



## SPRING SEMINAR SERIES

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### ***Human Food Addiction?***

- Associate Member, Monell Chemical Senses Center
- There are behavioral and neurochemical parallels between food addiction and other addictions like drug and alcohol addiction.
- **Clinical criteria for addiction:** According to DSM IV a person must meet three of the seven criteria to be considered dependent on a substance. These criteria include: tolerance, withdrawal (this includes craving), and difficulty controlling use.
- Therefore, there are people who meet the criteria for food dependence.
- **Craving:** an intense desire to eat food or engage in an activity
  - Craving is related to high BMI, higher likelihood of snacking and dropping out of your diet program, and is related to binge eating and bulimia.
- **Liking:** a hedonic response; pleasant feelings associated with food
- **Want & Desire:** are interchangeable
- **Reward:** food that is rewarding becomes more desirable in the future
  - Food that gives you pleasure may be rewarding, but you can also have a reward without pleasure.
- Concept of craving and liking have specific context.
  - For example: a craving for chocolate may be evoked by a sensory memory that must be matched to satisfy the craving.
- **Olds & Milner (1954):** trained rats to stimulate their brain by shocking it. The rats chose this brain stimulation over food or sex.
  - This is known as the **pleasure or rewards circuit**.
- In the 1950s and 60s humans were also shocked. Researchers found the participants pressed the button often. The participants said they were feeling something strange like sexual arousal but there was no satisfaction, however they were compelled to keep pressing the button to shock their brain.
- Drug users have a similar experience. They crave a drug even when they don't enjoy it.

- For example, many smokers don't enjoy smoking but they do it.
- If it's believed that drugs of abuse take over the brain, is the same true with food?
- Neurotransmitters have a similar effect on desire for foods and drugs.
- **Small, et al 2003:** dopamine is released by feeding so they looked at the brains of obese and non-obese.
  - Drug abuse is associated with a decrease in sensitivity of the dopamine reward system. The same was seen in the obese individuals.
- **Neurochemicals of pleasure:**
  - Naltrexone: decreases the short-term food intake of palatable foods, but doesn't make you less hungry
- **Study 1:** looked at the mechanisms of food craving and replicated it in a laboratory
  - A common belief is that a food craving is based on a nutritional need, but this not necessary.
    - It is possible, for example, that a person could have more food cravings when they are anemic (iron deficient), but they don't necessarily crave foods with iron in them.
    - One woman who had mercury poisoning ate a paperback book everyday. It also turned out she had anemia. Once the anemia was gone she stopped eating the paper.
  - Procedures:
    - Young and old adults were used for the study.
    - Three stages: 1) baseline: participants ate whatever they wanted; 2) monotony: participants got all of their calories from meal replacement drinks (Boost) for 5 days; 3) recovery: participants went back to eating as they normally did
  - Findings:
    - Drinking the meal replacement drink lead to spontaneous cravings. Was this due to monotony of meal or food restriction?
    - Cravings for the meal replacement drink peaked on day 2.
- **Study 2:** an fMRI study
  - Group 1 was given the monotonous drink diet and Group 2 was given the meal replacement drink (Boost) before going for the MRI (so as not to be hungry) but was allowed to eat what they wanted otherwise.
  - Note: hunger may increase a craving for something, but it is not necessary. It is possible to have cravings after you eat.
  - Researchers asked participants to name two foods they really liked. These food names were projected onto a screen and the subjects were told to imagine the act of eating the food.

- Everyone in group one experienced cravings; only a handful in group two experienced cravings; no one experienced cravings when they imagined Boost, the meal replacement drink.
- When you look at the contrast between images of when participants were told to think of the food they like versus thinking of Boost, people in Group one had activation above the threshold; there was none in group two.
  - The activation was in the limbic and paralimbic structure.
- From this the researchers were able to come up with the structures in the brain associated with craving instead of liking.
  - 1) hippocampus
  - 2) insula: involved in sensory memory, remembers what things feel like
  - 3) caudate" involved in habit learning, obsessive brain circuit
- It is important for expectations to be the same in order to compare brain activation: being told that you can or cannot have the desired food or drug afterwards will affect participants' mindset.
- **How are cravings learned?**
  - Drug studies show that cravings are conditioned. A man goes to rehab and rids himself of the craving, but the moment he returns to his neighborhood he uses the drug again because the old cues trigger the use.
- **Externality hypothesis:** heavier people are more influenced by external cues
- **Gismond & Desmond study:** gave participants a two-week supply of chocolate. Group one was told to eat the chocolate as dessert and group two was told to eat it whenever they were hungry.
  - There were increased chocolate cravings for group two, which may be due to a snacking situation. It is possible that snacking leads to cravings for a food.
- **Can you make a craving for neutral or disliked foods** (something healthy)?
- If you get someone to want something that they don't like, what brain activity is occurring?
- There are many parallels between drug and food addiction, so should tasty foods be outlawed?
  - This probably wouldn't be successful, especially because there are individual differences that predispose us to crave certain foods.
- One solution is to decrease the cost of fruits and vegetables and increase the cost of junk food.
- It is important to take lessons from drug exposure.