

## **Dopaminergic regulation of dietary learning in humans and rodents**

### **ABSTRACT:**

#### **Background**

The postingestive effects of food stimulate food intake. Dopamine is critically involved in encoding food reward, including postingestive reward.

#### **Aims**

We proposed to explore the possibility of conditioning flavor-nutrient associations in humans and, in parallel, use invasive tools in mice to explore the relevance of dopaminergic neuron activity in the VTA for nutrient conditioning.

#### **Methods**

To test flavour-nutrient conditioning in human subjects, consumption levels and pleasantness ratings of flavoured yoghurts were recorded prior to and after a conditioning protocol where one flavour was paired to delivery of a tasteless carbohydrate. In mice, we established instrumental learning paradigms where postingestive feedback was isolated using intragastric infusion of sugars, contingent upon lever pressing, or using *trpm5* KO mice, a transgenic model with deficits in orosensory processing of sweet taste. Finally, cell-type specific deletion of NMDAR1 was performed in VTA dopamine neurons to abolish phasic bursting of these neurons.

#### **Results**

In healthy human volunteers the conditioning process did not change flavour pleasantness ratings. However, after conditioning there was increased preference for carbohydrate-paired flavours when preference was calculated according to consumption levels, rather than pleasantness. In mice, caloric postingestive feedback was sufficient to sustain instrumental responses, and bursting activity of VTA dopamine neurons is necessary for such to occur.

#### **Conclusions**

Nutrient value modulates instrumental responses and food choice independently of orosensory and olfactory cues, in a process that depends on activity patterns of VTA dopamine neurons.

#### **Keywords**

Instrumental conditioning; flavor-nutrient conditioning; postingestive reward; dopamine; ventral tegmental area

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### **Published Work:**

Bugalho, P., & Oliveira-Maia, A. J. (2013). Impulse control disorders in Parkinson's disease: crossroads between neurology, psychiatry and neuroscience. *Behavioural Neurology*, 27(4), 547-557. doi: 10.3233/BEN-129019

Castro-Rodrigues, P., & Oliveira-Maia, A. J. (2013). Exploring the effects of depression and treatment of depression in reinforcement learning. *Frontiers in Integrative Neuroscience*, 7: 72. doi: 10.3389/fnint.2013.00072

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