

The Ellul Forum

For the Critique of Technological Civilization

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Academics on a Journey of Faith

From The Editor

My thanks to our guest editor, Dan Clendenin. And my heartfelt thanks to Daryl Fasching for faithfully editing *The Ellul Forum* for more than a decade. Daryl had a vision for going beyond a newsletter on Ellul activities to a roundtable on our technological civilization. And he has made it happen splendidly, actively involving a broad membership from Europe, North America, and elsewhere in dialogue on Ellul and technology. Daryl has been a superb leader, and I'm pleased he'll be vitally involved henceforth as a member of our editorial board. Now that we've made the transition to the University of Illinois, we'll be on our regular publication cycle of two issues per year appearing in January and July. Send your possible articles and book reviews to me. Topics for guest editing an issue are welcome too.

Clifford G. Christians, Editor

About This Issue

Whatever else Jacques Ellul was or sought to be, he was first and foremost a Christian, and that not merely by chance or coincidence but by choice. About half of his written work explores themes of the Biblical revelation and much of his time was spent in direct Christian ministry such as pastoring the blue-collar French Reformed church that met in his home, or serving on his denomination's committee for pastoral education and training. Ellul was typically unapologetic about his Christian journey; but on the other hand, he was consistently cryptic about his conversion experience. To my knowledge his two-volume autobiography that he wrote some time ago remains unpublished (in an interview he told me it would be left to his family to decide whether to publish it after his death).

Ellul was a man of formidable intellect and ideas, but he always wrote about his experiences. That is, he wrote out of his personal story. I suspect that many of the people like myself who have been so deeply influenced by Ellul were attracted by elements of his personal narrative.

A common but mistaken cultural assumption is that the modern university, to quote a physician friend from Yale, is "a Christless hellhole." This generalization has at least some merit, but people like Ellul belie its ultimate accuracy. A spate of recent books have chronicled the personal stories of believers who, like Ellul, work at the highest levels of the academy and likewise locate themselves squarely in the Christian community.¹

In the fall of 1997 a group of Christian professors at Stanford formed what has become known as the Christian Faculty Fellowship. A year later a second group of physicians at the Stanford Medical Center did likewise. In the last three years about 70 people have attended one of these groups (not all from Stanford and not all professors). Both groups meet on a weekly basis. In this issue of *The Ellul Studies Forum* three of these professors explore their specifically Christian journeys as university intellectuals--a truly Ellulian theme.

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¹See, for example, Kelly Monroe, *Finding God at Harvard* (Grand Rapids: Zondervan, 1997) or Paul Anderson, *Professors Who Believe* (Downers Grove: InterVarsity Press, 1998).

Science and Faith - A Personal View

by William T. Newsome

It is a privilege to contribute to this volume of the *Ellul Studies Forum*. Preparing this paper has "pushed" me more than any of the 80 or so papers I have published in my professional life, precisely because I have never before written for a public, academic readership on any aspect of religious faith. I do not, however, come to the topic completely unprepared. Across twenty-five or so years of adult life, I have tried to discern for myself whether there is anything in the universe worth having faith in, what it means for me personally to live in faith, and how my faith is related to all other facets of my life—including the science that I do. In a sense, then, my search for an authentic faith is as much a part of me as eating, sleeping and breathing, and it is certainly a more essential part of who I am than is the science I do.

I wish to begin with a disclaimer. I consider myself to be an expert—in the academic sense—only on the neurophysiology of visual perception, and I will have *nothing at all* to say about visual perception in this paper. However, my topic demands that I consider the nature of reality, the nature of meaning, ways of knowing, and the foundations of ethics—and I state openly that I am an expert in *none* of these subjects. While I have little formal training in philosophical analysis, I am a philosopher in the sense that every one of us is a philosopher: in the sense that we all must get out of the bed every morning and *act* in numerous situations throughout each day. I believe that every action we take, and every decision we make, form a living philosophy in the sense that our actions imply certain beliefs about what is real and about our ultimate sources of meaning and value. This is the spirit in which I write, and this spirit is reflected in the title I chose for this paper, "Science and Faith: A Personal View". I readily acknowledge that many readers have pondered these matters longer and more searchingly than I have. I am not writing to *instruct* anyone. Rather, I want only to share my own experience and reflections concerning the life of faith in a secular academic setting.

Many readers of this volume are probably Christians or perhaps theists of other stripes. Others are likely to be agnostic, perhaps tending toward atheism, simply because they have not been able to see a way to any form of faith that is both reasonable and nurturing in a deeply personal sense. A few readers may be strongly convinced atheists. My remarks are aimed predominantly toward that middle group—most of whom are authentic seekers—because this is the group that I seem to encounter most often in private conversations within the academic community.

I want to relate one such conversation because it captures the essence of many others I have had over the past

couple of decades. When I was a junior faculty member at SUNY Stony Brook, my wife and I invited a young couple over for dinner at our house. Karen and Dan were both postdoctoral fellows in other neurobiology labs, but they loved children and did some baby-sitting for us on occasion. Karen and Dan were aware that Zondra and I were members of a local Presbyterian Church. Vaguely religious topics had cropped up in conversation among us on previous occasions, mostly concerning childhood religious backgrounds, as I recall. As fate would have it, religious matters came up during after-dinner conversation on this particular evening, and Karen finally blurted out, rather indelicately, "I don't understand how a smart guy like you can believe in all that stuff!" Perhaps this unusually candid declaration was facilitated by the wine we had consumed during dinner; I don't know. But I relate this story because Karen's reaction is fairly common even though it is rarely expressed so straight forwardly. More often it is conveyed merely by a raised eyebrow or by a vaguely embarrassed or surprised facial expression when a friend discovers that I—a respected scientist (in some circles, at least)—am a Christian. What I would like to do in this paper is to answer Karen's question as straightforwardly as I know how, because it is fair; it is authentic; and, it arises so often.

Karen's question can be answered on a number of levels. At one obvious level, I am a Christian today because I was born in the United States of America rather than in a Moslem or Hindu country. Yet many native born Americans are not Christians, so this cannot be the entire explanation. At another level, one might say that I am a Christian because I was raised in a deeply religious family. I am the son and grandson of Southern Baptist ministers, and thus am a conspicuous outlier in the community of academic scientists. Obviously, my family milieu played an important role in my spiritual development, but neither was this a completely determinative factor. The stereotype of the rebellious 'preacher's kid,' in fact, might lead one to expect the opposite outcome. People raised in deeply religious families go on to a wide variety of lifestyles and belief systems as adults.

Historical factors—biological, cultural, and familial— influence all of us profoundly, but any of us with two wits to rub together will (or should, at least) examine and question these influences critically at some point in our lives. To some extent then, I am a Christian today because I consciously *choose* to be. For me, the simplest answer to Karen's question is that I am a Christian because my life makes more sense to me with my faith than without it. Now I would be the first to admit that there are times when my life doesn't seem to make much sense from any

point of view. But on the whole, I have not found any other system of belief—or disbelief—that accounts as well or as consistently for the world as I experience it, from deeply personal matters of ethics and hunger for meaning to my sense of awe at the physical universe.

Before getting to the heart of my remarks, I would like to clear away a bit of underbrush. When I speak with academic friends about religious faith, I often find that they have certain mental blocks that prevent them from taking the Christian faith seriously, and many of these obstacles appear to me unnecessary because they can be dealt with fairly straightforwardly. I want to mention four of them briefly, simply because I encounter them so frequently. I will not deal with any one in depth, but I hope merely to point toward ways of thinking that can perhaps defuse these issues a bit.

1) One obstacle is the perception that Christians, and evangelical Christians in particular, are intolerant. Claims for possession of ultimate truth are generally viewed with suspicion in academia, and attempts to make converts on this basis are viewed even more harshly. Let me state plainly that I believe in evangelism, but my model of evangelism differs importantly from other commonly encountered models. As anyone who knows me realizes, I am not out to beat anyone over the head concerning matters of faith. On the contrary, I am actually fairly private about my faith. To use a metaphor (not original with me), evangelism, properly understood, is simply “one bum telling another bum where he can find some food.” For me, the achingly good news of God’s love is most effectively offered out of a very deep sense of humility, within a relationship, and to a demonstrated need. From this perspective, faith is communicated in dialogue, arising from a sense of common humanity, not from a sense of arrogance or triumphalism. I have no problem with this sort of evangelism, either as a human being or as an academic. But, let me say something further about intolerance. To some extent intolerance is a virtue. If we are *tolerant* of everything, then we *stand* for nothing. For example, Stanford University—where I am employed—has values that it espouses, including academic freedom, dialogue by reasoned discourse, and mutual respect for the diverse members of the university community. Stanford is properly intolerant of gross violations of those values. If nothing else, the modern university is intolerant simply of intolerance! So it should not be surprising that Christians, or feminists, or scientists, or environmentalists, to name just a few, have certain bedrock values that they refuse to compromise. All such groups are entitled to a voice in our academic communities as long as they abide by the basic rules of reasoned discourse and respect for others.¹

2) A second obstacle is the perception that in terms of moral conduct, people inside the Christian community are no better, and may be worse in some respects, than people outside the community. For a community whose basic *raison d'être* is to be the hands, the feet, and the voice of Christ in the world, this perception can be particularly damaging. I think about this issue

on two levels. First, realize that Christians make no claim to be different at a fundamental human level than anyone else. We are all needy. We have all experienced the brokenness of this world in the pain that we inevitably inflict on others and the pain that is inflicted on us. Most of us have experienced despair at the way small people are damaged by the frenetic thrashings of our political and economic culture. Christians are simply a subset of ordinary people who have found a beacon of hope and light in a world that is all too often bleak. At a second level, however, the expectation of moral growth and leadership in the Christian community is entirely justified; most Christians I know would certainly affirm a desire to become more Christ-like as their journey of faith progresses, and that something is wrong if this is not happening, at least in some feeble way. Contrarily, as C.S. Lewis² has pointed out, however, the key issue is not whether some large collection of Christians is morally superior to a similar collection of non-believers. The central problem is whether each individual believer is growing in moral stature *more* than if he or she were a non-believer, and whether each individual non-believer *could grow more surely* if he or she were a believer. I am certain that the positive moral influence of my faith is real for myself, for my wife, and for most of my close friends who are believers; one can only make that judgment for oneself by trying, I think. In statistics, of course, the concept I am driving at is *partial correlation*. For those of you who speak statistical lingo, I am convinced that this effect is highly significant.

3) A third obstacle that I want to mention is the perception that the things that go on in churches are simply irrelevant to modern life, even if one is sympathetic in principle to some form of religious faith. Church gatherings are frequently perceived as little more than events for forming social and business contacts, and the forms of worship are sometimes perceived as outmoded relics of another age. While these criticisms have some truth to them, I can say emphatically that my primary experience of church is positive and directly relevant to the cutting edge of life. The best times are usually in small group gatherings or in retreat settings. At these times I see people struggling with grievous or impending loss, searching with each other for strength to continue the journey, in optimism and faith. I experience in these settings, and in corporate worship as well, clarion calls to remember who I really am, to constantly refresh my moral priorities, to be attentive to my highest intuitions, to be a servant as well as I can to my family and to those I work with each day. This is indeed food for the soul. Where do you go to get yours? I don’t know how I could live without it.

4) A fourth obstacle is the perception that Christians are anti-science, and I must admit that there is some justification for this view. Every Christian should study the history of the Church’s interaction with Copernicus and Galileo in the 16th and 17th centuries. As most of us know, Galileo provided the first compelling evidence that the celestial bodies in our solar system revolve around the sun rather than around the earth. While some of Galileo’s difficulties arose more from palace intrigue than

from theological considerations, he was nevertheless brought before the Church's Inquisition and forced to recant his beliefs, and remained essentially under house arrest for the rest of his life. It is the textbook example of how one of the greatest intellectual achievements in history was suppressed, the scientist himself persecuted, and the entire process rationalized religiously by narrow, very literal interpretations of specific passages of scripture. In our own age, a vocal segment of Christianity flirts dangerously with the same mistake by engaging in knee-jerk denunciations of biological evolution without open-minded consideration of the scientific evidence. Most Christians, however, value science deeply. One of the foremost achievements of liberal Protestantism in the United States was the establishment of our great research universities, including Stanford, and the nurture of the spirit of free inquiry that drives science today.³ The founders of our great universities realized that Christians should have no fear of truth from any source. We believe that there is only one author of truth, and that is God. All truth is a gift from God. Unlike some segments of academia, however, Christians realize that the truth offered by science is limited and cannot speak to our deepest questions and hungers concerning value, purpose and meaning. We believe in science, yes, but we believe in much more than science. Which brings me to the issues at the core of this paper: what are the proper roles of science and faith in my life or in anyone else's life? And, where does the power of one end and the power of the other begin?

It seems to me that we should make at least two major distinctions in thinking about the proper roles of science and religious faith. First, we should realize that science aims primarily to answer questions about *mechanism*, whereas religious faith seeks answers to questions about *purpose*, *meaning* and *value*.⁴ Much confusion arises when we look to science for ultimate answers to our quest for meaning and value, and I will have more to say about this shortly. Similarly, painful confusion arises if we look to religion for answers about mechanism. We need only look at the example of Galileo to see this. I believe that there is no necessary conflict between the two; I view mechanism and purpose as complementing each other, not as exclusive of each other. A balanced view of the world will realize the importance of both mechanism and purpose in almost every realm of endeavor. Many readers of this paper are deeply interested in mechanistic issues. For example, we wonder how physiological events within the brain give rise to perception, memory, and learning. We are curious about the fundamental forces that bind all matter together. We ask what molecular events turn a normal cell into a cancerous one. We seek to understand how macroeconomic phenomena arise from countless microeconomic decisions made by individuals. But all of us care deeply about issues of purpose and value as well. For example, is there any *absolute* difference between Hitler and Ghandi, or were their differences simply a matter of taste, or perhaps a matter of different gene pools competing for survival? Should our country's relationship with any other country be governed more by economic and military considerations, or by issues of human rights and social justice? What *is* justice

anyway? Do the countless ethical decisions that I make during a given year have any ultimate significance, or are they essentially hollow and transient?

I can illustrate this difference between mechanism and purpose with a simple, almost trivial, example. Someone who has never before seen a computer might rightly be amazed that the letter 'a' appears on the video monitor when the matching letter 'a' is pressed on the keyboard. If our observer is the curious type, she would want to know all about this spectacular phenomenon. Now I could offer her two types of explanation. A mechanistic explanation would talk about the key press closing a switch, which sends a particular voltage into the CPU over a particular input line, which exerts multiple effects on myriad transistors, flip-flops, etc. and eventually causes the monitor's electron beam to excite R, B & G phosphors at specific pixel locations to create a replica of the letter 'a.' A purposeful account, on the other hand, would simply note that the computer is a powerful machine that can perform remarkable services for the user, but only if the user has a way to communicate effectively with the computer. The keyboard/monitor system was designed to accomplish that communication. Now these are very different accounts, but both are obviously true. One concentrates on mechanism; the other on purpose. The levels of explanation do not compete with each other; they are complementary. The key question in any given situation is exactly what kind of truth are we looking for?

My point, of course, is that all of us have a stake in both kinds of questions—those of mechanism and those of purpose. We should not parse ourselves into scientific and religious communities who believe that truth lies substantially in one or the other camp. Rather, we should be clear about what kind of truth we are searching for when we ask a particular question, and then search for it in the proper place.

An important corollary to this distinction between mechanism and purpose or value is that science cannot provide adequate grounds for ethics. Science can tell us how to build nuclear weapons, but there is no experiment I can do in a laboratory that will tell us unequivocally whether it is ever right to use them. Science can tell us how to clone an organism from one of its cells, but cannot define for us when it is right to do so. Science can show us how to create pregnancies for infertile couples, and it can show us how to terminate pregnancies. But, it cannot tell us when we should or should not do either. Anyone who seeks to act ethically in the world or influence our political and economic culture in an ethical manner must obviously look beyond science for guidance.

The second major distinction we should make is that science is primarily concerned with public, repeatable events whereas religious faith is often most concerned with unique events. The phenomena that science likes best are those that occur reliably given a specific set of initial conditions, and can therefore be repeated again and again with various subtle but enlightening twists. Religious communities, on the other hand, are frequently concerned with *unique*, life-changing events that occur in the lives of individual believers, whose initial conditions can never again be replicated. Christianity, in

particular, is concerned with unique events that happened 2000 years ago in the life of Jesus of Nazareth. I would argue once again that these realms of experience are not in competition, but that all of us have a stake in both. If we want to know precisely what makes a normal cell cancerous—and what we might ultimately do about it—then we have a stake in the public, repeatable world of scientific investigation. We want as many bright young people as possible manipulating cells in all conceivable ways to discern the complex chains of molecular events that lead to uncontrolled cell division. But, all of us have an overwhelming interest in unique events as well. Anyone who has been a parent, especially of teenagers, knows all too well the excruciating decisions that must be made on the basis of very limited data. And once the moment of decision is past, we can never return to it. We can never start again at the same place, make a different decision, and see how it comes out. In scientific parlance, we can never do the control experiment. Although I used parenting as a specific example, anyone in an intimate relationship will find her or himself in the same boat. Decisions must be made and actions taken on the basis of woefully incomplete knowledge: incomplete knowledge of our partner, of ourselves, and of the deepest sources of behavior of either party. We are all afloat on a sea of unique events, and we must all try to discern deep patterns and truths that lie beneath the ever-changing surface. All of us have a stake in any source of wisdom, religious or otherwise, that will help us discern those truths and steer a stable course.

From these remarks, it should be quickly perceived that I perceive no necessary conflict between science and faith. Science, rightly understood, has no quarrel with religious faith unless religious authorities attempt to establish by fiat “facts” concerning mechanism that are properly in the domain of scientific investigation. Similarly, religion, rightly understood, has no quarrel with science itself. However, religion does have a major quarrel with the many attempts in our century to establish—in our universities in particular—a specific materialistic “faith” under the guise of science. Various forms of this faith have dominated the intellectual ethos of our major research universities for half a century at least. The core tenets of this faith, or world-view, are several-fold:

- 1) The universe and all that is in it works entirely by blind, cause-and-effect mechanism.
- 2) Mechanistic explanations, based on reductionist analysis, are the surest and perhaps only road to truth.
- 3) Phenomena which cannot be studied and verified by scientific means are either not real, or not meaningful, or simply not worth worrying about. (As Frederick Buechner has pointed out, this seems a bit like a blind man who believes that anything that cannot be heard, touched, tasted or smelled is a figment of the imagination.⁵)
- 4) Attempts to fashion a personal life in this world must be based, in the eloquent words of Bertrand Russell, on the foundation of unyielding despair.
- 5) Advances in scientific understanding are the best hope for addressing the world’s many ills. (This one is going out of

vogue faster than the rest.)

As should be easily observed by now, I have many misgivings about this particular world-view, but I will try to restrict myself to a few key observations. First, we should acknowledge that this world-view is not science or a necessary result of science. It is indeed a specific faith and interpretation of reality, arrived at by a segment of people. There is no experiment that one can do in a laboratory, and no unequivocal chain of reasoning, that can demonstrate any of these tenets to be true. Adherents to this world-view cling to it, I suppose, because it accounts for their experience of the world better than any alternative they have found. Or perhaps many cling to it simply because it represents a modern intellectual consensus, just as many academics in previous centuries adhered uncritically to theistic points of view that formed the intellectual consensus then.

My problem is that this materialistic faith does NOT account well for my experience of the world. The most deeply meaningful issues of my existence cannot be addressed on mechanistic grounds or by reductionist analysis. To give one outstanding example, how does one design a reductionist approach to the question: “Is it better to live or to die?” This is likely to be a live issue for some readers of this journal, or for some among their loved ones. I would argue that it is one of the most important questions a person can ask. Or how do we address a question that is surely a live one for many readers: “Should I marry this person? Do we have what it takes to form a life-long bond that can endure through severe difficulties?” Or how about the question asked by many bright but disaffected high school students: “Do I want to buy in to this society and its educational, political and economic values? Is there another way?” Such questions can certainly be reasoned about, but they cannot in the end be answered by scientific method. In contrast to the materialist ethos, I would argue that the importance of any question is in general inversely proportional to the certainty with which it can be answered.

Let us make no mistake about it: the central crisis of our culture is a crisis of meaning,⁶ and the dominant intellectual ethos of our academic communities does a paltry job of addressing the crisis. The world hungers for meaning, and our intellectual communities offer the spiritual equivalent of a stone. We need only consult many of our best scientists for confirmation of this critique. The astronomer, Stephen Weinberg, closed his widely read book, *The First Three Minutes*, with the observation that “The more the universe seems comprehensible, the more it also seems pointless.”⁷ In his highly acclaimed book, *The Selfish Gene*, the Oxford biologist Richard Dawkins concludes that all of the living, striving, loving and valuing of any human being serves only to abet one set of DNA molecules in its competition with other sets of DNA molecules.⁸ That’s the whole ball of wax! This is the faith that is frequently presented under the guise of science; it is a faith that does not sustain, uplift or ennoble; it is a faith that I resist, both within the academy and without.⁹

So what does Christianity offer as an alternative? A retreat to a discredited if more cozy past? An opiate to ameliorate our pain? An altar upon which to abandon our minds in favor of dogma? A lifetime of boring church services and stifling piety? I don't think so. These certainly are traps that can be fallen into, but they can be avoided with reasonable judgment.

At its best, Christianity offers a balanced, holistic view of the universe in general, and each of our individual existences in particular. It offers a sense of awe at the majesty and intricacy of God's creation in the physical universe. It provides a deep appreciation of scientific inquiry. (In one of Einstein's most memorable phrases, the process of scientific discovery is learning to think God's thoughts after him.) Christianity points the way toward an ecologically sound ethic: this is not our world, it is God's—we are only stewards. Christianity provides perhaps the best, most saving personal news that we can ever hear: that we are known and loved deeply and fully, that our highest values and intuitions are not a farce, but rather point more or less faithfully toward the essential core of reality. It frankly acknowledges the brokenness of our self-centered psyches, but offers us forgiveness and healing. It does not shrink from the pain of our existence, but points toward a man on a cross and says that no horror, however dark, cannot yield some good. It offers as much challenge for the future as any human being can embrace—to become as fully Christ-like in the time we are allotted on earth as God gives us the grace to be. It is a coherent view of existence that tolls the depths of our being, that calls out from us the very best that we have to offer. It reveals to us a world that is permeated with holiness at every turn, if only we have eyes to see it.

Charles Birch, an Australian biologist, has captured much of this vision in a memorable reflection on the book of Job.¹⁰ Job, as most readers will recall, was a righteous man who lost all that he had—wealth, family, health—but sought to remain faithful to God. In the end, broken and embittered, he lashed out at God with great anger and frustration. In a dramatic passage, the Almighty finally responds to Job's ranting, confronting him with his own finitude:

Who is this obscuring my designs with his empty headed words? Brace yourself like a fighter; now it is my turn to ask questions and you to inform me. Where were you when I laid the foundations of the earth? Tell me, since you are so well-informed! Who decided the dimensions of it, do you know? Have you journeyed all the way to the sources of the sea, or walked where the Abyss is deepest? Have you been shown the gates of Death or met the janitors of Shadowland? Have you an inkling of the extent of the earth? Tell me all about it if you have! Who carves a channel for the downpour, and hacks a way for the rolling thunder, so that rain may fall on lands where no one lives, and the deserts void of human dwelling, giving drink to lonely wastes, and making grass spring where everything was dry? Who gave the; this wisdom and endowed the cock with foreknowledge? Does the

hawk take flight on your advice when he spreads his wings to travel south? Does the eagle soar at your command to make the eyrie in the heights?

Job 38 & 39, Jerusalem Bible

In reflecting on this passage, Birch says:

Some of these questions are still questions to us, though not all. For we have more than an inkling of the extent of the earth, even of the universe. Someone has calculated the number of electrons in the universe and has come up with the round figure of 10^{80} ! We have journeyed all the way to the sources of the sea and beyond to the moon. We have walked where the abyss of the sea is deepest and now we plan to dig it up. We know something of how the This got its wisdom and the cock foreknowledge. We think we know something about the beginnings of the universe and the beginnings of life. But our dominant scientific-technological world view provides no framework within which we can find comprehensible answers to questions of point and purpose.

Birch then tries to imagine what God would say to the modern questioner:

Who is this obscuring my designs with his mechanistic models of the universe so that there is room neither for purpose, mind nor consciousness?

Brace yourself like a fighter, for now it is my turn to ask questions and yours to inform me.

Where were you at the big bang?

How is it that out of a universe of pure hydrogen you have come into existence?

Did life begin when the first cell came into existence or do elements of life exist in the foundations of the universe?

How can you be so sure that all is contrivance? How can mind grow from no-mind? How can life grow from the non-living?

Do people grow from blind mechanism? Is not a universe which grows human beings as much a human or humanizing universe as a tree which grows apples is an apple tree?

Or do you think that figs grow on thistles and grapes on thorns?

Does not the life of Jesus tell you something about the life of the universe? Was he not there in some sense from the foundations of it all?

You who live in rich countries, can you not see how every increase in your standard of living reduces that of someone in a poor country now, as well as threatening the survival of future generations?

Who is madly Christian enough among you to cut his standard of living by a third for the sake of the poor?

Do you think the world and all that is in it is

simply for your use? Has it no other value?

Because there are accidents and chance in the world, why do you think there is therefore no room for purpose? Can you not have both?

And when you have analyzed life down to its molecular building blocks in DNA, why do you think you have discovered the secret of life when you have not yet discovered the source of love and all feeling?

And why do you want to make of me either an all-powerful engineer or an impotent non-entity when I am neither?

To all of which we can only reply as Job replied:

I have been holding forth on matters I cannot understand, on matters beyond me and my knowledge. I knew you then only by hearsay; but now, having seen you with my own eyes, I retract all that I have said, and in dust and ashes I repent.

Job 42 (Jerusalem Bible)

I hope that by now everyone is beginning to see the shape of my answer to Karen's question—"How can a smart guy like you believe in all that stuff?" I write in one sense as a successful, middle-aged neuroscientist. But in a more profound sense, I figure out, in a semi-bewildered way, what sort of mess I have landed in. I am convinced—most of the time—that it is a holy mess. I struggle for coherence and consistency, and this holy view of existence is the one that accounts best for life as I experience it, both with my mind and with my heart.

One of the saints in my personal pantheon is the Christian writer and minister, Frederick Buechner. Buechner gets to the essence of this holy world-view in a memorable reflection on the creation story in the first chapter of Genesis:¹¹

"Who knows what I have in me of the [woman and the man] who in their heyday begot me? Who knows what all of us have in us not just of our parents but of their parents before them and so on back beyond any names we know or any faces we would recognize... Who knows what we carry in us, either, from those unspeaking, unthinking creatures that slithered and crept their way through the millennia until they turned into the likes of you and me and who have never stopped speaking and thinking since? And you 'can carry it back farther even than that to whatever unimaginable event took place, in one instant of time to bring time itself into being, and space itself, and that basic matter of which you and I and the star of Aldebaran and the tooth of the great white shark and the petal of the rose are all composed. As individuals, as a species, as a world, our origins are lost in mystery.

"The passage from Genesis points to a mystery greater still. It says that we come from farther away than space and longer ago than time. It says that evolution and genetics and environment explain a lot about us but they don't explain all about us or even the most important thing about us. It says that

though we live in the world, we can never be entirely at home in the world. It says in short not only that we were created by God but also that we were created in God's image and likeness. We have something of God within us the way we have something of the stars.

"...I believe that what Genesis suggests is that this original self, with the print of God's thumb still upon it, is the most essential part of who we are and is buried deep in all of us as a source of wisdom and strength and healing which we can draw upon, or with our terrible freedom, not draw upon as we choose. I think among other things that all real art comes from that deepest self... I think that our truest prayers come from there too, the often unspoken, unbidden prayers that can rise out of the lives of unbelievers as well as believers whether they recognize them as prayers or not. And I think that from there also come our best dreams and our times of gladdest playing and taking it easy and all those moments when we find ourselves being better or stronger or braver or wiser than we are."

I share Buechner's belief here, and I say this acknowledging fully the peculiar nature of religious belief. For me at least this is always composed of roughly equal parts of cognitive assent, intuition and unspeakable yearning, leavened with a dash or three of doubt. We are all probing at the edges of a very great mystery, or perhaps the best way to say it is that *we are being probed* by the greatest of mysteries. To paraphrase the Apostle Paul, now we see through the glass darkly, but we hope for a day when we see face to face.

I would like to conclude by saying to those who are trying to walk in Christian faith, I think you are on the right track, that the path you are following is the path that leads *home* in the truest sense of the word. For those who are interested skeptics—and believe me, that is all of us most of the time—I would encourage you simply to try this path and see where it leads. It can be a tough road to go alone, and finding (or forming!) a small group of like-minded travelers to share the journey is a tremendous gift. For those who disagree with everything I have said and are searching for answers to ultimate questions elsewhere, I can only say in the parlance of my teenage sons: "Hey, that's cool, dude!" I certainly admit that in the end, you may be right and I may be wrong. I would urge you, however, to attend closely to your "best dreams, times of gladdest playing, and those moments when you find yourself being better, stronger, braver or wiser than you are." The voice that rises up within us in those moments, I think, is an eternal voice that beckons us to our truest being, our most joyous selves, our ultimate destiny. And I would also ask, if you reach a point in life where the way is dark and the spiritual hunger overwhelming, remember that there is a place where you can find some food. The path of Christ *is* a living option.

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"community" they provided during preparation of the original talk and the written version as well. Please address all correspondence to William T. Newsome, Department of Neurobiology, Stanford University School of Medicine, Fairchild Building, Room D209, Stanford, CA 94305. Email: bill@monkeybiz.stanford.edu.

¹This point is argued at length in G.M. Marsden, *The Outrageous Idea of Christian Scholarship*. New York: Oxford University Press, 1997.

²C.S. Lewis, *Mere Christianity*. New York: Macmillan Publishing, 1952.

³G.M. Marsden, *The Soul of the American University*. New York: Oxford University Press, 1994.

⁴I realize that the distinction between mechanism and purpose is not a black-and-white cleavage. Upon scrutiny, neither mechanism nor purpose is likely to remain tidily contained in its separate box. The evolutionary idea of a "niche", for example, reaches outside the confines of "mechanism" into some aspects of "purpose". Nevertheless, the distinction that I am making is fundamental, and it captures substantial truth about the relationship between science and religion. For present purposes, it is most important to get the primary distinctions clear; extended analysis of exceptions is beyond the scope of this paper. The view of complementarity between science and religion along the lines of mechanism and purpose is, of course, not remotely original with me. I follow in the footsteps of a host of others, including recently, S.J. Gould, *Rocks of Ages: Science and Religion in the Fulness of Life*. New York: Ballantine Publishing Group, 1999.

⁵F. Buechner, *Wishful Thinking*. New York: HarperCollins Publishers, 1973.

⁶See, for example, V. Frankel, *Man's Search for Meaning: An Introduction to Logotherapy*. New York: Simon and Schuster, 1984.

⁷S. Weinberg, *The First Three Minutes*. New York, Basic Books Inc., 1977.

⁸R. Dawkins, *The Selfish Gene*. Oxford: Oxford University Press, 1976.

⁹I argue vehemently here against a particular materialistic philosophy, substantially devoid of meaning, that is peddled on our campuses and in popular culture as a "scientific" world view. In so arguing, I do not mean to neglect or denigrate the many reflective academics who are

sensitive to the transcendent dimension of life but are seeking patterns of meaning outside the usual religious traditions. A recent example is Ursula Goodenough's book, *The Sacred Depths of Nature* (New York: Oxford University Press, 1998). Ursula, in fact, has gently chided me for the "caricature" of a scientific world view presented in this paragraph. In response, I can only say that this "caricature" is very much alive and well in the corner of academia that I inhabit. I recently spoke with a faculty colleague at Stanford who declared his (hyperbolic) desire to "bomb" Memorial Church (a campus landmark established by the Stanford family) because it is a "monument to irrationality." More importantly, I frequently speak with Stanford students who are grappling with this materialistic world view as the received wisdom of our academic culture; they are usually amazed and gratified to find a Stanford faculty member who will argue strongly what they already suspect—that this particular emperor is short on clothing.

¹⁰Quoted from L. Charles Birch, "Nature, Humanity and God in Ecological Perspective". Address delivered at the Conference on Faith, Science and the Future, sponsored by the World Council of Churches. Boston, MA, July, 1979.

¹¹F. Buechner, *Telling Secrets*. New York: HarperCollins Publishers, 1991.

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Experiences of God's Guidance by Richard H. Bube

In a number of wonderful ways my life's journey, by the grace of God, has involved personal commitment to Jesus Christ, as well as to authentic scientific descriptions. It is not surprising that exploring the interaction between science and Christian faith has been a major activity of my life.

My first book was published in 1955, *To Every Man An Answer: A Textbook of Christian Doctrine*.¹ It was written to explore the Biblical revelation following the birth of our first

child. My first paper on science and Christianity was published the following year, "The Relevance of the Quantum Principle of Complementarity to Apparent Basic paradoxes in Christian Theology."² I started work on my second book in 1955, *Photoconductivity of Solids*,³ the first of seven scientific books related to photoelectronic and photovoltaic properties of semiconductors. In the following forty years I gave talks on science at many scientific meetings and conferences around the

world, and I also spoke on science and Christian faith at over sixty colleges and universities. I almost continuously participated in Adult Education programs in at least seven local churches. A particular focus of my efforts has been to clarify what a whole vocabulary of words involving science and Christianity really mean, as opposed to the ways they are often popularly used to argue for various special agendas. The central theme of these reflections is the many ways in which critical decisions and opportunities in my life can be traced with thanksgiving to the providential guidance of God.

Early Years

I grew up in Providence, Rhode Island, with parents who were loving and supportive, but were not believing Christians. In my first year at Classical High School I became good friends with another student in my class. One day he told me that his church, the Lutheran Church - Missouri Synod, was building a new church building not far from my home, and he invited me to attend the dedication service. I always remembered that the first hymn in the service was *Holy, Holy, Holy*. The church, the people, and the service spoke to me, and I started to attend Sunday School shortly thereafter. I do not know how long it was—but probably not very long—before my kindly Sunday School teacher clearly presented the Christian Gospel of God's grace in Jesus Christ to us teenagers in the class as part of the regular lesson. My heart said "Yes" to God almost immediately, I was a member of the 1941 Confirmation Class, and I began my walk with Christ as one for whom He had died and risen again.

Brown University

After Classical High School, where I started my writing and editing experience by editing the school newspaper for two years, I went on to Brown University during the non-typical war years. My fundamental concern in choosing a career program at Brown was to find some kind of activity for which I had some talent, and which promised to provide gainful employment. I was, after all, a child of the Great Depression, and the ability to find a job that would enable one to support a family, live a reasonably constructive life, and be a helping member of society dominated the list of job requirements. I think I subconsciously assumed that any honorable job could (and should!) be done to the glory of God.

These were very nontypical days for life on a university campus. There was only a handful of civilians on campus. My own list of courses was almost totally limited to those related to science: physics, chemistry, mathematics, and a single course in astronomy. The few non-science courses consisted of required Freshman English, two semesters of French (I knew that ultimately, to fulfill the requirement for a Ph.D., I would need to be able to read in two languages other than English, and I already had some education in German.), and my major excursion away from the standard science curriculum: two courses in Political Science.

The two Political Science classes were a radical departure from my technical curriculum and reflected a growing

interest I had in some of the ideas involved. The two courses I took were "From Luther to Hitler", and "The United Nations". I took the latter around the birth of the United Nations, when there were high hopes for major changes because of its existence. I even wrote a major paper entitled, *Religion and Internationalism*, which had a section titled, "Religion and Science"; I was overjoyed when this paper was awarded the Samuel Lamport Prize. It is interesting to note that I was later strongly criticized by a physics faculty member for having done an inappropriate thing for a physics major: to seriously spend time thinking about political science! "You'll never succeed in physics that way!" I was warned. You can imagine the response that my Christian faith stimulated.

There are a few other papers, written while I was at Brown, related to the interaction between science and Christian faith. One of these is not specifically dated and is titled simply, *Science and the Christian*. Its major concern is the development of a positive treatment of the meaning of science for a Christian, and it sets forth the capabilities and the limitations of science in a way that foreshadows my more complete treatment of these issues in later years.

Other Examples of Divine Guidance

Several times in my life I made crucial, life-shaping decisions that in many ways were not really mine at all. Some of these can be seen in the early years described above. In the following I have called these 'special occasions of divine guidance' and have singled them out for particular attention.

Princeton University

My eight consecutive semesters at Brown during the war came to an end in February 1946. Considerably before this, however, came the consideration of how to continue my education after receiving my Bachelor of Science degree in Physics from Brown. Again, I had very little experience to draw on, but for a variety of reasons I decided that good choices would be Cornell, Yale and Princeton. I felt it important to get my graduate education in a different environment from my undergraduate education. I applied to each, with the obvious proviso that I couldn't come without financial aid in some form, and waited to hear what would happen.

Cornell admitted me, but regretted that they had no financial aid available in the middle of the academic year. Yale responded in the same way. Finally Princeton admitted me, with the happy news that they did have a Teaching Assistantship for me if I chose to accept. I had no trouble in making a decision between them.

I have always regarded this particular set of circumstances as a focal point for God's providential activity in my life, and as an example of how God often does choose to act in a person's life. I did not make the independent decision to attend Princeton rather than Cornell or Yale; God made the choice through the circumstances in which the events happened. Left to myself, and with my limited knowledge, Princeton might well have been my last choice among these three Universities. But the opening of the door to Princeton—and particularly the

delay of the offer of financial aid from Cornell until too late—set the entire framework for the rest of my life. The wonderful relationship with the woman who became my wife, my growth as a Christian, and my fulfilling scientific career all grew out of the Princeton experience in unique ways.

While I was a graduate student in physics, I was on the founding committee for a new Lutheran Church in Princeton; however, I was too young to serve on the first governing board of the church. I received notice that I had been hired to work on the cyclotron project at Palmer Physics Laboratory during my first summer at Princeton. The cyclotron in question was a 12-ft diameter model, which was quickly replaced over the next few years in the field by machines orders of magnitude larger and more complicated. I came away from the experience with the reinforced conviction that I did not want to do 'big machine' physics.

In 1947 I did some of my most careful reflection on what kind of a future career I felt called to pursue. Should I continue my path toward a career in science, or should I consider instead a calling to some specific theological ministry? It was obviously a critical point in my life; a number of crucial events occurred in the next couple of years. First, I became convinced by the end of my Ph.D. degree work that I had better gifts for scientific research than I did for pastoral ministry. Second, there was born within me the conviction that God was calling me to serve Him through my science, especially through my witness as a respected Christian scientist, a member of both the scientific and Christian communities. Third, a whole new field of physics, solid-state physics—or as it has become known in recent years, condensed matter physics—was just opening up. This was exactly the kind of challenging, 'small machine' science that appealed to me at that time.

While I was a grad student in physics at Princeton, I attended a talk given by a distinguished and respected Old Testament scholar, who had written a book stressing the literal interpretation of Genesis One. At the end of his talk in the question period, one of the students asked him, "How can one reconcile the scientific theory of evolution with a literal Genesis account of creation?" He replied, "Until evolution is proven to be true, I do not really need to consider its possible interactions with the Genesis account." This answer struck me as being so inappropriate that it triggered my lifelong concern for dealing with the interactions between science and Christian theology in a way that preserves the integrity of each.

The love of my life.

While I was a 20-year old grad student at Princeton, I met Betty, a wonderful Christian woman with whom I quickly fell deeply in love. We had a brief period of turmoil when we tried to come to grips with the fact that she was 10 years older than I, which neither of us had earlier suspected. After a brief struggle with some of the socially defined issues in such a relationship, we both came to the conclusion that God had called us together. We shared life together for the next 48 years passionately in love, with our four children, until God called her home to him in 1997. Certainly no single experience in my life

could express so powerfully the loving guidance of God in my life.

Choice of scientific field of research.

My first two summers at Princeton I worked on projects at the university, but there did not seem to be a suitable opportunity for the third summer. Since Betty was working at the nearby RCA Laboratories, I applied to them to see if a summer appointment might be available. Providentially there was.

When I began this work, my supervisor said to me, "Which would you rather do: grow crystals or measure luminescence?" Because of my background in physics, I said, "measure luminescence," and this simple choice set in motion the main focus of much of my scientific research in following years.

Opportunity for Ph.D. research

Betty and I wanted to get married in the Fall of 1948, and I had heard that it might be possible to do my Ph.D. research while employed at the RCA Laboratories. So I was led to the situation where I was able to do my complete Ph.D. thesis research to fulfill my requirements at Princeton University, while being employed full time for the next two years at the RCA Laboratories, supported by a Navy Contract.

My first summer's research at RCA resulted in my first scientific publication, "A Correlation between Cathodoluminescence Efficiency and Decay as a Function of Temperature".⁴ My interactions with my group director provided me with valuable instruction in a variety of activities essential to a successful scientific career in addition to the actual experimental and theoretical scientific work itself. Every member of our little research group was required to speak at each weekly meeting, even if it was to confess that no progress had been made in the previous period. Week after week of this activity through the years provided essential training in public speaking.

We also had a monthly written Progress Report to which each member of the staff was required to contribute. In addition to the experience gained by several years of this activity, in subsequent years I was assigned the job of putting together and integrating all of the individual progress reports into one total Progress Report for the whole group. This gave me valuable experience in scientific writing that was very important to me in the future, as well as helping me to develop my general editorial and writing skills.

An extension of my thesis work, summarizing the principle thrust of my research in luminescence, was published in 1953 as "Electronic Transitions in the Luminescence of Zinc Sulfide Phosphors".⁵ This work began to involve explicitly the phenomenon of photoconductivity—a change in the electrical conductivity of a material upon absorption of light—which was soon to become the principal focus of my research in the future. Again I was providentially at an exciting place at the right time. The September 1951 issue of the *RCA Review* was devoted to the subject of "Photoconductivity in Insulators," and included a

fundamental paper, "An Outline of Some Photoconductive Processes".⁶ Throughout my years at RCA, the author of this paper served as a continuing example and mentor for me in my research. In this paper he had laid the foundation for a thorough investigation of photoconductivity phenomena; almost the only thing that was needed was someone to carry out the experiments, test the models, and contribute to the theoretical descriptions. What a wonderful spot to be in!

While my own research in photoconductivity was developing, I started to write *Photoconductivity of Solids* in 1955.³ This book proved to be one of my best-received contributions. It sought to describe all of the developments in photoconductivity and its applications since it was first discovered in 1873. It included 1009 references, was published by John Wiley & Sons in 1960, and stayed in print for 26 years. It is interesting that an invited article on "Photoconductivity" by me was published in 1999 in the *Wiley Encyclopedia of Electrical and Electronics Engineering*.⁷

I also started the practice of including a Bible passage on the dedication page of each technical book that I wrote. In *Photoconductivity of Solids*, the reference was to Romans 1:20: "Ever since the creation of the world His invisible nature, namely, His eternal power and deity, has been clearly perceived in the things that have been made." The book had the good fortune to become a worldwide classic in its field, and for years afterward I met researchers from many countries who instantly knew me because they had read the work when they were students. It was even republished in a Russian language edition. I probably partially owe my appointment to the Stanford faculty to the general reputation associated with this book.

In the early 1950's I joined an organization named the American Scientific Affiliation, an association of men and women with commitments to both Christianity and science. The ASA had been formed in 1941 by a small group to be of service to college and university students as they encountered questions relating science and their Christian faith. For the years of my association with the group, I have repeatedly testified that it is one of the few such groups in the world (like the Research Scientists Christian Fellowship in England—today known as Christians in Science, and the Canadian Scientific and Christian Affiliation) that seeks to maintain both the integrity of authentic science and the integrity of authentic Christian theology. It has certainly played an important role in the development of my own thinking. As part of its work the ASA publishes a quarterly journal, originally known simply as the *Journal of the American Scientific Affiliation* for which I served as Editor from 1969 to 1984 (now known as *Perspectives on Science and Christian Faith*), holds an annual meeting, and is supported by local groups around the country that also hold occasional meetings.

Moving to Stanford

For several years I had been taking a look at other opportunities to use my research skills in other organizations. Things were changing. When I first came to RCA, it was almost unthinkable that anyone on the staff would actually leave. The '50's were a Golden Age for research at RCA, as well as a

number of other industrial research laboratories. The principal emphasis was on the quality of the research and the possibility of its results leading to new patents, which could be licensed to anyone in the entire electronics industry. Now with each passing year, the emphasis shifted more and more to guiding research efforts at the Laboratories by the immediate manufacturing needs of other parts of the company, or obtaining Government Contracts to support desired research.

And so it was at such a time that I had attended my first scientific meeting ever in California, the Spring American Physical Society meeting at the Naval Postgraduate School in Monterey, after my first cross-country flight. I had attended these Spring APS meetings around the country every year because of their concentration of interest in solid-state physics. It was March, things were cold and dead in New Jersey, and things were warm, blossoming, and beautiful in Monterey. I have said often my feelings were like those of Moses viewing the Promised Land. I was impressed and began to reflect that perhaps there might be an opportunity for employment in California.

In another of those marvelous providential events in our lives, I realized that a former member of the RCA staff whom I knew was currently Director of Research of an electronics company in Palo Alto, California. My friend went out of his way for us, set up interviews at several local companies, and even made contacts for us with the School of Engineering at Stanford University, who were looking for someone with my qualifications. The Department of Materials Science at Stanford appeared to be very interested in someone who could bring inputs on electronic materials into their program. We visited the campus, had dinner with a group of the faculty, and I gave a basic talk on photoconductivity.

On the next-to-last morning in California, Betty and I were discussing events at breakfast at our motel. I had about decided not to accept an offer from Stanford, since it was such a major move away from my 14-year research program at RCA and all the way across the country, disrupting our lives and the lives of our four children. That morning I was scheduled to have a meeting with the Stanford Provost. In the course of our conversation, he said to me, "Dr. Bube, we really want you to come." It was all I needed! What a difference to the rest of my life it would have made if I had not had that last-day appointment. I returned to tell Betty that I thought that we should come to Stanford. At any rate I received an offer to be appointed Associate Professor of Materials Science and Electrical Engineering at Stanford, starting in Summer Quarter 1962, and accepted. A new research program in Materials Science was just being started, supported by a major grant from the Advanced Research Projects Agency (ARPA).

And so, we brought to an end 14 years of married life in Princeton, and began to make plans to move across the country and start a new life. Immediately upon arriving at Stanford, I became involved as one of two faculty sponsors for the undergraduate InterVarsity Christian Fellowship group, an association that has continued since then. In the last few years the ministry at Stanford has broadened to include an active

Graduate Student Christian ministry, and a Christian Faculty ministry.

I was editor and author of *The Encounter Between Christianity and Science* (1968),⁸ which was the first of my five books on science and Christianity; it included a set of personal memoirs, *One Whole Life*.⁹ My most recent book was *Putting It All Together: Seven Patterns for Relating Science and Christian Faith*,¹⁰ which summarized a theme I had been developing for a number of years, dating back to before the 1985 joint ASA-RSCF conference at Oxford.

At Stanford I started another tradition in 1968: an Undergraduate Seminar in "Science and Religion", which I taught for academic credit relatively continuously one quarter each year for 25 years. I prepared a reading list and a syllabus for this seminar, which focused in the first half of the 10-week series on the history of the interaction between science and Christianity and the importance of different worldviews, the definition of science and its potential and limitations, the interaction between science and theology, determinism and chance, and the significance of being human. In the last half it considered test areas of practical, interaction such as creation and evolution, abortion, euthanasia, genetic engineering, and the environment. Since the seminar was an elective, it was taken primarily by students who already had a Christian commitment. Indeed, one of its contributions was to help students who had been taught that as Christians they could have nothing to do with science, to not forsake their faith when they realized that there were inputs from science that they could not in good conscience ignore.

In 1971 my book *The Human Quest: A New Look at Science and Christian Faith*¹¹ was published with a Foreword by a Fuller Theological Seminary Professor. Written within the context of the issues raised by my Undergraduate Seminar, and with topics for discussion at the end of each of the ten chapters, it represented my most complete attempt to date to deal with a broad range of questions. In spite of the fact that the time it remained in print was rather brief, it received a good reception by those interested in these issues, and references to it continue even after more than twenty years have passed.

Beginning research in photovoltaics.

My research during my first decade at Stanford was concerned primarily with a variety of issues related to photoconductivity and photoelectronic properties of semiconductors. My first Ph.D. student completed his work in 1965, and over the next 30 years I mentored a total of 56 Ph.D.'s at Stanford.

A significant new ingredient entered our research pattern with the beginning of our 25-year research program dedicated to the photovoltaic conversion of sunlight into electricity (solar cells). Our entrance into the field came about in a very providential way. One day I received a phone call from an Electrical Engineering Professor (one of the inventors of the first silicon solar cell when he was at the Bell Laboratories), who said, "I have in my office a man from NASA, who would like to get some work started at Stanford on cuprous

sulfide/cadmium sulfide (Cu₂S/CdS) thin-film solar cells. I haven't worked with cadmium sulfide, but you have. Would you be interested in getting involved?" The opportunity afforded by this offer from NASA, particularly with the broad non-military applications for solar cells as one considered the environmental and energy needs of the future, was particularly appealing to me. It was close to my areas of previous interest and experience, and it seemed to afford a special opportunity to live out a Christian sense of stewardship for God's world.

Many years later when I wrote *Photoelectronic Properties of Semiconductors*,¹² I included a special section that I called, "Cu₂S/CdS: Theater for Photoelectronic Effects." A colleague, Alan Fahrenbruch, who had done his Ph.D. work with me, and I wrote a book on *Fundamentals of Solar Cells* (1983),¹³ and more recently I wrote a book on *Photovoltaic Materials* (1998).¹⁴

Opportunities to see the world

One of the great blessings given to my wife and me was the opportunity to establish contacts around the world. In one way the world came to us, as more than 40 international scholars came to Stanford to spend time with my research group over the past 35 years. And in another way I was encouraged to travel to many places in the world, making many friends along the way—some under quite providential circumstances. This started with my teaching a NATO Summer School in Ghent, Belgium two weeks after we moved to California, and included later participation in scientific conferences in Berlin, Hamburg, and Montreux, with sidetrips to other research centers. We were also able to participate in two conferences on science and Christian faith in 1965 and 1985 at Oxford, between the ASA and the Research Scientists Christian Fellowship of Great Britain.

Certainly one of the most wonderful experiences for us personally was making eight trips in eleven years to Switzerland, with sidetrips into Germany. My elderly parents had moved to California in 1967 and care for them made long absences impossible in the last 15 years of their life. In 1984 our first opportunity for a traditional Sabbatical came up. I had had a Visiting Scholar from Neuchatel, Switzerland, working with me on photovoltaics during 1982, and so I was providentially led to spend our first Sabbatical at the University of Neuchatel, while also giving a class on photovoltaics at the Ecole Polytechnic Federale Lausanne. We made friends with a number of families in Neuchatel, and were active both in the Eglise Evangelique Libre of Neuchatel, and the state Eglise Reformee in nearby Cortaillod. I was even enabled to give a sermon in French with the help of one of the good friends whom we had met in Neuchatel earlier. The sum of those eight trips enabled us to live a little over a year in Switzerland and we were thankful for every minute.

Summary

As I look back over my life, I am filled with gratitude to God for His providential leading and guidance on so many occasions.

The central emphasis of my perspective is that authentic science and authentic Christian theology—both of which must be carefully defined—give us valid insights into what reality is like. Each gives us descriptions from a different perspective, and yet they tell us about aspects of the same reality. They should be regarded as complementary and then be appropriately integrated, while preserving the authenticity of each approach.

¹*To Every Man an Answer: a Textbook of Christian Doctrine.* Moody Press, Chicago (1955).

²"The Relevance of the Quantum Principle of Complementarity to Apparent Basic Paradoxes in Christian Theology," *Journal ASA* 8, No. 4, 4 (1956).

³*Photoconductivity of Solids*, Wiley, N.Y. (1960); Russian translation (1962); reprinted by Krieger, Huntington, N.Y. (1978).

⁴"A Correlation between Cathodoluminescence Efficiency and Decay as a Function of Temperature," *J. Optical Soc. Am.* 329, 681 (1949).

⁵"Electronic Transitions in the Luminescence of Zinc Sulfide Phosphors," *Phys. Rev.* 90, 70 (1953).

⁶A. Rose, "An Outline of Some Photoconductive Processes," *RCA Review* 12, No. 3, 362 (1951).

⁷"Photoconductivity," *Wiley Encyclopedia of Electrical and Electronics Engineering*, Vol. 16, John G. Webster, Editor, Wiley, N.Y., 257-269 (1999).

⁸*The Encounter Between Christianity and Science.* Eerdmans, Grand Rapids, MI (1968).

⁹*One Whole Life: Personal Memoirs* (privately published) 1994, 3rd ed. (1998).

¹⁰Putting It All Together: Seven Patterns for Relating Science and Christian Faith, University Press of America, Lanham, MD (1995).

¹¹*The Human Quest: A New Look at Science and Christian Faith.* Word Books, Waco, Texas (1971).

¹²*Photoelectronic Properties of Semiconductors.* Cambridge University Press (1992).

¹³A. L. Fahrenbruch and R. H. Bube, *Fundamentals of Solar Cells: Photovoltaic Solar Energy Conversion.* Academic Press, N.Y. (1983); Russian translation (1988).

¹⁴*Photovoltaic Materials.* Imperial College Press, England (1998).

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Now a Convinced Theist by Robert G. Olsen

I was born in Brooklyn, New York, and grew up in New Jersey. My family was Christian, and almost all of my social life was within this group. I was expected to go to Sunday School, Morning Church, Youth Group, and Evening Church every Sunday as well as all other organized youth activities. Although I attended public schools and participated in sports, questionable activities such as dancing were discouraged. As a result, I was on the periphery of the high school social scene and did not experience much of the world.

As far as I can remember, I believed in God since I was a small child. But as I grew older I had serious difficulties with fundamentalist culture. Looking back on it, I find things for which I am grateful (such as a family—including uncles, aunts, etc.—clearly committed to the "best" for me, the importance of the fact that you believe something to be true, and the importance of an individual decision to believe in God). Other things I still have a great deal of difficulty with (such as family devotions, the tendency to believe in salvation by perfectly correct theology, and an unnecessarily judgmental spirit).

Most people in my subculture were expected to go to Christian Colleges. Since I found open rebellion unpalatable, my quiet rebellion was that I did not consider it and broke the

mold. To my parents' credit, they did not choose to enforce the unwritten rule. With simultaneous fear and relief, I enrolled at Rutgers University. My interests were to prepare for a good job and to find out what the world was like since I had been separated from it in my high school years.

I found out quickly that without God, the world (from which I had been isolated to a great degree) was not bright. I remember my neighbor; he always wanted sex with his girlfriend, but when asked if he would marry her said no—because she had no principles. Somehow he failed to see the inconsistency that was so obvious to me. I also remember seeing people plastered after weekend drinking binges and wondering if they had anything to live for.

I came to realize that something about life without God didn't add up, but couldn't fully articulate it until later. I quickly found and became associated with InterVarsity Christian Fellowship (IVCF); that group became a source of great stability for me. For the first time, I became publicly committed to the faith. In my undergraduate years I learned about my responsibilities as a Christian, but I did not grow much in the faith intellectually.

The first inkling of the way I was to develop

intellectually came in response to a challenge to read through the Bible. Most of my reading was perfunctory. However, when I came to Ecclesiastes I couldn't put it down. For example, I read

2:10, I denied myself nothing My heart took delight in my work....Yet when I surveyed all that my hands had done....everything was meaningless.

12:13, Here is the conclusion....Fear God and keep his commandments for this is the whole duty of man.

This hit home but I didn't really know what to do with it.

After graduating from Rutgers with a degree in Electrical Engineering in 1968, I enrolled in graduate school at the University of Colorado-Boulder. During my studies there, the Anti-War, counterculture, and Jesus movements all peaked. Exposure to these produced many challenges to my faith, including: 1) the counterculture claim as pursued in the United States that middle class life is meaningless; 2) the Jesus movement assertion that preaching (especially about salvation and the end times) is the only meaningful thing to do since the end of the world was near. This was a challenge to my brand of Christianity, which fit in well with middle class life; 3) the anti-war movement statement that the government was corrupt to its core and war was always wrong. This was a special challenge to me since I had been commissioned an Army Lieutenant through ROTC.

I matured as a Christian in Boulder in many ways. I had several outstanding Christian teachers and began a program of serious reading about Christian issues. However, I have never had any formal training, such as seminary classes. During the time of growth I faced numerous intellectual challenges. I was developing as a scientist, and for the first time learned that doing research is fundamentally different from doing homework problems. I spent two years trying to solve a problem, and learned that that process of science is one of proposing a theory and trying to disprove it by comparison to consistency, plausibility argument, and experiment. If you can't disprove the theory, then you can accept it as tentative. In retrospect, I learned a great deal about becoming a researcher from this frustration.

By having to struggle with what I could believe scientifically, I came to believe that there was never proof of any belief, only corroborating evidence which makes the belief plausible. In fact, scientific models were not necessarily a representation of the real world (or "truth"), but only successful at predicting the results of experiments. This would haunt me later.

During this time, I became interested in a career in academics. In fact, I came to believe that God had called me to this. If you ask me today *how* I knew, I'm not sure that I could give you a satisfying answer. This led me to another defining period in my life.

I had backed into a ministry to street people from the counterculture by living at a house with fourteen Christians in the Hill district of Boulder, and by being asked to be part time

manager of the local Logos bookstore. During that time, I remember that within (I think) a few days I had two distinct conversations about God. One was with a street person to whom I said that feeling something is right is not sufficient. I stated that you must also have a reasonable basis for your belief. Another was with my Ph.D. advisor, to whom I said that reasons alone are insufficient but that you must also just "know" some things.

The apparent incongruity of my statements--plus my scientific belief about proof and truth--started me on a spiral downward to as close to agnosticism/atheism as I could go. I felt that I could not come up with good enough reasons for many of the things I claimed to believe. I was moved by those who said that then you should simply leave those questions unanswered and live your life as an agnostic. Somehow I never could go all the way because I believed (and still do) that agnosticism necessarily leads to despair, and I could not embrace that. I continued reading but my reading list (at least of Christian books) got narrower and narrower. One writer I could read was Pascal, and I was impressed with the *preface* to his wager. In the wager, Pascal concedes that you cannot prove or disprove God. He then suggests that it is more rational to wager your life on God than on atheism because you have more to gain by belief than unbelief. The wager didn't mean much to me, but the preface to it did. In the preface, Pascal was confronted by a skeptic who said that he would not condemn Pascal for either wagering on God or atheism but for taking any stand at all. He said that without "proof" you should take no position at all (i.e. agnosticism). Pascal's response was to say that *you must wager*. You have no choice. Since you are in this life, you wager by default. Your only choice is which way to wager. This hit me; I recognized that everyone makes a decision about belief in God and that not deciding was not an option. Despite this insight, the transition out of my black period was neither easy nor quick.

I remember praying a number of times in desperation for God to unequivocally show himself to me. Among other things, I prayed for the more public gifts of the Spirit--which I never received. I also never received any *unequivocal* demonstration of God's presence. Once I prayed the following: I said that I believed that I was called into an academic career and that (despite the fact that there were no jobs at that time in academia) I would not accept employment in industry. I remember getting up and feeling rather silly, since it would be at least a year before I finished my Ph.D., and no answer to this prayer was possible before then. Nevertheless within a few days Westinghouse Georesearch Lab in Boulder called and wanted me to consider coming to work for them. I knew that they were looking for a permanent replacement for an employee who had left. I went for an interview, which was quite humorous (at least to me) since I had decided to be true to my promise. I told them all the reasons not to hire me and why some of the other graduate students were more well suited for the job; I didn't tell them the real reason. They called back and still wanted me. I struggled, and finally told them that I was committed to a career in academics and would consider the job only if it was part time, and if I left after my Ph.D. They offered me the job anyway.

The fact that I was able to carry through was one small step back to God. Further, it played a part in a bigger picture later.

When I finished my Ph.D. in 1973, there were still almost no advertisements for faculty positions in Electrical Engineering. In fact, I was advised to not bother looking. Then one appeared from Washington State University (WSU) in Pullman that seemed to be written for me. I was quite skeptical that I could get it, but said I would apply because "I owed it to God" to try. I knew I had no chance. Later, when I got the job as an Assistant Professor, I found out that I surfaced to the top in part because I had some industrial experience. Was this God? Is it true that when you pray, coincidences happen more often?

Shortly after I arrived in Pullman, I met Marsha (a student, though not mine). We were married the next year. We now have 3 children: Erik (who is a senior in Management of Information Science at WSU), Karl (who is a junior in Mechanical Engineering at WSU) and Kari (who is beginning the seventh grade).

I have had a wonderful career. This is in part because the expectations of WSU when I first arrived were not as great as my own expectations of myself. Because I was not under as much pressure to produce, as is now the case, I was able to study many different issues within electromagnetics, from fiber optics to underground wave propagation, antenna theory, radar scattering, and applications to power systems (which is what brought me to Electric Power Research Institute). I have also enjoyed teaching at all levels, from freshman to Ph.D. students.

During the last 20 years, I have not been very vocal about my faith. I have only shared my faith in small ways with individual students. I do, however, hope that part of my witness is that I have been more moral as a Christian than I would otherwise have been. I also hope that I have been salt and light in a number of other ways. I have concentrated on career and family matters and am now reaping the fruits of this. My family is a great source of joy (not always of course!). Now perhaps it is time to give back.

Often, I wonder why I have been as silent as I have been. I think it is partly (at least) because I fear being put in a "fundamentalist" box without a chance to defend myself and partly that I don't have confidence in some of the responses I give to questions. I also worry about living consistently with my stated faith when there are so many temptations around. And, I also honestly continue to struggle with doubt.

I am a convinced theist, and am very strong in this because I cannot live with the thought of the consequences of being an atheist. I am sure that it leads to despair. Going beyond that to exactly how God interacts with us has always been difficult for me. I sometimes feel that Mark 9:22-24 describes my Christian life rather well. Here a father requests help from Jesus for his son.

"...If you can do anything, take pity on us and help us." "If you can?" said Jesus. Everything is possible for he who believes." Immediately, the boy's father said, "I do believe; help me overcome my unbelief!"

I have found the book, *Disappointment with God*, by Phil Yancey, to be a favorite of mine. I identify with those in the book who have desired but not experienced unambiguous evidence of God's presence and yet continue to believe and serve. Despite these doubts, I identify with Peter in John 6: 66-68.

No one can come to me unless the father has enabled him. From this time, many of his disciples turned back and no longer followed him. "You do not want to leave too, do you?" Jesus asked the twelve. Simon Peter answered him, "Lord, to who shall we go? You have the words of eternal life."

Let me add just a few further comments on my beliefs. I have no interest in atheism or rationalism. They appear to me to lead nowhere. For example, morality cannot be based on science. What is, is not the same as what ought to be. Without God, there is no morality. This is one theme of Dostoevsky. For example, in *The Brothers Karamazov*, one of his characters said, "If there is no God, all things are permissible." Humanism (while on the surface appealing) appears to be solidly grounded in mid-air. I don't understand how I can simultaneously say that we are the product of nothing but time and chance and yet infinitely valuable. I also have no interest in many of the more modern religious ideas. It seems to me that the basic idea is to find a concept of God with which you are comfortable and to adopt it. This circumvents the issue of truth. If there is a God, then the fact that I believe something has very little, if anything, to do with whether it is true. God is to be discovered—not invented.

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