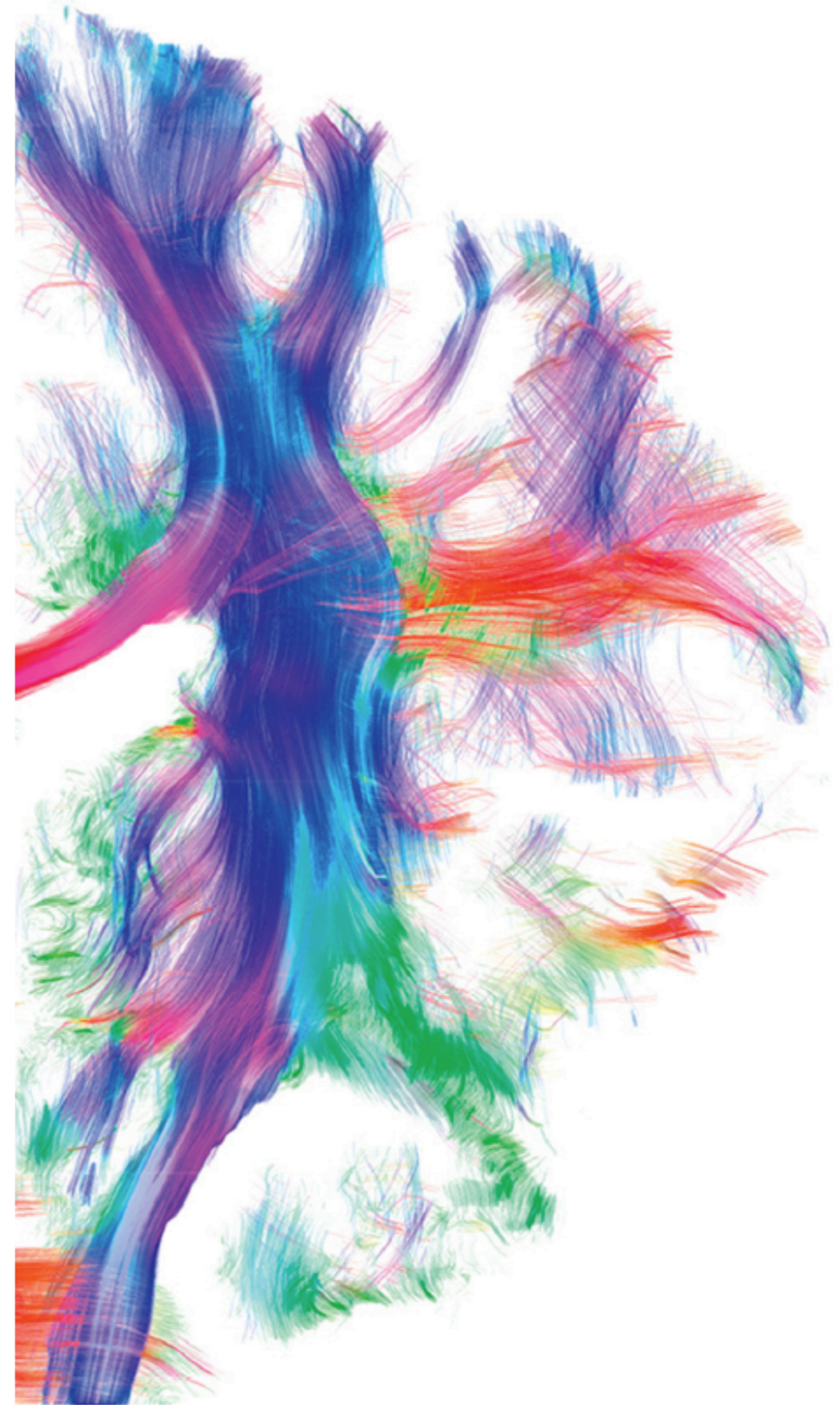


FRIEDERICI CHAPTERS 5 & 6

Frederik Mallmann-Trenn

Chapter 5

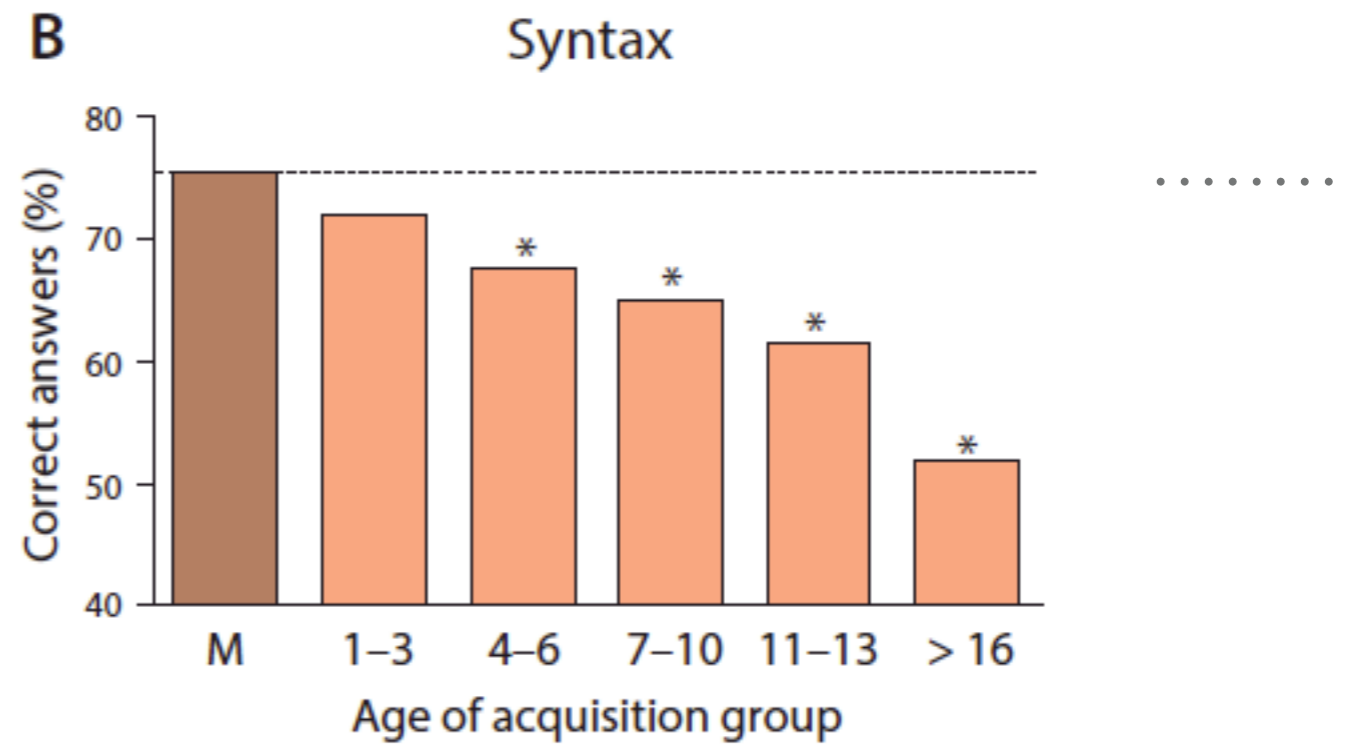
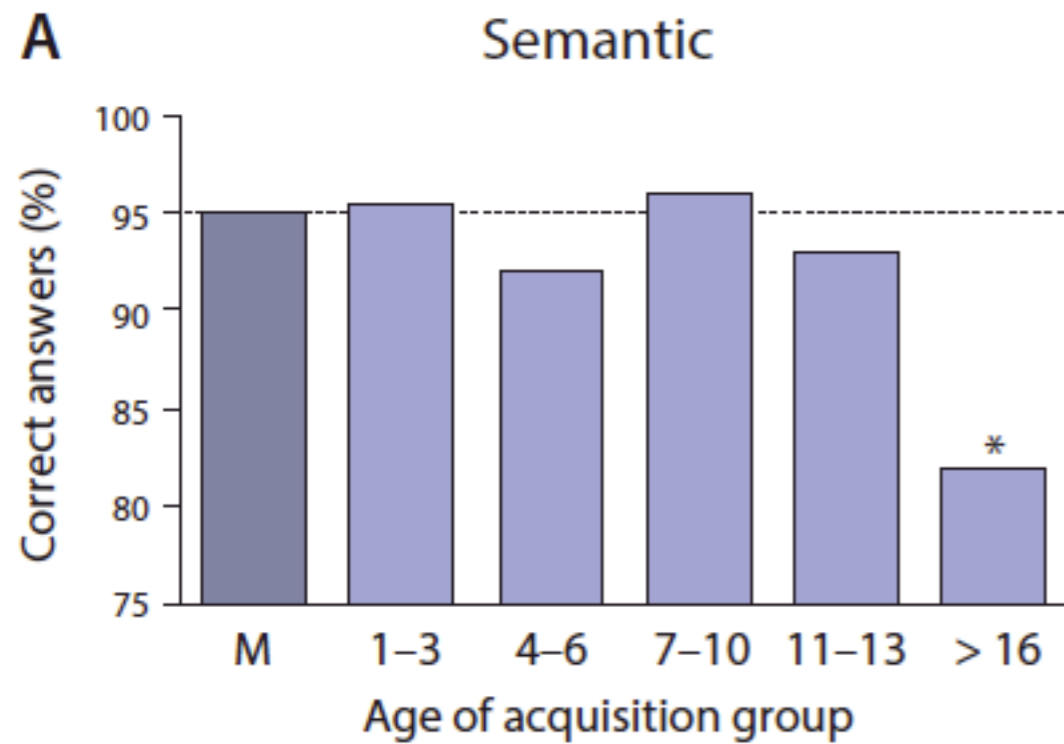
The Brain's Critical Period for Language Acquisition



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- Learning a foreign language, as we know, is difficult later in life
 - Ongoing debates question why second language learning appears to be easy early in life but much more difficult as we age.
 - Leads to Critical Period Theory which says that there is a threshold age. After the threshold it's tough to learn a language.
 - This theory is widely accepted.

SYNTAX VS SEMANTICS

- Fundamental difference between the acquisition of syntax and semantics.
- Syntax error: The jumps dog. (correct: the dog jumps)
- Semantic error: The ball sings.



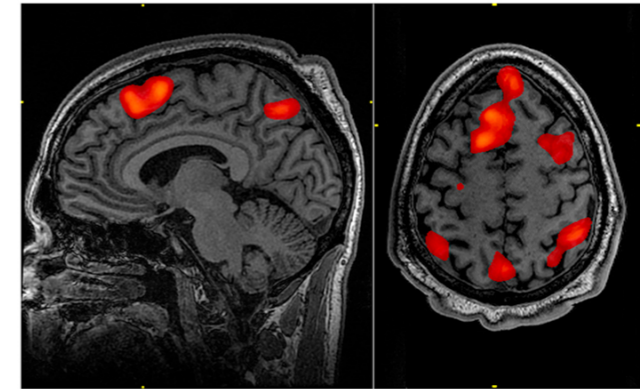
(M) monolinguals

Findings:

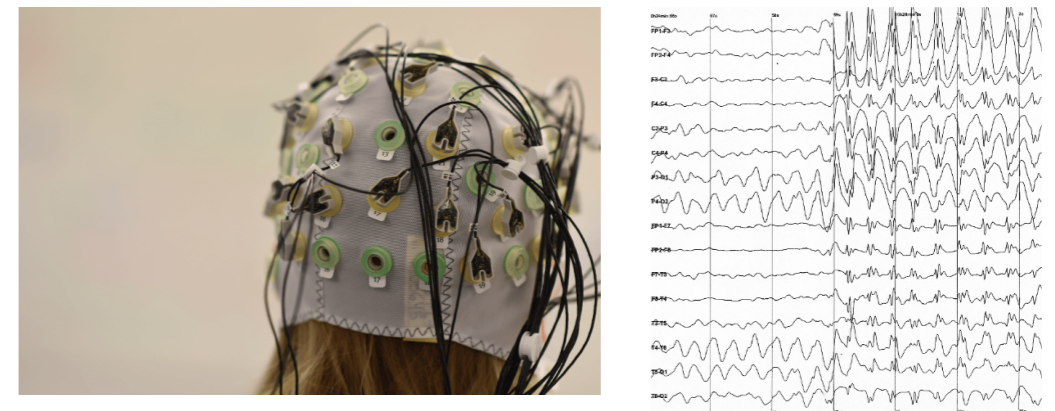
- in the period from birth to 3 years of age language learning for a second language is native-like for both syntax and semantics,
 - after the age of 3 years acquisition is native-like for semantics, but already non-native-like for syntax, and
 - after puberty a second language does not seem to be acquired in a native-like manner.
- These findings suggest that the human brain is most responsive to language input during critical periods in the first years of life.
- Whether in an auditory language or a sign language.
- FYI: For accents the critical period is around 10 (though exceptions possible)

General challenges of live brain study: limited tools

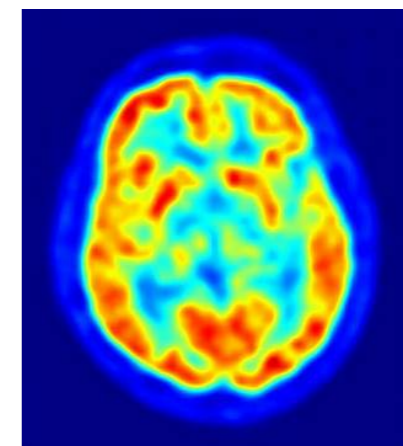
- fMRI: see extensive oxygen usage



- EEG: electro physical response



- PET scan (radioactive tracer)

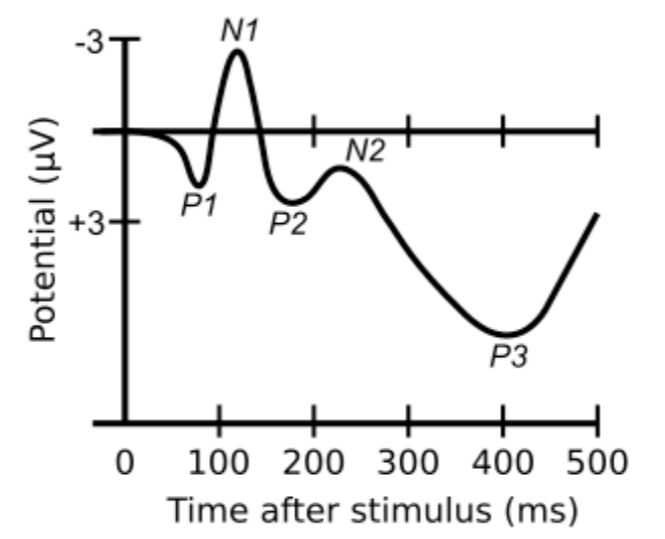


Challenges of studying language learning

- For a solid scientific analysis it would be important to know under what conditions and when during development, the second language was learned
- How intensively the second language was used, and what happened to the first years of life with respect to the language input.
- Hard to control for first language (what if someone never learned a language at all? Does that influence the results? All discovered tribes use language.)

ELECTROMAGNETIC STUDIES

- The **N400** is part of the brain response to semantic inputs: words and other meaningful stimuli,
- (e.g., visual and auditory words, sign language signs, pictures, faces, environmental sounds, and smell)



- It is a negative-going deflection that peaks around 400 milliseconds post-stimulus onset
- The more weirdness, the greater the amplitude:

For *sparrow is a **building***, the N400 response to *building* is more negative than the N400 response to *bird* in the sentence *A sparrow is a **bird***.

-
- **P600** is thought to be elicited by hearing or reading grammatical errors and other syntactic anomalies
 - **P600s** are also elicited by errors in musical harmony, such as when a chord is played out of key with the rest of a musical phrase. This implies that P600s are not "language-specific," but "can be elicited in nonlinguistic (but rule-governed) sequences."

➤ Findings

➤ **N400** response often similar in late learners (semantics)

➤ Less automatic syntactic processes in late learners (**P600**)

Connectivity of key cortical regions for language processing

German, with its predominant morphosyntax, showed higher fronto-temporal connectivity in the dorsal pathway, associated with the processing of sentence structure,

English, with more salient semantically guided processing, showed higher connectivity in the ventral pathway, associated with the processing of language content.

Chinese, with its distinct phonology of tones and frequent homophones, showed enhanced connectivity in temporo-parietal and interhemispheric circuits, related to storage and discrimination of speech sounds

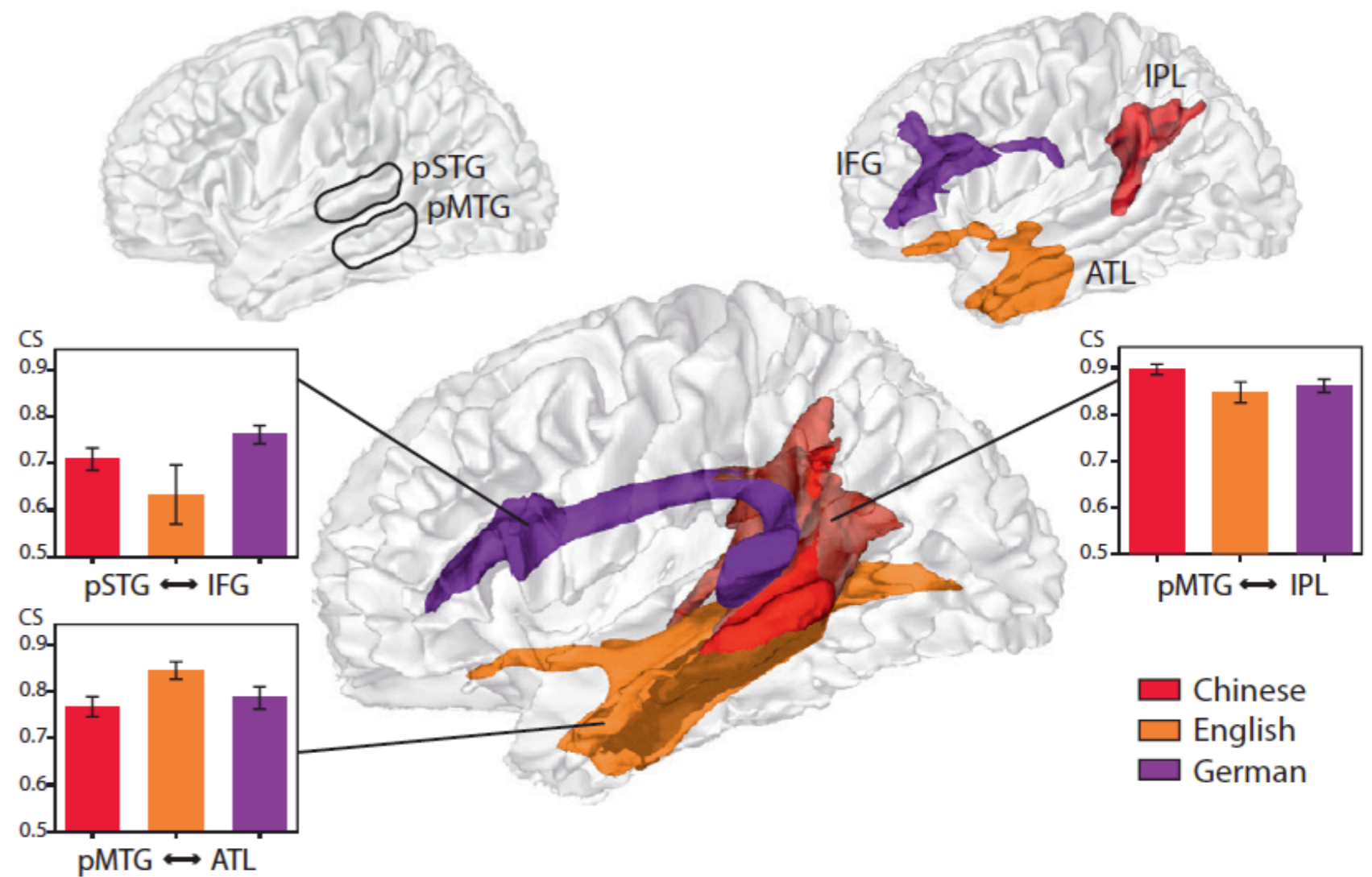


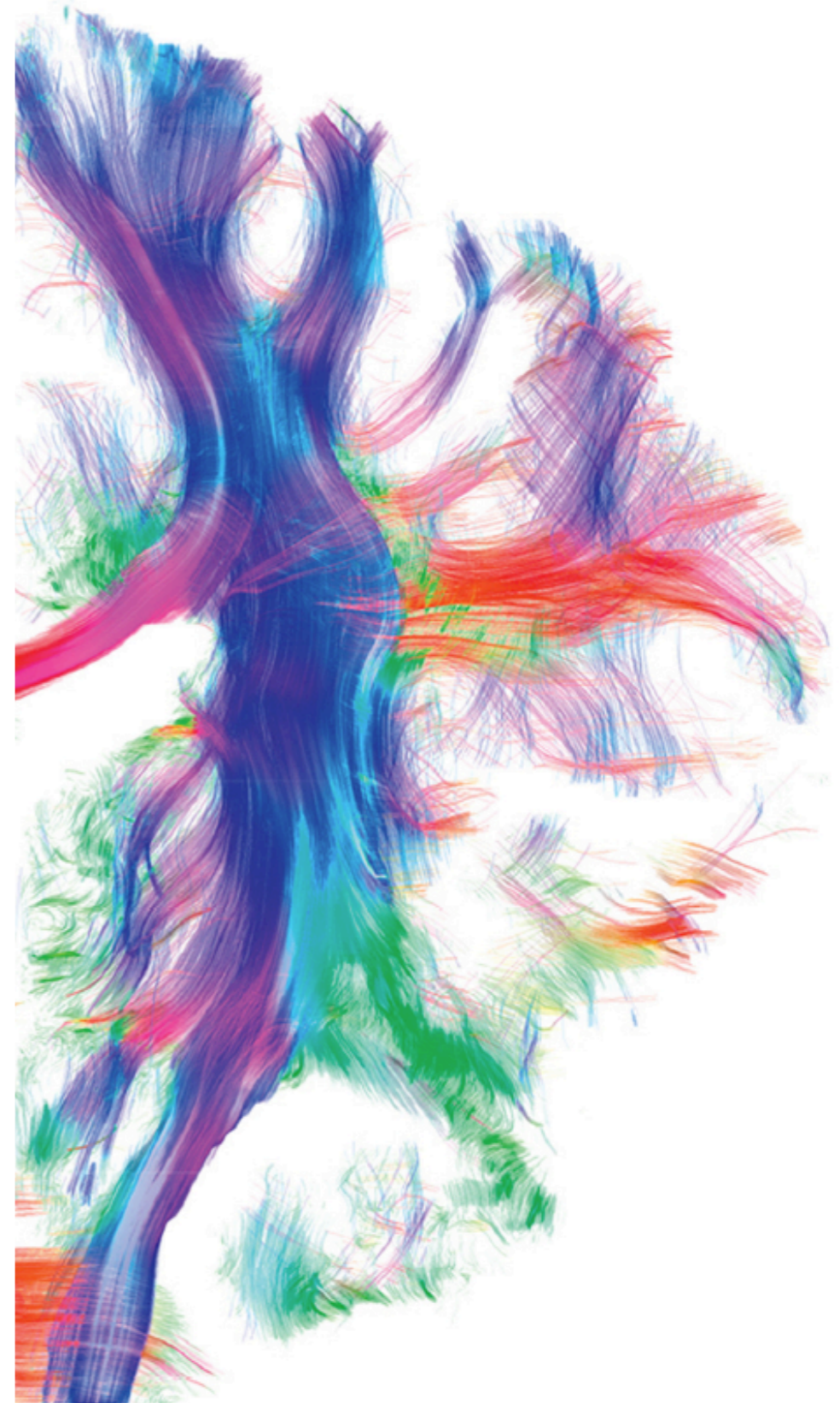
Figure 5.4

White matter fiber tracts in natives of different languages. Chinese (red), English (orange), and German (purple). Boxes display the strength of the fiber tracts (myelin) of the respected tracts between language-relevant region: pSTG to IFG, pMTG to anterior temporal lobe (ALT) and pMTG to inferior parietal lobe (IPL). Abbreviations: STG = superior temporal gyrus, MTG = middle temporal gyrus, ATL = anterior temporal lobe, and IPL = inferior parietal lobe. From Goucha, Anwander, and Friederici (submitted). Language shapes the brain: Cross-linguistic differences reflected in the structural connectivity of the language network.

Chapter 6

Ontogeny of the Neural Language Network

(Ontogeny is the origination and development of an organism)



-
- Language seemingly starts with the first cry of the baby
 - But starts already as a fetus receiving filtered auditory information
 - First cry is language specific
 - French babies cry with a melody that is different from German babies, each mirroring the speech melody of their mother tongue

-
- Very early on an infant is able to extract language-relevant information from the acoustic input.
 - Infants appear to be equipped with the ability to identify those language sounds relevant for the phonetics of the target language
 - This allows them to chunk the input into phrases, and to recognize positional regularities and dependencies that are crucial for the syntax of the target language.
 - Moreover, associative learning allows infants to rapidly acquire names of objects and actions, and the relation between them.
 - All the processes mainly involve the temporal cortices of both hemispheres with a shift toward the left hemisphere with increasing age.

PART IV

Chapters 7 & 8

Ontogeny of the Neural Language Network

(Ontogeny is the origination and development of an organism)



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- About evolutionary aspects of the language network
 - Comparisons between species based on behavioral as well as neuroanatomical aspects.
 - These data make a strong suggestion concerning the crucial differences between the human who easily learns and uses language and the non-human primates who only are able to learn simple sequences but not complex syntactic sequences.
 - The crucial neuroanatomical differences appear to be the neuroarchitectonic structure of the posterior part of Broca's area, namely BA 44, and its connection to the posterior temporal cortex—structures that we have seen to be involved in syntactic processes.

THANK YOU

