Constructal Law Conference
Freedom, Design and Evolution

To Emerge or Not To Emerge,
Reductive Freedom creates Life, Being and Death

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Independent

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Emergence = **Coming** into *existence*.
(The constructal law is about **being** and **staying** in existence.)
[Note: "Natura" = The continual *birth* (or emergence) of what is.]

Life never lasts.
Death has many forms.
'Frozen' or 'bricked' forms are fundamental to reality.

Constructal Law = Law of **Life**.

To **Emerge** or Not To **Emerge**,
Reductive Freedom creates **Life**, **Being** and **Death**

Reductive Freedom = The freedom named in the constructal law.
(Bejan did not yet define freedom.)

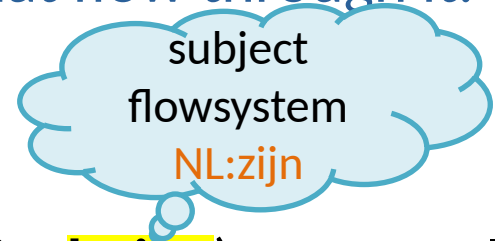"Beings" = Persistent systems (Flowing or Death).

Life, Existence & Being

Constructal Law (Bejan):

For a finite-size **<mark>system</mark>** to persist in time (to live), it must evolve [freely] in such a way that it provides easier access to the imposed currents that flow through it.

object
design
NL:zij*nde*

subject
flowsystem
NL:*zijn*

⇔ **Law of Life:**

For a (finite) **<mark>existence</mark>** to persist (in time), thus to **live**, it (or its **<mark>being</mark>**) must evolve freely in such a way that it can handle what it encounters more easily.
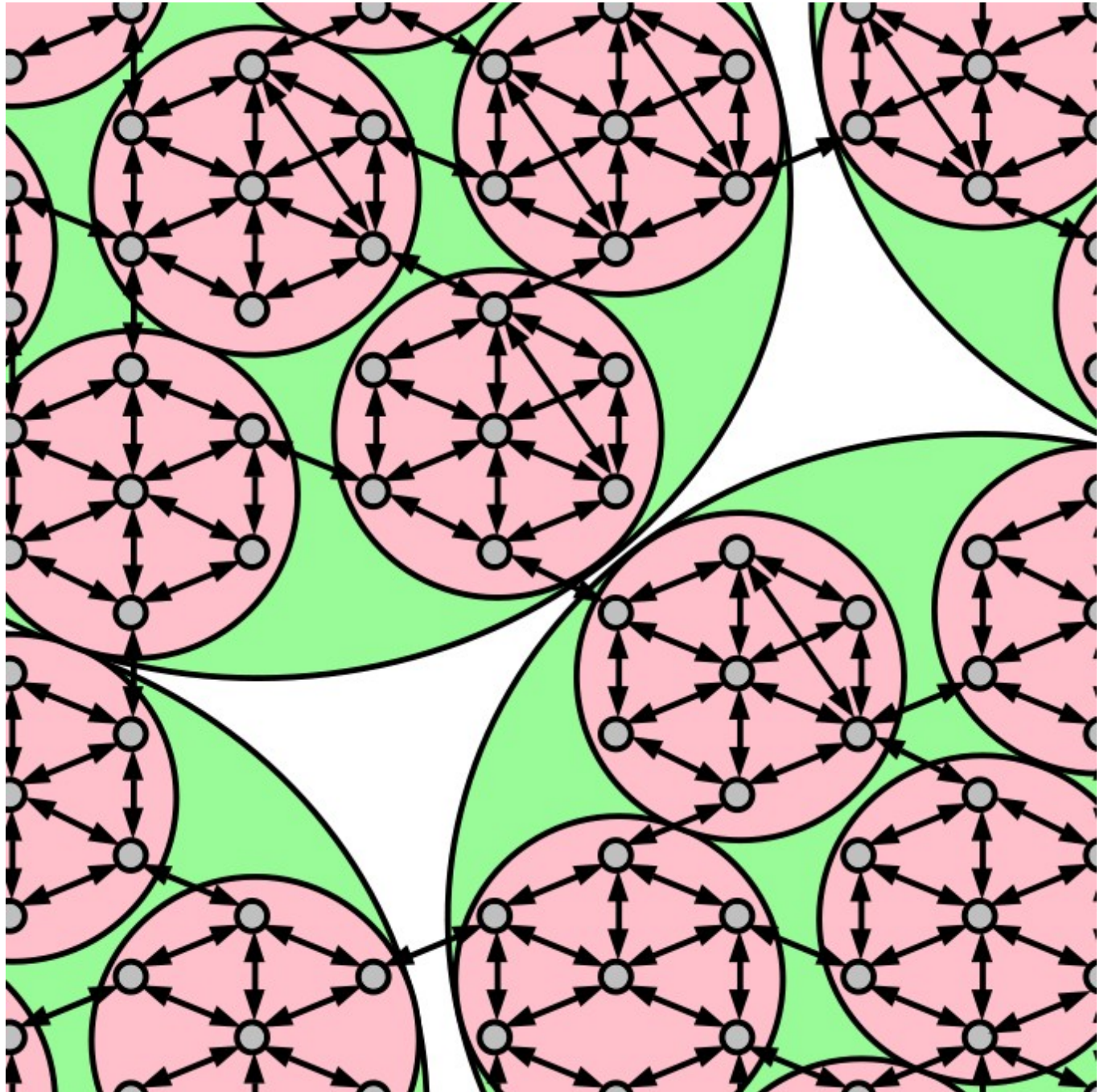
⇔ **Definition of Life:**

Life is the (in time) persisting and freely evolving **<mark>being</mark>** (or flow-system) of a (finite) **<mark>existence</mark>** (or design) (that can handle what it encounters ever more easily).
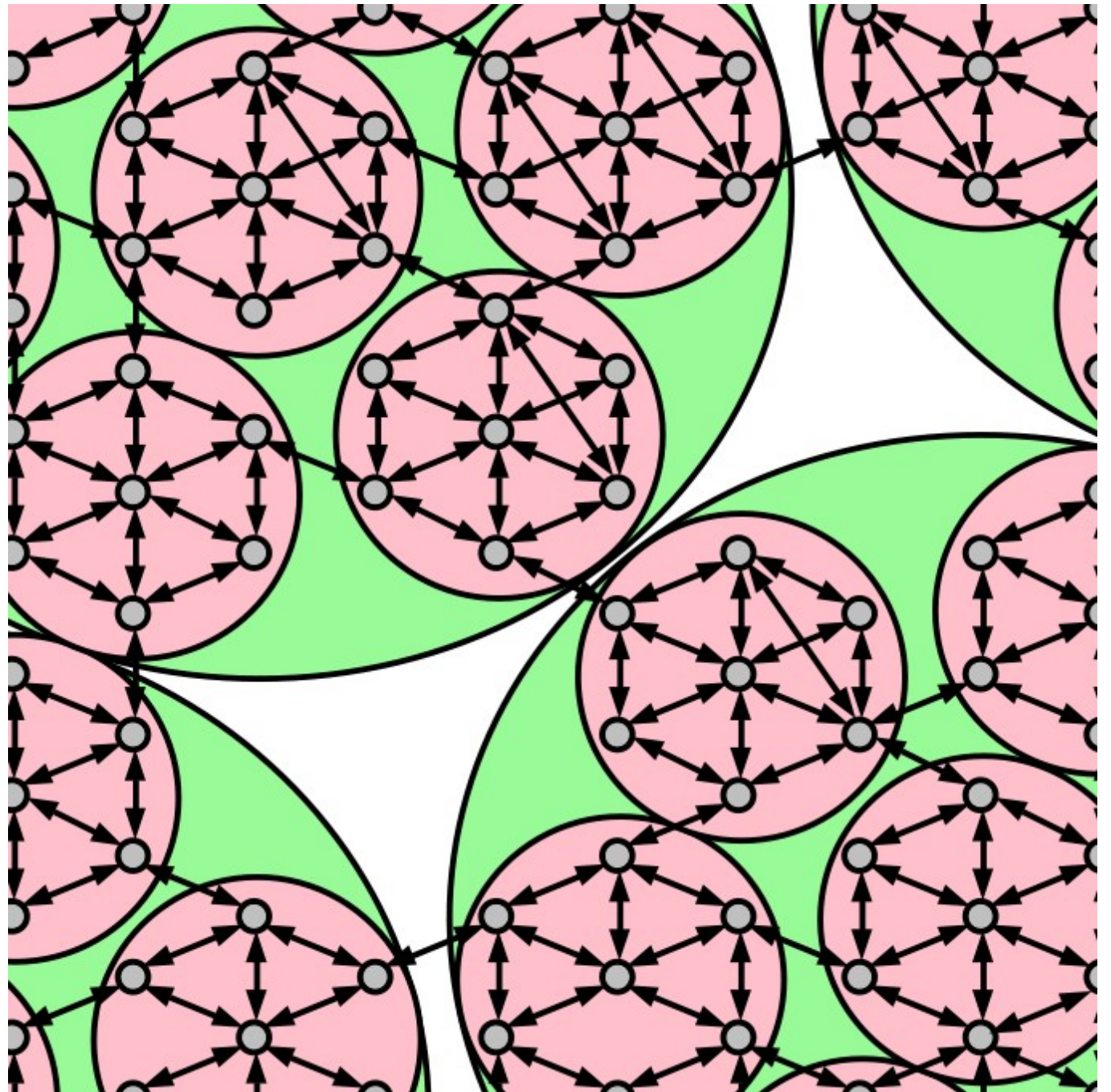
Causation & Reductionism

- Reductionism: Smallest particles are causative.

- Causation by 'wholes' is an illusion.

- But: 'wholes' are systems/beings.

Reductive Freedom

- My claim: Smaller particles often form a **mechanism**, **system** or **being** in which 'particles' are subdued.

- This creates (reducible) **reductive freedom**.

- Reductive freedom creates **life** with 'behavior' and possibilities.

Examples of reductive freedom & life

- A micro-controller provides functions & instructions to software
  (this is artificial, 'dead' hardware + software that needs humans to evolve);

- A biological cell provides *freedom* to DNA
  (alive at, respectively, an ontogenetic and a phylogenetic timescale);

- Your thoughts, perceptions, consciousness and knowledge
  live in your brain (alive as momentary knowing & consciousness,
  and as lifetime knowledge & memory);

Definition: A conscious being can incorporate (or copy) other beings within its knowledge, possibly including itself (=self-consciousness).
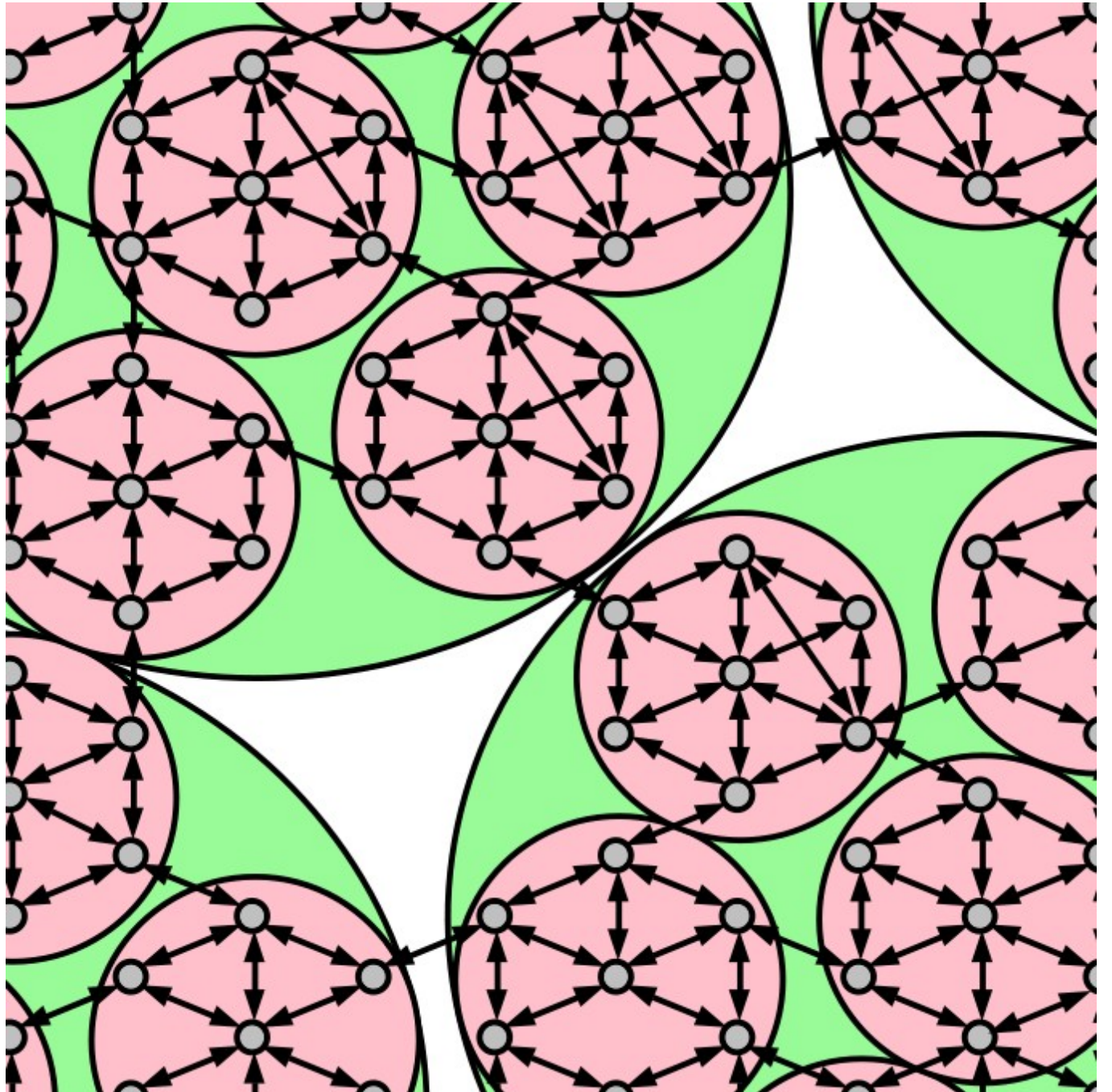
Erwin Schrödinger

"(i) My body functions as a pure mechanism according to the Laws of Nature. (ii) Yet I know, by incontrovertible direct experience, that I am directing its motions, […] and take full responsibility for them. The only possible inference from these two facts is, I think, that I […] am the person, if any, who controls the 'motion of the atoms' according to the Laws of Nature."

Epilogue in *What Is Life? The Physical Aspect of the Living Cell* (Cambridge: Cambridge University Press, 1944)

Subverse
& **Super**verse

Reductive freedom creates a distinction between a subverse (or intraverse) and a superverse (or extraverse).

- The (intraverse or) subverse causes a certain *reducible* freedom, possibilities or 'behavior',

- and makes itself ~invisible.

- The (superverse or) extraverse is **made** to be causative through providing it freedom.

Examples of 'Invisibility'

- Software (and software engineers) use the instructions provided by a computer, but 'they' do (or need) not know how this hardware works;

- Information coded in DNA (which evolves phylogenetically) "supervenes" on biological cells, living in an ecosystem;

- Your thoughts, perceptions and consciousness *live* in your brain without having any knowledge about neural networks nor brains; *Lower level systems (=subverses) work for us (=caused top-down).*

'New' (or 'free') (")Matter(")

- *If* the reductive freedom of an existence would be *absolute*, then its inside/subverse/intraverse/being/system would be 'absent,' unknowable and **not causative**;

- Then we experience the existence to be a *particle* or *matter*.

- Note: This is what life/beings/systems do with *'input'* and *'output'*; If you *know* the output of a system at a certain input, then there is *no causation from within*.

  (how could we not see this 100s of years ago?)

Summary

- An existence is alive because
  - it flows (= its being or system), and
  - because it persists (= its design);
- 'Inside' it consists of a (flowing) (intra)being or subverse; (=existence as being)
- 'Outside' it is part of another being: its superverse; (existence as existence/design)
- This is <u>not</u> a part/whole structure (= reductionist thinking); (parts disappear)
- And it is <u>not</u> a descriptive structure (no arbitrary part/whole selection);
- Subverse and superverse result *existentially* from reductive freedom;
- Reductive freedom is <u>*predictive*</u> of (the structure of) reality.

Freedom Law

When and only when reductive freedom arises, life may cause new natural systems or beings to come into existence, i.e. to emerge.

- The freedom law predicts the **birth** of a new being.
- The law of life (=the constructal law) predicts **how** and **if** this being will stay alive or die.

Find the freedom and you will find a being emerging.

Persistence, Life and Death

Life is the persisting and freely evolving being (or flow-system) of an existence (or design)

- Reductive freedom is **persistent**; persistent structures are stable.

Death may fixate existences or beings even more

- New atoms come into existence in stars;
  they are rather 'dead' or 'bricked' at lower temperatures;
  but with chemical freedom.
- DNA is quite fixed, ontogenetically;
- Memory in neural networks and brains is quite fixated in synapses;
- The design of a river is quite fixated in the sand that it flows in.

Non-linearity & feed-back

- Less absolute freedom ⇒ a somewhat independent being;

- Non-linearities exist everywhere ⇒ life (and death) is abundant;

- Freedom / non-linearity is usually limited through *feedback loops*;

- Without feedback, beings die (except for artificial mechanisms).

- Dissolving after death is essential for the evolution of complex lifeforms (i.e. no old and inferior dead things laying around).

Reductionism & Freedom

Since the Constructal Law *assumes* the existence of freedom;

⇒ it presupposes *emergence*;

⇒ it dismisses reductionism.

Reductive Freedom = Being free from reductive/intra-/subversal causality;

⇒ *'local,'* extra-, or *superversal* causality ;

⇒ *emergence* (e.g. of consciousness, matter, our universe, …).

(Intra- or) Subverses may break through (e.g. feelings influencing consciousness).

No constructal law nor life without reductive freedom.

More examples…

- Your thoughts, perception and consciousness *live* in your brain;

- Language *lives* in communities;

- Truths *live* in spoken language;

- Our relativistic universe emerges from freedom 'designed' in the quantum mechanical realm;

- Reality – and consciousness – is a *tree of life* and death.

Squeeze Pouch (Quantum) Gravity

History through Etymology…

- **Life**: laufen, love, elevate; **zoi**: Chi (Hebrew), zoo, qi (Chinese life energy), **to go** (from 'to chew'; both refer to *motion*); **bio**.

- **To be**: nebo (Russian sky), oben (German **above**), nebula (Latin cloud or fog), Bein (German *leg*), B hieroglyph is a leg.

- **Death**: deaf (without breath no Word).

- *Adam*: *atmen* (German **breathing**); Spirit: breath, bird, bread, **birth**; Spirit = creative breath = (*animating*) words = using your *legs*.

- *Anime*: animal, *name*, animate.

https://linguistics.stackexchange.com/questions/30002/why-are-there-words-meaning-both-breath-and-life-spirit-in-so-many-languages

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Abstract

This article explains *strong emergence* in reductionist terms. Two laws are introduced which predict the structure of reality from general relativity to consciousness. The freedom law predicts (in a reducible way) how and when new beings, existences, life, and even new "matter," will emerge and where reducibility ends. The law of life, or Bejan's "constructal law," predicts how this life will evolve or die. If this be-