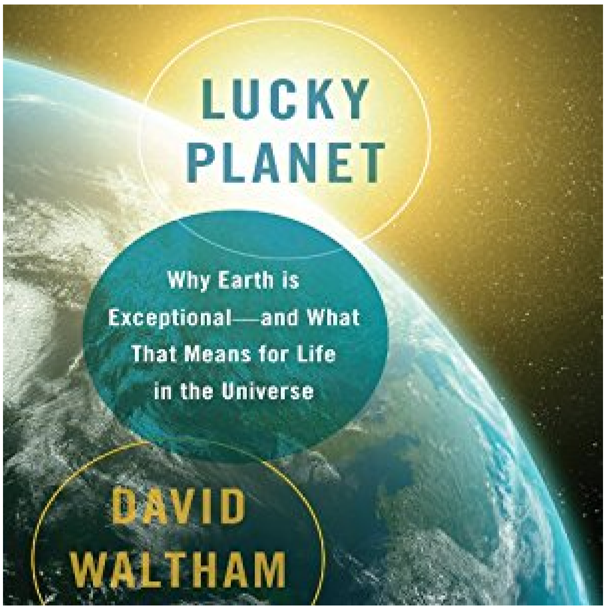
Lucky Planet: Why Earth Is Exceptional - And What That Means For Life In The Universe



Synopsis

Why Earth’s life-friendly climate makes it exceptional - and what that means for the likelihood of finding intelligent extraterrestrial life We have long fantasized about finding life on planets other than our own. Yet even as we become aware of the vast expanses beyond our solar system, it remains clear that Earth is exceptional. The question is: Why? In Lucky Planet, astrobiologist David Waltham argues that Earth’s climate stability is what makes it uniquely able to support life, and it is nothing short of luck that made such conditions possible. The four-billion-year stretch of good weather that our planet has experienced is statistically so unlikely that chances are slim that we will ever encounter intelligent extraterrestrial others. Citing the factors that typically control a planet’s average temperature - including the size of its moon, as well as the rate of the Universe’s expansion - Waltham challenges the prevailing scientific consensus that Earth-like planets have natural stabilizing mechanisms that allow life to flourish. A lively exploration of the stars above and the ground beneath our feet, Lucky Planet seamlessly weaves the story of Earth and the worlds orbiting other stars to give us a new perspective of the surprising role chance plays in our place in the universe.

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Customer Reviews

See above, a marvelous book, no need to be a scientist to comprehend and have your mind expanded, changed my view of earth and the uniqueness of our very existence

All in all, I agree with the author that Earth is a very special, maybe unique, planet.

I got this at my local library in hardcover. It took me about 24 hours to read, which I appreciate the author saying his piece in under 200 pages.The thesis is that life on Earth has survived due to random chance as much as anything. Things have been tough over time with multiple mass-extinctions but might just as well have been worse, bad enough to actually extinguish life on our planet. There's no arguing with that point nor can we say that such a catastrophe might not happen yet.Well, yeah. And? Dr. Waltham asserts with good reason that climate and weather are the important long-term actors in this survival drama. But I think he errs - or is deliberately obscure -- on at least a couple things.* On page 59 he says that, "In infrared light the world is a uniform, featureless, haze-shrouded globe..." And yet I and my colleagues have used infrared satellite pics and loops for the last 40 years to help analyze weather. Fact is, there are windows and there are absorption bands all through the IR-spectrum. CO2 absorbs at two or three bands, that's all.* On page 77-78 he ascribes lack of (chemical) weathering of rock to lack of rainfall which is undoubtedly true, but here he's talking about rocks that have already been covered by ice in a glacial world, "Snowball Earth." Hard to see any weathering in that case, rain or not. Physical erosion, sure. The text could be cleaned up some.* On page 170 he states, "As a result of...Coriolis deflection, transport of heat away from the tropics is less efficient than on a more slowly-spinning Earth, and...our poles are colder as a consequence..." This contradicts all my training. We use the slowly-spinning Earth in our 101 classes to show how inefficient is the resulting transport, and how much more efficient is our present condition in which oceans and atmosphere combine to reduce the temperature gradient. It is true that if you ramp up the Coriolis force far enough, you begin to get latitudinal bands as on Jupiter and Saturn (where the f-parameter is 50 times stronger). Mixing is surely limited there. But here on Earth mixing is quite vigorous; it is when the mixing ceases we get extreme conditions.* On page 181-182 he arrives at predictions. Here is where the theory or thesis kinda runs out of oxygen. He sates that, 1.) Intelligent aliens are unlikely to visit us. 2.) Any life or evidence of previous life found on Mars will resemble Earth-life. 3.) Gas giants in our Solar System are unusually widely-separated. Numbers 1 and 2 seem to me to be true without much prodding, not much of a test. Number 3 is what I would call reaching. If yes, so what? (I do want to know more about gravitational dynamics.)The book appears to have arisen from a poster-session at a conference. He has drawn it out here and given a nice presentation but it might've been better, a lot better. As a reader I felt it lacked cohesion and wandered, then ended with a flop. As a meteorologist I felt it had serious flaws as per the above. As an amateur astronomer and geophysicist I wondered why the book was created. The Anthropic Principle is well-known. right?But I hope this is only the first book by this author. Once the author learns the knack of narrative and how to include his interesting colleagues in the colloquium we can expect some more fun reads.

ItÃ¢Â Â™s been fashionable and perhaps even comforting to believe in the essential unity, benevolence and even environmental-competence of life on Earth. The Gaia hypothesis makes us feel good, but hard-nosed evolutionary biologists and planetary scientists crunch the numbers and just canÃ¢Â Â™t get it to work. Forget the galaxy of a billion friendly alien civilizations, perhaps thereÃ¢Â Â™s just one: ourselves. Perhaps weÃ¢Â Â™re just very, very fortunate. HereÃ¢Â Â™s a much abbreviated summary of what David Waltham has to say in this lively and intelligent book.Our very existence shows that the Earth has experienced life-friendly climatic conditions for billions of years. During this time the output of the sun has increased by 30% while early high levels of greenhouse gases such as methane, water vapour and carbon dioxide have been almost scrubbed from the atmosphere. These changes ought to have produced enormous and lethal climatic variation yet somehow, by some magic, the effects have largely cancelled out.For some people, this shows that powerful negative feedback mechanisms are at work, stabilising the climate for life. Strange then, that such benign processes are so hard to pin down. The alternative view is that for most planets like the Earth, the climate did indeed transition to fire or ice, with the consequent destruction of any biosphere; the Earth is special and very, very lucky. Of course, the fact that weÃ¢Â Â™re here at all to make such an observation indicates that for the Earth it could hardly have been otherwise. This is called the principle of Anthropic Selection - to be contrasted with the Principle of Mediocrity, that the Earth is not that special in the universe.David Waltham systematically takes us through the unique features of the Earth. Our star, the sun, is unusually large and bright Ã¢Â Â“ most long-lived stars are smaller and redder than ours. However, they are prone to stellar flares which are extremely harmful to the biosphere. The Earth has an astonishingly strong magnetic field which deflects the solar wind, which otherwise could split water vapour into hydrogen and oxygen allowing the former to escape into space Ã¢Â Â“ this is how a planet loses all its water.Despite the early sun emitting only 70% of todayÃ¢Â Â™s output, the Earth remained suitable for life due to the immense greenhouse effect of the early atmosphere. As the sun heated up, the greenhouse effect reduced in tandem: carbon dioxide was washed out of the atmosphere by rain and locked up in sedimentary rocks, while methane was oxidised away as soon as early photosynthesis evolved.The Earth did not experience a smooth, stabilised, homeostatic climate Ã¢Â Â“ there were episodes of great heat interspersed with at least four Ã¢Â Â˜snowball earthÃ¢Â Â™ episodes where the entire planet became icebound. Thanks, however, to plate tectonics and volcanism, carbon dioxide was released back into the atmosphere to unfreeze the Earth and to allow early life to reboot.Some people believe that this is an example of the Gaia principle Ã¢Â Â“ life stabilising its own environment. The author sees instead systems of climate dynamics that could so easily have sheared off into uncontrolled positive feedback or blundered into wild oscillations. In his opinion, this is exactly what happens to most planets like ours Ã¢Â Âˆout thereÃ¢Â Â™ - but as a consequence, they have no observers to later theorise about it.Parenthetically, the authorÃ¢Â Â™s concerns about current anthropogenic global warming are consistent with his view of underlying instabilities. ItÃ¢Â Â™s not so much that increased carbon dioxide levels in the atmosphere directly warm the climate; itÃ¢Â Â™s more that they catalyse changes in more potent greenhouse gases (water vapour, methane) and itÃ¢Â Â™s not at all clear that there are negative feedback mechanisms which could dampen their effects. The climate models are very complex and who knows if theyÃ¢Â Â™re either comprehensive or correctly tracking all the mechanisms?Another climate-changing influence is the EarthÃ¢Â Â™s axial inclination (currently around 23 degrees) and its orbit around the sun. Under the impact of the other planets in the solar system, the shape and tilt of the EarthÃ¢Â Â™s orbit is continually changing on long-period cycles (69,000 years for orbital tilt and tilt-direction, 400,000 years for orbital eccentricity with other influences clustering around 100,000 years). These affect solar heating and drive the ice ages. The Earth also precesses on its axis every 26,000 years. WeÃ¢Â Â™re very lucky that these numbers are rather different because if they converged we would experience orbital resonances, and the inclination of the EarthÃ¢Â Â™s axis would become unstable and chaotic (of the order of a few million years). This would trash the climate, leading to the extinction of all complex forms of life. How did we come by that luck?ItÃ¢Â Â™s somewhat well-known that our large moon Ã¢Â Âˆspin stabilisesÃ¢Â Â™ the inclination of the EarthÃ¢Â Â™s axis. What is less well-known is that as the moon continues to spiral away, the precession rate will slowly decay and in 1.5 billion years time resonance will occur with the orbital periods discussed above. At that point, the Earth will have an unstable spin axis. This is of academic interest only, as for reasons concerned with the sunÃ¢Â Â™s increasing output, the earth will become uninhabitable for multi-cellular life within the next 500 million years. But, if the moonÃ¢Â Â™s radius had been just 10 km larger and the early EarthÃ¢Â Â™s day just ten minutes longer, the Earth would have an unstable spin axis today. What are the chances?So why does it pay to have a large moon? The author suggests that a moon almost large enough to eventually generate axial instability also stabilises the spin prior to that, and in doing so allows the planet to have relatively mild and infrequent ice ages - another case of fine-tuning for intelligent life.The author concludes that the chances of all these things coming together to guarantee a four billion year life-benign climate are so remote that the Earth is possibly the only planet with intelligent life in the entire visible universe: we are quite alone. This solution to the Fermi Paradox might be considered depressing, but it should increase our caution Ã¢Â Â" Ã¢Â ÂœWe may just find out the hard way that planets with nasty climates are quite easy to produce.Ã¢Â Â•The reader may be left with another thought: although few planets may experience multi-billion year climate stability, this is hardly a pre-requisite for interstellar colonisation, and thereÃ¢Â Â™s a lot of unoccupied real estate out there.

Lucky Planet: Why Earth Is Exceptional - and What That Means for Life in the Universe Karen Browns Switzerland Exceptional Places 2008: Exceptional Places to Stay and Itineraries (Karen Brown's Switzerland: Exceptional Places to Stay & Itineraries) DARK ENERGY: The Biggest Mystery In The Universe (dark matter, how the universe works, holographic universe, quantum physics) (black holes, parallel universe, the string theory) The Science of Being Lucky: How to Engineer Good Fortune, Consistently Catch Lucky Breaks, and Live a Charmed Life Their Skeletons Speak: Kennewick Man and the Paleoamerican World (Exceptional Social Studies Titles for Intermediate Grades) (Exceptional Social Studies Title for Intermediate Grades) Karen Brown's Tuscany & Umbria 2008: Exceptional Places to Stay and Itineraries (Karen Brown's Tuscany & Umbria: Exceptional Places to Stay & Itineraries) From Lava to Life: The Universe Tells Our Earth Story: Book 2 (The Universe Series) Karen Brown's Tuscany & Umbria 2010: Exceptional Places to Stay & Itineraries (Karen Brown's Tuscany & Umbria: Exceptional Places to Stay & Itineraries) Karen Brown's Tuscany & Umbria 2009: Exceptional Places to Stay & Itineraries (Karen Brown's Tuscany & Umbria: Exceptional Places to Stay & Itineraries) Karen Brown's Austria 2010: Exceptional Places to Stay & Itineraries (Karen Brown's Austria: Exceptional Places to Stay & Itineraries) Karen Brown's New England 2010: Exceptional Places to Stay & Itineraries (Karen Brown's New England: Exceptional Places to Stay & Itineraries) Karen Brown's Italy Bed & Breakfasts 2010: Exceptional Places to Stay & Itineraries (Karen Brown's Italy Bed & Breakfast: Exceptional Places to Stay & Itineraries) Karen Brown's Ireland 2009: Exceptional Places to Stay & Itineraries (Karen Brown's Ireland: Exceptional Places to Stay & Itineraries) Karen Brown's New England 2009: Exceptional Places to Stay & Itineraries (Karen Brown's New England: Exceptional Places to Stay & Itineraries) Karen Brown's Mid-Atlantic 2010: Exceptional Places to Stay & Itineraries (Karen Brown's Mid-Atlantic: Exceptional Places to Stay & Itineraries) Karen Brown's England, Wales & Scotland 2009: Exceptional Places to Stay & Itineraries (Karen Brown's England, Wales & Scotland: Exceptional Places to Stay & Itineraries) Karen Brown’s England, Wales & Scotland 2010: Exceptional Places to Stay & Itineraries (Karen Brown’s England, Wales & Scotland: Exceptional Places to Stay & Itineraries) "The Lucky Monkey " (Children’s books-The Lucky Monkey Book 1) A Lucky Luke Adventure : Ghost Town (Lucky Luke) A Lucky Luke Adventure : Billy the Kid (Lucky Luke)