

GABAergic influences increase ingestion across all taste categories



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Benzodiazepine Drugs



- Benzodiazepines are a depressant
- Facilitate the main inhibitory neurotransmitter in the brain called GABA (*gamma-amino butyric acid*)
- Six million people are diagnosed with generalized anxiety disorder (GAD) per year
 - Half are given anti-anxiety drugs which contain benzodiazepines
- Typical benzodiazepines include: Valium, Xanax, and Librium (chlordiazepoxide, CDP)

Concerns about Benzodiazepines



- Some side effects include drowsiness, muscle weakness, depression, and weight gain.
- In 2007 around 31% of people in the US were diagnosed with obesity, defined as having a body mass index (BMI) above 30.

Benzodiazepines Influence Palatability

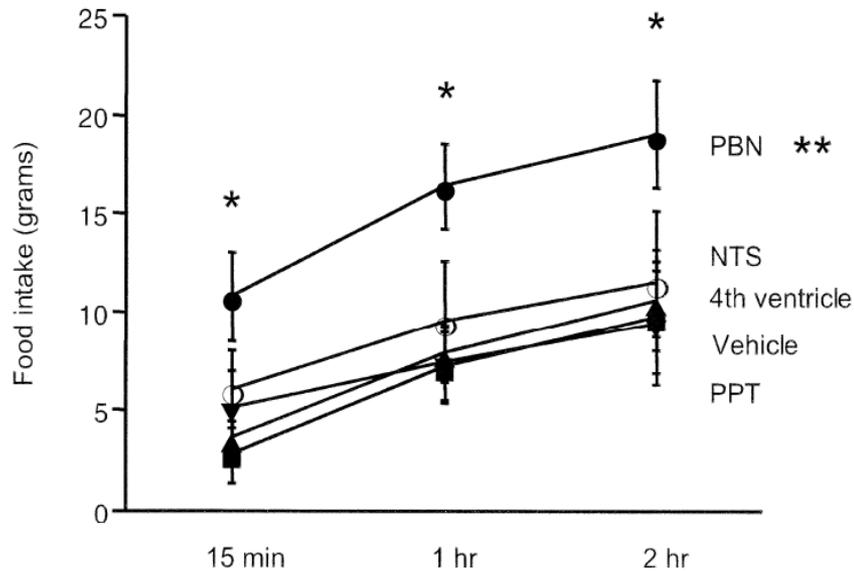


Fig. 2. Microinjections of midazolam ($7.5 \mu\text{g}$) into the parabrachial nucleus (PBN), nucleus of the solitary tract (NTS), pedunclopontine nucleus (PPT), and the fourth ventricle (experiment 1). Amount of food consumed after the time course 15 min, 1 h and 2 h. Midazolam ($7.5 \mu\text{g}$) into the PBN increased food intake over NTS, PPT, and the fourth ventricle ($P < 0.001$). The results are presented as mean \pm S.E.M. An asterisk denotes significant elevations in food intake relative to vehicle.

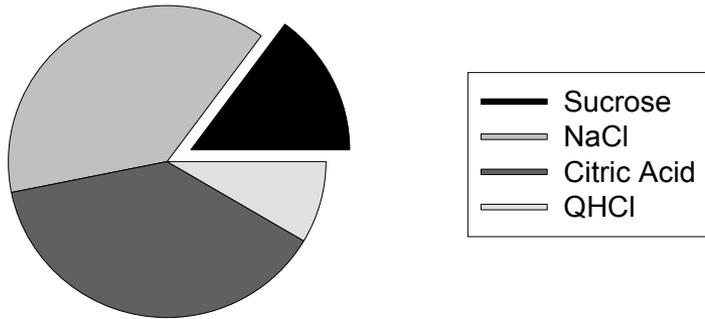
- This graph shows the significance of direct injection of benzodiazepines into the PBN.

From: Söderpalm & Berridge. *Brain Res.* 2000 Sep 22;877(2):288-97.

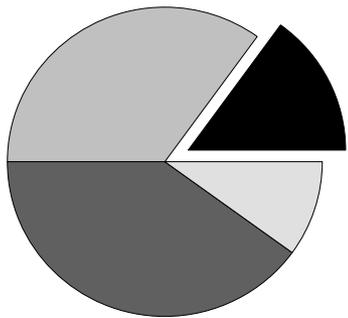
PBN as site for GABA to influence taste palatability



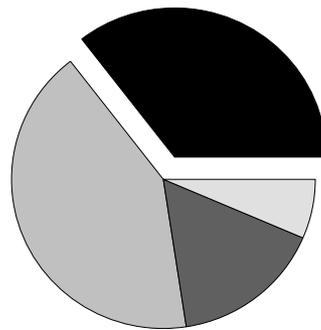
BEFORE INJECTION



AFTER SALINE



AFTER CDP



- Proportion of PBN neurons that respond BEST to a taste stimulus
- CDP increases sweet and salt responsiveness and decreases sour and bitter responsiveness

From: Baird, J.P., Chung, Y.N., Loveland, J. 2008
AChemS / ISOT Poster Unpublished Data

Previous Research in the Pittman Lab: *Dinnen & Farr 2007*



- Tested both male (n=12) and female (n=12) rats
- Tested both long-term and brief-access in same group of rats (counterbalanced)
- Only 1 concentration of sucrose, NaCl, citric acid, and quinine in long-term tests
- Found no differences between sexes
- Found equivocal effects of CDP across the microstructural variables

Objectives of this Study

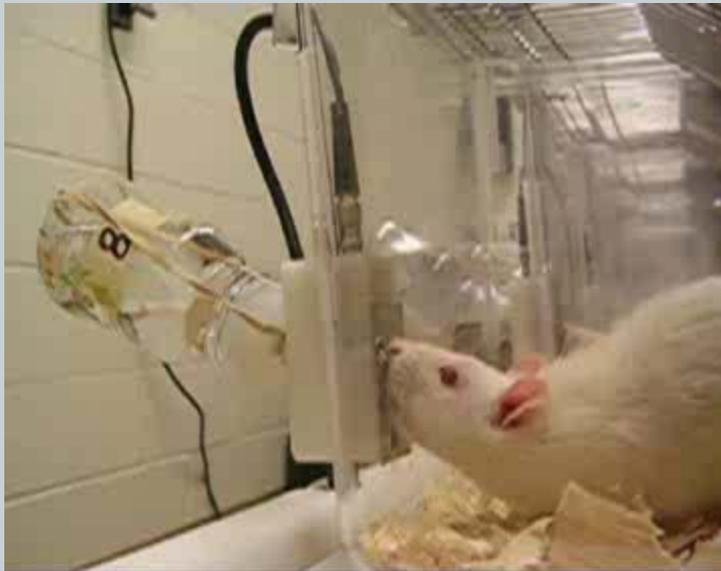


- The purpose of this study was to examine the effects of CDP on the feeding patterns of rats.
- We tested both appetitive and aversive stimuli.
- Low, medium, and high concentrations of the following tastants were used:
 - Sucrose
 - Saccharin
 - NaCl
 - QHCl
 - Citric Acid
 - MSG

Data Collection in the AC-108 Gustometer



- Dependent variable: licks measured during daily 60 min test sessions



Independent Variables



- Between-subjects effect: concentration of the tastant (low, medium, or high)
- Within-subjects effect: CDP_(10 mg/kg) versus saline

Licking Pattern Analysis



Meal Analysis

- Meal Licks
- Meal Duration

Taste-Mediated

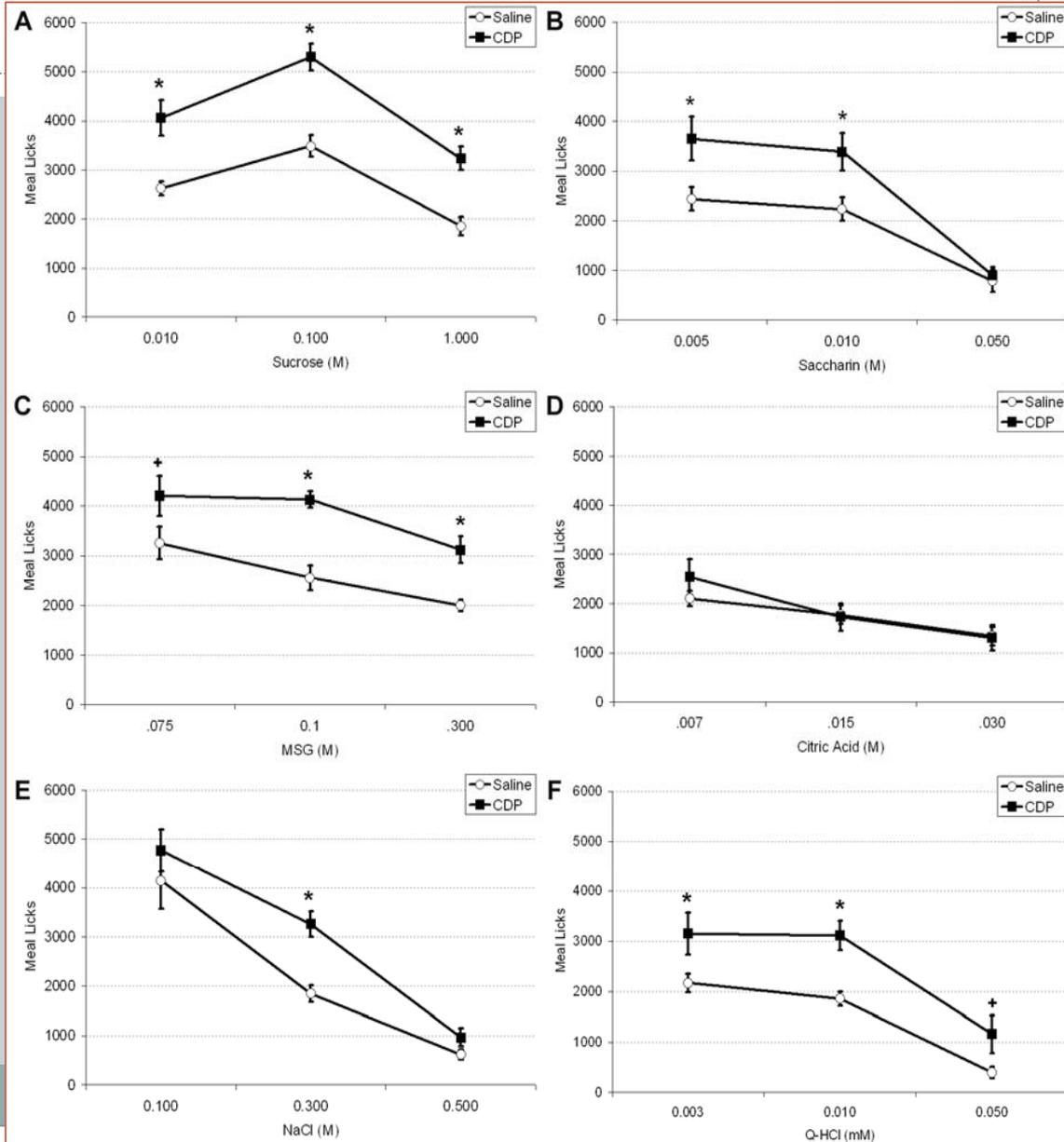
- Lick Rate
- 1st Minute Licks

Pattern Analysis

- Number of Bursts
- Burst Size (# licks)
- Burst Duration
- Pause Duration

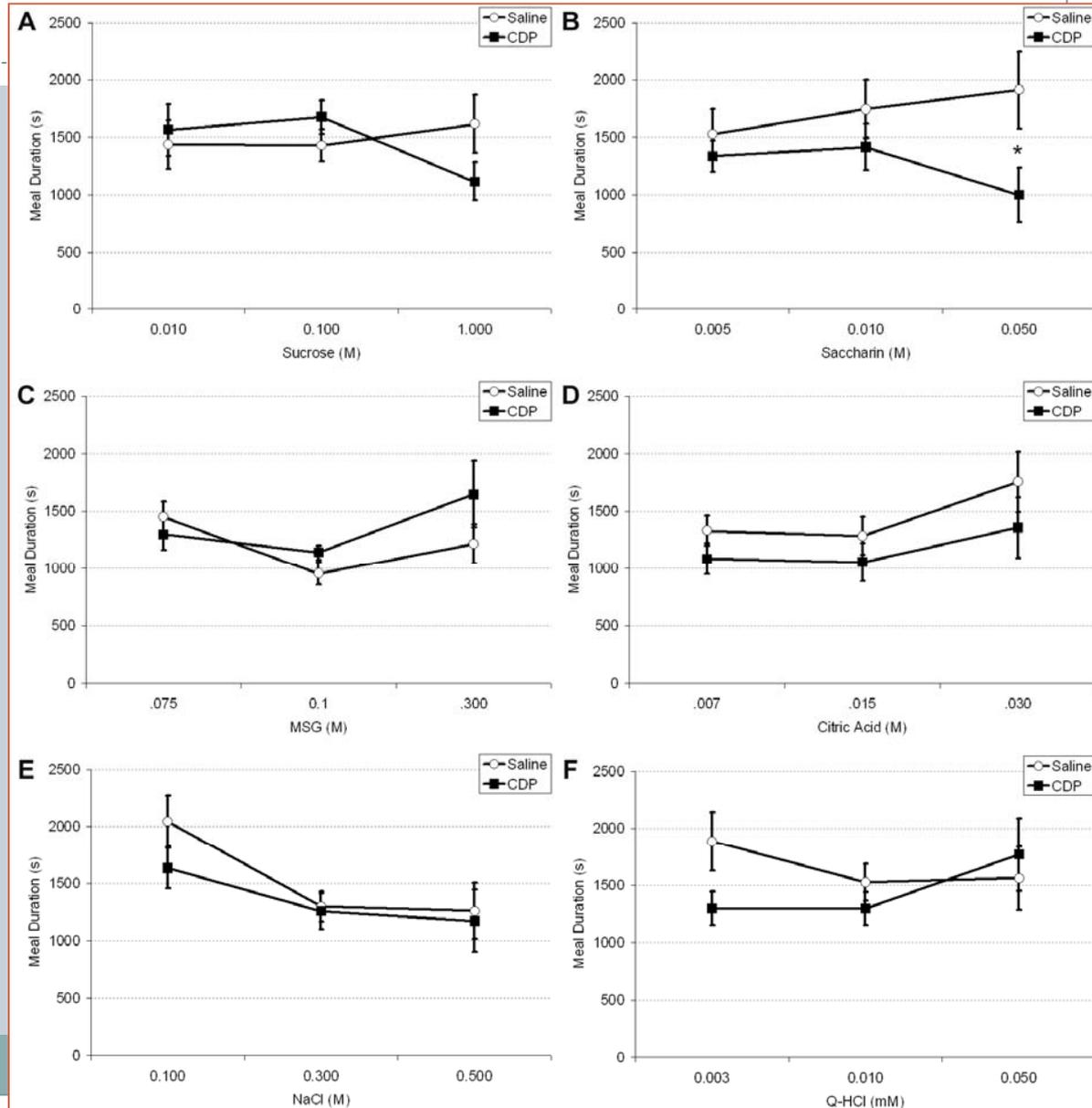
Total Licks in the Meal

- Appetitive:
 - CDP increased the number of licks in meals
- Aversive:
 - No effect of CDP for sour and strong salt
 - CDP increased mild bitter



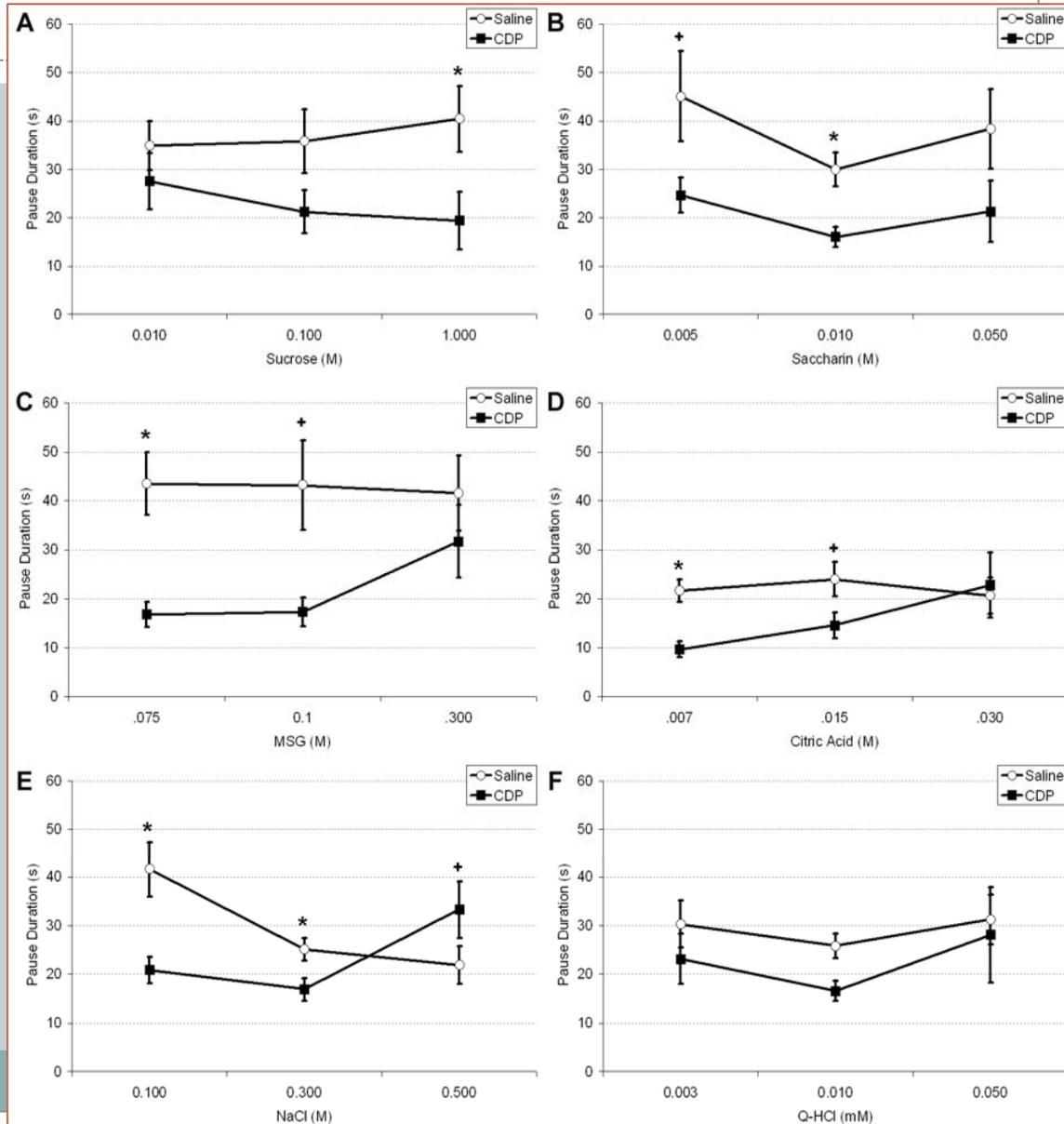
Duration of the Meal (*seconds*)

- Appetitive:
 - No effect of CDP
- Aversive:
 - No effect of CDP



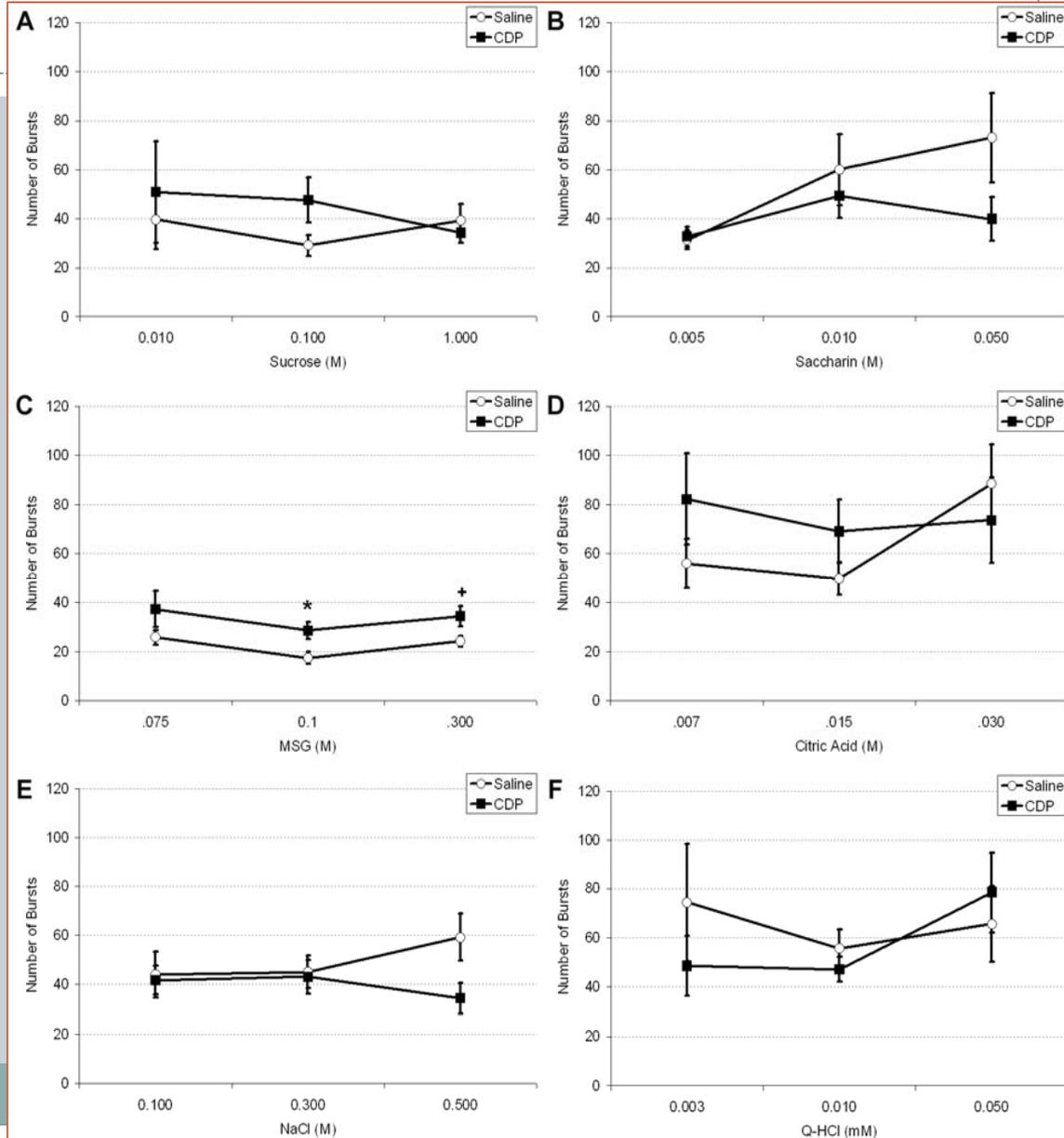
Mean Duration of Pauses (*seconds*)

- Appetitive:
 - CDP decreased the duration of pauses across all appetitive stimuli
- Aversive:
 - CDP decreased length of pauses for sour and bitter
 - CDP increased the duration for strong salt



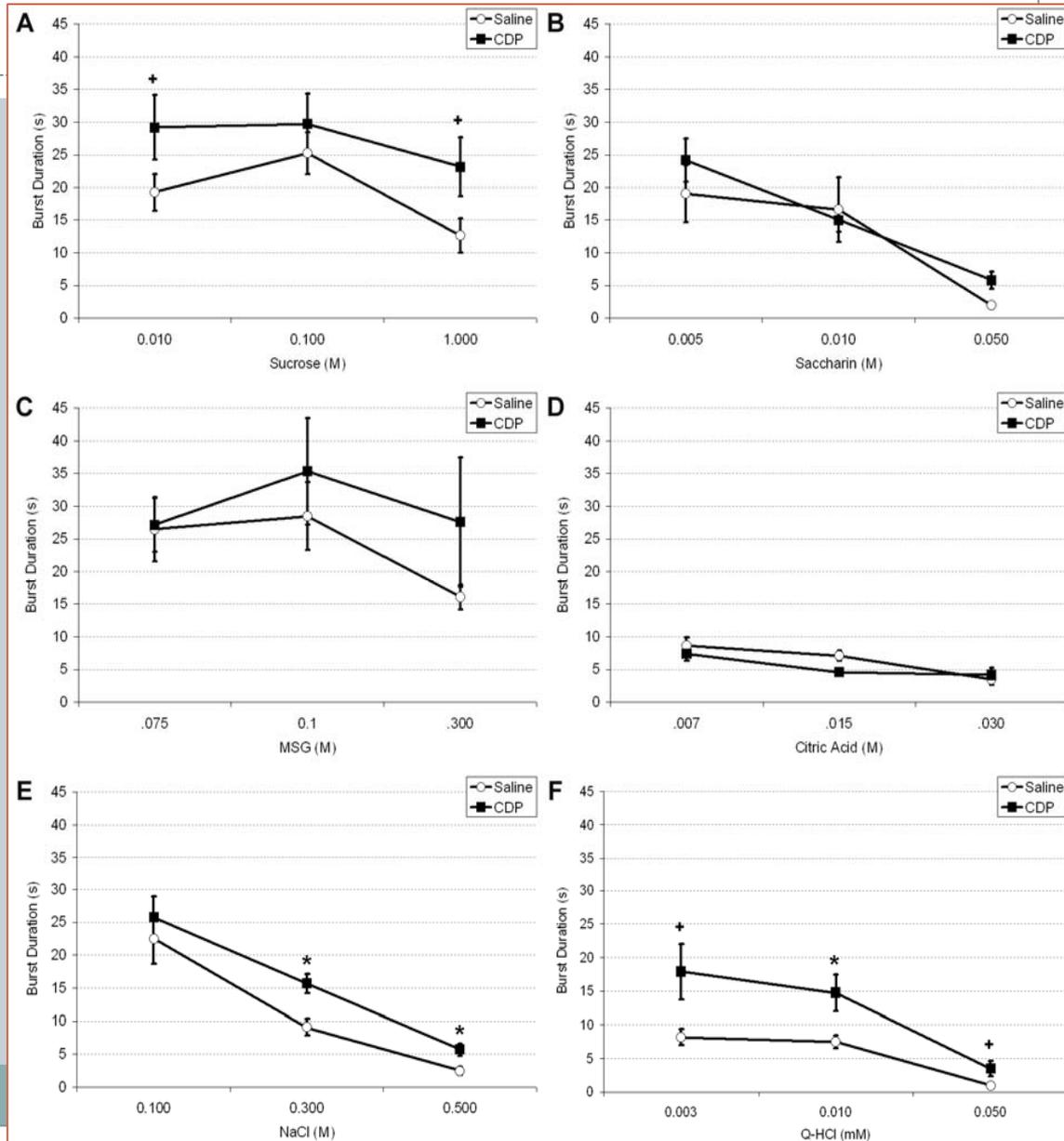
Number of Bursts in the Meal

- Appetitive:
 - No effect of CDP for sweet or mild salt
 - CDP increased number of bursts for MSG
- Aversive:
 - No effect of CDP



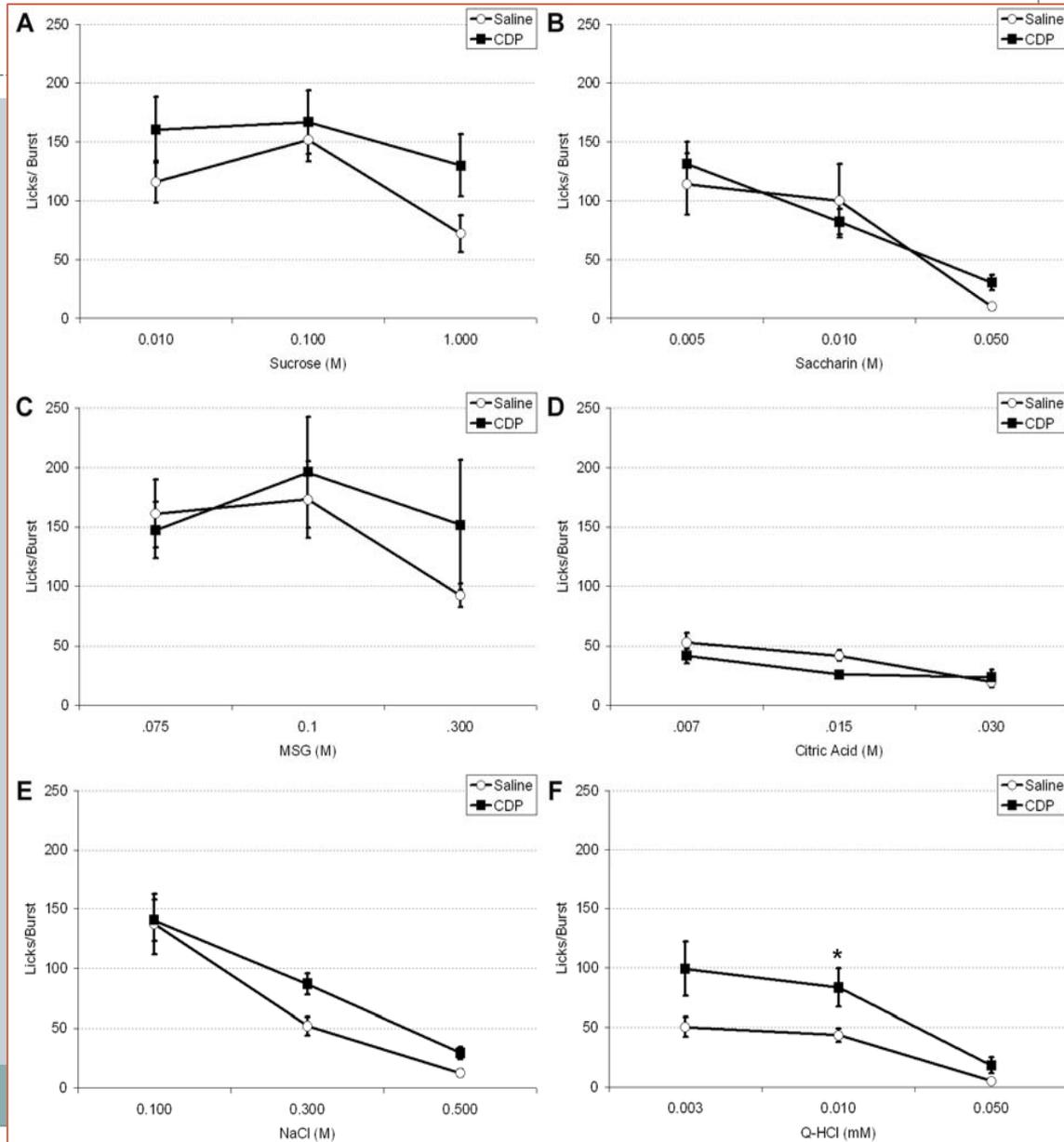
Mean Duration of Bursts (*seconds*)

- Appetitive:
 - CDP increased the duration of bursts for sucrose & strong MSG
- Aversive:
 - CDP increased mild bitter and NaCl



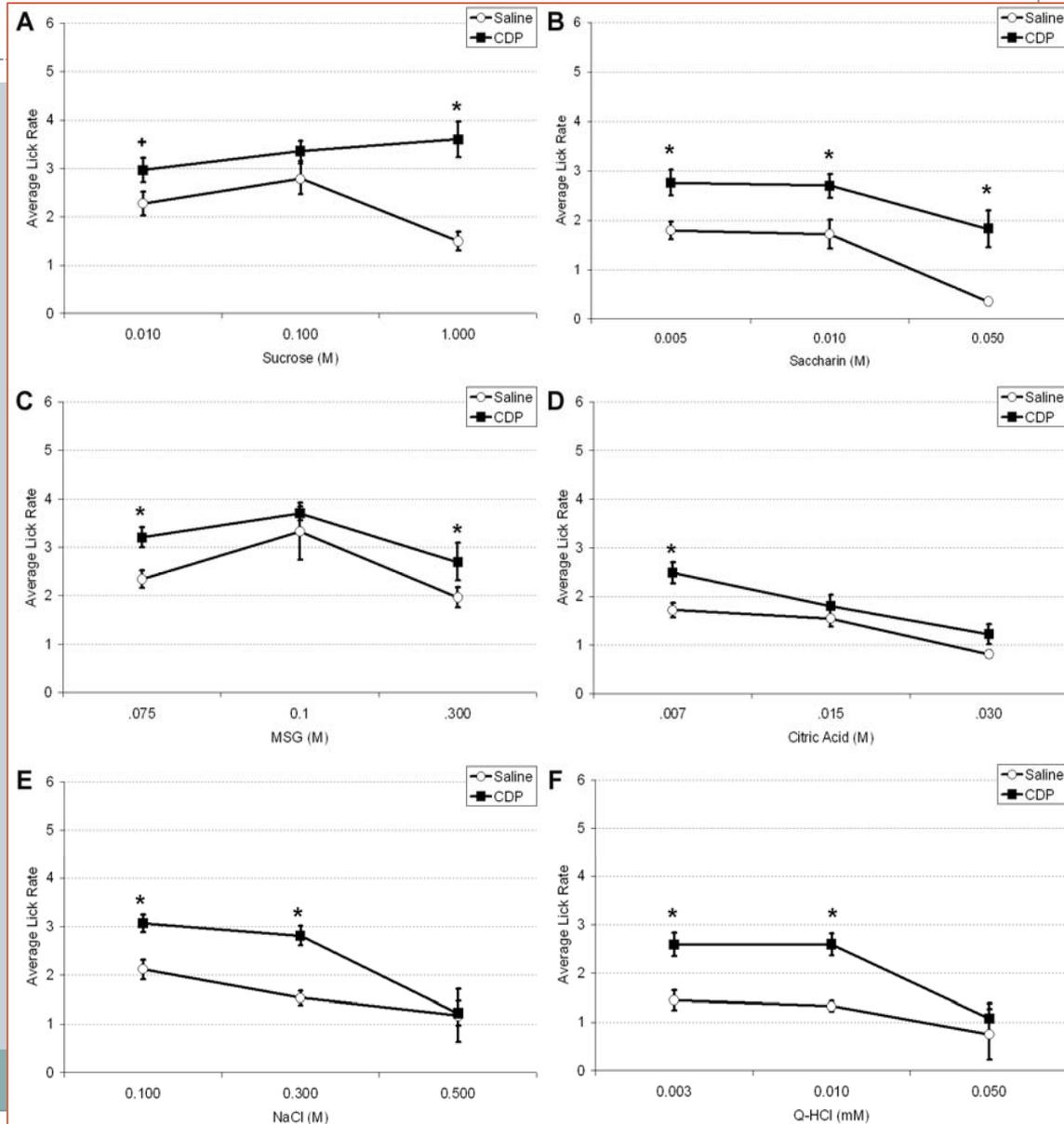
Number of Licks per Burst

- Appetitive:
 - CDP produced small increases in sucrose and MSG licks
- Aversive:
 - CDP increased strong NaCl and mild bitter



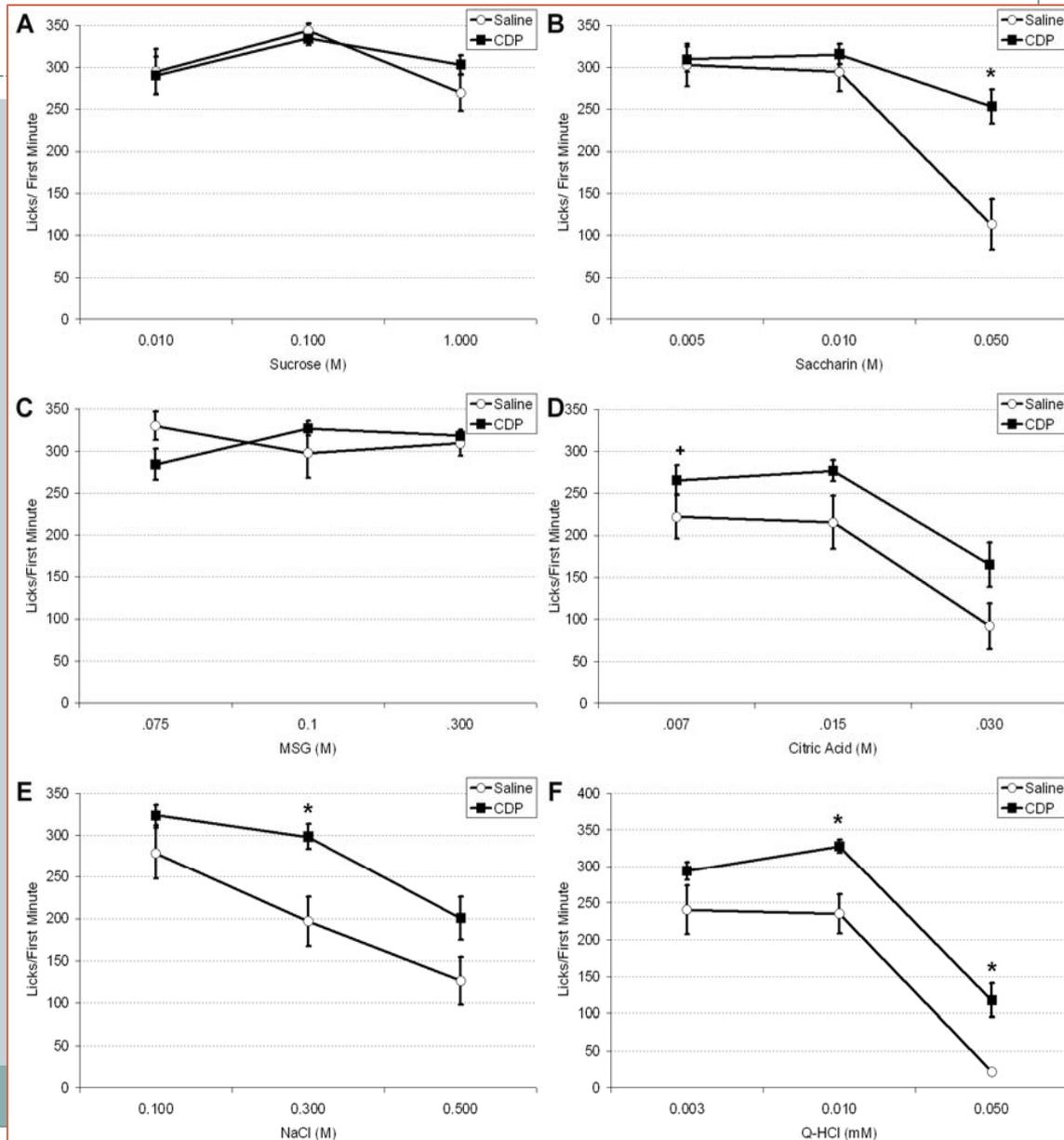
Rate of Licking (*licks per second*)

- Appetitive:
 - CDP increased the average lick rate
- Aversive:
 - CDP increased the average lick rate



Licks within the First Minute

- Appetitive:
 - No effect of CDP for sweet or MSG – *ceiling effect*
- Aversive:
 - CDP increased 1st minute licks for sour, bitter and salt



Summary & Conclusions



- Baird has shown that CDP increased responsiveness to appetitive stimuli and decreased responsiveness to aversive stimuli in the PBN
- These results show a general increase in palatability across all tastants that support his PBN data.
- Our behavioral results indicate that CDP increased the appetitive qualities and decreased the aversive qualities of each stimulus primarily through changes in taste-mediated variables

Acknowledgements



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- Dr. David Pittman

