

# 1. Names and dates in modern science

So you wanted some names after all? Well, here are a few, with their best-known accomplishments, in chronological order.

1543	Nicolaus Copernicus (Germany) proposes heliocentric theory of universe (just before his death, so avoiding the church's (f)ire)
c. 1570-1600	Tycho Brahe (Denmark) makes astronomical measurements which will be used by his assistant, Johannes Kepler.
1605	Johannes Kepler (Germany) shows that planets move around the Sun in elliptical orbits
1609	Galileo Galilei (Italy) observes moons of Jupiter, studied law of motion
1665	Robert Hooke (England) coins the term "cell"
c. 1670	Antonie Philips van Leeuwenhoek (Netherlands) first observes microorganisms with his handcrafted microscope
1687	Isaac Newton (England) publishes Principia Mathematica, containing his laws of motion and the law of universal gravitation
1735	Carl Linnaeus (Sweden) publishes <i>Systema naturae</i> , founding the science of taxonomy.
1785	James Hutton (Scotland) proposes geological cycles
1791	Luigi Galvani (Italy) discovers bioelectricity
1824	Nicolas Léonard Sadi Carnot (France) founds the science of thermodynamics with his studies on heat engines
1839	Theodor Schwann (Germany) states the cell theory, that all living things are composed of cells.
1859	Charles Darwin (England) publishes "On the origin of species", proposing evolution by natural selection
1861	James Clark Maxwell (Scotland) publishes the equations of electromagnetism; later, shows that electric and magnetic fields travel through space as electromagnetic waves
1865	Gregor Mendel (Moravia) presents first paper on rules of heredity.
c, 1890	Santiago Ramón y Cajal (Spain) discovers definitive evidence for neuron theory, that the brain is made up of discrete neurons, and explains their form and function.
c. 1890	Ludwig Boltzmann (Austria) shows statistical significance of entropy
1896	Henri Becquerel (France) discovers radioactivity

1905	Albert Einstein (Germany) publishes papers on photoelectric effect (which would give rise to quantum mechanics) and special relativity; in 1915, theory of gravity (general relativity)
1912	Alfred Wegener (Germany) publishes theory of continental drift; it would be accepted only in the 1960s as the theory of plate tectonics
1924	Wolfgang Ernst Pauli (Austria) publishes the exclusion principle, stating that no two electrons can occupy the same quantum state; would become the basis of solid-state physics and transistors.
1926	Erwin Schrödinger (Austria) publishes the wave equation, the central equation of quantum mechanics
1927	Werner Heisenberg (Germany) publishes the uncertainty principle of quantum mechanics
1953	Francis Crick (Great Britain) and James Watson (USA) use Rosalind Franklin's x-ray diffraction photos to understand the structure of DNA
1964	Arnold Penzias and Robert Wilson (USA) discover cosmic background radiation
1979	Alan Guth (USA) develops idea of cosmic inflation

Since those times, science has become bigger and more expensive, so single names do not stand out so much any more. For instance, the discovery of the Higgs boson at CERN in 2012 involved thousands of people, far too many to include in this table – or on the list of Nobel Prize winners (which is limited to three living people)!

## 2. Cheat sheet

Geological Time Scale (Mya = million years ago)

	Eon	Era	Period	Epoch	Mya	
Phanerozoic		Cenozoic (mammals)	Quaternary		Holocene	0.01
					Pleistocene	
			Tertiary	Neogene	Pliocene	1.8
					Miocene	5.3
				Paleogene	Oligocene	23
					Eocene	35
					Paleocene	55
		Mesozoic (dinosaurs)	Cretaceous (S. America, Africa)			65.5
			Jurassic (Alps/Himalaya)			146
			Triassic (Pangea)			200
		Paleozoic (invertebrates)	Permian			251
			Carboniferous	Pennsylvanian		299
				Mississippian		320
			Devonian (fish)			359
Silurian				416		
Ordovician				444		
Cambrian (Pannotia, Rodinia)				488		
Pre-cambrian	Proterozoic (O <sub>2</sub> -rich atmosphere)	Ediacaran			542	
					635	
	Archean (appearance of life)			2500		
	Hadean			3800		
					4700	

Figure 2.1: Geological time scale, by author.

Red lines are mass extinctions, past or to come...

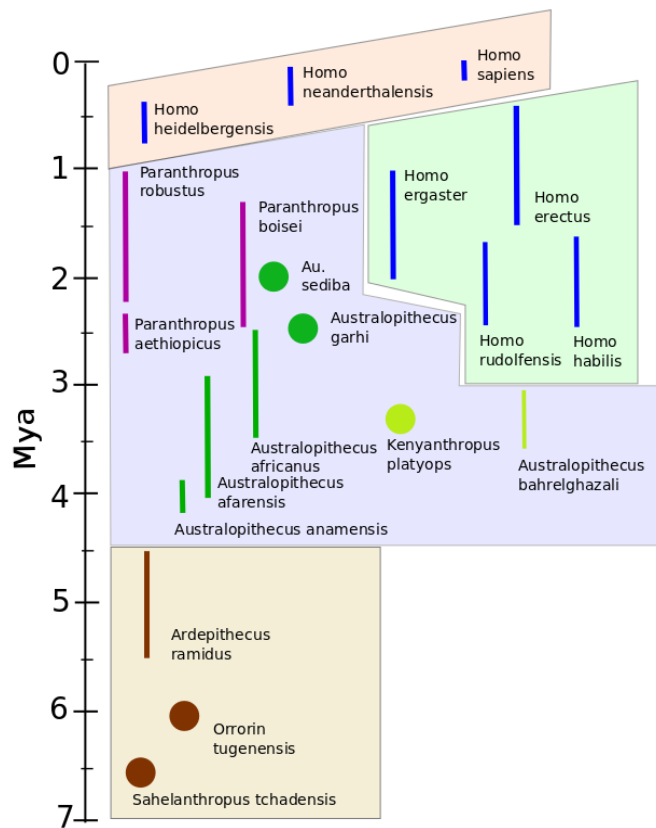


Figure 2.2: Timeline and grouping of principal fossil hominid species (by author)

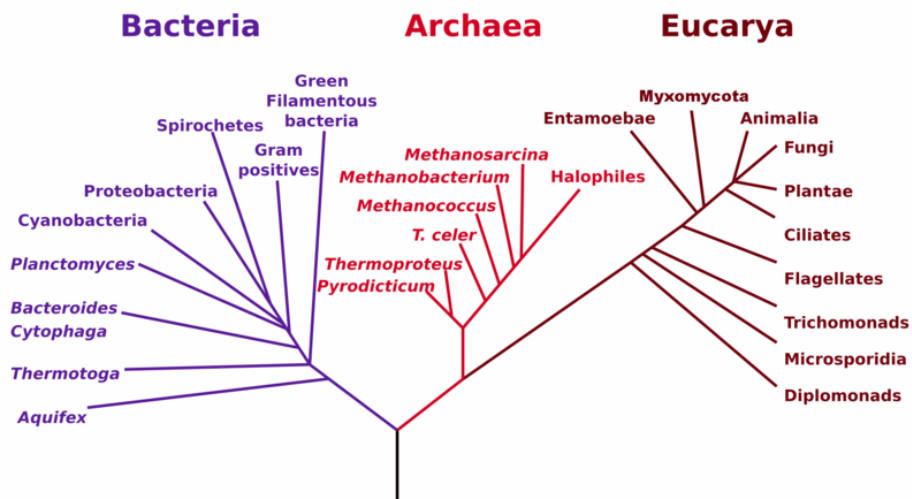


Figure 2.3: Phylogenetic tree by MPF [Public Domain], via Wikimedia Commons<sup>1</sup>.

<sup>1</sup> <https://commons.wikimedia.org/wiki/File%3APhylogeneticTree.png>

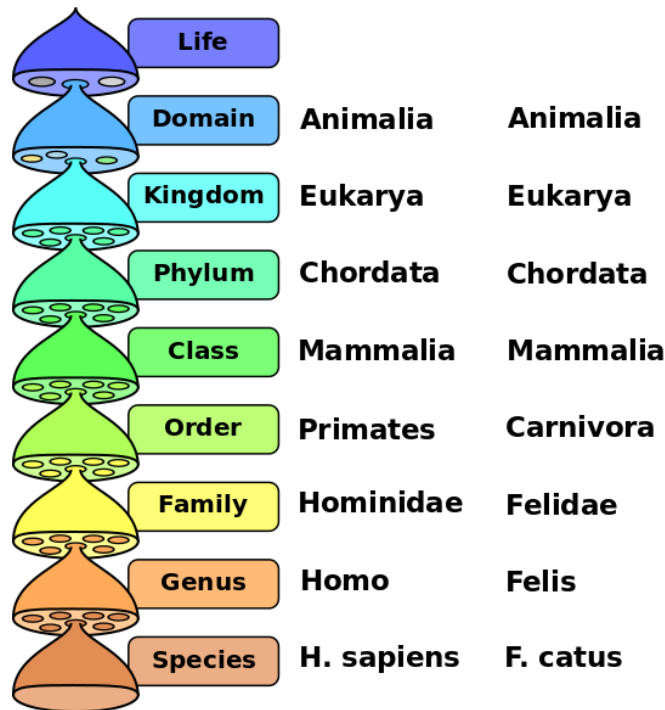


Figure 2.4: Classification of modern humans and house cats, after Wikipedia<sup>2</sup>

Group→	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
↓Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	*	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	**	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo
			*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
			**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Figure 2.5: The periodic table of the elements, from Wikimedia Commons<sup>3</sup>

2 [https://commons.wikimedia.org/wiki/File:Biological\\_classification\\_L\\_Pengo\\_vflip.svg](https://commons.wikimedia.org/wiki/File:Biological_classification_L_Pengo_vflip.svg)

3 [https://commons.wikimedia.org/wiki/File:14LaAc\\_periodic\\_table\\_1lb.jpg](https://commons.wikimedia.org/wiki/File:14LaAc_periodic_table_1lb.jpg)

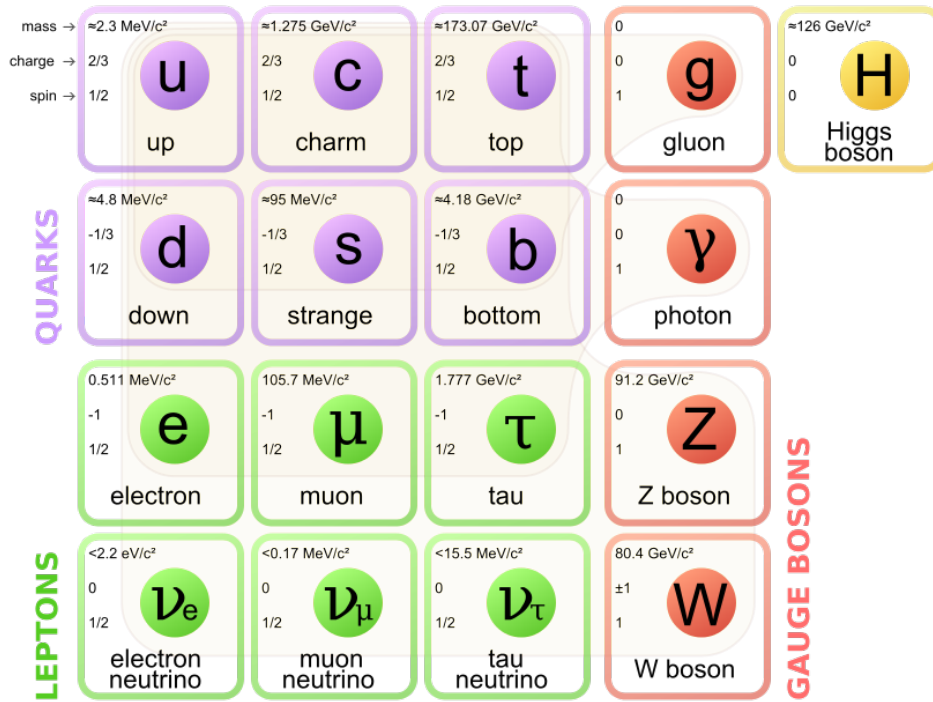


Figure 2.6: Standard model particle zoo, from Wikimedia Commons<sup>4</sup>

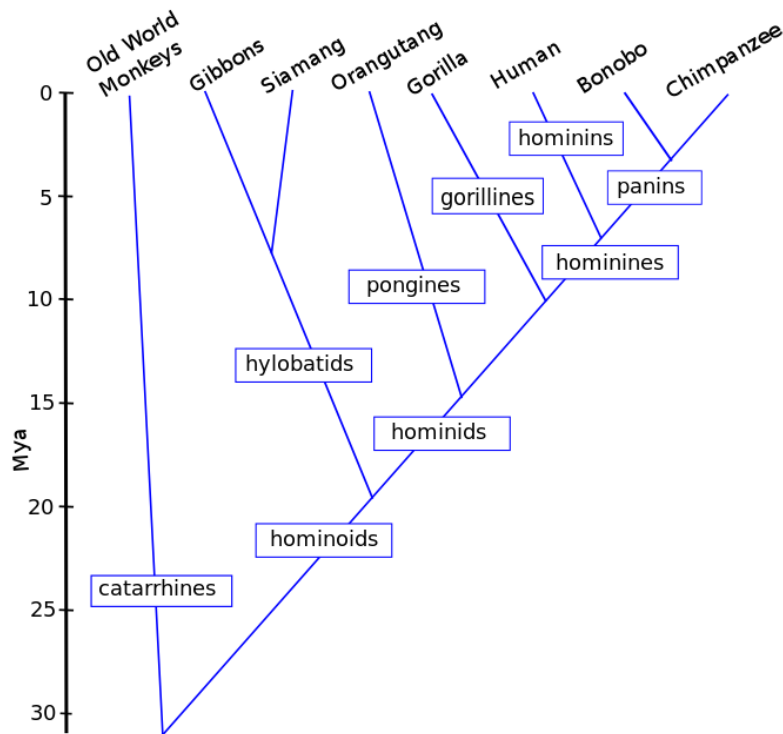


Figure 2.7: Hominoid families with dates, by author.

<sup>4</sup> [https://commons.wikimedia.org/wiki/File:Standard\\_Model\\_of\\_Elementary\\_Particles.svg](https://commons.wikimedia.org/wiki/File:Standard_Model_of_Elementary_Particles.svg)

## 3. Bibliography

### 3.1. Basic modern physics (including quantum theory and relativity)

Atkins, Peter, *The laws of thermodynamics: A very short introduction*. Oxford: Oxford University Press, 2010. Print.

Callan, Herbert B. *Thermodynamics and an introduction to thermostatistics*. New York: John Wiley and Sons, 1985, 2005. Print.

Feynman, Richard P. *Six Easy Pieces: Essentials of physics explained by its most brilliant teacher*. Cambridge, MA: Perseus Books, 1995. Print.

Feynman, Richard Phillips. *Six Not-so-easy Pieces: Einstein's Relativity, Symmetry, and Space-time*. London: Penguin, 1999. Print.

Kumar, Manjitt. *Quantum: Einstein, Bohr and the great debate about the nature of reality*. London: Icon Books Ltd, 2009. Print.

Neffe, Jurgen. *Einstein: A Biography*. New York: Farrar, Straus, and Giroux, 2007. Print.

Seife, Charles. *Decoding the universe: How the new science of information is explaining everything in the cosmos, from our brains to black holes*. New York: Penguin, 2006. Print.

Shankar, R. *Fundamentals of Physics. Mechanics, Relativity, and Thermodynamics*. New Haven: Yale UP, 2014. Print.

Stannard, Russell. *Relativity: A very short introduction*. Oxford: Oxford University Press, 2010. Print.

Susskind, Leonard and Friedman, Art. *Quantum mechanics, the theoretical minimum*. New York: Basic Books, 2014. Print.

Susskind, Leonard and Hrabovsky, George. *The theoretical minimum: What you need to know to start doing physics*. New York: Basic Books, 2013. Print.

Von Baeyer, Hans Christian. *Warmth disperses and time passes: The history of heat*. New York: Modern Library Paperbacks, 1999. Print.

### 3.2. Cosmology

Carroll, Sean. *From eternity to here: The quest for the ultimate theory of time*. New York: Plume, 2010. Print.

Carroll, Sean. *The big picture: On the origins of life, meaning and the universe itself*. New York: Dutton, 2016. Print.

Carroll, Sean M. *The Particle at the End of the Universe: How the Hunt for the Higgs Boson Leads Us to the Edge of a New World*. London: Oneworld, 2012. Print.

Chandra X-ray Observatory, web site, <http://chandra.harvard.edu/index.html>.

Coles, Peter. *Cosmology: A Very Short Introduction*. Oxford: Oxford University Press, 2001. Print.

De Palma, Christopher. *Astro 801*, on-line course from Pennsylvania State University. <https://www.e-education.psu.edu/astro801/>

Goldberg, Dave and Blomquist, Jeff. *A user's guide to the universe: Surviving the perils of black holes, time paradoxes, and quantum uncertainty*. Hoboken: John Wiley & Sons, Inc., 2010. Print.

Greene, Brian. *The fabric of the cosmos: Space, time, and the texture of reality*. New York: Vintage Books, 2005. Print.

Greene, B. *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos*. New York: Vintage, 2011. Print.

Guth, Alan. *The inflationary universe: The quest for a new theory of cosmic origins*. New York: Basic Books, 1997. Print.

Kirshner, Robert P. *The extravagant universe: Exploding stars, dark energy, and the accelerating cosmos*. Princeton: Princeton University Press, 2002. Print.

Krauss, Lawrence M. *A universe from nothing: Why there is something rather than nothing*. London: Simon and Schuster, 2012. Print.

Larson, Richard B. and Bromm, Volker. *The first stars in the universe*. Scientific American, 2004 (update from December 2001 issue).

Rothery, David A. *Planets: A very short introduction*. Oxford: Oxford University Press, 2008. Print.

Tegmark, Max. *Our Mathematical Universe: My Quest for the Ultimate Nature of Reality*. London: Penguin, 2014. Print.

Wilkinson Microwave Anisotropy Probe, "Universe 101: Big Bang Theory". National Aeronautics and Space Administration. Online at <http://map.gsfc.nasa.gov/cosmology/cosmology.html>.

### 3.3. Geology

There are geology books, e.g., those by Spooner or McDougall, which are excellent introductions to physical and historical geology. Benton's book is more recent than McDougall's, but it is shorter and so denser and less easy to follow, although filled with interesting information. Then there are the books of Richard Fortey. Fortey's books are not textbooks and, in this writer's opinion, not good for learning the subject. But they are simply wonderful field trips. Yes, trips. Fortey has a way of describing a tour of, say, the 250-Mya supercontinent Pangea or of the Cretaceous Era as if you were actually wandering around it with Fortey as guide and companion. He does the same for current environments, like the area around Vesuvius. It is very human, a combination of field trip and tour guide and not to be missed.

The USGS web site is a mine of information for amateur geologists. The article "This dynamic earth" is an excellent explanation of plate tectonics, explained clearly with very good illustrations.

For a general history of earth and life on it, McDougall's book is excellent, including geology, climate and the origins of life and its subsequent evolution. But Emiliani's book is extraordinary. Ostensibly an earth-science book, it starts with atomic physics, cosmology, chemistry and works its way through geology and paleontology. He is not afraid of using some mathematics and the result is almost like reading a novel. An excellent book. Too bad Emiliani died shortly after the book's publication in 1992, but it is still quite useful.

Benton, Michael J. *The history of life: A very short introduction*. Oxford: Oxford University Press, 2008. Print.

Bonewitz, Ronald Louis. *Rocks and Minerals: The definitive visual guide*. London: DK, 2012. Print.

Emiliani, Cesare. *Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment*. Cambridge: Cambridge UP, 1992. Print.

Fortey, Richard A. *Earth: An Intimate History*. New York: Vintage, 2005. Print.

Fortey, Richard. *Fossils: The key to the past*. London: Natural History Museum. 1982. Print.

Fortey, Richard. *Life: An unauthorised Biography*. London: Flamingo. 1998. Print.

Kious, W, Jacquelyne and Tilling, Robert I. *This dynamic earth: The story of plate tectonics*. Washington: USGS, 2012. Online at <http://pubs.usgs.gov/gip/dynamic/dynamic.html>.

McDougall, J. D. *A short history of planet earth: Mountain, mammals, fire, and ice*. New York: John Wiley and Sons, Inc., 1998. Print.

Marshak, Stephen. *Earth: Portrait of a Planet*, 4th Ed. New York: Norton, 2012. Print.

Redfern, Martin. *The earth: A very short introduction*. Oxford: Oxford University Press, 2003. Print.

Spooner, Alecia M. *Geology for dummies*. Hoboken: John Wiley & Sons, Inc., 2011. Print.

[Various authors]. U. S. Geological Survey. [www.usgs.gov](http://www.usgs.gov)



### **3.4. Biology, genetics, evolution, paleontology (and some philosophy)**

Carroll, Sean B. *Endless Forms Most Beautiful: The New Science of Evo Devo and the Making of the Animal Kingdom*. New York: Norton, 2005. Print.

Carroll, Sean B. *Serengeti Rules, The: The Quest to Discover How Life Works and Why It Matters*. New Jersey: Princeton UP, 2016. Print.

Churchland, Patricia Smith. *Touching a Nerve: Our Brains, Our Selves*. N.p.: n.p., n.d. Print.

Costa, James T. *The annotated Origin: A facsimile of the First Edition of On the origin of species*. Cambridge, MA: Harvard University Press, 2009. Print. As the title says, this includes a copy of the first edition of Darwin's *On the origin of species*.

Coyne, Jerry A. *Why Evolution Is True*. Oxford: Oxford UP, 2009. Print.

Dawkins, Richard. *A devil's chaplain: Selected writings*. London: Orion Books, 2003. Print.

Dawkins, Richard. *The greatest show on earth: The evidence for evolution*. New York: Free Press, 2009. Print.

Dawkins, Richard. *The magic of reality: How we know what's really true*. London: Transworld Publishers, 2011.

Dawkins, Richard. *The selfish gene (30<sup>th</sup> anniversary edition)*. Oxford: Oxford University Press, 2006. Print.

Dawkins, Richard. *Unweaving the rainbow: Science, delusion and the appetite for wonder*. London: Penguin, 1999. Print.

Gazzaniga, Michael S. *Who's in Charge?: Free Will and the Science of the Brain*. New York, NY: HarperCollins, 2011. Print.

Hublin, Jean-Jacques, and Bernard Seytre. *Quand d'autres hommes peuplaient la terre: Nouveaux regards sur nos origines*. Paris: Flammarion, 2011. Print.

Knoll, Andrew H. *Life on a Young Planet: The first three billion years of evolution on earth*. Princeton, NJ: Princeton UP, 2003. Print.

Kolbert, Elizabeth. *Field notes from a catastrophe: A frontline report on climate change*. London: Bloomsbury Publishing PLC, 2007. Print.

Lane, Nick. *Life ascending: The ten great inventions of evolution*. London: Profile Books, 2010. Print.

Leakey, Richard E.. *The origin of humankind*. New York: Basic Books, 1994. Print.

Meredith, Martin. *Born in Africa: The quest for the origins of human life*. London: Simon & Schuster, 2011. Print.

Monod, Jacques. *Le hasard et la necessite*. Paris: Le Seuil, 1970. Print.

Openstax College. *Concepts of Biology*. Openstax College, 25 April 2013. On-line.  
<<http://openstaxcollege.org/textbooks/concepts-of-biology/get>>

Pääbo, Svante. *Neanderthal man: In search of lost genomes*. New York: Basic Books, 2014. Print.

Picq, Pascal. *Au commencement était l'homme*. Paris: Odile Jacob, 2013. Print.

Picq, Pascal. *Les origines de l'homme.: L'odyssée de l'espèce*. Paris: Editons Tallandier, 2005 Print.

Picq, Pascal and Roche, Hélène. *Les premiers outils*. Paris: Le pommier, 2013. Print.

Picq, Pascal, Sagar, Laurent, Dehaene, Ghislaine and Lestienne, Cécile. *La plus belle histoire du langage*. Paris: Editions du Seuil, 2008. Print.

Prothero, Donald R. *Evolution: What the fossils say and why it matters*. New York: Columbia University Press, 2007. Print.

Prothero, Donald R. *The story of life in 25 fossils*. New York: Columbia University Press, 2015.

Print.

Reznick, David N. *The Origin then and now: An interpretive guide to the Origin of species*. Princeton, New Jersey: Princeton University Press, 2010. Print. This book is not only a great help when reading Darwin's *Origin*, it is also a veritable history of biology since and an excellent explanation of speciation.

Shubin, Neil. *Your Inner Fish: The Amazing Discovery of Our 375-million-year-old Ancestor*. London: Penguin, 2009. Print.

[Various authors]. *Hominidés, les évolutions de l'homme*. Online at [www.hominides.com](http://www.hominides.com). (In French)

[Various authors]. Smithsonian Human Origins Program. Online at [humanorigins.si.edu](http://humanorigins.si.edu).

[Various authors at the University of California]. *Understanding evolution*. Online at <http://evolution.berkeley.edu/evolibrary/home.php>.

Wells, Spencer. *The Journey of Man: A Genetic Odyssey*. New York: Random House Trade Paperbacks, 2002. Print.

Westerhoff, Jan. *Reality: A Very Short Introduction*. Oxford: Oxford UP, 2011. Print.

Wilson, David Sloan. *Darwin's cathedral*. Chicago: The University of Chicago Press, 2003. Print.

Wilson, David Sloan. *Evolution for everyone: How Darwin's theory can change the way we think about our lives*. New York: Bantam Dell, 2007. Print.

Wolpert, Lewis. *Developmental biology: A very short introduction*. London: Oxford University Press, 2011. Print.

Wood, Bernard A. *Human Evolution: A Very Short Introduction*. Oxford: Oxford UP, 2005. Print.

### **3.5. Anatomy, physiology and neurosciences**

Aamodt, Sandra, and Sam Wang. *Welcome to Your Brain: Why You Lose Your Car Keys but Never Forget How to Drive and Other Puzzles of Everyday Life*. New York: Bloomsbury, 2008. Print.

Amthor, Frank. *Neuroscience for Dummies*. Mississauga, Ont.: Wiley, 2012. Print.

Bear, Mark F., Barry W. Connors, and Michael A. Paradiso. *Neuroscience: Exploring the Brain*. Philadelphia, PA: Lippincott Williams & Wilkins, 2007. Print.

Damasio, Antonio. *Descartes' error: Emotion, reason and the human brain*. New York: Penguin, 1994. Print.

Edelman, Gerald M. *Second nature: Brain science and human knowledge*. New Haven: Yale UP, 2006. Print.

Edelman, Gerald M. *Wider than the sky: A revolutionary view of consciousness*. London: Penguin, 2004. Print.

Frith, Chris. *Making up the mind: How the brain creates our mental world*. Malden, MA: Blackwell Publishing, 2007. Print.

Gibb, Barry J. *The rough guide to the brain*. London: Rough Guides, 2007.

Kandel, Eric R.. *In search of memory: The emergence of a new science of mind*. NY: W. W. Norton and Company, 2006. Print.

Kratz, Rene Fester. *Molecular & Cell Biology for Dummies*. Hoboken, NJ: Wiley, 2009. Print.

Levitin, Daniel J. *This is your brain on music: The science of a human obsession*. New York: Penguin Group, 2006. Print.

Norris, Maggie, and Donna Rae Siegfried. *Anatomy & Physiology for Dummies*. Hoboken, NJ: Wiley, 2011. Print.

O'Shea, Michael. *The brain: a very short introduction*. Oxford: Oxford University Press, 2005. Print.

Openstax College. *Anatomy & Physiology*. Openstax College, 25 April 2013. On-line.  
<<http://cnx.org/content/col11496/latest>>

Pinker, Steven. *How the Mind Works*. New York: Norton, 1997. Print.

Pinker, Steven. *The language instinct: How the mind creates language*. New York: Harper Collins, 1994. Print.

Ramachandran, Vilayanur and Blakeslee, Sandra. *Phantoms in the brain*. London: Harper, 2005. Print.

Ramachandran, Vilayanur. *The emerging mind: The Reith Lectures 2003*. London: Profile Books, 2003. Print.

Ramachandran, Vilayanur. *The tell-tale brain*. London: Windmill Books, 2012.

Rose, Steven. *The 21st-century brain: Explaining, mending and manipulating the mind*. London: Vintage, 2005. Print.

Sacks, Oliver. *Hallucinations*. New York: Borzoi, 2012. Print.

Sacks, Oliver. *Musicophilia: Tales of music and the brain*. New York: Vintage, 2008. Print.

Sacks, Oliver. *The man who mistook his wife for a hat*. New York: Touchstone, 1970. Print.

### **3.6. More**

Bryson, Bill. *A short history of nearly everything*. London: Transworld Publishers, 2003. Print.

Lightman, Alan P. *Mr G: A Novel about the Creation*. New York: Pantheon, 2012. Kindle Edition.