



A new dream for 21st-century science

**It's time to abandon the search
for a single principle to explain the world**

An essay by Eric Dietrich



An old curse supposedly goes, “May you live in interesting times.” Pretty obviously this curse, or one of its close cousins, has been hurled at us inhabitants of the 21st century, for this century bids fair to be the most interesting ever.

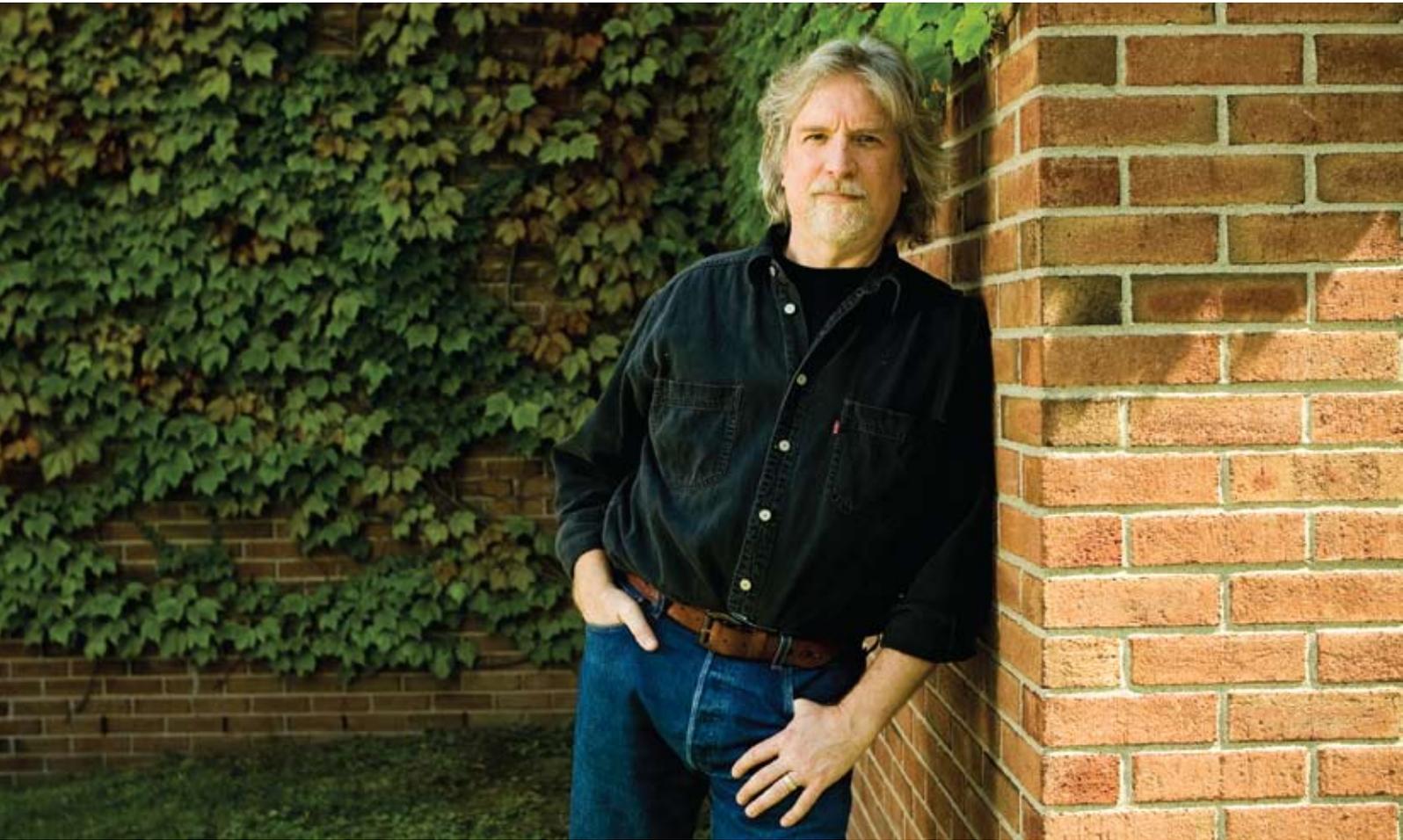
Everything will change. The way we live on this planet, including the way we house ourselves, eat, work, learn, get from one place to another, communicate and use currency. The way we conceive of ourselves and our place in the world, including the ways we think of religion, morality, justice, our histories and cultures and the way we define what matters. With nearly seven billion of us here at the beginning of the century, we will be changing the way we think about reproduction, and perhaps even the way it is accomplished. And all of these changes will be, and are being, reflected in our art and music.

One of the largest changes will come to science. Since at least the time of the pre-Socratic philosophers, thinkers and researchers have dreamt of and searched for a single principle to explain the world. This search for a grand, unifying theory continued up through Descartes and

then Newton — who gave the search, in physics, a large and much-needed dose of steroids. After the individual sciences started to mature at their own pace, developing their own theories and methodologies, the search for a unifying theory became, and remains today, the search for unifying theories — each science searching for its own.

In the 21st century, we will see this search move in two opposing directions. Some sciences will move closer to their dream of a unifying theory; others will see their dream dashed to bits. Why these two directions should prevail is itself a matter of great interest. To be specific, let us consider two sciences: biology and cognitive science.

Biology’s success at finding a unifying theory is one of the great success stories in the history of science. The discovery of evolution and the creation of the



theory of evolution was a remarkable accomplishment. To this day, however, many don't appreciate how powerful the theory of evolution is. This will change.

The way we humans define ourselves is deeply tied up with our religions and our moralities. As this century progresses, the theory of evolution will extend its reach to cover both of these. Evolutionary theory is now beginning to explain why humans are religious, why religions are structured the way that they are, and even why religions have a supernatural component. Evolution is also being used to explain our moralities — the implicit, internal rules of conduct that knit together our societies and are the foundation of our cultures. Furthermore, evolution is linking our embrace of religion and the way we conceive of our morality and moral duties. Allies in this bold advance include neuroscience, psychology and

philosophy. It is possible that by the end of the century we will know the biological and neuropsychological reasons that humans are religious and why we parse the world of human actions into right and wrong, good and bad, in the ways that we do. This possibility is sobering, to say the least, but there could well be important benefits from such advances.

The 21st century is likely to continue to be a century tortured by terrorism of various sorts. The sheer stress of population increase will be one major contributor to this. But much of the terrorism will be, as it now is, based on deep religious and cultural differences. It's a reasonable hope that we could place these differences in a better perspective once we know their biological and psychological origins. This might allow us to mitigate the problem of terrorism, for often progress toward solving a problem is made by knowing its cause.

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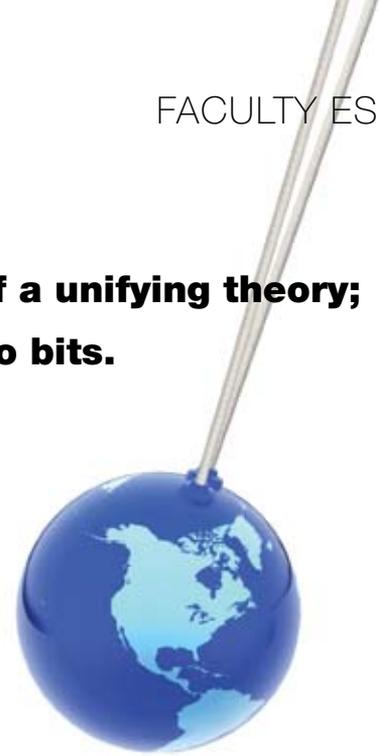
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If biology's grand unifying theory has such success, obviously we will all be much better off. Oddly, the same is true if some sciences' dreams of finding unifying theories fail. The most important science in this class is psychology, specifically, cognitive science. Cognitive scientists have been looking for decades for a unifying theory to explain the entire mind and brain. Their search was modeled on other, better established sciences, like physics (an irony, it turns out, since physics is also in this class). For example, one major contender in this heated race for unification is the computational theory of mind. Large parts of thought and thinking can be explained as the software of a very sophisticated computer (one we are currently unable to even come close to building). The computer is the brain, and the mind is its working software. While this theory has been enormously successful, it now appears as if the goal of using it for a grand unifying theory was wrong-headed.

Looking for a unifying theory of the mind and brain is now being compared to looking for a unifying theory of the entire Amazon rainforest — a theory that explains all of its flora and fauna, their interactions, how they all came to be, the rainforest's weather and its geology. No such theory is in the cards: The rainforest is simply too complex. The same realization is beginning to be accepted in cognitive science: The mind and the brain that produces it are just too complex for one theory to be able to explain all that needs explaining. The gap between the dynamics of the cytoskeletons of neurons and being able to pass a class in the history of the American novel is so large that completely different sciences are going to be needed to explain the relevant phenomena.

But this is just the tip of the iceberg. Developing theories of memory, reasoning, learning, perception, action and emotion all look like they will require very different methodologies. These different methodologies, though perhaps not lying in completely different sciences, will definitely lie in quite different subfields of cognitive science.

The situation is exacerbated by the fact that there is a paradox within biology's and cognitive science's futures. In so far as we think of ourselves as organisms subject to the power of evolution, we can explain some of our deepest beliefs and motivations — one unifying theory has enormous power. In so far as we think of ourselves as thinking things, we can only explain ourselves in a piecemeal way — one unifying theory is a pipe dream. But we are both a kind of African ape, subject to evolution, as well as cognizers best classified as unique in the animal kingdom. Paradoxes like this, which are starting to crop up in other sciences, make it hard to understand what nature is trying to tell us.

Furthermore, we can't predict which of all the sciences will wind up like cognitive science or like evolutionary biology. And just because a science at one time is closing in on its dream of unification, doesn't mean that the dream will continue to unfold that way. As mentioned, physics, the Platonic ideal of a science, looks as if it is going to be forced to give up its dream of a grand unifying theory. So, though the situation is puzzling, the message is clear. We humans live in a vastly complex universe, and this complexity is mirrored in our own minds. The furniture of the universe does not fit into neat categories, fixed once and for all. Rather, it lies in categories that sometimes contradict each other, and

that often crisscross each other in ways we may never fully understand.

All of this is going to play out on the 21st century's stage. And nowhere will this drama be more important than at universities. The dream of one world, one theory is dead. Even the dream of one world, many theories is dying, for it is far from clear that there is "one world."

Our students need to be given a new dream. Our students need to be given the dream that humans, the world and the universe are far richer, far more wonderful than any single science can handle, and indeed more wonderful than all the sciences combined. Science is one of the greatest achievements of humankind. But one of the things science reveals is the universe's inexhaustible supply of surprises.

This new dream might be unsettling. But it is actually far more optimistic than the dream of unification. We need not fear this new dream, for it will reveal a universe of excellent beauty. And, as Francis Bacon taught us, "There is no excellent beauty that hath not some strangeness in the proportion." ■