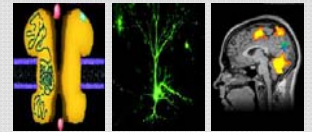


SFB 874 / IGSN

## CONFERENCE



## Cortical and subcortical representation of sensory and cognitive memory

April 28 - 29, 2015 Ruhr University Bochum

Wednesday,

April 29, morning ( 9:15 – 12:15 )

Session 3:

**Cortical plasticity as an orchestrator of sensory flexibility**

### TAKEO WATANABE

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### Roles of attention and reward in perceptual learning

Perceptual learning (PL) is defined as long-term performance improvement on a perceptual task as a result of perceptual experience. We first found that PL occurs for task-irrelevant and subthreshold features and that pairing task-irrelevant features with rewards is the key to form task-irrelevant PL (TIPL) (*Watanabe, Nanez & Sasaki, Nature, 2001; Watanabe et al, 2002, Nature Neuroscience; Seitz & Watanabe, Nature, 2003; Seitz, Kim & Watanabe, 2009, Neuron; Shibata et al, 2011, Science*).

These results suggest that PL occurs as a result of interactions between reinforcement and bottom-up stimulus signals (*Seitz & Watanabe, 2005, TICS*).

On the other hand, fMRI study results indicate that lateral prefrontal cortex fails to detect and thus to suppress subthreshold task-irrelevant signals. This leads to the paradoxical effect that a signal that is below, but close to, one's discrimination threshold ends up being stronger than suprathreshold signals (*Tsushima, Sasaki & Watanabe, 2006, Science*).

We confirmed this mechanism with the following results: Task-irrelevant learning occurs only when a presented feature is under and close to the threshold with younger individuals (*Tsushima et al, 2009, Current Biol*), whereas with older individuals who tend to have less inhibitory control task-irrelevant learning occurs with a feature whose signal is much greater than the threshold (*Chang et al, 2014, Current Biol*). From all of these results, we conclude that attention and reward play important but different roles in PL (*Watanabe & Sasaki, Ann Rev Psychol, 2015*).

