

“At Home in the Cosmos”

Probably since the dawn of time, individuals have been looking up at the starry firmament, the luminous moon, the bright beacon of the planets, the immense orb of space, and pausing to ask themselves, "I wonder what's on TV tonight?"

But sometimes—when nothing's on—more cosmic questions pass through our minds, as well. People inquire where we came from and where we're going, why it's all so beautiful, and how it all got started. Are we alone, or here by accident, or participants in some bigger story? And the answers to those questions that are emerging today aren't the same answers that satisfied our forebears, who pictured the Almighty reaching out to touch Adam's finger at the very beginning of things.

When Dori and I visited Rome a few years ago, we saw many splendid churches. Besides the Sistine Chapel, there were smaller but still magnificent edifices filled with Michelangelos, and Caravaggios, beautiful works of art depicting the creation of the world and scenes from the life of Christ and the apostles. But the one site where I felt truly moved by a religious spirit was not a church at all but a rectangular piazza called the Campo de' Fiore, the Field of Flowers, now a bustling vegetable market but back in the year 1600 the cobblestone square where the Italian philosopher Giordano Bruno was burned by the Inquisition—the Dominicans—for the heretical teaching that the universe was much, much larger than either Aristotle or the authors of Bible had imagined, that the earth was not at the center of the cosmos, but whirled around the sun, and that the countless stars that dotted the night sky were in fact also suns very much like our own, surrounded in turn by their own planetary systems and, most shocking of all, that these far-away planets might be inhabited. Unlike Galileo, who under the threat of torture renounced his heliocentric theories a few years later, Bruno refused to recant, but according to one contemporary witness received his death sentence with a response that God would judge his accusers. And time has certainly judged them, if no one else. For now a handsome statue now stands in the square where, at the age of fifty-two, Bruno was immolated, a martyr to modern cosmology. And it was before that effigy that I experienced a little shudder of reverence and gratitude for this thinker so courageous in his convictions, so cruelly executed, and so far ahead of his time.

It took just over four centuries, but last year the Vatican observatory finally issued an acknowledgment that Bruno was probably right: intelligent life may exist elsewhere in the cosmos. According to the Jesuit astronomer Jose Funes, in an interview titled "Aliens are My Brothers," Catholics should be prepared to embrace their "extraterrestrial siblings" who are also part of God's creation and who don't necessarily require the Church or its sacraments to bring about their salvation. God's freedom is unlimited, Father Funes explained. And creatures elsewhere in the universe might be very well be part of the divine plan, indeed, may have been fashioned without the taint of original sin, staying on good terms with the Creator, so to speak, and needing no extra redemption from the Holy See. Space aliens, in other words are a little like Jews and Unitarians--more advanced life forms who can get along fine without Hail Mary's and the Nicene Creed!

As usual, though, the Vatican was just playing catch-up, echoing the growing consensus that we have company. Just last March, NASA launched a probe called the Kepler whose mission is literally to "seek out new life and new civilizations and boldly go where no one has gone before," as Gene Roddenberry would have put it. Currently eleven million miles from Earth, Kepler is now surveying about 100,000 stars near the constellation Cygnus where scientists think earth-sized bodies might be orbiting stars at distances that make them suitable candidates for species like Betazoids and Klingons to evolve. Results won't be known until close to the end of the three-and-a-half year project, but NASA's working assumption is that most stars, the majority, do have one or two earth-sized satellites spinning at the proper range for liquid water to be present, as we know it to have been present on Mars in the recent past and as researchers discovered it in the form of vapor geysers just this summer on Enceladus, one of the moons of Saturn. Maybe NASA's baseline estimate will be off. Perhaps only one percent or half a percent of the stars surveyed will turn out to have earth-like planets. But with hundreds of billions of stars in the Milky Way, that still means that life is everywhere, flourishing, variegated, and persistent.

Like the grass poking up through cracks in a city sidewalk, like the weeds that won't go away in your garden, like that hard-to-kill moss that insists on getting a foothold on the shingles of my garage, there's nothing unusual about organic evolution. Instead, there's no stopping it. Amino acids, the chemical building blocks for proteins, and the essential ingredient for making improbable beings like you and me, are ubiquitous. They're made out of simple stuff, carbon and oxygen, nitrogen and hydrogen, atoms that are just about as rare as blond-headed Norwegians or African Americans in the NBA or feathers on a chicken. They've been discovered in meteorites that slapped down to Earth from the tails of stray comets, and amino acids have been found floating in the depths of interstellar space, in the vast clouds of gas and dust that are the cauldron where planets like ours take form.

So it turns out that Giordano Bruno was close to being correct. The universe might not be infinite, as he taught, but it is inconceivably big. And whether or not E.T. ever makes contact, we can be almost certain, statistically speaking, that he and all the other little green men from science fiction aren't fictional at all but matters of hard-nosed fact.

And if the Italian philosopher was right about that, then he may have been right about some other things, too. Like his theology, for example. For if the stars are other suns, with solar systems like ours, then it means that "heaven" isn't "up there" somewhere. As Bruno wrote in one treatise, *"There is no absolute up or down, as Aristotle taught; no absolute position in space; but the position of a body is relative to that of other bodies."* So God is not a celestial personality dwelling in an unchanging realm of timeless perfection just beyond the gaze of our most powerful telescopes. Rather, Bruno said that God is immanent in the world, inside and not outside the everyday stuff of rain and wind and sun, present as the principle of growth and vitality within nature itself, whose material forms are always changing, as the soft wax of a candle can shift shape, but whose light remains steady and ever constant.

And what this means, historically speaking, is that supernatural religion, including the religion that springs from a literal reading of the book of Genesis, belongs to a bygone era. There, the deity creates Adam from the dust of the earth, shaping him as a potter

shapes the clay, breathing into this lumpish manikin the animating elixir of awareness and life, an indwelling and insubstantial spirit whose origins are otherworldly and whose final destiny also lies beyond this world. But following Bruno and the scientific revolution he helped to start, I'd advise you to "forget otherworldly." What you see around you, for better or worse, is the only world there is. There won't be any Rapture. This planet is our home, it's all we've got, and we'd better learn to take care of it. Because we're part of this universe and have grown out of it the way leaves grow out of a tree, by a process every bit as natural, which doesn't mean that the cosmos is designed that way, but which doesn't imply that it's all accidental either. It's no accident that oak trees grow oak leaves and not some other kind of foliage—that oaks produce acorns instead of butternuts, for instance. And it's no accident that worlds like this one produce such an amazing diversity of living creatures, from people to pandas to peonies. It's no accident that there are planets and asteroids galore. No accident a supernova occurs whenever a star runs through its supply of nuclear fuel and explodes, pouring all those lovely elements out to start producing more amino acids and more NASA scientists to study them. It's just what universes like ours do.

On the whole, our world is much more fertile, more creative, more luxuriant than otherwise, and more so than most past generations would have imagined. Who can explain it? Bruno tried to. In one thought experiment, he imagined himself rising into space, floating higher and higher above the Earth's surface. And as he approached closer and closer to the moon, it slowly increased in size while our own planet diminished. From the surface of moon, Bruno reasoned, the Earth must seem to be a mere satellite, while to one standing there the lunar surface must seem like *terra firma*. He was perhaps the first ever to imagine the scene that Apollo crews glimpsed and photographed for the first time forty years ago—the grey, desiccated, pock-marked landscape of the Sea of Tranquility in the foreground, with the rising, waxing earth in the distance, sapphire blue with its dynamically churning white clouds, all set against the indigo depths of deep space. As it turned out, of course, the moon was lifeless, a spherical pile of uninteresting rubble. Why anyone would want to go back there to look at Neil Armstrong's boot print is puzzling. But our moon is probably also an anomaly, astronomically speaking, unlike anything else we know of in the solar system, probably formed from a collision when the Earth with its iron core had already begun to solidify. Other moons, those of Jupiter for instance, seem to have condensed out of spinning clouds of stellar particles, congealed by forces of gravitation at the same time and in the same way that the solar system itself presumably formed. So most astrophysicists and exobiologists agree: our own planet is a much more ordinary object and a much more typical indicator of what to expect once we get the warp drive working and start to really explore those brave new worlds. The Earth, it's beginning to seem, is a fairly average place.

And knowing that we're average beings, on an average planet, circling an average star in the outer spiral arm of a average galaxy that contains millions of other average stars, does nothing to lessen the wonderment. Instead it only increases my sense of appreciation and thanks, giving me the same kind of little shudder I experienced back there in Rome. Knowing this universe is filled with a multitude of conscious beings does nothing to lessen my sense of reverence for creation or the intelligence it manifests. It makes the universe seem like a slightly more neighborly place. It makes me feel more

special, not less, more embedded and embraced in the matrix of nature and nature's laws. It makes me more likely to linger out there underneath the stars for an extra minute or two, beneath the nighttime canopy, and a little less inclined to go back inside to the basement to watch another episode of "Star Trek" or "I Love Lucy." After all, I know that someone out there may be listening.