



E. Zimmermann

Elke Zimmermann

- 1985** Dr. rer. nat., University of Stuttgart-Hohenheim

Postdoctoral work at the Duke Primate Center, Arizona State University (USA), the MRC Babraham, Cambridge (GB) and the University of Konstanz, Germany
- 1992-1996** Heisenberg-fellow of the German Research Foundation (DFG) and Group leader, German Primate Center, Göttingen
- Since 1996** Full Professor and Chair of the Institute of Zoology, School of Veterinary Medicine Hannover
- Since 2003** Speaker of the interdisciplinary DFG Research Group Acoustic communication of emotions in nonhuman mammals and man (FOR 499)

Current Research

A central question in research on the neurobiology of music, speech and language is to what extent humans share mental capacities as well as coding and decoding strategies in communication with their closest biological relatives, the nonhuman primates. We apply a comparative approach using similar methods to separate cross-taxa universals in primates from species-specific e.g. unique, human-specific adaptations. Major questions of interest include: How do nonhuman primates gain knowledge about their world? To what extent do emotion and cognition rule their social communication? What are the selective pressures leading to changes in the respective information processing systems during primate evolution? What are the evolutionary roots of mental capacities such as language and music?

1. Socioecology of communication and cognition

We study primates in nature using socioecological, bioacoustic and genetic techniques to elucidate the interaction between brain, behavior and the environment.

After discovering different degrees of sociality in the most ancient group of primates, the lemurs, we investigate the relation between their sociality, communication and cognition. Whereas field studies illuminate the selective pres-

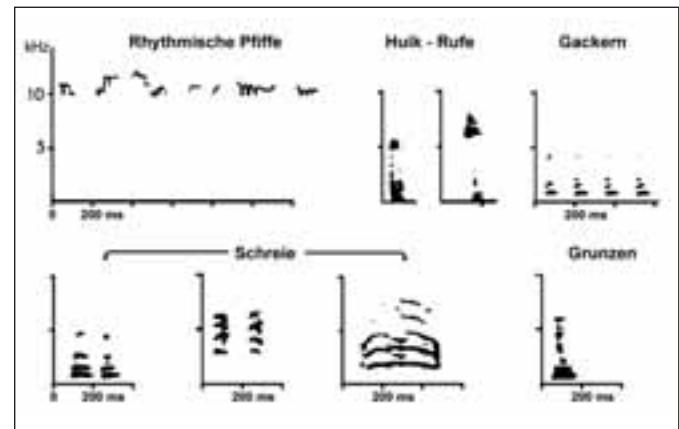
ures which may trigger evolutionary changes in brain and behavior in nature, controlled experiments in the laboratory are necessary to reveal the underlying mechanisms.

2. Acoustics and psychoacoustics of communication

The successful establishment of breeding colonies of tree shrews and mouse lemurs in our laboratory provides a unique opportunity to gain insight into communication and cognition of the early primate stock by studying individuals with controlled experience and known genetic background.



Tree shrews (Tupaia belangeri, shown above) are the closest genetic relatives of primates. Vocalizations used during social interactions are displayed here by sonograms. Studying their communication abilities will help to separate primate-specific from universal mammalian adaptations.



By focussing on the acoustic communication we ask e.g. for the acoustic morphology of social calls, for messages and meanings conveyed by them, for the perceptual mechanisms underlying call classification and for the effect

experience has on their acquisition. We use spontaneously available behaviors in social groups, induced social interactions, mate choice experiments, playback and conditioning techniques coupled with videometry and measurements of physiological activity (e.g. heart rate telemetry) and sound recording, analyzing and synthesizing methods. In a comparative study on apes we investigate the ontogeny and evolution of emotional communication (e.g. crying, laughter).

3. Evolution of communication and cognition

In close collaboration with other groups from Hannover, Göttingen, Leipzig and Ulm we have put forth a collaborative research grant initiative on the acoustic communication of emotions in man and nonhuman mammals. This research lies at the intersection between zoology, anthropology, psychology, linguistics, musicology and medicine and is unique in bringing together similar research approaches on different levels of brain complexity from mouse to man (see e.g. research profiles of Altenmüller, Dengler, Esser, Schmidt). We propose that perceptual mechanisms underlying music and speech perception in humans are based on general auditory mechanisms found in all mammals. Using music, language and non-verbal acoustic communication as models for emotions, we seek to determine similarities and differences in the acoustics, psychoacoustics and neural processing across the different domains and mammalian groups. Since march 2003, this initiative is supported by the German Research Foundation as an interdisciplinary DFG-research group.

Future Projects and Goals

One longterm goal is to understand the evolution of communication and cognition in primates from a comparative perspective. We will use combined socioecological, bioacoustic and psychoacoustic approaches in different primate groups to reconstruct evolutionary pathways in emotional and referential communication. It will further be important to use controlled behavioral experiments along with neurophysiological approaches in collaboration with other groups to separate neural substrates for emotional, referential and linguistic information processing in the acoustic domain. The implementation of functional brain imaging techniques for small awake mammals would be a major breakthrough to study these aspects across species.

Selected Publications

- [1] Zimmermann, E.; Newman, J.D.; Jürgens, U. (1995): Current Topics in Primate Vocal Communication. Plenum Press, New York, 286 pp
- [2] Zimmermann, E. (2001): Dialects in lemurs. In: MacDonald, D.: Encyclopaedia of Mammals. Oxford University Press, Oxford, pp 319.
- [3] Zimmermann, E.; Hafen, T. (2001): Colony-specificity in a social call of mouse lemurs (*Microcebus spp.*). Am. J. Primatol. 54: 129-141.
- [4] Radespiel, U.; Sarikaya, Z.; Zimmermann, E.; Bruford, M. (2001): Socio-genetic structure in a free-living nocturnal primate population, the grey mouse lemur. Behav. Ecol. Sociobiol. 50: 493-502.

[5] Weidt, A.; Hagenah, N.; Randrianambinina, B.; Radespiel, U.; Zimmermann, E. (2003): The social organization of the golden brown mouse lemur (*Microcebus ravelobensis*). Am. J. Phys. Anthropol., (2003) in press.

Group Structure

Group leader:	Elke Zimmermann
Senior scientist:	Ute Radespiel
Postdoctoral fellows:	Luis Pauchard, Solofonirina Rasoloharijaona
Graduate students :	Pia Braune, Marina Davila Ross, Maria Mendez Cardenas, Simone Schehka Marina Scheumann
Undergraduate student:	Melanie Dietz
Technicians:	Elisabeth Engelke, Karsten Instenberg, Birgit Haßfurther, Brigitte Lohmeyer
Animal husbandry:	Wolfgang Mehl, Achim Sauer

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