Research Proposal

(*in progress*)

Full title of the project: "Differentiated linguistic and genetic explorations of language impairments and disorders within a biolinguistic approach on language faculty and language design (UG)"

Working title (German): "Das Sprach-Gen"
Working title (English): "Language Gene(s)"

Research team:
Head: Prof. Dr. Peter Kosta (Slavic Department, Slavic linguistics, University of Potsdam)
Research investigators: Dr. Teodora Radeva-Bork, Diego Krivochen, Dr. Lilia Schürcks, Dr. Mike Putnam, Erika Corbara

Partners so far: Dr. Peter Robinson (Institute for Medical Genetics, Charité Berlin), Prof.Dr. Roland Friedrich (Humboldt University Berlin), PD Dr. Uli Sauerland (ZAS, Zentrum für Allgemeine Sprachwissenschaft, Berlin), Prof. Dr. Chris Schaner-Wolles (Institute of Linguistics, Vienna)

External consultants: Prof. Dr. Angela D. Friederici (MPI, Leipzig), Prof. Dr. Naomi Friedmann (Tel Aviv), Prof. Simon E. Fisher (Director of the Max Planck Institute for Psycholinguistics, Professor of Language and Genetics at the Donders Institute for Brain, Cognition and Behaviour, in Nijmegen, the Netherlands, and an honorary research fellow at the Wellcome Trust Centre for Human Genetics (WTCHG), University of Oxford, UK)

Research scope: interdisciplinary research within the following areas:

- Molecular genetics
- Biolinguistics
- Patholinguistics
- Language acquisition
- Neurolinguistics
- Theory of language and universals
- Generative Syntax

Research goal: We argue that an understanding of the faculty of language requires substantial interdisciplinary cooperation. One of the possible methods how to get access to what the recent work on biolinguistics has called *FLN* (language faculty in the narrow sense, cf. Chomsky 2005; Hauser, Chomsky, Fitch 2002) is to explore the type of language impairments and disorders that are attested as genetically inherited disorders of different types ensuring at the same time that other deficits of cognition or cognitive capacities based on genetic mutations are not concerned. Our objectives are to pursue fruitful research into the genetic basis of the language faculty based on certain (selected) language disorders and impairments.
The research project aims to investigate the biological and genetic fundamentals of the language faculty and to examine the nature and source of various genetically attested language disorders and/or speech impairments.
We try to analyze only those types of problems that are not caused by different complex cognitive genetic syndromes (e.g. Down syndrome, Hypopituitarism, other forms of retarded

cognitive development with mental retardation or other genetically related deficits such as mutation of FOXP1 and SLI/MR). Therefore, we look for subjects who are only genetically healthy subjects in order to investigate the phonological, morphological, syntactic and lexical-semantic language impairments.
We aim to discover whether the language faculty is constrained by principles of universal grammar which includes human language operations such as composition operation called MERGE and of the recursive procedure called RECURSION and - if this is so - whether these basic operations of human language in genetically speech impaired individuals are suspended. The identification of the cognitive deficits of language disorders and impairments - the language faculty phenotypes - will be parallelized with the most heritable genotypes - zones as indices and will be interpreted. Furthermore, we will try to identify the language genes that are responsible for production and comprehension of language faculty by applying a special method of research called New Generation Sequencing. Besides the zones of *FOXP2*, the first case of a gene mutated in speech and language impairment, we try to discover new genes being potential candidates for language faculty. We will use the state-of-the-art methods to uncover how language-related genes influence the brain. The discovery of the KE family in Great Britain shows opportunities but also limits of linkage between genotypes-phenotypes and cortex. But new methods, such as the New generation sequencing, as applied in our project, will enlarge and enforce the interdisciplinary research and show new paths how to access the link between genes, cortex and language faculty.
This will help us to uncover the etiology of developmental disorders. Furthermore, a prime aim of the project is to provide a solid basis for the development of therapeutic procedures that may be applied by practitioners to improve the language skills of linguistically impaired people.

Position and relevance of the planned research in the field: For many years, it has been known that specific language impairment (SSES), an unexpected error of age-appropriate language skills, is highly heritable. However, the molecular genetic studies were until now concerned with therapy and were often not successful due to the heterogeneity of diseases and by the prevailing lack of clear genotype-phenotype relationships impeded.
We review inter alia new test methods for determining the relation between phonological output and short-term memory - time the phonology-Short memory interface (PF / STM) - to suggest that a better understanding of the genetics is possible if other than purely clinical criteria are included.
There is a need to develop a new adequate linguistic method and diagnosis of disorders that is from one viewpoint 1) theoretically sound, and at the same time 2) empirically verifiable, and 3) usable in order to obtain a clear equivalent, e. g. a quantitative and qualitative 'cognitive tertium comparationis' for the phenotype. Thus, we have to include not only the most discussed theories on language faculty design and LAD (language acquisition device, cf. Chomsky, Fitch, Hauser 2002, Chomsky 2005, Chomsky 2011, Kosta, Krivochen, Peters 2011) but also the recent research in human genetics and language evolution (cf. Horn et al. 2010). As part of the International Network in Biolinguistics, we have a very close contact to the upcoming discussion in all these areas.

Method: Our research focuses on the examination of 3 “big families” with mono- or bizygotic twins that exhibit genetically inherited speech disorders and language impairments in syntax and/or phonology. At least one or better two other members of the family should be indicative of the same type of language impairments (symptoms) and another member (father, mother or another relative).

Profile of the persons to be tested: families with multiple affected / diseased persons
families with a healthy and at least one affected child

Exclusions: Exclusion of functional or anatomical disorders
Exclusion of stroke
Exclusion of hearing impairments
Exclusion of genetic syndromes, birth defects or trauma

Controls: In addition a control group of persons with typical language development will be studied to assure the felicity and validity of the used test materials.

Test materials: Specifically designed language tests to enable an elicited production (and in certain contexts elicited comprehension) in three main grammatical areas:

1. Word order (e.g. verb placement)
2. Case on DPs
3. Embedding

(In addition *Phonetic paraphasia)

Language to be tested: German

Foreseen time of research: 3-5 years

Output: Monograph, papers, 3 big conferences in the beginning, middle and end of the project on 1) Biolinguistics (University of Potsdam), 2) Computation, Mind and Brain (Potsdam and Berlin) and 3) Methods in Molecular and Experimental Genetics (HUB, Berlin), invited lectures, research workshops, presentations in the media, popularization of the conducted research work.