Preface

Communication means interactions that are mediated by signals in contrast to purely physicochemical interactions where no signals are present. Additionally these sign-mediated interactions need rules on how the signals may be combined to transport more complex informational content. Last but not least, communicative interactions mediated by signs depend essentially on living agents that are able to follow such rules of sign use. Additionally it must be mentioned that sign-mediated rule-governed interactions represent a kind of social interaction, i.e., communication processes are social events, involving groups of interacting agents that share the rules on how to use signals, and this means that group identity is essential in living nature.

Whenever living cells, whether akaryotic or eukaryotic, coordinate their behavior, communication processes are necessary to reach coordinative goals. Each activity on all levels of biocommunication (intraorganismic, interorganismic, transorganismic, and generating response behavior to abiotic influences) is usually achieved by means of specialized signaling. If these signaling processes are disturbed, damaged or incomplete, the activity remains incomplete or rudimentary or is deleted.

The prerequisites of communication are its social character, its dependence on the use of signals according to three levels of rules, the primacy of context (pragmatics) which determines the meaning/function (semantics) of the used signs and—last but not least—the inherent capability of sign-using agents to change these rules of sign use according to environmental or adaptational needs. None of which is found in inanimate nature. No signs, no semiotic rules, and no socially interacting living agents are present when, e.g., water freezes to ice.

The change of sign-using rules, which gives signals and sign sequences new meanings that never existed before and are not the result of a recombination of former ones, is an inherent feature of living agents competent to use a natural language or a natural code. The generation of new sign sequences is essentially not the result of the selection of beneficial mutations out of an abundance of defective variants. In contrast to this passive derivation narrative of positive selective forces,

the generation of new sequences is an active process in which natural code-using agents produce new sequences in vivo.

This short description of the essentials of biocommunication contradicts former opinions of communication in natural sciences, information theory, systems theory, mechanistic and reductionistic approaches which rely on a mathematical theory of language, i.e., concepts of quantifiable sets of signs. The history of the philosophy of science clearly demonstrates a variety of such approaches in which signals are molecules which are subject to quantitative investigations and comparisons usually based on investigations of the molecular syntax structure of the natural codes. This means that molecular syntax as a result of chance mutations (error replications) and selection represents the material reality of the physicochemical world which can best be represented by mathematical equations. In this perspective, material reality is the only reality because it can be objectivized, measured, and empirically investigated. The molecular syntax of natural codes is therefore the information-bearing content out of which its functions and its meaning can be distilled.

Yet this paradigm was falsified in the 1980s by pragmatic philosophy and sociology which empirically tested that meaning was not represented by the syntax structure of natural codes, but by the context in which sign sequences are used by in vivo interactions of living agents. In contrast to the former narrative, pragmatics (context) determines the meaning of sign sequences, with the consequence that identical sequences of signs may transport different meanings, even contradictory ones. This makes sense in light of energy costs: It is not necessary to represent an ontological entity or event by unequivocal representations. One sign sequence can designate multiple meanings according to contextual needs. A sign- and rule-sharing population only needs a limited number of signals and a limited number of rules to produce multiple variant communications; even de novo generation, although rare, is possible in principle.

This means it is not the syntax which is the relevant information for extracting the meaning of signals used to coordinate and organize behavior. To avoid the term "meaning," Francis Crick wanted to use "Information" only in a strict mechanistic way ("*'Information' in the DNA, RNA, protein sense is merely a convenient shorthand for the underlying causal effect. As to "meaning" … I would keep away from the term.*").

In contrast to this perspective, it is the context in which social interactions occur, i.e., that in which signs and sign sequences are used. This means the sociological aspect is essential for deciphering the meaning of natural codes.

Biocommunication processes have been documented meanwhile on the whole area of living nature, i.e., plants, animals, fungi, akaryotes, viruses, and even RNA consortia. One missing publication on communication of archaea is presented here. The published works on biocommunication are not the end but the start of a coherent process of investigations and data mining regarding communicative actions within cells, between cells and between non-related organisms during the whole biosphere, and could lead to a better understanding of the principles governing living nature and a better picture of life on this planet to restructure the behavioral motifs of humankind in its relation to non-human living nature.

The benefit of this new type of research which integrates empirically derived knowledge about archaea physics and chemistry with pragmatic action theory is its more coherent explanatory power. It complements the current knowledge about the physiology of archaea and motifs on each level of archaeal life with the available habitats and contexts in which archaea species live. In contrast to pure reductionistic biology, it can integrate the basic motifs of archaea signaling within varying contexts with the knowledge about all physiological interactions. In contrast to mechanistic biology—it only recalls on the outdated narrative of "information" transfer—the biocommunication approach focuses on the real-life situations in which signaling directs the various forms of interaction. In this context, communication is not restricted to information transfer but predominantly acts as a kind of social interaction.

Finally, the editor hopes that Biocommunication of Archaea will integrate a diversity of research goals on the function, taxonomy, and genetics of archaea, representing their main principles of life, evolution, and developmental stages. Understanding the full range of archaea life will have repercussions for the understanding of life and its evolution in general.

Bürmoos, Austria   Guenther Witzany
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