FUNCTIONAL IMAGING

# The lightest touch

When you pick up an object, you probably don't think too hard about the way you grip it. Your hand position and the force you use are adjusted automatically, depending on the weight and texture of the object, to make sure that it doesn't slip through your fingers. But if you know that the object is particularly delicate — a piece of fine glassware or origami, for example — you will be careful to use the gentlest grip possible without dropping it. Kuhtz-Buschbeck *et al.* have used functional imaging techniques to investigate how the brain performs such precise scaling of grip force.

The subjects in the study were asked to pick up an object between their forefinger and thumb while undergoing functional magnetic resonance imaging (fMRI). They had to hold it in one of three ways: using a natural, automatic grip force; holding it as gently as possible without letting it slip; or increasing the grip force to hold the object more firmly.

Unsurprisingly, holding the object with the right hand caused increased activity in sensory and motor areas on the left side of the brain. The activity increased when the subjects had to hold the object either more strongly or more gently than in the natural grip condition. Rather than increasing in proportion to the grip strength, the brain activity appeared to increase in proportion to the degree of voluntary control required. Of all three conditions, the gentle grip produced the strongest brain activation in primary and secondary sensorimotor areas, perhaps because this condition required much more precise control than either of the others to avoid dropping the object.

The specific areas most affected were the supplementary motor area and the cingulate motor areas, indicating that these regions might be particularly important for precise scaling of fingertip forces. The findings could be relevant for the evaluation of patients with damage to sensorimotor areas of the brain, who often use inappropriately strong grip forces and appear to have lost this ability to scale fingertip forces precisely.

*Rachel Jones*

**References and links**

**ORIGINAL RESEARCH PAPER** Kuhtz-Buschbeck, J. P. *et al*. Human brain activity in the control of fine static precision grip forces: an fMRI study. *Eur. J. Neurosci.* **14**, 382–390 (2001)

SYNAPTIC PLASTICITY

# Metabolic weighting

When considering the mechanisms that underlie activity-dependent changes in synaptic strength, researchers have often focused solely on changes in the probability of transmitter release or in the responsiveness of the postsynaptic cell. In a recent paper in the *Journal of Physiology*, Engel and colleagues draw attention to another potential source of variation in synaptic efficacy — the metabolism of neurotransmitter and its effect on the filling of synaptic vesicles.

The production of the inhibitory transmitter GABA (γ-aminobutyric acid) is known to vary in response to changes in neuronal activity. But could regulated fluctuations in vesicular GABA content represent a mechanism of plasticity at inhibitory synapses? To examine this possibility, Engel *et al.* used pharmacological tools to increase or decrease the presynaptic GABA content of interneurons in cultured hippocampal slices. The effects of GABA release were assessed by monitoring spontaneous miniature inhibitory postsynaptic currents (mIPSCs) in CA3 pyramidal cells. They found that blocking the degradation of GABA led to an increase in the amplitude and frequency of $GABA_A$-receptor-mediated mIPSCs; conversely, the suppression of GABA synthesis was associated with a decrease in these measures.

These data are evidence of a direct relationship between synaptic efficacy and GABA metabolism at a central synapse. It will be interesting to determine whether fluctuations in GABA content can lead to short-term, activity-dependent changes in the strength of inhibitory synapses. But more importantly, these findings might have parallels at excitatory synapses, which would further challenge the commonly made assumptions about the reliability of quantal analysis in the central nervous system.

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**References and links**

**ORIGINAL RESEARCH PAPER** Engel, D. *et al.* Plasticity of rat central inhibitory synapses through GABA metabolism. *J. Physiol. (Lond.)* **535**, 473–482 (2001)

**FURTHER READING** Tian, N. *et al.* The role of the synthetic enzyme GAD65 in the control of neuronal γ-aminobutyric acid release. *Proc. Natl Acad. Sci. USA* **96**, 12911–12916 (1999)