Research Profile

A. Ngezahayo

Anaclet Ngezahayo

1994:	Dr. rer. nat. University of Constance, Germany
	Postdoctoral work, University of Tübingen (Physiology) and University of Constance (Neuroscience)
1995 - 1997:	Postdoctoral work, Institute of Neurobiology, ETH Zurich, Switzerland
1997 – 2003:	Assistant professor (C1), Institute of Biophysics University of Hannover, Germany
2004:	*venia legendi*: Cell Biology and Developmental Biology
Since 2004	Assistant professor (C2), Institute of Biophysics University of Hannover, Germany

Current research

The main research topic of our group is to understand the regulatory mechanisms of gap junction dependent cell-to-cell communication and the involvement of this form of cell communication in different cellular processes. Gap junctions are cell-cell adhesion structures characterised by cell-to-cell channels. The channels allow a direct exchange of ions and metabolites between adjacent cells without the involvement of the extracellular space.

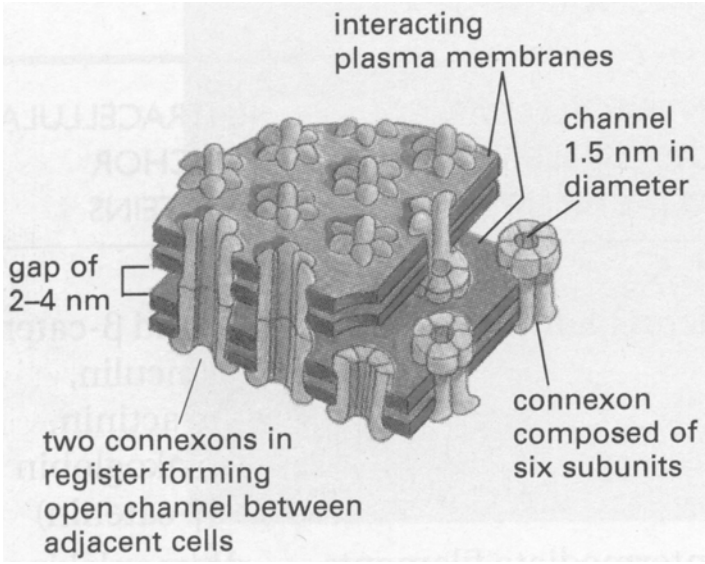

Fig.1: Schematic representation of gap junction

At molecular level, a gap junction channel is composed by oligomerised innexins or connexins (Cx) in invertebrates and vertebrates, respectively. Recently, a new class of putative gap junction forming proteins, the pannexins (Panx1-3), has been identified in invertebrates and as well as in vertebrates. The connexins, which are expressed by a gene family with 19, 20 and 37 putative members by mouse, human and zebra fish, respectively, hexamerized in the cellular membrane to form hemichannels (connexons). By association via their extracellular domains, two connexons of neighbouring cells build a channel, which directly joins the cytoplasmic spaces of the two interacting cells.

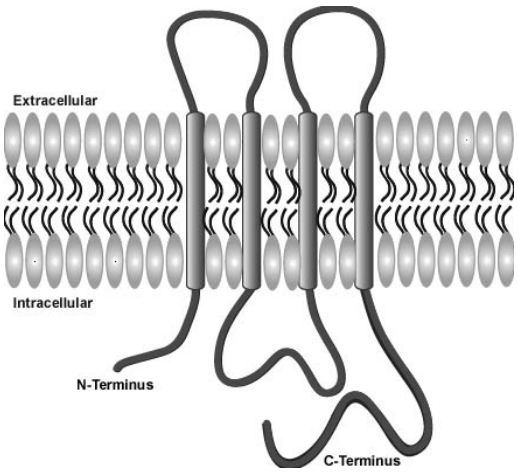

Fig. 2: Schematic illustration of the topology of a connexin in the cellular membrane

The involvement of gap junction channels and hemichannels in regulation of cellular functions like differentiation, apoptosis, antigen presentation, etc has been proposed. In the nervous tissue, it was shown that gap junction coupling regulates synaptic development and synaptic modeling of the neocortex, it seams to be involved in selection of subsets of neurons for further connection processing, stimulus representation, modulation of the synaptic efficiency. Furthermore different pathologies of the nervous tissue like epilepsy or Alzheimer disease were shown to correlate with defective gap junction dependent cell-to-cell communication between different cells of the nervous tissue

Our group combines electrophysiological, cell imaging, cell biological and molecular biological techniques to analyse the involvement of gap junction coupling in regulation of different cellular functions and pathologies. We could show that gap junction coupling of the supporting cells of the cochlear Corti organ is involved in drug related ototoxicity. In granulosa cells, we showed that gap junction coupling participates to regulation of apoptotic reactions. In cooperation with the group of Prof. R. Gerardy-Schahn, we could recently show that polysiarylation of NCAM alters gap junction coupling in CHO cells. Additionally, we have established the *Xenopus laevis* oocyte expression system to analyse the modulation of gap junction channels and hemichannels formed by specific connexins.

Future goals

Gap Junction dependent cell-to-cell communication, the so called electrical synapse is common in different areas of the nervous tissue. However, the involvement of this form of communication in synaptic function and plasticity have been neglected by the research community. Recent results however show that an interaction between electrical and chemical synapses exist. Moreover, evidences are accumulating that gap junction dependent cell-to-cell communication is involved in development and function of the nervous tissue.

We will apply the different techniques available in our group to identify the connexins expressed in relationship with the developmental stage of nervous tissue and to study the involvement gap junction dependent cell-to-cell communication in synaptic plasticity. Furthermore the role of gap junction in pathologies of the nervous system like then non syndromal hearing loss related to mutation in Cx26 will be investigated.

Selected publication

[1] Ngezahayo A., Schachner M., Artola A. Synaptic activity modulates the induction of bidirectional synaptic changes in adult mouse hippocampus. **J. Neurosci.** 20, 2451-2458 (2000)

[2] Blödow A., **Ngezahayo A.**, Ernst A., Kolb H.A. Calmodulin antagonists suppress gap junction coupling in isolated Hensen cells of the guinea pig cochlea. **Pflügers Arch.** 446, 36-41 (2003)

[3] **Ngezahayo A.**, Altmann B., Steffens M., Kolb H.-A. Involvement of gap junction coupling in regulation of apoptosis in GFSHR-17 granulosa cells. **.J. Membr. Biol**. 204, 137–144 (2005)

[4] Breidert S., Jakob R., Ngezahayo A., Kolb H.A., Naim H.Y. Trafficking of Cx49 in living mammalian cells. **Biol. Chem.** 386, 155-160 (2005)

[5] Kikuchi T., Zhao H.B., Ngezahayo A., White T.W. (2006) Gap junctions and cochlear homeostasis (invited review). **J. Membr. Biol.** 209, 1-10 (2006)