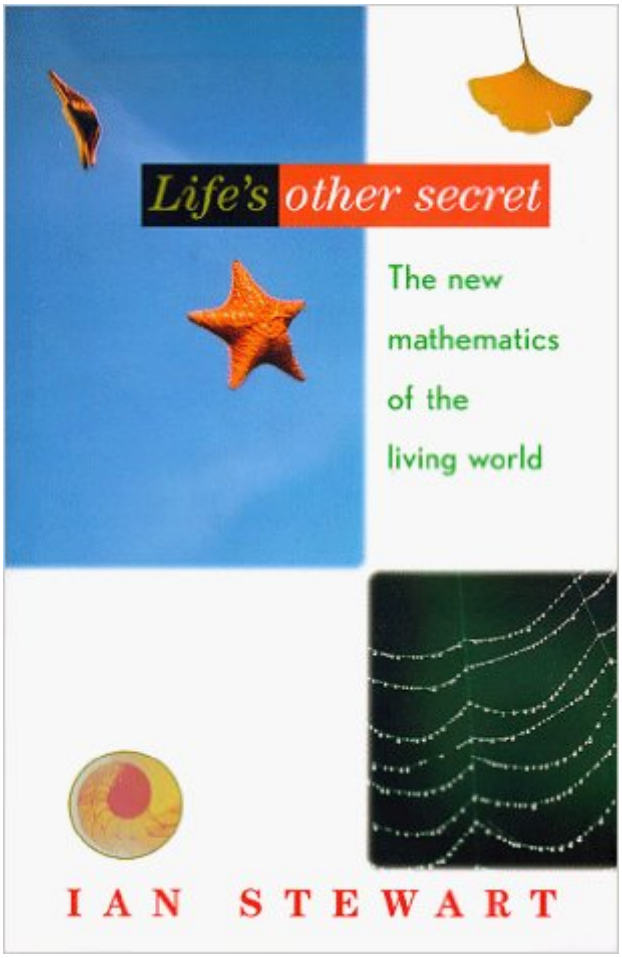
Life's Other Secret: The New Mathematics Of The Living World



Synopsis

Is there an underlying set of principles that connects the pattern of a tiger’s stripes with the design of a butterfly’s wings? Are there hidden laws of life that lie deeper than DNA? According to award-winning science writer Ian Stewart, the answer is yes, and the hidden rules are called mathematics. In Life’s Other Secret, Stewart exploits a realm of pattern and beauty that links the pulse of life with the creative enterprise of mathematics. Pointing to what he describes as an exaggerated emphasis on the power of DNA in determining the shape and behavior of life-forms, Stewart compares DNA to a recipe book of ingredients, quantities, and sequences: very useful, but far from a complete plan of the final result. Beneath the genes lies the rich texture of the physical universe with its deep patterns, forms, structures, processes, and systemsâ ”a world of infinite subtlety that can be described only through mathematics. Genes may move a life-form in a specific direction, but it is the mathematical laws of chemistry and physics that control an organism’s response to its genetic instructions. With the visionary work of the zoologist D’Arcy Thompson as his touchstone, Stewart unfolds a series of dazzling mathematical patterns in the organic world: the ethereal spiral of the nautilus shell, the fluid forms of a jellyfish, the boastful beauty of the peacock’s tail, and the amazing numerology of floral petals. He leads us to a place where number and nature coalesce, and where the order of mathematics manifests itself in life. Life’s Other Secret teems with surprising insights. Stewart describes how complexity theory may help explain the origin and evolution of life, and how the Fibonacci number sequence of 1, 2, 3, 5, 8, 13, 21, 34 seems to rule the number of petals, stamens, and other parts of most plant life. He traces the mathematical patterns of locomotion through the broad range of limbs, wings, muscles, and fins. We learn about hidden mathematical order in flocks of birds, crowds of humans, and in the firing patterns of fireflies. The very nerve cells that relay the perception of these natural phenomena to the brain are most accurately described by mathematical models. Through this eye-opening tour of an exciting new area of research, we perceive a growing sense of the wonders that will come out of a union of biology and mathematics, a union that will provide a deeper comprehension of the fundamental forces of life. An invitation to a hidden world In Life’s Other Secret, mathematician and award-winning science writer Ian Stewart reveals the way mathematics describes the origin, structure, and evolution of life. With an abundance of illustrations, many in color, here is an intriguing invitation to enter a world deeper than DNA, a world where number series bloom in the spring and equations gallop across the plains. "From one of mathematics’ most gifted expositors . . . challenging and interesting. . . . Those with no knowledge of the subject will be able to glimpse its beauty and appeal." â ”New Scientist Praise for Nature’s Numbers "An example of first-rate popular

mathematics writing. . . . Stewart achieves what other popular writers merely strive for." â ”Nature

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Customer Reviews

Stewart begins his book by telling the reader:"I am going to try to convince you that as wonderful as genes are, they are not the whole answer to the question of life. More radically, I am also going to try to convince you that a full understanding of life depends upon mathematics."Basically, Stewart believes that scientists have overemphasized genetics and ignored (or at least under emphasized) the role of what I'll call large-scale or macro rules of physics and chemistry and the comparatively simple mathematics that describe them. For example, a molecular biologist might see a striped shell and wonder which genes caused them. Stewart would be more inclined to ask if there isn't some sort of chemical diffusion equation that leads to the stripes without them being specifically encoded in the genes. The point is that DNA may not need to encode much detail in many cases because the detail arises spontaneously out of macroscopic laws.Stewart has studied at the Santa Fe Institute in New Mexico. Other prominent scientists associated with the Institute are Murray Gell-Mann and Stuart Kauffman. Kauffman, in particular, has conducted studies regarding emergent properties of self-catalytic systems and you can see the influence of his thinking in much of Ian Stewart's book (see Stuart Kauffman's book "At home in the universe, the search for laws of self organization and complexity").The book begins with discussions relating to the nature of life and musings about DNA and replication. It's interesting to see the line between life and non-life blur under Stewart's prose.

Is life regulated and given structure by genetics alone? Or do physical and chemical constraints have a significant bearing on an organism’s morphology? Inspired by D’Arcy Wentworth Thompson’s classic, On Growth and Form, mathematician Ian Stewart argues convincingly that, the current popular view of the primacy of the genome notwithstanding, the major phenotypical influences, including those of the genes themselves, are highly constrained by physics and chemistry, both as endogenous and exogenous processes. What’s more, such processes are manifestations of underlying mathematical "rules". (Stewart is, of course, neither the first nor the last to champion the "life is math" viewpoint. Other strange bedfellows in this general tradition range from William Paley, the eighteenth century theologian who conceived a mechanical universe so finely crafted and tuned that there must be a (divine) "watchmaker", to Stephen Wolfram, whose recent vanity tome, A New Kind of Science, posits, at its core, cellular automata as life’s computing mechanism.)Life’s Other Secret is a beautifully written book that teaches about symmetry and symmetry breaking and oscillators and other important facets of evolution’s geometry. It might seem odd that a mathematician takes on a subject more apparently appropriate to biology or zoology. And, indeed, life does often imitate art: In Collapse of Chaos, Stewart and Jack Cohen provide an example destructive professional encroachment: Two ice cream venders at the beach increasingly move in on each other’s territory, so that, in the end, neither the bank accounts of the venders nor the gustatory desires of their customers are best served.

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