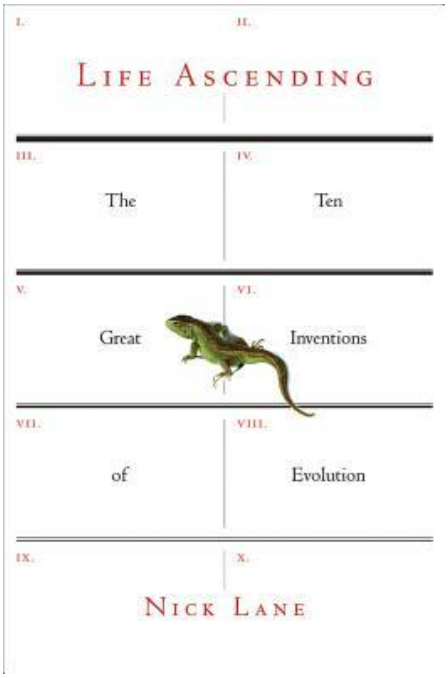

Life Ascending: The Ten Great Inventions of Evolution

Nick Lane

Life Ascending: The Ten Great Inventions of Evolution

Nick Lane

Life Ascending: The Ten Great Inventions of Evolution Nick Lane
A renowned biochemist draws on cutting-edge scientific findings to construct the mosaic of life's astounding history.

How did life invent itself? Where did DNA come from? How did consciousness develop? Powerful new research methods are providing vivid insights into the makeup of life. Comparing gene sequences, examining atomic structures of proteins, and looking into the geochemistry of rocks have helped explain evolution in more detail than ever before. Nick Lane expertly reconstructs the history of life by describing the ten greatest inventions of evolution (including DNA, photosynthesis, sex, and sight), based on their historical impact, role in organisms today, and relevance to current controversies. Who would have guessed that eyes started off as light-sensitive spots used to calibrate photosynthesis in algae? Or that DNA's building blocks form spontaneously in hydrothermal vents? Lane gives a gripping, lucid account of nature's ingenuity, and the result is a work of essential reading for anyone who has ever pondered or questioned the science underlying evolution's greatest gifts to man.

Life Ascending: The Ten Great Inventions of Evolution Details

Date	:	Published June 22nd 2009 by W. W. Norton & Company (first published 2009)
ISBN	:	9780393065961
Author	:	Nick Lane
Format	:	Hardcover 352 pages
Genre	:	Science, Biology, Evolution, Nonfiction, Popular Science, History

From Reader Review Life Ascending: The Ten Great Inventions of Evolution for online ebook

Mark says

One can study the biochemistry of photosynthesis in some detail and be unaware of the different pathways that exist and existed in different organisms, of its effect on the color of the sky, of its effect on the structural components of large plants and animals, and of the peculiarities of its evolutionary origin. Nick Lane gives a brilliant overview of the nature, significance and origin of the 10 greatest inventions of evolution including, the origin of life itself, DNA, photosynthesis, the eukaryotes, sex, movement, sight, warm bloodedness (homeothermy), consciousness, and death. I found the degree of detail to fit well with the text's readability and I was uniformly impressed with the author's knowledge and presentation. The relative low point, for me, was the chapter on consciousness. There is a great deal of interest there, but I think I am a little more radical than the author on this topic; he blows off Dennett with a single paragraph and he ends his discussion of the tragic case of a girl with hydranencephaly by stating that if it is the case that if the roots of consciousness are not to be found in the cerebral cortex, "then the neural transform, from firing to feeling, loses some of its mystique". Yes, that's what Dennett says, and it loses **all** of its mystique.

???? ??????? says

?? ???? ?????? ??? ?????? ???? ?????? ?? ?? ????? ?? ?????? ??? ???? ???? ??? ??? ????? ???, ????? ??? ?????? ?? ????? ?? ?????? "?????????? ?????? ??????? ??????" ??? ??? ??? ???????? ???? ????? ???? ????? ????? ?? ????? ?????? (???? ????? ???????? ?????? ??????? ??? ?????? ??? ???? ??????), ??? ??????? ???? ?????? ?????? ?????? ?????? ???? ???? ?? ???? ?? ???? ?????? ???? ??????? ???? ?? ???? ????? ???? ???, ??? ??? ?????? ?? ???????? ????? ???? ?????? ??? ?????? ???????? ???? ????????? ???????? ?? ??? ??????, ????? ?? ????? ??? (????? ?????) ???? ??? ?????? ?? ???? ????? ?? ????? ??? ????? ??? ??? ??????, ????? ???? ?????? ?????? ???? (??? ???? ???? ????????? ??????? ??? ??????? ????? ???? ???????) ????? ??? ?????? ???? ??? ?????.
???? ???? ?? ????? ?????? ????? ????? ???? ????? ?????? ?? ????? ?????? ????? ????? ????? ???? ??????.

Veronika Sebechlebská says

Na základe genetického rozboru dochovanej kosti sa zistilo, že *tím nejbližším žijícím p?íbuzným T. rexe je oby?ejné ku?e, t?sn? následované pštrosem* . Ke?že som v detstve bola prenasledovaná nejedným kikiríkajúcim diablom, priklá?am sa k tejto teórii.

Vidíme asi 80x lépe n?ž v?tšina hmyzu, jehož vid?ní je tak rozost?ené, že by se dnes snad už dalo prohlásit i za um?ní. Made my day, ale ve?mi tomu neverím, pretože tie sprosté komáre vždy ve?mi dobre vidia, ke? na ne úto?ím.

Inak pre laika je to dos? náro?né ?ítanie, plné ATP, genetického kódovania, hentakých bielkovín, tamtakých enzýmov a všeliakých iných biochemických pojmov a vysvetlení, ktorým som samozrejme nerozumela, ?o mi ale nikdy nebránilo necha? sa fascinova?.

M. says

Göz nas?l ortaya ç?kt??
Cinsiyetler nas?l ve neden var?
Baz? canl?lar neden s?cak, baz?lar? so?uk kanl??
Neden cinsel ili?ki var?
Kaslar nas?l çal???r?
DNA nas?l olu?tu?

Gibi s?kl?kla dile getirilen, bilimin aç?klayamad??? dü?ünülen pek çok konu üzerine güncel tart??malar hakk?nda muazzam bilgiler içeren bir kitap.

Bu kitapta benim de kafamda bugüne kadar soru i?areti olan pek çok konunun cevaplar?n? buldum.

??????? ???? ??? says

?????? ?????? (?????????? ?????? ??????? ??????)
??? ???
.....
????? ??? ?????? ?? ????? ??????? ??? ?? ?????? ??? ????? ?????? ???? ???? ?????? ??? ?????? ???? ?????.
???? ?? ?????? ??? ??? ?? ??????? ?? ??????? ?? ?????? ??? ?????? ????? ????? ??????.
?? ????? ????? (??? ???????) ??? ?????? ????? ?? ????? ???? ?????? ??? ????? ??????? ??? ?? ????? ????
????????? ???? ?? ????? ?????? ????? ??? ?? ?? ???? ????. ??? ??????? ?? ?????? ??? ??? ????? ??? ????????
?? ??? ????? ??? ???????? ???? ??? ?????? ??? ???? ?? ??? ????? ??? ????? ??????? ???????? ???? ???? ????
????? ?? ???? ?????? ?? ???? ???? ??? ???????? ?? ??? ??????? ?????? ?? ??? ??????? ??? ??????? ????????
??????? ????????. ?? ???? ???? ??????. ??? ???? ???? ?? ????? ????? ??? ?? ???.
?? ????? ?????? (?? ?? ???) ???? ?? ??? ?????? ????????? ??? ????? ??????? ??????? ??? ????? ??(?? ?? ???)
?????? ????? ?? ??????.
?? ????? ?????? (????? ?????? ??????) ??? ?????? ?? ????????? ???? ?????? ???? ???? ???? ?? ?????? ???????
????? ???? ????? ???????? ?????? ?? ?????? ?????? ??? ?? ????? ????????? ??????? ?? ????? ?? ????? ????
?????. ???? ?? ??? ????? ?? ?????????? ????? ?? ????? ?????? ????? ?? ??????? ?????? ? ????? ???? ????????
??? ?? ??? ?????? ??? ????? ?????.
?? ????? ?????? (?????? ???????) ???? ?? ????? ?????? ????? ? ????? ?????? ?????.
?? ????? ?????? (??????? ??????) ??? ??? ???? ??????? ????? ??????? ???? ??? ??? ????? ??????? ????????
??? ??? ??? ???? ?? ??????? ??? ?? ??? ?????? ?? ???? ??????? ???? ????.
????? ?????? (??????) ???? ?? ?????? ??????? ???? ???? ?????? ????? ?? ?????? ?????? ??? ????? ???? ???
??????. ??? ???? ?? ???? ???? ?? ??? ?????? ?????? ????? ?????? ?????????? ??? ???? ????? ?? ???? ???????.
?? ????? ?????? (???????) ???? ?? ??????? ??????? ???? ?? ????? ?? ????? ???????? ????? ?? ????????
??????? ??? ?????? ??? ???? ?? ???? ????? ?????? ?????? ?? ??????? ?????? ???? ??????? ????? ??? ?????.
?? ????? ?????? (???? ?????) ??? ?? ???? ?? ???? ???? ?????? ???? ?? ??? ??? ??? ??? ?????? ??? ???? ?????
????? ?????? ????????? ????????? ?????? ???? ??? ????????? ???? ?????????? ??? ??? ??????? ??? ??????
??????? ???? ??????? ? ????? ?????? ??? ??????? ???????? ???? ??????? ?? ?????????.
??? ???? ?????? ???? ?? ?????? ??? ????? ?????? ??????? ???? ?? ?????.
?????? ??? ??? ?????? ?? ?????? ????? ?? ???? ???? ? ????? ????? ???? ?????? ??? ?????? ??? ??? ???? ?????

??? ?????? ?? ????????? ???? ???? ???? ???? ???? ???.

Gendou says

I had a lot of fun reading this book up until the end, when I started to worry about the author's propensity towards exaggeration and speculation.
For anyone who wants to learn about cutting edge speculation on the origin of life, Eukaryotas, and sex, it's definitely worth a read!
Anyone allergic to new-age nonsense sociology, just skip the last 9th chapter.
Everyone should take the last chapter with a very large grain of salt, because it's full of speculation, overblown claims, and other lies.

1. The Origin of Life
The author is obsessed with hydrothermal vents.
The evidence for life's origin in hydrothermal vents is overstated as fact, despite its true status as a highly speculative theory.

2. DNA
I was astounded to learn that the evolution of the genetic code (which RNA sequences code for which amino acids) arose only once,
but the machinery for DNA replication arose twice, independently! Once in the archaea, and once for all the others.
Though, the crucial evidence in the argument is the interpenetration of the DNA replication genes as a molecular clock.
The author carefully hides the error margin for this method of dating, which approaches unity when applied to organisms capable of lateral genetic exchange.
Still, it is curious that the whole machinery of DNA replication seems to follow two, reportedly distinct, paradigms.

3. Photosynthesis
The textbook story of photosynthesis is exposed as a gross over-simplification.
A more detailed, but again speculative, re-telling is a neat story of long-lost cousins exchanging DNA.
Not as incestuous as it sounds...

4. The complex cell
Like photosynthesis, the story ends up being quite involved compared to the high-school biology explanation.
To me, the most interesting insight is the theorized reason for a cell nucleus: to provide a barrier to transposons.
The porous nuclear acts as a speed bump, allowing time for transposons to be broken down before traveling out to the mitochondria.
Cool stuff!

5. Sex
What is it good for?
This chapter was pretty hot, but nothing I didn't learn in High School.

Get your mind out of the gutter! I was talking about AP Biology!

6. Movement
Lots of talk about muscles, and, as usual, some neat surprises.

7. Sight
Yes, I'd rather half an eye than no eye at all.
Brine shrimp come to the rescue as a supreme example in support of evolution.

8. Hot Blood
Were the dinosaurs hot blooded?
What makes "hot" vs. "cold" blood?
The answers may bore you...
I'm half joking, because this chapter was full of interesting theories, too.
But I could care less for paleontological bickering.

9. Consciousness
This chapter is full of half-baked (and worse) philosophy, on top of misunderstandings on basic lessons from physics.
For example: "we don't even know ... why matter exists, rather than nothing at all"
This is an atrocious misunderstanding of physics.
See A Universe from Nothing by Lawrence Krauss.
The most frightening digression in this chapter was the authors claim that "panpsychism is taken seriously again".
He touts Graham Cairns-Smith's "bomb in the basement" dualist argument. (Boo! Hiss!)
Yes, this chapter, in a modern biology book, contains a "serious" claim of DUALISM!!
The orgy of ignorance continues as the author asserts "we don't even understand how quantum mechanics works".
He goes on to claim that quantum physics leaves room for free will and a soul.
It's a good thing I listened to the formless audiobook, or I'd have had a bonfire right then and there.
But I had the misfortune to be in the middle of my commute to work, so I kept reading.
I tried to find my happy place during some talk of "consciousness as quantum vibrations".
Then, I wept aloud at the mention of a particle source of feelings which might be discovered in the particle accelerators.
Obviously, the wiring and behavior of the brain's neural network is the source of mind and feelings.
Nick Lane should stick to biology, he hasn't the background to discuss physics.

10. Death
Following the chapter on consciousness, I had little patience left.
This chapter is about how death works and how we can overcome it.
The author seems pretty set in his Ray Kurzweil like denial of the inevitability of death.
It is claimed multiple times that death is simple and can be prevented biochemically.
The chapter focuses chiefly on the hype surrounding the TOR gene.
It's really not worth reading unless you're a fan of popular (i.e. mythological) pharmacology.
There is some interesting theorizing as to the evolutionary cause of aging and death.
Strangely, there is NO MENTION of the primary cause of aging: telomere shortening.
The primary defense against cancer our body uses is a fixed number of cellular replications.
This ensures that, unless or until malignancy is achieved, tumors eventually stop growing.
The replication limit on stem cells produces a finite lifetime to enjoy tissue repair.

It seems obvious to me that reduced quality and speed of tissue repair and replacement amount to the symptoms of aging.
Nick Lane either has never heard of telomeres, or has chosen to deceive the reader by leaving them out.

Dr. Carl Ludwig Dorsch says

Nick Lane is a self-described evolutionary biochemist and presently Senior Lecturer in the Research Department of Genetics, Evolution and Environment at University College London. His **Life Ascending: The Ten Great Inventions of Evolution** was awarded the 2010 Royal Society Prize for Science Books. He has previously published **Oxygen: The Molecule that Made the World** and **Power, Sex, Suicide: Mitochondria and the Meaning of Life**. His **What is Living? Why Energy Drives the Origin and Evolution of Life** is expected in 2014.

In **Life Ascending: The Ten Great Inventions of Evolution** Lane focuses on the inventing rather than the inventions, the origination, the birth of the thing rather than its life. And biological understanding being what it is, this leads him, from the very beginning (The Origin of Life) to the search for precursors. The subsequent deployment, operation, and implications of the enumerated "inventions," though not entirely ignored, are not really the purview here.

For example:

If the railroad happened to be one of Lane's "Ten Great Inventions of Evolution", there would be much about ancient Greek wheel-rut roads (including those in Sicily and Cyrenica), noting their consistent depth of 7 to 15 centimeters, their rut width of 20 to 22 centimeters and gauge of 138 to144 centimeters. Mention would be made of rut sidings, allowing vehicles to pass where only a single rut is available. These Greek rut-roads might be compared with those cut into Vespasian's tunnel at Bons (in that segment of the *Via Flamina* known as *Petra Pertusa*) where the gauges ranged from 110 to 165 centimeters.

Further extended discussion would be had of Greek cartage, and the sometimes unclear distinction between the *hamaxa* and the *hamaxa tetrakulos* – two and four wheeled carts – this in the context of the inappropriateness of the *hamaxa tetrakulo*s for travel on wheel-rut roads, unless, of course, they possessed a swiveling front axle.

Which in turn would lead to a discussion of the development of the bogie, or turning-train, the mechanism by which, through first attaching the front wheels of a cart or wagon to its shaft and only then to the chassis by way of a pivot, the front wheels of a four wheeled vehicle may turn independently – and how this, though used by the Celts before the Common Era, only came into fuller use in the Middle Ages, perhaps encouraged by the needs of steerable four wheeled battering rams, propelled from the rear.

Eventually we would come to a discussion of mining technology, and mining trucks running on wooden rails in the middle of the European millennium, and then even more eventually to metal clad wood rails, then to iron and steel, then the history of steam engines (with emphasis on the Greek aeopile), etc., etc.

What we would not get from Lane however would be a discussion of the economic and political imperatives which drove, in fairly short order, the spanning of the terrestrial planet with a network of rail lines. Nor

would we likely find much consideration of the resultant transformation of world's social, economic and political culture (not to mention the matériel of its industrial base, from fossil fuels to forestry to metallurgy), or of the railroad's relation to the various imperialist projects on all the world's inhabited continents, or to the great European wars of the 20th century, or even to the telegraph (though we might have an amusing aside on Railroad Time and the institution of time zones).

And we fairly certainly would not find any mention of the various other technical and social transformations which occurred in partial causal tandem with railroad development, like the iron and steel transformation of the advanced metropolitan urban environment, and most certainly nothing of rail's still shifting relation to a subsequent high-speed pavement-based internal combustion culture (or to air traffic and air freight, for that matter), etc.

Of course even a 28 page essay (the average length of those in **Life Ascending**) on the invention of the railroad, if that invention were indeed to be offered as one of the 10 most pivotal in the course of human history, would have to have its limits. One makes choices. I only offer the preceding to illustrate the sort of choices **Life Ascending** makes.

That essential frustration aside (and, admittedly other smaller and perhaps related complaints – though I cannot help but note here Lane's consistent propensity to flog his own favorite contemporary evolutionary speculations while only vaguely qualifying their standing relative to the current consensus), I found the volume a useful hint at an early 21st century biochemical perspective. Dr. Lane is a biochemist; I have not even the faintest grasp of the fact of the three? four? five? 103? 118? a possible 155? elements. He's got me thinking about the phase problem in x-ray (particularly protein) crystallography and transposons, I'll grant him that.

Ram says

A well written description of the (in the authors opinion) ten greatest "inventions" of evolution

These include
the origin of life itself,
DNA,
photosynthesis,
the eukaryotes,
sex,
movement,
sight,
warm bloodedness (homeothermy),
consciousness,
and death.

The author is a biochemist and his analysis is very chemical oriented , but still very readable for a layperson. He explains various techniques for discovering the information in a way I could understand.

I admit that in some places I lost him but overall, the read is interesting and educational.

“Men are even worse: a hundred rounds of cell division are needed to make sperm, with each round linked inexorably to more mutations. Because sperm production goes on throughout life, round after round of cell division, the older the man, the worse it gets. As the geneticist James Crow put it, the greatest mutational health hazard in the population is fertile old men.”

“Life itself turned our planet blue and green, as tiny photosynthetic bacteria cleansed the oceans of air and sea, and filled them with oxygen. Powered by this new and potent source of energy, life erupted. Flowers bloom and beckon, intricate corals hide darting gold fish, vast monsters lurk in black depths, trees reach for the sky, animals buzz and lumber and see. And in the midst of it all, we are moved by the untold mysteries of this creation, we cosmic assemblies of molecules that feel and think and marvel and wonder at how we came to be here.”

Radiantflux says

38th book for 2018.

This book confirms that my opinion that the very best science writing is inevitably done by active and opinionated scientists.

This is a wonderful book that covers everything from the origin of life, though the creation of DNA, photosynthesis, sex, movement, sight, warm bloodness, consciousness and even death.

5-stars.

Jennifer says

I found this to be a mixed bag. I found some chapters such as Complex Cells and Hot Blood fascinating and others such as Movement and Consciousness quite tedious. The author does a good job of reducing complex biological processes into simpler terms but I felt he used weird analogies far too often to illustrate his point. When he started comparing muscle proteins into classical music I had to roll my eyes. In addition, a few more illustrations would be useful to show some concepts.
It was nice to catch up on recent discoveries and see how much the science has progressed since I last studied biology which was in high school and first year university fifteen years ago.

Bettie? says

[Bettie's Books (hide spoiler)]

Sne says

Before reading Nick Lane I have never had interest in Biology. I didn't even watch Animal Planet. And for a month now I can't stop talking about mitochondria, DNA, evolution, etc.
His books are fascinating. I like the way he structures his statements, his sense of humor, the analogies he makes, the notions that start floating in your head. I like that he obviously likes The Hitchhiker's Guide to the Galaxy :)
Somebody here has said that he is speculating too much with unproved theories. May be because I'm not a scientist, but I don't mind. I think that he is giving a fair warning every time he is speculating about something.

Migl? says

Skaitant šit? knyg? man susidaro ?sp?dis, kad turiu lengv? disleksij?.

Ar tai d?l vertimo? Ar originalus tekstas irgi toks raišas? Ar knygos vertimas buvo pernelyg skubiai išleistas? Nenoriu badyti pirštais ? vert?j? ar kalbos redaktori?, ar leidykl? - niekad žmogus nežinai, kaip tokia situacija susiklost? - bet kaip b?t? buv? nuostabu, jei šios knygos tekst? b?t? perži?r?j?s dar koks vienas žmogus ir padar?s j? labiau skaitom?! Dabar, deja, ši knyga man kelia frustracij? ir širdg?l?.

Pavyzdys:

Vienintelis b?das planetai susikurti deguonies prisotint? atmosfer?, išvengti dulk?tos, raudonos Marso lemties - išsaugoti šiek tiek augalin?s materijos, kuri b?t? atspari stichijoms ir gyvyb?s išradingumui ieškant b?d? j? panaudoti energijai. Ji turi b?ti palaidota.

Kas "ji"? Turb?t energija, nes ji minima paskutin?. Ži?rime kit? pastraip?:

Taip ir yra. Išsaugota augalin? materija palaidota kaip anglis, nafta, gamtin?s dujos, suodžiai, medžio anglis ar dulk?s uolienose Žem?s gelm?se.

A, vadinasi ne - "ji" buvo augalin? materija. Kod?l tada nepakartojus fraz?s "augalin? materija", užuot rašius "ji", jei yra dviprasmyb?? Be to, argi neb?t? puiku, jei fraz? "atspari stichijoms ir gyvyb?s išradingumui ieškant b?d? j? panaudoti energijai" b?t? kažkaip suskaidyta ar bent jau pamažinta t? vienas ant kito lipan?i? naudinink??

Kitas pavyzdys:

Didžiausia medžiag? apykaitos sparta galiausiai priklauso nuo to, kiek deguonies suvartoja "galutiniai naudotojai" - t.y. raumen? mitochondrijos. Kuo grei?iau suvartoja, tuo didesn? didžiausia medžiag? apykaitos sparta.

Tai priklauso nuo grei?io ar nuo kiekio? Ta prasme, pagalvojus galima išsiaiškinti, bet esu tikra, kad buvo

galima parašyti aiškiau. Ok, praleidžiam vien? pastraip? ir toliau pateiksiu ištrauk? be joki? iškarpym? (taigi n?ra tr?kstam? detali?, kurias praleidžiu), tik su savo komentarais.

Anot A. Beneto ir Dž. Rubeno, didžiausia medžiag? apykaitos sparta kažkaip "padidina" ir medžiag? apykaitos spart? ramyb?s b?senoje. Kitaip tariant, atletiško žinduolio, pasižymin?io didele ištverme, medžiag? apykaitos sparta ramyb?s b?senoje taip pat bus didel? - jis ir toliau kv?puodamas sunaudos daug deguonies, net jei gul?s nieko neveikdamas.

Cool, super aišku.

Š? teigin? grind? empiriniais steb?jimais. Anot j?, bet kurios priežasties sukelta didžiausia žinduoli?, paukš?i? ar ropli? medžiag? apykaitos sparta yra maždaug 10 kart? didesn? už medžiag? apykaitos spart? ramyb?s b?senoje.

Ok, ?ia truput? trikdo, kad panaudotas tas "dešimt kart?", bet galim suprasti, kad kalbama apie tam tikro gyv?no grei?iausios medžiag? apykaitos ir medžiag? apykaitos ramyb?s b?senoje tiesiogin? ryš?. Ramyb?s b?senoje medžiag? apykaita vyks ne šiaip random l?tai, o 10 kart? l??iau negu grei?iausias to gyv?no medžiag? apykaitos variantas.

Taigi atrankos b?du ?tvirtinama didžiausia medžiag? apykaitos sparta did?ja ir ramyb?s b?senoje. Jei ji padid?ja dešimteriopai (tiek skiriasi žinduoli? ir driež?), medžiag? apykaitos sparta ramyb?s b?senoje padid?ja tiek pat.

Kokios atrankos b?du ?tvirtinama? Ta prasme susidariusi per nat?rali? atrank?? Nesvarbu. ?ia tas pats skai?ius 10 kažkod?l naudojamas lyginti ne vieno gyv?no, o dviej? skirting? r?ši? gyv?n? medžiag? apykait?, kas v?l žiauriai confusing. Nu bet gerai. Žinduoli? medžiag? apykaita 10 x didesn? už driež?, nesvarbu, ar abu jie miega, ar b?ga.

Tuo metu gyv?nas sukuria tiek daug vidin?s šilumos, kad, ties? sakant, atsitiktinai tampa "šiltakraujis".

KOKS GYV?NAS?! Turb?t driežas, jei tapimas "šiltakrauju" yra kažkas ne?prasto? KURIUO METU?? Ta prasme, j?s matot, kad niekas prieš tai pastraipoje nesufleruoja, apie kok? gyv?n? ?ia kalbama paskutiniame sakinyje.

Gerai, ?ia baigsiu su pavyzdžiais, juos rodau ne tam, kad pasišaipy?iau, o d?l to, kad man iš tikr?j? baisiai skaudu ir li?dna. Knygos temos be galo ?domios ir aš iš visos širdies noriu suprasti, bet negaliu, nes tekstas man trukdo. Bandau prisiminti, ar pastaruoju metu nepatyriau kokios galvos traumos. Gal kitiems tas tekstas visai skaidrus ir aiškus? Gal man tiesiog reikia labiau pasistengti? Bet negaliu, po kiek laiko tiesiog apima jausmas, kad ta teksto hermeneutika visai beprasmiška ir nepadeda man suprasti nei ribosom?, nei medžiag? apykaitos.

Skaudama širdimi padedu knyg? atgal. Gal verta susirasti j? originalo kalba?..

Mohammed-Makram says

?? ????? ???? ???? ???? ?????
???? ????
????? ???? ???????
????????
???????

??? ???? ?????
? ???? ???? ?? ????? ?????????

????? ?? ???? ???? ???? ?? ????
?? ???? ???? ???? ????? ??? ????

?? ?? ?????? ??? ???? ?? ? ?? ??????? ??????? ?????? ?? ??????

?? ???? ???? ?????????? ???????? ?????? ??? 1996? ??? ?????? ????? ???? ??????: ?? “?????
?????? ???? ??? ???????? ??? ????? ?????? ?? ???? ?? ???? ?????. ?? ?????? ??? ??? ?? ???? ???
??????? ??????? ?? ??? ?????? ?? ????? ????? ?? ?????????? ?? ?????? ?????? ?? ???????. ??
???????? ??? ??????? ???? ???????? ?????? ??????? ???? ????? ???? ????? ?? ??? ???? ??? ?????
???? ?? ???? ??? ???????"

????? ?????? ???? ???? ??????? ? ??? ???? ??? ?? ???? ?????? ??????? ????? ?????

?????? ?? ??? ?????? ? ????? ?? ???????
?? ????? ????? ? ???? ?????? ????? ?? ?????
???? ????? ???? ????? ?????? ???????? ?????? ??? ????? ??? ?? ??? ???? ???? ?????? ??????

1 ??? ??????

?? ??? ?????? ? ???? ??????? ????????? ??????? ?????? ???????? ????? ??????? ???????? ? ?? ??
???????? ?? ???? ?????

2 DNA

???? ???? ???? ?? ??? ???? ?????????? ? ??????? ???????? ???? ??????? ??????? ?????? ?????
??????? ??? ????? ??????? ????

3 ?????????? ? ??????????? ??????? ? ????? ??????? ??????

???? ?? ?????? ???? ??????? ????????? ???? ???? ?? ???????? ??????? ??? ?????????? ???????
??? ???? ???????? ???? ??? ?????? ??? ????? ???????? ??? ????? ??? ?? ???? ???? ? ???? ???
?????? ???????

4 ?????? ???????

???? ??????? ??? ????? ????? ??? ????? ??????? ????? ? ??? ???? ? ????? ?????? ?? ???? ?? ??? ????

5 ??????? ??????

?? ??? ??????? ???? ?????? ?????? ????? ?? ???? ?????? ???? ???? ?????? ? ?????? ??? ???????? ?? ???? ???? ?? ????? ??? ?????

6 ??????

?? ??????? ??????? ???? ?????? ? ?????? ????

7 ???????

??? ????? ??? ???? ?????? ? ???? ????? ???? ? ???? ???? ?? ???? ????? ????? ????? ?? ????? ???? ??? ?? ??? ????

8 ???? ?????

??? ??? ???? ????? ?? ??? ?????? ????? ??? ??????

9 ?????

??? ?? ??? ????? ??? ???? ?? ????? .. ?? ? ????

10 ?????

?? ???? ???? ??? ???? ??????
???? ????? ?? ?????
???? ?? ???? ???? ??
?? ????? ????

Gavin Drury says

"I think that the picture painted in this book is true. Life most surely evolved, along the lines described here. That is not dogma, but evidence tested in reality and corrected accordingly. Whether this grand picture is compatible with faith in God, I do not know. For some people, intimately acquainted with evolution, it is; for others, it is not. But whatever our beliefs, this richness of understanding should be a cause for marvel and celebration. It is a most wonderful thing to share so much with the life around us on this blue-green marble, floating through the bleak infinity of space. There is more than grandeur in this view of life. There is fallibility and majesty, and the best human eagerness to know."

If you are interested in evolution, this is a fantastic book, though because it is

quite heavy it may be better to start with something like Richard Dawkin's 'Greatest Show On Earth'. Winner of last year's Royal Society prize for Science Writing, it has some of the latest scientific research. This book covers ten particular aspects of life, how exactly they work, how they developed through the process of evolution, and how we know this. The areas he chose to cover fell under the criteria of 'the invention had to revolutionise the living world, and the planet; it had to be of surpassing importance today; it must be a direct outcome of evolution by natural selection; and finally the invention had to be iconic in some way. Some readers may disagree with his ten choices, as the introduction acknowledges, but I went with the flow and it made sense to me."
Starting with the Origin Of Life, it doesn't just trace life back through DNA history to the earliest known forms of bacteria, but goes much deeper into the chemical reactions required to create and maintain these early bacteria and how this could be achieved with what is known about early Earth. It suggests we are not far from finding out exactly how life can emerge from simple proteins. The chapter on Sight, one of the most interesting, shows that the human eye is not as flawed as oft cited and traces back to the origin of sight.

Throughout all the different chapters - Sex, Hot Blood, Death, Photosynthesis to name a few - you will learn in depth, the beauty of each of these systems and how and why they evolved, far more than just 'survival of the fittest' and 'selfish genes', but the chemical balances and trade off restrictions involved. One of the most fascinating things I've learned from this book is how and why aging and death evolved, and is not just the natural order of things. The only chapter that deviates from the rest of the book is the chapter on Consciousness as there's no accepted definition of what exactly consciousness is, but it takes a scientific analysis of how it developed and how it may be explained.
The book does at points offer up competing theories and admits where scientific knowledge is lacking.

Ultimately, reading this gave me a much deeper realisation of the beauty of evolution than I already held. And even if at times some of the chemical processes went beyond my understanding, it's an acceptable level and there's far more information here that's accessible to anyone with an interest in the subject.

Score: 6/7

---

kokobatsu says

I was going to point out that the third chapter, about photosynthesis, was my favorite chapter because I could read it over and over again and I would still be fascinated, then I remembered that the second chapter was also as good, the fourth chapter as well. I really really loved the book and I will definitely read Nick Lane's other books starting with the book about Oxygen because the third chapter left its mark on me!!

Bill Leach says

This book has much more content than the title would suggest. The ten inventions are examined in detail from an evolutionary perspective, providing the latest knowledge and current theories as to how and when each evolved. Super engaging.

Chapter 1 - The Origin of Life

It appears that life started in the alkaline sea floor vents where seawater reacts with newly exposed rocks, creating the mineral serpentine. A steady supply of hydrogen reacts with carbon dioxide to form organic molecules (reverse Kreb cycle). The porous structure of serpentine concentrates the reactions. The spontaneous production of an ATP precursor in the serpentine pores would drive the Kreb cycle.

Chapter 2 - DNA

Lane details the various steps after the discovery of DNA, in understanding it's code. The first letter of the code relates to the precursor that forms the amino acid. The second letter relates to whether the amino acid is hydrophilic or water soluble. The third letter is degenerate in that many letter combinations yield the same amino acid. It is suggested that at one time it was a two letter code giving 15 amino acids, that evolved into a three letter code giving 20. Lane goes on to show how RNA would have formed in the undersea vents, and led to the creation of DNA.

While bacteria and eubacteria both arose from the vents and share the same genetic code, they differ in the enzymes used in DNA replication. DNA replication appears to have evolved twice. Prior to DNA replication, it may be that replication was through RNA using a process similar to that of retro-viruses. DNA evolved as it had a great advantage of stability.

Chapter 3 - Photosynthesis

While photosynthesis creates organic molecules using carbon dioxide and water, respiration is the opposite process. The oxygen surplus on earth is due to the burial of plant matter. While relatively constant over recent time, the rate of carbon burial in the Carboniferous period lead to oxygen concentrations above 30%, allowing animals like dragonflies to become huge. Rapid burials are largely due to volcanic activity.

In photosynthesis, the oxygen is released from water, not carbon dioxide. It is a two step process (two photosystems) with one photon energizing an electron to produce ATP, and a second process where the electron re-energizes the electron to convert carbon dioxide to a sugar. A complex process is needed to overcome the stability of both CO2 and water molecules.

Plant chloroplasts were once free-living cyanobacteria.

Both photosystems arose from a single ancestor. Some bacteria have one photosystem, while others have the second. How they became linked is not known but one theory is that an early bacteria possessed both photosystems and used them under different conditions. This would have lead to situations where the first system would produce too many electrons and the second would need electrons. A single evolutionary step would allow both systems to operate, giving the two step process.

The oxygen evolving step (part of the first photosystem) is done with a four manganese atom structure. This inorganic "oxygen evolving complex" probably formed in the vents and was utilized by early cyanobacteria. Researchers are now trying to duplicate it for use in using solar energy tp separate water into oxygen and hydrogen.

Chapter 4 - The Complex Cell

Eukaryotic cells possess a nucleus, and are much more complex than bacteria. All eukaryotes share common genetics, showing that complex life arose from bacteria only once. Bacteria were the only lifeform for 3 billion years, with the eukaryotes arising only 600 mya.

The eukaryotes have more commonality with the Archaea than the Bacteria, in their proteins, gene replication process and protein formation. Understanding evolution of eukaryote cells is difficult as lateral gene transfer and whole genome fusions cloud the gradual evolution processes. Two theories are current. In the first, the primitive cell evolves the characteristics of eukaryotes, then consumed a bacterium to form the mitochondria. The second sees the fusion of two prokaryote cells. Lane characterizes this as "a rare and fortuitous event".

Eukaryotes have numerous sequences on non-coding sequences called introns. These are the remains of jumping genes, and make up half of the human genome. Prokaryotes are able to cut jumping genes out, although the mechanism is not known. Most of these appear to have been accumulated by the early ancestor of eukaryotes. The introns appear to be an advantage to eukaryotes in adding a source of variation and allowing more complex processes to evolve.

Chapter 5 - Sex

Despite being a difficult and somewhat costly process, sex is almost universal among complex lifeforms. Sex allows favorable mutations to spread through a population more quickly, but also allows the purging of unfavorable mutations. Lane reviews past and current theories of the mechanisms providing these advantages.

Chapter 6 - Movement

Motility has transformed life, increasing the complexity of ecosystems and the pace of evolution.

Muscle contraction is due to long filaments of actin and myosin. Myosin cross-bridges bind to ATP and swing to a new position before re-attaching to the actin and releasing the fragments of the ATP. There is variation in the speed of myosin processes with smaller animals having faster processes. Mice are three times faster than humans, rats twice and tortoises one-twentieth.

While the evolution of muscle has been detailed, the origin of movement is yet unclear.

Chapter 7 - Sight

The eye has developed many times. While the octopus design seems to be more straightforward with the retina at the back, the human eye has better blood supply to the receptors allowing greater processing of the pigments. The human eye uses more energy than the brain on a unit weight basis.

Eyes developed rapidly during the Cambrian explosion, with the first lenses appearing in the trilobites. The lens is the most "difficult" step in the evolution of the eye. Trilobites (and modern brittle stars) used calcite, which naturally crystallizes into a rhombic form that passes light in one direction. However, most animals have lenses made from proteins called crystallins that were co-opted from other uses in the body.

Virtually all creatures use rhodopsin in their retinas. It appears that the photoreceptor cell evolved only once. Small changes in the structure of opsins can change their absorption of light through the range of red to UV. Attempts to replicate the ancestral protein indicate it was receptive to UV.

The algae Volvox uses rhodopsin to sense light. The facility probably came from chloroplasts.

Chapter 8 - Hot Blood

Hot blood allows animals to generate more power. Each increase of 10 deg C doubles the power output. Moreover, they has much greater stamina.

Large animals are effectively hot blooded because their large volume to surface area retains heat.

Hot blood has the large cost of eating. A mammal consumes 30 times the food used by a lizard of similar size. A primary benefit is stamina. Whenever a lizard runs, it is anaerobically, requiring a resting period.

In most animals the m maximum metabolic rate is about ten times the resting rate. It is not known why this is the case. Some exceptions include the Pronghorn at 65 times and the Alligator at 40 times.

Hot blooded animals have larger internal organs that are packed with more mitochondria. This appears to aid the power and stamina advantages, but also cause the higher resting metabolism.

In the early Triassic lystrosaurs dominated, representing 95% of all terrestrial vertebrates. Later in the Triassic, cynodonts started to displace the lytosaurs. While lytrosaurs were herbaceous, some of the cynodonts were carnivores and shown signs of hot blood.

Therapods show signs of the highly efficient breathing system possessed by the birds, which allows air to be passed over the lungs during both inhalation and exhalation. Birds acn extracted two or three times as much oxygen from rarefied air as can mammals.

Chapter 9 - Consciousness

Discussion on possibilities for the neural basis of consciousness.

Chapter 10 - Death

The diseases of old age appear to be tied to specific genes, suggesting that they are generally caused by a specific pathway. A single fix to sure a pathway provides the possibility of curing diseases of old age in

general.

There is a trade-off between sex and longevity. Calorie reduced diets turn off the sex drive.

Free radicals are central to cell signaling. The use of anti-oxidants to reduce free radicals does not work as the body excretes them, maintaining the free radicals at the proper level. Lifespan varies with free radical leak in all species. While a rat and a pigeon have similar metabolisms, the pigeon lives ten times longer.

As we age, the mitochondrial populations wear out and the free radical leak creeps up. The increased signaling gives rise to a chronic, mild inflammation that characterizes many of the diseases of old age,

A DNA variant has been found in some Japanese that causes a tiny reduction in free radical leak. By the age of 80, half as many of those with the variant are likely to arrive in a hospital. Those with the variant are twice as likely to reach 100.

The idea of a cure for any of the diseases of old age may be "... missing the wood for the trees", as it may be more fruitful to examine the underlying mechanisms of aging.

Charlene says

This was one of the best books I have ever had the pleasure to read. If you like a book that delves deep into every tiny detail, this is the book for you. If things like ATP, leaky mitochondria, bacteria that can live in strange conditions, how DNA was discovered (and how Crick thought aliens put it on Earth), you will enjoy Lane's wonderful adventure of how life came to be. The science in this book was outstanding.

Lois Bujold says

Excellent pop science writing, as absorbing as a novel (I read it in two days). The author has a knack for compelling narrative flow that seems both natural, and accumulating to some sense of Getting Somewhere by the end, always very satisfying.

Lots of new things from recent (and less recent) research that I hadn't yet heard about, which was much of what I was hoping for from this book. It also gives, in passing along the way, a good sense of how science itself evolves. Wow has biology ever advanced since I was in college. (I credit the computer, even more than the new scanning techs. Mass DNA crunching, with all the new data it is revealing, would be impossible without it.)

One kudo deducted for describing Watson and Crick without giving credit by name to Rosalind Franklin, which would only have taken a clause. Half a clause. "and a few pilfered X-ray diffraction photos" --> "and a few X-ray diffraction photos pilfered from Rosalind Franklin" would have done just that little bit towards righting an old wrong.

I had been rather hoping Lane would do for photosynthesis the sort of lucid and detailed explanation he'd

done for mitochondria in his prior title, but since it only had a chapter and not a whole volume, we only got as far as "lucid". He did offer a book rec for further reading on the topic, *Eating the Sun* which, ha, my county library has and therefore so will I, shortly, so that's promising.

Highly recommended for general readers.

Ta, L.

Courtney Johnston says

How do I love this book? Let me count the ways ...

I love Nick Lane's tone, which manages to balance wit and clarity without overusing the analogy button:

> Thermodynamics is one of those words best avoided in a book with any pretence to be popular, but it's more engaging if it's seen for what it is: the science of 'desire'. The existence of atoms and molecules is dominated by 'attractions', 'repulsions', 'wants' and 'discharges', to the point that it becomes virtually impossible to write about chemistry without giving in to some sort of randy anthropomorphism. Molecules 'want' to lose or gain electrons; attract opposite charges, repulse similar charges; or cohabit with molecules of similar character. A chemical reaction happens spontaneously if all the molecular partners desire to participate; or they can be pressed to react unwillingly through greater force. And of course some molecules really want to react but find it hard to overcome their innate shyness. A little gentle flirtation might prompt a massive release of lust, a discharge of pure energy. But perhaps I should stop there.

I love him because he blew my little mind. Lane begins with the origins of life, deep in the mineral-rich sea, on alkaline vents on the sea floor. How life on Earth began is still not entirely agreed upon, but Lane has thrown his lot in with biochemists Martin Russell and Mike Russell:

> If Martin and Russell are right - and I think they are - [the Last Universal Common Ancestor] was not a free-living cell but a rocky labyrinth of mineral cells, lined with catalytic walls composed of iron, sulphur and nickle, and energised by natural proton gradients. The first life was a porous rock that generated complex molecules and energy, right up to the formation of proteins and DNA itself.

Rocks. We all come from rocks. It's almost too big an idea to hold in your head at one time. (This all causes me to ask why I hadn't wondered where life came from before. I know how planets formed, and beyond that I think I had some hazy notion of 'primordial ooze', which is apparently discredited). With the next chapter, DNA, I was on steadier ground. I was back with some familiar friends - (hello Watson and Crick) and knew what was happening. There's some lovely passages in this chapter too:

> Crick pictured messenger RNA just sitting in the cytoplasm with its codons projecting like a sow's nipples, each one ready to bind its transfer RNA like a suckling pig. Eventually all the tRNAs would nestle up, side by side down the full length of the messenger RNA, with their amino acids projecting out like the tails of piglets, ready to be zipped up into a protein.

[It's probably worth noting here that Lane is explaining why Crick's theory was wrong, not right.]

I love the structure of the book. Lane slowly builds up from rocks to DNA to photosynthesis to sex to sight to hot blood to death and consciousness, at each point asking why these things were invented - what evolutionary advantage they offer, and what their histories are (or might be). Each chapter reaches back to the ones before, and often signals developments further within itself. Each is filled with those small details that make you realise that you know nothing - which makes you feel *terrific*. [Sincerely, is there anything better than realising you have years and years and books and books on a fascinating topic ahead of you?].

Sight was the surprise winner chapter for me. Sight - in the form of light-sensitive areas - first appeared in the form of naked retinas, a light sensitive sheet of cells that still appear on some of the creatures, like the swarming shrimp, that live near the vents where life (may have) originally appeared. It is possible that eyes triggered the entire Cambrian explosion, the point when most modern Phyla emerged. We're used to thinking of the lens of the eye as a disk of transparent cells - the tribolite's lens were made of the mineral calcite - another name for calcium carbonate, which in an impure form is limestone and a purer form is chalk. One living creature, the brittlestar, still uses calcite to make its lenses.

Most of all though, I love that Lane shows us the process of science - the areas where things aren't settled, the places with scientists disagree, the ways that personalities can conflict with credibility. He sketches out both theories and the people who devised them. For example - there has been significant debate over whether life originated in 'black smokers' or alkaline vents (mentioned earlier). Günter Wächtershäuser, a German chemist and patent attorney, advanced the black smoker theory, hypothesising that the key materials of life were hydrogen sulphide, carbon monoxide and iron pyrites:

> One scientist, on first reading Wächtershäuser's wok, remarked that it felt like stumbling across a scientific paper that had fallen through a time warp from the end of the twenty-first century.
>
> But is he right? Harsh criticism has been levelled at Wächtershäuser too, in part because he is a genuine revolutionary, overturning long-cherished ideas; in part, because his haughty manner tends to exasperate fellow scientists; and in part, because there are legitimate misgivings about the picture he paints.

Another example, from the chapter on the complex cell:

> In the face of little solid evidence, I'd like to raise another gloriously imaginative hypothesis from the ingenious duo we met in Chapter 2, Bill Martin and Eugene Koonin. Their idea has two great merits. It explains why a nucleus should evolve specifically in a chimeric cell, notably one that is half archaea, half bacteria (which, as we've seen, is the most believable

> origin of the eukaryotic cell itself). And it explains why the nuclei of virtually all eukarytoic cells should be stuffed with DNA coding for nothing, completely unlike bacteria. Even if the idea is wrong, I think it's the *kind* of thing we ought to be looking for, and it still raises a real problem facing the early eukaryotes that has to be solved somehow. This is the sort of idea that adds magic to science, and I hope it is right.

With the idiotic debates that continue to be pursued around evolution and 'intelligent design', I think it is crucial that society understands that 'gaps' in the evidence, and disagreements among scientists, do not weaken the case for evolution (which should, really, not have to be made). Lane does an elegant and enjoyable job of laying out the current state of research, focused on topics he cares about and finds intriguing, and even though I'm going to have to read the book again in order to fully understand it, I am truly grateful to him for doing so.
