disobedient manner. Only God is eternal, without beginning, and wholly self-sufficient.

The Non-self-sufficiency and Referential Character of Creation[24]

Creation, or "nature," or however else we may refer to "the known universe and all that it contains," is not self-sufficient. It was created by God and is sustained by him. Its existence is wholly dependent on its Creator. Moreover, having no existence "in itself," its only meaning and purpose can be, directly or indirectly, to serve its Creator. Thus, everything in creation refers back to its Creator, either in accordance with his will or in some distorted and disobedient manner. Only God is eternal, without beginning, and wholly self-sufficient.

The sin of idolatry occurs whenever humankind

views creation, or some part thereof, as it ought to view God. In modern expressions of naturalism, for example, the material world, reduced to atomic and sub-atomic particles, is considered to be "all that is." Matter and energy are believed to be eternal (the First Law of Thermodynamics as taught to junior high school students: "matter and energy are neither created nor destroyed but only changed from one form to another"). Another example of idolatry occurs when humankind deifies some part of creation, claiming it to be "sacred" or "holy," relative to the rest of creation. This deifying of creation is the idolatry of ancient pagan or animist cultures. It can also be the idolatry of modern cultures that circumscribe certain parts of creation, claiming them to be "off limits" to human interaction, including inquiry.

The Goodness, Diversity, and Unity of Creation

God created all things "good." Whether we read the creation account in Genesis, the divine poetry of the Psalms, Proverbs and Job, or the words of the prophets, we are confronted with the unmistakable message that God loves and delights in his whole creation: lions and dandelions, the birds of the air and the fish of the sea, humans created in his image, mountains, and stars. His expressed love for and delight in the creation entail the command that his image-bearing creatures, humankind, are to love, care for, and delight in that creation as well.

The creation is diverse. There are innumerable individual creatures that have existed, presently exist, and will exist before Christ returns. Moreover, there are mind-boggling numbers of "kinds" of creatures. The command given to Adam to name the living creatures[25] suggests both the ordered diversity within creation and humankind's task in recognizing, respecting, and bringing to verbal expression that diversity.

Notwithstanding this great diversity, there exists a fundamental unity to creation. All creatures owe their origin, their continued sustenance, and their final redemption to the Word of God. [26] All share a common non-self-sufficiency and finitude.

The goodness of creation means that evil is always a distortion of what is good, never a creature[27] (or substance) in itself. The diversity of creation stands over against attempts to reduce creation to one or two substances, e.g., the matter and energy of the modern naturalist, Descartes' thinking substance and material substance, or even those occasions when Christians divide the world dualistically into spiritual and physical realms. The unity in creation assures us that nothing that exists does so neutrally or autonomously, apart from the Word of God calling it into being for service. That unity also leads to the next critical point: the unity that human creatures have with the rest of creation.

The Creatureliness of Being Human

God created humankind in his image, as explained in Genesis 1 and Psalm 8. But this image-bearing creature is nonetheless a part of creation, called into being for service. As image-bearers of the Creator, humans are given responsibility and (unlike non-human creatures) are thus free to respond either obediently or disobediently to the Creator. Human actions are therefore no less natural than the actions of plants and animals, stars or atoms. The difference is that human actions are performed in responsibility and, therefore, can be judged to be either in service or in disservice to the Creator and the rest of creation. Human actions should no more be characterized as "interventions" or "intrusions" into creation than should the actions of squirrels. The "natural" course of human actions ("natural" being defined as "in accordance with God's will") is to assist the rest of creation in flourishing, in being what the Creator calls it to be. The "unnatural" course of human actions ("unnatural" being defined as "in disobedience to God's will") brings brokenness and distortion to creation.

Being creaturely also means that humans are finite. We recognize that finitude in many ways. Our physical strength is finite. Our vision is finite. Each day of our lives contains a finite amount of time, which itself is part of the created order. In this post-fall world, the length of our lives is finite. Considering together the radical distinction between God, on the one hand, and creation and the finitude of humanity, on the other, we are able to conclude, in a relatively straightforward way, that our thinking and reasoning ability is finite and creaturely as well. Reason is something that God created in order to enable his image-bearing creature

to respond to him freely; thus, it is in this matter of *reason* that, from a biblical perspective, we must take issue with Galileo. To equate human knowing with God's knowing is to elevate a part of creation to the position of God—it is to create an idol. Reason is not God; it is part of creation. It is finite and creaturely. When we talk of "God knowing," we do so analogically. When God "reasons" with us,[28] he does so through his created means, by stooping to the level of his creature. Science, whether mathematics, quantum mechanics, molecular biology, or theology, is always finite and creaturely, characterized by our nature as beings created in the image of God.

Sin and the curse afflict the whole of creation much as original sin afflicts all humankind: it is systemic, pervasive to the very core of creation's being.

Sadly, there is one more important characteristic of creatureliness which must be recognized. Genesis 3 tells the story of humankind's fall into sin and the consequent curse upon the whole of creation that followed that fall. Thus, creatureliness in our post-fall world implies sinfulness and brokenness. Surely that is the case for God's image-bearing creatures. However, it is also the case—in a different way, of course—with the non-human creation. The "thorns and thistles" of Genesis 3:18 and the "bondage to decay" of Romans 8:21 may be metaphors, but they are metaphors that point unambiguously to a creation that suffers under the curse, brought about by humanity's sin. Sin and the curse afflict the whole of creation much as original sin afflicts all humankind: it is systemic, pervasive to the very core of creation's being.[29] Thus science and technology must work with a creation that is both orderly and broken. On the one hand, there is much that can be learned by studying creation.[30] On the other hand, we must be careful not to assume that those parts of creation not directly affected by humans—as it were, untouched by human hands—are somehow pristine, in an ideal state that requires no healing or warrants no development.

The Relationship Between the Human and the Non-human Creation

Given this biblical-theistic starting point, can we begin to articulate an answer to the question of the relationship between the human and non-human creation? I believe we can if we take into consideration one more important biblical doctrine—a doctrine sometimes referred to as the "creation mandate." In Genesis 1:28, we read the following regarding the first humans:

> God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground."

This command is re-stated in Genesis 2:15 as follows:

> The LORD God took the man and put him in the Garden of Eden to work it and take care of it.

This task given to humanity—to develop and preserve creation—is directly related to our being created in the image of God. This is stated succinctly in Psalm 8:4-8 (although to understand the word "ruler," we need to consult other parts of Scripture such as the Genesis accounts of creation and those dealing with God's covenant with creation):

> What is man that you are mindful of him, the son of man that you care for him? You made him a little lower than the heavenly beings and crowned him with glory and honor. You made him ruler over the works of your hands; you put everything under his feet: all flocks and herds, and the beasts of the field, the birds of the air, and the fish of the sea, all that swim the paths of the seas.[31]

Humankind, thus, has a unique place in creation. However, it is too easy to misinterpret that uniqueness to mean "wholly otherness." One such misinterpretation is to devalue the non-human creation to the extent that it exists only for the purposes of

humankind. Stress is then placed on development to the exclusion of preservation, and humankind supposes itself free to use (or abuse) the non-human creation in whatever manner it fancies. Sadly, this has been the tendency of the Church, under the influence of a dualistic mentality that values only "the spiritual" and devalues "the material" as worthless. The other misinterpretation of humankind's uniqueness as "wholly other" is to view humanity as creation's intruder, who is capable of doing very little except pillaging creation. In this view, all non-human phenomena are considered "natural" while human actions affecting creation are considered "artificial" (the implication being that artificial is "unnatural"). The Scriptures, however, countenance no such misinterpretations. In the biblical narrative and the biblical worldview, humanity is an integral part of creation. There exists a necessary relationship between the human and the non-human creation, such that neither can be what it is called by God to be without the other. Obviously humankind is dependent on the non-human creation for its very existence. However, the non-human creation depends on humanity as well. It cannot fully flourish without the cultivation to which humanity is called by God. This mutual dependence is made wonderfully clear in a passage from the book of Ezekiel, where the Lord commands the prophet to speak to the mountains and hills:

> Therefore prophesy concerning the land of Israel and say to the mountains and hills, to the ravines and valleys: "This is what the Sovereign LORD says: I speak in my jealous wrath because you have suffered the scorn of the nations. Therefore this is what the Sovereign LORD says: I swear with uplifted hand that the nations around you will also suffer scorn.
>
> But you, O mountains of Israel, will produce branches and fruit for my people Israel, for they will soon come home. I am concerned for you and will look on you with favor; you will be plowed and sown, and I will multiply the number of people upon you, even the whole house of Israel. The towns will be inhabited and the ruins rebuilt. I will increase the number of men and animals upon you, and they will be fruitful and become numerous. I will settle people on you as in the past and will make you prosper more than before. Then you will know that I am the LORD. I will cause people, my people Israel, to walk upon you. They will possess you, and you will be their inheritance; you will never again deprive them of their children." [32]

The message here is straightforward: the mountains and hills prosper when they serve as the inheritance of God's people. Likewise, God's people can be fruitful only in mutual dependence with those mountains and hills. Thus the relationship between the human and non-human creation is one of interdependence. While the non-human creation provides God's image-bearers with food, clothing, shelter, and the very materials out of which their bodies are made, God's image-bearers serve the non-human creation by enabling it to flourish.

EPISTEMOLOGICAL HUMILITY

> You asked, "Who is this that obscures my counsel without knowledge?" Surely I spoke of things I did not understand, things too wonderful for me to know. (Job 42:3, *NIV*)

Job learned epistemological humility the hard way. From the ash heap of his wrecked life, he came to understand what the prophet Isaiah knew when he wrote,

> "My thoughts are not your thoughts, neither are your ways may ways," declares the LORD. "As the heavens are higher than the earth, so are my ways higher than your ways and my thoughts than your thoughts." (Isaiah 55:8-9, *NIV*)

By "epistemological humility," I want to suggest a posture of appropriate servanthood and creatureliness with respect to our relationship with God and the non-human creation, particularly in terms of how we know the latter. To know—in the fullest sense of that word—is a peculiarly human and, hence, a distinctly creaturely activity. As mentioned earlier, to speak of God "knowing" is to speak analogically and legitimately as image-bearing creatures of God. Human knowing, even rational knowing, is never absolute. Thus certainty never has the absolute character that Galileo ascribed to mathematics or that Descartes ascribed to deduction.

Knowledge is multi-dimensional. For example,

if a teacher drops a chunk of iron sulfide into a small beaker of hydrochloric acid in the midst of class of high school sophomores, they will break out in giggles because they "know" that distinctively biotic odor. They haven't had chemistry yet, so they don't "know" hydrogen sulfide in the same way that the upperclassmen who have been through chemistry lab know hydrogen sulfide. Rather, they know it "sensitively." Although there are surely elements of reason involved in their knowledge, those sophomores know hydrogen sulfide gas primarily by means of their sense of smell.

There are other modes of knowing beside the rational and the sensitive. Perhaps the one we tend to overlook most easily is faith knowledge. When we recite the Apostle's Creed, we begin by saying, "I believe." The knowledge content of the Apostle's Creed certainly has a rational side, but it is, first and foremost, faith knowledge. What we too often fail to see is that faith knowledge is also fundamental to our work in science. In order for us to proceed in science, we must trust that the scientific method is valid, that there is indeed a dependable lawfulness behind the regularities we observe in nature, and that the relationship between our thinking abilities and those regularities outside ourselves provide us faithfully, even if only provisionally, with insight into the behavior we observe.

This is perhaps a good place to summarize a major thesis of this paper. Given that we are creatures and not the Creator, and on the evidence provided by the history of science—particularly when we see the historic roles played by the Aristotelian, Newtonian, modern worldviews in the development of scientific thought—we must conclude that scientific knowledge will always be finite and tentative, never absolute. Thus, an attitude of epistemological humility ought to characterize our work in science and technology.

From an attitude of epistemological humility, we will want to question the basic assumptions of naturalism. Why should causality be exclusively physical causality? Certainly this is the way we have experienced nature during the last four hundred or so years. However, it is not an attitude common to humanity across the world and throughout recorded history. Furthermore, why should the explanation of all our experience be reducible to what we have come to call the laws of physics? Might it not be because we have absolutized both our understanding of physical law and human understanding itself?

From an attitude of epistemological humility we will certainly reject the hubris of technicism. Ray Kurzweil's notions of immortality based on increasing technological development are rooted in the contradictory notions that, on the one hand, human understanding is unlimited and that, on the other hand, humans are nothing more than evolving centers of matter, energy, and information. Epistemological humility will not curtail our imagining of future technological developments, but it will certainly persuade us of the foolishness of technological triumphalism. Science fiction can play a healthy role in the technological imagination, as long as it remains science "fiction."

While the non-human creation provides God's image-bearers with food, clothing, shelter, and the very materials out of which their bodies are made, God's image-bearers serve the non-human creation by enabling it to flourish.

We will also reject bio-romanticism: the notion that what we understand as the non-human creation is somehow perfect and that it is we humans who are the sole cause of all brokenness in the world. Interestingly this notion rests upon the naturalistic assumptions that all causality is physical causality and that human knowledge of the non-human creation is valid in an absolute sense. It also rests upon the assumption that there is something about human beings that makes them "un-natural." If one probes those assumptions a bit, one comes to the conclusion that for William Wordsworth [33] or for ardent

followers of PETA, [34] bio-romantic inclinations are rooted in a commitment to the autonomy of human thought, not unlike that expressed by Galileo and Descartes. Thus epistemological humility calls into question the naturalism of physical reductionists as well as the naturalism of bio-romanticists.

Epistemological humility, however, will embrace the notion of servanthood. By rejecting the kind of absolute certainty that Galileo and Descartes claimed for human knowledge, we come to recognize our own creatureliness and our dependence on the One who created us. We are thereby enabled to take up our role as servants of our Creator, of each other, and of the non-human creation.

EGBERT SCHUURMAN'S PHILOSOPHY OF TECHNOLOGY

Returning to the questions of the relationship of the human to the non-human creation and the apparent tension between development and conservation, we find that an examination of the philosophy of technology developed by Egbert Schuurman can be most helpful. In particular, Schuurman uses the concept of "meaning disclosure" to get at the essence of obedient technological development and to distinguish it from technicism, understood as technological development for its own sake. Schuurman's recent book, *Faith and Hope in Technology*, published in 2003, is most helpful because it addresses in particular the concerns raised by biotechnology. A more complete discussion of the concept of "meaning disclosure," however, is found in his earlier work, *Technology and the Future* published in 1980. [35]

Schuurman argues that creation is more than just the physical and the biotic. Human functioning gives clear evidence of dimensions beyond the physical and biotic, dimensions such as the historical, social, lingual, as well as the dimension of faith, just to name a few. However, Schuurman argues also for the participation of the non-human creation in these post-biotic dimensions. [36] For example, just as humans cannot be fully human (cannot even exist!) without the physical and biotic sides to their integral selves, the non-human creation requires the service of human beings for the full expression of its multifaceted wholeness. This service occurs when humans interact with the non-human creation, enabling the non-human creation to flourish in ways otherwise impossible.

Recall the prophecy of Ezekiel 36. The land flourishes when God brings his people back to it, when the ruins are rebuilt, and people and animals are once more thriving "in the land." The unity and interdependency evidenced in that prophetic vision are what guide Schuurman's view of technology. When humans engage in technology obediently, according to God's normative Word, then creation is opened up, its post-biotic dimensions are disclosed, and it glorifies its Creator in new ways. Of course, when humans engage in technology disobediently, in opposition to God's normative Word, then the non-human creation is distorted, and its capacity for glorifying its Creator is diminished.

A second key element in Schuurman's philosophy of technology is his careful distinction between science and technology. Both involve meaning disclosure. However, science is seeking to understand creation by analysis, that is, by means of logical abstraction. In physics, for example, we separate the irreducibly physical characteristics of a given phenomenon from its other characteristics in order to better understand that abstracted physical aspect. Technology, on the other hand, discloses meaning in a different way. Instead of seeking to understand what is already there, technology seeks to bring into being what exists only in potential. The method of technology is likewise different from the method of science. Rather than dealing with abstractions from our experience of reality, technology deals with reality in its wholeness. A significant part of Schuurman's critique of technicism is that it focuses on technological problems as if they were scientific problems, examining only aspects of a situation, detached from the context of the whole.

A third key element in Schuurman's philosophy of technology is his careful distinction between physical and biotic meaning and his warning, with regard to biotechnology, that we heed this distinction.[37] Modern technology, up until the present time, has dealt overwhelmingly with physical phenomena. Only recently has biotechnology significantly altered that emphasis. However, physical technology must concern itself with the laws for physical subjects. One of the most important of those laws is what we have come to call the Second

Law of Thermo-dynamics. It states that for closed systems and in all physical processes, the tendency is always to move in the direction of uniformity and randomness. In physical processes involving energy transformation, for example, the Second Law states that some energy will always be dissipated as low-level thermal energy, the random motion of the mass particles of a system. This characteristic of physical things is a primary factor in all physical technology. Any and all design that seeks to transform the physical must cope with the Second Law of Thermodynamics.

When humans engage in technology obediently, according to God's normative Word, then creation is opened up, its post-biotic dimensions are disclosed, and it glorifies its Creator in new ways. Of course, when humans engage in technology disobediently, in opposition to God's normative Word, then the non-human creation is distorted, and its capacity for glorifying its Creator is diminished.

Biotic meaning, however, is different. Despite having a physical dimension and therefore also being subject to the Second Law, living things are subject to biotic laws that transcend and are irreducible to physical law. In part, this biotic lawfulness may be stated as "autonomous procreation and the preservation of the whole despite the continuous change of its parts."[38] Let us use the term "biotic flourishing" to connote these characteristics as well as some others that help us distinguish living things from physical things. Biotic flourishing leads living things in the direction of higher complexity and increased differentiation. The Lord makes use of this characteristic of living things in his mustard seed metaphor: "Though it is the smallest of all your seeds, yet when it grows, it is the largest of garden plants and becomes a tree, so that the birds of the air come and perch in its branches."[39] Of course, the language of the creation mandate contains, in part, the same language used to direct all living things: "Be fruitful and increase in number."[40]

The key point here is not only that the Second Law of Thermodynamics and biotic flourishing distinguish, respectively, physical things and living things but also that these two general laws direct their respective creatures *oppositely*. All physical things are subject to the Second Law of Thermodynamics. All living things—which are also physical—are subject to the law for biotic flourishing as well as the Second Law of Thermodynamics. Schuurman puts it this way:

> The difference between the technology of the inorganic and the technology of the organic becomes clear when we note the different laws which apply to the two domains. In inorganic nature everything tends in the direction of leveling. …In the world of living things, however, we witness a process of increasing differentiation.[41]

If in our minds we reduce living things to physical things, if we believe that biological activity is merely an expression of physical law, we will approach biotechnology with the same tools, procedures, and attitudes with which we approach physical technology. Doing so may have dire consequences.

Consider that since the Industrial Revolution—the period of history that has given expression to "modern technology"—technological initiatives have had chiefly to contend with physical law such as the Second Law of Thermodynamics. Thus, the tools, procedures, and attitudes of modern technology are those associated with physical technology, developed in the course of dealing with the tendency of things to move in the direction of random-

ness, uniformity, and leveling—the tendencies of processes to slow down and stop. On only relatively rare occasions has modern technology had to deal with flourishing *as a problem*. Those problems have largely had to do with the transplantation of species of living things from their native habitat to one that enabled reproduction to occur in an uncontrolled and profligate manner (e.g., rabbits in Australia; gypsy moths, Africanized bees, and carp in the United States [42]). In physical technology, problems of profligacy are never truly physical but always social in nature, [43] for example, the proliferation of automobiles and the resulting social and environmental degradation.

The posture of modern technology has thus been established by the technology of the physical. If we take a reductionistic approach to living things, seeing them as nothing but complicated expressions of physical law, we will have no inclination to alter that posture as we engage in biotechnology. The result will be our unpreparedness to deal with problems such as biotic profligacy, problems associated with the response of living things to distinctively biotic laws.

Edward Tenner, in his book *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*, describes the kind of technological problems that can occur when the whole is mistaken for the sum of its parts, as when a living thing is mistaken for a series of complex chemical reactions. He calls these technological problems "revenge effects," in order to distinguish them from "side effects" and trade-offs—two kinds of technological problems that are more clearly understood.[44] Revenge effects are not confined to biotechnology. Revenge effects in information technology are legion. One has only to consider how the "blessing" of e-mail has induced the "curse" of *spam*. However, revenge effects in biotechnology are both precipitated and aggravated by those characteristics of living things that are not reducible to physical systems, e.g., flourishing.

STEWARDSHIP: BOTH BIOTECHNOLOGY AND CREATION CARE

A Story of Buffalos and Chimney Pots

Early on a snowy Sunday morning some time ago, I sat in the enclosed porch on the back of my house and watched the sky slowly brighten. The softly falling snow obscured the sunrise, but the view to the east and south was nonetheless beautiful. I had enclosed the porch the previous summer; and with floor-to-ceiling windows enveloping more than half the room, a gas-fired stove for heat, carpet on the floor, and a comfortable reading chair in which to sit, the new room provides a way of experiencing the outdoors while maintaining indoor comfort. Since I live on a ridge on the Iowa prairie, on a clear day I am able to see many miles toward the distance horizon, despite the presence of the surrounding houses that constitute the suburban development of which my house is one part. For example, the water tower in the next town, twelve miles to the southeast, is often striking in its round, orange visibility.

On this particular morning, however, the obscuring quality of the lightly falling snow focused my attention on what once was the surrounding prairie. I tried imagining what the scene was like a hundred years ago, with the rolling hills dominated by prairie grass—and perhaps a herd of buffalo nearby. It was then that I was tempted to wish away the other houses, streets, lampposts, and other signs of civilization so that I could glimpse the natural, unadulterated prairie. Notice I said "tempted." I couldn't really bring myself to wish away those artifacts of civilization because I believe that houses, streets, and lampposts are just as "natural" as the prairie grass. They are simply a different kind of nature—cultural nature, if you will. As an engineer, I am someone who believes firmly that the Lord has called us to unfold and develop the creation, bringing forth creatures (like houses, streets, and lampposts) that exist only in potential until humankind's response to the creation mandate brings them into being.

Still, on this particular morning I was torn. I had developed a sense of empathy for my Dordt colleagues in the life sciences for whom, it sometimes seems, the only truly beautiful landscape is one that shows no influence of technology. I yearned to see the pristine prairie grass bending slightly under the weight of lightly falling snow, the playful scurrying of prairie dogs, and the slow-moving buffalo as the snow creates a cloak of white on their woolly and dark- brown backs.

Then, however, I realized that I had seen all these things before. In fact, the imaginative longing that stirred within me that snowy Sunday morning could never have occurred had I not already been acquainted with those denizens of God's good creation. I remembered the film *The Vanishing Prairie*, which was produced by Walt Disney back when I was a child in the 1950s. I also remembered more recent real life experiences of these prairie creatures in Blue Mounds, Minnesota, and in Custer National Park in South Dakota. It was these memories, coexisting with the scene before me, that helped create that yearning for a more pristine scene, a yearning that seemed somehow out of synch with my appreciation for technology.

After a few more moments of musing, however, it occurred to me that I have other memories with the power to create other imaginative longings for very different vistas. In particular, I recalled traveling with my wife two years ago to England. One of the cities that we visited was York, a place whose medieval personality is preserved in the layout of the streets, the character if the buildings, and especially the ancient wall that surrounds the city. Many of the older cities in England were walled cities, built in early medieval times with the need for protection from less-civilized neighbors. The wall in York is the best preserved of all these cities, and an ambitious visitor can walk atop the wall, almost completely around the city, in just a few hours. One vantage point on the wall offers an exquisitely beautiful view of the York Minster Cathedral of St. Peter, one of England's largest and oldest churches, completed in the year 1470, after two hundred and fifty years of construction. The sight I remember best, however, occurred when we stood atop the wall and looked outward from the city center toward the surrounding suburbs. Of course, this being England, the "suburbs" of York were developed during the nineteenth century and so represent the Victorian era, the time in which Charles Dickens lived and about which he wrote in his many novels and stories. What struck me most about that view were the ubiquitous earthenware chimney pots that punctuated the horizon, telling of a time when the hundreds of aged houses were heated by fireplaces that burned wood or coal. Thinking about that view from the wall in York, and contrasting it with the view from my enclosed porch, I realized that the vision of Victorian society suggested by the one, and the vision of prairie grass and buffalo suggested by the other, are both beautiful, God-glorifying, and very much natural in their own way. The tension between biotic nature, on the one hand, and cultural nature, on the other, is a false tension and was here resolved for me by my recalling the aesthetic experiences of viewing the once-upon-a-time, prairie-grass-dominated horizon from my enclosed porch, and the Victorian suburbs of Northern England from the wall in York. Truly, as the writer of Ecclesiastes has told us, God "has made everything beautiful in its time."[45]

Conclusion

The tension between biotechnology and creation care, between development and conservation, is a false one. We are called by our Creator to be stewards of his good creation, caring for it both by bringing healing and helping it flourish. By adopting a posture of epistemological humility, we will be prone neither to abuse the non-human creation nor to set it on a pedestal out of reach. Rather, we will see ourselves as one part of creation—the part that has responsibility for the wellbeing of the whole. We will see our knowledge as finite and affected by sin, and we will see our artifacts—including biotechnological artifacts—as the products of that finite and fallible knowledge. When produced with care, they will have as much natural place as the flowers of the fields and the birds of the air. For they will be evidence of the unity in nature: "cultural nature" arising from "biotic nature."

Endnotes

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25. Genesis 2:19-20 (*New International Version*).
26. Proverbs 8, John 1, Colossians 1, Hebrews 1 (*NIV*).
27. Even Satan is an example of this—a fallen angel.
28. Isaiah 1:18 (*NIV*).
29. The most obvious evidence of this is human suffering brought about by disease, genetic malformations, and "natural" occurrences, such as tornados, volcanic eruptions, and earthquakes. But those same kinds of sufferings are found to occur among animals as well. Beyond these, it is the task of the scientist to attempt to distinguish the effects of the curse from the good structure in creation.
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31. *NIV.*
32. Ezekiel 36: 6-12 (*NIV*).
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35. Schuurman, 1980, 361.
36. Schuurman, 1980, 329-330.
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43. And because the social is built upon the biotic, the nature of the biotic contributes to the problem.

44. Tenner, 5.

45. Ecclesiastes 3:11 (NIV).

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