EDITORIAL COMMENTARY

Mechanisms of recovery from aphasia

How do the brains of aphasic stroke patients cope with lost function? What mechanisms underlie the often substantial, and occasionnally considerable recovery that proceeds for weeks—long after the classic acute cellular derangements (for example, ischaemic penumbra, oedema) have subsided? This is an important issue for neurology, because better knowledge of the underlying mechanisms should result in time in novel and more efficient management of the individual patient. Thus future approaches to enhance recovery may be directed at the cellular level (for example, manipulating neurotransmission or trophic factors), the cognitive level (for example, individually designed language rehabilitation), or both. However, this is a formidable challenge, because as language is essentially unique to human beings, the investigations must be carried out directly in patients. It has proved generally difficult to test in humans the neurobiological hypotheses of recovery that have emerged from basic research, even more so in the case of aphasia because of the complexities of the cognitive operations that underlie even the simplest language operation. In this issue of the *Journal* (pp 155–61), however, Warburton *et al* show that thanks to functional imaging methods that allow the mapping of brain areas at work while performing a linguistic task, it is now possible to determine in individual aphasic patients the similarities with and differences from the "normal" brain activation pattern during the generation of verbs from concrete nouns. Based on the extensive knowledge about the brain organisation of language operations that has accumulated from studies in brain damaged subjects and functional imaging in normal subjects, novel hypotheses about the neuronal basis of language recovery can then be generated.

Because the techniques involved are so complex, and the interpretation of the data requires such an extensive understanding of the neural basis of language operations and the neurobiology of recovery, only few studies have been published so far on this topic.[1–4] Also, the results have been partly divergent, not only because the patients belonged to different aphasic patterns (for example, fluent *v* non-fluent) and different paradigms were used, but also because some used group averaging methods,[1] looking only for activation patterns common to the different patients, whereas others studied single cases.[2–4] However, one common finding has been that of an excessive activation of homologous right sided brain regions, compared with normal subjects. Although, according to a prevalent notion, most have attributed to this non-dominant hemispheric activation a role in the recovery process,[1–3] others see it merely as an expression of abnormal function predicting poor recovery.[4] By claiming no major difference from the normal pattern, the study of Warburton *et al* indirectly supports the opposite view, that preserved left hemispheric perilesional tissue subserves the return of function,[2 4] even though their cognitive paradigm was admittedly suboptimal. Regardless, they do show that much more complex assessment of individual subjects will be necessary before a clear understanding of the mechanisms of recovery emerges, and the notion that even fully right handed healthy subjects have different patterns of brain activation when performing the same task with similar success indicates that much more work in healthy subjects is necessary to even understand the normal brain. Finally, only longitudinal studies[4] correlating the changes in brain activation patterns over time with the parallel changes in performance in fundamental linguistic operations, will shed light on the exact meaning of the individual differences in brain activation patterns—that is, whether they are beneficial, epiphenomenal, or even deleterious with regard to actual recovery. This will have to be coupled with some cognitive assessment of the new strategies that progressively develop in each particular patient. Obviously, studies of this type will shed light not only on the tricks used by the brain to recover from aphasia, but also on the basic mechanisms of brain plasticity and its behavioural correlates. Such studies, no matter how difficult they are, must be pursued because of the burden of aphasia to the patients, their family, and society, and because language is the most complex of all brain processes and as such deserves special interest.

J-C BARON
INSERM U 320, Bd H Becquerel, BP 5229, F 14074 Caen Cedex, France

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