

God of creativity

At a time when there seems no danger of peace breaking out in the war between science and religion, **Stuart Kauffman** argues that we need some serious rethinking if we are to rescue our humanity and ride out the looming global crises

WITH economic and communications globalisation, some form of a global civilisation is beginning to emerge, perhaps homogeneous, perhaps forever diverse. We all face the challenges of global warming. We face peak oil, that year after which we shall never recover so much oil again – with unknown economic consequences, including hunger and resource wars. And all the while, our diverse cultures are being crushed together.

One response is a retreat into fundamentalisms, often religious, often hostile. This is hardly surprising, as humanity is still split between 3 billion who believe in the Abrahamic God (the majority of whom are Muslim, though a powerful minority are fundamentalist Christians), a billion who, like myself, believe in no supernatural god (though some of these are militant atheists), and the other traditions such as Buddhism. Clearly there is an urgent need for some new thinking.

That is why I wrote *Reinventing the Sacred*, though I am well aware that the very possibility and wisdom of such an enterprise is suspect. For those of faith, it is sacrilegious; those who are not religious remember Galileo recanting before the Inquisition and the millions killed in the name of God, and want

Profile

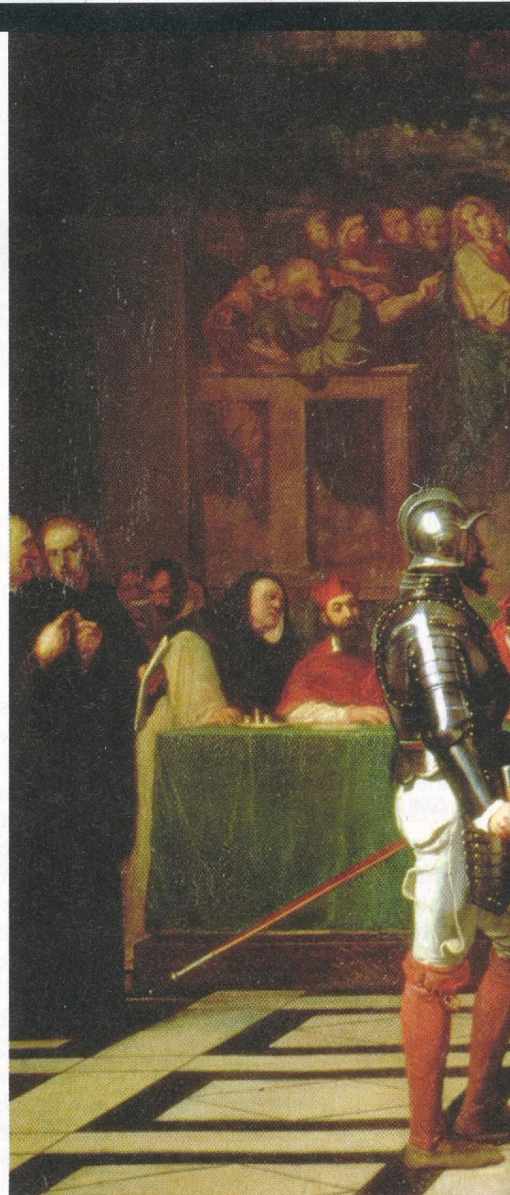
Theoretical biologist and complexity theory pioneer Stuart Kauffman originally trained as a doctor. He is now head of the Institute for Biocomplexity and Informatics, University of Calgary, in Canada. A seminal member of the Santa Fe Institute, he is now an external professor. The question that currently occupies him is: if selection operates all the time, how do we combine it with self-organisation? His books include: *The Origins of Order*, *At Home in the Universe*, and most recently *Reinventing the Sacred* (Basic Books).

no part of a God or a sacred that demands retreat from the truth of the world.

The process of reinventing the sacred requires a fresh understanding of science that takes into account complexity theory and the ideas of emergence. It will require a shift from reductionism, the way of thinking that still dominates our scientific world view. Perhaps the purest and simplest version of reductionism was voiced in the early 19th century by the mathematician Simon Pierre Laplace. He envisioned a “demon” – an intelligence which, if supplied with all the current positions and velocities of all the particles in the universe, could, using Newton’s laws, compute the entire future and past of the universe.

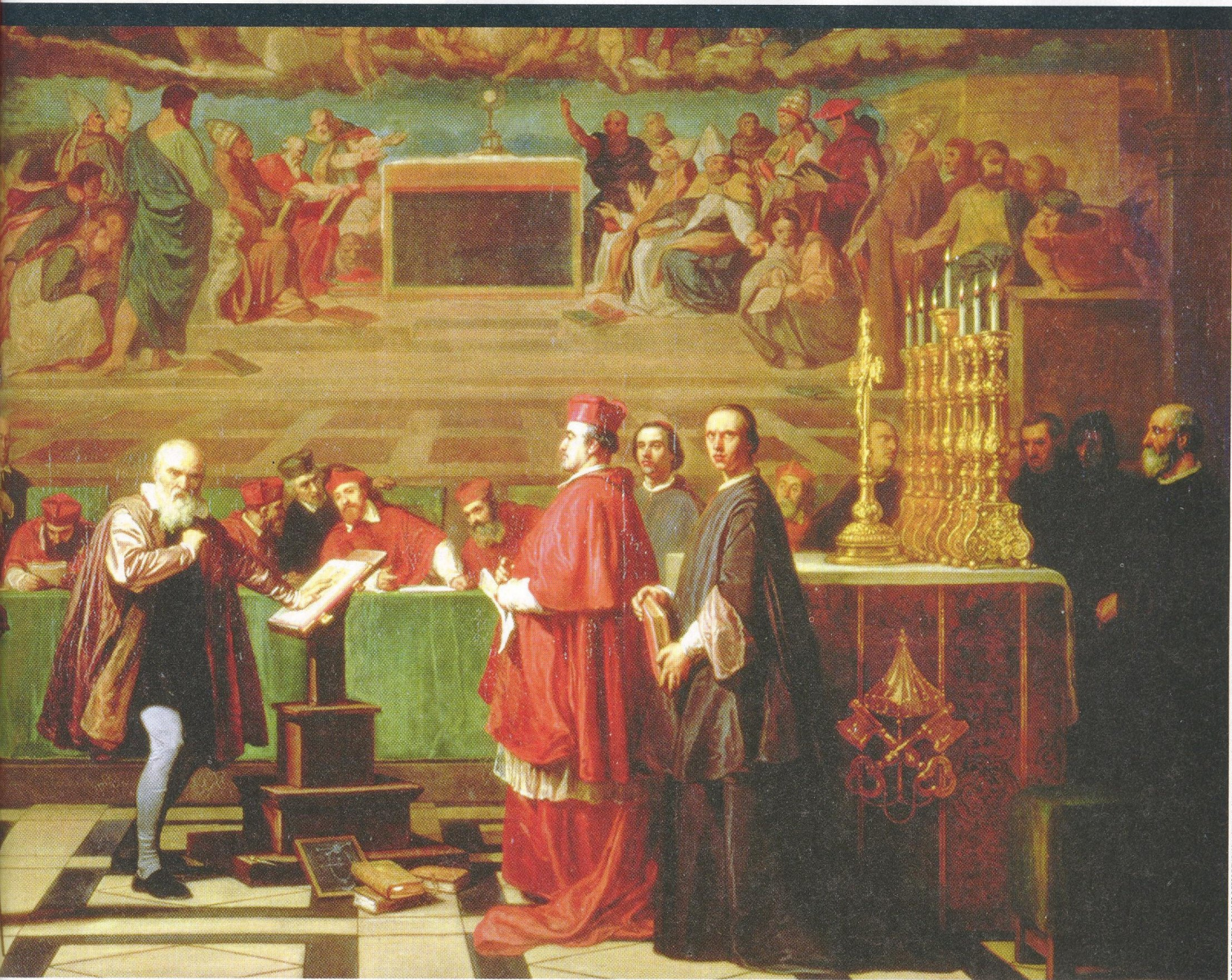
This world view has two features. One is determinism, abandoned in part when quantum mechanics began to emerge a century or so later. It is also the “nothing but” view of the universe which, for example, sees a man found guilty of murder as nothing but particles in motion. As the physicist Steven Weinberg put it, the explanatory arrows all point downwards from societies to people to organs to cells to biochemistry to chemistry and ultimately to physics.

Now we appear to be at the frontier of a new scientific world view. Many physicists, from Philip Anderson back in the 1970s to, more recently, Robert Laughlin, are coming to doubt the adequacy of reductionism. I am with them: I do not believe that the evolution of biosphere, economy and human culture are derivable from or reducible to physics. Physicists cannot deduce, simulate or confirm the detailed evolution of the biosphere that gave rise to the organised structure and processes that constitute, for example, your heart. Entities such as hearts, that have causal consequences, are “real” in their own right.



The second transition in our view of science is based on Darwinian pre-adaptations. Were we to ask Darwin what the function of the heart is, he would say, to pump blood; but the heart also makes heart sounds and these are not the function of the heart, which was selected, and hence exists, because pumping blood was of selective value. Darwin’s idea of a pre-adaptation refers to a property of an organism – heart sounds, say – that is of no selective value in the present environment, but might become of selective value in some different environment and therefore be selected. An example is human middle-ear bones, which are derived from three adjacent jawbones of an early fish. Did a new function come to exist in the biosphere as part of human hearing? Yes. Did that development have consequences for the evolution of the biosphere? Yes.

Now comes the big question. Could you enumerate ahead of time all possible Darwinian pre-adaptations for all organisms alive now, or even just for humans? We all seem to think the answer is no. Among the



ROBERT FLEURY: GALILEO BEFORE THE HOLY OFFICE (LOUVRE, PARIS) / PETER WILLY THE BRIDGEMAN ART LIBRARY

problems is the question of how we would list all possible selective environments? How would we pre-specify features of organisms that might go on to become pre-adaptations? There seems no way to do so. We do not seem to be able to pre-specify all of what I will call the “adjacent possible” of the biosphere.

If this is correct, the consequences seem profound. They break the spell cast by Galileo, that everything in the universe is describable

bones, lungs or livers – before they arise. We cannot even make probability statements about such pre-adaptations because, statistically speaking, we do not know the “sample space” of possibilities.

So the unfolding of the universe – biotic, and perhaps abiotic too – appears to be partially beyond natural law. In its place is a ceaseless creativity, with no supernatural creator. If, as a result of this creativity, we

For non-believers, Galileo’s treatment by the Inquisition is a potent reminder to be wary of the sacred

evolved from Yahweh in the desert some 4500 years ago, a jealous, law-giving warrior God, to the God of love that Jesus taught. How many versions have people worshipped in the past 100,000 years?

Yet what is more awesome: to believe that God created everything in six days, or to believe that the biosphere came into being on its own, with no creator, and partially lawlessly? I find the latter proposition so stunning, so worthy of awe and respect, that I am happy to accept this natural creativity in the universe as a reinvention of “God”. From it, we can build a sense of the sacred that encompasses all life and the planet itself. From it, we can change our value system across the globe and try, together, to ease the fears of religious fundamentalists with a safe, sacred space we can share. And from it we can, if we are wise, find means to avert wars of civilisations, the ravages of global warming, and the potential disaster of peak oil. ●

“Reason is an insufficient guide to living our lives: put Einstein and Shakespeare in the same room”

by a natural law. If a natural law is a compact description of the regularities of a process, there seems to be no natural law sufficient to describe Darwinian pre-adaptations.

Here we cannot do what Newton taught us to do: state the variables, the laws linking the variables, and the initial and boundary conditions, and from these compute the forward trajectory of the biosphere. We do not know the relevant variables – the middle-ear

cannot know what will happen, then reason, the Enlightenment’s highest human virtue, is an insufficient guide to living our lives. We must use reason, emotion, intuition, all that our evolution has brought us. But that means understanding our full humanity: we need Einstein and Shakespeare in the same room.

Shall we use the “God” word? We do not have to, yet it is still our most powerful invented symbol. Our sense of God has