In describing the approach to language change expressed by the Jesuit missionary Filippo Salvatore Gilij (1721–1789) in Ch. 17, Matthias Pache, Arjan Mossel, and Willem F. H. de Laar remark on the very modern notions he proposed while documenting Indigenous languages of the Orinoco region. Many of his ideas, such as the role of language contact in language change, are also found in modern linguistic views of language change. He discussed loanwords, Indigenous language borrowings into Spanish, language extinction, word-order patterns, sound change, and sound correspondences, and he identified several language families. He further described dialect differences as well as the influence of age, genre, and profession on language variation.

Marta Luján applies Bakhtin’s (1981) dialogical principle in characterizing the development of Latin American Spanish and language contact in the Americas. In viewing language as interactive, creative, and contextualized, she demonstrates how speakers participated in developing meaning in their language through their interactions. She distinguishes between intra-group dialogic contact among the Spanish, which produced the first bicultural terms, and extra-group contact with native peoples, which resulted in loans that were adopted into Latin American Spanish.

Although it is not comprehensive, LCCMB contains high-quality articles of interest to Mesoamericanists, historical linguists, sociolinguists, and any scholar interested in language-contact effects. The chapters include detailed descriptions of linguistic phenomena that reveal the complexity, layering, and interwoven nature of language contact.

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Investigating the neural mechanisms of cognition is never an easy task, but it is particularly difficult in the case of language. This is because, surprisingly, there is no general consensus even on what language is. Imagine if, in the neuroscience of memory, there were not general agreement on what memory actually is, or even whether it exists at all. Luckily, that is not the case. Nevertheless, even after more than a century of research, there are major disagreements about the neural representation of memory, at both the brain and the cellular level. In the case of language, prospects are even bleaker. But an investigation can be done, as Angela Friederici demonstrates in Language in our brain, in which she reviews the impressive research that she and her collaborators have conducted—and indeed continue to be involved in—in this complex field of inquiry. This is clearly a very exciting and dynamic paradigm, with many of the findings discussed in this book having been published very recently.
Essentially, in her research F has to negotiate two major hurdles. As I suggested above, the first seems to be unique to the study of language, namely the issue of whether language actually exists as an autonomous computational system within the human mind. As a biologist approaching linguistics from the outside, familiar with the cognitive revolution of the mid-twentieth century, I find it rather odd that there is so little agreement on what the faculty of language is. In fact, Noam Chomsky, key to both the cognitive revolution and the development of modern linguistics, has often stated that perhaps the majority of cognitive scientists are suggesting that, in this sense, language does not exist. That is, these authors would argue that language is not an autonomous cognitive mechanism, but merely a combination of different forms of learning: a culturally transmitted motor skill that serves ‘communication’. If this were true, then clearly the study of the neural mechanisms of language would essentially become a study of learning and memory—quite a different prospect. This may seem rather bizarre to the readers of Language—after all, Chomsky (1959) published his famous review of B. F. Skinner’s Verbal behavior in this very journal, which for many signaled the start of the cognitive revolution and of linguistics as a proper natural science. And of course it is bizarre, but it does seem that there is some kind of ‘cognitive counterrevolution’ (Bolhuis 2017) going on. For example, the motto for Daniel Everett’s (2017:xiv) recent book on language evolution is the following quote from Philip Lieberman (2000:1): ‘language is not an instinct, based on genetically transmitted knowledge coded in a discrete cortical “language organ.” Instead it is a learned skill … that is distributed over many parts of the human brain’. Let this sink in for a moment. Replace the word ‘language’ with any other kind of cognitive system (‘working memory’, ‘face recognition’, ‘color vision’, etc.), and you realize just how remarkable a viewpoint this is. Yet it is a view that can boast an increasing popularity, for example in the various ‘usage-based’ or ‘deep learning’ approaches to language acquisition. In this neo-behaviorist ‘kingdom of speech’, children’s acquisition of language is merely a case of teaching them tricks—no need for universal grammar (UG) here. The fact that virtually all of the evidence speaks against this peculiar notion (e.g. Yang et al. 2017) is conveniently ignored. Occasionally, rationality prevails, for example when Mendívil-Giró (2018: 862) states that ‘[w]e can only deny the existence of the initial state of the language faculty if we deny that the language faculty exists’. Or as we put it in an earlier commentary: ‘UG or not to be, that is the question’ (Bolhuis et al. 2015). F ends this particular sea of troubles not by opposing them, but by simply ignoring them, and by following Chomsky’s lead in recognizing the reality of language as an autonomous system that is part of human biology. It is fitting that Chomsky wrote an approving foreword to the book.

Having adopted this view of language, the second hurdle that F has to negotiate is similar to that in other fields of cognitive neuroscience, such as learning and memory. This concerns the possible ways that these cognitive mechanisms can be represented in the brain. F adopts the eminently sensible approach that syntax is at the heart of the language faculty. Following the generative grammar tradition, she describes how language is essentially a computational system with hierarchical syntactic structure at its core. The hierarchical structure of phrases is essential to their meaning. In accordance with suggestions made within the minimalist program, the idea is that such hierarchical structure is achieved through the repeated (i.e. recursive) application of a simple binary function called Merge. F and colleagues have adopted an elegant way to uncover the neural substrate of language, by titrating semantically meaningful and syntactically correct phrases. The result is not unlike that in memory research, involving a dynamic system of interacting networks—in this case in the frontal and temporal lobes, mainly in the left hemisphere.

The two networks (roughly, concentrated around Broca’s area and Wernicke’s area) are connected by two dorsal and two ventral fiber tracts. Generally speaking, ‘syntax’ and ‘semantics’ are not so much related to the two cortical systems but to the interactions between them, mediated by the different pathways. The two dorsal pathways connecting the superior temporal cortex (STC) and the frontal cortex are functionally different, with the arcuate fascicle connecting the STC to Brodmann’s area (BA) 44 in Broca’s area involved in syntactic processes, and the superior longitudinal fascicle connecting the STC to the premotor cortex (PMC) and supporting auditory-to-motor mapping. One of the major findings by F and colleagues (Part II, Chs. 3 and 4; see
also Friederici et al. 2006) is that the former is crucial for syntactic processing. They were the first to show that the strength of this connection is correlated with the ability to process syntactically complex sentences (Skeide et al. 2016), and that unlike the STC-to-PMC connection, it is not yet myelinated in newborn infants (Ch. 6; see also Perani et al. 2011), consistent with the fact that syntactic prowess takes time to develop and is preceded by auditory-vocal learning. In Part IV, Ch. 7, F discusses comparative evidence showing that the dorsal connection between the STC and BA 44 is virtually absent in nonhuman primates (see Rilling et al. 2008). Taken together, this neurolinguistic, developmental, and comparative evidence strongly suggests that human language is subserved by the interconnected networks in the frontal and temporal lobes. In their recent monograph, Berwick and Chomsky (2016:164) called this the ‘ring’, which needs to be ‘fully wired’ for human syntax. Incidentally, note that F’s interpretation (involving two dorsal and two ventral pathways) differs from Hickok and Poeppel’s (2004) idea of dorsal versus ventral processing ‘streams’—a concept that was derived from the dorsal ‘where’ and ventral ‘what’ systems originally proposed for visual processing.

Predictably, the ‘language-as-acquired-motor-skill’ camp opposes the idea of brain regions dedicated to language syntax. For these authors, Broca’s area might simply be the substrate of working memory that is needed to produce spoken language. Recently, however, there has been a remarkable volte-face by one of the leading proponents of this view, Lorraine Tyler and her group at Cambridge. It is worth quoting the main conclusion from a recent article (as stated in the abstract) in full:

While we have long argued that syntactic processing does not occur in isolation but is processed in parallel with semantics and pragmatics—functions of the wider language system—our recent work makes a strong case for the domain specificity of the frontotemporal syntax system and its autonomy from domain-general networks. (Campbell & Tyler 2018)

Of course, from the classic work of Andrea Moro and colleagues (e.g. Musso et al. 2003) and others (e.g. Friederici et al. 2017), we already knew that Broca’s area is important for syntax, but still, with increased confidence in the Friederici approach, we can ask the question of whether there is further localization of function (i.e. syntactic processing) within ‘the frontotemporal syntax system’. Or is syntactic structure building underpinned by the electrophysiological characteristics of neurons? (Ding et al. 2015) These are difficult and often controversial issues, and again reminiscent of discussions in memory research: hippocampus, medial temporal lobe, sensory cortex, or interactions between all of these? Changes in neuronal connectivity through alterations of synaptic strength or intracellular macromolecular changes? (e.g. Gallistel & Balsam 2014) In both language and memory, it could be a combination of all of the above. For instance, neurophysiological processes can be localized. Also, just as subregions of the medial temporal lobe subserve different aspects of episodic memory (e.g. perirhinal cortex and object recognition), different subregions of the frontotemporal system could be involved in different aspects of syntactic structure building. Some fascinating recent work from F’s group (Ch. 1; see also Goucha & Friederici 2015, Zaccarella & Friederici 2015, Zaccarella et al. 2017, reviewed in Friederici et al. 2017) would suggest this. Specifically, F and colleagues inquired whether Merge is accompanied by localized neuronal activation. For example, in fMRI experiments, subjects were exposed to ‘semantics-free’ combinations of words that could be merged into hierarchical structures (e.g. a determiner and a noun, the and pish) or they were exposed to two-word sequences where this is not the case (e.g. two nouns, cloud and pish). During the former, there was invariably activation of the most ventral part of BA 44 in Broca’s area. In contrast, the latter situation led to activation of phylogenetically older brain regions outside BA 44 (frontal operculum and anterior insula, to be precise). Just as the perirhinal cortex does not function in isolation in memory processing, so BA 44 does not function on its own during the building of hierarchical structure, but in interaction with the STC through the dorsal pathway. However, simplest binary Merge appears to activate the ventral part of BA 44 only. As Merge is the basic operation that leads to hierarchical syntactic structure, this work, although recent, is discussed straight off in Ch. 1.

The suggestion that a subregion of BA 44 is crucially involved in the simplest syntactic operation (Merge) has been questioned by some authors. For instance, Hickok, Matchin, and Poeppel
have suggested that the neural substrate of Merge may not be changes in neural connectivity localized to a particular brain region, but rather the electrophysiological properties of cortical neurons (e.g. Ding et al. 2015)—somewhat similar to the discussions in the neurobiology of memory that I mentioned before. I think that these alternatives do not rule out localization at the brain level (cf. the example of perirhinal cortex and object recognition). Also, Merge is a rather basic process—crucial to syntactic structure building, but in itself a simple operation. Syntactic processing is more than just Merge, and it is plausible that it involves the interaction between networks that F has identified, rather than just the frontal lobe system, or the temporal lobe system, as for example Matchin and colleagues (Matchin et al. 2017) have suggested. However, the question of whether simplest binary Merge is subserved by regions either in BA 44 or in the STC should in principle be amenable to empirical testing. But just as in memory research, clinical results in humans are not always easy to interpret, and unlike memory, language is not present in nonhuman animals.

In conclusion, I think this is a very important book that sets the standard for the neurobiology of language. F and colleagues have conducted pioneering research in this field. The book is essentially a linguistic theory-driven attempt to bring together, for the first time, an enormous amount of published empirical evidence—much of it from the author’s own laboratory—and propose a novel and comprehensive neurocognitive view of language. Evidence was obtained at different neural levels, from the molecular and dendritic level, the brain-structural level (fiber tracts), and the level of neural network dynamics (functional connectivity and oscillations). Further, the author brings together results from studies of language processing in the developing and mature brain, as well as comparative evidence from humans and other animals. There will be ongoing discussions about the possibility of neurally localizing the substrates of language, and what kind of neuronal mechanisms, as well as which brain regions, are involved. F’s approach is important because she recognizes that language is an autonomous computational mechanism, and she is systematically investigating its neural substrates. Frankly, I do not see any other way of doing it. It is never going to be easy, as we have learned from the ongoing discussions in the field of learning and memory. Science is never finished. Nevertheless, this book shows that, with the right scientific approach, as spearheaded by F and her colleagues, great advances can be made.

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This volume on Arabic linguistics edited by Yonatan Mendel and Abeer AlNajjar is a refreshing compendium consisting of eleven chapters of research, reaching from Morocco to the Sudan, to Israel and Palestine, with historic comparisons in some cases. The chapters celebrate the scholarship of Yasir Suleiman, a towering figure in Arabic linguistics with a career that spreads over more than three decades of research and mentoring. In his dedication to Arabic linguistics, Suleiman’s scholarship demonstrates a remarkable breadth and depth of approaches and methods (see e.g. Suleiman 1999, 2003, 2013). The contributors to the chapters are scholars who know

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