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Will Wernicke's area ever be defined?

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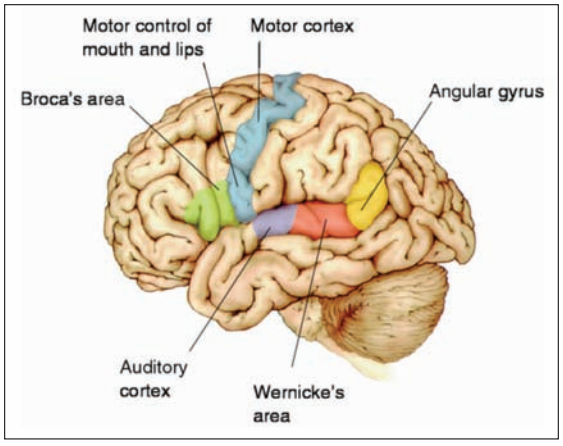
Will Wernicke's area ever be defined?

By Frank Musiek, PhD, Angeli Mohanani, Erin Wierzbinski, Gloria Kilgore, Jacob Hunter, and Jamie Marotto

Language processing is assumed to be based in the left inferior frontal lobe, in Broca's area, which controls language production. While Bogen and Bogen defined this area anatomically as the posterior third of the inferior frontal gyrus,[1] the exact location of Wernicke's area, a section often mentioned in concert with Broca's, remains a mystery. But that's a enigma that needs solving because not understanding its function may mean missing a part of the brain vital to auditory processing.

That general part of the cortex was first referred to as Wernicke's area following Carl Wernicke's study of stroke patients with lesions in this general area of the left posterior temporal cortex. He described them as being able to speak and hear but incapable of understanding speech.[2] We now know these patients likely were not hearing correctly, or rather, were not processing sound. Wernicke categorized his findings as a linguistic problem when perhaps it should have been considered a central auditory issue.



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Wernicke questioned whether there was a region in the brain where a lesion will produce a serious deficit in language comprehension without a loss of linguistic abilities. Bogen and Bogen countered that with questions of their own: Because many differences in the types of aphasia could be identified, did that mean different types of aphasia exist in this area of the brain? If they did, are the lesions in different places? Is agreement possible on the location of the loci for lesions that produce different kinds of aphasia if researchers cannot agree on the identification of the various types? Is the condition really aphasia or a central auditory deficit?

Wernicke's early diagram of the area has the first temporal gyrus overlapping just barely into the second gyrus. What is unclear is whether the area includes part of the second temporal gyrus located above the external ear. In the diagrams of French aphasiologists Jules Dejerine and Pierre Marie, several distinct parts of the left cerebral hemisphere were included as part of Wernicke's area, including the posterior part of the superior and middle temporal gyrus, extending to the supramarginal and angular gyri. This area includes the underlying arcuate fasciculus, the large tract of fibers that connect the superior temporal and the inferior frontal gyri.

The planum temporale is sometimes considered to be part of Wernicke's area, and it has been shown to be sensitive to various types of acoustic stimulation. Geschwind and Levitsky reported that the planum temporale was larger in the left hemisphere than in the right. These investigators reasoned that if the left hemisphere was the dominant speech hemisphere and the planum temporale was in the region of Wernicke's area, then the planum temporale could be an anatomical correlate to receptive language function.

Based on current research, Wernicke's area is likely to include the planum temporale and part of the superior temporal gyrus. Some functional magnetic resonance imaging demonstrates that the planum temporale is not entirely devoted to linguistic processing, however, because it also plays a role in early auditory processing. According to Johnsrude et al, several positron emission tomography studies have demonstrated that the superior temporal gyrus, anterior to the primary auditory area in both hemispheres, is activated by speech sounds compared to rest, noise bursts, or tonal stimuli. (*Neuron* 2002; 36(4):767-776.)

Given the lack of agreement for the location of Wernicke's area, further investigation is needed. Otherwise, we may be missing a portion of the brain that is significant in auditory processing. To localize Wernicke's area, perhaps we need to define it in a different way.

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