Preface

Whenever living cells, whether prokaryotic 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.

Communication means interactions that are mediated by signals in contrast to purely physico-chemical 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 are 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.

The prerequisites of communication are: (1) its social character, (2) its dependence on the use of signals according to three levels of rules, (3) the primacy of context (pragmatics) which determines the meaning/function (semantics) of the used signs, and (4) 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. For example, no signs, no semiotic rules, and no socially interacting living agents are present when 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 other reductionistic approaches which rely on a mathematical theory of language, i.e., the analysis of a quantifiable set 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 physico-chemical 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 fundamental 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 the 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. 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, prokaryotes, viruses, and even RNA consortia. The missing publication on communication of single-celled protozoa is presented now. The published works on biocommunication are not the end but the start of a coherent process of investigations and data mining regarding communicative acts 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.

Communication between ciliates or between ciliates and non-ciliates is not the only subject of this book. Of equal interest was to find the communication pathways within the ciliates how the information transfer between nuclei is organized, i.e.,

how RNA-mediated genome arrangements and rearrangements are coordinated or conserved or remain an important source for genome plasticity as indicated between parental and offspring ciliates.

The benefit of this new type of research which integrates empirically derived knowledge about ciliate physics and chemistry with pragmatic action theory is its more coherent explanatory power. It complements the current knowledge about the physiology of ciliates and motifs on each level of ciliate life with the available habitats and contexts in which ciliate species live. In contrast to pure reductionistic biology it can integrate the basic motifs of ciliate 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 editors hope that *Biocommunication of Ciliates* will integrate a diversity of research goals on the function, taxonomy, and genetics of ciliates, representing their main principles of life, evolution, and developmental stages. Understanding the full range of ciliate life will have repercussions for the understanding of life and its evolution in general.

Buermoos, Austria
Bern, Switzerland
May 2016

Guenther Witzany
Mariusz Nowacki

http://www.springer.com/978-3-319-32209-4

Biocommunication of Ciliates
Witzany, G.; Nowacki, M. (Eds.)
2016, X, 372 p. 65 illus., 40 illus. in color., Hardcover
ISBN: 978-3-319-32209-4