Transition work - Year 12 Biologists

Have you ever
wondered...
• Why your sister looks like you?
• How medicines work?
• What DNA is?
• Do clones exist?
• Who Darwin was?
Study A Level Biology A to
find out the answers

A Level Biology A will give you an exciting insight into the contemporary world of biology. It covers the key concepts of biology and practical skills are integrated throughout the course. This combination of academic challenge and practical focus makes the prospect of studying A Level Biology A highly appealing.

You will learn about the core concepts of biology and about the impact of biological research and how it links to everyday life. You will learn to apply your knowledge, investigate and solve problems in a range of contexts.

Key features

• Simple straightforward assessment through examinations
• Based on key concepts in biology
• Opportunities to develop practical skills through a range of experiments and investigations

Please complete all the questions in this booklet, mark them honestly and bring them with you in September. These questions are based on GCSE exam questions and are designed to test your knowledge of the Biology you have studied thus far.
The following are the units that you will study over the two year course, many elements of which, build on your knowledge and understanding from GCSE.

Module 1 – Development of practical skills in biology
Module 2 – Foundations in biology
Module 3 – Exchange and transport
Module 4 – Biodiversity, evolution and disease
Module 5 – Communication, homeostasis and energy
Module 6 – Genetics, evolution and ecosystems

The content you study over the two-year course will be examined as outlined below:

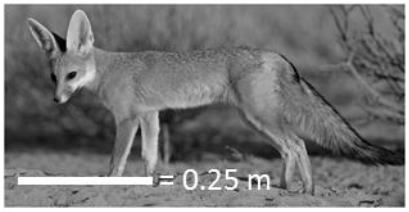
Biological processes: 2 hours 15 minutes 37% of total A level
Biological diversity: 2 hours 15 minutes 37% of total A level
Unified biology: 1 hour 30 minutes 26% of total A level

Good luck and we look forward to seeing you in September!

1. The pictures show four foxes from different parts of the world.

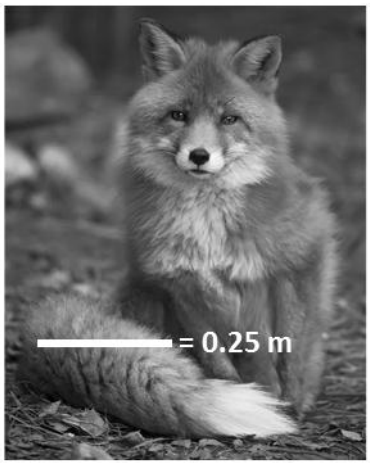
Which fox has the largest surface area:volume ratio?

A

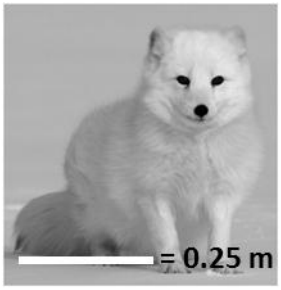


B

C



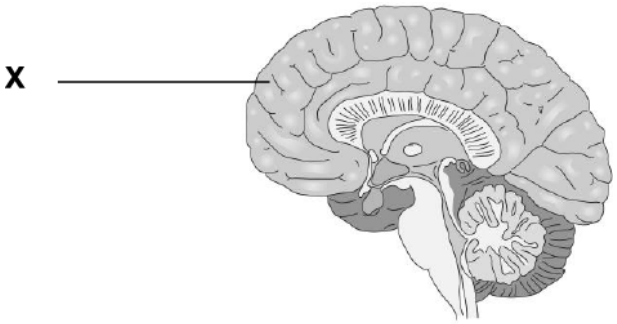
D



Your answer ☐

[1]

2. The diagram shows the brain.
What is the name of part **X**?



A. Cerebellum-
B. cerebrum
C. hypothalamus
D. medulla

Your answer ☐

[1]

3. A student uses a microscope.

The magnification on the eyepiece lens is ×10.

The magnification on the objective lens is ×4.

What is the total magnification?

A. 2.5
B. 6
C. 14
D. 40

Your answer ☐

[1]

4. Which of these hormones is involved in the control of the menstrual cycle?

A. insulin
B. progesterone
C. testosterone
D. auxin

Your answer ☐

[1]

5. What is the process when water goes out of plant leaves into the air?

A. osmosis
B. photosynthesis
C. translocation

D. transpiration

Your answer ☐

[1]

6. What is the word equation for aerobic respiration?

A. carbon dioxide + water → glucose + oxygen
B. glucose + carbon dioxide → oxygen + water
C. glucose + oxygen → carbon dioxide + water
D. oxygen + water → glucose + carbon dioxide

Your answer ☐

[1]

7. What type of reactions are photosynthesis and respiration?

	photosynthesis	**respiration**
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

Your answer ☐

[1]

8. Through which type of cell do plants take in water?

A. guard cell
B. phloem cell
C. root hair cell

D. xylem cell

Your answer ☐

[1]

9. In DNA, which base does A (adenine) pair with?

A. A
B. C
C. G
D. T

Your answer ☐

[1]

10. A boy picks up a hot plate and quickly drops it.

This is a reflex action.

Describe the sequence of events that happens in his nervous system during this reflex action.

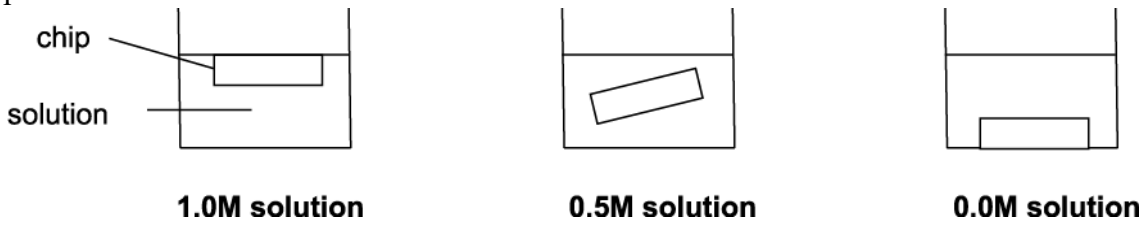
[5]

11. An investigation is done to investigate changes in potatoes placed in different sucrose solutions.

Three chips are cut from a potato.

Each chip is 5.0 cm long.

Each chip is left in a different concentration of sucrose solution for two hours.



These are the results after two hours:

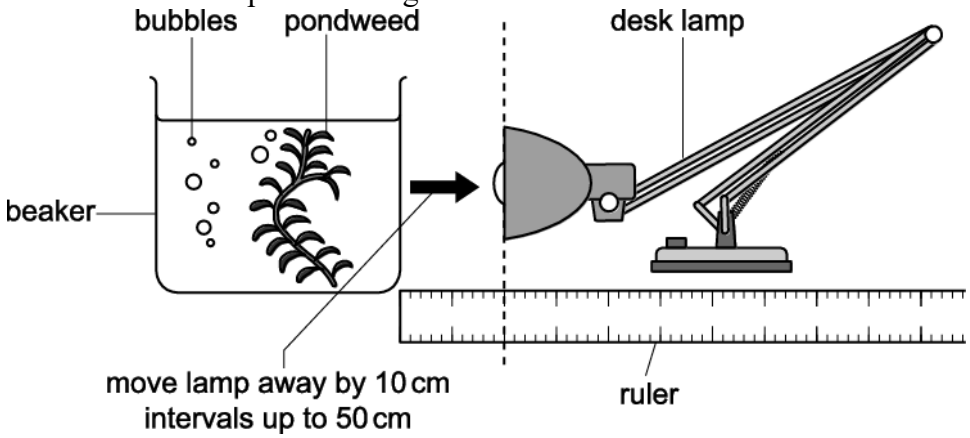
chip in **1.0M solution**	4.5 cm
chip in **0.5M solution**	5.0 cm
chip in **0.0M solution**	5.5 cm

Explain why the chip in the **0.5M solution** stayed the same length.

[2]

12. Puj investigates how light intensity affects the rate of photosynthesis in pondweed.

The diagram shows how he sets up his investigation.



Puj plans to place the lamp at distances 10 cm, 15 cm and 20 cm from the beaker.

Puj plans to measure how much gas the pondweed gives off in 10 seconds.

His teacher says he could improve his plan.

Write down two improvements he could make to his plan.

[2]

13. Oxygen enters red blood cells by diffusion.

Describe and explain how red blood cells are adapted for the efficient uptake and transport of oxygen.

[5]

14(a). A group of students investigate the effect of temperature on the breakdown of the fat in milk by the enzyme lipase.

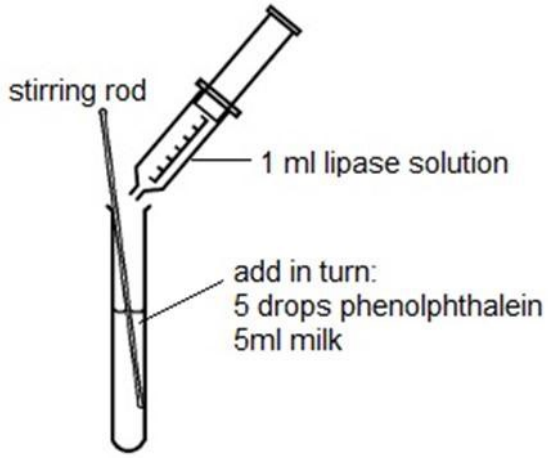
In their investigation they use an indicator called phenolphthalein.

Phenolphthalein is pink in alkali conditions but becomes colourless when the pH falls below pH8.

A student puts 5 drops of phenolphthalein and 5 ml of full fat milk into a test tube.

She adds 1 ml of lipase, stirs the mixture and times how long it takes to lose the pink colour.

Other students repeat this but at different temperatures.



The table shows the group's results.

Temperature (°C)	Time for pink colour to disappear (s)
20	480
40	240
60	270
80	960

Explain why the pH falls when lipase breaks down the fat in milk.

[2]

(b). i. One student says that the results show that the optimum temperature for the lipase is 40 °C.

The teacher says that she **cannot** say for certain that it is 40 °C.

Explain why.

[1]

ii. Give **two** reasons how the students could modify their method to find out the optimum temperature more accurately.

[2]

15. What are the names of the two scientists who first suggested the theory of natural selection?

A. Darwin and Mendel
B. Mendel and Wallace
C. Wallace and Darwin
D. Watson and Crick

Your answer ☐

[1]

16. A sperm cell of a mouse has 20 chromosomes.

Which row in the table shows the correct number of chromosomes in each cell?

	Number of chromosomes in	
	a mouse egg cell	**a mouse eye cell**
A	40	40
B	20	20
C	20	40
D	40	20

Your answer ☐

[1]

17. Probash is ill and is having tests in hospital.

His doctors monitor his body temperature frequently.

Explain why it is important to monitor Probash's body temperature frequently.

[2]

18. One treatment for heart valve problems is to lower the patient's blood pressure.

To lower the blood pressure, a drug can be taken to **increase** the amount of water excreted by the body.

Which organ would be targeted by the drug and what effect would it have on the urine?

organ .....

effect on urine .....

[2]

19. The rock pocket mouse is a small grey coloured mouse that lives in Mexico.

These mice are the main food for owls.

Rattlesnakes also feed on these mice.

The mice get most of their food from grass plants.

Scientists want to construct a pyramid of biomass for this food web.

They first need to estimate how many organisms there are in the area.

They decide to do this using sampling.

i. Describe how the scientists would sample an area and ensure that the sample was not biased

[2]

ii. * To estimate grass cover and the number of animals, they use a quadrat.

Why do scientists use sampling when studying the organisms living in a habitat?

Identify the limitations of this method and potential improvements that could be made to ensure that the estimated population size of plants and animals closely matches the actual value.

[6]

20. In many countries people rely on bananas for food.

Black sigatoka is a disease of banana plants.

It is caused by a fungus.

A type of pesticide called fungicide can be used to kill the fungus.

Scientists are investigating how well the fungicide works.

They also want to see if it works better if they add a chemical called a sticking agent.

This helps the fungicide stick to the banana leaves.

The scientists grow banana plants in four blocks.

The table shows the treatments each block is given.

	treatment	
block	**fungicide**	**sticking agent**
A	✓	✓
B	✓	X
C	X	✓
D	X	X

i. Why did the scientists include the treatments given to block C and block D?

Block C was used so the scientists could

Block D was used so the scientists could

[2]

ii. After a few months the scientists gave the plants in each area a disease rating.
The higher the rating the more disease present.

block	disease rating
A	20
B	35
C	45
D	60

iii. What conclusions could the scientists make from this study?

iv.

v.

vi.

vii.

viii. **[3]**

21. Which does **not** contain DNA?

A. cell membrane
B. chromosome
C. nucleus
D. plasmid

Your answer ☐

[1]

22. Which hormone is used to increase metabolic rate?

A. insulin
B. luteinising hormone
C. testosterone
D. thyroxine

Your answer ☐

[1]

23. Reproduction in humans is controlled by hormones.

FSH is an important hormone in reproduction.

i. Write down the name of the gland that releases FSH.

[1]

ii. FSH stimulates eggs to develop.

This causes the release of oestrogen.

High oestrogen levels then cause less FSH to be released.

Write down the name given to this type of control mechanism.

[1]

24. Mangroves are trees that grow on the coasts of many tropical countries.

Mangroves grow in mud.

The mud is low in oxygen and nutrients.

i. Suggest why the lack of oxygen makes the nutrient content low.

[2]

ii. Some mangroves grow structures from their roots to absorb oxygen from the air for respiration.

Why do mangrove roots need to respire?

[3]

25. Landfill rubbish dumps produce biogas called landfill gas.

Landfill gas is produced by anaerobic bacteria as they break down waste.

The production of landfill gas is affected by temperature.

The rate of gas production is greatest between 35 °C and 50 °C.

Explain why landfill gas production is reduced above and below these temperatures.

[2]

26. Bristlecone pine trees are among the longest living things on Earth.

One of them, called Methuselah, is in California and is over 4 800 years old.

Methuselah

Bristlecone pine trees live high up in the mountains.

The low temperature, dry soil and strong wind make the trees grow very slowly.

This is because these conditions affect both transpiration and photosynthesis.

Explain how and why these conditions affect both transpiration and photosynthesis.

The quality of written communication will be assessed in your answer to this question.

[6]

END OF QUESTION PAPER

Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1			A	1	
			Total	**1**	
2			B	1	
			Total	**1**	
3			D	1	
			Total	**1**	
4			B	1	
			Total	**1**	
5			D	1	
			Total	**1**	
6			C	1	
			Total	**1**	
7			B	1	
			Total	**1**	
8			C	1	
			Total	**1**	
9			D	1	
			Total	**1**	
10			detected by receptors in skin (1)	1	To gain marks these need to be in correct sequence
			impulse sent along sensory neurone (1)	1	
			to spinal cord / CNS (1)	1	
			impulse sent along motor neurone (1)	1	**ignore** brain
			to (hand / arm) muscles / effectors (1)	1	
			Total	**5**	
11			(potato has) same water potential / water concentration (as solution) (1)	1	
			no (net) water loss or gain (1)	1	
			Total	**2**	

12			do more repeats / more distances / greater range of distances (1) longer than 10 seconds (1)	1 1	**allow** specific values if they match the marking points **ignore** simply do more measurements
			Total	**2**	
13			small size (1) ● to travel through capillaries (1) ● to get in to small vessels / capillaries (1) biconcave disc shape (1) ● large surface area : volume (1) haemoglobin (1) ● to carry oxygen (1) lack of nucleus (1) (so) more room (for haemoglobin) (1)	5	can only gain explanation marks (bullet points) if correctly linked to a feature max 4 marks if only given features without explanations
			Total	**5**	
14	a		produces acids (1) but produces fatty acids (2)	2	
	b	i	(optimum) could be either side of 40 °C / could be anywhere between 40 °C and 60 °C (1)	1	
		ii ii	Do more repeats (1) Idea of narrower intervals around 40 °C (1)	2	 **allow** 30–50 °C
			Total	**5**	
15			C	1	
			Total	**1**	
16			C	1	
			Total	**1**	
17			idea that it is a sign of the extent of the disease (1) temperatures far away from normal can be dangerous (1)	1 1	
			Total	**2**	
18			kidney (1) higher volume / less concentrated (1)	1 1	
			Total	**2**	
19		i i	set out a grid / sample area (1) use random sampling within that area (1)	1 1	
		ii	* Please refer to the marking instruction point 10 for guidance on how to mark this question.	6	**AO3.3b: Analyse the information to develop the techniques to improve the sampling techniques**

			Level 3 **(5–6 marks)** **Explains improved animal sampling techniques.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2** **(3–4 marks)** **Explains advantages of plants being sedentary along with the limitations of animal sampling using a quadrat.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1** **(1–2 marks)** **Provides a basic description of why sampling has to be used and use of or the limitations of the quadrat.** *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** *No response or no response worthy of credit.*		• use of capture / recapture • use of pitfall traps • use of pooters • plants are sedentary so will not move and as such are easy to count • animals can move away / frightened away • risk of counting animal more than once • missing some animals e.g. burrowing **and** • further limitations of these methods **AO1.2: Demonstrate knowledge of sampling techniques and why sampling is carried out** • a basic description of use of capture / recapture pitfall traps and pooters • gives a basic description as to why sampling techniques are used • the habitat is often too large to count everything • saves time / would take too long otherwise
			Total	**8**	
20		i	Block C was used so the scientists could see if the sticking agent alone killed the fungus (1)	1	
		i	Block D was used so the scientists could compare the action of the other treatments with no treatment / as a control (1)	1	
		ii	fungicide and sticking agent were the best at killing fungus (1)	1	
		ii	fungicide on its own still killed the fungus (but less than with sticking agent) (1)	1	
		ii	sticking agent does kill the fungus (but less than fungicide) (1)	1	
			Total	**5**	
21			A	1	
			Total	**1**	
22			D	1	
			Total	**1**	
23		i	pituitary (1)	1	**allow** phonetic spelling **Examiner's Comments** Over half the candidates knew that FSH is released by the pituitary, although the spellings of that were very variable. Answers were credited if they were phonetically correct. The common error was ovary.
		ii	negative feedback (1)	1	**ignore** homeostasis **Examiner's Comments** Just less than half the candidates could name negative feedback. The common incorrect answer was menstrual cycle.

			Total	**2**	
24		i	(lack of oxygen causes) fewer / no (aerobic) bacteria / fungi (1) (therefore) no / slow / less decay (1)	2	**allow** fewer / no decomposers / microorganisms **ignore** germs / viruses **ignore** fewer / no detritivores **allow** no / slow / less breakdown of dead material **allow for additional marking point**: less / no / slower respiration (by bacteria / fungi / decomposers) (1) **allow** reverse arguments **Examiner's Comments** Only about a third of candidates appreciated that low oxygen levels would mean that few decomposers could survive and therefore the rate of decay would be low. Some candidates clearly thought that 'nutrients' were a type of organism that needed oxygen to survive. Some thought that a lack of oxygen would reduce photosynthesis.
		ii	(release) energy (1) to take in minerals / nutrients (1) by active transport / movement against a concentration gradient (1)	3	**ignore** absorb minerals from the air **Examiner's Comments** Less than half the candidates knew that respiration was needed to release energy. Very few were able to link this to the context and explain that the energy would be needed to absorb minerals by active transport. Weaker answers commonly explained that respiration was needed to bring in oxygen, or that respiration was needed for photosynthesis.
			Total	**5**	
25			(above) 50 (°C) or higher temperature kills the bacteria / denatures enzymes (1) (below) 35 (°C) or lower temperature slow down growth / respiration / reproduction (1)	2	**ignore** references to heat expanding the gas **ignore** 'kills enzymes' or 'denature bacteria' **allow** enzymes have less (kinetic) energy so fewer collision (1) **ignore** just 'slows process' or 'less enzyme activity' unqualified **Examiner's Comments** Although many candidates showed some understanding of optimum conditions they failed to provide a complete explanation of why gas production was reduced outside the optimum range. If they answered in terms of enzymes they were required to include ideas about fewer collisions rather than just energy levels. Many still have the misconception that bacteria denature or that enzymes die.
			Total	**2**	
26			**[Level 3]** **Explanation** of why rate of photosynthesis is reduced **AND** **Explanation** of how and why transpiration is affected. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Description** of reduced photosynthesis **AND** **Description** of effects on transpiration. **OR** **Explanation** of why rate of photosynthesis is reduced **OR explanation** of how and why transpiration is affected. Quality of written communication partly impedes communication of the science at this level.	6	**This question is targeted at grades up to A** **Indicative scientific points on explanations may include:** **Explanations of reduced photosynthesis** ● photosynthesis reduced because of fewer collisions ● photosynthesis reduced because reduced enzyme activity ● photosynthesis reduced because high winds cause stomata to close so less carbon dioxide taken in **Explanation of effects on transpiration.** ● transpiration increased because of increased diffusion (gradient) or increased evaporation

			(3 – 4 marks) **[Level 1]** **Description** of reduced photosynthesis **OR** **Description** of effects on transpiration. **OR** **attempts one explanation** without stating if they are increased or decreased Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		• transpiration increased because of decreased humidity • transpiration may be reduced by low temperatures reducing evaporation or diffusion • transpiration decreased as dry soils means there is less water and the guard cells become flaccid **Indicative scientific points on descriptions may include:** **Description of reduced photosynthesis** • lower temperatures or high winds decrease the rate of photosynthesis • high winds close stomata **ignore** effect of dry soil or sunlight on photosynthesis **Description of effects on transpiration.** • high winds increase rate of transpiration • high winds cause stomata to close so less transpiration • dry soils may reduce transpiration • low temperatures can reduce transpiration **allow absolute ideas e.g. no photosynthesis when cold** **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Examiner's Comments** This question discriminated the different levels well, the less able candidates would mention that transpiration and photosynthesis were affected by the different conditions but not actually say that the rates increased or decreased. Only the more able candidates used the correct terminology linked to evaporation from the leaves or enzyme activity. A large proportion of the candidates described the processes of photosynthesis and transpiration without actually linking them to the conditions.
			Total	**6**	

BIOLOGY SUMMER READING LIST 2023

In this reading list you will find a variety of biology related books sorted into various topics. Each book has a short blurb with detail about it.

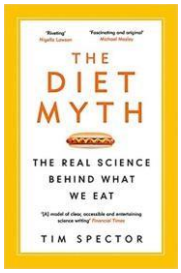
We hope you enjoy reading about biology and that these books inspire you to look beyond your A Level course. They are great to put in your Personal Statement too!

The Biology Department

IF YOU ENJOY LEARNING ABOUT BIOCHEMISTRY, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

The Diet Myth: The real science behind what we eat

Tim Spector



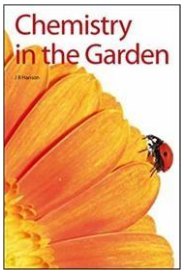
Why do most diets fail? Why does one person eat a certain meal and gain weight, while another eating the same meal loses pounds? Why, despite all the advice about what to eat,

are we all still getting fatter?

The answers are much more surprising - and fascinating - than we've been led to believe. The key to health and weight loss lies not in the latest fad diet, nor even in the simple mantra of 'eat less, exercise more', but in the microbes already inside us.

Chemistry in the Garden

J R Hanson

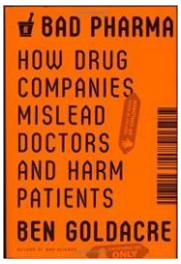


The aim of this book is to describe some aspects of the chemistry and chemical ecology which are found in the garden. In the garden, there are numerous interactions between plants, the soil and with other organisms in which chemistry plays a central mediating role.

The discussion concerns several of the chemically and ecologically interesting compounds that are produced by common ornamental garden plants and vegetables and by the predators that attack them.

Bad Pharma

Ben Goldacre



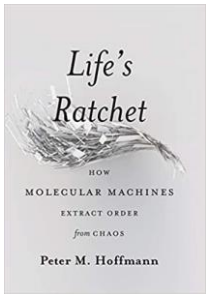
Ben Goldacre shows that the true scale of this murderous disaster in the unregulated

pharmaceutical industry fully reveals itself only when the details are untangled. He believes we should all be able to understand precisely how data manipulation works and how research misconduct in the medical industry affects us on a global scale.

With Goldacre's characteristic flair and a forensic attention to detail, *Bad Pharma* reveals a shockingly broken system and calls for regulation. This is the pharmaceutical industry as it has never been seen before.

Life's Ratchet

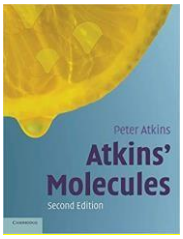
Peter Hoffman



Life, Hoffman argues, emerges from the random motions of atoms filtered through these sophisticated structures of our evolved machinery. Rather than relying on some mysterious life force" to drive them, as people believed for centuries, life harnesses instead the second law of thermodynamics and the disorder of the molecular storm. Grounded in Hoffmann's research, the incredible findings of modern the book reveals own cutting-edge nanotechnology to tell the story of how the noisy world of atoms gives rise to life itself.

Atkins' Molecules

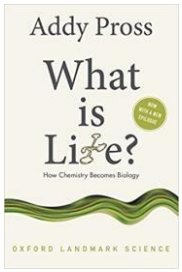
Peter Atkins



Originally published in 2003, this is the second edition of a title that was called 'the most beautiful chemistry book ever written'. In it, we see the molecules responsible for the experiences of our everyday life - including fabrics, drugs, plastics, explosives, detergents, fragrances, tastes, and sex. With engaging prose Peter Atkins gives a non-technical account of an incredible range of aspects of the world around us, showing unexpected connections, and giving an insight into how this amazing world can be understood in terms of the atoms and molecules from which it is built.

What is Life?

Addy Pross

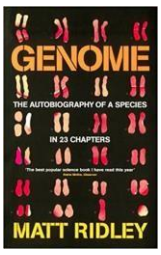


Addy Pross shows how the different kind of stability that operates among replicating molecules results in a tendency for chemical systems to become more complex and acquire the properties of life. Strikingly, he demonstrates that Darwinian evolution is the biological expression of a deeper, well-defined chemical concept: the whole story from replicating molecules to complex life is one continuous process governed by an underlying physical principle. The gulf between biology and the physical sciences is finally becoming bridged.

IF YOU ENJOY LEARNING ABOUT GENETICS, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

Genome

Matt Ridley

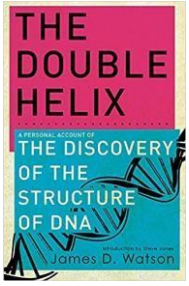


Genome, a book of about 100,000 words, is divided into 23 chapters, a chapter for each chromosome.

By looking at our genes we can see the story of our evolution, what makes us individual, how our sexuality is determined, how we acquire language, why we are vulnerable to certain diseases, how mind has arisen.

The Double Helix

James Watson



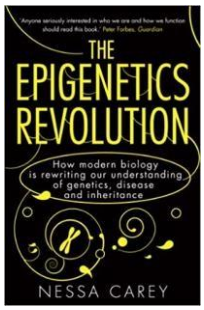
By elucidating the structure of DNA, the molecule underlying all life, Francis Crick and

James Watson revolutionised biochemistry. At the time, Watson was only 24. His uncompromisingly honest account of those heady days lifts the lid on the real world of great scientists, with their very human faults and foibles, their petty rivalries and driving

ambition. Above all, he captures the extraordinary excitement of their desperate efforts to beat their rivals at King's College to the solution to one of the great enigmas of the life sciences.

The Epigenetics Revolution

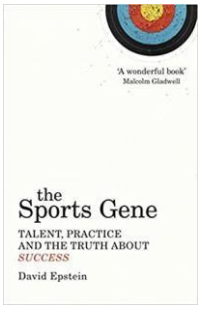
Nessa Carey



At the beginning of this century enormous progress had been made in genetics. The Human Genome Project finished sequencing human DNA. It seemed it was only a matter of time until we had all the answers to the secrets of life on this planet.

The Sports Gene

David Epstein

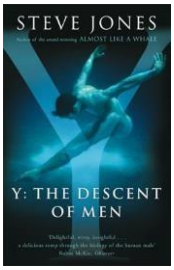


In this ground-breaking and entertaining exploration of athletic success, David Epstein gets to the heart of the great nature vs. nurture debate.

Along the way, Epstein exposes the flaws in **the so-called 10,000-hour rule** that states that rigorous practice from a young age is the only route to success, Shows why some skills that we imagine are innate are not – like the bullet-fast reactions of a baseball player and Uncovers why other characteristics that we assume are entirely voluntary, like the motivation to practice, might in fact have important genetic components.

Y: The Descent of Man

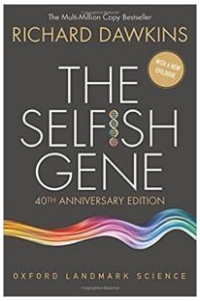
Steve Jones



This book is about science not society; about maleness not manhood. The condition is, in the end, a matter of biology, whatever limits that science may have in explaining the human condition. Today's advances in medicine and in genetics mean at last we understand why men exist and why they are so frequent. We understand from hormones to hydraulics how man's machinery works, why he dies so young and how his brain differs from that of the rest of mankind.

The Selfish Gene

Richard Dawkins

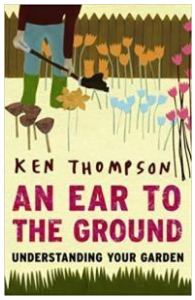


Professor Dawkins articulates a gene's eye view of evolution - a view giving centre stage to these persistent units of information, and in which organisms can be seen as vehicles for their replication. This imaginative, powerful, and stylistically brilliant work not only brought the insights of Neo-Darwinism to a wide audience, but galvanized the biology community, generating much debate and stimulating whole new areas of research. Forty years later, its insights remain as relevant today as on the day it was published.

IF YOU ENJOY LEARNING ABOUT PLANTS OR ECOLOGY, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

An Ear to the Ground: Understanding Your Garden

Ken Thompson



How did plants get to be the way they are? How different would things have been if the

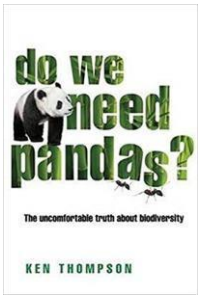
wrong kind of pollinators had got the upper hand? Why are Latin names so complicated, and why Latin anyway? Why is a weed-free lawn an impossibility?

The book shows how a little botanical knowledge can bring not just better results but peace of mind, and that losing sleep over such traditional gardening bogeys as weeds, pests

and pruning is not necessarily the best course.

Do We Need Pandas?

Ken Thompson



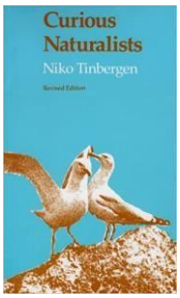
Do We Need Pandas? surveys the Earth's biodiversity, its origins and some of the threats it

currently faces. It then asks how biodiversity loss will affect the human race. Will we even notice, and if we do, what will we notice? It asks what we should be doing to secure the survival not only of the species with which we share the planet, but of ourselves and

whether we need to be more concerned about ecosystems as a whole than about iconic species.

Curious Naturalists

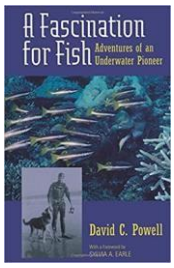
Niko Tinbergen



Readers cannot fail to be struck-and possibly sometimes amused-by the patience and ingenuity shown in the field studies undertaken by Dr Tinbergen and his fellow naturalists- and which are now passed on for the benefit and interest of his readers. The studies were always undertaken seriously, but this did not prevent Dr Tinbergen from writing about them in the liveliest way; he realised that quite often he and his friends must have seemed to onlookers to be very curious naturalists indeed.

A Fascination for Fish

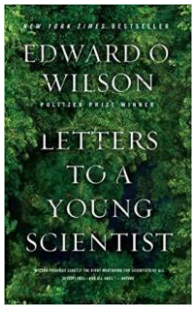
David Powell



This engaging memoir presents one man's lifelong love of the ocean and gives a highly personal, behind-the-scenes look at California's magnificent and innovative aquariums. David Powell tells the story of his life as a pioneering aquarist. From handling great white sharks to transporting delicate fish on bumpy airplanes to night diving for fish in the Indian Ocean, the book describes many of the mind-boggling challenges that make modern aquariums possible and offers an intriguing glimpse beneath the ocean's surface.

Letters to a Young Scientist

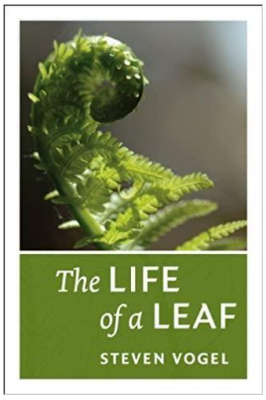
Edward O. Wilson



At a time in human history when our survival is more than ever linked to our understanding of science, Wilson insists that success in the sciences does not depend on mathematical skill, but rather a passion for finding a problem and solving it. From the collapse of stars to the exploration of rain forests and the oceans' depths, Wilson instils a love of the innate creativity of science and a respect for the human being's modest place in the planet's ecosystem in his readers.

The Life of a Leaf

Steven Vogel



In Vogel's account, the leaf serves as a biological everyman, an ordinary and ubiquitous living thing that nonetheless speaks volumes about our environment as well as its own. Thus, in exploring the leaf's world, Vogel simultaneously explores our own.

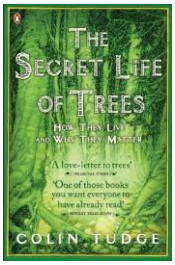
What Nature does for Britain

Tony Juniper

Through vivid first-hand accounts and inspirational examples of how the damage is being repaired, Juniper takes readers on a journey to a different Britain from the one many assume we inhabit, not a country where nature is worthless or an impediment to progress, but the real Britain, the one where we are supported by nature, wildlife and natural systems at almost every turn.

The Secret Life of Trees

Colin Tudge



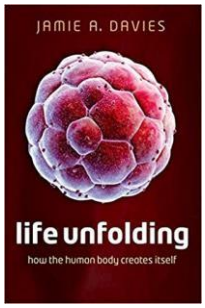
What is a tree? As this celebration of the trees shows, they are our countryside; our ancestors descended from them; they gave us air to breathe. Yet while the stories of trees are as plentiful as leaves in a forest, they are rarely told.

Here, Colin Tudge travels from his own back garden round the world to explore the beauty, variety and ingenuity of trees everywhere: from how they live so long to how they talk to each other and why they came to exist in the first place. Lyrical and evocative, this book will make everyone fall in love with the trees around them.

IF YOU ENJOY LEARNING ABOUT CELLS, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

Life Unfolding

Jamie Davies

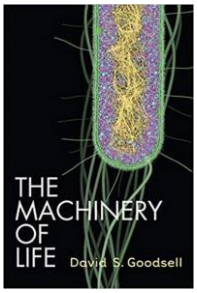


Life Unfolding tells the story of human development from egg to adult, from this perspective, showing how our whole understanding of how we come to be has been transformed in recent years. Highlighting how embryological knowledge is being used to

understand why bodies age and fail, Jamie A. Davies explores the profound and fascinating impacts of our newfound knowledge.

The Machinery of Life

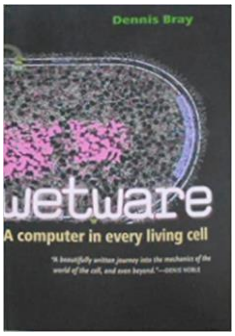
David Goodsell



The book explores the ways in which molecules work in concert to perform the processes of living, and how vitamins, viruses, poisons, and drugs each have their effects on the molecules in our bodies.

Wetware

Dennis Bray

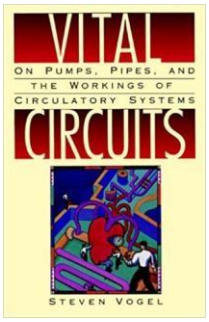


In clear, jargon-free language, Dennis Bray taps the findings of the new discipline of systems biology to show that the internal chemistry of living cells is a form of computation. Cells are built out of molecular circuits that perform logical operations, as electronic devices do, but with unique properties. This book explores these properties in detail.

IF YOU ENJOY LEARNING ABOUT ANATOMY, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

Vital Circuits

Steven Vogel

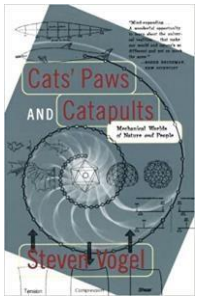


Why does dust collect on the blades of a fan? Why should you wear support hose on a

long airplane flight? Vogel ranges across physics, fluid mechanics, and chemistry to show how an enormous system of pumps and pipes works to keep the human body functioning. Anyone curious about the workings of the body will want to read this book.

Cat's Paws and Catapults

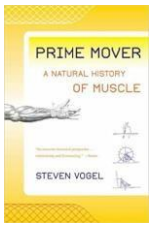
Steven Vogel



Cat's Paws and Catapults is about the ways living things work – and walk, jump, run fly and grow. Inviting the reader into the surprising world of biomechanics, Steven Vogel explains how physical law, size and historical accident work together to determine both natures designs and the things that we make.

Prime Mover

Steven Vogel



Our everyday activities turn on the performance of nature's main engine: we may breathe harder going uphill, but we put more strain on our muscles walking downhill. Those of us who are right-handed can tighten screws and jar lids more forcibly than we can loosen them. Here we're treated to the story of how form and performance make these things happenhow nature does her work.

IF YOU ENJOY LEARNING ABOUT BEHAVIOUR, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

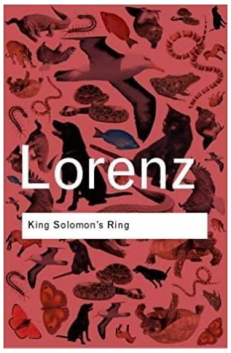
Life at the Extremes: The Science of Survival

Frances Ashcroft

How do people survive the extremes of heat, cold, depth, speed and altitude? In survival the 'logic of life' is crucial – explore answers to many of the problems affecting humans at the extremes.

King Solomon's Ring

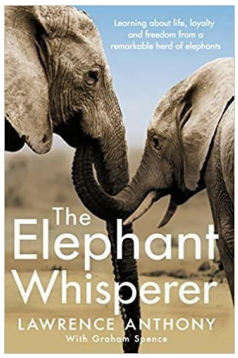
Konrad Lorenz



King Solomon's Ring, the book which brought Lorenz worldwide recognition, is a delightful treasury of observations and insights into the lives of all sorts of creatures, from jackdaws and water-shrews to dogs, cats and even wolves. A must for any animal-lover!

The Elephant Whisperer

Lawrence Anthony



When South African conservationist Lawrence Anthony was asked to accept a herd of

'rogue' elephants on his game reserve in Zululand, his common sense told him to refuse. But he was the herd's last chance of survival – they would be killed if Anthony wouldn't take them in.

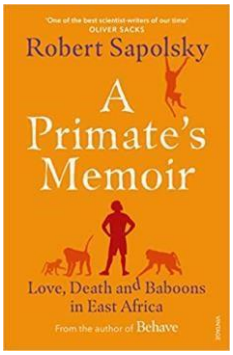
As Anthony risked his life to create a bond with the troubled elephants and persuade them

to stay on his reserve, he came to realize what a special family they were, from the wise matriarch Nana, who guided the herd, to her warrior sister Frankie, always ready to see off

any threat, and their children who fought so hard to survive.

A Primates Memoir

Robert M Sapolsky



Alone in the middle of the Serengeti with no electricity, running water or telephone, and surviving countless scams, culinary atrocities and a surreal kidnapping, Sapolsky becomes

ever more enamoured with his adopted baboon troop.

A uniquely honest window into the coming-of-age of one of our greatest scientific minds

IF YOU ENJOY LEARNING ABOUT DISEASE, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

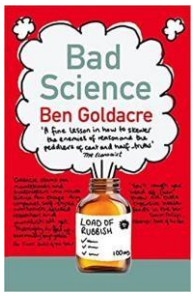
The Immortal Life of Henrietta Lacks

Rebecca Skloot

Rebecca Skloot's fascinating account is the story of the life, and afterlife, of one woman who changed the medical world for ever. Balancing the beauty and drama of scientific discovery with dark questions about who owns the stuff our bodies are made of, *The Immortal Life of Henrietta Lacks* is an extraordinary journey in search of the soul and story of a real woman, whose cells live on today in all four corners of the world.

Bad Science

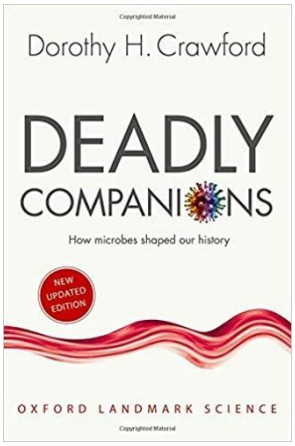
Ben Goldacre



In this eye-opening book he takes on the MMR hoax and misleading cosmetics ads, acupuncture and homeopathy, vitamins and mankind's vexed relationship with all manner of 'toxins'. Along the way, the self-confessed 'Johnny Ball cum Witchfinder General' performs a successful detox on a Barbie doll, sees his dead cat become a certified nutritionist and probes the supposed medical qualifications of 'Dr' Gillian McKeith. Full spleen and satire, Ben Goldacre takes us on a hilarious, invigorating and ultimately alarming journey through the bad science we are fed daily by hacks and quacks.

Deadly Companions

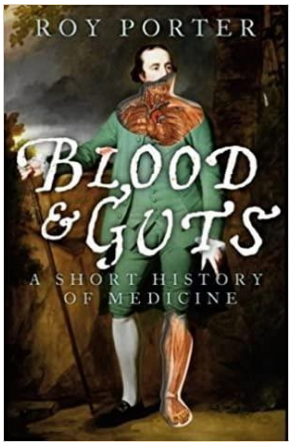
Dorothy H Crawford



Ever since we started huddling together in communities, the story of human history has been inextricably entwined with the story of microbes. They have evolved and spread amongst us, shaping our culture through infection, disease, and pandemic. At the same time, our changing human culture has itself influenced the evolutionary path of microbes. One cannot be truly understood without the other.

Blood and Guts

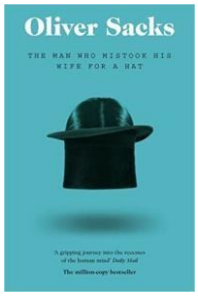
Roy Porter



Mankind's battle to stay alive is the greatest of all subjects. This brief, witty and unusual book by Britain's greatest medical historian compresses into a tiny span a lifetime spent thinking about millennia of human ingenuity in the quest to cheat death. Each chapter sums up one of these battlefields (surgery, doctors, disease, hospitals, laboratories and the human body) in a way that is both frightening and elating.

The Man who Mistook his Wife for a Hat.

Oliver Sacks



These are case studies of people who have lost their memories and with them the greater part of their pasts; who are no longer able to recognize people or common objects; whose limbs have become alien; who are afflicted and yet are gifted with uncanny artistic or mathematical talents. In Dr Sacks's splendid and sympathetic telling, each tale is a unique and deeply human study of life struggling against incredible adversity.

IF YOU ENJOY LEARNING ABOUT THE HUMAN BODY, HERE'S SOME BOOKS YOU MAY BE INTERESTED IN…

The Spark of Life

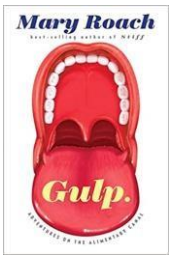
Frances Ashcroft

From before birth to the last breath we draw, from consciousness to sexual attraction, fighting infection to the beating of our hearts, electricity is essential to everything we think

and do. In *The Spark of Life* award-winning physiologist Frances Ashcroft reveals the secrets of ion channels, which produce the electrical signals in our cells. Can someone really die of fright? How do cocaine, LSD and morphine work? Why do chilli peppers taste hot? Ashcroft explains all this and more with wit and clarity. Anyone who has ever wondered about what makes us human will find this book a revelation.

Gulp – Adventures on the Alimentary Canal

Mary Roach



In Gulp we meet scientists who tackle the questions no one else thinks of or has the courage to ask. We go on location to a pet-food taste-test lab, a fecal transplant, and into a live stomach to observe the fate of a meal. With Roach at our side, we travel the world,

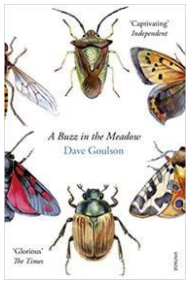
meeting murderers and mad scientists, Eskimos and exorcists (who have occasionally administered holy water rectally), rabbis and terrorists who, it turns out, for practical reasons do not conceal bombs in their digestive tracts. Like all of Roach's books, Gulp is as

much about human beings as it is about human bodies."

IF YOU ENJOY LEARNING ABOUT INSECTS, HERE ARE SOME BOOKS YOU MAY BE INTERESTED IN…

A Buzz in the Meadow

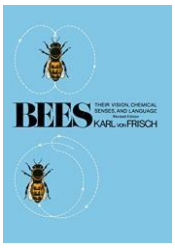
Dave Goulson



In this book you will learn how a deathwatch beetle finds its mate, about the importance of houseflies, why butterflies have spots on their wings, about dragonfly sex, bed-bugs and wasps. But it is also a wake-up call, urging us to cherish and protect life on earth in all its forms. *A Buzz in the Meadow* is a captivating look at our natural world and a call to arms for nature-lovers everywhere.

Bees

Karl von Frisch



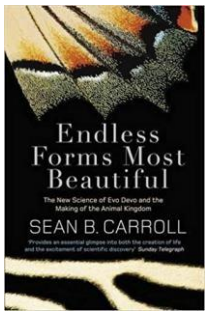
Over half a century of brilliant scientific detective work, the Nobel Prize-winning biologist Karl von Frisch learned how the world, looks, smells, and tastes to a bee. More significantly, he discovered their dance language and their ability to use the sun as a compass. Intended to serve as an accessible introduction to one of the most fascinating areas of biology, Bees (first published in 1950 and revised in 1971), reported the startling results of his ingenious and revolutionary experiments with honeybees – which continues to amaze and inspire today.

IF YOU ENJOY LEARNING ABOUT EVOLUTION, HERE'S SOME BOOKS YOU MAY

BE INTERESTED IN…

Endless Forms Most Beautiful

Sean Carroll

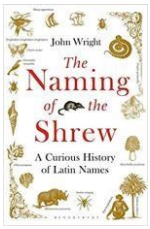


By looking at how a single-celled egg gives rise to a complex, multi-billion celled animal, Evo Devo is illuminating exactly how new species butterflies and zebras, trilobites and dinosaurs, apes and humans are made and evolved. The key, it turns out, is all about location and timing... For anyone who has ever pondered 'where did I come from', Endless

Forms Most Beautiful explores our history, both the journey we have all made from egg to adult, and the long trek from the origin of life to the very recent origin of our species.

The Naming of the Shrew

John Wright



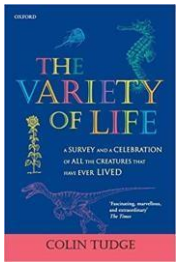
Why on earth has the entirely land-loving Eastern Mole been named *Scalopus aquaticus*, or the Oxford Ragwort been called *Senecio squalidus* - 'dirty old man'? What were naturalists

thinking when they called a beetle *Agra katewinsletae*, a genus of fish *Batman*, and a Trilobite *Han solo*? Why is zoology replete with names such as *Chloris chloris chloris* (the greenfinch), and *Gorilla gorilla gorilla* (a species of, well gorilla)?

This book will unveil these mysteries, exploring the history, celebrating their poetic nature and revealing how naturalists sometimes get things so terribly wrong.

The Variety of Life

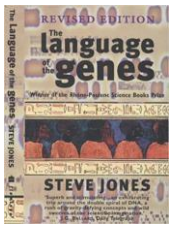
Colin Tudge



The Variety of Life explains the means by which systematists have attempted such a mammoth classification of so many various creatures - which in turn leads us into some of the most intriguing and knottiest areas of modern biology: evolutionary theory, molecular genetics, and the history of biological thought. Finally, however it can simply be seen as a celebration. We should all share Miranda's pleasure in Shakespeare's Tempest - 'How many goodly creatures are there here!' - and feel, as she did, what a privilege it is to share this planet with such wonders.

The Language of Genes

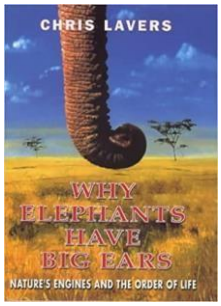
Steve Jones



Sensitive to the social issues raised by genetics… yet Jones's interest reaches beyond contemporary social issues to the human past, to what genetics can and cannot tell us about our evolution and patterns of social development. He interleaves a broad knowledge of biology with considerations of cultural, demographic and - as his title indicates - linguistic history. At once instructive and captivating.

Why Elephants have Big Ears

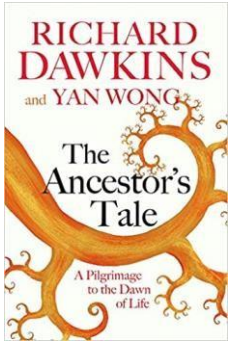
Chris Lavers



Why do elephants have big ears? Why do shrews have large hearts? Why don't gnats get wet when it rains? And why are there no snake-shaped mammals? Chris Lavers explores how the process of evolution has led creatures to have the forms they have today.

The Ancestors Tale

RichardDawkins



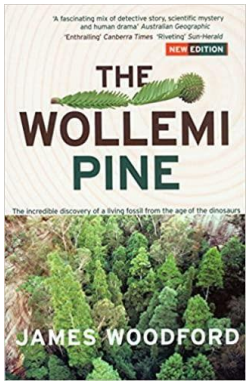
Written with unparalleled wit, clarity and intelligence; taking in new scientific discoveries of the past decade; and

including new 'tales', illustrations and fractal diagrams, The Ancestors Tale shows us how remarkable we are, how

astonishing our history, and how intimate our relationship with the rest of the living world.

The Wollemi Pine

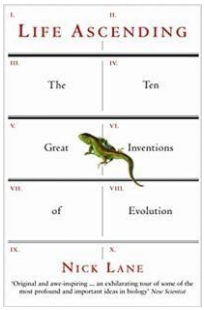
James Woodford



An enthralling detective story about evolution and natural history, and the botanical find of the century: the freak survival of a species that offers a window on to an ecosystem one hundred million years old. The discovery has been described as "the equivalent of finding a small dinosaur still alive on Earth."

Life Ascending: The 10 Great Inventions of Evolution

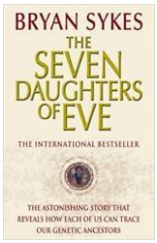
Nick Lane



Powerful new research methods are providing fresh and vivid insights into the makeup of life. Comparing gene sequences, examining the atomic structure of proteins and looking into the geochemistry of rocks have all helped to explain creation and evolution in more detail than ever before. Nick Lane uses the full extent of this new knowledge to describe the ten greatest inventions of life, based on their historical impact, role in living organisms today and relevance to current controversies. DNA, sex, sight and consciousnesses are just four examples.

The Seven Daughters of Eve

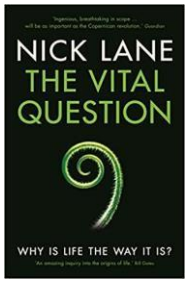
Brian Sykes



In this remarkable scientific adventure story we learn exactly how our origins can be traced, how and where our ancient genetic ancestors lived, what their live were like and how we are each living proof of the almost miraculous strength of our DNA which has survived and prospered over so many thousands of years to reach us today. It is a book that not only presents the story of our evolution in a wholly new light, but also strikes right at the heart of ourselves as individuals and of our sense of identity.

The Vital Question

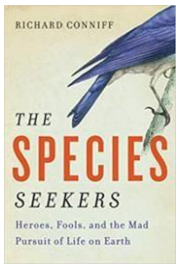
Nick Lane



In *The Vital Question*, Nick Lane radically reframes evolutionary history, putting forward a cogent solution to conundrums that have troubled scientists for decades. The answer, he argues, lies in energy: how all life on Earth lives off a voltage with the strength of a bolt of lightning. In unravelling these scientific enigmas, making sense of life's quirks, Lane's explanation provides a solution to life's vital questions: why are we as we are, and why are we here at all?

The Species Seekers

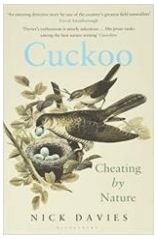
Richard Conniff



Alongside the species seekers' globespanning tales of adventure, he recounts some of the most dramatic shifts in the history of human thought. At the start, everyone accepted that the Earth had been created for our benefit. People weren't sure where vegetable ended and animal began, they couldn't classify species and didn't understand the causes of disease. But all that changed as the species seekers introduced us to the pantheon of life on Earth - and our place within it.

Cuckoo: Cheating by Nature

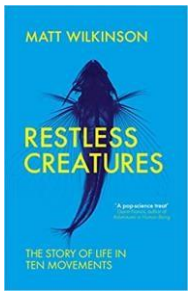
Nick Davies



Beloved as a herald of spring, cuckoos have held a place in our hearts for centuries. But for many other birds the cuckoo is a signal of doom, for it is nature's most notorious cheat. In this enormously engaging book, naturalist and scientist Nick Davies reveals how cuckoos deceive other species, uncovering an evolutionary race between cuckoos and the hosts. *Cuckoo* offers a new insight not only into the secret lives of these extraordinary birds, but also how cheating evolves and thrives in the natural world.

Restless Creatures

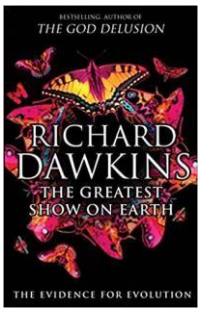
Matt Wilkinson



Evolutionary biologist Matt Wilkinson traces this 4-billion-year history, showing why our ancestors became two-legged, how movement explains why we have opposable thumbs and a backbone, how fish fins became limbs, how even trees are locomotion-obsessed, and how movement has shaped our minds as well as our bodies. He explains why there are no flying monkeys or biological wheels, how dinosaurs took to the air, how Mexican waves were the making of the animal kingdom, and why moving can make us feel good.

The Greatest Show on Earth

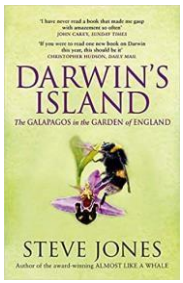
Richard Dawkins



Richard Dawkins takes on creationists, including followers of 'Intelligent Design' and all those who question the fact of evolution through natural selection. Like a detective arriving on the scene of a crime, he sifts through fascinating layers of scientific facts and disciplines to build a cast-iron case: from the living examples of natural selection in birds and insects; the 'time clocks' of trees and radioactive dating that calibrate a timescale for evolution; the fossil record and the traces of our earliest ancestors; to confirmation from molecular biology and genetics.

Darwin's Island

Steve Jones



Darwin spent forty years working on the plants, animals and people of his native land and wrote over six million words on topics as different as dogs, insect-eating plants, orchids, earthworms, apes and human emotion. Together they laid the foundations of modern biology.

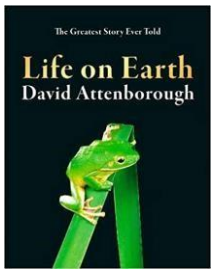
In this beautifully written, witty and illuminating book, Steve Jones explores the domestic

Darwin, tracing the great naturalist's journey across Britain: a voyage not of the body, but of the mind.

NO BIOLOGY BOOK LIST WOULD BE COMPLETE WITHOUT A CERTAIN SIR DAVID ATTENBOROUGH. HERE ARE SOME OF HIS CLASSICS…

Life on Earth

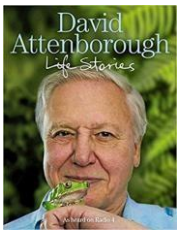
David Attenborough



Told through an examination of animal and plant life, this is an astonishing celebration of the evolution of life on earth, with a cast of characters drawn from the whole range of organisms that have ever lived on this planet. Attenborough's perceptive, dynamic approach to the evolution of millions of species of living organisms takes the reader on an unforgettable journey of discovery from the very first spark of life to the blue and green wonder we know today.

Life Stories

David Attenborough

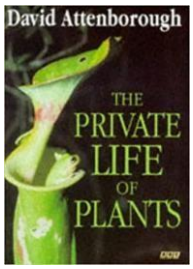


The complete BBC Radio 4 series featuring all 20 episodes about some of the strangest plants and creatures from around the world.

One of the nation's most popular presenters examines 20 marvels of the natural world from his extraordinary and pioneering experiences.

The Private Life of Plants

David Attenborough



Accompanying a David Attenborough series on BBC Television, and with the aid of time-lapse photography, this book reveals hidden events and phenomena of plant-life throughout the world.

Some clips of the series are available here: https://www.youtube.com/channel/UCiMGyK3AXy97VW_fple7RoQ

Plus some more recommendations for those interested in a career in Medicine:

Spillover by David Quammen
Lab Girl by Hope Jahren
Gut by Giulia Enders
The Immortal Life of Henritta Lacks by Rebecca Skloot
Behave by Robert Sapolsky
Written in the Bone by Sue Black
Unnatural Causes by Richard Shepherd
War Doctor by David Nott
Being Mortal by Atul Gawande