62. Wissenschaftlicher Kongress der Deutschen Gesellschaft für Ernährung e. V.
Was bestimmt unsere Lebensmittelauswahl? – Einfluss von Kultur und Biologie

12.–14. März 2025, Kassel

ABSTRACT

Control of hunger by intrinsic signals and environmental cues

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Common to all causes of body weight disturbance, whether genetic, psychiatric, side effects of commonly used medications or linked to disease, are disturbances in the neural circuitry controlling eating behaviour. Such brain pathways include those that receive physiological information about energy need/excess as well as those that respond to environmental cues signalling food availability. These pathways are critical for survival since they function to ensure that immediate energy and nutritional needs are met and that sufficient energy/nutritional reserves exist for times of famine. The drive to eat is triggered not only by hunger and energy deficit but also by food cues that increase appetite for palatable food when sated. Both these drivers engage the *brain ghrelin signalling system*.

Ghrelin is a stomach-derived hormone that is released when hungry and when anticipating food. It is even released when anticipating a palatable treat when sated and when exposed to food cues, suggesting that it's physiological role may extend beyond hunger to include appetite for foods that escape metabolic need.

The neuronal circuitry involved in feeding control is complex. It engages pathways involved in appetitive (e. g., *food/reward-seeking*) and consummatory behaviours (e. g., *how much, when and what we eat*) as well as pathways involved in valence (e. g., *pleasantness, aversion*) and reward evaluation, which are crucial for sustaining a diversity of food selection to meet metabolic needs. To gain new insights into this neural circuitry, we use functional neural circuit mapping techniques, employing stimuli such as ghrelin, energy deficit and food cues to identify key populations involved, both neurochemically and functionally.

A powerful neural circuit mapping technique, so called "Fos-TRAP" enables us to map neural circuitry activated by orexigenic stimuli and then attribute function to specific populations/ensembles with a network. Using RNAscope, we can then figure out the composition and neurochemical identity of the activated populations. We will explore some recent examples of ways in which we have used this technology to identify novel components of the orexigenic neurocircuitry functionally and neurochemically.