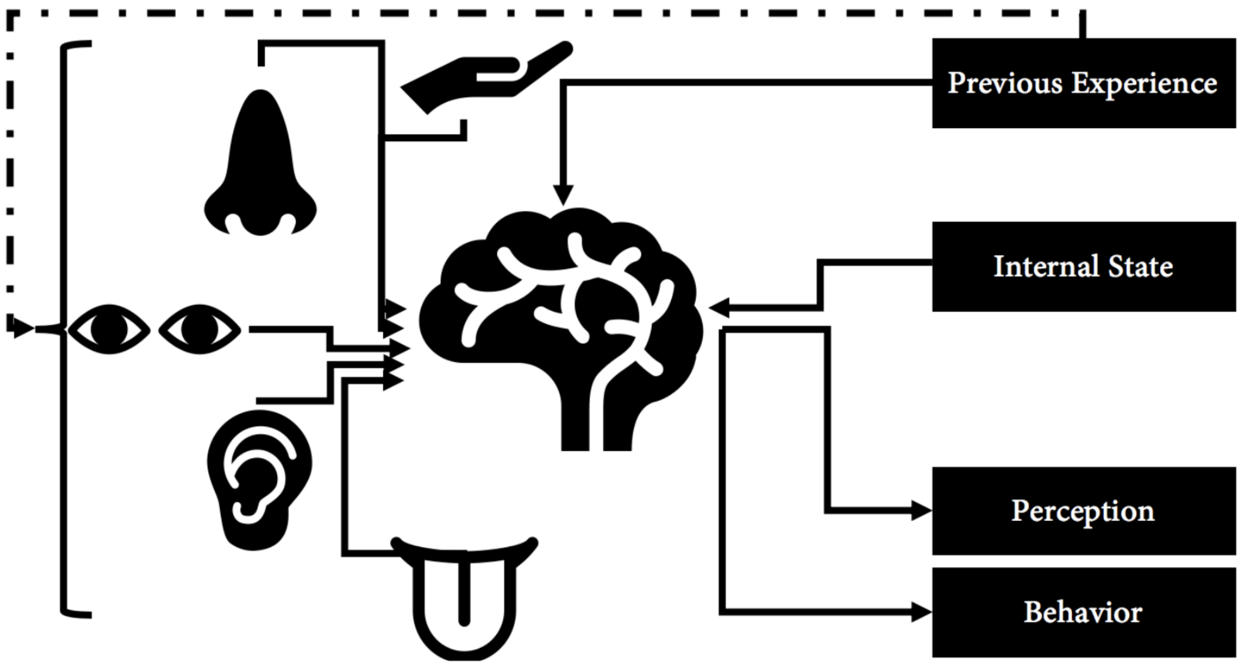
Multisensory perception, how our brains synthesize multiple types of sensory information to form our perspective of the world around us, is inherent to dining. The exploration of how each of our senses combine to affect our dining experience has been of interest to chefs and scientists alike for decades.



Multisensory Integration Schematic: I*nformation collected from each of our senses, as well as our previous experiences, affect how we perceive the world around us. Importantly, previous sensory experience can modulate our future sensory perception, and, in dining, can affect our future expectations. Congruence between our new flavor experiences and our flavor expectations affects our perceived pleasantness of the dining experience*.

All of the senses appear to be relevant for our perception of food during dining. Gustation and retronasal olfaction (odor from food in the oral cavity to the nasal cavity) compose flavor, while orthonasal olfaction (odor from the food outside the mouth to the nasal cavity), vision, audition, and somatosensation modulate flavor. Evidence from multiple studies suggests that retronasal olfaction may even impact flavor more so than taste alone. Recent research indicates that visual attributes of dishes, such as food color and shape, as well as serving dish color and shape, have impacts on flavor perception. For example, red items tend to be perceived as sweeter than green items with identical chemical composition; items served on round plates are also perceived as sweeter than ones served on square plates. Additionally, evidence suggests that diners consistently associate particular pitches and timbres of music with types of flavors, associating sweet flavors with higher-pitched piano notes and bitter flavors with lower-pitched brass notes. Manipulating these facets of multisensory perception interacts with diners' learned expectations and prior experiences with food. Congruence between food flavor and food expectations derived from other senses determines how pleasant diners find their overall dining experience (*reviewed in* Spence, 2015).

The neural substrates of the multisensory experience of flavor are still being uncovered; yet considerable progress has been made in identifying human brain regions which integrate the fundamental gustatory and olfactory information of flavor. Gustatory information travels from chemical-specific neurons in taste buds to the primary gustatory cortex, while olfactory information travels from chemical-specific neurons in the olfactory epithelium to primary olfactory cortex. Neurons from the primary gustatory and olfactory cortices project to the orbitofrontal cortex (OFC), where studies have found increases in human brain blood-oxygen levels (which are suggestive of activity) upon combined gustatory and olfactory input. Interestingly, perceived flavor pleasantness is also correlated with increases in OFC blood oxygen levels. In one study, congruent taste and scent resulted in correlated increases in perceived flavor pleasantness and in OFC activity. However, evidence still lacks for where in the brain other sensory modalities modulate flavor perception (*reviewed in* Spence, 2015 & Small, 2012).

I designed this course to combine some of the previous multisensory dining findings, and with these combinations, to experiment further with how different sensory modalities shape our expectations and enjoyment of food. In this Multisensory Dining Experiment (MDE) recipe, you will find a rough outline of the components necessary for your dining experience and suggestive instructions for planning an MDE. The sensory combinations and particular item choices are largely up to your curiosity and interests.

Spence, C., (2015). Multisensory Flavor *Perception, Cell, 161: 24-35.*
Small, D.M., (2012). Flavor is in the Brain, *Physiology & Behavior, 107: 540-552.*
Additional Information: Shepherd, G.M., (2011). *Neurogastronomy: How the Brain Creates Flavor and Why It Matters.*