

## An adaptive strategy in modern times

Natural environments are limited in food-resources, and food-seeking behavior results from an adaptation to such environments. If the characteristic property is scarcity, then animals should approach cues with the highest associative strength to actual food-resources, this approach (Montague, Dayan, and Sejnowski 1996) suggests that prediction error signal if the current state is better or worse than expected, so animals should prefer options with the highest expected value (Kacelnik and Bateson 1996). However, uncertainty in food delivery increases lever pressing, and reduces time latency to approach lever (Anselme, Robinson, and Berridge 2013). Creating intermittent access to high fat diets generates binge eating behavior (Hess et al. 2019; King et al. 2016; Lardeux, Kim, and Nicola 2013), increases reinforcement value upon withdrawal (McGee et al. 2010) and operant behavior without withdrawal (Wojnicki, Babbs, and Corwin 2013; Wojnicki, Stine, and Corwin 2007; Wojnicki et al. 2015), psychomotor behavior (Hardaway et al. 2016), DA and Ach release (Rada, Avena, and Hoebel 2005). Mainly because of logistic reasons intermittent access is provided at the same time of days (in most cases), and that allows animals to accurately predict arrival of food, although with some inconsistencies within animals (Luby et al. 2012). However, the behavioral effects, except anticipatory behavior, are common if intermittent access is completely random or given at certain times of the day (Muñoz-Escobar, Guerrero-Vargas, and Escobar 2019).

Intermittent feeding schedules, and in general uncertainty of food-access disrupts eating patterns. Food-seeking behavior is increased to avoid starvation when a food shortage is predicted, and as previously noted this derives in increasing exploration, amount of foraging bouts and time expended in foraging (Harris, Chapman, and Monfort 2010). This could be translated to the concept of food insecurity, which defines the perception on how secure food access is (Dhurandhar 2016), which is positively correlated with positive energy balance (Dhurandhar 2016), increasing preference for high-fat alternative (Nettle, Andrews, and Bateson 2017) which corresponds to food of cheap access in developed countries where this effect is more pronounced (Moradi et al. 2019) in females (Dinour, Bergen, and Yeh 2007; Nettle and Bateson 2019). The strategy responsible for overweight in food-insecure individuals is to overeat fats and carbohydrates in periods of high food availability (Stinson et al. 2018).

In modern urban environments high-fat food are of easy access, coupled with a food-seeking behavior which seeks to maximize energetic gain, when food shortage is predicted due to food-access uncertainty, can create overweight in the population because the mechanism is adapted to low resource environments, however in developed countries caloric density is extremely high, so increasing food-seeking behavior results in excessive caloric intake. In the following section we present orexin as a potential mediator of uncertainty-driven foraging because of its pivotal role in both reactive and predictive homeostatic control (Burdakov

- 2020), and motivated behavior (Tyree, Borniger, and de Lecea 2018).
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