

Natural Codes do not code themselves

Guenther Witzany Telos – Philosophische Praxis 5111-Buermoos, Austria www.biocommunication.at

www.biocommunication.at

0/30



- DNA RNA Proteins anything else
- replication errors drive evolutionary genetic variation



Main Narratives of the last 2500 Years





- All derives from the one substance or law
- Single parts are illusions of our senses

Heraclitus, Spinoza, Giordano Bruno, Leibniz, Hegel, Huxley, Darwin, Spencer, Bergson, Einstein, Steven Hawking, ... Holisms



- only smallest parts and mechanistically functioning natural laws
- structures, forms, bodies, movements, are illusions of our sensual constructions

Parmenides, Demokritus, Boyle, Proust, Dalton, Descartes, Newton, LaPlace, Mach, Carnap, Quine



- Strictly empirically, objective, measurable, in reproducable experiments
- Naturalism, materialism, mechanicism, according everlasting natural laws
- Because at the end all scientific communities depend on arguments: "Build correct scientific sentences!"



Only scientific sentences depict material reality

Material Reality = Physics + Chemistry

- Mathematical equations are the only appropriate tools to depict material reality
- Scientific sentences must be formalizable to depict material reality

Leibniz, Hilbert, Russel, Whitehead, Wittgenstein, Carnap

Life = Material Reality = Physics + Chemistry (1940)

- Life emerges out of atoms and molecules
- Life = physics + chemistry (E.Schrödinger)
- Life can be investigated by scientific sentences (mathematical equations)

Life = physics + chemistry + information

- Information is a molecular feature (M. Eigen)
- Information as syntax structure with context-free generation rules (N. Chomsky)
- Life = Self reproducing matter according self reproducing automaton (Turing/v.Neumann machines)

Some Examples for Mathematical Theories of Language involved in Biochemistry

- Cybernetic systems theory
- information theory
- biolinguistics
- bioinformatics
- synthetic biology
- mathematical biology



Falsified:

Mathematical theories of natural languages

- Ludwig Wittgensteins pragmatic turn:
- natural languages depend on interacting <u>social groups</u>
- the meanings in natural languages depend on <u>context</u>, not syntax
- Manfred Gödels incompleteness theorem

The construction of a contradiction-free axiomatic system is <u>impossible</u> in principle

(as suggested by Hilbert, Russel & Whitehead)



Current empirical knowledge about natural codes:

- No natural code codes itself
- agents in social interactions use such codes
- Code using agents follow syntactic, semantic, pragmatic rules.
- **Rule-following** is a kind of **social** interaction

All natural code user follow rules, not laws

Syntactic RULES

determine *combination* of vocabulatory elements

• Semantics RULES

determine *content* (meaning) of vocabulatory elements

• Pragmatics RULES

determine how agents install *interactions* according varying *context*

Context dependence optimizes natural codes

- In natural codes similar or identical sequences can transport different meanings dependent on varying contexts: e.g. coopted adaptation
- Through epigenetic marking it is possible to fix or even refix different meanings on the same genetic text sequence
- Memory: memory of context-determined patterns helps to faster react on similar situations



• Machine metaphor for living organisms is outdated (machines cannot generate coherent sequence content de novo)

• Quantitative analyses cannot extract different meanings out of same syntax structure



www.biocommunication.at

Manfred Eigen about the genetic code

- Genetic syntax = physical reality = mathematics
- Genetic syntax = protein semantics (meaning/function)
- Evolution of Life = self-reproducing matter (v.Neumann/Turing machines)

In natural codes/languages this is **falsified because**:

In natural codes context (pragmatics) determines meaning
No self-reproducing machine has been seen in the last 50 years

Primacy of Context: Pragmatic Turn in Biology

Copyrighted Material

Günther Witzany

Life: The Communicative Structure a new philosophy of biology

Copyrighted Material

2000

www.biocommunication.at

If the genetic code is really a natural code there must be **agents** that

- generate code sequences *de novo*
- identify sequence-specific target sites
- **integrate** in pre-existing genetic content arrangements without destruction of former content
- recombine according adaptational purposes
- mark sequence sites to epigentically alter meaning

What are these agents?

2005

www.biocommunication.at

Examples of infectious agents that **insert** into and **recombine** host genetic content

- Omnipresent phages in prokaryotes
- The eukaryotic nucleus has a variety of large dsDNA virus features
- Persistent viral parts in mitochondria and other organelles
- Endogenous retroviruses (active and/or defective)
- Intronic regions that are spliced out during exon assembly

Some persistent viruses/virus-derived parts

- DNA-Viruses
- DNA-transposons
- RNA-Viruses
- non-retroviral RNA viruses
- endogenous retroviruses
- LTRs-retrotransposons
- non-LTRs (SINEs, LINEs, ALUs)
- group II introns
- group I introns
- non-coding RNAs

Retroagents are active in

- Transcription
- Post-transcriptional RNA-Editing + RNA Splicing
- Translation
- DNA replication
- Chromatin organisation
- DNA recombination and repair
- Epigenetic modifications

- co-opted adaptations of former genetic colonizers that now act as regulatory elements co- and post-transcriptionally
- non-coding RNAs act as modular tools for cellular needs

Bio-communication and Natural Genome Editing

2010

Natural genetic codes are **not randomly derived**

RNAagents generate, identify, integrate, recombine and mark nucleic acid sequences

Natural genome editing is the result of **social interactions** of viral and subviral agents with cellular host

Natural genome editing agents follow syntactic, semantic **and pragmatic** rules

RNA Sociology

non-mechanistic explanation of

Social interactions

- ✓ From single RNA stem loops to group (identity) building
- ✓ self/non-self identification competence
- ✓ Context dependent varying interactions
- ✓ Cooperation between RNA groups and host

De novo generation of

- ✓ Nucleic acid sequences
- ✓ Coherent integration into pre-existing ones
- ✓ Innovation by variations in RNA stem loops
- Innovative genetic identity by co-evolution

The DNA Habitat and its RNA Inhabitants: At the Dawn of RNA Sociology

Luis P. Villarreal¹ and Guenther Witzany²

¹Department of Molecular Biology and Biochemistry, University of California, Irvine, CA, USA. ²Telos–Philosophische Praxis, Buermoos, Austria. Corresponding author email: witzany@sbg.at

World J Biol Chem. 2013 Nov 26;4(4):79-90. doi: 10.4331/wjbc.v4.i4.79.

Rethinking quasispecies theory: From fittest type to cooperative consortia. <u>Villarreal LP</u>¹, <u>Witzany G</u>.

www.biocommunication.at

Thank you very much for your attention!