Basics of The Human Condition

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How we understand things in general, and ourselves in particular, shapes how we behave. This paper sets out a foundational view on the basics of the human condition. It is a work representing my own views, and subject to revision**.** It contains many links that will enable you to take things further.

1. How we work in physiological and functional terms. All complex systems are ***adaptive modular hierarchical structures***, for good functional reasons (Booch *et al* 2007). We are made of electrons and protons, which make atoms, which make molecules, which make cells, and so on, as in **Figure 1**.

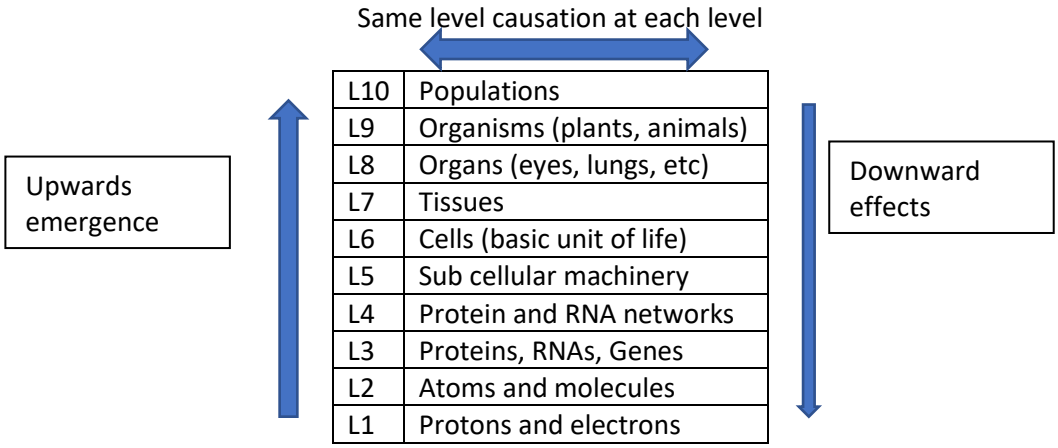

Figure 1 *The chaining up of developmental processes and down of constraints and adaptive processes in the hierarchy of emergent levels. Adapted from Noble (2012).*

Scientists who specialise in each emergent level often claim theirs is the only level that matters. But they all matter. We are not "nothing but" atoms/particles (some physicists), or chemicals (Atkins), or genes (Dawkins), or neurons (Crick), or whatever. Physics by itself can't explain real world outcomes, such as existence of a teapot (Ellis 1995); neither can genetics through "selfish genes".

Emergence takes place based in higher level principles, such as the needs for homeostasis and information processing in living systems, and physiological needs: the purpose of eyes is to see, the purpose of the heart is to pump blood, and so on. Studying living beings at the atomic level or genetic level will not reveal these higher level principles or functions, which are key to our existence.

The growing realisation of the limitations of the reductionist view in biology is indicated by Hartwell *et al* (1999) emphasizing the importance of emergent function in biology, and Nurse (2008) on the significance of information and associated emergent logic circuits. Biology involves many kinds of networks; systems biology studies how all these elements interact with each other.

G Booch *et al* (2007) *Object-Oriented Analysis and Design with Applications* (Addison Wesley).
G Ellis (2005) Physics, complexity and causality *Nature*, 435:743-743.
L Hartwell, J Hopfield, S Leibler, and A Murray (1999) From molecular to modular cell biology *Nature* 402 (Suppl 6761), C47–C52.
P Nurse (2008) Life, logic and information *Nature* **454**, 424–426.
K Farnsworth, J Nelson, and C Gershenson (2013) "Living is information processing: from molecules to global systems." *Acta biotheoretica* **61**: 203-222.

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All levels in Figure 1 must be working together to enable our functioning. Denis Noble and I have long been studying the mechanisms whereby this happens. Three key things emerge:

- **Every emergent level is causally effective**, and they are all needed for the whole to function.
- This functioning is enabled by the **combination of upward emergence and downward effects**.
- **Causal closure** only takes place when all the levels linked in this way are taken into account.

How does downward causation take place? By two key processes:

- Changes in **time dependent constraints** exerted by emergent higher levels on lower levels.
- **Creation, modification, or deletion** of lower level elements to meet higher level needs.

A key aspect of downward causation is,

- **Multiple realisability** Any emergent higher level state can be realised by a huge number of lower level states. Which specific lower level state realises a higher level state is immaterial as far as higher level causation is concerned; what matters is that the emergent level functions as needed.

Note that none of this modifies or overrides the lower level physics: animals and humans are certainly still solutions of Schrodinger's equation and Dirac's equation. Rather ***it alters the context*** in which that physics functions (Juarrero 2022). Physical laws *per se* do not determine any specific outcomes whatever: they only do so in a context of specific boundary conditions and constraints, with specific entities to act on.

D Noble (2008) *The music of life: biology beyond genes* (Oxford University Press).
D Noble (2012) "A theory of biological relativity: no privileged level of causation" *Interfacefocus*, **2**: 55-64
A Juarrero (2009) Top-down causation and autonomy in complex systems
G Ellis (2016) *How can Physics Underlie the Mind. Top-Down Causation in the HumanContext* (Springer).
G Ellis (2020) The causal closure of physics in real world contexts. *Foundations of Physics* **50:** 1057-1097.
C Figdor (2010) "Neuroscience and the multiple realization of cognitive functions" *Phil Science* **77**: 419-456.
A Juarrero (2022) *Context Changes Everything: How Constraints Create Coherence* (MIT Press)

In the rest of this paper, I first look at the cosmological context that is the framework for our existence (Section 2). I then give solidity to the above summary of emergence by looking in turn at each of the levels in Figure 1: the underlying physics and chemistry (Section 3), and the emergent biological levels and what they each do(Section 4). Then I turn to, How did we get here? Natural selection and developmental processes (Section 5); How our brain shapes our actions: the confluence of perception, rationality, emotions, and values (Section 6); and Society (Culture, Values, and Narratives) and Ecology (Section 7). I comment there on the crises facing us as humanity at the present time. I close with The Personal Dimension (Section 8), *inter alia* commenting on the potential negative outcomes of reductionist viewpoints, e.g.in health and education, but also in terms of how we view ourselves and our existence.

2: The Cosmological Context

We exist because the universe exists, and is of such a nature as to allow us to come into being.
Neither of those statements is inevitable.

A) This all takes place in a cosmological context of the expanding universe, which has evolved through many stages (**Figure 2**).

- The universe is of vast size, containing billions of galaxies like the Milky Way each made of billions of stars and gas, many with gigantic black holes at their centre. It may or may not be infinite.
- We determine its nature by a variety of exquisitely sensitive telescopes operating at many different wavelengths, many in satellites orbiting the Earth so as to get above the atmosphere.
- It is expanding, with galaxies receding from each other, as evidenced by redshift.
- It has been through various well understood stages during its evolution from a Hot Big Bang radiation-dominated early era when primordial nucleosynthesis took place, through decoupling of matter and radiation when cosmic blackbody radiation was emitted, to the formation of stars and galaxies via gravitational instability and astrophysical processes.

- The earliest stages are invisible to us because the very early universe was opaque to radiation.
- Our ability to see out to the furthest reaches of the Universe is limited by visual horizons, because light travels at the speed of light since decoupling of matter and radiation when it became transparent.
- We do not know if the Universe had a beginning, because we don't know the physics applicable in such extreme conditions: we don't know the theory of quantum gravity.

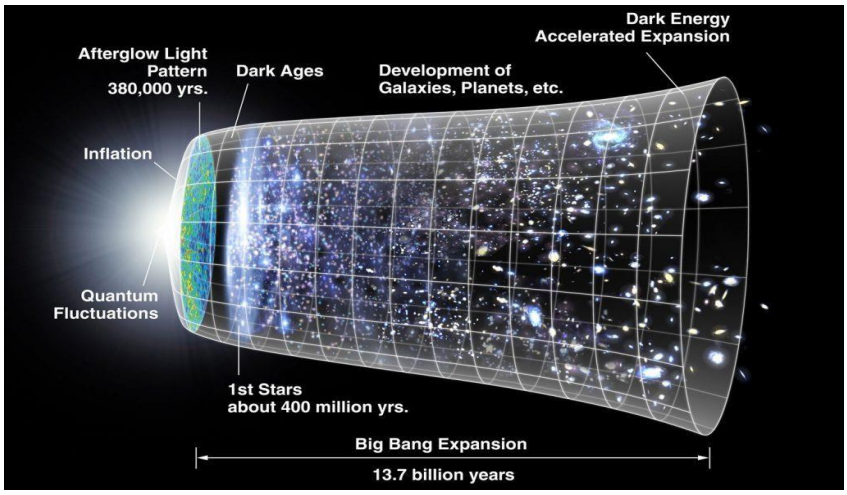

Figure 2: *The expansion of the universe. In this diagram, time passes from left to right, so at any given time, the universe is represented by a disk-shaped "slice" of the diagram* (Source: Wikimedia Commons)

Our current cosmological standard model (Ellis and Uzan 2017) is supported by a huge amount of data, but has a number of unresolved issues (Peebles 2022): particularly the nature of dark energy, dark matter, and the inflationary field. and a number of tensions between observations and theory. in particular, a Hubble parameter tension and a possible discordance between background radiation and quasar anisotropy.

Philosophical Issues There is one and only one Universe, and that makes the study of philosophy a unique subject amongst all the sciences. We can't rerun the Universe, or compare it with similar objects. This underlies unique issues that cosmology faces as a science (Ellis 2014).

G Ellis and J-P Uzan (2017) Modern Cosmology, Scholarpedia, **12**:32352.
P J E Peebles (2022) Anomalies in Physical Cosmology arXiv:2208.05018.
G Ellis (2014) On the philosophy of cosmology *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics* **46**:5-23.

1. Time passes Contra claims by some physicists, time passes because we live in an Evolving Block Universe, see my article Physical Time and Human Time. This is indicated in Figure 2: nowadays the Universe has an age of 13.7 billion years. This would not be the case in a block universe. The Universe *never* becomes infinitely old, because infinity is not just a very big number: it is bigger than any number that can possibly exist.

The emergence of an arrow of time in daily life – one of the most fundamental features of daily experience (you can't remember what has yet to happen but can remember the past; you can choose to change the future but not alter the past) – is a result of special initial conditions in the early universe, whereby the globally determined *Direction of Time* determined by the expansion of the universe determines local *arrows of time* (thermodynamic, electrodynamic, sound, chemical biological, mental).

G Ellis and B Drossel (2020) Emergence of time *Foundations of Physics* **50**:161-190.

2. The Universe allows our existence because of its special nature. This need not have been the case: our existence would not have been possible if some of the dimensionless constants of nature such as the fine

structure constant were different than they are. Thus in a scientific sense, the Universe is fine tuned in such a way that life can come into existence. This is the Anthropic Principle (Balashov 1991, Rees 2008). As stated by Stephen Hawking (Hawking 1988),

> *The laws of science, as we know them at present, contain many fundamental numbers, like the size of the electric charge of the electron and the ratio of the masses of the proton and the electron …….The remarkable fact is that the values of these numbers seem to have been very finely adjusted to make possible the development of life*.

Why this should be so is a philosophical issue. It depends on possibility spaces (see below)

Y Balashov (1991) Resource LetterAP-1: The Anthropic Principle
M Rees (2008) *Just six numbers: The deep forces that shape the universe* (Basic Books)
S Hawking (1988) *A Brief History of Time* (Bantam Books), pp. 7, 125.

3. We might live in a multiverse, but maybe not. A multiverse – a vast number of expanding universe domains like ours but with different physical properties - will result from some inflationary universes. The relevance to us on Earth is that it might solve the anthropic problem by making a biofriendly universe highly probable (Rees 2008). However the existence of a multiverse is not directly observationally provable, because the supposed other evolving domains lie beyond the visual horizon. What about indirect evidence? The underlying property of self-replication is a generic property of many inflationary universes. However standard large field models are basically ruled out by current data: they are strongly disfavoured compared to plateau inflation, according to Bayesian analysis. While eternal inflation is also mandatory in Starobinsky models, it is possible to build a model of inflation which is in perfect agreement with all the observations and where self-replication never starts: a multiverse does not arise. Claims it exists are thus controversial (Carr and Ellis 2008, Ellis 2011), as is the proposal of non-empirical theory confirmation. If the Universe had positively curved spatial sections, they would be excluded. This may be so, but the evidence is marginal.

Supposing a multiverse exists, to solve the anthropic problem underlying our existence one also needs a mechanism for populating the various bubbles with different effective physics. Such mechanisms have been proposed, but are not yet an established scientific result. They are a theory of a possible mechanism.

If both are indeed true, so a multiverse exists containing biofriendly domains, this displaces the explanatory problem one level up: Why does your multiverse allow life to exist? What explains it's fine tuning?

B Carr and G Ellis (2008) Universe or multiverse? *Astronomy & Geophysics* ***49***: 2-29.
G Ellis (2011) Does the multiverse really exist? *Scientific American* **305**: 38-43.

3. No we do not live in a simulation. This idea is physically and biologically absurd (do you really think all the emergent levels discussed below can be simulated, down to the last electron, in every galaxy in the universe?), completely unfeasible in engineering terms (what size is this computer? How much memory does it use, and what's the access time? Where does it get its energy supply?) and computational terms (who debugged it?) and philosophically inane (where does this computer exist? How did it come into being? How did *that* universe come into existence?) And who is responsible for it? It's basically a nerd's Intelligent Design argument: fun for late night at the pub, but not a serious cosmological proposal.

4. What exists in physical reality is there because it is allowed by underlying possibility spaces. Underlying physical reality are various possibility spaces (Ellis 2021). Something can only happen if it is possible. There are Platonic possibility spaces for physical stuff: for physics itself; physical chemistry; proteins, and genotype to phenotype maps (Wagner 2014); physiology; life itself, including brains. These spaces determine what can and cannot happen in the physical universe, for example you can't hit a tennis ball faster than light for physical and physiological reasons. They determine what is possible.

Then there are also possibility spaces for mathematics; logic; and thoughts themselves, the latter being encapsulated in the brilliant book The Library of Babel by Jorge Luis Borges. The deep questions are,

- What are these possibility spaces?
- What evidence is there about their existence and nature?
- How are they related to each other?
- What does their existence imply about the nature of the Cosmos?

G Ellis (2021) "The Philosophical Problem of Cosmology"
https://iai.tv/articles/the-philosophical-problems-of-cosmology-auid-1883?_auid=2020
A Wagner (2014) *Arrival of the fittest: solving evolution's greatest puzzle* (Penguin).

5. Science per se cannot explain why the universe exists This is a philosophical, not scientific issue, because we can't do any experiments on why the universe exists; we can't rerun it in a laboratory experiment; we can't observe the start of the universe itself. The underlying issue is that physics itself only came into being when space and time came into existence. There was no physics before the Universe existed: indeed there was no "before" then!

Some claims that the Universe "came into being out of nothing" are not scientific claims. Specifically, a "vacuum" is not nothing. It exists in spacetime. We can make many models of how and why the universe came into being, but they are not, and cannot be, scientifically tested theories, see Albert (2012).

D Albert (2012) "A universe from nothing" *New York Times* book review, March 23, 2012

B) The Sun, Earth, and Moon are our local astronomical context

The Sun is a typical star: a thermonuclear reactor transforming hydrogen to helium and other elements up to iron, and giving off solar radiation at a temperature of 5000C. It is losing mass due to its emission of radiation, and has a finite life time: eventually it will run out of nuclear fuel and end its life. It is vastly larger than the Earth, which orbits it at a distance of 93 million miles with a period of one year. This orbit is determined by the gravitational force, as shown by Isaac Newton, which also keeps our feet on the ground and prevents our atmosphere from floating off into space.

The Earth is much smaller than the Sun. It has land masses (continents) and seas surrounded by a very thin atmosphere made mainly of oxygen and nitrogen. Major circulation of the seas is a key driver of weather patterns. The Earth's interior has many layers and a high temperature core of molten rock, kept hot by thermonuclear decay that powers continental drift of tectonic plates. Occasionally this hot material escapes to the surface in volcanic eruptions. The Earth has various biogeochemical cycles, powered by heat from the Sun, that recycle the elements of life: the water cycle, carbon cycle, key to regulating global temperature cycles, oxygen cycle, nitrogen cycle, calcium cycle, and so on. The oxygen, nitrogen, and carbon cycles are key to making Earth capable of sustaining life, forming a central element of the biosphere.

Earth spins on an axis that is tilted relative to its orbit round the sun, the spin resulting in the cycle of day and night. The tilt results in the annual cycle of Earth seasons (summer, fall, winter, spring).

The Earth provides the essentials for human existence:

- Our existential needs of air, water, and soils, seasons: the basis of food production
- The resources for modern technological society: energy sources, minerals, and renewable resources, enabling production of fertilisers, concrete, steel, plastics that underlie society.

Thermodynamically considered, the Earth receives high grade solar radiation from the Sun and emits low grade infrared radiation to the sky. Some of this radiation is reflected back to the Earth – the greenhouse effect, without which we could not live because the temperature on the Earth's surface would be too low. However anthropogenic gas emissions have strengthened this effect so that the amount of reflected radiation is too high, leading to global warming and consequent climate change resulting in floods, droughts, fires, and ecological changes.

The Moon is a satellite of the Earth that circles the Earth with a period of one month, causing tides that play a key role in aquatic life, and hence in the evolutionary emergence of life on land.

Our home The Sun-Earth-Moon system, with the Earth at a suitable distance from the Sun, is the basis of our physical existence. Seen from a great distance, the Earth is a "pale blue dot", as seen in a famous photo taken from the Voyager spacecraft. Carl Sagan (1994) wrote in book The Pale Blue Dot

> *From this distant vantage point, the Earth might not seem of any particular interest. But for us, it's different. Consider again that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every "superstar," every "supreme leader," every saint and sinner in the history of our species lived there--on a mote of dust suspended in a sunbeam.*

The Solar System, including the other planets, came into being by astrophysical processes in the expanding universe; all life on Earth, including humans, then came into being via abiogenesis followed by natural selection (Morowitz 2002, Baggott 2015). That was possible because the universe is biofriendly.

H Morowitz (2002) *The Emergence of Everything: How the World Became Complex* (Oxford)
J Baggott (2015) *Origins: The Scientific Story of Creation* (Oxford)

3. The underlying physics and chemistry

Levels L1 and L2 are the levels of physics and physical chemistry, enabling the rest to exist. A brief overview of relevant scientific laws is given in the Wikipedia entry on the topic. Physics has many branches, most described in depth in the famous *Feynman Lectures in Physics*, available online at https://www.feynmanlectures.caltech.edu/. They volumes are,

- Volume I: *Mainly Mechanics, Radiation, And Heat*,
- Volume II: *Mainly Electromagnetism And Matter*,
- Volume III: *Quantum Mechanics*.

While one can understand the broad ideas underlying physics without engaging with its formalism, it is a key feature of physics that it is a quantitative subject described via mathematical equations (as remarked by Galileo, mathematics is the language of nature). To tackle basic physics, you need linear algebra and matrices, ordinary differential equations, partial differential equations including Green's Theorem and Green's identities, Stokes' Theorem, the divergence theorem, Green's Function, distributions, and complex analysis. For higher levels you need group theory, topology, differential geometry, and fibre bundles. I will largely avoid mathematical equations in what follows.

A) Particles, forces, and fields

- **Atoms** Everything physical is made of atoms (Feynman, Volume I), including you and me. This is not obvious. The air in a room seems continuous, as does glass or a metal. But each is made of atoms bound together; in a gas, in the form of molecules buzzing around in empty space; in a metal, vibrating in a lattice.
- Atoms are made of protons and neutrons (made of quarks) forming a nucleus, and much lighter electrons orbiting the nucleus. The atom again is mostly empty space.
- Particles have mass, position, momentum, and electric charge (positive, negative, or zero).
- A particle's motion is determined by the forces acting on it, as described by Newton's laws of motion:

Force = mass x acceleration ⇔ acceleration = Force /mass; (1)

If two bodies interact, the forces exerted by each on the other have the same magnitude but are opposite direction. (2)

If a car crashes into a wall, both the car and the wall are damaged.

Conservation of energy, momentum, and matter Summing up local interactions of all the particles in a physical body and using (1) and (2), it follows that if no forces act on the body, its energy and momentum will be conserved. Furthermore matter is conserved: the mass of an isolated body does not change. However bodies do interact, and energy can be interchanged between various forms. Einstein showed that because of special relativity, which is the dynamic theory that replaces Newtonian dynamics when relative motion is very large (i.e. significant relative to the speed of light **c**), matter and energy are equivalent, and can be transformed into each other according to the famous equation

$$E = m\,c^2 \quad \text{where} \quad c = 3 \times 10^{10}\ \text{m/sec}\ . \qquad (3)$$

This underlies nuclear weapons, nuclear power, and stellar nucleosynthesis in the Sun where nuclear burning of hydrogen to helium makes the Sun shine and so provides the energy for life on Earth.

At a deep level, symmetries generate conservation equations, which is Noether's Theorem. Emergence of complexity is based in symmetry breaking (Anderson 1972).

P W Anderson (1972) More is different: broken symmetry and the nature of the hierarchical structure of science. *Science* ***177***:393-396.

Four Forces: By (1), the motion of particles is determined by the forces acting on them, or equivalently, by related fields, such as the gravitational field. What are the fundamental forces?

- **Gravity** Isaac Newton's great discovery was that the gravitational force **F** between any two objects is an attractive force directed towards each other, of magnitude

$$F = G\ M_1 M_2 / R^2 \qquad (4)$$

where M_1 and M_2 are the masses of the objects, R the distance between them, and G the gravitational constant. Combined with (1), this makes apple's fall to Earth, keeps the Moon in its orbit around the Earth, and the planets in their orbits around the Sun. A key point is that the masses M are always positive: gravity is always attractive.

Since 1916, Newton's gravitational theory has been replaced by Einstein's theory of General Relativity, ascribing gravitational effects to the curvature of spacetime, but Newton's theory remains an excellent approximation for engineering and biology. Because of the large mass of the Earth, gravity attracts us towards its centre according to (1) and (4). Thereby it is a dominant force on Earth in architecture and engineering and biology and sport. We experience gravity as pulling us towards the surface of the Earth, underlying standing, sitting, and falling, as well as walking, running, climbing, and gymnastics.

- **Electromagnetism** Electric and magnetic fields are generated by static and moving electric charges q, which can be positive or negative. Static charges attract each other if of different sign, or repel each other if of the same sign, also according to (4) but with mass M_I replaced by electric charge q_I and G by a constant k_0. This electrostatic attraction underlies many engineering and biological effects, for instance underlying chemical bonding and existence of crystal structures such as metals and rocks.

In non-static contexts, electromagnetic fields interact in a complex way: each generates the other when time change takes place, as described by Maxwell's equations. This underlies electric generators and relays and motors, resulting in electric lighting, cooking, refrigerators, washing machines, and so on. Nature has discovered this and used it in the nervous system, e.g. in governing action potential propagation in nerves.

Maxwell's momentous discovery was that these equations predict that electric and magnetic fields can generate transverse waves moving at the speed of light. He then realised this meant that light was indeed an electromagnetic wave, with the colour depending on frequency, which is inversely proportional to

wavelength. This in turn meant that other wavelengths are possible for electromagnetic radiation: radio waves (long wavelengths), infrared, visible light enabling vision, ultraviolet, X-ray, and gamma ray (very short wavelengths), forming the entire electromagnetic spectrum **(Figure 3**).

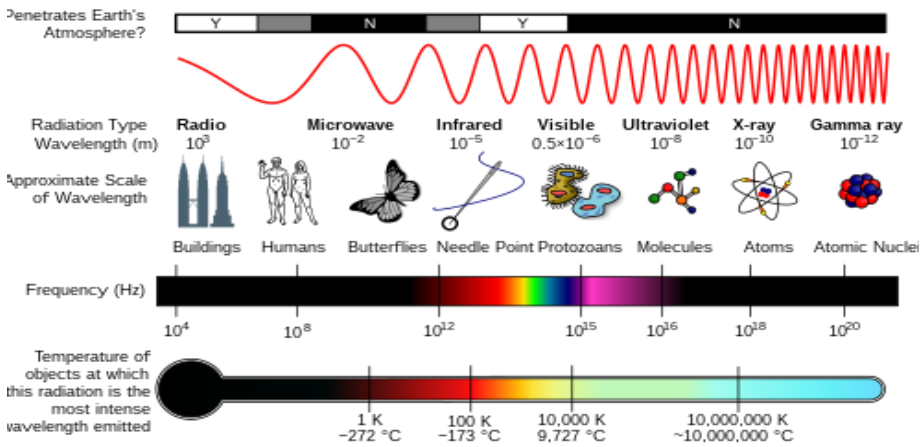

Figure 3: *The electromagnetic spectrum. Long wavelengths on the left, short on the right; high frequencies (cycles per second) on the right, low frequencies on the left* (Source: Wikipedia).

This remarkable realisation has transformed human life by enabling radio, television, radar, wifi, iPhones, remotes, CAT scanners, and so on. It is a key feature of daily life and technology.

- **The Strong force** The strong force holds atomic nuclei together, despite the repulsive force between the protons in the nuclei. It is one aspect of why matter can be stable, and so is crucial to life.

- **The Weak force** The weak force governs radioactive decay of unstable elements, and is crucial to internal processes in the Sun, which gives off neutrinos as part of its nucleosynthesis processes that produce sunlight that is crucial for life. Apart from that, it plays no role in daily life on Earth or biology.

Bulk matter: forces acting on particles at the micro level imply how physical stuff behaves at the macro level, depending on how it is ordered (solid, liquid, gas, or plasma).

- **Kinetic theory of gases** At a macro level, a gas looks like a continuous entity characterised by its density ρ, pressure P, temperature T, and entropy S. At a micro level it consists of billions of molecules in rapid motion, banging into each other all the time. The kinetic theory of gases shows how these macro quantities can be expressed in terms of averages of the motions of molecules at the micro level, for example pressure is related to the averaged square of the speeds of the molecules.
- The **First Law of Thermodynamics** emerges at the macro level from micro level matter and energy conservation: ***the total matter and energy are conserved in any isolated system,*** although they exist in many forms which can be transformed into each other under suitable conditions; for example energy and matter can be transformed according to (3) at high enough temperatures. But perpetual motion machines cannot exist. No you cannot power your car with water.
- The **Second Law of Thermodynamics** puts realistic limits on what can be achieved in practice. Entropy - a measure of micro level disorder - grows because of processes such as viscosity and friction which cause loss of useful energy, and result in heating: ordered energy is converted into random micro level motion which cannot be accessed for useful purposes. You can locally create order by chemical and mechanical processes, but this will inevitably be at the cost of creating some disorder in the environment, experienced as heating, and will transform useful resources such as coal and wood into unusable stuff such as smoke and ashes. Life has learnt to harness matter and energy in useful ways and to create order despite these limitations via metabolic processes at the micro and macro level. The costs are that we have to eat and drink on the one hand, and excrete metabolic waste (sweat, urine, and faeces) on the other.

Analogous processes take place in a society: cities and buildings have similar needs. The arrow of time in the Second Law (entropy grows in the future direction of time) derives from cosmology (see Section 2).

These two laws place fundamental limits on what can occur in biology, technology, society, and ecology.

- **Binding energy and thresholds** The third fundamental feature emerging at the macro level is that when micro level entities – particles, atoms, molecules – are bound together to make macro level entities, which may occur spontaneously (self-assembly) or require energy to accomplish (as in metabolism or manufacturing), the resulting emergent entity is held together by binding energy which causes it to weigh just a little bit less than its parts did. This energy can be released by nuclear fission, according to (3). More important for daily life is that this applies also to orbital electrons in atoms, resulting in ionisation energy required to remove those electrons, and to chemical bonds, holding molecules together. Bond energy is a measure of the strength of chemical bonds, released in a fire or in catabolic processes in a cell. Bond dissociation energy is a measure of the energy required to break a bond and release the binding energy. It results in threshold energies and temperatures at the macro level required for reactions to take place, such as making tea, boiling an egg, or starting a fire. This results in the need for matches or other firelighters so we can generate fire when needed; learning to do so was one of the great cultural transitions in our social evolution. This thermal instability also results in the dangers of forest and bush fires.

Brownian motion and fluctuations Because a gas is made of billions of particles that are colliding with each other all the time, there is a great deal of randomness in particle motion at molecular scale, called Brownian motion (the fluctuation in position of small particles suspended in water). They undergo 10^{14} collisions per second, so detailed molecular motions cannot be calculated from initial data, though we can model how they perform a random walk. The atomic constitution of matter is proved by Brownian motion, and one can determine from it that Avagadro's Number - the number of nucleons in one gram of ordinary matter – has the enormous value of 6.0×10^{23}. This stochasticity of motion at the molecular level is a fundamental feature exploited by biological mechanisms such as molecular machines to obtain desired emergent outcomes. Similarly there is synaptic noise in neurons and sensory receptors. Stochastic resonance can result in synaptic noise aiding rather than impairing signal detection.

Quantum physics: wave functions or matrix mechanics At a particle and atomic level, quantum physics comes into play that is highly non-intuitive because it is quite unlike classical physics in these ways:

- Matter and energy and light are all quantised: they come in discrete units, as is demonstrated for light by the photoelectric effect, showing light is made of particles (photons).
- Superposition of quantum states occurs, where a state can be considered as being partly in each of two or more discrete states. There is no classical correspondence to this situation.
- Entanglement occurs, where the quantum state of each particle in a group cannot be described independently of the state of the others (but this rapidly decays due to decoherence).
- Non-locality of quantum physics is shown by the Aharonov-Bohm effect and Berry phase.
- Tunnelling: particles with energy E1 can tunnel through an energy barrier with height E2 > E1, which is impossible classically. This underlies tunnel diode functioning and nuclear fusion.
- Uncertainty principle (Heisenberg): the position and momentum of a particle cannot be prescribed to arbitrary accuracy. This puts limits on the accuracy of possible predictions.
- Unpredictable outcomes occur: radioactive decay of excited atoms is unpredictable in principle, as is the position of a particle on a screen after passing through double slits. This uncertainty applies to any quantum measurement process: only probabilities of outcomes can be predicted from the wave function, not the result of any particular measurement.

How the associated quantum to classical transition takes place is the subject of much contestation, as is foundations of quantum mechanics. My take on the measurement problem is in Drossel and Ellis (2018).

B Drossel and G Ellis (2018) Contextual wavefunction collapse: An integrated theory of quantum measurement. *New Journal of Physics*, **20**:113025.

Quantum Field Theory extends quantum theory to a theory where fields are more fundamental than particles and the vacuum state has non-zero energy due to quantum fluctuations. The theory

- Extends Maxwell's theory of electromagnetism to quantum electrodynamics
- Describes creation and annihilation of particles
- Predicts the existence of antimatter such as positrons
- Shows that particles can have spin;
- Shows that integer spin particles (bosons) such as photons can be in the same state. This underlies Bose-Einstein statistics, the functioning of lasers, and black body radiation. To a good approximation this describes both the light we receive from the Sun, and radiation the Earth re-emits to space.
- Leads to the Pauli Exclusion principle which states that two particles cannot be in the same state if they are spin half particles (fermions) such as electrons. This leads to Fermi-Dirac statistics, and underlies the periodic table characterising the nature of the chemical elements.

B) Atoms and the Periodic Table

Atoms are made of a nucleus, made of an approximately equal number of positively charged protons and uncharged neutrons of approximately the same mass, surrounded by a cloud of negatively charged much lighter electrons, orbiting in distinct shells. An element's atomic number N is the number of protons in the nucleus, the same as the number of electrons surrounding the nucleus in a neutral atom. If an atom loses an electron it becomes a positively charged ion; if it gains one, it becomes a negatively charged ion. Ionisation can result in an electric spark as used in spark plugs in internal combustion engines.

Atoms have different chemical properties, characterised by their position in the Periodic Table of the chemical elements (**Figure 4**). ***This is the key link between physics and chemistry***. All elements in a column have similar physical properties, but size (increasing downward, and decreasing from left to right) and ionisation energy (changing in the opposite way) vary both across columns and in columns.

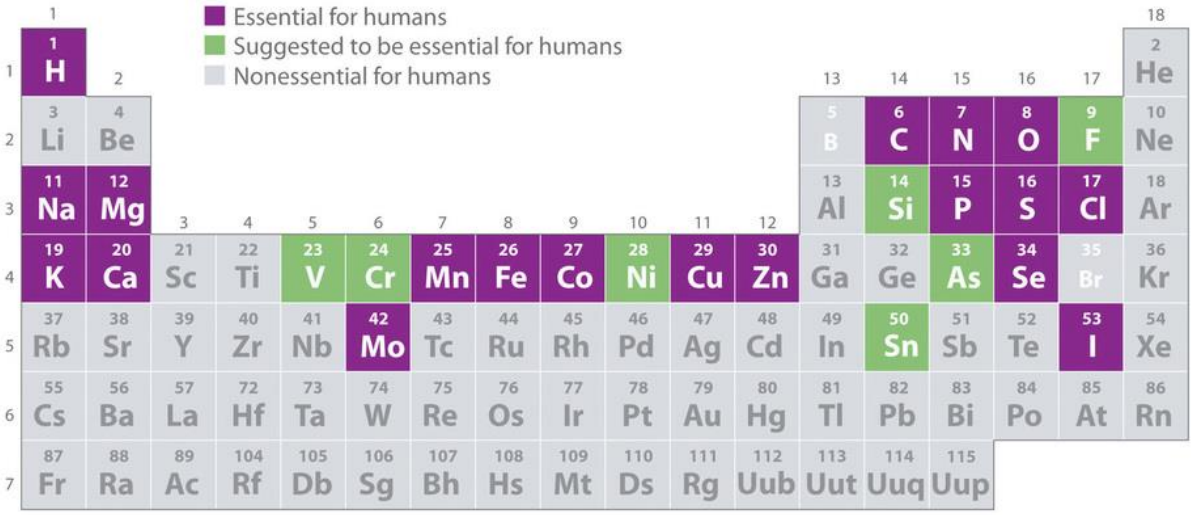

Figure 4: *The periodic table of the elements, indicating those that are essential for life.* From Libretexts.

The human body: Figure 4 indicates the elements essential for life (purple) and maybe so (green). 99% of the mass of the human body is made up of just six elements: oxygen (65%), carbon (18.5%), the basis of organic chemistry, hydrogen (10%), nitrogen (3.2%), calcium (1.5%), and phosphorus (1%). About 0.85% is composed of sodium, magnesium, potassium, sulphur, and chlorine. All these elements are necessary for life, as are the trace elements indicated in Figure 4. Physical disorders can arise if we lack them. Water is a key non-organic molecule enabling cells to function (Ball 2017), and so life to exist: an adult body is about 60% water.

P Ball (2017) Water is an active matrix of life for cell and molecular biology. *Proc Nat Acad Sci* **114**:13327-13335.

- **How do we acquire these elements?** In order of increasing importance, eating, drinking, and breathing. Breathing is crucial: our cells die if we lack oxygen for more than a few minutes, as for example in drowning. Drinking is not required so often, but is vital too; the required water intake is about 3.7 litres per day for an adult male, and 2.7 litres for an adult female. Eating provides the other elements essential to life.
- **How did these elements come into being?** They were generated by stellar nucleosynthesis in the interior of stars of various kinds (massive stars, dying low mass stars, supernova explosions, exploding white dwarfs) and by merging neutron stars, the resulting elements then being spread through space at the end of the star's life (Johnson *et al* 2020). Hence the phrase, "We are made of stardust".

C) Level L2: Biomolecules – Chemical bonds

Binding of atoms to form molecules takes place through chemical bonding enabled by electrostatic forces, with the nature of allowed bonds being determined by position in columns in the periodic table (which is why elements in the same column have similar chemical properties).

The main types of bonding of concern in biology are,

- Covalent bonding, when atoms share electron pairs and so are bound together as molecules, and the individual atoms lose their identity, e.g. as in the case of hydrogen and oxygen bonded to form water;
- Ionic bonding, such as the electrostatic attraction between oppositely charged ions, or between atoms with very different electronegativities; again the atoms can lose their identity, as in common salt;
- Much weaker hydrogen bonding, an electrostatic force between two bound hydrogen atoms.

These bonds form from atoms, the biomolecules that are key to our physiological functioning: proteins, carbohydrates, lipids, and nucleic acids, as well as smaller molecules such as metabolites. Studying how this happens is the topic of quantum chemistry. No it is not true that this can be described by a single linearly evolving wave function, see for example the Nobel Lecture by Martin Karplus.

D) **Implication of physics and chemistry for the human condition:**

- First, they **underlie the existence of life** by being the bottom levels in the hierarchy of emergence (Figure 1). We would not be here if the needed matter, as in Figure 4, did not exist on Earth. As explained above, they originated because of nuclear interactions in the interior of stars.

A key feature to note is this: we do not know how baryonic matter – ordinary everyday matter - came into existence in the early universe! On simple models, the universe should have produced equal amounts of matter and anti-matter. We don't know how the matter-antimatter asymmetry arose.

- **The material basis of society** The materials that make up everything around us – metals, glass, ceramics, fabrics, paper, plastics, ink, dyes – each have specific physical properties that we need for particular use: being hard, soft, pliable, strong, elastic, and so on, based in their underlying specific molecular structure and bonding. Through a process of adaptive experimentation, we have determined how to make each of these materials that are the background for social life, see Miodownik (2014).
- Physics and chemistry **underlie all engineering outcomes in society**; aircraft, motor cars, bridges, buildings (mechanical and civil engineering); electricity supply and use: lights, motors, refrigeration, heating, lifts, escalators, etc (electrical engineering); transistors, computers, internet, Radios, radar, TV, cell phones (electronic engineering); lasers with physics, military, medical use, and enabling use of CDs; medical imaging via CAT scans, fMRI and PET scans, that has transformed medicine; chemical engineering outcomes such as oils, petrol, diesel, tars, plastics; and medicines, made by pharmaceutical manufacturing.

In short, they are the basis of modern society. They transform our everyday possibilities and experiences. Every one of these innovations is based in someone's creative thinking (Cropley 2015).

J A Johnson, B D Fields and T A Thompson (2020) The origin of the elements: a century of progress *Phil. Trans. R. Soc. A.***378:**20190301

M Miodownik (2014) *Stuff Matters: The Strange Stories of the Marvellous Materials that Shape Our Man-made World* (Houghton MIflin)

D H Cropley (2015) Creativity in engineering. In G. E. Corazza and S. Agnoli (Eds.), *Multidisciplinary Contributions to the Science of Creative Thinking*, Chapter 10 (pp. 155-173), London, UK: Springer

4. What are the emergent biological levels and what do they do?

Each level **L** has **specific functions**, carried out at that level by its **structure**. This is enabled by the next lower level **L-1** (it emerges from that level), and underlies functioning of the next higher level **L+1** (Figure 1). Each higher level **L+1** constrains and controls functioning at the next lower level **L** in order to fulfil its needs.

I now explain each level in turn, because they are the heart of our existence as material entities.

P Menzies and C List (2010) "The Causal Autonomy of the Special Sciences", in *Emergence in Mind,* (Oxford University Press) https://philpapers.org/rec/MENTCA)

J Butterfield (2011) Emergence, reduction and supervenience: A varied landscape. *Foundations of physics* 41:920-959.

K D Farnsworth, L Albantakis, and T Caruso (2017) "Unifying concepts of biological function from molecules to ecosystems" *Oikos***:** 1367-1376.

Level L3: Macromolecular chemistry

The foundation of molecular biology is interaction between macromolecules (Level L3). The discovery of the structure of such molecules transformed biology: haemoglobin by Perutz, the structure of DNA by Crick and Watson in the pivotal year of 1953, and later a variety of RNAs and proteins. Proteins - chains of amino acids - are the workhorse of biology. DNA and the many forms of RNA store and replicate genetic information that bring proteins into existence. That is the reason for their importance.

Molecular biology **function** is based in conformational changes in molecular **structure** (that is, change of molecular shape) and the lock and key molecular recognition mechanism underlying cell signalling processes (Behr 2008). In this way, macromolecules (Lehn 2004) are the foundation of life.

This is the first level where biological activity occurs, because these molecules enable logic to emerge from the underlying physics, thereby underlying all biological activity by change of shape. An example is voltage gated ion channels (**Figure 5**). In this case, the emergent logic is

IF (V upward) THEN (channel closed), IF (V downward) THEN (channel open), (5)

where V is the voltage across the cell wall, a higher scale physical level that of the ion. This is a key kind of emergent functioning arising from the underlying physics (Ellis and Kopel 2019). Because of this molecular function, proteins are selected to come into being by processes of natural selection based in emergent physiological function (Wagner 2014); otherwise these extraordinary structures would not exist.

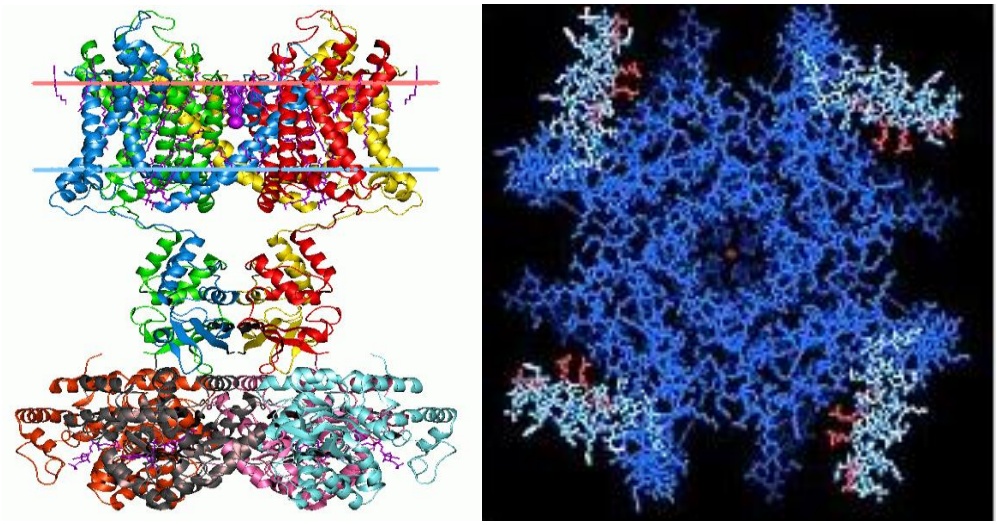

Figure 5. *A Voltage gated ion channel. Left, side view when closed. Right, top view when open (the red dot is the ion). Change of shape allows the ion to pass through the ion channel.*

J P Behr (Ed) (2008) *The lock-and-key principle: the state of the art--100 years on* (Wiley).
J M Lehn (2004) Supramolecular chemistry: from molecular information towards self-organization and complex matter *Reports on progress in physics* **67**:249.
G Ellis and J Kopel (2019) The dynamical emergence of biology from physics: branching causation via biomolecules. *Frontiers in Physiology*, *9*, 1966.
A Wagner (2014) *Arrival of the fittest: solving evolution's greatest puzzle* (Penguin).

L4: Protein and RNA networks

Proteins and RNA and DNA interact via gene regulatory networks, metabolic networks, and cell signalling networks, functioning by the conformational changes of shape of macromolecules, together with the lock and key mechanism of molecular recognition underlying enzyme specificity. Generically these are protein interaction networks and *inter alia* underlie metabolic pathways.

This enables higher order logic such as AND, OR, NOT to emerge from the molecular interactions via allosteric processes discovered by Jacob, Monod, and Changeux, which underlie developmental processes.

L5: Subcellular Machinery

Cells come in two forms: Prokaryotes, without a nucleus, and Eukaryotes with a nucleus, the basis of plants and animals. Eukaryotic cells are modular in nature (Hartwell *et al* 1999), being made of many parts: they contain various types of organelles, including mitochondria, the endoplasmic reticulum, the Golgi apparatus, and lysosomes (**Figure 6**), each carrying out a specific function critical to the cell's survival. Lipid bilayer membranes surrounding organelles function to confine reactions by keeping the inside "in" and the outside "out", this separation permitting different kinds of reactions to take place in the different kinds of organelles. Molecular channels made of membrane proteins (such as the voltage and ligand gated ion channels) control ingress and egress of molecules and ions in and out of membranes.

F Jacob and J Monod (1961) "Genetic regulatory mechanisms in the synthesis of proteins". *Journal of Molecular Biology* **3**:318–356.
J Monod, J P Changeux, and F Jacob (1963) Allosteric proteins and cellular control systems. *Journal of molecular biology* ***6***:306-329.
L Hartwell, J Hopfield, S Leibler, and A Murray (1999) From molecular to modular cell biology *Nature* **402** (Suppl 6761), C47–C52

L6: Cells (the basic unit of life)

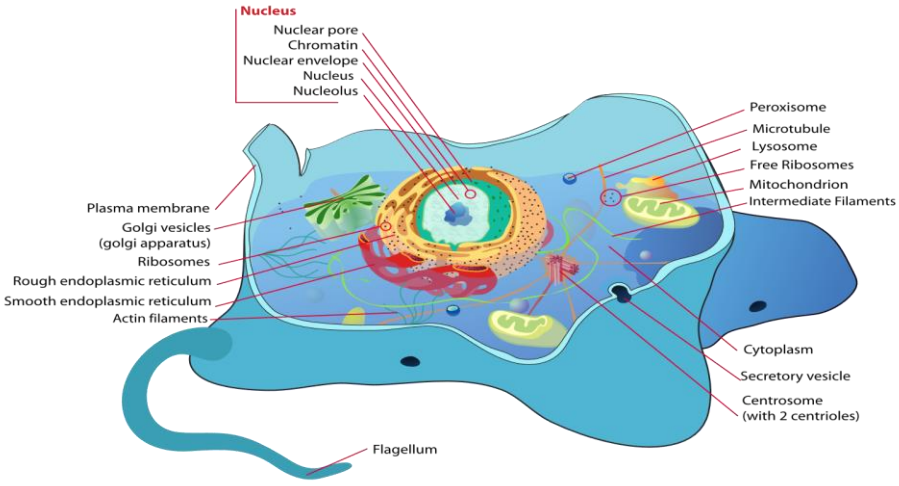

Figure 6: *Eukaryote cell structure.* From Wikipedia: Cell (biology). *Multi-cellular animals are made by eukaryotic cells imbedded in an extracellular matrix, and linked via cell adhesion molecules.*

Cells (**Figure 6**) are the lowest level where all the functions of life exist: they are replicators, and so provide the basis of body growth as development takes place from a single cell to the huge number of 10^{13} cells. We grow because they multiply, dividing many times. Cell function depends on the continual uptake and conversion of energy: metabolism is the complete set of biochemical reactions within a cell that keep it alive, including the citric acid cycle. We are alive because our cells are alive. We die if they do not get the oxygen, glucose, fats, and proteins they need, provided to them by our circulatory system.

L7: Tissues

Body tissues are a level of organisation between cells and a complete organism. The main kinds are

- Epithelial tissue, forming a barrier between the external environment and the organ it covers, providing protection and allowing controlled ingress and egress to the organ. Skin is a key case, covering the body as a whole and so defining our physical boundaries.
- Connective tissue is found between other tissues everywhere in the body, including the nervous system. They bind other tissues to each other, and form a scaffolding for other cells.
- Muscular tissue functions to produce force and cause motion. It is what enables us to speak, see (controlling eye movement), move, and act on the world around us.
- Nervous tissue is the main component of the nervous system. It is composed of neurons connected by synapses, which receive and transmit action potential spike chains, and glial cells which assist propagation of nerve impulses and provide nutrients to the neurons

Thus they each have different functions in the emergent body, underlying and enabling the emergent physiological level L8, which acts down to shape specific outcomes at level L7, e.g. specific muscle motions.

L8: Organs (eyes, lungs, the heart, etc): the level of physiology

The human physiological systems meet basic needs of life. In each case form and function are closely intertwined (Brewer and Burrough 1990; Wainwright 1988), as for example the heart (Figure 7).

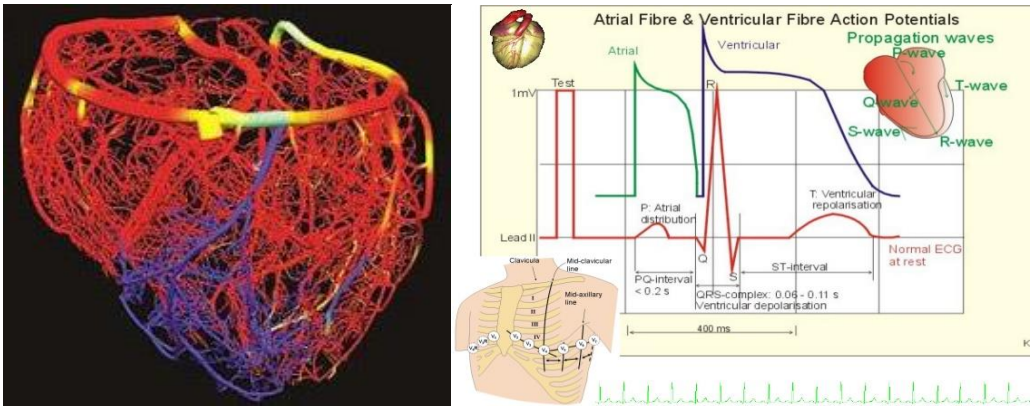

Figure 7: The human heart. *Hierarchical structure (left), functioning (right). From Noble (2002).*

They are,

- Systems that **establish identity**: A muscular-skeletal system that establishes rigidity with flexibility, and the permeable membrane of skin that establishes the boundary of the body.
- The **existential needs**: air, water, food, providing energy we need, and elimination of waste, met by the digestive system together with the circulatory system powered by the heart.
- The **ability to act**: arms and hands with fingers, powered by muscles and directed by the brain.
- The **ability to move**: met by legs and feet with toes, again directed by the brain
- **Stability**: Homeostatic systems to keep the internal state in acceptable limits: body temperature, blood pressure, electrolyte levels, calcium levels, blood sugar levels in particular. We are ill if any of them are out of limits. Homeostasis is a deep principle of biological existence.

- Ability to **ward off infectious disease**s The immune systems (innate and adaptive) exist to fight off both previously encountered and novel infections.
- **Sensory systems** to receive information about the physical and social world and the internal milieu: vision (eyes), hearing (ears), taste (tongue) and smell (nose), and somatosensory systems including touch.
- **Brains** to analyse that information, predict outcomes, and make action choices.
- **Reproductive systems** that ensure the survival of the species.

Each of these systems is an emergent system with functioning that is characterised and studied at the physiological level, enabled by the underlying levels, which this level in turn coordinates to meet these emergent needs, as in the case of the heart, with its hierarchical structure (**Figure 7**). These systems have all evolved to be what it they are because they greatly enhance our survival prospects. They work in an integrated way to enable us to function as organisms as a whole, each meeting a separate need. The key point is that, regarding graphs representing physiological processes (Davies 2021:15),

> *These diagrams represent the idea of a **system**: a set of components acting in very specific ways to generate properties at the system level that are absent from any one component. The existence of **system level properties** that are not seen in their components is called **emergence**, and is a very important property of living systems. Indeed life itself can be seen as an emergent property of the physiological mechanisms that underlie it.*

We are in trouble if that emergence fails, as e.g. in the case of the heart (Rappel 2022)

C V Brewer and C D Burrow (1980) *Life: Form and Function* (MacMillan).
S A Wainwright (1988). Form and function in organisms. *American Zoologist* ***28***:671-680.
D Noble (2002) Modelling the heart--from genes to cells to the whole organ. *Science* ***295***: 1678-1682
J A Davies (2021) *Human Physiology: A Very Short Introduction* (Oxford)
W J Rappel (2022) The physics of heart rhythm disorders. *Physics Reports*, *978*, 1-45.

L9: Organisms (plants, animals, humans)

This is the integrative level of organisms as a whole, able to react to and adapt to the environment, in the case of animals involving the emergence of agency.

The mind/brain coordinates all this and enables mental causation by humans (Robb and Heil 2021). All humans have the same physiology and needs, irrespective of skin colour or culture, through our common genetic inheritance, even with a great variety of characteristics such as height, weight, hair and eye and skin colour, and so on. We are very special amongst animals because of our anatomy, allowing the use of hands with opposable thumbs for all kinds of fine manipulation, a larynx, vocal chords, lips, and tongue allowing fine control of speech and song, These physiological adaptations are crucial to our abilities.

A symbolic brain (Deacon 1998) that can understand and plan emerged, with language enabling communicating, planning, logical argumentation, making theories, and reasoning via verbalised mental models and metaphors (Lakoff and Johnson 2008). Then writing emerged, enabling transfer of ideas over time and space. Development of mathematics enabled science and engineering to emerge, underlying both warlike and peaceful uses of technology.

Humans can be regarded as having a hierarchy of needs which extends from basic physical needs to higher levels of needs, including self-actualisation and transcendence (Maslow 1943).

D Robb and J Heil, J (2021): "Mental Causation", *The Stanford Encyclopedia of philosophy,* Ed. E N Zalta
T Deacon (1998) *The symbolic species: The co-evolution of language and the brain* (WW Norton).
G Lakoff and M Johnson (2008). *Metaphors we live by* (University of Chicago Press).
A H Maslow (1943) "A theory of human motivation". *Psychological Review*. **50**: 370–396.

L10: Groups, societies, and organisations

Taken together, we form social groups of various sizes and degrees of coherence. We are social animals relying on our communities for existence, support, and life opportunities, leading to existence of societies with varied cultures, and a variety of organisations that fulfil specific functions in those societies. Trust is central to their functioning (Simpson 2012). Humans have via their symbolic ability developed technology in successive stages that has enabled them to conquer the Earth and travel to space. This took place by a process of adaptive selection, for example the development of personal transport from horse drawn carriages to steam driven carriages to motor cars powered by internal combustion engines with clutches. This technology depends on ball bearings and lubrication, which is why cars need oil. Above all, it depended on harnessing new energy sources needed for agriculture, industry, commerce, transport, domestic use, telecommunications, computing, and so on.

Because societies involve interactions between people with their own agency and agendas in very varied social contexts, it is much more difficult to characterise relevant emergent behaviours in a reliable way, and many of you reading this will have a much deeper knowledge of such interactions than I do. Nevertheless I will make some remarks that situate these interactions within the broad framework I am putting forward in this document. I return to the theme in Section 7.

A) Universal needs of all societies, material and socio-cultural, must be met in one way or another

The existential needs of a society are clean air, clean water, safe food, adequate waste disposal and toilets and sewage systems, and protection from the elements. In an industrial society, key needs are ammonia (for fertiliser to enable producing sufficient food), plastics, steel, and concrete, together with industrial scale energy to allow agricultural, production, construction, and transport processes to take place, and communication and information systems that allow coordination of the whole.

Organisations of all kinds exist to meet all our physical and social needs. Agricultural, manufacturing, distribution, sales, transport, and waste disposal systems meet material needs. Infrastructure to support this are energy systems, water supply and disposal systems, sewerage and waste disposal systems, and news and telecommunication systems including the internet.

Socio-cultural needs include government and administration, a financial system, a legal system, an education system, adequate computing facilities and training, health and welfare systems, arts and cultural facilities, religious organisations, and entertainment, recreation, and sports facilities.

B) Societies to meet these needs have arisen by cultural evolutionary processes

Analogously to the process of natural selection in biology, a process of adaptive selection by trial and error in society has developed and shaped social systems and organisation so as to meet these needs. They have resulted in key innovations such as control of fire, development of agriculture, harnessing of varied energy sources, the invention of money, development of closed corporations, and so on. They have also led to an astonishing increase in our understanding of the physical and biological worlds.

TW Simpson (2012) What is Trust? *Pacific Philosophical Quarterly* **93**:550-569.

D F Aberle, A K Cohen, A K Davis, M J Levy Jr, and F X Sutton (1950). "The functional prerequisites of a society". *Ethics*, *60*(2), 100-111

V Smil: *How the World Really Works: A Scientist's Guide to Our Past, Present, and Future*

J Bronowski (1973): The Ascent of Man

Y Harari (2015): Sapiens

C) Society and those in it interact in upwards and downwards ways

Societies emerge from the people making them up, but they do so through organisations that are more than the sum of the parts: they have agency as organisations They acts downwards on the individuals making them up by the same mechanisms whereby this happens in general:

- Economic and legal constraints shape what resources individuals have and so what they can do.

These are abstract constraints that shape outcomes, particularly laws defining ownership and use of resources, which constrain actions of individuals and thereby material outcomes

- Job descriptions, laws constraining what we can do, rules of games, etc shape outcomes.
- Societies also shape their members in a downward way by a number of processes: informal and formal education, training, and apprenticeship programs that change the very nature of people in the society from novices to skilled pilots, engineers, doctors, lawyers, and so on, thereby being made fit for many of the roles that society needs to be filled.
- Relevant authorities decide on public holidays and celebrations (Freedom Day, Worker's Day, Easter, Diwali, etc) which then result in public holidays, decorations, and so on which alter physical outcomes. Symbolism shapes public discourse in this way.
- Cultural influences also act down to shape individual understandings and behaviour and values, for example through role models (Longres 1966). These result in "cognitive gadgets" in our brain - special-purpose organs of thought built in the course of development through social interaction (Heyes 2018). These are products of cultural rather than genetic evolution. Crucially, this includes norms (Heyes 2022).
- Through our experiencing all these effects, our interpretation and indeed understanding of society and the world around us is shaped in a cultural way (Berger 1963, Berger and Luckmann 1966).

J F Longres (1990) *Human Behaviour in the Social Environment* (E F Peacock)
C Heyes (2018) *Cognitive Gadgets: The Cultural Evolution of Thinking* (Harvard)
C Heyes (2022) Rethinking Norm Psychology. Perspectives on Psychological Science 7 June 2022
P L Berger (1963) *Invitation to Sociology: A Humanistic Perspective* (Anchor Books)
P L Berger and T Luckmann (1966) *The social construction of reality: A treatise in thesociology of knowledge*

The set of levels overall: As stated at the start, each of these levels L1 to L10 has been brought into being by evolutionary processes (Section 5) because each of them fulfils a vital function enabling us to exist. Each level has its own characteristic behaviours, characterised by effective laws and variables, that is irreducible to any lower level, although they are able to exist and function only because of those lower levels. The levels L1 to L10 are each different from each other, but with outcomes dependent on each other, as claimed at the start of this paper. It requires the kind of reasonably detailed exposition given in this section to substantiate the claims made there. It shows how different the levels are both in structure and function.

Causal closure only occurs via the upwards and downwards interactions between all the levels L1 to L10: specific real-world outcomes are not determined if we omit any of these levels.

An example is a well-established causal relation: at the physiological level, ***smoking causes lung cancer***, as analysed by Judea Pearl (2018), carefully separating causation and correlation. This starts with pressures at the societal level L10 where major advertising campaigns, carefully researched, encourage smoking, and it may also be encouraged at social events. At the psychological level L9 a choice has to be made as to whether to smoke or not: this is where emotion and rationality battle it out. If smoking is chosen, smoke particles will enter the lungs and greatly enhance the probability of catching cancer at level L8. It will be caused by changes to gene regulatory networks at Level L4, with different proteins at level L3 changing cell division processes and hence causing uncontrolled cell proliferation at level L6, enabled by molecular processes based in physical chemistry and physics at Levels L2 and L1. Specific outcomes that occur are determined by this entire set of interactions as a whole. This process chains down from level L10 to level L1, which enables the whole to take place. The physics level L1 by itself is not causally closed, *contra* claims often made. It is the set L1 to L10 as a whole that is (Montévil and Mossio 2015).

J Pearl (2018) The Book 0f Why
M Montévil and M Mossio (2015) "Biological organisation as closure of constraints" *Journal of Theoretical Biology* **372**:179-191.

Conclusion of this section: I have summarised a great deal of biological understanding in this section. What is the point of doing so? It is to fill out the claims in the introduction in a solid way.

- Same level causation occurs at every level, with completely different variables and emergent laws at each level, as shown above. This is based in upward emergence of higher levels from lower levels, with emergent higher level needs shaping lower level processes accordingly.
- Life achieves what it does through the combination of all these levels. If any level were to be missed the whole could not work: they are all equally important to life (Noble 2012).
- Needs chain up through these levels: cells need nutrition and oxygen (L6), which is why related physiological systems exist (L8), and why we need to eat and drink (L9), and therefore why agriculture is needed in society (L10).
- Outcomes chain down: agriculture (L10) provides food which is used by physiological systems (L8) to ensure cells (L6) have the energy they need to continue functioning and stay alive via levels L4 and L3, which shape outcomes at L1 and L2 that would otherwise be undetermined.

5. How did we get here? Natural selection and developmental processes

Two different timescales are involved in our coming into being: evolutionary (millions of years) and developmental (decades). Quite different processes are involved in these two cases.

A) Evolution by natural selection on long timescales

Evolutionary processes of natural selection (Darwin 1872, Godfrey Smith 2007) are the origin of the DNA that makes up the genome – the 'coded information' that is used to shape both our universal human nature, and the detailed physical differences between each of us. This is a key foundation of our existence, determining what kind of animal we become. Our DNA is different than that of plants, mice, and great apes, even though in the last case there is a great deal in common between our sets of genes.

The process is simple in principle (Dobzhansky 2013, Gardner 2009), see **Figure 8**. In a given population (sharing the same DNA pool), when reproduction takes place variations in DNA in the offspring will take place as a result of mutation, genetic recombination and other sources of genetic variation.

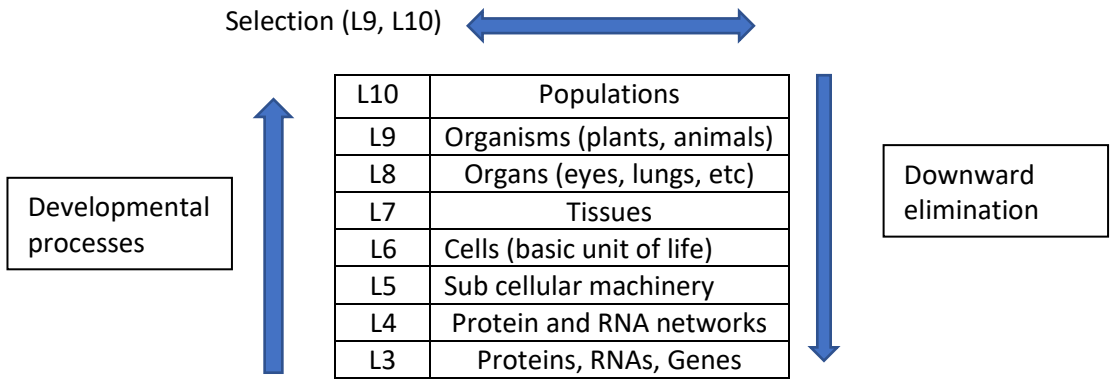

Figure 8 *The chaining up of developmental processes and down of selective processes in the hierarchy of emergent levels. The same as Figure 1, which applies to physiological functioning, but here applied to developmental and evolutionary processes. As variation takes place, every emergent level must adapt in a consonant way, else the whole will not work. Selection works right down to molecules: proteins and DNA, and includes selection of developmental systems. It does not alter levels L2 and L1, which are universal.*

Developmental processes will result in a varied population of adults based in these varied genes, who will compete with others for resources and indeed survival until they themselves produce progeny. Those adults that have a relatively better survival rate because of their physiological and ecological interactions in the relevant ecosystem will become relatively dominant in the shaping the next generation gene pool, because the genes of other less successful adults will be eliminated. Selection chains down from either the organism or the group level, depending which is more dominant in determining survival, to the gene level. Major

transitions in evolution occurred as new levels of structure and information processing emerged through this process (Szathmáry and Maynard Smith 1995, Jablonka and Lamb 2006).

Selection can take place due to organism level changes, leading to more useful individual traits (stronger limbs, better eyes, etc), and so leading to a more successful group; or it can take place at the group level due to existence of cooperative traits that enhance group survival, the prime example being a symbolic brain allowing the evolution of language (Fitch2005) and hence development of cooperation and culture.

Evolutionary selection extended to the evolution of consciousness (Heyes 2012, Birch *et al* 2020), because this enabled causal thinking and predictive powers that enabled better adaption to the ecological environment, and then development of technology that enabled humans to dominate the world.

T Dobzhansky (2013) "Nothing in biology makes sense except in the light of evolution". *The American Biology Teacher* ***75***:87-91.

A Gardner (2009) Adaptation as organism design *Biology Letters*, *5*:861-864

E Szathmáry and J Maynard Smith (1995) "The major evolutionary transitions." *Nature* **374**: 227-232.

E Jablonka and M J. Lamb (2006) "The evolution of information in the major transitions." *Journal of theoretical biology* 239, no. 2 (2006): 236-246.

W Fitch (2005) The evolution of language: a comparative review . *Biology and philosophy* **20:**193-203.

C Heyes (2012) New thinking: the evolution of human cognition *Philosophical Transactions of the Royal Society B: Biological Sciences*, *367*(1599), 2091-2096.

J Birch, S Ginsburg, and E Jablonka (2020). Unlimited Associative Learning and the origins of consciousness: a primer and some predictions. *Biology and Philosophy* **35**: 56.

Evolutionary processes as a whole depend on an interaction of development and function (physiology, ecology) with evolutionary genetics. All levels are involved (Figure 8). Consequently,

> *Noble's principle of biological relativity for biological functioning applies to developmental/evolutionary processes as well. Every emergent level takes part both in development as a basis for emergence of the next highest level, and in the selective evolutionary processes as a constraint on the next lower level (Figure 8). Evolution thereby tunes every emergent level so they all function consistently.*

Debates While there is agreement on the overall process, there are many vigorous debates about specifics. Darwin laid down the general basis as above - a competition to survive, the relatively fittest win, resulting in apparent design (Gardner 2009). But the following issues arise.

a) **Cooperation** As well as competition for survival, what occurs in evolution is emergence of cooperation. In the end cooperation often wins, as in the case of multicellularity, and the emergence of language that separated us from the great apes (Deacon 1998), allowing us to develop technological society. A technical argument has raged over explaining how evolution of cooperation could occur, and specifically whether group selection or kin selection took place. However in formal terms they are equivalent (Birch and Okasha 2015).

b) **The molecular view** Since the discovery of the way DNA shapes our genetic inheritance, population geneticists have taken over much of evolutionary theory, and essentially claimed that molecules are all that matter in evolution: function (physiological, ecological) as considered here has dropped out of sight for them, only genetic processes matter (Gardner 2009). But they all matter: genetics, physiology, ecology, and developmental processes all interact in evolutionary processes. This is how humans got to be what they are. But I emphasize there are many other evolutionary theorists with a broader view.

c) **Genetic Drift** A specific debate is about to what degree selection shapes outcomes, or rather random genetic drift does so, so some features are not in fact the result of adaptive processes. The analogy used to make the point was the existence of the spandrels of San Marco – decorative features of San Marco

cathedral with no structural significance, so their existence is not explained by structural function and selection (Gould and Lewontin 1979). Drift plays a key role in molecular evolution, but arguably a relatively minor role at the macro level, for example underlying details of skull shape, but not the overall features of the skull which enables eyes and ears and the nose to exist (Ackermann and Cheverud 2004).

However we are indeed a product of our evolutionary past, and some aspects of that past may remain with us as useless appendages. One must be careful with such claims; they used to be made about the appendix and tonsils, but which are now believed to play important roles in maintaining gut flora and in the immune system respectively. There however are a few evolutionary outcomes that can be regarded as negative in terms of outcomes, e.g. the pain and problems experienced by women while giving birth.

T W Deacon (1998) *The symbolic species: The co-evolution of language and the brain* (WW Norton)

J Birch and S Okasha (2015) Kin selection and its critics. *BioScience* **65**: 22-32

A Gardner (2009) Adaptation as organism design *Biology Letters* ***5***:861-864

S J Gould and R C Lewontin (1979) The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme *Proc. R. Soc. Lond. B.*205581–598.

R R Ackermann and J M Cheverud (2004) Detecting genetic drift versus selection in human evolution *Proc Nat Acad Sci* **101**: 17946–17951.

d) **The selfish gene and all that**: What is simply wrong is Richard Dawkins' statements that genes - DNA - is a replicator that controls human beings. DNA by itself cannot replicate, this is a basic biological error. Genes by themselves do nothing at all. It is gene regulatory processes that determine what gene will get read where and when, and hence determine genetic outcomes. This only happens in the context of a living cell, which does all the work of duplication of DNA and of the cell itself. The cell is the replicator.

e) **Genes and culture** Once consciousness evolved, evolution extended to gene-culture co-evolution with genes and culture both evolving in a symbiotic way (Laland *et al* 2010), as in the evolution of language (Tomasello 2019), and cultural evolution itself evolving (Birch and Heyes 2021).

f) **Downward causation** Because this overall is a process of adaptation to the environment, at its heart it is a downward causal process (Campbell 1974). Different environments result in different developmental systems, gene regulatory networks, genes, and proteins, as needed to fulfil physiological function in a specific ecological context with specific ecological niches (Wagner 2015). This is shown in Figure 8.

However evolution also has an upward component: living beings can engage in niche construction by altering the environment, as for instance ants creating anthills, beavers creating dams, and humans engineering the environment. Then consequent environmental feedback is important (Lion 2018).

During this process, keystone species (Mills *et al* 1993) have an inordinate effect on the natural environment, and hence play a key role in the ecology and evolution interaction.

K Laland, J Odling-Smee, and S Myles(2010): "How culture shaped the human genome: bringing genetics and the human sciences together." *Nature Reviews Genetics* 11:137-148.

M Tomasello (2019) *Becoming Human: A Theory of Ontogeny* (Harvard)

J Birch and C Heyes (2021). "The cultural evolution of cultural evolution." *Philosophical Transactions of the Royal Society B*, *376*(1828), 20200051

D Campbell (1974) "Downward causation in hierarchically organised biological systems". In Ayala, F.J., Dobhzansky, T. (eds.) *Studies in the Philosophy of Biology: Reduction and Related Problems*, 179–186.

A Wagner (2015) Arrival of the Fittest: How Nature Innovates

S Lion (2018) "Theoretical approaches in evolutionary ecology: environmental feedback as a unifying perspective." *The American Naturalist* **191**: 21-44.

L S Mills, M E Soulé, and D F Doak (1993). The keystone-species concept in ecology and conservation. *BioScience*, *43*(4), 219-224.

What was the origin of life ? We do not know how abiogenesis took place: that is, how life came into being from non-living matter There are competing theories, particularly as to whether metabolism or genetic information came first, or if both evolved together, and in what environment this took place.

B) Developmental processes on shorter timescales, and the life cycle.

Development of a human being from a fertilized cell to an adult human being is an extraordinary process, enabled by developmental systems that have arisen through evolutionary processes (Wolpert 1991).The prime problem faced in these processes is that every cell contains identical genetic information, but each cell must adapt to produce the specific kind of cells and tissue that is needed at each place in the developing organism. Different cell types must be generated at different positions in the body so as to create arms, bone, legs, skin, eyes, neurons, and so on, as will be needed by the adult organism.

Developmental processes are based in positional information derived from morphogens diffusing from organising centres, controlling what genes are turned on and off in what places and at what times in a developing organism, and so controlling embryonic development. This process relies on the interaction of Gene Regulatory Networks (GRNs) and Metabolic Networks, where the GRNs involve allosteric processes and homeobox genes. Carroll (2005) beautifully describes how this works. The same segmentation processes result in vertebrate backbones and fruit fly segments.

These processes are cases of downward causation (Pezzulo and Levin 2016), because position (a macro variable) determines genetic activity, and so cellular differentiation, at the molecular level. Cell processes correct errors that occur in DNA duplication, else cells would cease to function in short order.

L Wolpert (1991). *The triumph of the embryo*. Courier Corporation.

S B Carroll (2005). *Endless forms most beautiful: The new science of evo devo and the making of the animal kingdom.* (WW Norton & Company)

G Pezzulo and M Levin (2016). "Top-down models in biology: explanation and control of complex living systems above the molecular level". *Jour Royal Society Interface 13*: 20160555

Developmental programs shape our lives as we progress through the various life stages: zygote to embryo to birth to infant to youth and learning guided by caring adults, the pre-school years being developmentally crucial, to puberty, to adult with responsibility, to aging, to death. We share all these stages with all mammals. The emergence of the brain and consciousness is part of the process (Lagercrantz and Changeux 2009, Lagercrantz *et al* 2010), with learning (and so education) being crucial. Aging results from cellular and genetic changes, such as genome instability and telomere shortening (López-Otín *et al* 2013).

Related to this is the inevitability of death (Breitbart 2017): each life comes to an end. Despite desperate attempts by some billionaires to avoid it, it will forever be a profound unavoidable aspect of the human condition. We have to learn to face up to it and live with it. All development is shaped by the interaction of our internal states with social and cultural influences. An negative example is fetal alcohol syndrome.

H Lagercrantz and J P Changeux (2009). The emergence of human consciousness: from foetal to neonatal life. *Pediatric research*, *65*(3), 255-260.

H Lagercrantz, M A Hanson, L R Ment, and D M Peebles (Eds.). (2010). The newborn brain: neuroscience and clinical applications.

C López-Otín, M A Blasco, L Partridge, M Serrano, and G Kroemer (2013) "The Hallmarks of Aging". *Cell*. **153** (6): 1194–1217.

W Breitbart (2017) On the inevitability of death. *Palliative & supportive care* **15**:276-278

C) EVO-DEVO processes

Developmental processes and evolutionary processes affect each other reciprocally, because organisms that survive are the outcome of developmental processes, so adaptive selection selects developmental systems that lead to preferred outcomes, as indicated already in Figure 8.

The EVO-DEVO integrated view arises by combining the effects of these two processes on different timescales (Gilbert *et al* 1996, Carroll 2008).

S F Gilbert, J M Opitz, and R A Raff (1996) "Resynthesizing evolutionary and developmental biology". *Developmental biology* **173**:357-372.

S B Carroll (2008) "Evo-devo and an expanding evolutionary synthesis: a genetic theory ofmorphological evolution" *Cell* **134**:25–36.

6. Our brain shapes our actions: perception, rationality, emotions, and values

The mind/brain integrates all the systems of an organism through the physical central nervous system and the phenomenal experience of consciousness, with decision making changing outcomes in the physical world around us. Brains are networks made of neurons connected via synapses that analyse information, predict outcomes on the basis of mental models, and choose action plans. Some excellent big picture views of the mind/brain are given by (Kandel 2012, Frith 2013, Solms 2021).

E Kandel (2012) *The age of insight: The quest to understand the unconscious in art, mind, and brain, from Vienna 1900 to the present* (Random House)

C Frith (2013) Making up the mind: How the brain creates our mental world

M Solms (2021) *The Hidden Spring A journey to the source of consciousness* (WW Norton)

A) Consciousness is real We experience qualia and our own consciousness, being aware of our own existence (Strawson 2018, Pigliucci 2019) and the passing of time. Being awake and sleeping are different states of brain activity, where consciousness largely recedes during sleep but dreams take place.

Our perceptions are shaped by our senses (sight, hearing, touch, taste and smell, and balance/ proprioception), which means we experience the world differently than animals with other senses (e.g. bats, Nagel 2002) or extended sensory perception (e.g. dogs' sense of smell; birds' ultraviolet vision). Our sensory perceptions are not direct reports of what is out there in the external world: they are what our brain interprets to be out there, and may sometimes result in sensory illusions. Nevertheless they provide by and large a good representation of the external world: that has to be the case, or we would not survive. These representations are strongly influenced by culture: some cultures can make fine distinctions others cannot, as for example in the case of eskimo words for snow, revealing how culture and language are shaped by physical conditions and experience.

We experience both rational thought and emotions, which interact with each other to shape our thought processes and action choices. We do indeed make a difference to the world by our actions, at smaller (personal) and larger (social, environmental) scales; this is what we experience in daily life, and why we have to make choices. Some of them can be undone, but some cannot: time passes (Maudlin 2002**)** and some actions make irreparable changes to our physical or social situation:

"The Moving Finger writes; and, having writ,
Moves on: nor all thy Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all thy Tears wash out a Word of it."

(Omar Khayyám). This is a key feature of our individual and communal lives: a fundamental aspect of the human condition, with the arrow of time ultimately originating in cosmology (Section 1).

G Strawson (2018) The consciousness denier*s The New York Review* March 13 2018

M Pigliucci (2019) Consciousness is real *Aeon* 16 December 2019

T Maudlin (2002) Remarks on the passing of time. *Proceedings of the Aristotelian Society* 102:259-274.

T Nagel (1974) What is it like to be a bat*? The Philosophical Review* 83:435-450

Animal Sentience and our response Human consciousness can be placed in a broader view of animal sentience, which also exists, for example in the case of octopuses (Birch *et al* 2020, Browning and Birch 2022). Realisation that this is so lead to the *Animal Welfare (Sentience) Act 2022* becoming law in the UK. Human sentience is affirmed by the criteria set out there (if we weren't sentient, we could not read it!).

J Birch, A K Schnell, and N S Clayton (2020) Dimensions of animal consciousness. *Trends in Cognitive Sciences* **24**:789–801.
H Browning and J Birch (2022) Animal Sentience *Philosophy Compass* 17:e12822

B) Learning Brains exhibit *plasticity*: we learn by altering neural connection weights in response to experiences. You may read breathless articles about how learning mathematics or how to play the piano or whatever alters your brain. Well everything you experience does! That is how memories are formed, and stored by the brain (Kandel 2001, Edelman 1987, 1993).

E Kandel (2001) ``The molecular biology of memory storage: a dialogue between genes and synapses'' *Science*:**294**:1030-1038
G Edelman (1987) *Neural Darwinism: The theory of neuronal group selection*. Basic books
G Edelman (1993) Neural Darwinism: selection and re-entrant signalling in higher brain function. *Neuron* **10**:115-125

C) A complex set of interactions take place in the mind/brain, see **Figure 9**.

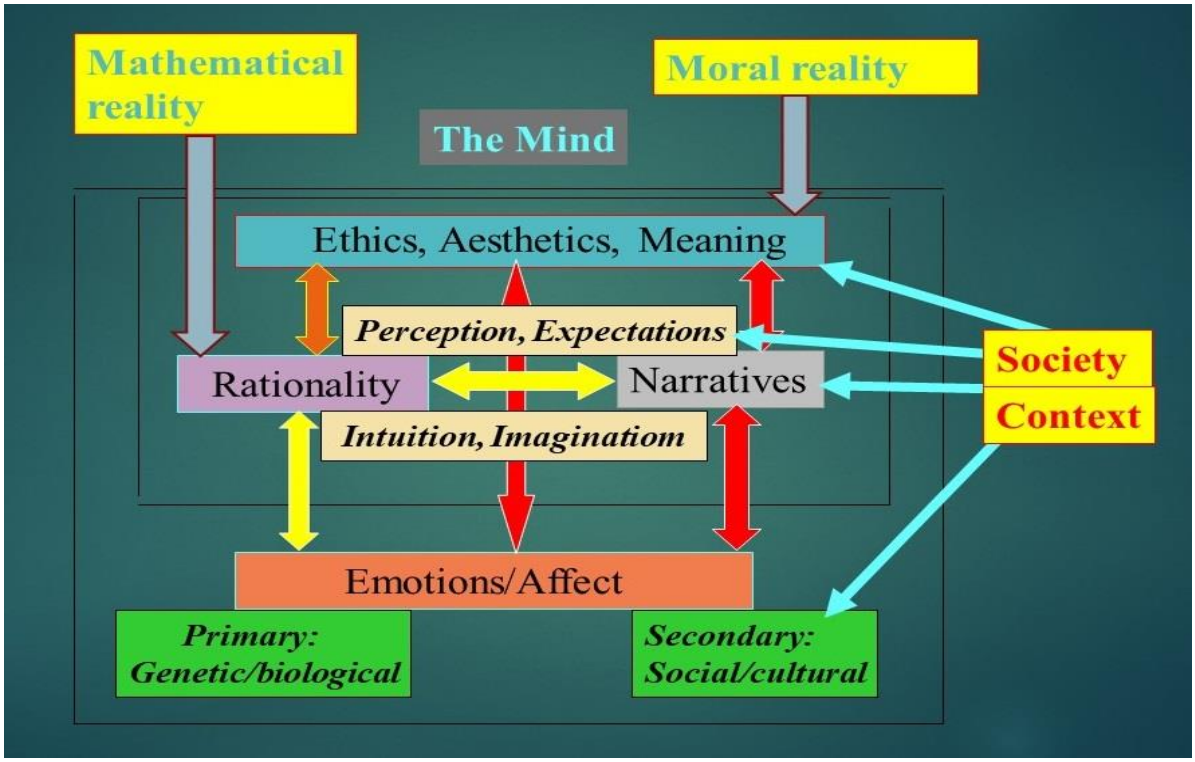

Figure 9: *The complex of interacting factors shaping mental processes*

1. Rationality leads to outcomes: deductive causation takes place. Mental states have causal power (Menzies 2003) e.g. plans for a building, rules of chess, traffic laws, closed corporations change physical outcomes. Deductive causation can take place, enabled by macromolecular interactions that underlie logical branching (Ellis and Kopel 2019: Section 6.3). Decision making involves choosing between a finite set of

alternative possibilities, using explicit or implicit evaluative criteria with cognitive, psychological, emotional, and normative aspects. The process is threatened by information overload, and the famous problem of unknown unknowns. Incommensurable values are a problematic issue (Chang 2017, Hsieh and Anderson 2021). However as pointed out by Chang, making a choice involves making a commitment which crucially alters the decision making context at the next stage.

P Menzies (2003) "The Causal Efficacy of Mental States". In *Physicalism and Mental Causation*, pp. 195–224.
G Ellis and J Kopel (2019) The dynamical emergence of biology from physics: branching causation via biomolecules. *Frontiers in Physiology* **9**:1966
R Chang (2017) Hard choices *Journal of the American Philosophical Association*, *3*(1), 1-21.
N Hsieh and H Andersson (2021) Incommensurable Values *The Stanford Encyclopedia of Philosophy* (Fall 2021 Edition), Edward N. Zalta (ed.)

2. Abstract Possibility spaces (Ellis 2021) **inform rational thought,** for example determining possible mathematical outcomes to be explored by reason: that is, one can argue for mathematical Platonism. The adaptive neural network structure of our brain enables us to investigate these spaces (Churchland 2012).

G Ellis (2021) "The Philosophical Problem of Cosmology" IAI TV (2021)
P M Churchland (2012) *Plato's camera: How the physical brain captures a landscape of abstract universals*.

3. Imagination (Rugg 1963) determines how large the space of possibilities considered by rational exploration will be. Crucial progress results from "thinking outside the box". Processes that encourage this are explored by Hadamard (1954).

H Rugg (1963) Imagination. Harper & Row.
J Hadamard (1954) *The Psychology of Invention in the Mathematical Field* (Dover, New York)

4. Perception is by predictive processing and cue selection The mind has evolved so as to predict the future (Hawkins 2004) on the basis of incoming data, together with expectations based on past experience (Clark 2013). This applies in particular to perception: what we see is what the brain expects us to see, modulated by incoming data that corrects expectation in the light of new information. This happens via cortico-thalamic circuits in the brain (Alitto and Usrey 2003). A key question is cue selection: how are cues recognised? Felin and Koenderink (2022) argue that organism-specific, top-down factors play a role in transforming "raw" optical structure and latent or dormant cues into clues for-something.

J Hawkins, (2004) *On intelligence* (Macmillan).
A Clark (2013) Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and brain sciences*, *36*(3), 181-204.
H J Alitto and W M Usrey (2003) Corticothalamic feedback and sensory processing. *Current opinion in neurobiology*, *13*(4), 440-445.
T Felin and J Koenderink (2022). A Generative View of Rationality and Growing Awareness. *Frontiers in Psychology* **13:**807261-807261

5. Expectations are the outcome of our experiences and how we perceive them, in particular how we engage with others and likely outcomes of our interactions. But expectations do not guarantee what will occur; in the end a modicum of trust and hope is required to make real-world decisions (Temelkuran 2021).

E Temelkuran (2021) *Together: A Manifesto against the Heartless World*, Chapter 1

6. **Intuition** is a way of fast thinking (Kahneman2011) enabling understanding situations without a slow process of rational analysis. Intuitive understandings arise from the basis of past experience that has become internalised (Meyers 2002), but can later be rationalised if need be: e.g. why a doctor concluded

you might have pneumonia after a cursory inspection, or a woman understands what a man is about to do without specific communication taking place between them, and vice versa.

D Kahneman(2011) *Thinking, Fast and Slow*
D G Myers (2002) *Intuition: Its Powers and Perils*

7. Narratives are a key form of understanding a complex situation and likely outcomes, allowing an in depth way of understanding and communicating complex interactions (Johnson *et al* 2020). This is a very important way of communicating: we tell stories that convey meaning and emotion (Gottschall 2012).

J Gottschall (2012) *The storytelling animal: How stories make us human*. Houghton Mifflin Harcourt.
S Johnson, A Bilovich, and D Tuckett (2020) "Conviction narrative theory: A theory of choice under radical uncertainty." *Behavioral and Brain Sciences* (2020): 1-47.
J Kay and M King (2021) *Radical Uncertainty: Decision making for an unknowable Future*

8. Emotions guide rationality. Damasio (1994) makes a strong case that our emotions play a key role in guiding our rationality, so that if emotional functioning is disturbed rationality will suffer. He cites the key case of the brain damage suffered by Phineas Gage that resulted in impaired cognitive function. How emotion and cognition work together is discussed in Pessoa (2015). A crucial difference is that between the genetically determined primary emotional systems, built in by evolution because they enhance survival probabilities, and socially determined secondary emotional reactions. I return to this below.

A R Damasio (1994) Descartes' Error: Emotion, Reason, and the Human Brain (New York, Putnam)
L Pessoa (2015) Précis on the cognitive-emotional brain. *Behavioral and Brain Sciences* **38**:e71.

9. Putting it all together: Global Workspace Theory is a model that tried to put this all together. It has been superseded by the comprehensive LIDA cognitive architecture (Franklin *et al* 2013, Franklin *et al* 2016), representing many of the interactions in Figure 9.

S Franklin, T Madl, S D'mello, and J Snaider (2013) LIDA: A systems-level architecture for cognition, emotion, and learning *IEEE Transactions on Autonomous Mental Development* **6**: 19-41.
S Franklin, T Madl, S Strain, U Faghihi, D Dong, S Kugele, J Snaider, P Agrawal, and S Chen (2016) A LIDA cognitive model tutorial *Biologically Inspired Cognitive Architectures* **16**: 105-130.

10. Wide cognition takes place: The Social Brain and Mindreading The social context affects all these processes . Recent 'wide' perspectives on cognition (embodied, embedded, extended, enactive, and distributed) should be seen as steps toward building integrated explanations of the mechanisms involved, including not only internal mechanisms but also interactions with others, groups, cognitive artifacts, and their environment (Milkowski *et al* 2018). In particular, perception extends to the social context where we are continually reading the minds of those we encounter, as a basis of predicting what they will do (Frith and Frith 2005, Frith 2013); the extended mind includes emotional sharing (Leon et al 2019). Context is crucial**, so** we have a social brain (Dunbar 1998).

M Miłkowski *et al* (2018) From wide cognition to mechanisms: A silent revolution. *Front Psychology*, 2393.
C Frith and U Frith (2005) "Theory of mind." *Current biology* **15** R644-R645.
C Frith (2013) Making up the mind: How the brain creates our mental world
F León, T Szanto, and D Zahavi (2019) Emotional sharing and the extended mind. *Synthese* **196**:4847-4867.
R Dunbar (1998) The social brain hypothesis. *Evolutionary Anthropology* ***6***:178-190.

11. Values, purpose, and meaning shape outcomes Absolutely fundamental to the human condition is the box "Ethics, Aesthetics, Meaning" in Figure 9. These are both motivators and constraints on all else that the brain does. In the end, they shape what we do: our choice of purpose and understanding of

meaning will shape what actions we take (Noble and Ellis 2022); for example if I choose to be an artist, this will shape all I do; the same is true if I chose to be a politician, engineer, entrepreneur, and so on.

Three essential points arise:

a) Haidt (2003) has written extensively on the **moral emotions**. However values/ethics are not the same as emotions, though they are informed by them. This is a crucial distinction because something feels right does not mean it is right. To discern that needs moral reflection ("explicit normativity", Heyes 2022).

b) **Moral realists** propose that moral truths exist and are discovered by the mind, in analogy with how this is true for mathematical truths (Gabriel 2022). I support that position (Ellis 2017). It is compatible with the position that norms arise via cultural experiences overlaying implicit normativity (Heyes 2022).

c) In the end, as stated by Martin Luther King, the key issue as regards values is simple: it is how self-centred a person is, or how generous, kind, and even kenotic (self-sacrificial) they are (Ellis 2017). Do I choose to live my life making myself as rich as I can at the expense of others, or will I devote myself to improving life for all? It is **this moral axis** that is at the core of the human condition, and how we behave.

D Noble and G Ellis (2022) Biological Relativity Revisited: the Pre-Eminent Role of Values *Theoretical Biology Forum* **115**:45-70

J Haidt (2003) The Moral Emotions In R. J. Davidson, K. R. Scherer, and H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 852–870). Oxford University Press

M Gabriel (2022) *Moral Progress in Dark Times: Universal Values for the 21st Century* (Polity Press)

G Ellis (2017) "On the origin and nature of values" Tanner Lecture

C Heyes (2022) Rethinking Norm Psychology. *Perspectives on Psychological Science* 7 June 2022

D) There are three key debates as regards the brain.

a**) What is innate in our brains and what not**, e.g. Chomsky's allegation of existence of a Language acquisition device and other suggestions of "folk physics" modules and so on. Evolutionary psychology proclaims many "just so" stories of innate modules such as these that have no real basis: they cannot in fact exist for evolutionary, genetic, and developmental reasons (Ellis and Solms 2017).

"Cognitive gadgets" such as imitation, mind reading, and language have been shaped by cultural rather than genetic evolution (Heyes 2019). What is in fact innate are the primary emotional systems I discuss below. However much brain activity is not due to dedicated circuits: it is quite common for neural circuits established for one purpose to be exapted (exploited, recycled, redeployed) during evolution or normal development and put to different uses, often without losing their original functions (Anderson 2010).

G Ellis and M Solms (2017) *Beyond evolutionary psychology* (Cambridge UniversityPress)

C Heyes (2019) Précis of cognitive gadgets: The cultural evolution of thinking. *Behavioral and Brain Sciences*, *42*.

M L Anderson (2010). Neural reuse: A fundamental organizational principle of the brain. *Behavioral and brain sciences*, *33*(4), 245-266.

b) **The nature and function of emotions**: how do they relate to intellect? A key feature is innate (genetically determined) emotional systems that guide the process of learning via neuromodulators such as dopamine and norepinephrine that are known to have emotional effects (Panksepp 2004). This is disputed by the Theory of Constructed Emotions, which claims emotions are intellectual constructs in precisely the same way as the idea of money is. This theory is denying the status of emotions as qualia – experiences that we deeply feel. For a convincing response, see Westland (2021), pointing out that the theory has no sound evolutionary basis, the meta-analysis supposed to support it mixes incompatible data sets, and it ignores neuromodulators that are known to play a key role in emotions.

The plausible view is that primary emotional systems exist and are based in physiological systems ("ascending systems" or "reticular formations") and associated neuromodulators such as dopamine and norepinephrine that have come into existence through natural selection because they are essential for our existence. I find this claim convincing because the neurological systems Panksepp identifies related to his

affective neuroscience proposal (Panksepp 2004, Panksepp and Biven 2012) are precisely the same as those identified by Edelman in his theory of *Neural Darwinism*, later relabelled the *Theory of Neuronal Group Selection* (Edelman 1987, 1993). Edelman's "value system" that guides neuronal group selection is the same as Panksepp's affective systems, although Edelman does not relate them to emotions.
Thus the view I take is that of Panksepp (2004) and Solms (2021)

- The primary emotions are genetically determined self-regulatory systems, and exist to help regulate our behaviour in a way that will enhance survival, which is why they exist;
- Hence they are not primarily aimed at conveying emotions via facial expressions and other bodily signalling, although that may be beneficial in group contexts;
- These systems are shared with all mammals, which is why we feel empathy with them, and so many people love their pets, and grieve their death.

K Westlund (2021) https://illis.se/en/constructed-theory-of-emotions/
J Panksepp (2004) *Affective neuroscience: The foundations of human and animal emotions* (Oxford)
J Panksepp and L Biven (2012) *The archaeology of mind: neuroevolutionary origins ofhuman emotions*.
G M Edelman (1987) *Neural Darwinism: The theory of neuronal group selection*. Basic books.
G M Edelman (1993) Neural Darwinism: selection and re-entrant signalling in higher brain function. *Neuron*, *10*(2), 115-125.
M Solms (2021) *The Hidden Spring A journey to the source of consciousness* (WW Norton)

Panksepp proposed 7 primary (genetically determined) emotional systems. With Judith Toronchuk I have proposed including another two (Ellis and Toronchuk 2013). The resulting full set is shown in **Table 1**.

Evolutionary needs met		**Primary emotional system**	**Function**
INDIVIDUAL NEEDS			
Basic Functioning	E1	SEEKING system	Situation evaluation, incentive salience, hedonic appraisal, facilitates learning
Basic Survival	E2	DISGUST system*	Avoiding harmful foods, substances, environments
	E3	RAGE system	Defence: protection of organism, resources, and conspecifics
	E4	FEAR system	Defence: flight, limiting of tissue damage
SOCIAL NEEDS			
Reproduction	E5	LUST system (desire, satiation)	Ensuring procreation, enhancement of bonding
Group cohesion: Bonding, affiliation	E6	PANIC/attachment (affiliation, separation distress)	Protection of vulnerable individuals; creates bonding through need for others
	E7	CARE system	Caring for others, particularly offspring
Learning, cooperation	E8	PLAY system	Bonding with conspecifics, development of basic adaptive, and social skills, creativity
Group function: regulating conflict	E9	POWER/dominance system* (rank, status, submission)	Limiting aggression in social groups: allocating resources, esp. sexual ones

Table 1: *Evolutionary needs met, and the systems that meet them* (Ellis and Toronchuk 2013).
*The two marked with an asterisk * are the extra ones proposed in that paper.*

G Ellis and J Toronchuk (2013) "Affective neuronal selection: the nature of the primordial emotion systems." *Frontiers in psychology* 3 (2013): 589.

Some comments on this table:

- The SEEKING systems underlies exploration, and the fundamental need to find meaning in what we experience (Frankl 1946).
- The DISGUST system is an anticipatory system, protecting us from harm before it has happened. In humans, it gets transformed to play a powerful role in social contexts.

- The PANIC/attachment system was given that name because of the distress infants experience when separated from caregivers, but gets extended in teenage and adult social contexts to distress associated with being excluded from groups, as emphasized by Stephens and Price (2000). It is the emotional driver underlying the social brain.
- The PLAY system is key to learning, starting off with rough and tumble play in animals as emphasized by Panksepp, but then extending to symbolic play in children, which leads on to symbolic learning but also to stories, theatre and suspension of belief, and imagination.
- The POWER/dominance system arose as an evolutionary solution to the problem of conflict over access to resources. What evolution discovered is that a dominance hierarchy could solve the problem of conflict over resources once a group has formed. Members of the group compete for position in the social hierarchy, either by combat or by behaviour, but then accept their position in that hierarchy until the next struggle for position in the hierarchy takes place. It has ancient evolutionary roots, stretching back to lizards, the pecking order, and the existence of alpha-male wolves. It is associated with notions of ourselves because it is associated with the territorial imperative (Ardrey 1966), where "territory" is not just physical territory, but also social, economic, political, and academic territory that is deeply tied into human identity. Malfunctioning of this hierarchy system is identified by Stevens and Price (2000) as one of the major causes of psychiatric illness in humans, and it plays a strong role in social and academic conflict.

I have emphasized these systems because in my view they are a key feature of the social condition. We are each born with all these systems, but with different relative strengths of the systems in each individual. If any of them are genetically set either too high or too low, problems will ensue.

V Frankl (1946) Man's Search For Meaning (Beacon Press, 2006)
S Stevens and J Price (2000) *Evolutionary Psychiatry: A New Beginning*. London, UK: Routledge
R Ardrey (1966) The territorial imperative: A personal inquiry into the animal origins of property and nations.
S Johnson (2016) *Wonderland: How Play Made the Modern World*

Secondary (social) emotions piggy-back of the primary ones, and are both positive (e.g. pride) and negative (e.g. shame, guilt). They are of course strongly culturally dependent.

c**) The existence of agency, free will, and moral action** Determinists insist that if we could exactly reproduce every details of our physical brain down to the smallest detail – the atomic structure of every neuron, the details of their connections via synapses, and the state of excitation of every synapse at an instant – one could then use the relevant laws of motion and the known forces acting on every particle to predict in detail every future brain state. Call all that data D. Then data $D(t_0)$ at time t_0 uniquely determines the data $D(t_1)$ at any later time t_1:

$$D(t_0) \rightarrow D(t_1) \quad \text{for all } t_1 > t_0 \ . \qquad (5)$$

Because all the relevant forces are known (Carroll 2021), and assuming (5) is true, agency and free will are illusions. Physics is doing all the work, and all higher states are epiphenomena.

S Carroll (2021) Consciousness and the Laws of Physics. *Journal of Consciousness Studies* **28**:16-31.

This is wrong for three reasons.

- **Open systems** Human beings are open systems. Given all that data $D(t_0)$, it tells nothing about all the incoming data that will impinge on our senses or affect our bodies in the future: rain and storms, motor accidents, actions of others, political and financial events, and so on. That is why we have homeostatic systems to counter physical and chemical disturbances, adaptive immune systems to counter unpredictable viruses, and predictive processing brains to predict what will happen, read the minds of those in the vicinity, and plan what to do next based on probabilities. We have evolved to handle the fact that the data $D(t_0)$ is not sufficient to deal with what will happen in the future because of these external events. That is key to our survival.
- **Top down effects** Furthermore, (5) implicitly involves the assumption that all physical effects are bottom up: nothing at the particle level L1 is affected in a downward way by higher emergent levels. I have argued

above in depth that this is wrong, and fails to take into account the interlevel causation that actually occurs and opens up the way for higher levels such as the integrative level of the whole organism to have causal power over lower levels (Hoel *at al* 2013). Thereby emergent powers occur at every level, including that of the brain and the organism as a whole; see Murphy and Brown (2007), Ismael (2019), and List (2019) for concurring views. Downward control occurs of lower levels by emergent brain states, with a logic of their own.

E P Hoel, L Albantakis, and G Tononi (2013) Quantifying causal emergence shows that macro can beat micro *Proceedings of the National Academy of Sciences* **110:** 19790-19795.

N Murphy and W Brown (2007), *Did my neurons make me do it*? (Oxford University Press),

J Ismael (2019). *How physics makes us free*. Oxford University Press

C List (2019) *Why Free will is Real* Harvard University Press

- **Molecular unpredictability** The predictive equation (5) does not take into account the molecular randomness mentioned earlier (Section 3), manifested in Brownian motion. There is an immense stochasticity in molecular collisions in a cell, which means that predictability of outcomes at that level as in (5) is completely impracticable, not just in practice, but in principle, because with these huge numbers of collisions, the Heisenberg uncertainly principle prevents the initial data $D(t_0)$ being determinable at the molecular level at an accuracy that will allow precise enough predictions. Laplace's Demon cannot even in principle know the initial data needed in (5) with sufficient accuracy to predict specific outcomes, in particular because chaotic dynamical systems occur in the real universe, for example in weather patterns that affect our lives (should I take an umbrella to work today or not?), so arbitrarily small changes in microscopic initial conditions can lead to very different macro level outcomes (the butterfly effect, see Palmer *et al* 2014).

Biological processes have evolved to take advantage of this randomness through the structure of molecular machines like kinesin and dynein that extract order from molecular chaos in order to achieve useful outcomes (Hoffmann 2012). That dynamic opens up the way for higher levels to select lower level desirable outcomes, freeing us from the tyranny of physical determinism and enabling agency to emerge (Noble and Noble 2018, 2021), since causal closure includes the logic of the emergent LIDA architecture where decisions are made, and downward causation from that level can select lower level states accordingly.

T N Palmer, A Döring, and G Seregin (2014) "The real butterfly effect." *Nonlinearity* **27**: R123.

P M Hoffmann (2012) *Life's ratchet: how molecular machines extract order from chaos* (Basic Books).

R Noble and D Noble (2018) Harnessing stochasticity. How organisms make choices *Chaos* **28**: 106309

R Noble and D Noble (2021) Can reasons and values influence action: how might intentional agency work physiologically? *Journal for General Philosophy of Science*, *52*(2), 277-295.

I have covered here the physical/biological reasons for agency existing. Philosophical arguments that this enables free will to be real are given by Gabriel (2017, 2022).

Moral action is possible in this context when one uses one's free will to undertake meta-reflection on life and purpose, meaning and morality, as discussed in Murphy and Brown (2007). They state,

> *"The keys are sophisticated language and hierarchically ordered cognitive processes allowing humans to evaluate their own actions, motives, goals, and moral principles. This allows the processes of moral reflection and character building to influence outcome choices. Symbolism allows off-line prediction and logical branching of thought when assessing outcomes, thus enabling moral reasoning as a basis of action choice".*

This is the *explicit normativity* referred to by Heyes (2022).

M Gabriel (2017) *I am Not a Brain: Philosophy of Mind for the 21st Century* (John Wiley & Sons).

M Gabriel (2022) Basics of Free Will, *Working paper 2 for The Human Condition*

N Murphy and W Brown (2007) *Did My Neurons make me do it?* (Oxford).

C Heyes (2022) Rethinking Norm Psychology *Perspectives on Psychological Science* 7 June 2022

7. Society (Culture, Values, Narratives) and Ecology

On the basis of our interactions with each other, we build societies with diverse cultural practices, and organisations that have agency in their own right. These are the basis for our social existence. This takes place in an ecological context that is the basis of our physical existence, which we interact with.

Our own development and values take place in this interacting complex. I do not aim to develop any of this in detail; rather the aim is to give a broad brush overview of relevant interacting factors, with links to some resources that may be useful, to fulfil my project of providing an integral overview of the basics of the human condition. You will each have your own views on how these themes should be developed.

A) Emergent Institutions and Society

It is not true that organisations are nothing but the sum of their members, as claimed by many economists. Genuine emergence of social organisations with agency takes place via existence of abstract structures such as constitutions and laws (Elder Vass 2010). A key point is that large organisations, and society as a whole, are modular hierarchical structures for the same reasons that living systems are (Section 1).

Of particular importance is the concept of a organisations that can act as a responsible entity, just like a person (Harari 2015), such as a closed corporation, and associated laws of ownership and accountability. These are instituted by relevant abstract agreements, instantiated physically in terms of people, buildings, and material entities of many kinds. Through such structures, meso-level institutions are key to any society.

D Elder-Vass (2010) *The causal power of social structures: Emergence, structure and agency* (Cambridge)
Y Harari (2015): Sapiens

Organisational Practice How to actually run organisations is taught at business schools, which are looked down on by academic economists. But it is in fact a very interesting topic, because management is a difficult thing to do well, with many interacting dimensions (Ellis 1989); how it is done crucially shapes the social world around us. Constraints play a key role, as in all emergent systems (Rahman 1989). Bottom up and top down effects take place in an organisation, with a key issue being on the one hand decentralising as much agency to the periphery as possible for motivational and causal reasons (the people at the coal face actually know what is going on there and can respond locally), but on the other hand ensuring that organisational purposes and values shape outcomes at the periphery as well as the centre (Beer 1981). Organisational culture makes a key difference (MacQueen 2020).

There are a series of pitfalls that institutions fall prey to in the real world, that are very difficult to avoid: namely Parkinson's Law, The Peter Principle, and The Institutional Imperative.

G Ellis (1989) "Organisation and Administration in a democratic era": Pages 1- 192, Pages193-564.
S Rahman (1998) "Theory of constraints: a review of the philosophy and its applications." International journal of operations & production management (1998).
S Beer (1981) Brain of the Firm (Wiley)
J MacQueen (2020). *The flow of organizational culture*. Palgrave Macmillan.

The emergent aspects of society A society has welfare, social, economic, political, and legal aspects that interact with each other and with the environment in ways controlled by individuals and institutions. It can be seen as a multilevel feedback (homeostatic) control system that works to increase the welfare of individuals and groups via these interactions (Ellis 2001). Through this system, economics interacts with all aspects of social and political life: it is not an isolated aspect of human life, as implied by standard economic theory (Snower and Wilson 2022).

G Ellis (2001): The Development of Quantitative Social Indicators with particular reference to the measurement of Poverty
D J Snower and D S Wilson (2022) "Rethinking the Theoretical Foundations of Economics I: The Multilevel paradigm" *Economic: Economics as an Evolutionary Science* *https://bit.ly/D2200030*

B) Cultural Mental Models and Narratives are a key form of understanding

The understandings on which we base our decisions in society are based in *mental models*, perhaps the rational choice models proposed by economists. We need analytic models to plan outcomes, but they are limited in what they can represent and reliability of outcomes. This of course applies particularly to standard economic models that have repeatedly failed to predict real-world events, influenced by emotions and social and political factors which are not recognised by many models.

In the context of irreducible uncertainties, *cultural mental models*—categories, concepts, social identities, narratives, and worldviews—profoundly influence judgment and behavior (Hoff and Steiglitz 2016, Demerit and Hoff 2018). In this context, narratives become both a useful form of understanding, and an agent of persuasion (Froese 2009, Johnson *et al* 2020). Understanding history is a key aspect.

K Hoff and J E Stiglitz (2016) "Striving for balance in economics: Towards a theory of the social determination of behavior." *Journal of Economic Behavior & Organization* 126: 25-57.

A Demeritt and K Hoff (2018) The making of behavioral development economics. *History of Political Economy*, 50:303-322.

M D Froese (2009) Towards a narrative theory of political agency. *Available at SSRN 1507175*

S Johnson, A Bilovich, and D Tuckett (2020) "Conviction narrative theory: A theory of choice under radical uncertainty." *Behavioral and Brain Sciences* (2020): 1-47.

C) The Environmental and Ecological context

A society exists in its environmental and ecological context, which provides the basis for our physical existence. How we interact with that environment is therefore a key issue. We interact with it by extracting resources from it (fishing, hunting, harvesting trees, farming), which is essential for our existence, and mining, extracting petroleum from oil wells, and so on. We to some degree restore damage that may be caused by these processes. However we use it for disposal of both toxic and non-toxic waste, including industrial and medical waste and sewage. We also interact with it by caring for it and enjoying it in many ways: walking, climbing, sailing, skiing, swimming, picnicking, and so on.

Pragmatic environmental policy recognizes that all relevant choices are trade-offs (Baxter 1974). Our mere existence together with the Second Law of Thermodynamics guarantees that we will cause some damage to the environment; however we can engage in restorative policies. Industrial scale energy generation of whatever form will always cause some kind of negative environmental impact, all we can do is choose what kind of negative impact that will be, and take steps to minimise it. Key are measures to use less energy (Sorrel 2015) and efficient energy use, and to reduce food wastage and water wastage.

Planetary boundaries is a concept highlighting human-caused perturbations of Earth systems.

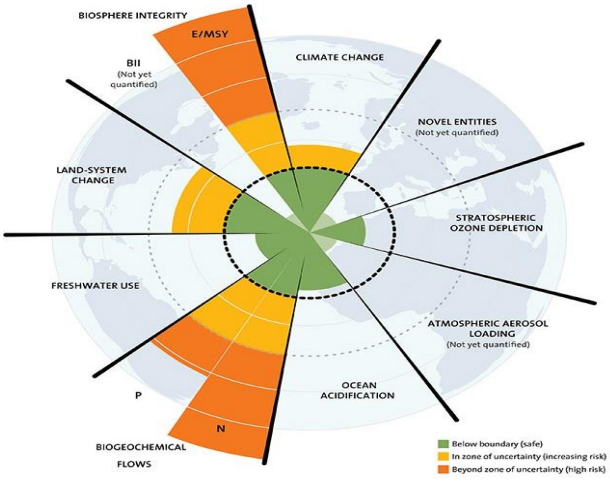

Figure 10. *Planetary Boundaries* From Stockholm Resilience Centre

They relate biosphere integrity, climate change, novel entities, stratospheric ozone depletion, atmospheric aerosol loading, biogeochemical flows, freshwater use, and land system change (Rockstrom *et al* 2009, 2009a), as summarised in **Figure 10**.

W F Baxter (1974) People or penguins: the case for optimal pollution (Columbia University Press)
S Sorrell (2015) Reducing energy demand: A review of issues, challenges and approaches. *Renewable and Sustainable Energy Reviews*, *47*, 74-82.
J Rockstrom *et al* (2009) Planetary Boundaries: Exploring the Safe Operating Space for Humanity *Ecology and Society* **14**: art 32
J Rockström *et al.* (2009a) A safe operating space for humanity. *Nature* **461**, 472–475.

Planetary Health diet A commission (Willett *et al* 2019) has reported on how to obtain healthy diets from sustainable food systems. Complex feedback loops occur: for example the connection between soil microbiomes and gut microbiomes means using pesticides decreases biodiversity in both microbiomes.

How do we advocate for it? One is back at the issues of behaviour and narratives taking place in a complex of interacting social, political, and economic factors summarised in **Figure 11** (Fanzo et al 2020).

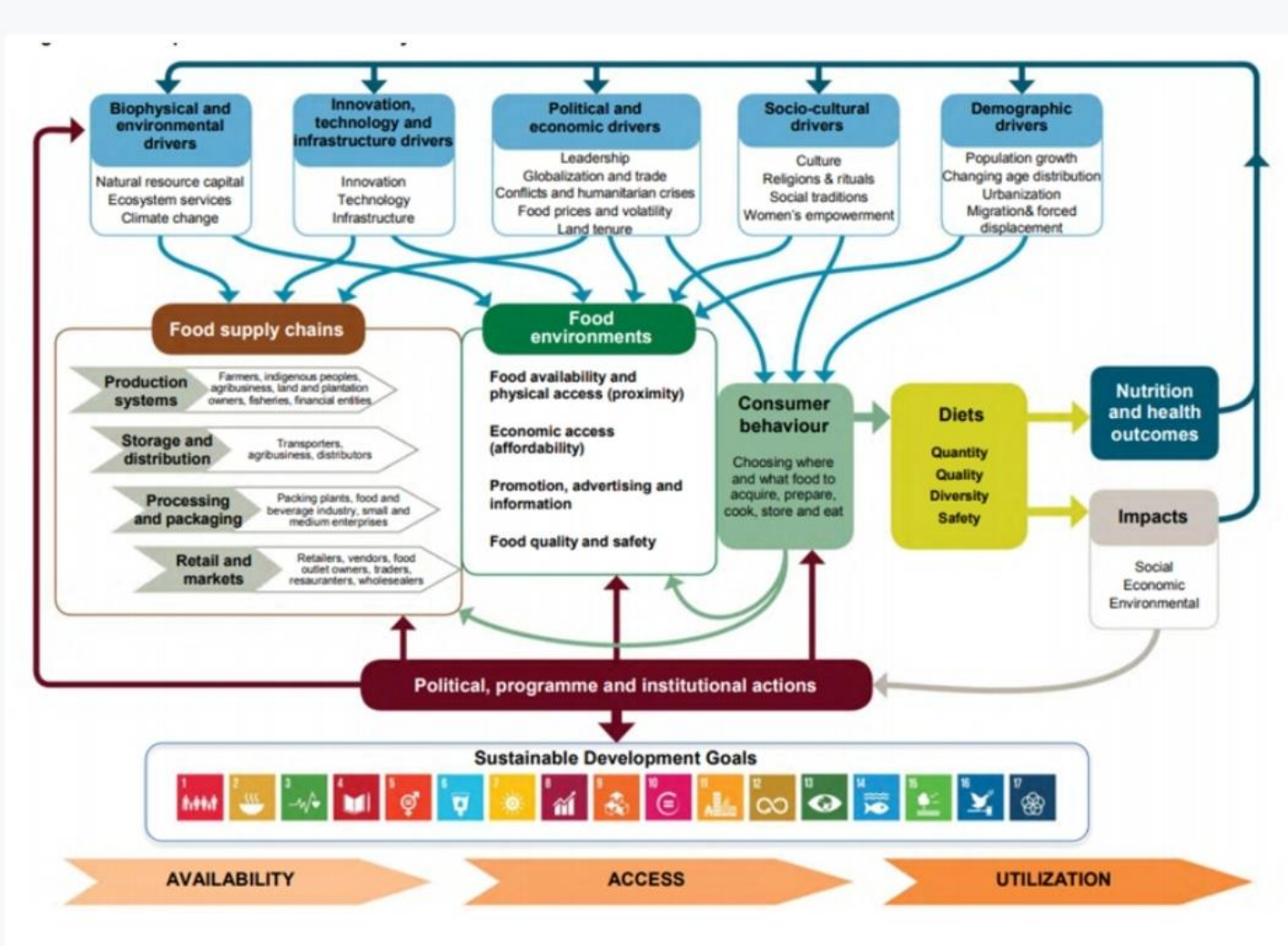

Figure 11. *Environment and food: the interacting factors (Fanzo et al 2020)*

W Willett *et al* (2019) "Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems." *The Lancet* **393**: 447-492.
J Fanzo, A Drewnowski, J Blumberg, G Miller, K Kraemer, and E Kennedy (2020). Nutrients, foods, diets, people: Promoting healthy eating. *Current Developments in Nutrition* **4**:nzaa069

The same issue arises for each activity that impinges on the environment, for example

- Providing industrial scale energy, and specifically for agriculture
- Transport of all kinds, particularly air travel in the stratosphere
- Residential and commercial buildings, urban design

A key issue here is the tension between centralised planning, required to provide the large-scale supply of water and dams, electricity, drainage, sewerage systems, transport, and other infrastructure and associated urban design, and a decentralised system that allows for local adaptive developmental processes over time to shape outcomes in a locally responsive way: the issue of decentralisation in organisation mentioned above. This local adaptive process is described carefully in Christopher Alexander's great book (Alexander 1979)

C Alexander (1979) *The Timeless Way of Building* (Oxford University Press).

Population Growth One must never forget that in the end our major environmental problems are due to global population growth; they would not occur on the same scale if the global population were smaller. UN estimates are that the global population of 7.9 billion in 2020 will grow to 11.2 billion by 2100. Achievement of the agreed Sustainable Development Goals may succeed in reducing this growth by improving the standard of living globally; this will somewhat reduce pressure on the environment. Socio-cultural viewpoints on how many children are desirable play a key role.

D) The crises Part of our present day condition is that we faces interlocking crises: global pandemics, global warming, and a global rise in anti-democratic activity and global inequality. In summary form:

⇨ **Global Pandemics such as flu and COVID-19 occur.** Key issues:

- Expected, but unpredictable
- Devastating global effects
- Political and social divisions
- Global inequality
- Will happen again

⇨ **A global rise in anti-democratic activity and global inequality is occurring.** Key issues:

- Failure of modern societies to meet the physical and psychic needs of many
- Manipulation of information via global media and social media
- Value systems that promote selfishness and othering, e.g. Donald Trump
- Massive inequality due to current economic values and practice of capitalism
- Courts that are based in partisanship and lies during confirmation processes

⇨ **Global warming is happening**, and will cause massive disruption**.** Key issues:

- Tipping points as global warming occurs
- Carbon emissions, and steps to mitigate it
- Energy usage, and a reassessment of use of nuclear power
- Food production, and a reassessment of genetic engineering
- Global population growth, sexual education, and family planning access

A Hothschild (2018) Strangers in their own land: Anger and Mourning on the American Right

K Pickett and R Wilkinson (2010) *The spirit level: Why equality is better for everyone* (Penguin UK)

T Lenton *et al* (2008) "Tipping elements in the Earth's climate system." *Proceedings of the national Academy of Sciences* 105.6 (2008): 1786-1793.

M Armstrong *et al* (2022) Exceeding 1.5° C global warming could trigger multiple climate tipping points. *Science* ***377***: 6611.

N Stern (2009) *A blueprint for a safer planet: How to manage climate change and create a new era of progress and prosperity*. Penguin.

Decisions on these crucial issues needs to be based in solid evidence, see Figure 12 for example.

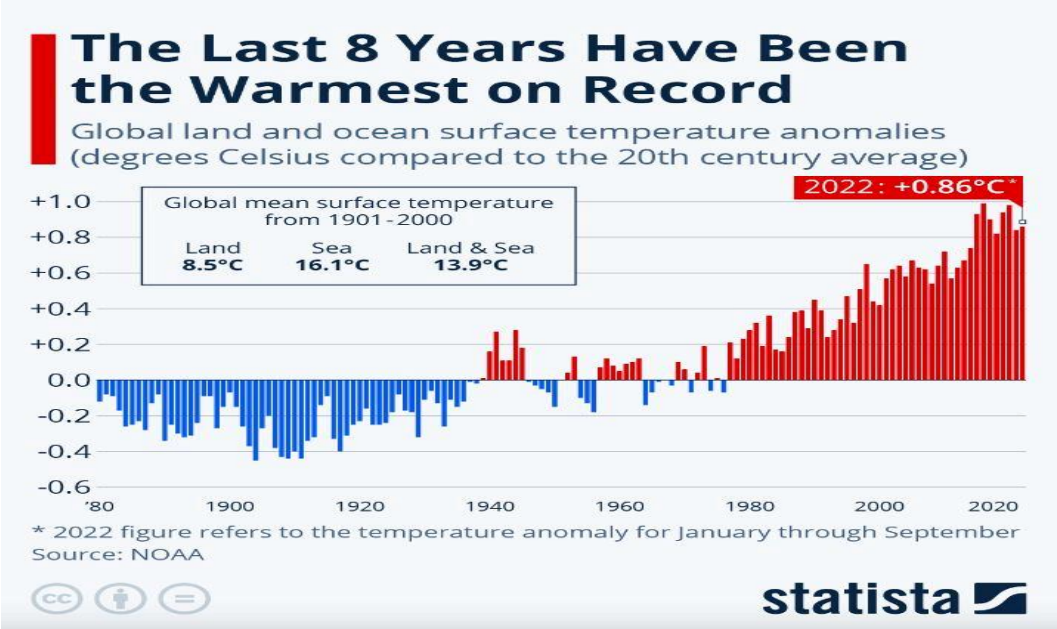

Figure 12 *The importance of evidence in making these policy decisions*

Goals and outcomes The Republican Study Committee (RSC) in the USA start from the position that taxes on the wealthy hurt workers by causing "the misallocation of capital, creating a less robust economy, and leading to slower wage growth and job creation." And so they pass policies where the rich become richer at the expense of the poorer. But contrasting polices are possible, based in communal values of uplifting everyone. They can change firms (Mayer 2018), the capitalist system (Collier 2018), and tackle the tragedy of the commons (Ostrom 2015). One can also search for and experiment with possible political systems based in such values (Carugati and Levi 2021), and particularly how to handle the interaction between formal and informal political power structures, and the associated battle between political power on behalf of society as a whole, and vested interests that capture political control (Grayling 2020).

C Mayer (2018) *Prosperity: Better business makes the greater good* (Oxford University Press).
P Collier (2018) *The future of capitalism: Facing the new anxieties*. (New York: Harper)
E Ostrom (2015) *Governing the Commons: The evolution of Institutions for Collective Action* (Cambridge)
F Carugati and M Levi (2021) *A Moral Political Economy: Present, Past, and Future* (Cambridge).
A C Grayling (2020) *The Good State: On the Principles of Democracy*

Significance of Values In the end values are the final arbiter of how this all works. Smoking and lung cancer and corporate profits is an example, as is the nature of economic systems, actions regarding global change, and so on. On a smaller scale, societies are built on trust and caring.

What is needed at all levels is a value system that is aimed at enhancing the common good (Sandel 2021). Transformational leadership is about managing values and so changing not just outcomes, but the character of the people comprising the organisation (Burns 2010). The key issue is, How can we help develop cooperative values that will lead to development of a caring society, with economic institutions that share wealth and care for the environment? This kind of leadership has the potential to do so. An example of an organisation run in this way is the Scott Bader Commonwealth.

Religious affiliations, in a broad sense, can be powerful motivators (Tucker 2008).

M J Sandel (2021) *The Tyranny of Merit: What's Become of the Common Good?* (Penguin)
J M Burns (2010) *Leadership* (Harper Classics)

M E Tucker (2008). World religions, the earth charter, and sustainability. *Worldviews: Global Religions, Culture, and Ecology*, *12*(2-3), 115-128.

8. The Personal Dimension

In the end, the Human Condition is about our personal lives, which is what we each individually experience.

A) Generality of these claims

The claims made below arise from my experiences and cultural context. There are important claims made *inter alia* by Henrich et al (2010), Henrich (2020) that such views may be of limited applicability because there is a big difference between WEIRD people with universal values, and kin based societies where kin is more important and democracy does not work because it is alien to their values. Also for example there are greatly varying attitudes to spirituality and religion in different cultures which can make a key difference.

Here I caution the reader to take this into account in reading what is set out here, and to expand on what follows from their own perspectives. Is dialogue possible between cultures? Perhaps yes.

J Henrich, S J Heine, and A Norenzayan (2010). The weirdest people in the world?. *Behavioral and brain sciences* **33**: 61-83.

J Henrich (2020) *The WEIRDest people in the world: How the West became psychologically peculiar and particularly prosperous* (Penguin UK).

B) Values and Personal Development

Underlying social outcomes is the interlocking set of issues associated with personal values and development.

Values Each individual lies somewhere on the spectrum of being focussed on their own personal wellbeing at whatever expense to others, to being generous and caring and kind to others, even at considerable personal cost (Ellis 2017).

Two issues arise.

- Whatever your state is, How did one get to be that way?

This opens a huge set of topics to do with social and psychological developmental issues regarding family interactions, school experiences, and social interchanges that have led to one's present state.

- How does one change it?

But that lies in the past. The issue of great concern is how does one get from that state, whatever it is, to a new one that is more aligned with the positive side of the caring spectrum?

Inner Development Goals There is of course again a huge literature on this, and I will just make one comment: there is a very interesting movement promoting Inner Development Goals, in parallel to the well-known Sustainable Development Goals. It has a framework with the following aspects:

- **Being**: Relationship to self, inner compass, integrity, regulating emotions
- **Thinking**: Cognitive skills, critical thinking, sense making, relating to complexity
- **Relating**: Caring for others and the world: connectedness, humility, compassion
- **Collaborating**: Social skills, communication skills, co-creation, trust, inclusiveness
- **Acting:** Driving change, making a difference, courage, creativity, optimism, perseverance

G Ellis (2017) "On the origin and nature of values" Tanner Lecture

Theory U This leads on to the issue, How does one actually make things happen in a social context of conflicting interests and understandings? How does one work towards mutual cooperation in real world contexts?

This is again a hugely complex topic, but one positive resource is Theory U developed by Otto Scharmer. It is a five stage process of interaction with others labelled co-sensing and cocreating, with the central point being a willingness to let go of the old and be open to the new ("Open Will", Figure 13). It has been criticised, but seems to me to encapsulate key aspects of how to make real change in social contexts.

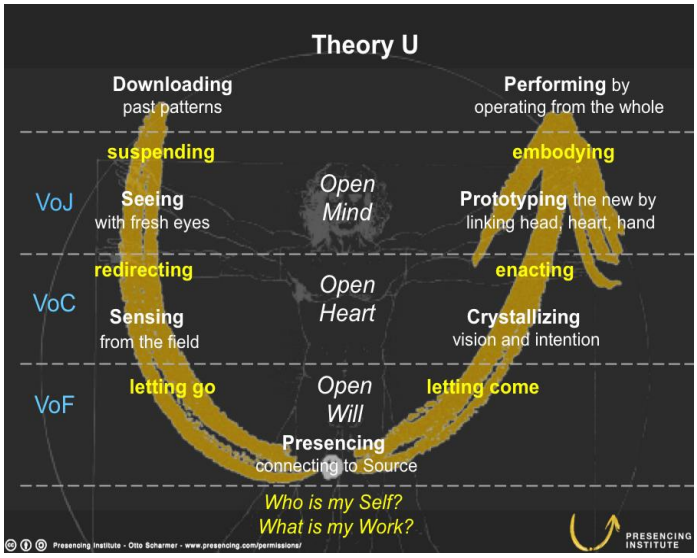

Figure 13. *The elements of Theory U: Learning from the future as it emerges* .

O Scharmer (2009). *Theory U: Learning from the future as it emerges* (Berrett-Koehler Publishers).

C) Wellbeing and the Human Condition

Personal wellbeing is affected by many physical and economic issues and social interactions in our specific community. The following briefly summarises these different dimensions of personal life, as seen from my perspective. Taken together, they may provide a holistic view of issues in our individual lives.

a) One's home environment One needs a house, flat, or whatever to live in with adequate rooms, amenities (electricity, hot and cold water, flushing toilet) and hopefully appliances (stove, refrigerator, washing machine, cleaning devices); rubbish removal; adequate water, drink (wine, beer?), suitable food and clothes; phone and internet connection. Being in a well-designed space can be beneficial to health (Sternberg 2010). Taken together, these form "Home": a place of refuge that is a key background to our daily lives.

Location is important: distance to transport, shops and markets, schools, and health facilities all count. The local environment needs to be adequate in terms of safety, air pollution, and cleanliness.

E M Sternberg (2010) *Healing spaces: The science of place and well-being*. (Harvard University Press).

b) Career/life path: income and success Whatever life path or career one choses, given the options one has in making this choice, one needs adequate income for survival. One may be able to take out loans or mortgages, but they always come with a price in terms of interest accrued. Thus a family unit needs at least one member with a formal income or grant or some kind of entrepreneurial activity to support the costs of living, transport, entertainment, and so on. This may often involve one member staying at home to look after children while the other is a breadwinner. Of course looking after a household is considerable work, and should be valued as such. Standard economic analyses famously assigns it no economic value.

Satisfaction or dissatisfaction with one's life path and career is an important issue in each individual's life. It has two features: is the career successful in its own terms, i.e. achieving relevant outcomes in terms of its aims? Is it recognised as being such? Both are important aspects of perceived welfare.

c) Effects of social life and companionship on wellbeing We are social beings and depend on friendships and a supportive social circle for wellbeing. Family, friends, clubs of all sorts provide a supportive matrix that meets this need, including social games such as bridge and chess and tennis that bring people together regularly. Health and friendship are linked. The need for such bonding results from the AFFILIATION primary emotional system.

d) Effects of art and culture on wellbeing Many forms of art are a creative activity giving satisfaction.

- Performing arts: the art is in the process. Theatre, dance, ballet, music of many kinds, gymnastics
- Visual arts including fine art: the art is in the product. Painting, drawing, sculpture, pottery, some photography, some films, in some cases architecture (Gothic Cathedrals, the Sagrada Familia).
- Literature, including fantasy literature and science fiction, and poetry.

Such endeavours are a form of self-realisation, which is essentially the same as self-actualisation in Maslow's hierarchy of needs. Various reports confirm that engaging in artistic endeavours can be beneficial to health:

- Arts and Health (WHU)
- Arts, Health and Wellbeing beyond the Millennium
- Report On The Effects Of Arts And Culture On Wellbeing And Health

Two key issues arise regarding the nature of artistic activity.

- **Domestic art:** artistic creativity does not only occur in "artistic" contexts. It can also occur in the context of the home: cooking ("culinary art"), sewing, crocheting, patchwork, making clothes, interior design, gardening, and so on, including the large variety of hobbies such as making and running model trains.

These form part of the texture of daily life, and the associated creative act can be very satisfying. In some societies, living in an aesthetic way is a central aspect of life.

- **The core of great art**: "*Art is a diverse range of human activity, and resulting product, that involves creative or imaginative talent expressive of technical proficiency, beauty, emotional power, or conceptual ideas*" (Wikipedia). Great art arises by a form of letting go by the artist, as in Theory U. She/he starts off with an initial conception of what the outcome should be, and fashions it in that way to start. But as the work progresses, it starts to have a form and character of its own that in effect starts a dialogue with the artist: "This is the way I should be developed, not the way you first thought". The grain of the wood, the swirls and veins of a particular coloured marble will offer natural ways of development; a poem written so far forms a context where new lines naturally develop; characters in a novel each develop a particular characteristic nature of their own that needs to be respected by the writer, once that character has taken shape. Great art arises in this way, as emphasized by Harold Pinter in his Nobel Prize lecture, as follows:

> *"It's a strange moment, the moment of creating characters who up to that moment have had no existence. What follows is fitful, uncertain, even hallucinatory, although sometimes it can be an unstoppable avalanche. The author's position is an odd one. In a sense he is not welcomed by the characters. The characters resist him, they are not easy to live with, they are impossible to define. You certainly can't dictate to them. To a certain extent you play a never-ending game with them, cat and mouse, blind man's bluff, hide and seek. But finally you find that you have people of flesh and blood on your hands, people with will and an individual sensibility of their own, made out of component parts you are unable to change, manipulate or distort."*

This process involves the interaction between empathy and imagination (Schmetkamp and Ferran 2020).

S Schmetkamp and I V Ferran (2020) Introduction: Empathy, fiction, and imagination *Topoi* **39**:743-749

e) Sport, Exercise, and wellbeing Health, sport, and wellbeing are linked. Regular bodily exercise is essential for physical well-being, and also plays an important role in mental wellbeing. Working all the time without a break will drain the mind and spirit, a key reason that almost all cultures have developed a seven day week (a natural timescale in the human body), with workdays separated by a weekend to relax and recuperate.

A great variety of sports have evolved to provide both exercise and enjoyment:

- Competitive sports: football, rugby, cricket, hockey, swimming, netball, rowing, and so on.
- Individual/social sport: walking, climbing, skiing, cycling, swimming, surfing, paddling, sailing.
- Fitness exercises: gym, use of exercise machines, Yoga, Pilates, Tai-chi.

Overall, these are forms of recreation, which means *re-creation*. Wikipedia again: " The need to do something for recreation is an essential element of human biology and psychology. Recreational activities are often done for enjoyment, amusement, or pleasure and are considered to be fun." They link to the PLAY system.

f) Health issues Physical and mental health, or the lack of it, are a key feature of our lives. Most of us are lucky enough to be healthy for most of our lives, and take this for granted, but a considerable number are not, and then health issues dominate their lives: what kind of treatment to take, how successful it will be, and what it costs. As we grow older, health issues and illness intrude more into our daily lives. Particularly distressing are mental disorders, whose origins are often not clear, and dementia such as Alzheimer's disease in the elderly.

A key feature is the relation of health to emotions (Sternberg 2001). Mindfulness practices may help.

E Sternberg (2001) The balance within: The science connecting health and emotions

g) Animal ownership and wellbeing Relationships with animals is often important. A feature of many lives is the joy arising from owning pets and interacting with them. Our empathetic bond with dogs and cats arises because we share the same primary emotional systems. Interacting with them and looking after them, and receiving affection in return, leads to wellbeing. Much distress is often caused by their death.

- Pets and Happiness: Examining the Association between Pet Ownership and Wellbeing

h) Meditation and an unhurried life For some, meditation practices of various kinds can achieve a mentally clear and calm state, and may significantly reduce stress, anxiety, depression, and pain, and enhance peace, perception, self-concept, and well-being. Times of silence and an unhurried pace can enhance our lives

i) Metacognition and higher awareness Metacognition is a key cognitive function with several dimensions:

- Monitoring and evaluating one's task performances,
- Thinking about one's own thought processes,
- Considering one's life story and progress through memories supported by photographs, videos, diaries, and stories that together constitute one's autobiographical identity,
- Self-reflection on the meaning of one's life, and in particular the nature of morality and what values one will choose to guide one's thoughts and actions.

D) Reductionist viewpoints, and their negative outcomes in society

Beware the ubiquitous fundamentalist views in all fields of study, including science, that deny the true complexity of what occurs, characterised by the key phrase "nothing but", followed by an explanation that the author's academic speciality or hobbyhorse is the only thing that matters.

The thing to point out here is that these authors contradict each other. If academic A1's speciality is the only one that matters, all else following from it, then academic A2's different speciality cannot be the only one that matters. For example if only physics matters, then genes cannot matter. But they all matter: each is a partial view of the whole. Black and white thinking is the avoidance of complexity and nuance in our models of reality - our way of understanding and making predictions that underlie action choices. The purpose of this paper is to provide a summary of the complexity that shapes our lives in the real world.

- **Agency** A key issue in how we understand ourselves is, Do we have agency? If the brain can be fully understood by a physio-biological approach (Crick 1994, Schouten and de Jong 2012, Gallagher 2012) choices and values and meaning are irrelevant. If we genuinely believe we have no agency, it crucially changes how we see ourselves and others. Fundamentalist thinking in physics that entails not only determinism but superdeterminism *inter alia* denies we have agency because what happens at the present time is uniquely determined by hidden variables at the start of the Universe. Local reasons such as my thoughts are irrelevant. I have argued above that we do indeed have agency, which *inter alia* is why science is possible. In reality, physics cannot determine from initial conditions in the early universe even what is happening today at the astronomical level (Neyrinck *et al* 2022), let alone at the level of brains.

A crucial context where this matters is legal: can we be held legally responsible for our actions? If society or our neurons or physics are responsible for what we do, then surely there can be no legal accountability? This issue has arisen in courts in recent years, with defences for criminal behaviour being given in terms of neuroscience: a key debate (D Hodgson and D Mobbs *et al* in Murphy *et al* 2009).

F Crick (1994) *The astonishing hypothesis: the scientific search for the soul* (Scribner).
S Gallagher (2012). Scanning the lifeworld. *Critical neuroscience: A handbook of the social and cultural contexts of neuroscience*, 85-110.
M Schouten and H de Jong (Eds.) (2012). *The matter of the mind: Philosophical essays on psychology, neuroscience and reduction*. John Wiley & Sons.
M Neyrinck, S Genel, and J Stücker (2022) "Boundaries of chaos and determinism in the cosmos." *arXiv preprint arXiv:2206.10666*.
N Murphy, G Ellis and T O'Connor (2009) Downward Causation and the Neurobiology of Free Will:225-260.

- **How Mental Illness should be handled** There is a tendency of some practitioners to treat mental illness purely by psychiatric medication; the issue is simply to find what the correct prescription is. By contrast, more holistic psychiatry combines medication with psychotherapy, as well as investigating personal and social reasons for mental problems. Treatments aimed at handling them may include cognitive behavioural therapy, assertive community treatment, community reinforcement, and supported employment. Some practitioners use psychoanalysis, which is controversial, but Kandel (1998) provides a framework for its use that derives from current biological thinking about the relationship of mind to brain. But the approach should have enough depth to deal with real issues of human existence.

  Related to the primordial emotional systems discussed above (Section 6), loneliness can be a cause of distress and even illness (Stevens and Price 2000). Friendship is the cure.

E R Kandel (1998) "A new intellectual framework for psychiatry". *Am Jour psychiatry* **155**: 457-469.
S Stevens and J Price (2000) *Evolutionary Psychiatry: A New Beginning*. London, UK: Routledge

- **How education/teaching should be shaped**, given the nature of how our brain works.

This is key in terms of creating environments where children on the one hand are encouraged to discover things for themselves, reliant on their inherent search for meaning and understanding, and on the other are taught things they could not possibly discover for themselves: our human cultural and scientific heritage that is the product of thousands of years of interaction of highly gifted and creative human beings in complex social contexts.

A foundational case is how reading and writing should be taught, because they are essential to learning in the modern world. The "reading wars" over this issue have raged for many decades. Reading is based in the brain, and a reductionist understanding of brain function will lead to quite different policy recommendations than an integrative view of the brain. Such an integrative understanding of how neuroscience relates to reading is given in Ellis and Bloch (2021), concordant with the overall integrative understanding set out in this paper. Learning to speak is a process of successive approximation with feedback; writing can be learnt in the same way, as beautifully illustrated in Bloch (1997).

G Ellis and C Bloch (2021) "Neuroscience and literacy: an integrative view." *Transactions of the Royal Society of South Africa* **76**:157-188
C Bloch (1997) Chloe's Story: First Steps into Literacy

- The dangers of Long-Termism I am no an expert in this, but it appears to be an extreme fundamentalist viewpoint based in many highly questionable assumptions, leading to extreme policy recommendations that illustrate the thesis of this paper: how we understand things changes how we behave. It can be a catastrophe.

E) The Human Condition A foundation of understanding the human condition is to have an adequate of overview of the interlocking set of complexities that underlie our existence and being, as outlined in this paper. It does not have to be detailed, but it should include a broad perspective that acknowledges these all occur and matter. Through them, complex emergence takes place leading to minds with purpose, values, and meaning, capable of loving and caring and acts of artistic creation.

Coming into being: our existence as individuals The most profound aspect of all of the human condition is that we each exist as individuals, because our parents brought us into existence! And that chain of procreation stretches back to all our ancestors: 2 parents, 4 grandparents, 8 great grandparents, and so on. At the Nth generation up, we have 2^N ancestors About 20 generations (about 400 years) ago, we each have about a million ancestors. Indeed it is not so long ago that the number of our ancestors was larger than the human population of the Earth at that time (which was much smaller then than now). This means we are all multiply related to each other; we all came out of Africa from the same small group of ancestors.

The sexual reproduction leading to our existence is an immensely complex aspect of the human condition, involving mental, emotional, physiological, and social consequences in a contested political and legal context.

- **Mother and child** are in a profound physical and biological interaction.

The mother During pregnancy, the mother experiences surges of hormones as the child's development takes place and maternal physiological changes occur. She is in the extraordinary situation of having a growing embryo that becomes a foetus, a coming into being human, in her belly. When normal birth takes place – a traumatic event – it is followed by breast feeding that bonds the mother to the child, nappy changing, and caring. Caesarean sections may be needed if severe distress occurs during childbirth.

The growing infant develops through many stages from embryonic development, including the key stage of gastrulation, to developing a nervous system and heart beat and then all physiological organs.

The interaction: mother and foetus are a united entity, physically the developing infant being kept alive by nutrition provided by the mother through the placenta, and emotionally the mother being aware of this situation of total dependency of the developing infant and the need to protect it.

- **Interacting adults** The process of insemination involves an adult male and adult female in a process of sexual intercourse, either consensual or not. In the first case it is a result of reciprocated sexual desire driven by the primary emotional system (labelled E5 in Table 1), placed there by evolution to ensure survival of the species through sexual interaction. The discovery of a variety of methods of birth control transformed the relation between consenting adults, allowing family planning – the decision as to whether or not to try to produce offspring - and a large reduction in birth rate**.** In the second case, it is rape, driven by a combination of lust and very often essentially a power play, disrespecting and violating the victim in a cruel way, with psychological and emotional consequences that can be devastating for decades after.

- **The family context** The relationship between father and mother to us as a child is a crucial aspect of our daily existence, and its quality matters greatly. This is the foundational personal relationship in our lives. This extends, albeit in weaker form, to the relationship between grandchildren and grandparents, uncles, aunts, and cousins: a hopefully protective group of people who will be supportive and protective of us. Family is a strong relationship. Those unfortunate enough to have an abusive family life as children may be scarred for life, unless they have supportive social nets that can help compensate.

We celebrate our coming into existence by commemorating our birthday as a social event, where friends and family can join together for that purpose. This acknowledges our being as human beings.

- **The social context** The existence of human sexual differences is a key shaper of social life. It shapes interactions after puberty and as young adults, with parties and dances, experimentation, acceptances and rejection being a central feature of social life with major emotional ups and downs. This complex interaction, often involving marriage, a central organising feature of many lives and societies, and sometimes divorce, continues throughout life. Inevitably pregnancies take place before marriage, and how they are received by those around is completely culturally dependent. In some societies it is welcomed and indeed marriage does not take place until a couple have children. In other cases, childbirth out of wedlock is a cause of great shame and often social rejection, resulting in widespread use of abortion procedures, safe or unsafe, to terminate pregnancy. A key issue is a lack of adequate sex education in many cases, which, together with access to safe birth control methods, should be a universal human right.

- **The political and legal context** hugely complicates this, because of so-called "pro-life" activism by political parties and churches who in fact are not interested in living children, they are only concerned about a foetus before it is born, but are determined to impose their partisan views on entire countries. They oppose abortion no matter what the circumstances, and even try to prevent birth control.

They tend to be the same people who oppose any kind of gun control in the USA, with the result that it is the country with the highest level of gun deaths in the world, particularly massacres at schools.

- **The ending: time as the ultimate resource** We have a limited time available to do what we wish to do because of the inevitability of death, as the counterpoint to birth. Our available time is precious. Death of a loved one is a devastating experience, leading to grief of loss, as chronicled by C S Lewis..

What is our nature and why do we exist? Return to the issue of cosmology: the existence of the various possibility spaces hints that more than physics exists, indeed that in some sense purpose underlies the universe and so our existence. Irrespective of views on that (Briggs *et al* 2018), I summarise as follows:

- We are material beings, our existence and nature being grounded in all the levels of emergence outlined here. Each level is a key part of our nature. If any of them go wrong, things go wrong.
- Consciousness, agency, and the possibilities of moral action emerge from them.
- Our understandings of our nature and existence underlie what we do and how we act.
- Narratives and stories shape our understanding as much as informal and formal models of how things work. These are ways we understand our lives shape how we think and make action choices. Symbolic action is a powerful way to create community and press for social change.
- Materialism is not true: abstract causation takes place, values matter, love and caring make a difference to individual lives, local communities, and in the end to society as a whole.
- One can make a case for moral realism that supports generous attitudes and has a transformative nature based in *kenosis*, or giving up on behalf of others (Ellis 2017, Stucke and Ezrahi 2020): the opposite of all the self-centredness and that drags humanity down into self-concerned warring factions.
- We can act in ways that make at least some parts of the world a better place. Future oriented humanities can help us do so (Gabriel *et al* 2022)
- There is a spirit within which shines. At our highest, we are capable of producing art and literature and music that mentally lifts us out of the material world, and in the end has what can only be described as being of a transcendent nature. The poem on the last page attempts to capture this.
- Whatever one's deeper explanation for our existence, it is utterly astonishing. We can experience the awe of being alive.

What we need to do (Temelkuran 2021)**:** Value each other as we form communities of caring**,** face up to fear, choose dignity over pride, choose attention over anger, choose strength over power, choose enough over too much, choose friendship and to be together, and choose the whole reality The last point is what this paper is about. The issues discussed here, taken together, form the large context for our existence. How we understand them makes a difference to how we understand the human condition, and so to how we act.

A Briggs, H Halvorson, and A Steane (2018) *It Keeps Me Seeking: The Invitation from Science, Philosophy and Religion* (Oxford University Press).

G Ellis (2017) "On the origin and nature of values" Tanner Lecture

M E Stucke and A Ezrachi (2020) *Competition Overdose: How Free Market Mythology transformed us from Citizen Kings to Market Servants* (Harper).

M Gabriel, C Horn, A Katsman, W Krill, A L Leipold, C Pelluchon, and I Venke (2022) *Towards a New Enlightenment: The case for a Future-Oriented Humanities.* The New Institute Interventions Vol 1

E Temelkuran (2021) *Together: A Manifesto against the Heartless World.*

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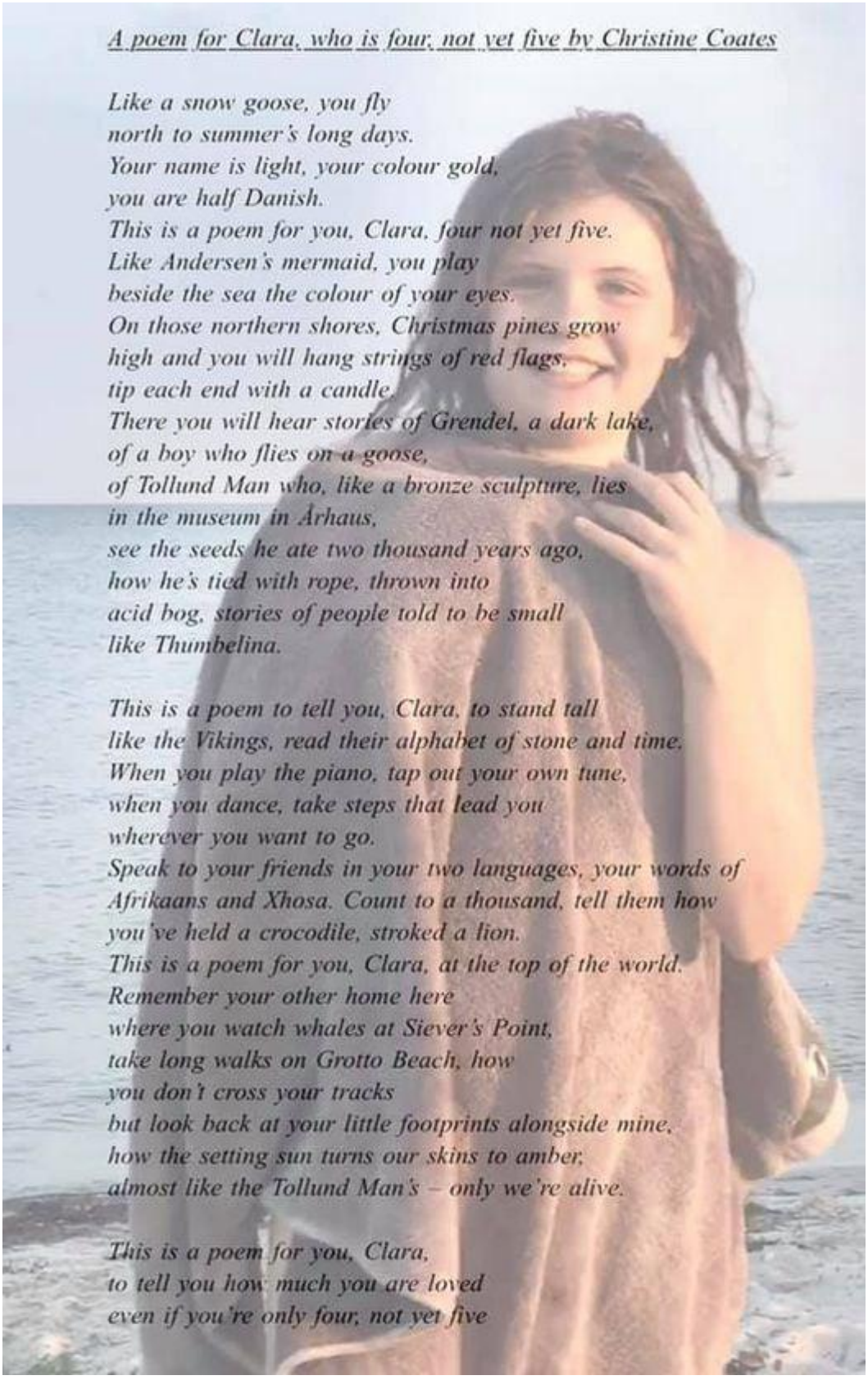
A poem for Clara, who is four, not yet five by Christine Coates
Like a snow goose, you fly
north to summer's long days.
Your name is light, your colour gold,
you are half Danish.
This is a poem for you, Clara, four not yet five.
Like Andersen's mermaid, you play
beside the sea the colour of your eyes.
On those northern shores, Christmas pines grow
high and you will hang strings of red flags,
tip each end with a candle.
There you will hear stories of Grendel, a dark lake,
of a boy who flies on a goose,
of Tollund Man who, like a bronze sculpture, lies
in the museum in Århaus,
see the seeds he ate two thousand years ago,
how he's tied with rope, thrown into
acid bog, stories of people told to be small
like Thumbelina.
This is a poem to tell you, Clara, to stand tall
like the Vikings, read their alphabet of stone and time.
When you play the piano, tap out your own tune,
when you dance, take steps that lead you
wherever you want to go.
Speak to your friends in your two languages, your words of
Afrikaans and Xhosa. Count to a thousand, tell them how
you've held a crocodile, stroked a lion.
This is a poem for you, Clara, at the top of the world.
Remember your other home here
where you watch whales at Siever's Point,
take long walks on Grotto Beach, how
you don't cross your tracks
but look back at your little footprints alongside mine,
how the setting sun turns our skins to amber,
almost like the Tollund Man's – only we're alive.
This is a poem for you, Clara,
to tell you how much you are loved
even if you're only four, not yet five

Who made the world?
Who made the swan, and the black bear?
Who made the grasshopper?
This grasshopper, I mean —
the one who has flung herself out of the grass,
the one who is eating sugar out of my hand,
who is moving her jaws back and forth instead of up and down —
who is gazing around with her enormous and complicated eyes.
Now she lifts her pale forearms and thoroughly washes her face.
Now she snaps her wings open, and floats away.
I don't know exactly what a prayer is.
I do know how to pay attention, how to fall down
into the grass, how to kneel down in the grass,
how to be idle and blessed, how to stroll through the fields,
which is what I have been doing all day.
Tell me, what else should I have done?
Doesn't everything die at last, and too soon?
Tell me, what is it you plan to do
with your one wild and precious life?

+ Mary Oliver