

Gaia Brno Dec 2010











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Chrysosplenium alternifolium



Life is execution of a program

Life is a homeostat

“No supplementary input of information other than the genetic is necessary; nor, it seems, even possible, as the mechanism as we know it leaves no room for any. [...] The cell is indeed a *machine*.”

“The necessary information was present, but unexpressed, in the constituents. The epigenetic building of a structure is not a *creation*; it is a *revelation*.”

Jacques Monod : *Chance and necessity* (1970)

- **“All manifestations of life, from elementary biomolecular interactions to human behavior, are tightly associated with, if not in full command of, sequence-specific interactions. ... The genome that carries or encodes all these sequence patterns is, thus, a compact, intricately organized, informational depot.”**

- E. Trifonov

Homeostatic (cybernetic) engines

fridge

body temperature

Daisyworld



How novelty comes into existence

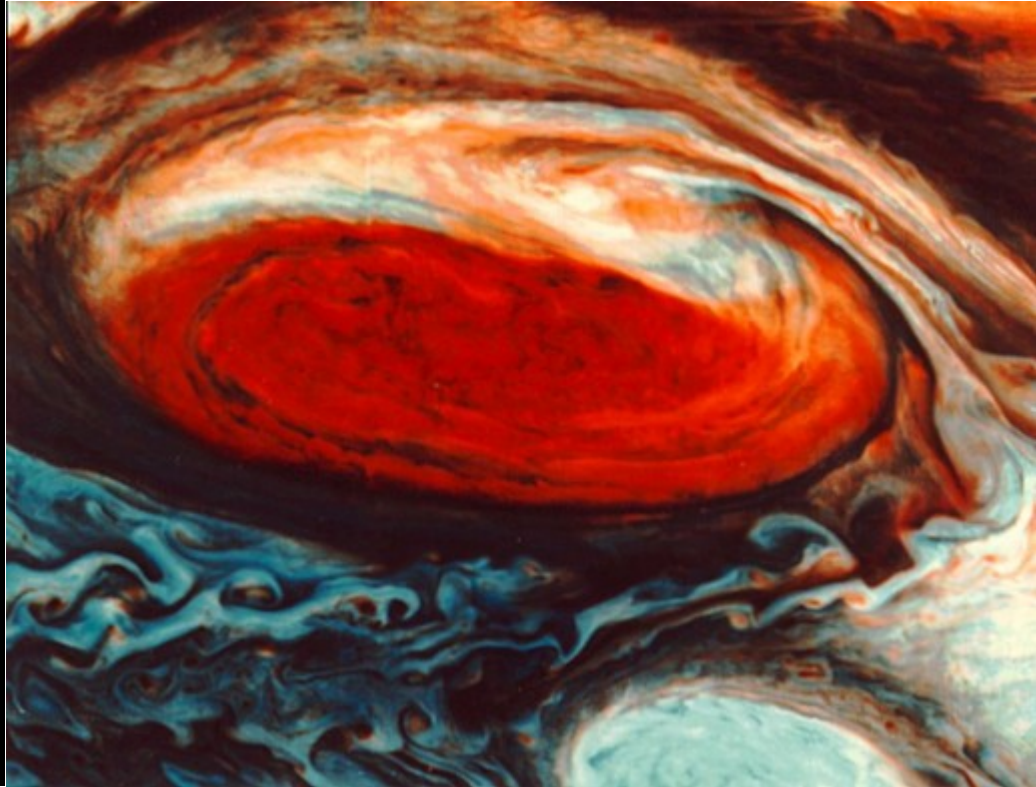
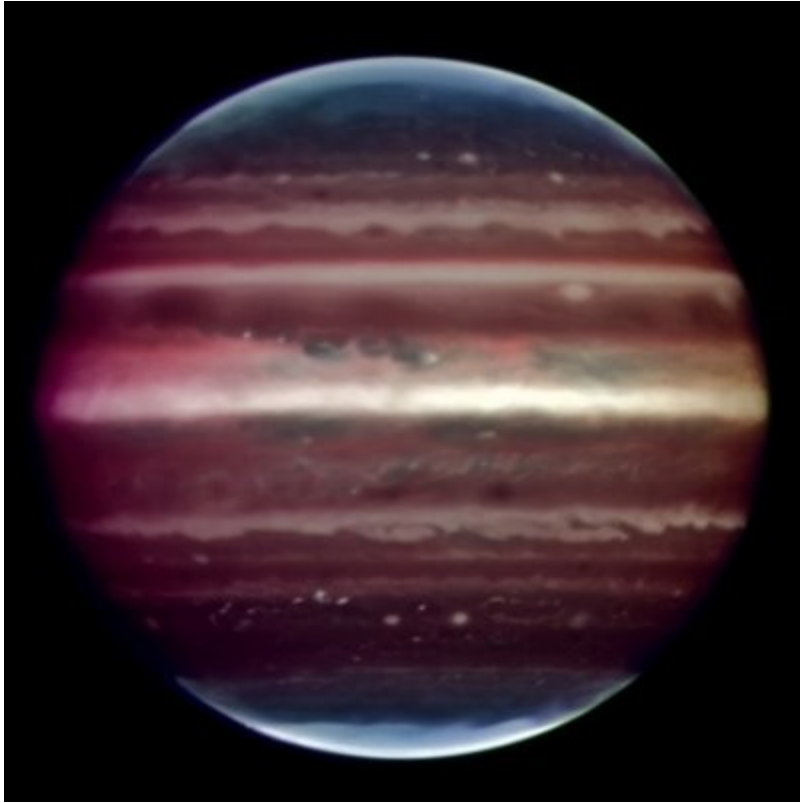
Construction

Emergence

Birth

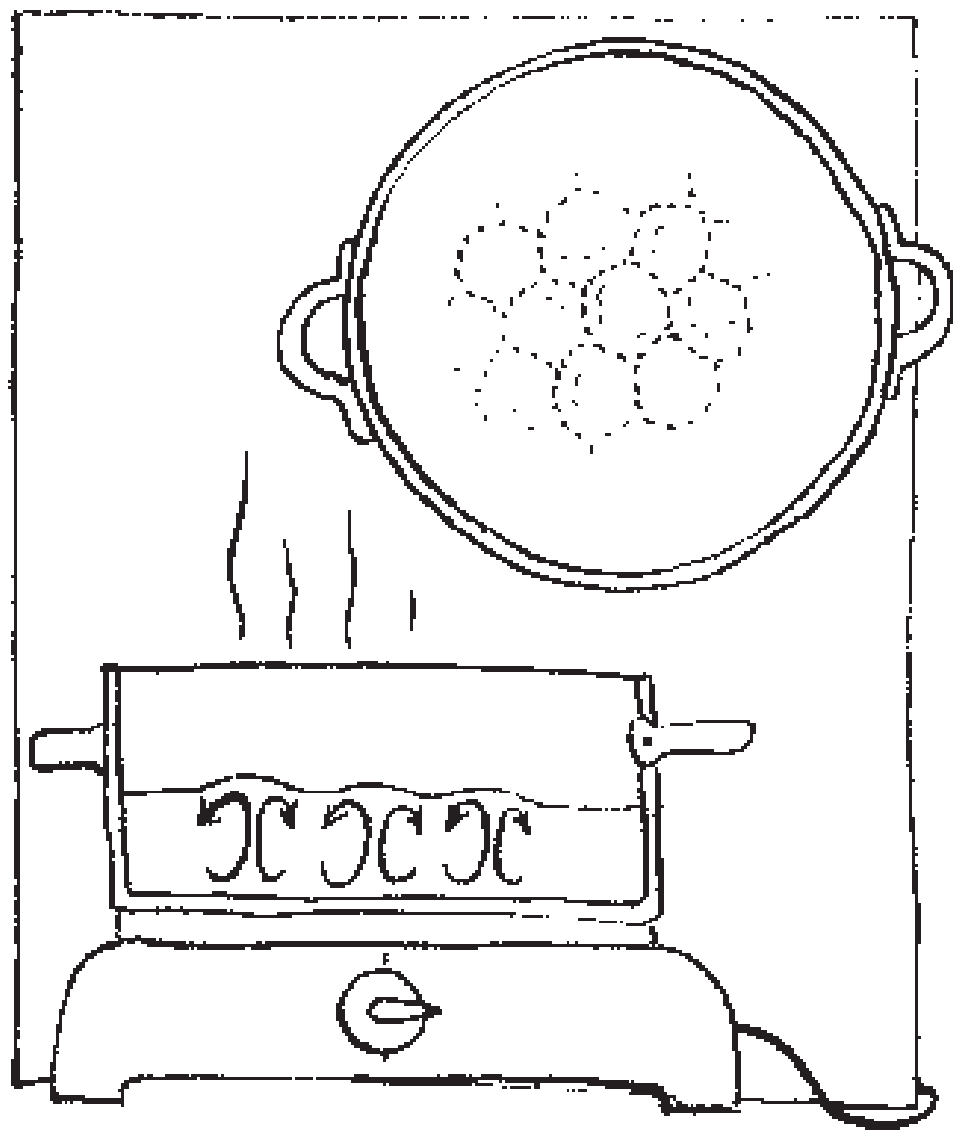
Self-organization

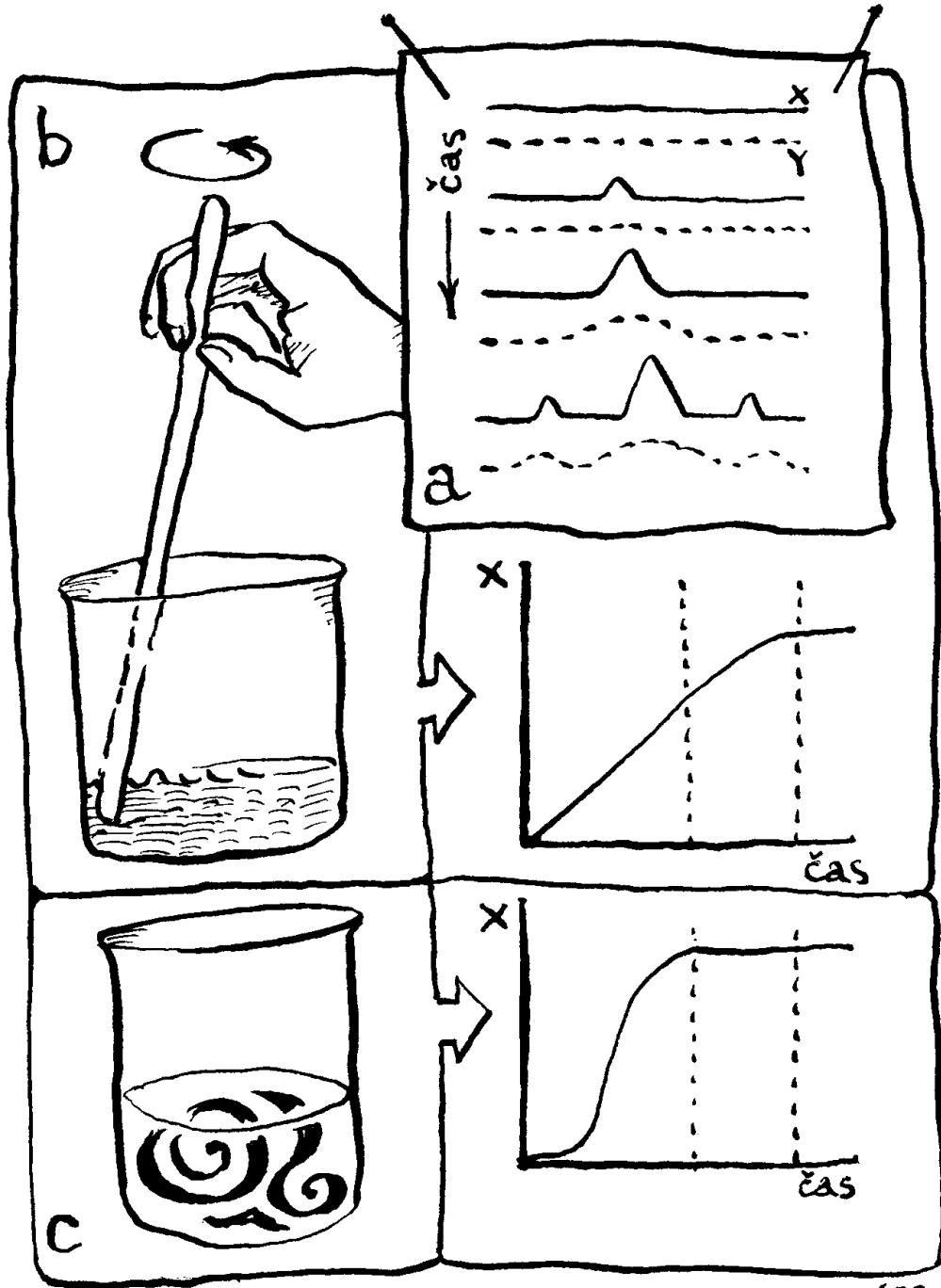
- emergent order from scratch: dissipative structures, Boolean networks, dialectics of nature
- deterministic chaos; butterfly effect
 - far from equilibrium, collateral energy (G. Bateson)
- programmed emergence: fractals, software, genetic algorithms
- **gratuity: experience gained in evolution**





Belousov & Žabotinskij

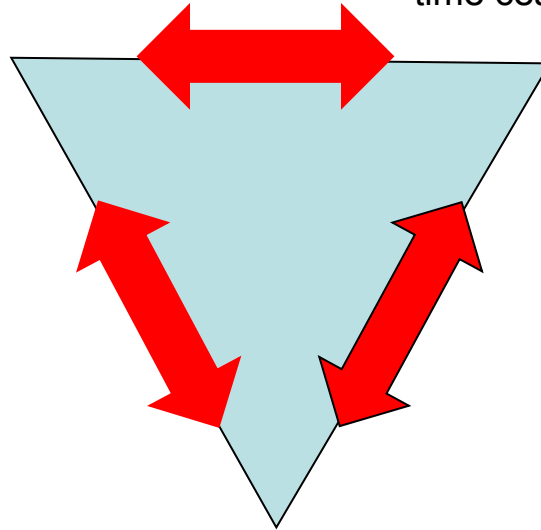




I. Prigogine

Molecular systems; causal systems of classical mechanics
Time: reversible

Macroscopic systems isolated and open
Arrow of time towards an equilibrium - when in eq., time ceases.

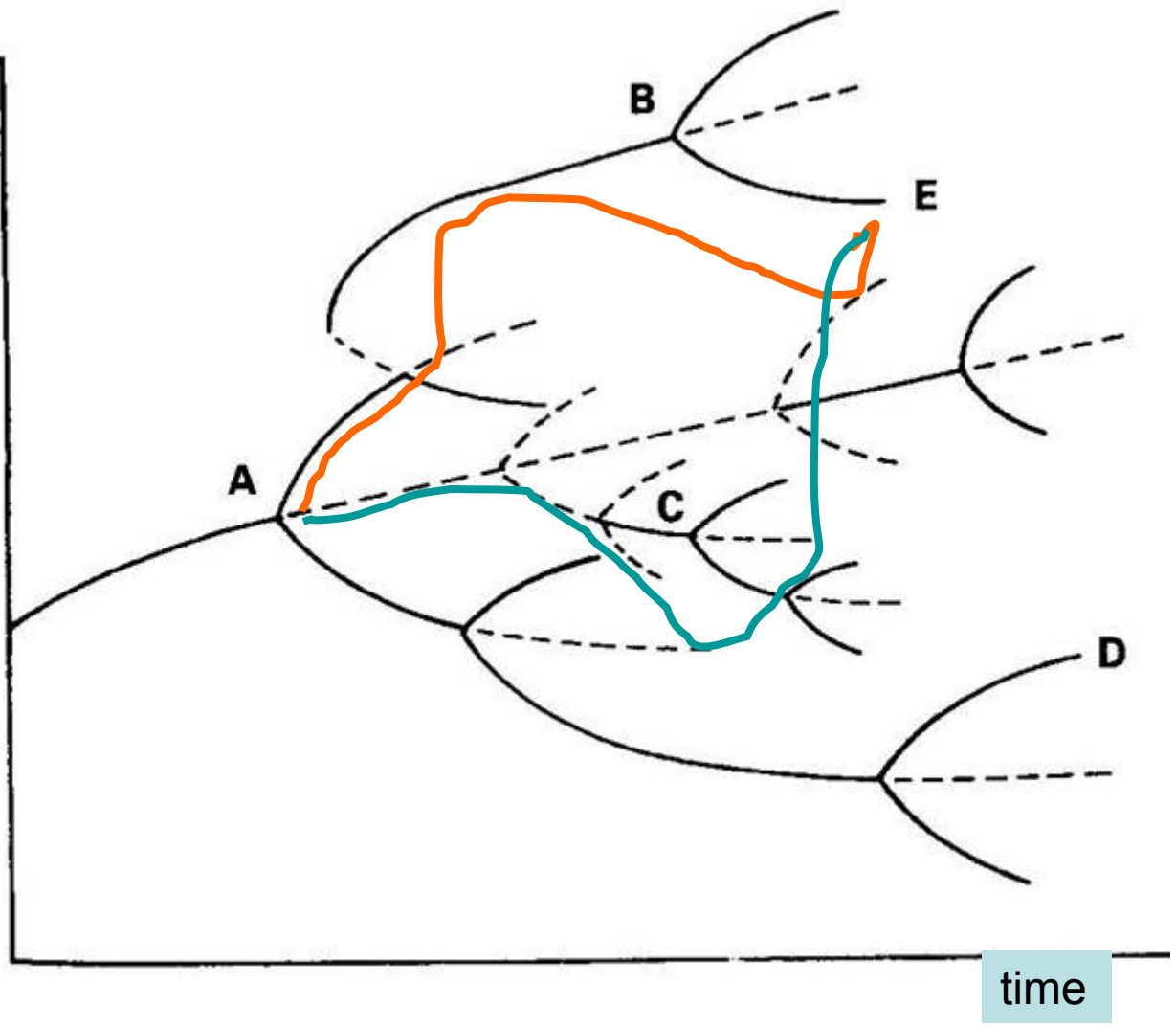


Dissipative systems = open macroscopic systems
Historical time

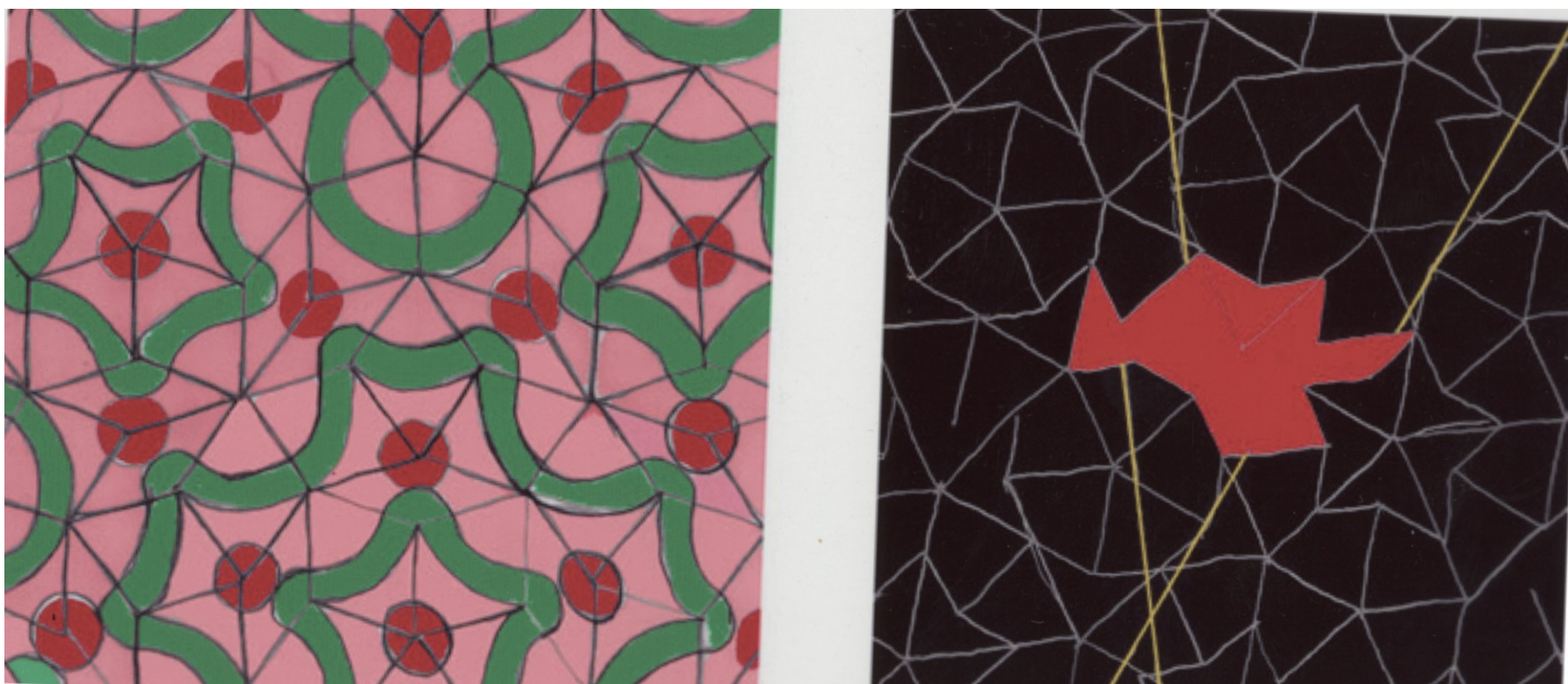
Transformations between levels not canonical - how to gain an unequivocal description of the system?

Can the diagram absorb also life, culture, history?

magnitude followed



time



Penrose – nepravidelná dlažba

How to get an insight into history?

Interpretation of palimpsests

geological strata

fossils

radionuclide datation

metabolic pathways

genes

development

dendrochronology

behavior

Thus it is, as I believe, that two or more genera are produced by **descent, with modification**, from two or more species of the same genus. And the two or more parent-species are supposed to have descended from some one species of an earlier genus.

Darwin: *Origin*

We

bodily beings

culture

no beginnings

novelty through birth

„biospheres“ (Kauffman) negotiating their adjacent possible



No quasi-persons like nation, universal mind, church, goddess Earth

only self-governing community without clear-cut beginnings

„clearing through the region“ (Heidegger)

evolutionary landscape (Kauffman)

Evolution started with a biosphere of language-like beings negotiating their ways of existence with the environment (internal or external);

(species as a culture)

Successful solutions were subsequently hardwired into deterministic mechanisms working with established codes.

Mother, like all educators, makes it her duty to teach him [the child] to be *objective* – objective in a simple way adults themselves believe to be „objective“. He is stuffed with sociability. He is prepared for his life as a man along the lines of the ideal of stabilized men.

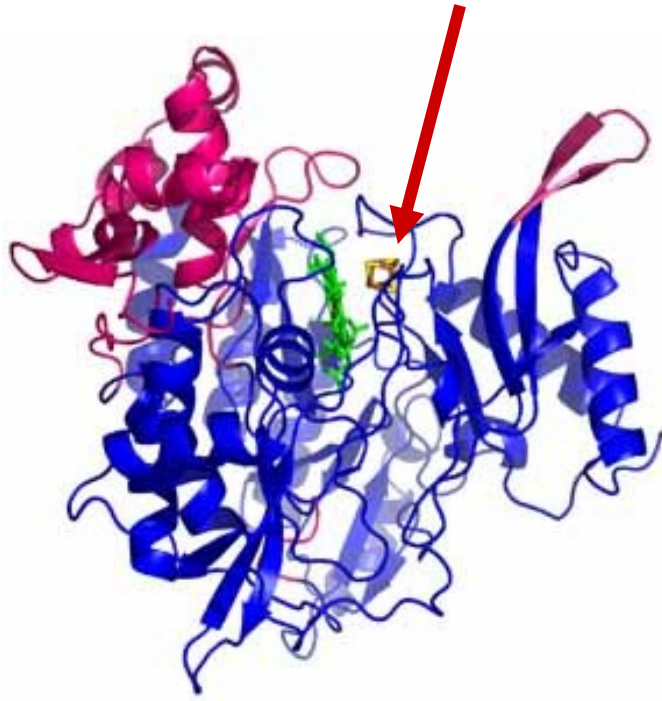
G. Bachelard: *The poetics of reverie*.

Handwritten text in a script, possibly Indic or Southeast Asian, with a prominent line of text in red ink. The text is arranged in horizontal lines across the page.

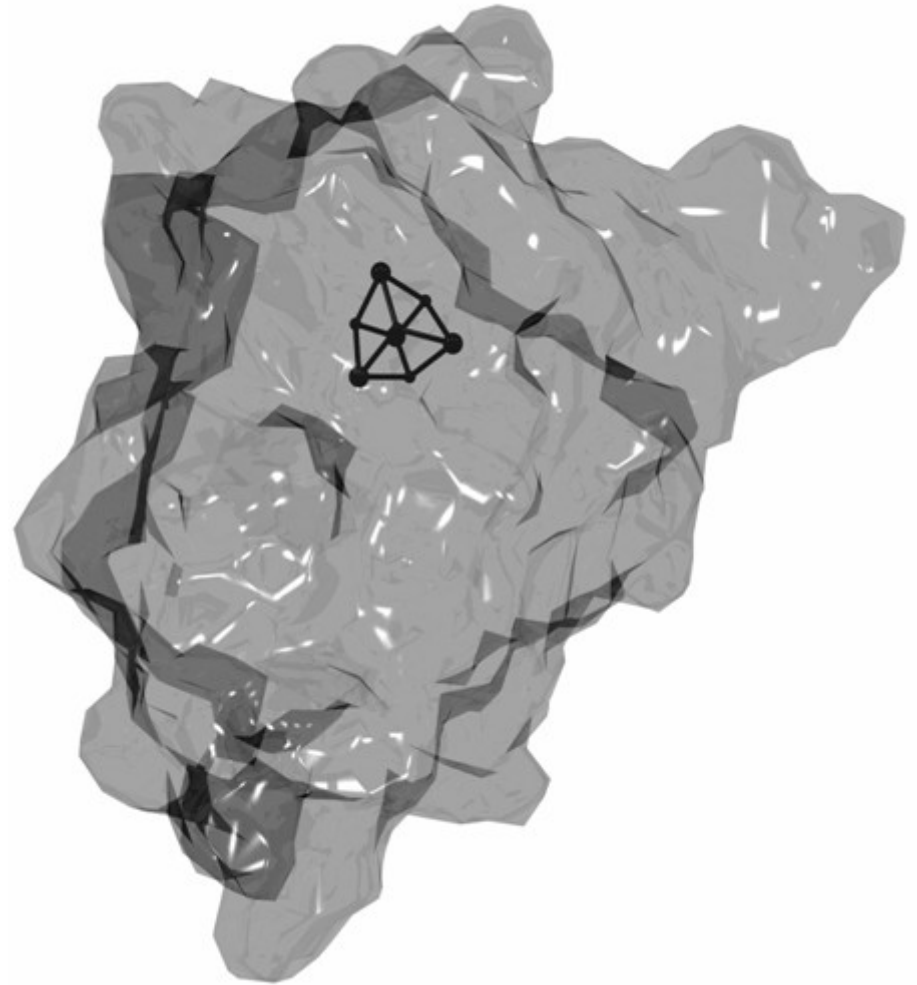

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 ruit angelus & conuincit eum filium iohannem
 & demarice conuincit angelus
 filium ihm.  toribus.  ucci.
 Nativitate ihu adiuuata angelus pas-
 pic sineopii puerum ihm & benedixit
 omi & deumna professa.  bat
 & inorum duodecim ihu in templo doce-
 seniores.  bi iohannis baptista populum bapt.

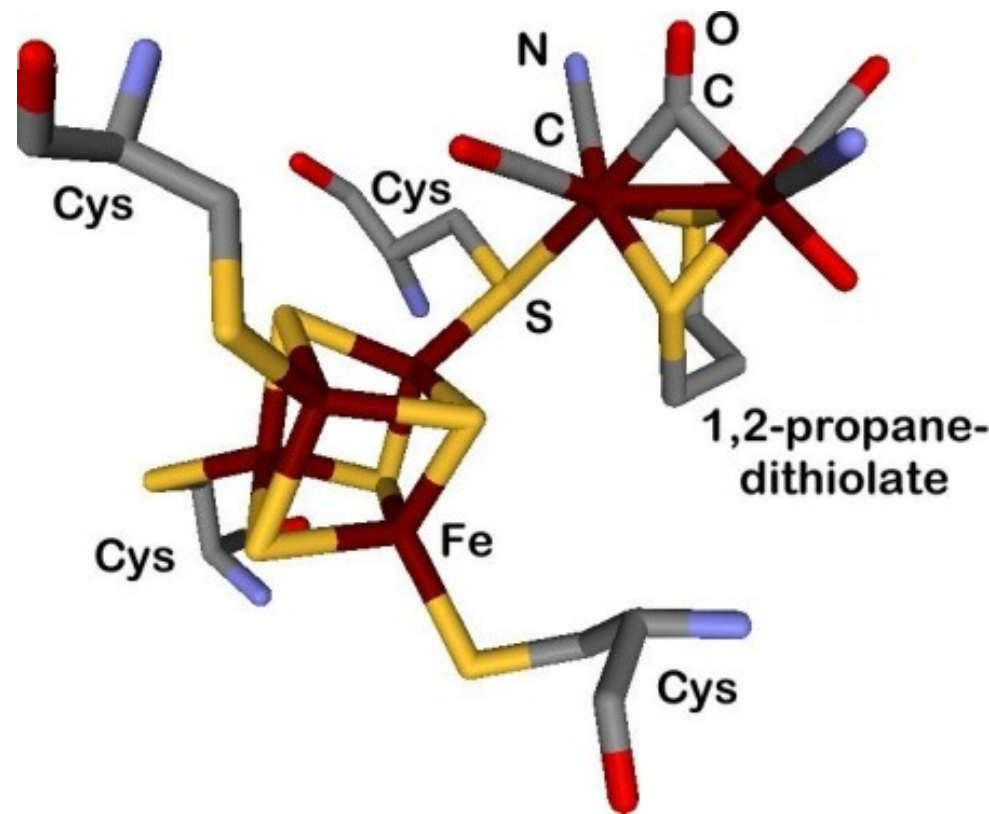
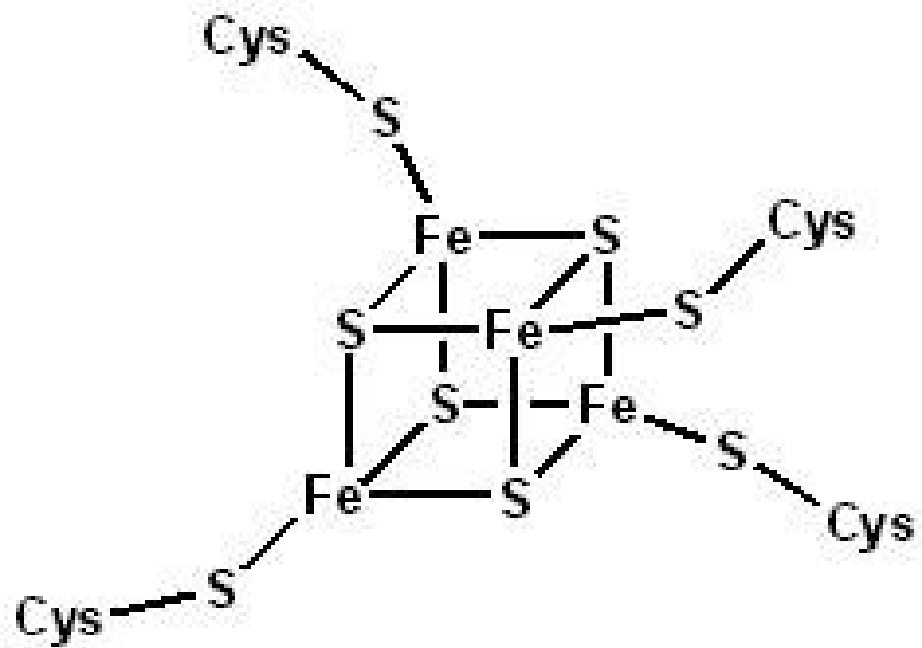
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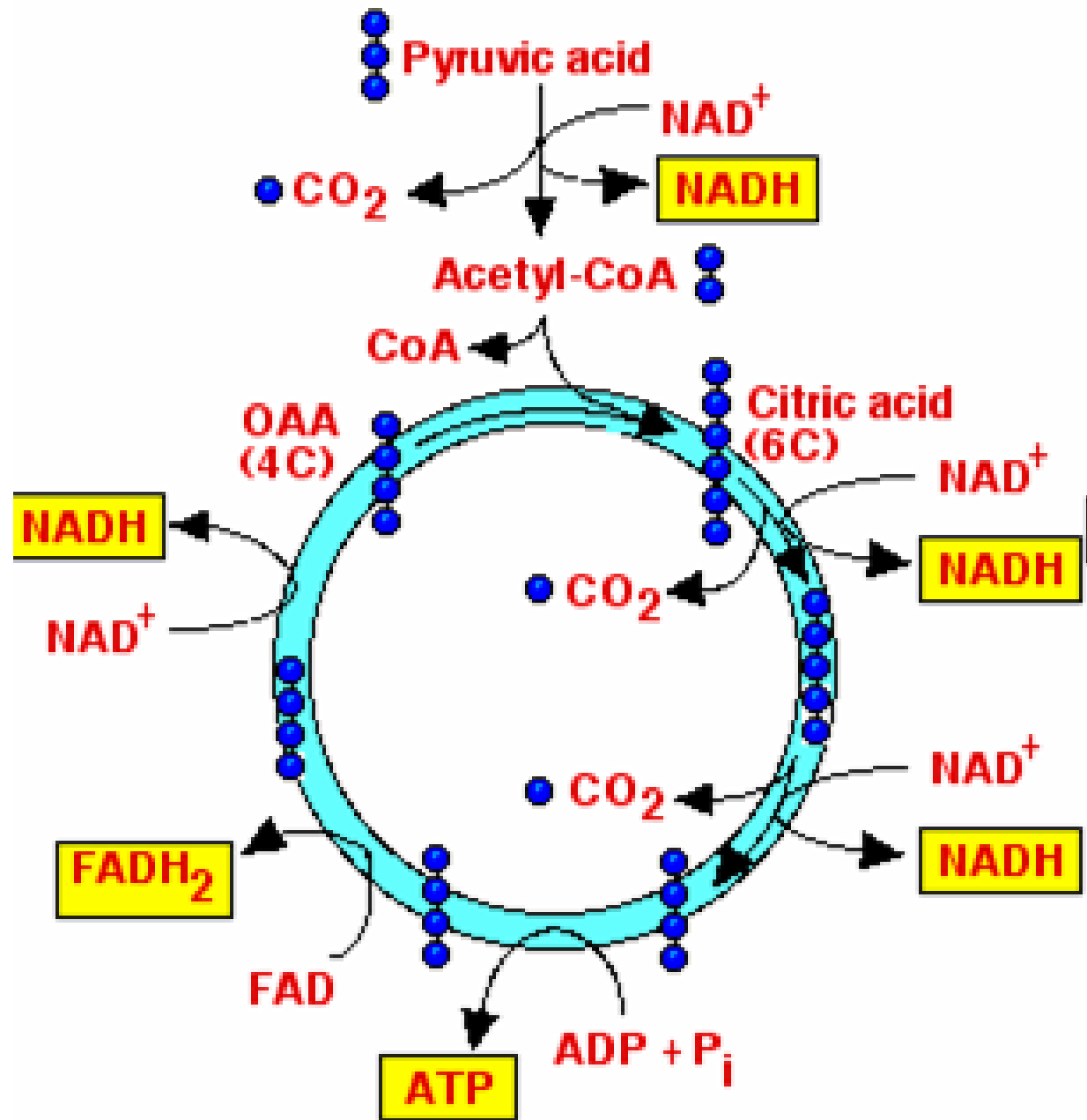


- ferredoxin

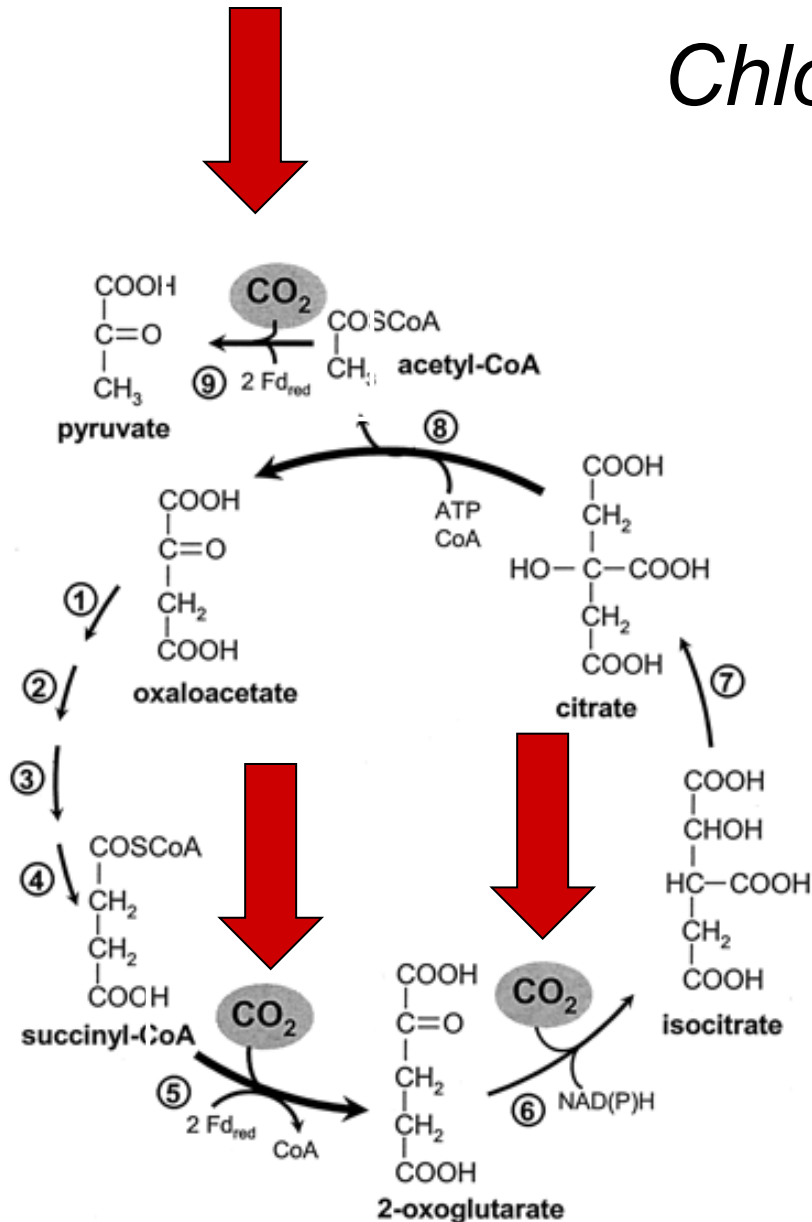




- Ferredoxin



Chlorobium tepidum

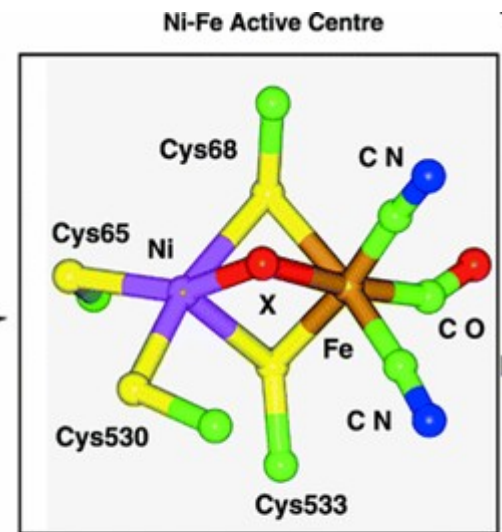
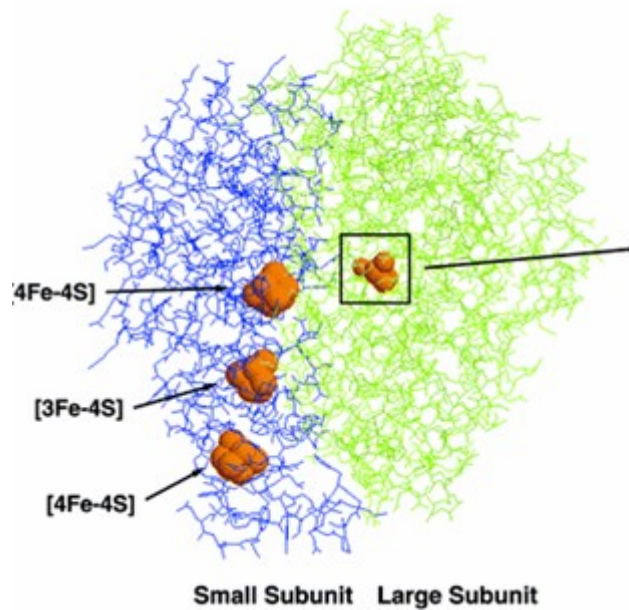
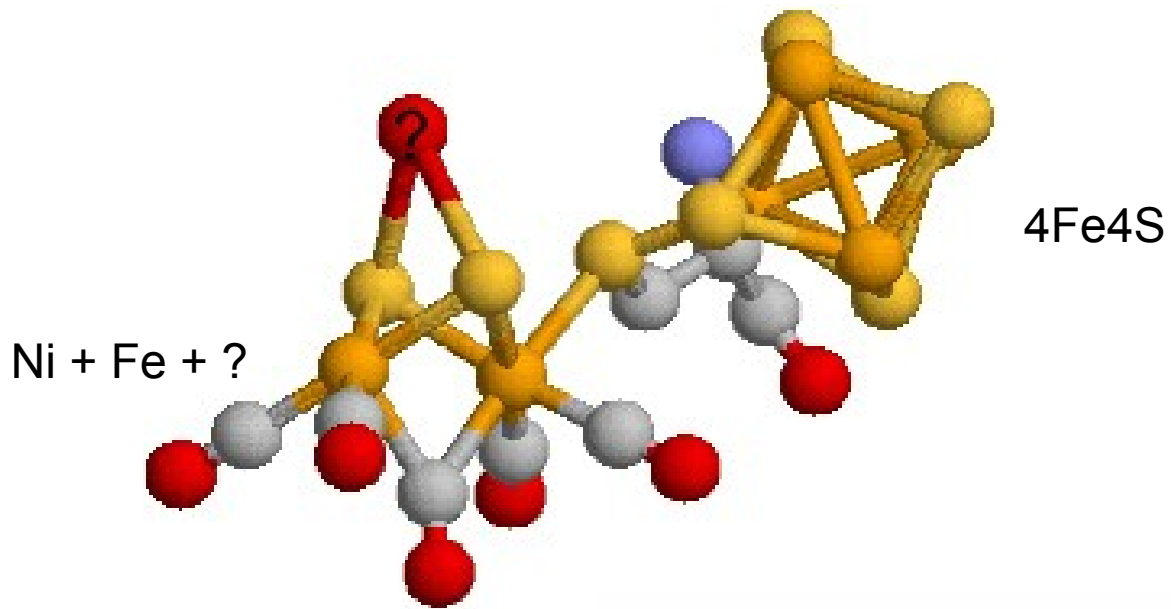


Step 5: 2-oxoglutarate:ferredoxin oxidoreductase

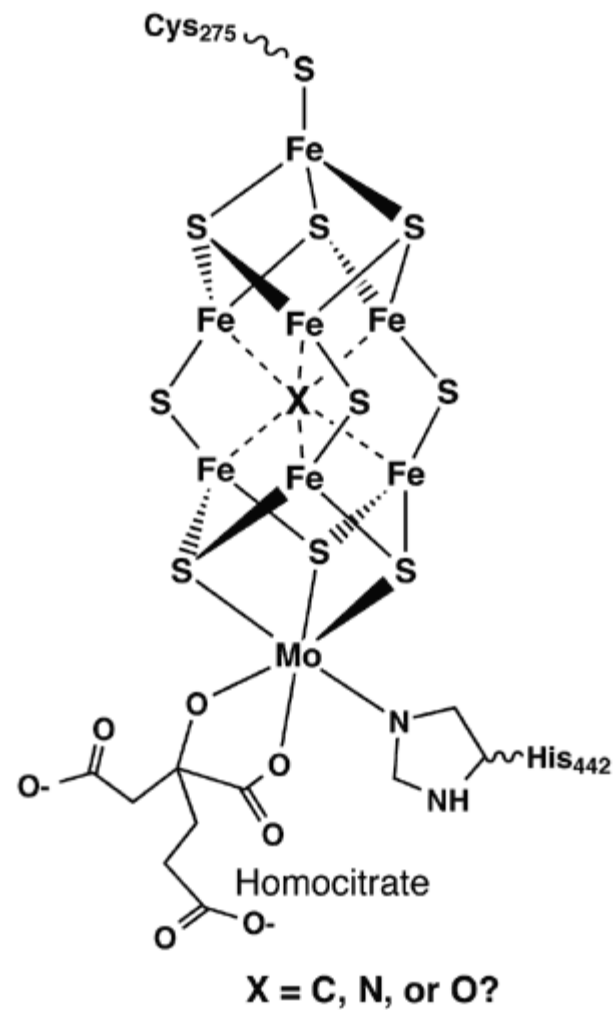
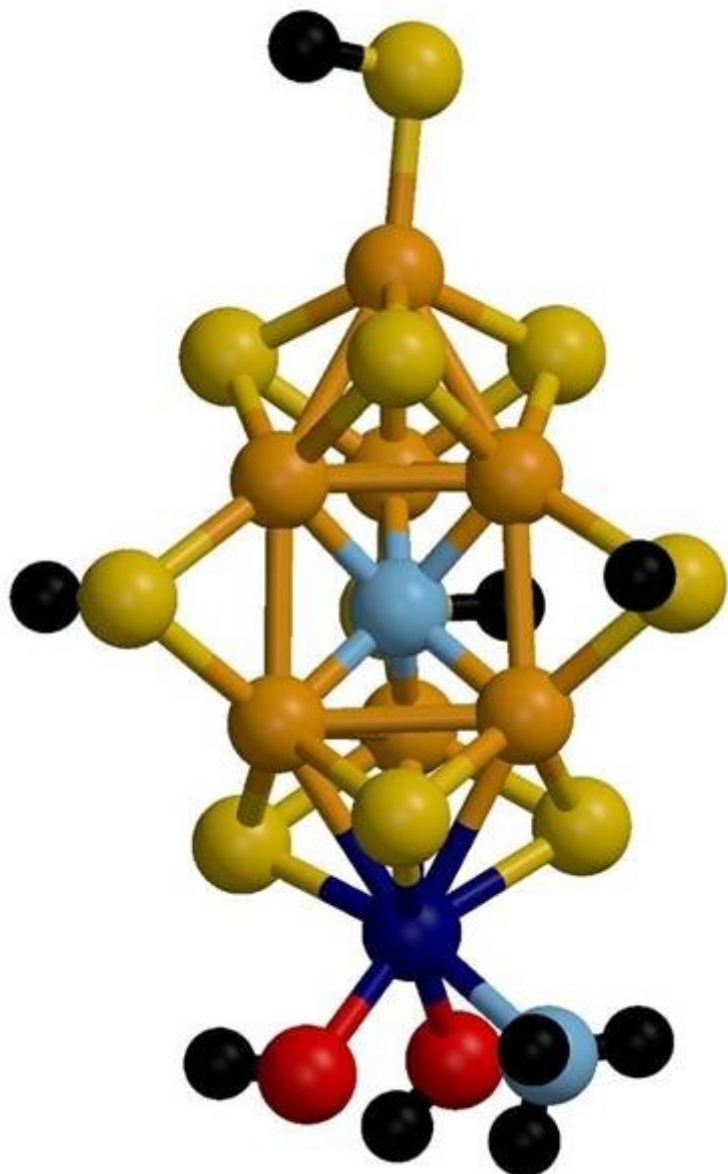
- Role of ferredoxin not completely understood.

Step 9: pyruvate synthase/ pyruvate:ferredoxin oxidoreductase (PS/PFOR)

- Requires a source of reducing equivalents and enzyme transfers reducing equivalents to discrete electron acceptors.
- Found 2 different ferredoxins used as electron donors.



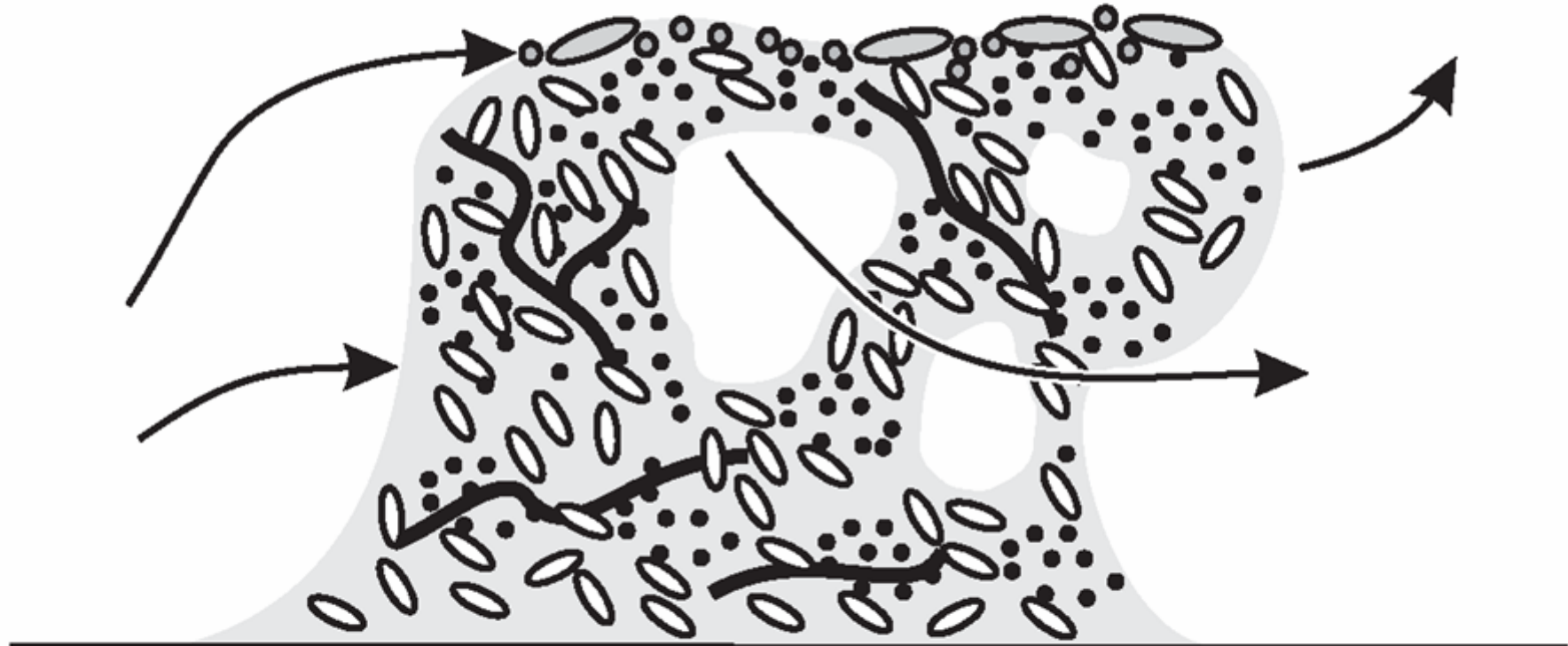
- Hydrogenase



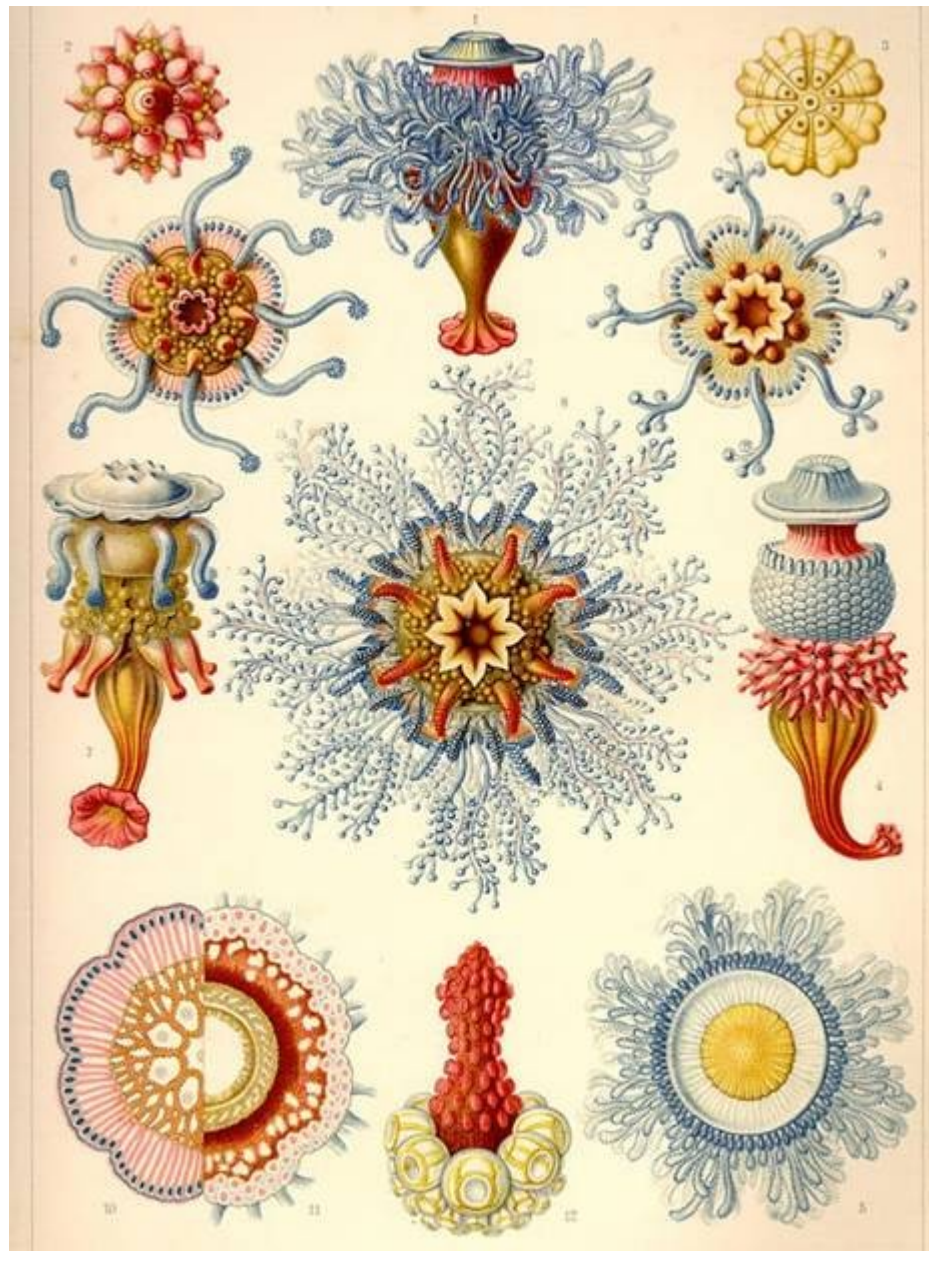
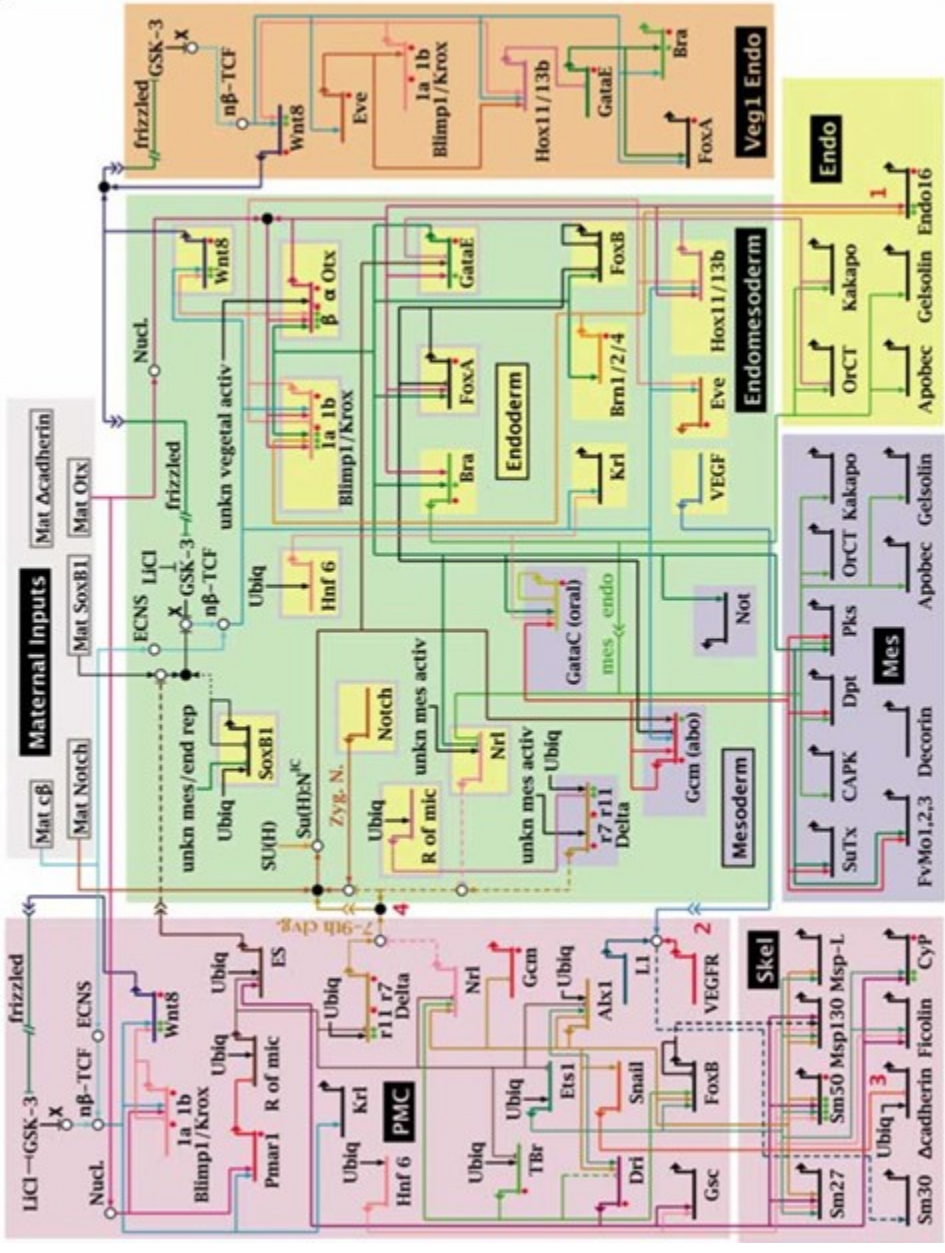
- **Nitrogenase**, J. Am. Chem. Soc. 125, 1466 (2003)).

- matrix
- bacteria
- enzymes
- fungus hyphae
- cyanobacteria
- algae

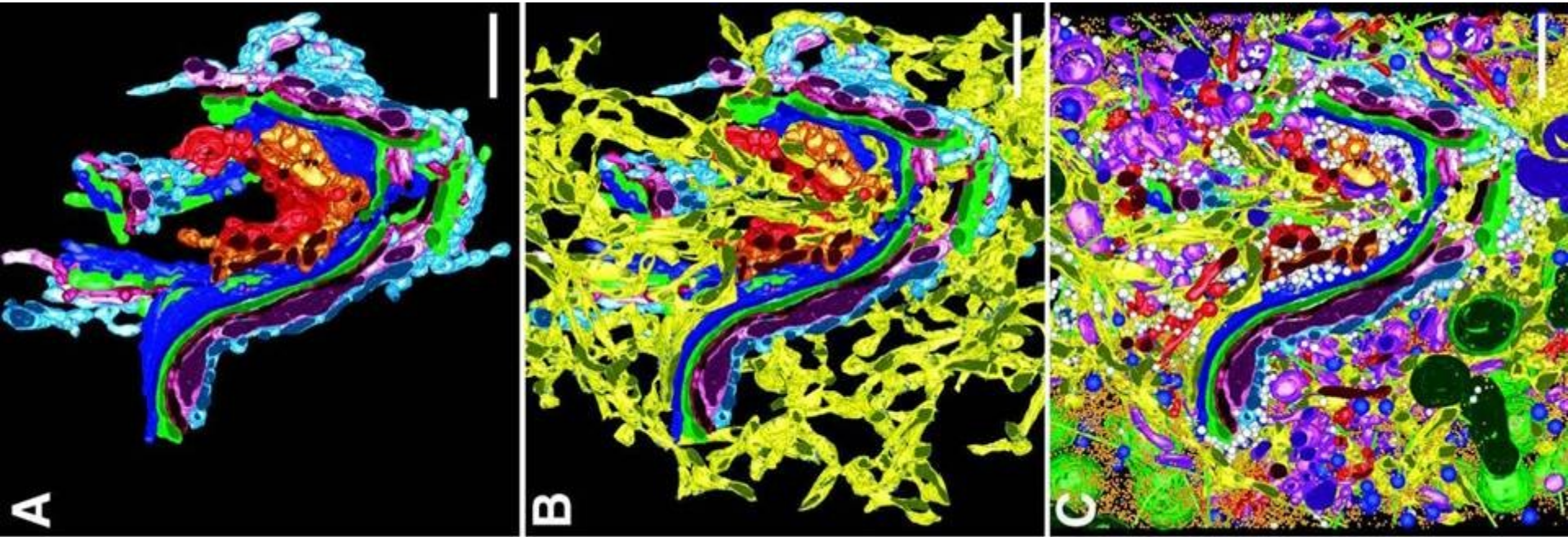
light



substrate



3-D model of the Golgi region



3-D model of the Golgi region. By using the software imod, each modeled object could be extracted and viewed in any given orientation and in context with any other object(s) to analyze complex morphologies with minimal ambiguity. (A) The seven cisternae that comprise the Golgi in the region modeled. C1, light blue; C2, pink; C3, cherry red; C4, green; C5, dark blue; C6, gold; C7, bright red. (B) The ER (yellow) traverses the Golgi stack at multiple points and extends in opposite directions beyond the cis-most and trans-most cisternae. (C) The Golgi displayed in the context of all organelles, vesicles, ribosomes, and MTs visible by EM in the modeled region. ER, yellow; membrane-bound ribosomes, blue; free ribosomes, orange; MTs, bright green; dense core vesicles, bright blue; clathrin-negative vesicles, white; clathrin-positive compartments and vesicles, bright red; clathrin-negative compartments and vesicles, purple; mitochondria, dark green. Bars = 500 nm.

Marsh B. J. et.al. PNAS 2001;98:2399-2406

PNAS

transcendence

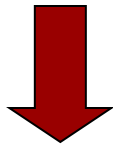
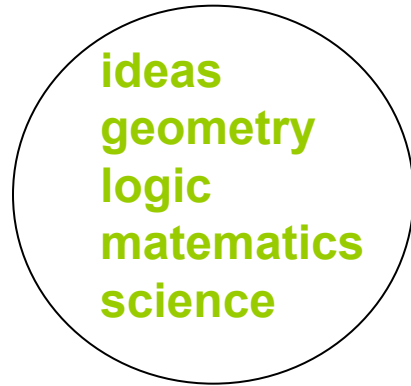
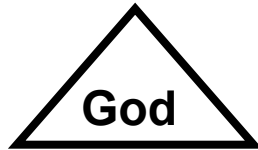
natural world

“truly existing essence”
concepts

„imperfect“ *fysis*
Likeness



transcendence



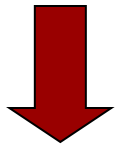
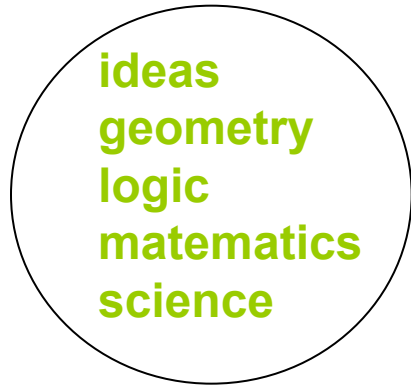
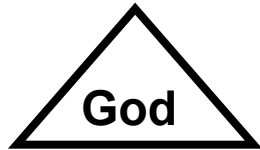
Alphabets

natural world

nature
life
language



transcendence (objective world)



Alphabets

characters
...01000101101101...

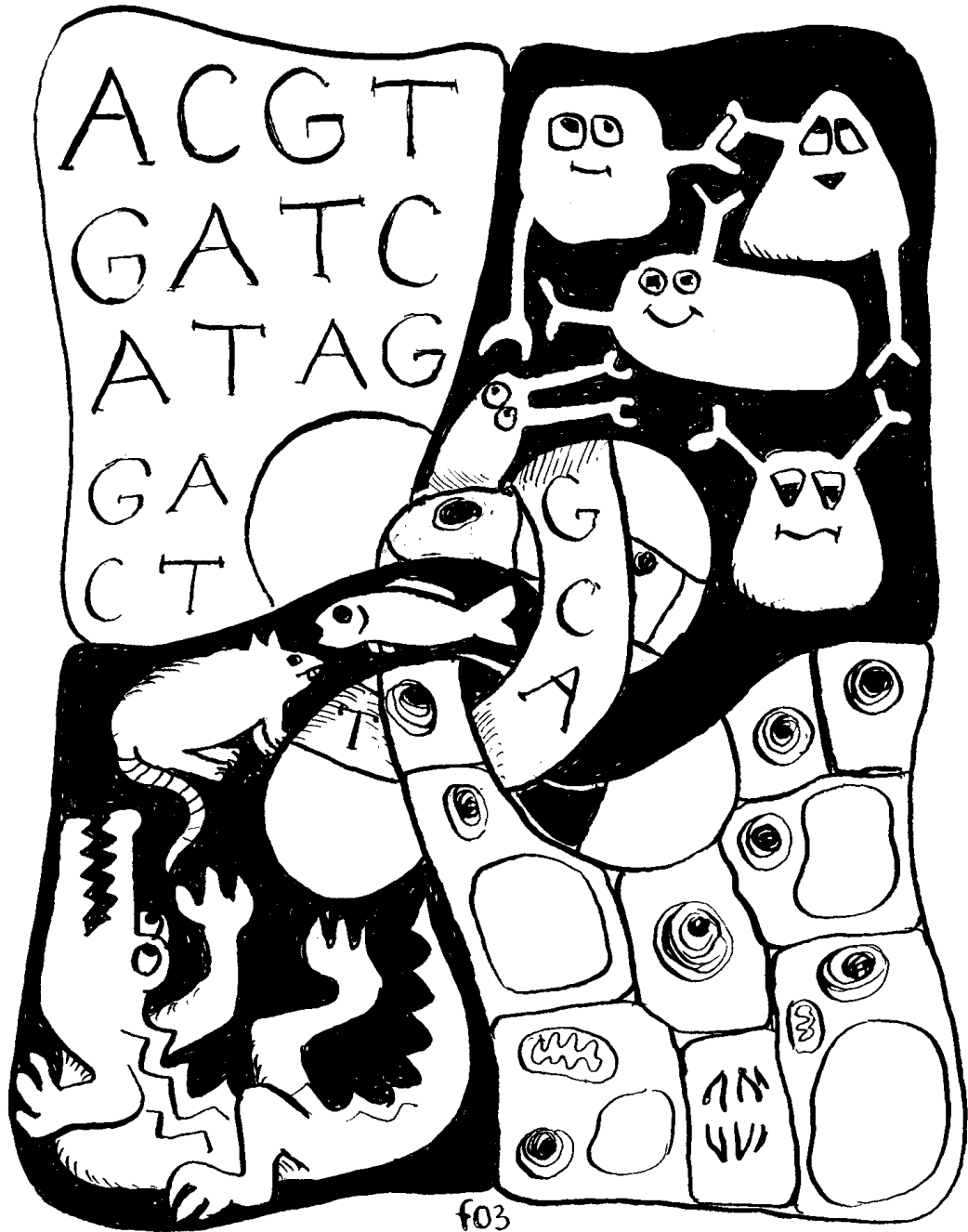
natural world

nature
life
language

? elements?

?anima mundi?

signs & symbols



Hallingskarvet 2005



Hallingskarvet 2005





Hallingskarvet 2005