

Commencement Address, Augsburg, 2 May 2009

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President Pribbenow, ladies and gentlemen, and graduates of the Class of 2009:

It is a privilege to be with you on this magnificent day. And I am delighted to be in the state where all the women are strong, all the men are good looking, and all the children are above average.

It is an auspicious time to be celebrating the accomplishments of science. This year marks the 200th anniversary of the birth of Charles Darwin, and the 400th anniversary of Galileo's discovery of the moons of Jupiter using a new invention, the telescope. The scientific revolutions brought about by enlightenment-era physics and 19th century biology revolutionized our understanding of the universe and led to technological and medical advances that have utterly transformed the way we live. But they seriously challenged the role of faith in our lives and brought reason and revelation into a state of conflict which has only intensified in modern times.

My message to you today is that the subsequent scientific revolutions of the 20th century should have largely obliterated any conflict between faith and reason. Their failure to do so is largely the result of *our* collective failure to make 20th century science central to what it means to be educated in the 21st century. Today's philosophical arguments between people of faith and champions of reason are trapped in a prison whose bars are made of outdated 19th century science. It is time we broke out of this prison.

But what a prison it is. It is hard for us today to imagine the psyche of pre-enlightenment man, for whom the workings of everything were veiled in mystery. It was easy to believe that God or gods played a direct role in every action and in every outcome. Explanations of the physical world were provided by the church as revealed wisdom.

Then came the great scientific upheavals of Copernicus, Kepler, Galileo, Bacon, DesCartes, and Isaac Newton. In a short span of time, the workings of the universe were shown to conform to remarkably simple laws; the great mystery that hitherto had cloaked everything was removed far into a distant background. The French mathematician Pierre-Simon LaPlace understood the full implications of Newton's laws: The initial state of the universe fully determines its destiny; the God of the everyday world was demoted to a mere watchmaker.

For some, this revolution was an enormous leap forward, a great enlightenment. In the words of Alexander Pope,

*Nature and nature's laws lay hid in night;
God said Let Newton be! and all was light.*

But for others, like the poet John Donne, the revolution was a traumatic dislocation:

*The new Philosophy calls all in doubt,
The Element of fire is quite put out;
The Sun is lost, and th'earth, and no man's wit
Can well direct him where to look for it*

The scientists behind the revolution struggled to reconcile their faith with their discoveries. They could not make the new view of nature as obeying fixed laws compatible with the old idea of a God of the everyday world, but they could and did see the hand of God in the laws themselves. The clergy, after first attempting to suppress science, later did what they could to make peace with it. Olympia Brown, the first woman ordained as a minister in the U.S., put it this way:

The more we learn of science, the more we see that its wonderful mysteries are all explained by a few simple laws so connected together and so dependent upon each other, that we see the same mind animating them all.

Yet the painful implications of Newton's laws hovered over all philosophy. Only by making an exception for man himself could an idea like human freedom survive. But for many, this human exceptionalism was finally killed off by Darwin's theory of evolution by natural selection. It seemed impossible to reconcile Darwin's scientific revelation with divine revelation as embodied, for example, in Genesis. Nor is the idea of free will, even if reduced to the simple choice to follow one's faith, compatible in any way with a deterministic universe. Attempts to redefine morality as nothing more than biological imperative led in the 20th century to such horrors as "scientific" socialism. The cruel morality of natural selection quite evidently legitimizes murder and war. Indeed, as Dostoevsky's character Ivan Karamazov remarked, if God is dead, everything is permitted.

Had science stopped with Newton, Darwin, and Freud, it would have been very difficult if not impossible to reconcile science with faith; they could only have become sworn enemies. Science had to tackle religion only as a phenomenon to be explained; Sigmund Freud likened it to a childhood neurosis. And faith could only have seen science as its assassin.

But science did *not* stop. The first intimations of a crack in the armor of Newtonian determinism came already in 1850 with the development, by Rudolf Clausius, of the Second Law of Thermodynamics, which states that a quantity called *entropy* must always increase in any spontaneous change of the state of a system. For the first time since Newton, time had been accorded the respect of having a definite direction; at least the hands of LaPlace's clock could not run backwards. But the beginnings of a real break came in 1900, when Max Planck discovered that energy can be emitted or absorbed by matter only in discrete quanta, leading in 1927 to Werner Heisenberg's Uncertainty Principle, which puts definite limits on man's ability to measure and to predict the physical world. At first, it seemed that our fundamental inability to predict outcomes might be limited to the subatomic world. But with the discovery of chaos by Edward Lorenz in 1961, the last nail was hammered into the casket of the clockwork universe; we now know beyond any doubt that it is formally impossible to predict even such simple systems as an ordinary pinball machine beyond a few ricochets. But perhaps the most profound

development of 20th century science is the recognition that the outcome of at least some physical processes depends on their being observed. In the strange, wonderful world of quantum physics, consciousness is fundamental and mankind is brought back from the abyss to play a central role in the universe; indeed, in some interpretations of quantum physics (such as that of the late, great physicist John Archibald Wheeler), our existence and that of the entire universe are mutually dependent. Science has become powerful enough to discover its own limitations and in so doing has freed us forever from the deterministic shackles of Newtonian science. It can no longer rule out free will or its logical corollary, the existence of God. In short, reason, once our jailer, has now set us free.

But not so that you'd notice. Unfortunately, to the extent that science is taught at all, almost all of its teaching is stuck in the 19th century. Only about 1/3 of U.S. colleges and universities require students to take at least one course in the natural sciences, and these rarely expose students to the wonders of quantum physics and nonlinear dynamics. The resulting mass ignorance of 20th century science has had the paradoxical effect of perpetuating a revolt against the shackles of enlightenment-era science, a revolt that dates back to 19th century Romanticism and now takes the form of postmodernism. 21st century culture is thus in full revolt against a version of science that ceased to exist almost a century ago. This revolt can be seen in the isolation of science from other intellectual culture, lamented by C.P. Snow in his 1959 essay on the two cultures, in the portrayal by Hollywood of scientists as mad, nerdy, power hungry, or all three, and most tragically in the refusal of our culture to insist on more science education, thus insuring that the problem will live on in perpetuity. Ignorance of 20th century science allows U.S. senators to proclaim that global warming is a hoax, while the misbegotten, quixotic war against 19th century science waged by creationists and their ilk damages science and faith equally, pretending as it does that scientific revelation has nothing to do with divine revelation. At the same time, the radical fragmentation of science itself means that even gifted specialists can remain largely ignorant of important advances outside their narrow fields of view. This is perhaps why the accomplished biologist Richard Dawkins, drunk on the power of natural selection, can proclaim that God is a delusion. Ignorant armies clash by the night of outdated physics.

Your generation is in a position to change all that. We should together insist that henceforth every high school student be exposed to 20th century science, to the full power and implications of quantum physics and chaos theory. Physics is far too important to be left to physicists. The only prayer we have of uniting the two cultures is to see to it that every educated person's understanding of science is updated to at least 1961. We will then be able to fully appreciate Albert Einstein's point that *science without religion is lame, religion without science is blind*.

Augsburg College has a compelling motto: "Through Truth to Freedom". How wonderful it is to live in an era in which science can accommodate the unity of these two central concepts as well as the compatibility of faith and reason.

As befits you as Augsburg graduates, let faith give you the motive to do good in this world, and let reason give you the power to do so.