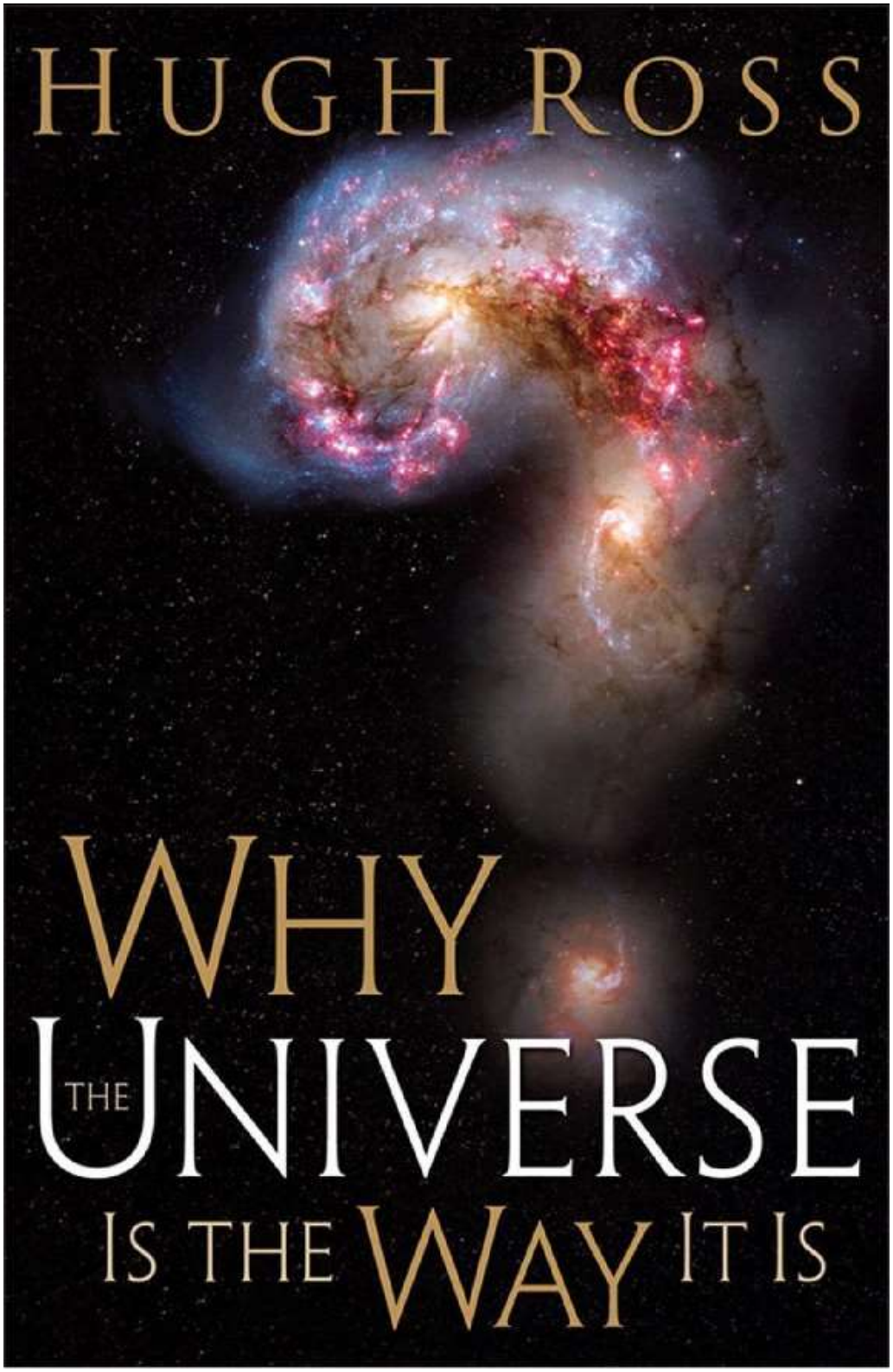
بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

Why the Universe Is the Way It Is

By: Hugh Ross



نبذة مُختصرة عن الكتاب:

أهمّ وأفضل كُتُب «**هيو روس**» التي يتكلَّم فيها عن الكون، ومدى ضبطه بإحكام وإتقان للسَّماح بنشأة الحياة على الأرض، وهو في الكتاب يُجيب على أسئلة "لماذا؟"، ويُبيِّن في النِّهاية أنَّ كلّ هذه الظُّرُوف المضبوطة بإحكام وإتقان مُنذ البداية دليل على "عناية" الله بالإنسان، وأنَّ الكون بالفعل له هدف وغاية، وليس عشوائياً، وعُنوان الكتاب ليس بصيغة تساؤل، وإنَّا بصيغة البيان والتَّقرير، أي أنَّ «**هيو روس**» كَتَب هذا الكتاب ليُبيِّن للنَّاس السَّبب وراء أنَّ الكون موجود بالهيئة التي هي عليها.

يبدأ «**هيو روس**» بالكلام عن الغريزة البشرية لطرح الأسئلة والسَّعي لتحصيل إجابات، ومن ثمَّ يبدأ بمُناقشة أسئلة مُختلفة حول خصائص مُعيَّنة للكون، والبحث عن السَّبب وراء وُجُود هذه الخصائص بالكيفية التي هي عليها، وهذه الخصائص هي: حجم الكون: لماذا هو كبير؟، عُمر الكون: لماذا هو قديم؟، وجودنا في الكون: لماذا نحن بمُفردنا؟، طبيعة الكون: لماذا هو مُظلم في الغالب؟ ولماذا يتَّجه إلى التَّدهور والانهيار؟ وهل هذا الكون هو أفضل الأكوان المُمكنة؟ ولماذا القوانين الفيزيائية بالكيفية التي هي عليها؟

في النِّهاية، وكعادة «**هيو روس**»، يُحاول الرَّبط بين المُكتشفات العلمية والكتاب المُقدَّس، ويُحاول جاهداً أن يُبيِّن أنَّ الكتاب المُقدَّس مُتناغم ومُتَّسِق مع كل الاكتشافات العلمية الحديثة الخاصة بالكون والفلك! (الفُصُول الهامَّة من ١ إلى ٨، أما من ٩ إلى ١٣ فهي تنصيرية لا قيمة لها! مع الإشارة إلى أنَّ المُلحق الثالث للكتاب يُعتبر أكبر قائمة بالمراجع الدَّالة على الضَّبط الدَّقيق للكون)

الكتاب يستحق تقدير مُمتاز، بغضّ النَّظر عن مُحاولاته التَّنصيرية الفاشلة، ولكنَّه يُقدِّم إجابات رائعة لأشهر الشُّبُهات التي يُثيرها عُلماء الكوزمولوجيا الملاحدة، مثل «**فيكتور ستنجر**» و «**ستيفن هوكينج**»، بالإضافة إلى تقديم الأدلَّة العلمية الواضحة على إحكام وإتقان الكون، فيما يُعرف بالضَّبط الدَّقيق، وأدلَّة العناية الإلهية بالكون!

Introduction: Let's Play "I Spy"

- Famed British theoretical physicist Stephen Hawking described this observation in A Brief History of Time, the bestselling science book of all time: It would be very difficult to explain why the universe should have begun in just this way, except as the act of a God who intended to create beings like us. [Stephen W. Hawking, A Brief History of Time: From the Big Bang to Black Holes (New York: Bantam, 1988), 127.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 197-201). Baker Publishing Group. Kindle Edition.]
- American physicist Freeman Dyson expresses this same impression: The more I examine the universe and study the details of its architecture, the more evidence I find that the universe in some sense must have known that we were coming. [Freeman J. Dyson, Disturbing the Universe (New York: Basic, 1979), 250.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 202-205). Baker Publishing Group. Kindle Edition.]
- Hawking, Dyson, and many other distinguished physicists emphasize the realization that only in the context of human existence does the universe make any rational sense. Why this is so, however, puzzles even the greatest minds. Albert Einstein has been widely quoted as saying, "The most incomprehensible thing about the universe is that it is comprehensible." [For the original quote, see Albert Einstein, "Physics and Reality" (1936), in Ideas and Opinions, trans. Sonja Bargmann (New York: Bonanza, 1954), 292.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 206-209). Baker Publishing Group. Kindle Edition.]

1 Why Ask Why Questions?

- This urge compels humans to ask questions, BIG questions. In A Brief History of Time, Stephen Hawking, the world's most famous physicist, expresses this compelling desire: We want to make sense of what we see around us and to ask: What is the nature of the universe? What is our place in it and where did it and we come from? Why is it the way it is? [Hawking, A Brief History of Time, 171.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 237-241). Baker Publishing Group. Kindle Edition.]
- Scientific curiosity arises from the desire to understand the way things work.

People want to understand how things like gravity, electricity, and magnetism—as well as living organisms—function. That type of curiosity stimulated Newton's question about why apples fall to the ground, Darwin's question about why the finches on one of the Galapagos Islands had larger beaks than those on another, and my question about why the stars are hot. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 257-260). Baker Publishing Group. Kindle Edition.]

- Previous to the twentieth century and the building of telescopes that can clearly see galaxies beyond the outer limits of the Milky Way, scientists and philosophers tended to complain that the universe was far too small to be the work of God. While acknowledging that the existence of the universe implied some kind of cosmic Creator, these researchers deduced that the Creator could not be very big or strong. If God were all-powerful and infinite, surely, they reasoned, he would have created an infinite universe or at least a much larger universe. [See, for example, Immanuel Kant, "Universal Natural History and Theory of the Heavens," trans. W. Hastie, in Theories of the Universe: From Babylonian Myth to Modern Science, ed. Milton K. Munitz (New York: Free Press, 1957), 240; Giordano Bruno, "On the Infinite Universe and Worlds," in Theories of the Universe, 174–83; John North, The Norton History of Astronomy and Cosmology (New York: Norton, 1995), 374–79.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 285-289). Baker Publishing Group. Kindle Edition.]
- The arrival of the twenty-first century and telescopes powerful enough to help us see back in time (see "Looking Back in Time," p. 21), even as far back as the initial moments of cosmic existence, has prompted a very different kind of complaint from scientists and skeptics. The universe as now measured appears absurdly too large to serve merely as humanity's home. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 290-292). Baker Publishing Group. Kindle Edition.]
- Thanks to modern technology, astronomers today have access to images that show what was taking place in the universe many billions of years ago. Several independent measures establish with a high degree of certainty that the universe is, indeed, 13.73 billion years old. Astronomical images now cover the entire span of cosmic history. In other words, astronomers can

directly observe all of cosmic history from its beginning until the present. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 307-310). Baker Publishing Group. Kindle Edition.]

- People also wonder or grumble about the age of the universe. Now that astronomers have determined the universe's age to be 13.73 billion years, many scholars and laypeople ask why, if God's goal in creating the universe was to provide a home for humanity, he took so much time. They suggest that an all-powerful God would have set up everything all at once (or simultaneously). [For a well-known early example, see Augustine, The Literal Meaning of Genesis, trans. and annotated by John Hammond Taylor, bk. 4, chap. 33–34, and bk. 5, chap. 3, in vol. 41 of Ancient Christian Writers: The Works of the Fathers in Translation, ed. Johannes Quasten, Walter J. Burghardt, and Thomas C. Lawler (New York: Newman, 1982), 141–45, 149–50.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 321-324). Baker Publishing Group. Kindle Edition.]
- China's distinguished astrophysicist Fang Li Zhi declares, "A question that has always been considered a topic of metaphysics or theology—the creation of the universe—has now become an area of active research in physics." [Fang Li Zhi and Li Shu Xian, Creation of the Universe, trans. T. Kiang (Singapore: World Scientific, 1989), 173.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 366-368). Baker Publishing Group. Kindle Edition.]

2 Why Such a Vast Universe?

- The sheer enormity of the universe is enough to make anyone feel inconsequential. This feeling raises questions: Does life really have any ultimate value, meaning, or purpose? If God is responsible for our existence, why would the universe be so large? [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 386-387). Baker Publishing Group. Kindle Edition.]
- Physicist Victor Stenger states the skeptic's case: If God created the universe as a special place for humanity, he seems to have wasted an awfully large amount of space where humanity will never make an appearance. [Victor J. Stenger, God: The Failed Hypothesis: How Science Shows That God Does Not Exist (Amherst, NY: Prometheus, 2007), 156.] [Hugh Ross: ***Why the***

Universe Is the Way It Is (Kindle Locations 390-393). Baker Publishing Group. Kindle Edition.]

- Stephen Hawking echoes this concern: Our Solar System is certainly a prerequisite for our existence. . . . But there does not seem to be any need for all these other galaxies. [Stephen W. Hawking, A Brief History of Time, 126.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 394-397). Baker Publishing Group. Kindle Edition.]
- Stenger also points out that only a tiny fraction (0.0007) of the mass of the universe is carbon. "Yet," he questions, "we are supposed to think that God specially designed the universe so it would have the ability to manufacture in stars the carbon needed for life?" (See "Why So Little Carbon?") He claims, "Energy is wasted, too. Of all the energy emitted by the sun, only two photons in a billion are used to warm Earth, the rest radiating uselessly into space." [Stenger, God, 157.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 398-401). Baker Publishing Group. Kindle Edition.]
- Like an automobile, the universe: has a mass density that can be measured, appears to have been manufactured to certain specifications, carries passengers, burns fuel and emits exhaust, moves forward (though it cannot reverse), is capable of slowing down and speeding up (though not of standing still), won't run forever. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 404-409). Baker Publishing Group. Kindle Edition.]
- Why So Little Carbon? Without carbon, physical life is impossible. No other element displays the rich chemical behavior needed to form the range of complex molecular structures life requires. Given that physical life must be carbon-based, why would God make a universe with so little carbon? Researchers have found that the quantity of carbon must be carefully balanced between just enough and not too much because carbon, though essential for life, can also be destructive to life. Too much carbon translates into too much carbon dioxide, carbon monoxide, and methane. In large quantities, these gases are poisonous. In modest quantities, their greenhouse properties keep the planet sufficiently warm for life. In larger quantities, they can heat a planet's surface beyond what physical life can tolerate. One of the wonders of Earth is that it is sufficiently carbon-rich and carbon-poor. It carries enough carbon for life but not so much as to interfere with life's

atmospheric needs, such as the appropriate pressure and density for efficient operation of lungs and a temperature range (and variability) that supports a wide diversity of active, advanced species. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 410-420). Baker Publishing Group. Kindle Edition.]

- One of the great wonders of the universe is an amazing gift that most people take for granted: the ability to see into the distance. Clarity makes an astounding difference when it comes to exploring, measuring, and understanding the cosmos. The more astronomers learn about the universe, the more they recognize how remarkable it is that the multiple cosmic characteristics that make human life possible also make the universe visible, knowable, and measurable. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 427-431). Baker Publishing Group. Kindle Edition.]
- If the universe were any smaller or larger, younger or older, brighter or darker, more or less efficient as a radiator, and if human observers were located where most stars and planets reside, the view would be so blocked as to give few (if any) clues about what lies beyond. We would be blind to the realm we live in! More importantly, no one would even be around to see it. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 431-434). Baker Publishing Group. Kindle Edition.]
- Right Mass, Right Elements Anyone who hasn't had the privilege of studying astrophysics may not realize that the universe must be as massive as it is or human life would not be possible—for at least two reasons. The first concerns the production of life-essential elements. The density of protons and neutrons in the universe relates to the cosmic mass, or mass density. That density determines how much hydrogen, the lightest of the elements, fuses into heavier elements during the first few minutes of cosmic existence. And the amount of heavier elements determines how much additional heavy-element production occurs later in the nuclear furnaces of stars. If the density of protons and neutrons were significantly lower (than enough to convert about 1 percent of the universe's mass into stars), then nuclear fusion would proceed less efficiently. As a result, the cosmos would never be capable of generating elements heavier than helium—elements like carbon, nitrogen, oxygen, phosphorus, sodium, and potassium, which are essential for any kind

of physical life. On the other hand, if the density of protons and neutrons were slightly higher (enough to convert significantly more than 1 percent of the mass of the universe into stars), nuclear fusion would be too productive. All the hydrogen in the universe would rapidly fuse into elements as heavy as, or heavier than, iron. Again, life-essential elements (carbon, nitrogen, oxygen, etc.), including hydrogen, would not exist. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 487-498). Baker Publishing Group. Kindle Edition.]

- Right Mass, Right Expansion Rate The second reason the universe must be hugely massive concerns its expansion rate. The rate at which the universe expands throughout cosmic history critically depends on its mass density. According to the law of gravity, the closer any two massive bodies are to one another, the more powerfully those bodies attract each other. Therefore, the closer various bits and pieces of mass are to one another in the universe, the more effectively they will slow down the universe's expansion. Conversely, the farther apart those bits and pieces are, the less "braking effect" gravity has on cosmic expansion. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 498-503). Baker Publishing Group. Kindle Edition.]
- Without any additional cosmic density factors such as dark energy (see pp. 38–40), a universe with less mass density would not form stars like the Sun and planets like Earth. Its expansion would be so rapid that gravity would not have opportunity to pull together the gas and dust to make such bodies. Yet if the cosmic mass density were any greater, gas and dust would condense so effectively under gravity's influence that all stars would be much larger than the Sun. Any planets such stars might hold in their orbit would be unsuitable for life because of the intensity of the stars' radiation and because of rapid changes in the stars' temperature, radiation, and luminosity—not to mention the radiation and gravitational disturbances caused by neighboring supergiant stars. With only a little extra mass, the universe would expand so slowly that all stars in the cosmos would rapidly become black holes and neutron stars. The density near the surface of such bodies would exceed five billion tons per teaspoon (one billion tons per cubic centimeter). At such enormous densities, molecules are impossible. So are atoms. Therefore, life would be impossible. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 503-511). Baker Publishing Group.

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- Cosmic component vs Percentage of total cosmic density: Dark energy (self-stretching property of the cosmic space surface) 72.1%, Exotic dark matter (particles that weakly interact with ordinary matter particles and light): 23.3%, Ordinary dark matter (particles that strongly interact with light): 4.35%, Ordinary bright matter (stars and star remnants): 0.27%, Planets (a subset of ordinary dark matter): 0.0001%. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 546-559). Baker Publishing Group. Kindle Edition.]
- This inventory began with an exhaustive compilation by Princeton cosmologists Masataka Fukugita and James Peebles. It was based initially on the best measurements prior to 2005. Updates were made possible in 2006 and 2008 by the second and third releases of the Wilkinson Microwave Anisotropy Probe's (WMAP) results. [Fukugita and Peebles, "Cosmic Energy Inventory," 643–68. Spergel et al., "Three-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations," 377–408. E. Komatsu et al., "Five-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Cosmological Interpretation" (preprint, National Aeronautics and Space Administration, 2008): http://lambda.gsfc.nasa.gov/product/map/dr3/pub_papers/fiveyear/cosmology/wmap_5yr_cosmo.pdf.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 560-563). Baker Publishing Group. Kindle Edition.]
- Little more than half a century ago astronomers came to realize that the stuff they see through their telescopes makes up only a tiny fraction of the total amount of matter in the universe. [North, Norton History of Astronomy and Cosmology, 502–7; P. J. E. Peebles, Principles of Physical Cosmology (Princeton, NJ: Princeton University Press, 1993), 417.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 563-565). Baker Publishing Group. Kindle Edition.]
- As that realization dawned, astronomers hypothesized that this "dark matter" was made up of cold gas and failed stars ("brown dwarfs," stars with so little mass they never ignite nuclear fusion). [Morton S. Roberts, "The Content of Galaxies: Stars and Gas," in Annual Review of Astronomy and Astrophysics, ed. Leo Goldberg, Armin J. Deutsch, and David Layzer (Palo Alto, CA:

Annual Reviews, 1963), 160–63; J. H. Oort, "Stellar Dynamics," in Galactic Structure, ed. Adriaan Blaauw and Maarten Schmidt (Chicago: University of Chicago Press, 1965), 469–73; Rudolf Kippenhahn and Alfred Weigert, Stellar Structure and Evolution, corrected printing (New York: Springer-Verlag, 1994), 268. Kippenhahn and Weigert, Stellar Structure and Evolution, 215, 266–69.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 565-567). Baker Publishing Group. Kindle Edition.]

- A bizarre feature called "dark energy" (discovered so recently that the scientific community still hasn't settled on exactly what to call it) serves as the acceleration system. Perhaps this quality is best described as a self-stretching property of the cosmic surface (the spatial surface of the universe along which all matter and energy are distributed). [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 589-591). Baker Publishing Group. Kindle Edition.]
- The observational verifications that dark energy is the predominant component of the universe and, therefore, that the universe will expand at an ever-increasing rate put an effectual end to the oscillating universe model and to the Hindu/Buddhist concept of a reincarnating universe. [For a more thorough analysis of the demise of the oscillating universe model and of the Hindu/Buddhist/new age concept of a reincarnating universe, see Ross, Creator and the Cosmos, 48–67, 87–98, 169–74.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 599-601). Baker Publishing Group. Kindle Edition.]
- Accelerating cosmic expansion means the universe can never contract; therefore it cannot rebound. This fact eliminates the possibility of a renewal, rebirth, or second beginning for the universe. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 601-602). Baker Publishing Group. Kindle Edition.]
- If dark energy were changed by as little as one part in 10120, the universe would be unable to support life. A number that small can be hard to picture. [Lawrence M. Krauss, Quintessence: The Mystery of the Missing Mass (New York: Basic, 2000), 103–5; Krauss, "End of the Age Problem," 461, 465.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 606-607). Baker Publishing Group. Kindle Edition.]

- Though often described in popular literature as an antigravity force, dark energy is not a force. A better, though still imperfect, analogy would be to describe it as the opposite of the effect you feel when stretching an elastic band. The more an elastic band is stretched, the more energy it gains to encourage its contraction. Thus, the more someone stretches the band with his fingers, the more he feels the tension that impels the band to contract. The surface of the universe acts the opposite way—it is like a gigantic elastic band that wants to expand outward. The more the cosmic surface stretches, the more energy the surface gains to propel even more stretching of the surface. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 611-617). Baker Publishing Group. Kindle Edition.]

3 Why Such an Old Universe?

- the latest measurements indicate the universe has been around for 13.73 billion years. That may seem like a long time from a layperson's perspective, but astronomers think otherwise. From an astronomical view, 13.73 billion years represents the minimum time necessary to prepare a home for humanity. [E. Komatsu et al., "Five-Year Wilkinson Anisotropy Probe (WMAP) Observations: Cosmological Interpretation," Astrophysical Journal Supplement Series (2008): in press.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 658-660). Baker Publishing Group. Kindle Edition.]
- 1. Essential heavy elements need to build up. For its first 365 million years, the universe contained only five elements: hydrogen, helium, and tiny traces of lithium, beryllium, and boron. In addition to hydrogen and (in the case of plants) boron, life requires over twenty different elements heavier than boron. These elements include carbon, nitrogen, oxygen, phosphorous, potassium, calcium, and iron. But the big bang creation event yielded none of them. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 661-665). Baker Publishing Group. Kindle Edition.]
- Human civilization, including high-tech societies with automobiles, demands a far greater variety and abundance of heavy elements and radioactive isotopes (see reason #2). Their creation took at least 9 billion years of heavy-element manufacture in stellar furnaces. That's how long it would have taken, at minimum, to provide for a heavy-metal-rich planet such as Earth.

And slightly more than 4.5 billion years ago, just as that essential abundance first became available, Earth's solar system came together. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 668-671). Baker Publishing Group. Kindle Edition.]

- Radiometric Isotopes An element is defined by the number of protons that reside in its nucleus. For example, all nuclei that contain six protons are carbon. All that contain seven are nitrogen, and all that contain eight protons are oxygen. However, each element is made up of a suite of different isotopes—that is, nuclei with the same number of protons but with different numbers of neutrons. Most elements are comprised of one or more stable isotopes (those that do not experience any radiometric decay) and several more isotopes that break down. For some elements, like uranium and thorium, no isotopes are stable. All their isotopes undergo radiometric decay. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 680-686). Baker Publishing Group. Kindle Edition.]
- Uranium-235, uranium-238, and thorium-232 may seem obscure, even dangerous, but they play a critical role in making Earth suitable for human habitation. The radiation they release provides nearly all the energy that drives and sustains plate tectonics. And the energy produced by these elements also helps sustain Earth's magnetic field. [Peter D. Ward and Donald Brownlee, Rare Earth: Why Complex Life Is Uncommon in the Universe (New York: Copernicus/Springer-Verlag, 2000), 191–220; Hugh Ross, Creation as Science: A Testable Model Approach to End the Creation/Evolution Wars (Colorado Springs: NavPress, 2006), 104. Ward and Brownlee, Rare Earth, 29, 194, 212–13.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 693-696). Baker Publishing Group. Kindle Edition.]
- 3. Dangerous events must subside. The same supernovae so crucial for building up the heavy elements and radiometric isotopes essential for advanced life also shower their environs with deadly radiation. Consequently, advanced life could not be safely introduced until the rate of supernova eruptions in the Milky Way Galaxy had subsided considerably. Bacterial life didn't need to wait so long, however, because it can survive under much harsher radiation conditions. [Two modern-day examples of

highly radiation-resistant bacterial species are Bacillus subtilis and Deinococcus radiodurans. The latter bacterium can survive 500 times more radiation than a human can.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 709-713). Baker Publishing Group. Kindle Edition.]

- The Sun's Stability As stars go, the Sun ranks as one of the most stable and benign stars we know of for the support of advanced life. Stars more massive than the Sun increase in brightness too quickly. Stars less massive manifest significantly greater flaring and chromospheric activity. However, all stars, including the Sun, exhibit some flaring activity. In the Sun's case, that flaring subsided to a minimum level when the Sun reached about 4.5 to 4.6 billion years of age (see figure 3.2). So advanced life and civilization would not have been viable until then. [M. W. Caffee et al., "Evidence in Meteorites for an Active Early Sun," Astrophysical Journal Letters 313 (February 1, 1987): L31–L35; M. W. Caffee et al., "Irradiation Records in Meteorites," in Meteorites and the Early Solar System, ed. J. F. Kerridge and M. S. Matthews (Tucson: University of Arizona Press, 1988), 205–45; Daniel P. Whitmire et al., "A Slightly More Massive Young Sun as an Explanation for Warm Temperatures on Early Mars," Journal of Geophysical Research 100 (March 1995): 5457–64; J. Geiss, "Solar Wind Composition and Implications about the History of the Solar System," in Proceedings of the 13th International Cosmic Ray Conference, vol. 5, ed. R. L. Chasson (Denver: University of Denver Press, 1973), 3375–98; J. Geiss and P. Bochsler, "Long Time Variations in Solar Wind Properties: Possible Causes Versus Observations," in The Sun in Time, ed. C. P. Sonett, M. S. Giampapa, and M. S. Matthews (Tucson: University of Arizona Press, 1991), 98–117; J. F. Kerridge et al., "Long-Term Changes in Composition of Solar Particles Implanted in Extraterrestrial Materials," in The Sun in Time, 389–412; Brian E. Wood et al., "Observational Estimates for the Mass-Loss Rates of α Centauri and Proxima Centauri Using Hubble Space Telescope Lyα Spectra," Astrophysical Journal Letters 547 (January 20, 2001): L49–L52.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 729-733). Baker Publishing Group. Kindle Edition.]
- The Bombardment Subsidence During the solar system's youth, it was filled

with an enormous abundance of asteroids, comets, rocks, and dust. This material once pelted the Earth with great frequency and intensity. These bombardment events made the planet inhospitable to advanced life for a few billion years. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 744-747). Baker Publishing Group. Kindle Edition.]

- Bombardments also yielded some positive benefits for advanced life. They provided fresh supplies of water to replace that lost to outer space. They also salted Earth's surface with valuable mineral deposits. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 754-755). Baker Publishing Group. Kindle Edition.]
- The Earth's Transformation Advanced life on Earth needs a rotation rate very close to twenty-four hours per day. Tidal interaction with the Moon and Sun has steadily reduced Earth's rotation rate from its initial two or three hours per day down to its current twenty-four. However, it has taken about 4.5 billion years of tidal interaction to accomplish this reduction. In addition, advanced life needs lots of free oxygen in its planetary atmosphere. For such oxygen to accumulate to the required level, a huge abundance of photosynthetic life had to work aggressively to pump out enough oxygen to fill oxygen sinks (oxygen-absorbing minerals) in both Earth's crust and mantle. Oxygen also had to reach appropriate levels in Earth's atmosphere. Figure 3.4 demonstrates how it took such life 3.8 billion years to raise the atmospheric oxygen level from less than 1 percent to its present 21 percent. [Donald E. Canfield and Andreas Teske, "Late Proterozoic Rise in Atmospheric Oxygen Concentration Inferred from Phylogenetic and Sulfur-Isotope Studies," Nature 382 (July 11, 1996): 127–32; Donald E. Canfield, "A New Model for Proterozoic Ocean Chemistry," Nature 396 (December 3, 1998): 450–53; John M. Hayes, "A Lowdown on Oxygen," Nature 417 (May 9, 2002): 127; Paul G. Falkowski et al., "The Rise of Oxygen over the Past 205 Million Years and the Evolution of Large Placental Mammals," Science 309 (September 30, 2005): 2202–4.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 757-764). Baker Publishing Group. Kindle Edition.]
- Many more reasons than these mandate that 4.5 to 4.6 billion years was the necessary preparation period before Earth was ready to receive the human

species and its global civilization. Adding the 4.5–4.6 billion years of planetary history to the 9.2 billion years of cosmic history (required to form a planet endowed with the heavy elements and long-lived radioactive isotopes needed by advanced life) yields a required total cosmic age of 13.7 to 13.8 billion years. Given the laws of physics that govern the cosmos, the universe was ready to serve as a home for human beings at the earliest imaginable date. From an astrophysical perspective, its ancientness seems more like youth. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 773-778). Baker Publishing Group. Kindle Edition.]

- At 13.73 billion years of age, it is just old enough—and young enough—to facilitate its visual and technological exploration. For several obvious and profound reasons, the universe must be that old for astronomers to properly study its history and structure. At least three of these reasons deserve examination. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 786-789). Baker Publishing Group. Kindle Edition.]
- First, in a continuously expanding universe, the space surface of a young universe would be much smaller than when the universe is older. A smaller space surface means that all the light-emitting objects in the cosmos—primarily stars, the regions around black holes, and galaxies—are jammed tightly together. The light of nearby objects would have blinded observers from seeing the more distant objects. Only in a universe where stars and galaxies are sufficiently spread apart can an observer potentially see everything the universe contains. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 789-793). Baker Publishing Group. Kindle Edition.]
- Second, these lights were much brighter in the past than they are today. The intensity of the light emitted by the cosmos is strongly tied to the rate of star formation. This rate reached a peak when the universe was about 5 to 6 billion years old. It took additional billions of years beyond that peak for the lights of the universe to dim sufficiently so as not to impair astronomers' viewing capacity. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 795-797). Baker Publishing Group. Kindle Edition.]
- Third, during Earth's infancy, its atmosphere was opaque to light. In its youth, the planet's atmosphere was translucent. Only when Earth reached what astronomers and physicists call "middle age" (an age of over 4 billion years)

did its atmosphere become transparent enough to enable its inhabitants to observe the most distant objects in the universe. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 798-800). Baker Publishing Group. Kindle Edition.]

- The universe is now sufficiently ancient that astronomers can actually witness the moment when light first separated from darkness (see figure 3.6). The human era is theoretically the earliest possible epoch that allows astronomers to study the light from the origin of the universe. They can see that light clear back to 0.000028 of its present age. Because of the universe's age, astronomers can directly view 99.9972 percent of cosmic history and almost behold the instant of cosmic creation. Astronomers' analyses of maps of the radiation from that cosmic origin event have taught them more about its beginning, history, structure, and design than any other set of observations. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 806-811). Baker Publishing Group. Kindle Edition.]
- Theoretically, the earlier in cosmic history humans arrived, compared to 13.73 billion years, the smaller the fraction of cosmic history they could have observed. If humans had arrived significantly later upon the cosmic scene, the situation also would have been less than optimal. The accelerating expansion of the universe (due to the effect of dark energy) will eventually propel the cosmic origin event beyond the limits of viewing. At some point dark energy will expand the universe at speeds exceeding the velocity of light. Someday, the space surface along which light travels will be stretching that fast. (For an explanation of how that is possible, see "Exceeding the Light-Speed Limit," p. 56.) Dark energy implies that the later in cosmic history (after about 14 billion years from the beginning of the universe) humans arrive, the smaller the fraction of cosmic history they will be able to see. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 821-827). Baker Publishing Group. Kindle Edition.]
- Two physicists, Lawrence Krauss and Robert Scherrer, in a prize-winning essay on gravity, calculated that in the distant future, observers on any planet in the universe will be fundamentally unable to ascertain any of the universe's important features. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 827-829). Baker Publishing Group. Kindle Edition.]

[Lawrence M. Krauss and Robert J. Scherrer, "The Return of a Static Universe and the End of Cosmology," General Relativity and Gravitation 39 (October 2007): 1545–50.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 827-831). Baker Publishing Group. Kindle Edition.]

- In particular, it will become impossible for any physical sentient being living anywhere within the cosmos to determine whether the universe is expanding or has a beginning. Researchers won't be able to learn anything about the origin of the elements or discover the existence of dark energy or map the temperature fluctuations in the cosmic background radiation. Cosmology as a science inevitably must come to an end. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 829-832). Baker Publishing Group. Kindle Edition.]
- Humans indeed are living at the only time in cosmic history when astronomers can see the entire history of the universe. This is our time not only to live but also to comprehend the miracle of our existence. Today scientists possess the tools to explore the origin and characteristics of the cosmos, to study its entire history. Their studies allow us to contemplate what lies beyond. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 847-850). Baker Publishing Group. Kindle Edition.]

4 Why Such a Lonely Universe?

- After 60 years of investigation into several million UFO reports, researchers have concluded that 90 to 99 percent of all UFO sightings are, in fact, IFOs. Identifiable flying objects include natural phenomena, human-made (often experimental) aircraft, pranksters' hoaxes, and psychological phenomena. Of the remaining 1 to 10 percent, scientists have found no credible evidence (such as crash debris or physical artifacts) indicating that these sightings involve physical craft, with or without beings on board. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 879-883). Baker Publishing Group. Kindle Edition.]
- Given the limitations imposed by the laws of physics and the conditions of interstellar space within the Milky Way Galaxy, a trip by physical intelligent aliens from another planetary system to Earth would take at least 25,000 years. That length of time implies multiple generations. As challenging as it might be to keep one generation focused on a single mission for their entire

lives, the possibility of maintaining that focus throughout hundreds of generations seems hard to imagine. [The 250-light-year minimum trip assumes that an intelligent species capable of interstellar space travel exists just beyond the 200 light-year distant region from Earth that Project Phoenix has ascertained is devoid of any species as technologically advanced as humans on Earth today. However, navigating a spaceship through the benign regions of interstellar space, that is, avoiding major interstellar hazards, will add at least another 50 light-years to the trip.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 899-903). Baker Publishing Group. Kindle Edition.]

- Jupiter and Saturn operate as gravitational shields for Earth. They protect it from catastrophic hits by asteroids and comets that would render advanced civilization impossible. If either Jupiter or Saturn were any less massive or any more distant, such protection would be inadequate. [For descriptions of how the solar system's gas giant planets protect Earth from receiving too many comet and asteroid collisions, see Jeff Zweerink, "Jupiter, Friend or Foe?" Reasons To Believe, November 7, 2007, http://www.reasons.org/tnrtb/2007/11/page/6/; and Dave Rogstad, "Two Steps Forward, One Step Back," Reasons To Believe, September 28, 2007, http://www.reasons.org/tnrtb/2007/09/.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 948-950). Baker Publishing Group. Kindle Edition.]
- Not all locales within our galaxy would make desirable homesteads for advanced life. For example, anywhere near the center of the Milky Way Galaxy (as of any galaxy), lethal radiation emanates from a massive black hole, as well as from a jam of supernova remnants and gigantic stars. Also, given the density of stars and molecular clouds there, the gravity from such objects would certainly disturb the orbits of any possible planets far more radically than life can tolerate. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 988-991). Baker Publishing Group. Kindle Edition.]
- These deadly conditions extend outward more than 20,000 light-years from the galactic core. Earth's solar system orbits at a distance of 26,000 light-years. Even at this distance, radiation remains a factor—unless the solar system stays protected within the plane of the spinning galaxy's disk.

Virtually all stars bounce up and down, above and below the galactic plane. As soon as they do, any planets orbiting them get blasted with radiation from the galactic core. Within the plane, however, thick dust provides a radiation shield. Because our solar system experiences very little up and down movement in its orbit about the galactic center, Earth's life remains protected behind that radiation shield. [Fukugita and Peebles, "The Cosmic Energy Inventory," 643–68. B. Evardsson et al., "The Chemical Evolution of the Galactic Disk. I. Analysis and Results," Astronomy and Astrophysics 275 (August 1993): 101–52; Guillermo Gonzalez, "Solar System Bounces in the Right Range for Life," Facts & Faith, first quarter 1997, 4.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 991-997). Baker Publishing Group. Kindle Edition.]

- Planetary systems farther out than 26,000 light-years from the galaxy's core face a different problem. Heavy elements (needed for advanced life's existence and survival) are sparse at such distances. Only within a narrow ring (annulus) about 26,000 light-years distant from the galactic core does advanced life stand a chance. Astronomers call this region the galactic habitable zone. [Guillermo Gonzalez, Donald Brownlee, and Peter Ward, "The Galactic Habitable Zone: Galactic Chemical Evolution," Icarus 152 (July 2001): 185–200; M. Sundin, "The Galactic Habitable Zone in Barred Galaxies," International Journal of Astrobiology 5 (September 2006): 325–26; Guillermo Gonzales, "The Galactic Habitable Zone," in Astrophysics of Life, ed. Mario Livio, I. Neill Reid, and William B. Sparks (Cambridge: Cambridge University Press, 2005), 89–97; Charles H. Lineweaver, Yeshe Fenner, and Brad K. Gibson, "The Galactic Habitable Zone and the Age Distribution of Complex Life in the Milky Way," Science 303 (January 2, 2004): 59–62; Guillermo Gonzalez and Jay Richards, Privileged Planet: How Our Place in the Cosmos Is Designed for Discovery (Washington, DC: Regnery, 2004), 143–68.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 997-1000). Baker Publishing Group. Kindle Edition.]
- Ironically, most areas within the galactic habitable zone aren't all that livable. The galaxy's spiral arms plus giant stars, star clusters, dense molecular clouds, and young supernova remnants intersect large segments of the so-called habitable region. All these bodies either emit deadly radiation, unleash severe dust storms, and/or cause gravitational disturbances. Earth's solar

system, at least for now, resides far from any of these perils (see figure 4.2, p. 67). Even a planetary system in a rare safe zone won't likely stay safe for long. The spiral structure of a galaxy like the Milky Way rotates at a certain rate while stars (and their planets) within the galaxy revolve around the center at different rates, depending on their distance from the galactic core. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1000-1006). Baker Publishing Group. Kindle Edition.]

- The solar system holds a special position in the Milky Way, close to (but not exactly at) the co-rotation distance—the one distance from the core where stars orbit the galaxy at the same rate as its spiral arm structure does. A star or planetary system located at the co-rotation distance and between two spiral arms would seemingly remain in that safe place. However, stars and planetary systems exactly at the co-rotation distance would experience a "mean motion resonance," repeated gravitational "kicks" exerted by the galactic arm structure. Such kicks would send the star and its possible planetary system flying out of the habitable zone. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1012-1016). Baker Publishing Group. Kindle Edition.]
- This protected location is truly exceptional. Not all spiral galaxies are like the Milky Way. In the vast majority, the co-rotation distance and the habitable zone fail to overlap. Not only is there a match for the Milky Way Galaxy, but also the best possible place for a newly forming planetary system to accumulate all the heavy elements and long-lived radioactive isotopes required for advanced life happens to lie just inside the co-rotation distance. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1028-1031). Baker Publishing Group. Kindle Edition.]
- The Milky Way Galaxy is extraordinary in two other respects. First, as figure 4.2 illustrates (see p. 67), the Milky Way Galaxy's spiral arms are exceptionally symmetrical and evenly spaced with respect to one another. Second, the arms are approximately the same size. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1031-1033). Baker Publishing Group. Kindle Edition.]
- Unlike other spiral galaxies, including its immediate neighbor, the Andromeda Galaxy[15] (see figure 1.1, p. 21), the Milky Way Galaxy has

experienced no significant collision or merger events with other galaxies over the past 10 billion years.[16] When we compare the characteristics of other spiral galaxies that come close to matching those of the Milky Way, its unique features for life support become all the more apparent (see figure 4.3). [D. L. Block et al., "An Almost Head-On Collision as the Origin of Two Off-Centre Rings in the Andromeda Galaxy," Nature 443 (October 19, 2006): 832–34. F. Hammer et al., "The Milky Way, An Exceptionally Quiet Galaxy: Implications for the Formation of Spiral Galaxies," Astrophysical Journal 682 (June 10, 2007): 322–34.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1036-1039). Baker Publishing Group. Kindle Edition.]

- Another distinctive of the Milky Way Galaxy is the galaxy cluster in which it resides. Nearly all other galaxies in the universe reside within dense clusters of galaxies, with giant or supergiant galaxies as neighbors (see figure 4.4). These giants and supergiants intermittently blast their whole neighborhood with deadly radiation. Also, their gravity and the gravity of the thousands of smaller galaxies associated with them significantly distort the structures of the galaxies they contain. Thus, advanced life is not possible for galaxies dwelling in typical galaxy clusters. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1039-1043). Baker Publishing Group. Kindle Edition.]
- The Milky Way Galaxy finds itself in a tiny cluster of galaxies without any giants or supergiants nearby and where the galaxies are widely dispersed. A typical galaxy cluster contains more than 10,000 closely packed galaxies. The Milky Way's cluster, called "the Local Group," contains only about forty galaxies—two medium-sized (Andromeda and the Milky Way) and the rest small or dwarf. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1057-1060). Baker Publishing Group. Kindle Edition.]
- Here the Goldilocks principle of being "just right" becomes even more obvious. The Local Group (see figure 4.5) is spread apart in such a way that the Milky Way's spiral structure remains largely undisturbed—an important requirement for the possibility of harboring advanced life. At the same time, the Local Group contains a sufficient number of the smaller dwarf galaxies to sustain the spiral structure of the Milky Way. (Star formation drives the spiral arm structure, and the infusion of gas and dust from dwarf galaxies

keeps the star formation rate high enough.) Unless Earth's galaxy absorbs a smallish dwarf galaxy about once every half-billion to one billion years, its spiral structure will inevitably collapse. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1060-1065). Baker Publishing Group. Kindle Edition.]

- Not only do galaxies reside in clusters, the clusters themselves exist in clusters of clusters called superclusters. Here again, Earth's location favors life's needs. The Local Group sits on the extreme outer fringe of the Virgo supercluster. If it were closer to the middle, Virgo's mostly massive clusters would disrupt the Local Group or swallow it up. Either way, its suitability for life would be destroyed. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1071-1074). Baker Publishing Group. Kindle Edition.]
- Astronomers' discoveries about the rarity of life-habitable locations in the universe challenge Enrico Fermi's proposition that the cosmos could be filled with inhabitants. While Earth's location is not geographically central to the solar system, galaxy, galaxy cluster, or galaxy supercluster, it deserves the description "spectacularly favored" for life. Perhaps Someone had a purpose or purposes in mind for limiting life to just one residence. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1074-1078). Baker Publishing Group. Kindle Edition.]
- Real estate brokers often say the key to property value is location, location, location. If this principle applies to the cosmic scene, Earth's location would be considered way beyond "prime." No amount of money could buy it. Earth appears to reside in the only neighborhood in the universe where humans can exist and thrive long enough to enjoy a global, high-tech civilization and to discover how rare they are. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1078-1081). Baker Publishing Group. Kindle Edition.]
- Dead organisms leave behind (in ancient strata) carbonaceous residues with a distinct ratio of carbon-13 compared to carbon-12 and of nitrogen-15 compared to nitrogen-14, a ratio that differs noticeably from the buildup of carbonaceous substances that arose chemically from inorganic compounds. Measurements of carbon and nitrogen isotope ratios in multiple ancient deposits show that none of the carbonaceous material in those deposits formed from prebiotic material. These findings imply that the quantity of

prebiotics on and in ancient Earth amounted to zero. [Minik T. Rosing, "13C-Depleted Carbon Microparticles in >3700–Ma Sea-Floor Sedimentary Rocks from West Greenland," Science 283 (January 29, 1999): 674–76; S. J. Mojzsis et al., "Evidence for Life on Earth before 3,800 Million Years Ago," Nature 384 (November 7, 1996): 55–59; John M. Hayes, "The Earliest Memories of Life on Earth," Nature 384 (November 7, 1996): 21–22; Manfred Schidlowski, "A 3,800-Million-Year Isotopic Record of Life from Carbon in Sedimentary Rocks," Nature 333 (May 26, 1988): 313–18; Daniele L. Pinti, Ko Hashizume, and Jun-ichi Matsuda, "Nitrogen and Argon Signatures in 3.8 to 2.8 Ga Metasediments: Clues on the Chemical State of the Archean Ocean and the Deep Biosphere," Geochimica et Cosmochimica Acta 65 (July 1, 2001): 2309; V. Beaumont and F. Robert, "Nitrogen Isotope Ratios of Kerogens in Precambrian Cherts: A Record of the Evolution of Atmosphere Chemistry?" Precambrian Research 96 (June 15, 1999): 63–82; Jay A. Brandes et al., "Abiotic Nitrogen Reduction on the Early Earth," Nature 395 (September 24, 1998): 365–67.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1096-1100). Baker Publishing Group. Kindle Edition.]

- Physicists have discovered at least one fundamental reason for the lack of prebiotics—the oxygen-ultraviolet paradox. If oxygen is present in the terrestrial environment, even in tiny amounts, it inhibits the production of prebiotics. However, without oxygen's presence, the Sun's ultraviolet radiation penetrates the environment, causing the destruction of prebiotic compounds. Both oxygen and ultraviolet radiation frustrate prebiotic chemistry. Thus, with or without oxygen in Earth's environment, prebiotic chemistry would have failed to produce biologically significant molecules. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1100-1104). Baker Publishing Group. Kindle Edition.]
- Pursuing a less lofty goal, astrobiochemists search for the chemical building blocks of life in outer space and the pathways by which such building blocks might be brought to Earth. Over 120 organic type molecules, including 3-carbon sugars, have been discovered in the interstellar medium and in comets. [For a list of the molecules, see Iain Gilmour and Mark A. Sephton, eds., An Introduction to Astrobiology (New York: The Open University, Cambridge University Press, 2004): 16.] [Hugh Ross: ***Why the Universe Is***

the Way It Is (Kindle Locations 1108-1110). Baker Publishing Group. Kindle Edition.]

- Recent claims for the discovery of low levels of glycine (the simplest of the amino acids) and for pyrimidine (a nucleobase) in interstellar molecular clouds have been withdrawn. While the possibility remains that such simple building-block molecules may yet be discovered, the upper limits already established on their abundances are so extremely low as to render them useless for any naturalistic origin-of-life scenario. [L. E. Snyder et al., "A Rigorous Attempt to Verify Interstellar Glycine," Astrophysical Journal 619 (February 1, 2005): 914–30; Yi-Jehng Kuan et al., "A Search for Interstellar Pyrimidine," Monthly Notices of the Royal Astronomical Society 345 (October 2003): 650–56.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1112-1115). Baker Publishing Group. Kindle Edition.]
- As for the very low levels of a few of the biologically significant amino acids found in a small percentage of meteorites, researchers concede that much and possibly all of what they have found may actually represent terrestrial contamination by Earth's life or the remains of Earth's life. [Keith A. Kvenvolden, "Chirality of Amino Acids in the Murchison Meteorite—A Historical Perspective," in ISSOL '99: 12th International Conference on the Origin of Life: Book of Program and Abstracts, comp. and ed. Lois Lane (La Jolla, CA: University of California, San Diego, 1999), 41; Daniel P. Glavin et al., "Amino Acids in Martian Meteorite Nakhla," in ISSOL '99, 62; Sandra Pizzarello et al., "The Organic Content of the Taglish Lake Meteorite," Science 293 (September 21, 2001): 2239nn15, 28.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1118-1120). Baker Publishing Group. Kindle Edition.]
- As far back as 1973, a deep sense of frustration over any possible naturalistic explanation for life's origin on Earth or anywhere else within the vast reaches of interstellar space led Francis Crick (who shared the Nobel Prize for the discovery of the double helix nature of DNA) and Leslie Orgel (one of the world's preeminent origin-of-life researchers) to suggest that intelligent aliens must have salted Earth with bacteria about 3.8 billion years ago. This suggestion, however intriguing or bizarre, fails to answer the question of where the aliens might have come from. It also contradicts evidence that

shows intelligent life could not have arrived on the cosmic scene any sooner than about 13.7 billion years after the cosmic origin event. The implausibility of interstellar space travel also remains an intractable problem. [Francis Crick and Leslie E. Orgel, "Directed Panspermia," Icarus 19 (July 1973): 341–46. Francis Crick later wrote a full-length book on the hypothesis, Life Itself: Its Nature and Origin (New York: Simon & Schuster, 1981).] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1133-1139). Baker Publishing Group. Kindle Edition.]

- Stenger sees the hostility of the universe as proof of God's nonexistence. He writes, "Even taking the most optimistic view of the future of humankind . . . , it is hard to conclude that the universe was created with a special, cosmic purpose for humanity." To him it seems "inconceivable that a creator exists who has a special love for humanity, and then just relegated it to a tiny point in space and time." He argues that humanity not only is alone in the cosmos but is imprisoned inside a tiny bubble within the vastness of the universe. For Stenger, this solitary confinement of humanity eliminates any possibility of a loving Creator—certainly of a God who cares for humanity. [Stenger, God: The Failed Hypothesis, 161; 160.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1156-1161). Baker Publishing Group. Kindle Edition.]

5 Why Such a Dark Universe?

- Not only are the quantities and locations of the various kinds of dark stuff exactly what advanced life needs, but because of Earth's dark cosmic location, the lights of the universe don't blind us or limit our view. Astronomers can see virtually all of the heavens' wonders, including the entirety of cosmic history. [Astronomer Guillermo Gonzalez and science historian Jay W. Richards wrote an entire book on the supernatural design of the universe and solar system for facilitating human observation of the structure and history of the universe: The Privileged Planet: How Our Place in the Cosmos Is Designed for Discovery. In this chapter I have sought to augment the evidence on which their conclusion is based.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1198-1200). Baker Publishing Group. Kindle Edition.]
- This visibility is possible because Earth resides in a very dark place. In fact,

Earth's solar system resides in the darkest part of the Milky Way Galaxy's life-habitable zone. And the Milky Way resides in the darkest life-habitable region of its galaxy cluster, which occupies the darkest life-habitable region of its supercluster of galaxies. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1201-1203). Baker Publishing Group. Kindle Edition.]

- The Moon's large mass relative to Earth's, the Moon's proximity to Earth, and the fact that the Moon is solo all play a crucial role in stabilizing the tilt of Earth's rotation axis. Other planets in our solar system which have either no moons or moons of relatively insignificant mass (compared to their planet's mass) experience chaotic tilting of their rotation axis. [Keiko Atobe, Shigeru Ida, and Takashi Ito, "Obliquity Variations of Terrestrial Planets in Habitable Zones," Icarus 168 (April 2004): 223–36; William R. Ward, "Comments on the Long-Term Stability of the Earth's Obliquity," Icarus 50 (May–June 1982): 444–48; Carl D. Murray, "Seasoned Travelers," Nature 361 (February 18, 1993): 586–87; Jacques Laskar, F. Joutel, and P. Robutel, "Stabilization of the Earth's Obliquity by the Moon," Nature 361 (February 18, 1993): 615–17. Atobe, Ida, and Ito, "Obliquity Variations," 223–36; Jacques Laskar and P. Robutel, "The Chaotic Obliquity of the Planets," Nature 361 (February 18, 1993): 608–12.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1211-1214). Baker Publishing Group. Kindle Edition.]
- Calculations done by British astronomer Dave Waltham demonstrate, however, that Earth's rotation axis tilt would still be stable if the Moon were only half as massive as it is. A less massive Moon would be smaller in the night sky and thus less disturbing to astronomers' attempts to study distant galaxies and quasars. Waltham also demonstrated, though, that unless the Moon is as massive as it is, its gravity would be insufficient to have slowed Earth's rotation rate to the twenty-four hours per day that human life and civilization require. If days were longer than twenty-four hours, day-to-night temperature extremes would be too great. Yet with shorter days rainfall and benign temperatures would not be so evenly distributed over all the continental landmasses. [Dave Waltham, "Anthropic Selection for the Moon's Mass," Astrobiology 4 (December 2004): 460–68.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1215-1221). Baker Publishing Group. Kindle Edition.]

- Another reason Earth needs the Moon's precise mass and present proximity has to do with their influence on tides. A Moon less massive or more distant from Earth and, therefore, smaller in the nighttime sky would mean weaker tides. Tides as powerful as those on Earth are necessary to effectively cleanse the coastal seawaters from toxins and to enrich them with nutrients. In fact, the Moon's specific properties are fine-tuned for life in so many different ways that one astronomer wrote an entire book on the subject in 1993. [Neil F. Comins, What If the Moon Didn't Exist? Voyages to Earths That Might Have Been (New York: HarperCollins, 1993).] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1221-1225). Baker Publishing Group. Kindle Edition.]
- the Moon has an extraordinarily dark surface. It reflects a mere 7 percent of its incident light. Earth, by comparison, reflects 39 percent, some of Jupiter's and Saturn's moons reflect 60 to 90 percent, and Neptune reflects 73 percent. Because the Moon is so exceptionally dark, or non-reflective (see figure 5.1), its bounced-back light presents a minor annoyance to astronomers rather than a blinding glow that obliterates astronomers' work and everyone else's enjoyment of the night sky. [Henry Norris Russell, "On the Albedo of the Planets and Their Satellites," Proceedings of the National Academy of Sciences, USA 2 (February 15, 1916): 74–77. Also available at http://www.pnas.org/content/vol2/issue2/ (accessed January 21, 2008).] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1227-1230). Baker Publishing Group. Kindle Edition.]
- If Venus and Mars traded places, Venus would be about ten times brighter at its closest approach to Earth than it is now, and it would remain bright all night long. Attempts to investigate the heavens anywhere near the position of Venus would be seriously problematic. If Mars and Jupiter traded places, the situation would be far worse. Jupiter, when closest to Earth, would become 1,550 times brighter in the night sky, about the same brightness as the quarter-phase Moon (half the illumination of a full Moon). Again, observation of galaxies would be impossible in such light conditions. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1243-1247). Baker Publishing Group. Kindle Edition.]
- The gas giant planets—Jupiter, Saturn, Uranus, and Neptune—work together

to shield Earth from life-exterminating collision events. Each gas giant acts like a gravitational blocker either to absorb or to deflect potential colliders such as asteroids and comets. If the gas giant planets were any smaller, more distant, or less numerous, Earth would be pelted more frequently and more disastrously for life. On the other hand, if the gravitational pull of the gas giant planets were too great (as a result of their being closer or more massive), or if the gas giants' relative positions produced certain gravitational resonances, the result would be a disturbance to the life-critical orbit of Earth. Remarkably, Mars, Venus, and Mercury are exquisitely positioned to break up such resonances. Thus, the solar system's planets are fine-tuned in two ways: (1) they maximize the observational capabilities of Earth's inhabitants, and (2) they provide essential protection for all life. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1254-1261). Baker Publishing Group. Kindle Edition.]

- Likewise, adjacent galaxy clusters and superclusters do little to block out the night sky. The closest significantly large cluster of galaxies is the Virgo cluster. If the Virgo cluster were much closer, it would present a major visibility barrier. However, if it were much farther away, astronomers would lack a large galaxy cluster to study in detail. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1325-1328). Baker Publishing Group. Kindle Edition.]
- Just as there are superclusters of galaxies in the universe, there are also super-superclusters of galaxies and apparently super-super-superclusters of galaxies. The Local Group is distant enough from the center of the Virgo supercluster that the Virgo does not significantly impair astronomers' view. So, too, the Virgo supercluster is distant enough from the center of its super-supercluster (the Great Attractor) and its super-super-supercluster (the Monster Attractor) that astronomers on Earth have no trouble probing the depths of the heavens and mapping out in great detail the structure of the entire detectable universe. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1328-1332). Baker Publishing Group. Kindle Edition.]
- Virtually all the matter and energy in the universe can be described as dark. Imagine the painful glare if it weren't! And without that dark stuff, we wouldn't be here to discover it or be mystified by it. [Hugh Ross: ***Why the***

Universe Is the Way It Is (Kindle Locations 1335-1337). Baker Publishing Group. Kindle Edition.]

- Swiss American astronomer Fritz Zwicky was the first to recognize that dark stuff dominates the universe and that its location plays a critical role in determining the structure of galaxies and galaxy clusters. In the 1940s he noted that the dynamics of galaxy clusters could only be kept stable if dark matter resides in and/or around those clusters in quantities far greater than the matter astronomers could then see. Not until the 1990s, though, did astronomers establish that exotic dark matter is indeed much more abundant than ordinary dark matter. And the confirmation of dark energy's existence took until the end of that decade. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1347-1352). Baker Publishing Group. Kindle Edition.]
- They have determined where the three different forms of cosmic darkness reside: Dark energy resides everywhere on the entire cosmic surface at the exact same level or strength. (All of the universe's matter and energy are confined to the cosmic surface.) Exotic dark matter resides in far-out halos around large galaxies and galaxy clusters. Ordinary dark matter resides in closer halos around galaxies of all types. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1353-1358). Baker Publishing Group. Kindle Edition.]
- The very best locations and quantities of all the different forms of darkness to allow humans to observe all the wonders of the universe equate with the very best locations and quantities of the same forms of darkness to allow for the existence of a bountiful, beautiful home for humanity. Such a convergence would seem more than an accident. These multiple "coincidences" speak of supernatural intention. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1382-1385). Baker Publishing Group. Kindle Edition.]

6 Why a Decaying Universe?

- The rate at which decay proceeds in the universe is extremely high. That may seem bad, but it's not. If the rate of decay were any lower, galactic systems would trap radiation in such a manner that stars could not form. Starless galaxies would fill the universe. On the other hand, if the decay rate were slightly higher, no galactic systems would form at all. [The rate of decay, or entropy, is a measure of the degree to which energy in a closed system dissipates as heat, and thus ceases to be available to perform work. Specific entropy is the amount of entropy per proton. A familiar high-entropy system would be a candle flame. Its specific entropy = 2. A supernova explosion's specific entropy = 10,000,000. The universe as a whole is the most entropic system known. Its specific entropy exceeds 100,000,000.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1398-1401). Baker Publishing Group. Kindle Edition.]
- Speculation about possible escapes from heat death ended when astronomers confirmed three facts: The universe had a definite beginning in finite time. The laws and constants of physics have been fixed since then. The universe has been continually expanding since that creation event and will keep on expanding. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1423-1426). Baker Publishing Group. Kindle Edition.]
- Lawrence Krauss, chairman of the physics and astronomy department at Case Western Reserve University, coauthored along with colleague Glenn Starkman an article titled "Life, the Universe, and Nothing: Life and Death in an Ever-Expanding Universe." In it they calculate the future consequences of ever-accelerating cosmic expansion. They show that any kind of advanced physical life confined to the space-time dimensions of the cosmos must suffer an inevitable, irreversible, and complete dissipation of heat. [Lawrence M. Krauss and Glenn D. Starkman, "Life, the Universe, and Nothing: Life and Death in an Ever-Expanding Universe," Astrophysical Journal 531 (March 1, 2000): 22–30.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1434-1438). Baker Publishing Group. Kindle Edition.]
- Though proton decay has yet to be directly observed, physicists are convinced it occurs. They are convinced because matter predominates antimatter in the universe. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations

1508-1510). Baker Publishing Group. Kindle Edition.]

- If "the cosmos is all that is or ever was or ever will be," to repeat Carl Sagan's claim, then the fact that it results in the extermination of all life and consciousness also extinguishes the possibility of ultimate hope, purpose, or destiny. [Sagan, Cosmos, 4.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1519-1521). Baker Publishing Group. Kindle Edition.]
- Their calculations essentially falsified the latest doctrinal pronouncements (published in 2002) of the Council for Secular Humanism. In part, its Statement of Principles declares: We deplore efforts . . . to seek to explain the world in supernatural terms and to look outside nature for salvation. We are citizens of the universe. We affirm humanism as a realistic alternative to theologies of despair. We believe in optimism rather than pessimism, hope rather than despair, learning in the place of dogma, truth instead of ignorance. ["The Affirmations of Humanism: A Statement of Principles," Free Inquiry, Fall 2002, 2. The statements appear on the inside cover of each issue of Free Inquiry.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1536-1541). Baker Publishing Group. Kindle Edition.]

7 Why a Realm beyond This One?

- Earth's rotation rate: Powerful tidal forces exerted on Earth by the Sun and even more so by the Moon slowed the planet's rotation rate from two to three hours per day (at the Moon's formation) to the current twenty-four. This slowing of Earth's rotation rate has taken 4.5 billion years, thus far, and continues still. In another 100 million years, Earth days will last twenty-five hours. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1602-1604). Baker Publishing Group. Kindle Edition.]
- Fossil fuels: The decayed bodies of creatures buried during or soon after the Cambrian explosion (about 543 million years ago) made the largest contribution to Earth's petroleum reserves. While the transformation of these buried remains (via geochemistry) into usable petroleum takes time, given too much time bacteria in the crust will turn the petroleum into natural gas. Likewise, the formation of reservoir structures in Earth's crust for the collection and storage of petroleum requires certain geological developments that take specific periods of time. However, with too much time, tectonic activity will cause cracks to form in the sealer rocks. Such cracks mean

petroleum loss through leaks. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1613-1617). Baker Publishing Group. Kindle Edition.]

- Solar stability When stars like the Sun reach "middle age" (as ours has), they achieve maximum stability. In the years before and after middle age, flaring activity is greater (see figure 3.2). More frequent and violent flares release radiation with the potential to harm advanced life, particularly those creatures with long life spans. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1621-1624). Baker Publishing Group. Kindle Edition.]
- Solar luminosity A star's brightness varies considerably during its hydrogen-burning phase (see figure 3.3). During the past 3 billion years, the Sun's luminosity has increased by about 15 percent, enough to destroy life if not for the carefully orchestrated introduction of the just-right species at the just-right population levels at the just-right times. These layers of life removed greenhouse gases (primarily carbon dioxide and water) from the atmosphere in just the right amounts to compensate for the Sun's heat-producing luminosity increase. More than 3 billion years of this ongoing process loaded Earth's crust with a wealth of biodeposits, the resources humans needed for the rapid launch and ongoing support of global civilization. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1627-1633). Baker Publishing Group. Kindle Edition.]
- Perfect eclipses Only when the Sun's diameter exactly matched the Moon's diameter as seen from Earth's surface did perfect eclipses become possible. Because the Moon continually spirals away from Earth, this matchup takes place within a certain time window. A few million years ago, the Moon's diameter was larger than the Sun's. Only a few million years from now, that diameter will be smaller. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1640-1643). Baker Publishing Group. Kindle Edition.]
- Perfect solar eclipses also helped astrophysicists confirm general relativity soon after Einstein first proposed the theory. [F. W. Dyson, A. S. Eddington, and C. Davidson, "A Determination of the Deflection of Light by the Sun's Gravitational Field, from Observations Made at the Total Eclipse of May 29, 1919," Philosophical Transactions of the Royal Society of London A 220 (June 1920): 291–333.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1647-1648). Baker Publishing Group. Kindle Edition.]

- Research shows that this is the ideal landmass coverage for sustaining a large, globally distributed, high-tech human population. Not only is the current land area ideal, but so are the shapes, elevation patterns, orientations, and relative positions of the continents, islands, and oceans. All appear to be optimal for the sake of human civilization. [Ward and Brownlee, Rare Earth, 194–234.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1652-1654). Baker Publishing Group. Kindle Edition.]
- Plate tectonics can be destructive too. Most of the energy-driving plate movement comes from the decay of long-lived radiometric isotopes in the Earth's interior. If the human race had arrived earlier on the terrestrial scene, this radiation exposure would have been deadly and volcanic and earthquake activity too intense. A later arrival would have meant living without the benefit of abundant nutrient-rich volcanic soils. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1655-1657). Baker Publishing Group. Kindle Edition.]
- Many other conditions necessary for human existence and beneficial to quality of life are also time critical. [Fazale Rana with Hugh Ross, Who Was Adam? A Creation Model Approach to the Origin of Man (Colorado Springs: NavPress, 2005), 97–109.] [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1658-1659). Baker Publishing Group. Kindle Edition.]
- The fact that these features, the known number of which continues to grow, all converge simultaneously at the moment human beings arrive on the planet defies realistic probability. One favorable time window's alignment with even one other window might be considered an astounding coincidence. But the lineup of so many independent time windows with the brief human moment on the cosmic calendar speaks powerfully of purpose. This conclusion is one component of what the scientific community has labeled the "anthropic principle"—the observation that the universe appears to have been engineered for the specific benefit of the human species. [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1659-1664). Baker Publishing Group. Kindle Edition.]

8 Why This Particular Planet, Star, Galaxy, and Universe?

- This idea can be more rigorously tested and established through more detailed comparisons of the fine-tuning required for the support of the following life-forms: ephemeral simple life (unicellular life that survives for 90 days or less) permanent simple life (unicellular life that persists for 3 billion years or more) intelligent physical life (human beings or their functional equivalent) intelligent physical life capable of launching and sustaining a global high-tech civilization [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1763-1768). Baker Publishing Group. Kindle Edition.]
- Cosmic Features That Must Be Fine-Tuned for Any Physical Life to Exist: Date (Features Observed): 1988 (15), 1991 (17), 1995 (26), 1998 (34), 2001 (41), 2002 (47), 2004 (77), 2005 (93), 2006 (140). [Hugh Ross: ***Why the Universe Is the Way It Is*** (Kindle Locations 1789-1811). Baker Publishing Group. Kindle Edition.]

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