HIGHLIGHTS

CEREBRAL ASYMMETRY

At the cutting edge

"The world can only be grasped by action, not by contemplation … The hand is the cutting edge of the mind."

Jacob Bronowski, *The Ascent of Man*

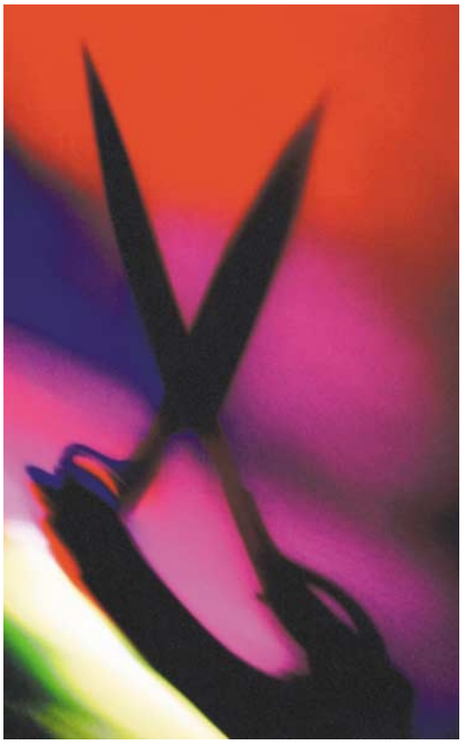
The importance of the connection between hand and brain might seem obvious, but much remains to be learned about this intimate relationship. Take, for example, the question of handedness. How does hand preference relate to cerebral asymmetry, and what are the developmental underpinnings of the laterality of hand and brain? In a paper published recently in *Proceedings of the National Academy of Sciences*, Geschwind *et al.* provide evidence in support of a right-hand/left-hemisphere-biasing genetic influence that is absent in most left-handers.

The vast majority of right-handers show predominant left-hemisphere language localization. By contrast, a significant proportion of left-handers show right-hemisphere language dominance or bihemispheric language localization. Moreover, left-hand preference tends to be accompanied by a lack of structural cerebral asymmetry. By studying cerebral lobar volumes obtained by magnetic resonance imaging in monozygotic and dizygotic male twin pairs, Geschwind *et al.* were able to explore the relative contributions of environmental and genetic factors to cerebral asymmetry, and to examine further its close relationship to handedness.

First, the authors established that genetic factors accounted for a large part of the variability in regional brain volumes. Shared environmental (*in utero*) factors contributed significantly to the variation in left temporal and left frontal volumes, but not to lobar volumes on the right, indicating that the left hemisphere is more susceptible to environmental factors, possibly because it develops over a longer period of time than the right.

Next, Geschwind *et al.* separated the groups into right-handed (RR) twin pairs and non-RR (RL or LL) pairs. Significant rightward asymmetry was observed in the frontal and temporal lobes of RR twins, with significant leftward asymmetry of parietal and occipital volumes. This classical pattern of cerebral asymmetry was found to be lacking in non-RR twins, an observation that affected left- and right-handed members of the non-RR group equally. Furthermore, in monozygotic twins, genetic factors had a much greater influence on left and right hemispheric volumes in RR twin pairs compared with non-RR twins.

These findings provide strong support for genetic theories of handedness — including those of Annett, Klar and McManus — in which right-handers are proposed to inherit a specific directional bias in brain asymmetry that is not inherited by left-handers. According to this group of theories, the majority of right-handers (most of those in the RR group) will carry the 'right-shift' genotype, although the models differ in their details. In the absence of a bias to the right, the process of cerebral pattern formation will be more random. So, those lacking the right shift (many of those in the non-RR group) may be right handed, left handed or ambidextrous, and may have left-hemisphere, bilateral or right-hemisphere language.



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References and links

ORIGINAL RESEARCH PAPER Geschwind, D. H. *et al.* Heritability of lobar brain volumes in twins supports genetic models of cerebral laterality and handedness. *Proc. Natl Acad. Sci. USA* **99**, 3176–3181 (2002)