THE CHEMOTOPY OF THE HUMAN INSULAR CORTEX

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The right insular cortex is crucially involved in taste discrimination, but its functional organization is still poorly known. The organizational criterion of taste representation remains a very basic unanswered question, yet fundamental to promote a system-level analysis of primary taste processing. As a general rule, sensory cortices represent the most relevant features for each sensory modality in an ordered way across the cortical space. The spatial position of stimuli, in the visual and in the somatosensory systems, or the frequency of sounds in the auditory system, are orderly represented in the specific primary cortices. Following this analogy, a chemotopic organization (i.e. depending on the chemical determinants of taste) is what is expected as the ordering criterion of the primary taste cortex.

In this study we used functional magnetic resonance imaging, a high resolution cortical registration method, and specialized procedures of feature prevalence localization, to map the right insular cortex response to six tastes with known receptorial mechanism (sweet, bitter, sour, salt, umami, CO_2).

We report for the first time a clear evidence of a chemotopic organization in the right human insular cortex, where the feature prevalence map highlights two spatially segregated clusters, processing two and three tastes coupled together (sweet-bitter and salt-umami-sour), with CO_2 in between. This organization may follow the ecological purpose of enhancing the discrimination between safe nutrients and potentially harmful substances, via lateral inhibition mechanisms operating within taste couples.