

## Laughter as a reliever of stress and fatigue: its neural mechanism and psychoimmunological effect.

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Laughter is an innate pleasant emotion with characteristic contraction pattern of the facial muscles, of which neural substrates remain to be explored. We empirically recognize its comfortable psychological effect of laughter. It is also reported that laughter has preferable effect on the physical condition. Therefore, we investigated the neural mechanism and psychoimmunological effect of this emotion. Emotion is comprised of the processes of cognition, experience and expression. To identify the whole emotional processes of laughter, we performed two PET studies of laughter induced visual comic films and voluntary facial movement mimicking laughter, simultaneously recording facial muscles activities during scans. Parametric analysis revealed the correlation between the magnitude of laughter and rCBF in the bilateral supplementary motor area (SMA) and left putamen (Figure 1). The comparison of laughter with voluntary movement revealed the activation in the visual association areas, left anterior temporal cortex, left uncus, and orbital and medial prefrontal cortices during laughter (Figure 2). From these findings and previous reports on laughter, we propose a scheme of visual emotional information processing in laughter (Figure 3). This scheme three contains three emotional components of cognition, experience and expression. The V1, visual association areas, left anterior temporal cortex and amygdala are included in cognitive component. The orbital and medial prefrontal cortices play essential role in the emotional experience. Basal ganglia-thalamocortical circuits and brain stem are important for the generation of facial expression of laughter

The famous report of Norman Cousins (1976) on his recovery from ankylosing spondylitis suggested that laughter had effects of reducing pain and inflammation. Since then, physical effects of laughter have been investigated. Following the first report of Berk *et al.* (1989), the elevation of natural killer cell activity (NKCA) by laughter was reported by several researchers, but these studies had methodological problems like small sample size or lack of control experiment. We (Takahashi, 2001) demonstrated the elevation of NKCA by laughter induced by 75-minute comic film in a crossover designed study in the 21 male subjects (Figure 4). We measured mood changes using a standardized psychometric questionnaire, Profiles of Mood States. Psychological assessment revealed fatigue preventing effect of laughter, compared with

control experiment (Figure 5). Reportedly, NKCA is decreased in the patients with Chronic Fatigue Syndrome (CFS). We are now applying the same protocol to patients with CFS to test the efficacy of laughter.

#### Publications

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