opertech bio

we make sense of taste®

TāStation®

Taste Evaluation Technology

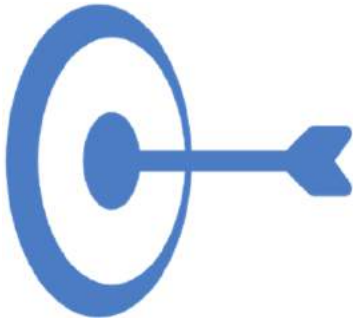
Overview

Scott Horvitz, CEO
R. Kyle Palmer, PhD, CSO

We Make Sense of Taste®

A Pioneering High Throughput Approach to Taste Testing

Faster Results



Greater Accuracy

Fewer Resources

Faster, more accurate and requires far fewer resources offering substantial savings in time and money to the food and beverage and flavor ingredient industries

opertech bio
we make sense of taste®

Markets

Food & Beverage

Improve taste and discover new healthier flavor ingredients

Pharmaceuticals

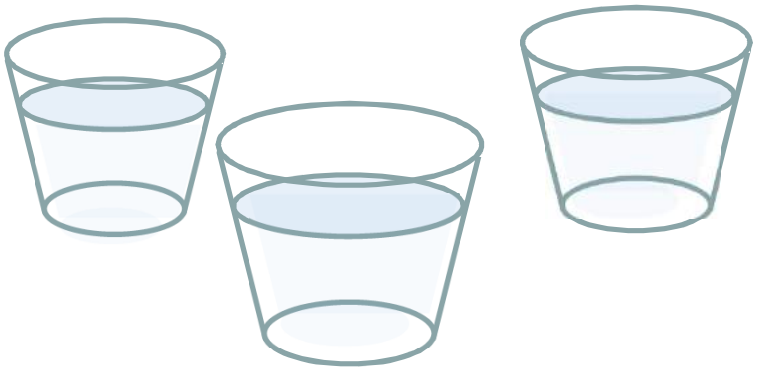
Better tasting liquid formulations

Our clientele include some of the world's largest and best known food and beverage, consumer healthcare and pharmaceutical companies.

opertech bio
we make sense of taste®

The Challenge

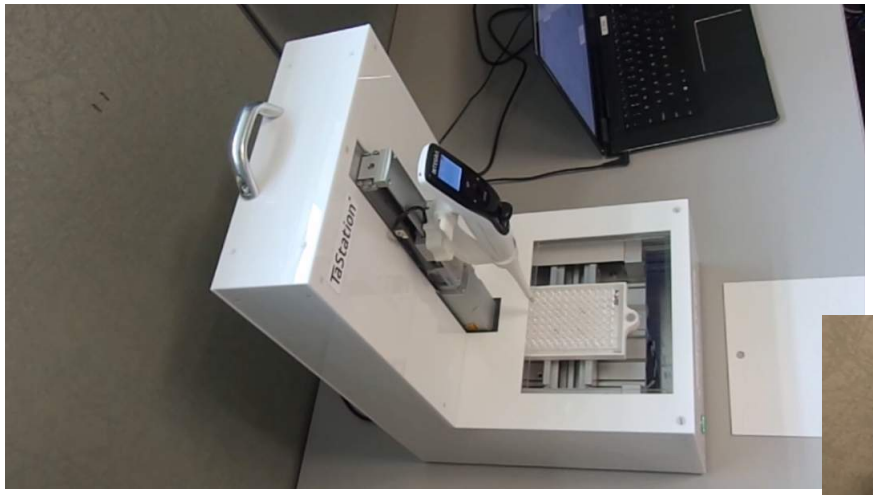
Traditional Taste Testing Methods are Time Consuming and Expensive

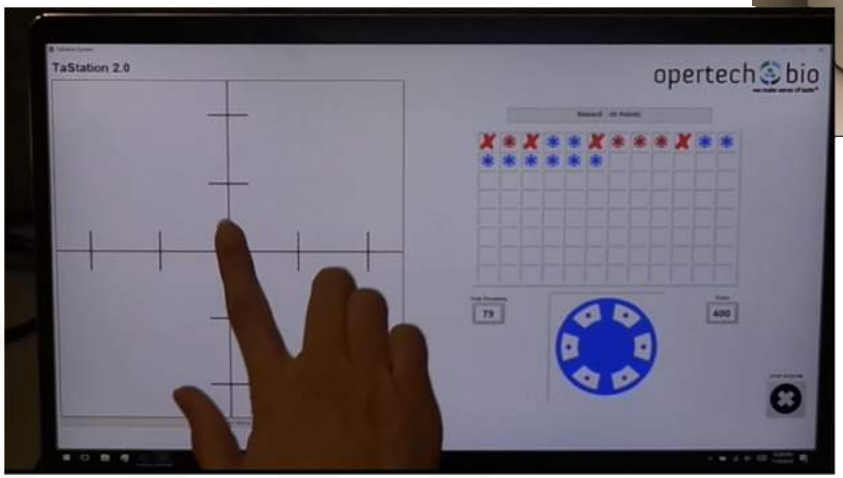


- Relatively few samples can be evaluated per test
- Many subjects are required for statistical power (20+)
- Measurements relying of sensory scaling can be inconsistent
- The large volumes of sample evaluated in sensory panels require significant quantities of materials

Opertech Solution: TāStation®

The First High-throughput Taste Evaluation System





U.S. Patents No. 8,820,265 and 9,841,897

opertech bio
we make sense of taste®

TāStation® Advantage

- Each subject evaluates 96 samples in ~45 minutes
- Large datasets are quickly generated
- Fewer subjects are needed
- Sample volumes are small (0.2 ml)
  - Overcomes taste desensitization
  - Reduces cost of materials required for testing
  - Testing of precious NPs can be done with ~ 10 mg
- Opertech has extensive experience in evaluating
  - Sweeteners and sweetness enhancers
  - Bitterness mitigation/blocking
- Protocols are approved by an independent, accredited, Institutional Review Board (IRB)

opertech bio
we make sense of taste®

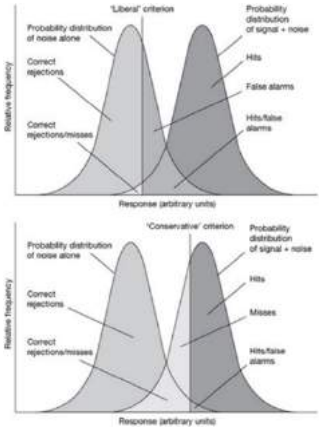
Proprietary Interactive Algorithms

Operant Conditioning

- Tie a consequence to the response
  - Reward accurate performance
  - Penalize poor performance

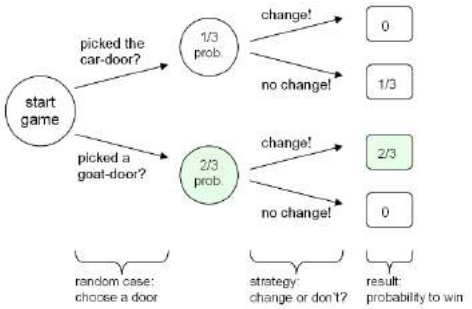
Signal Detection Theory

- Subject bias is inherent in sensory testing
- Identify, quantify, and control the bias



Game Theory

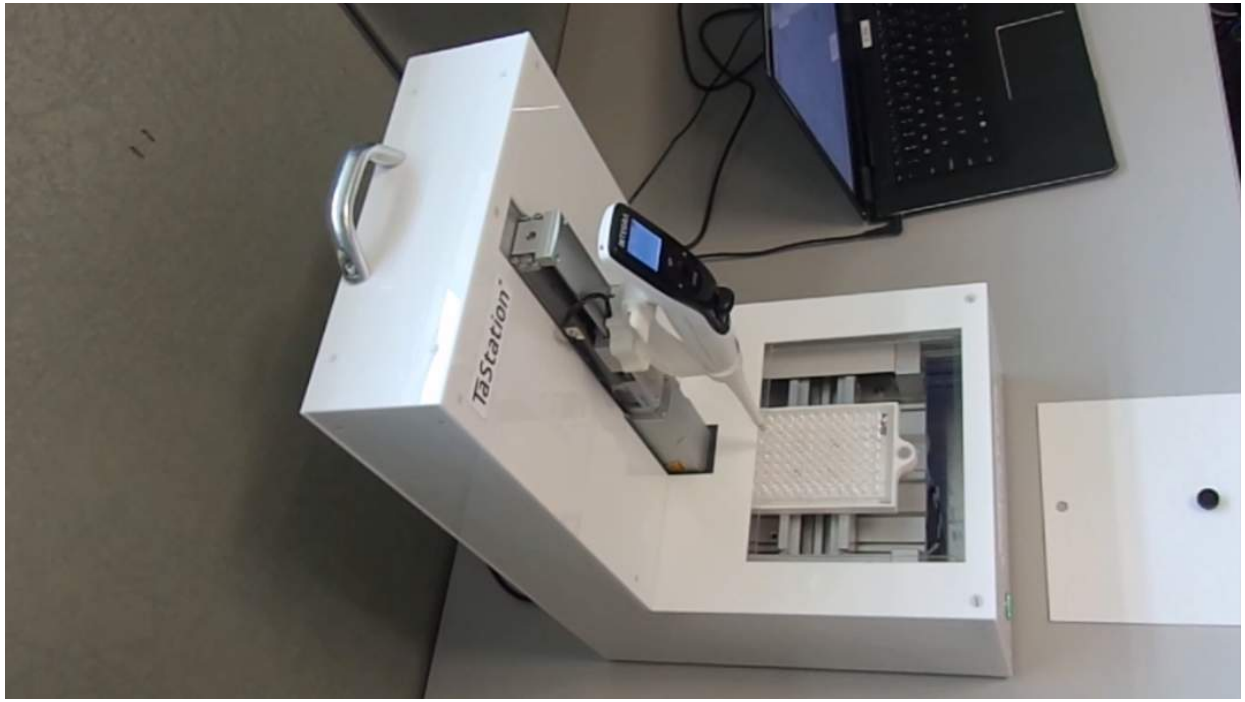
- Subjects make decisions about sensory stimuli
- Optimize decision strategies through algorithms



opertech bio
we make sense of taste®

The TāStation®

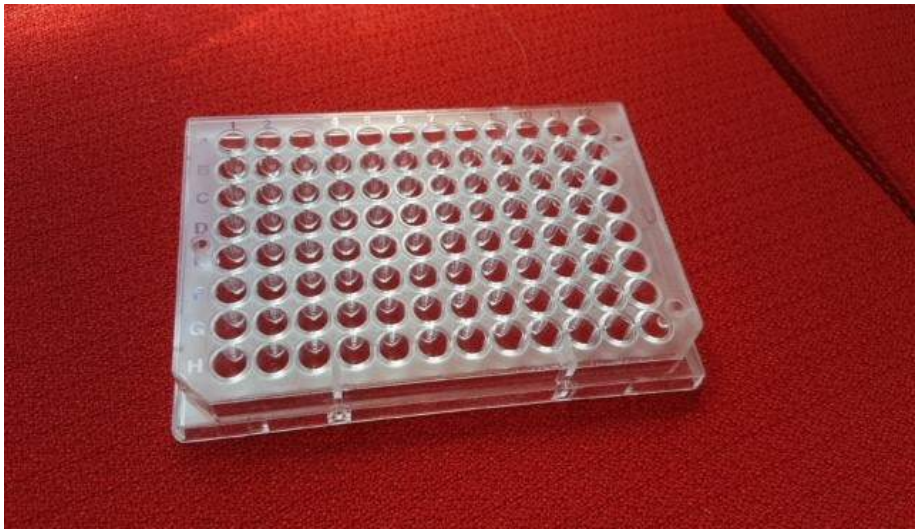
Automated High Throughput Sample Delivery

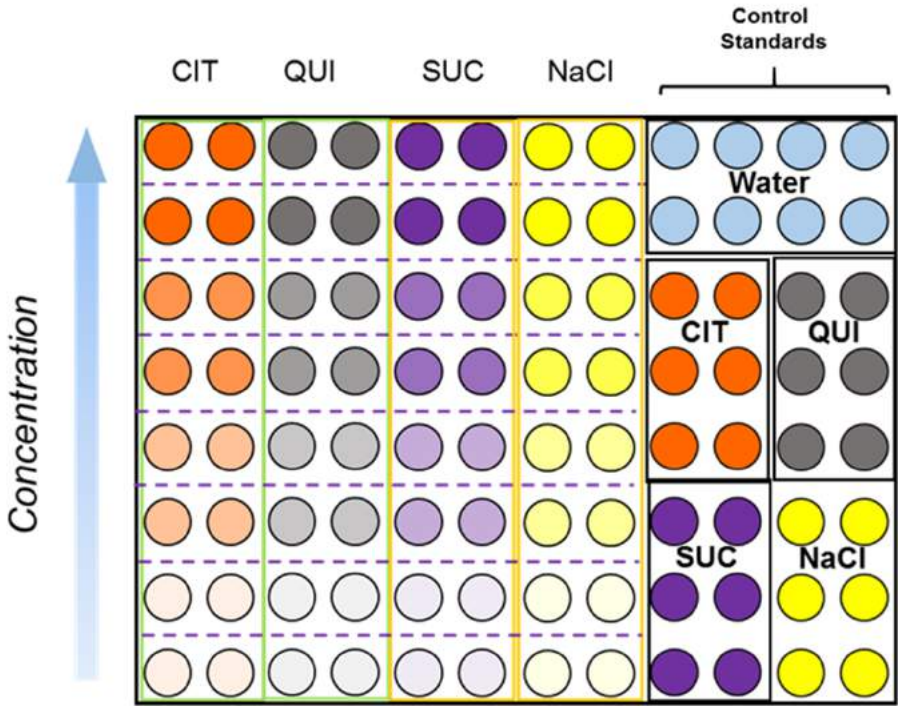


- Robotic pipette randomly selects a well from a 96-well plate
- Withdraws small volume (0.2 ml)
- Presents pipette to subject
- Subject self-administers to the tongue

opertech bio
we make sense of taste®

Samples are Distributed in a 96-well Plate





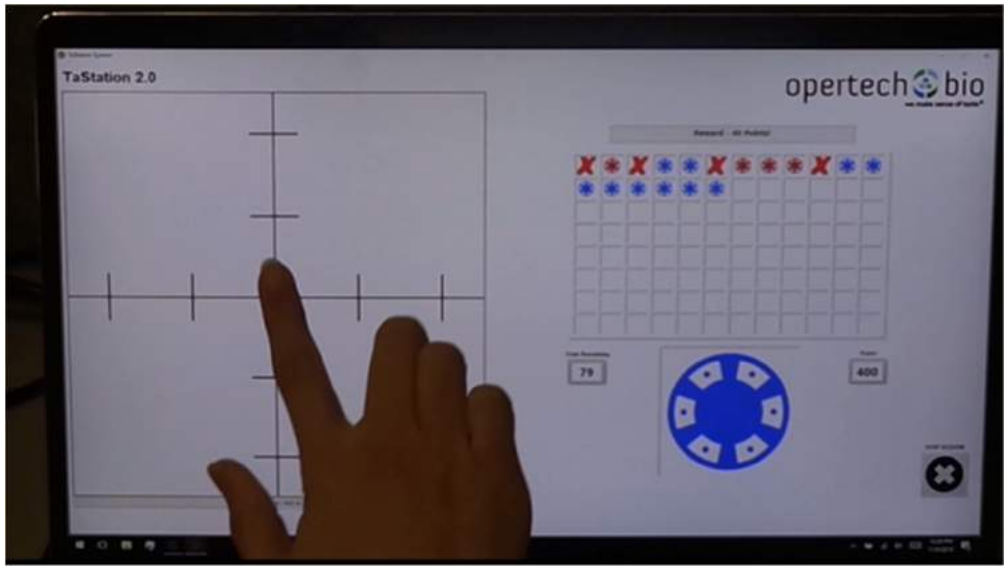
- *Volumes typically 0.2 milliliter*
- *Milligram amounts of test materials*
  - *Minimizes desensitization*
  - *Minimizes costs of natural products*
  - *Minimizes exposure lowering risk to subjects*

- *Maximal flexibility in experimental design*
- *Ideal for concentration-response analysis and screening*

opertech bio
we make sense of taste®

The TāStation®

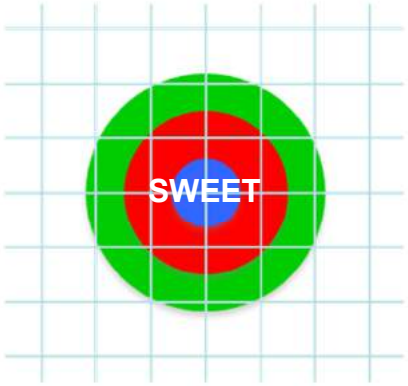
Responses have Consequences



- Subjects are instructed to search for poker chips buried in a visual field
- The taste stimulus is clue to their location
- After tasting, the subject is prompted by the computer to touch the screen
- The response has a consequence—reward or penalty—then on to the next trial
- Subject completes all 96 trials in ~45 minutes

opertech bio
we make sense of taste®

Taste Stimuli are Mapped to Specific Coordinates on the Touch-Screen



The target is invisible to the subject

- Subjects are trained to associate a taste standard with the target locus
- Target is designed like a dart board

- Responses in the center bring the highest point value
- Point value declines with distance from center
- Penalty occasions responses made outside the target

opertech bio
we make sense of taste®

TāStation® Demo

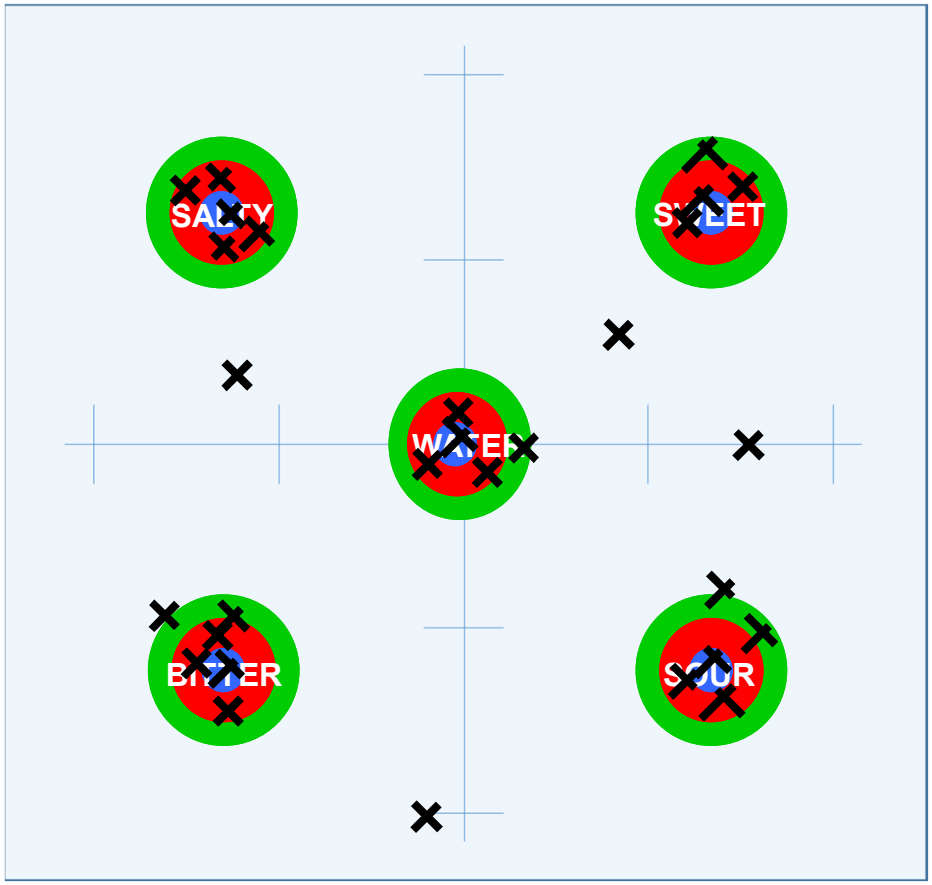
The First High-throughput Taste Evaluation System

U.S. Patents No. 8,820,265 and 9,841,897

opertech bio
we make sense of taste®

Responses are Registered via Touch Screen Calibrated by Taste Standards

What the Subject Sees

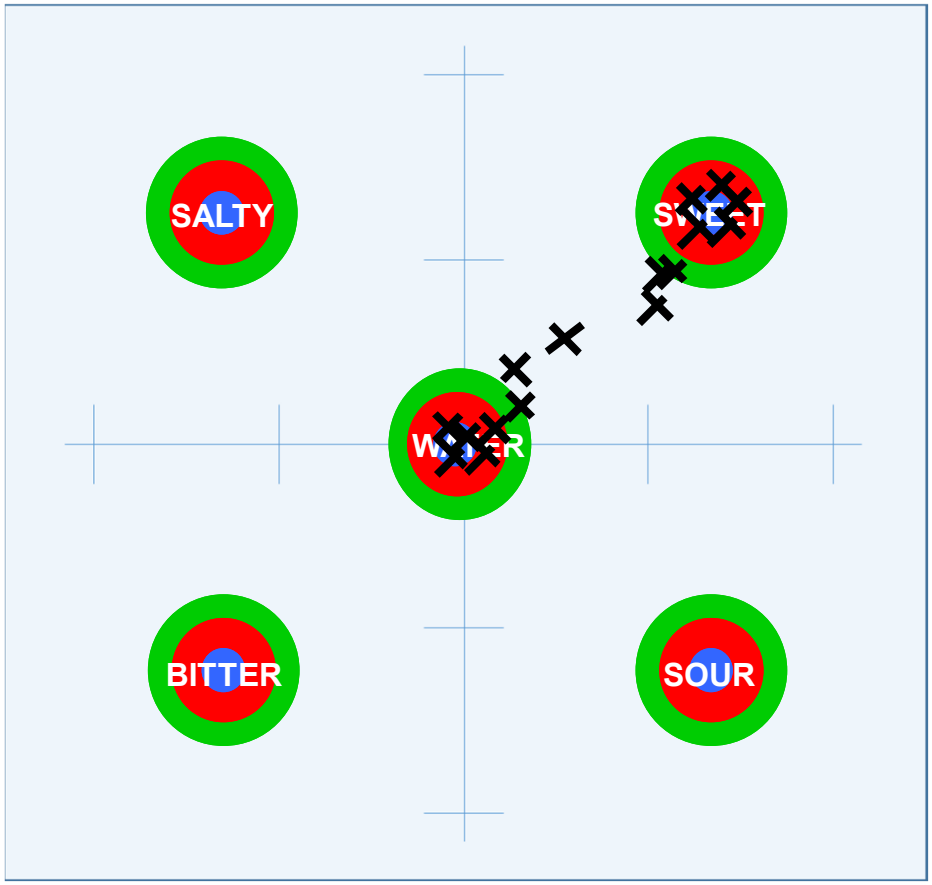


Targets Are Invisible

- During training, subjects learn the target locations by trial-and-error
  - Correct touch responses are rewarded
  - Incorrect responses are penalized
- Responses become associated with appropriate targets

opertech bio
we make sense of taste®

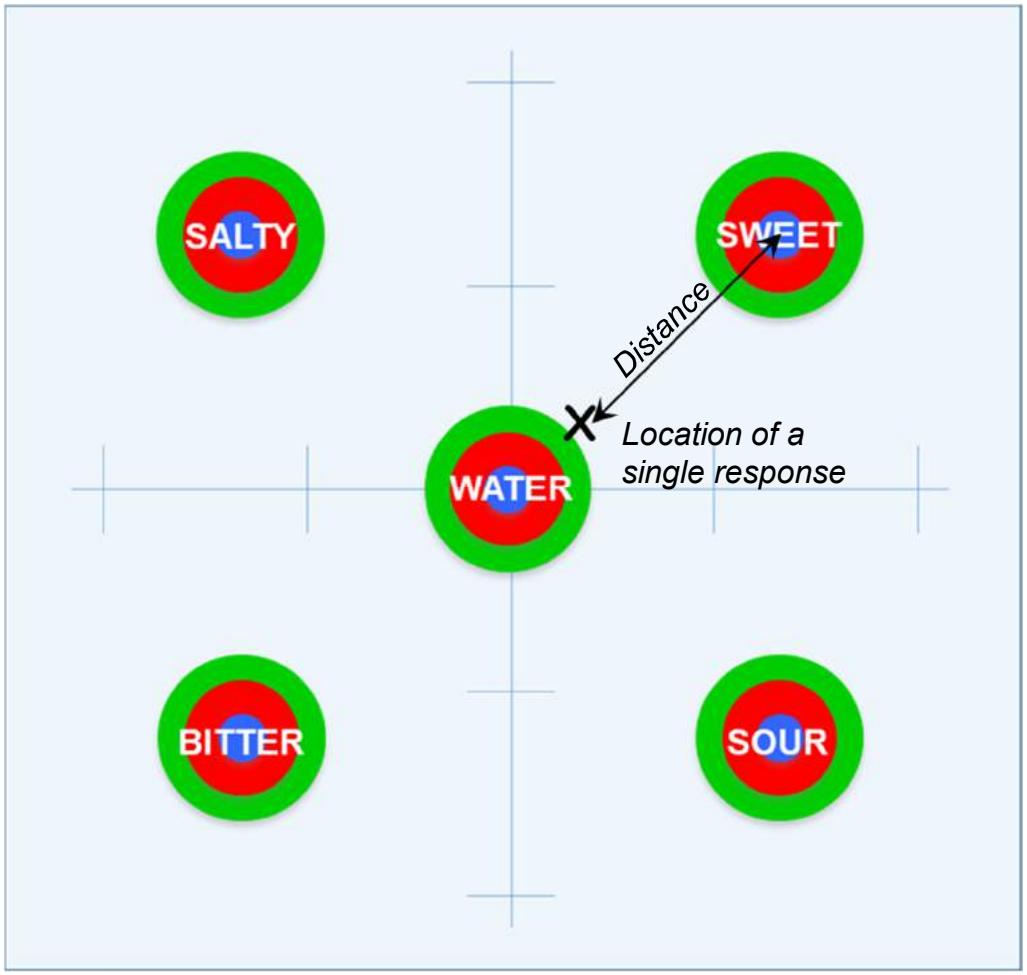
Responses to Test Articles Distribute According to Stimulus Generalization



- Test article are randomly presented multiple times (along with control standards)
- Responses to high and low concentrations of test article tend to cluster on standard target and water target coordinates
- Responses to intermediate concentrations tend to alternate or distribute between the targets

opertech bio
we make sense of taste®

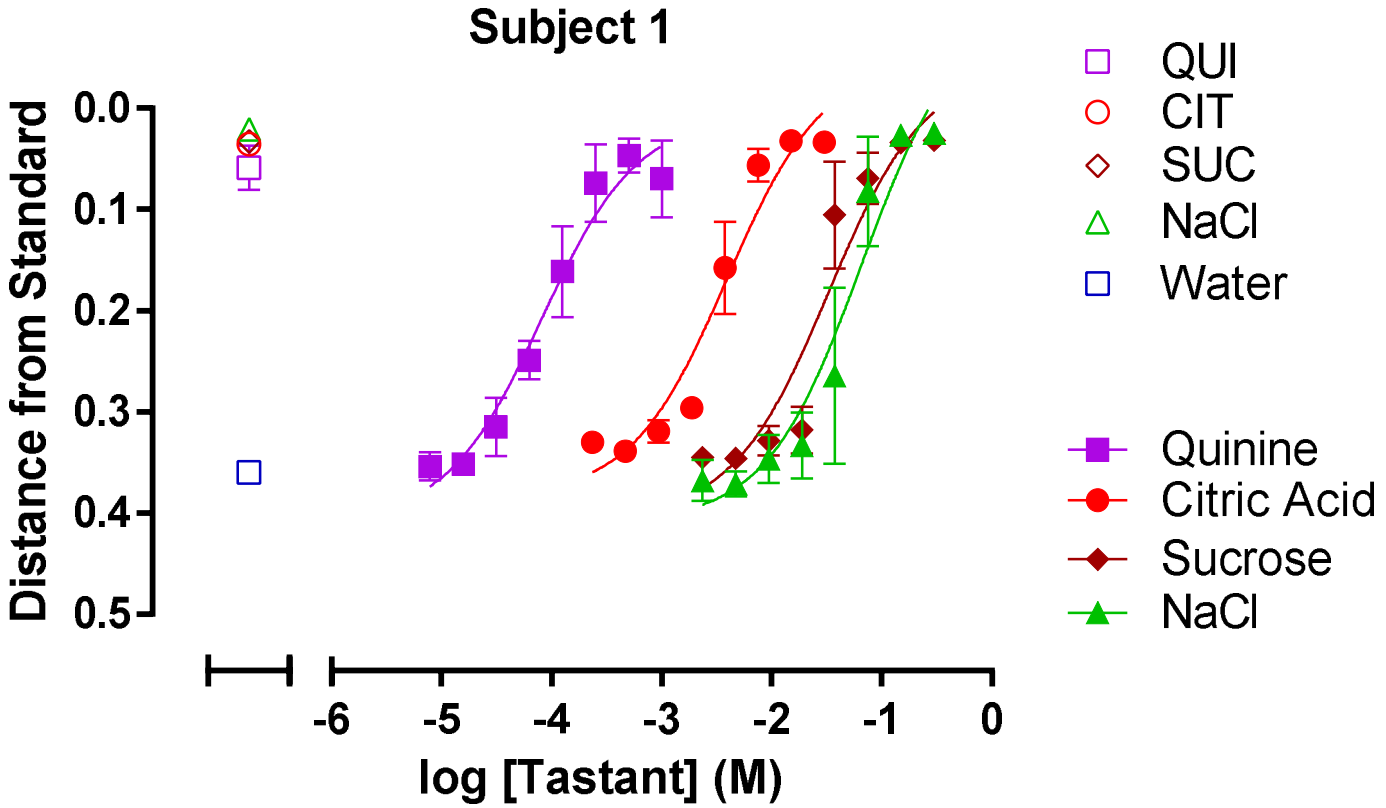
The Distances of the Subject's Responses from the Target of Interest is Measured and Plotted



opertech bio
we make sense of taste®

Responses are Plotted as Distance From Standard Target

Curve-fit Yields Concentration-Response Functions for Taste

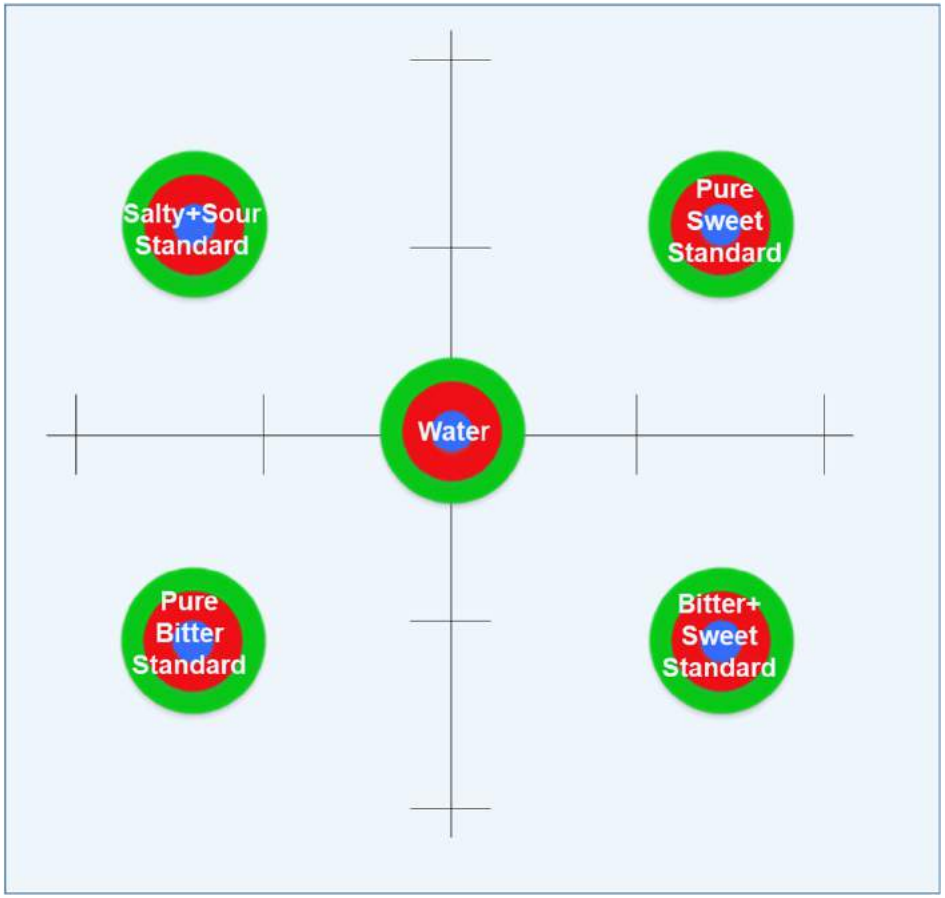


Complete concentration-response characterization for all four basic tastes achieved within single ~45 minute test session for a single subject

opertech bio
we make sense of taste®

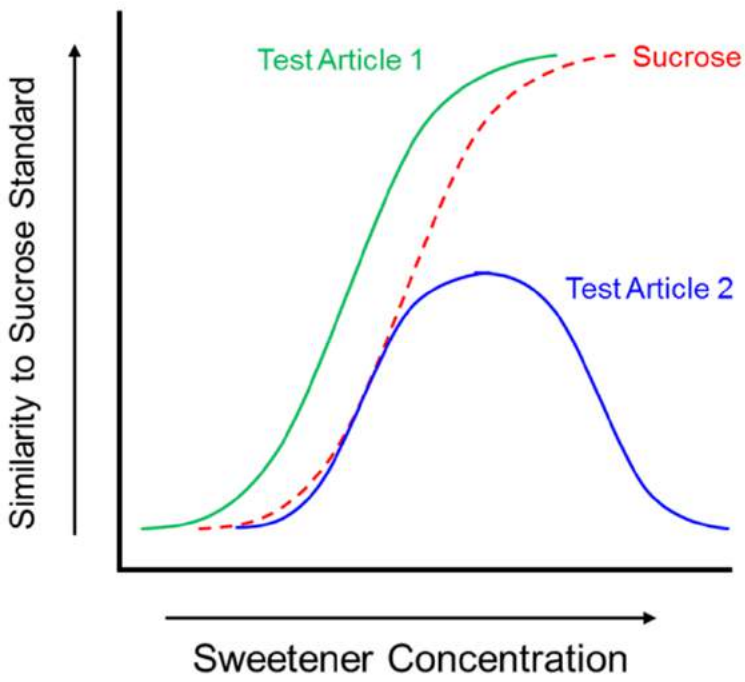
TāStation® Applications

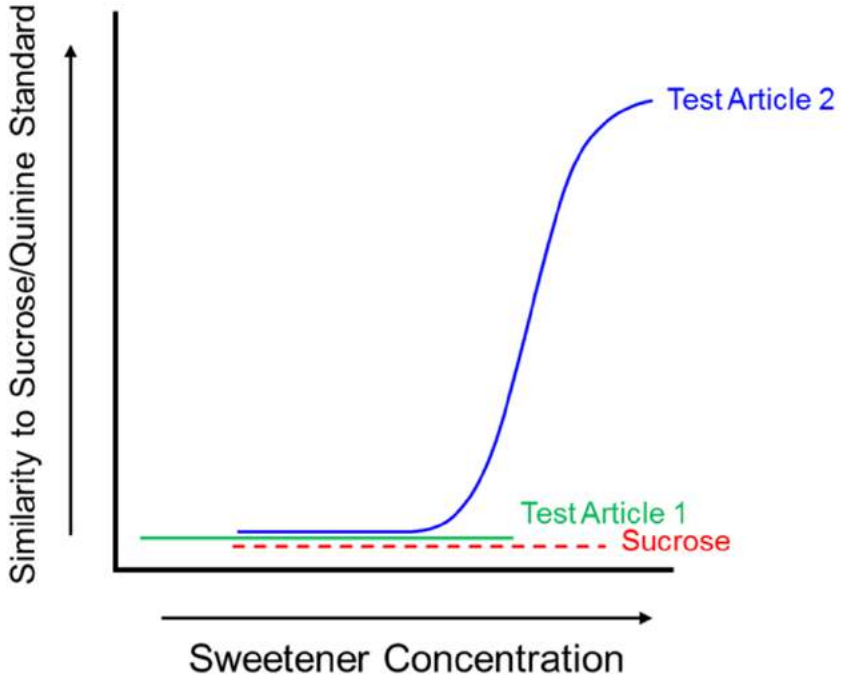
The Grid Can be Programmed to Accommodate Any Sensory Endpoint



opertech bio
we make sense of taste®

Concentration-Response Format Quantifies Taste Properties Across Entire Range of Activity

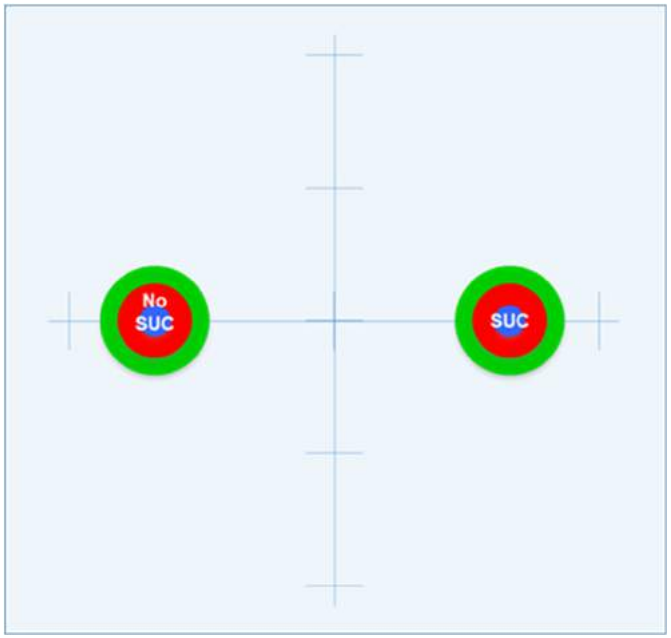


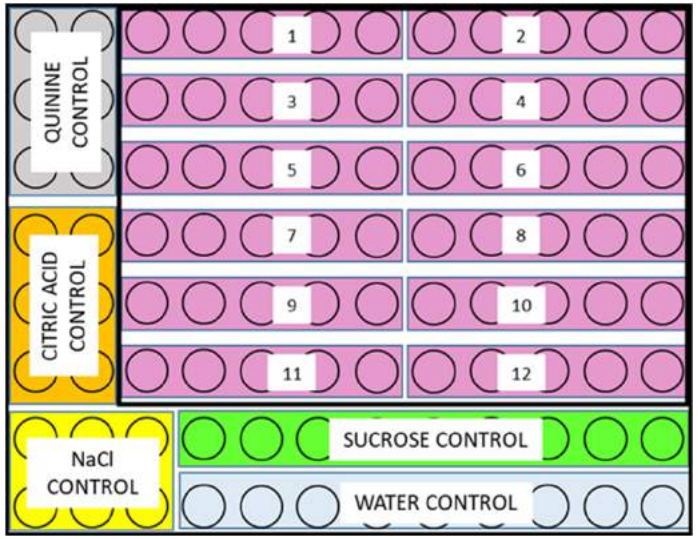


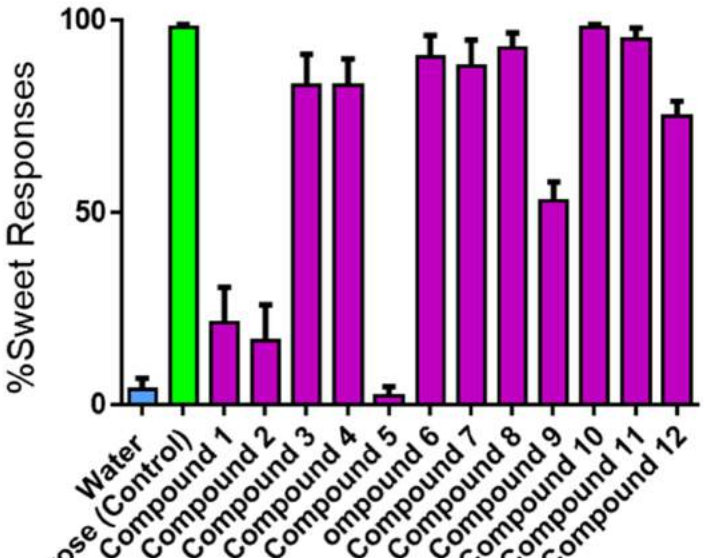
opertech bio
we make sense of taste®

Rapid Throughput Screening for Taste Active Substances

Simple “Sweet vs. Not Sweet”



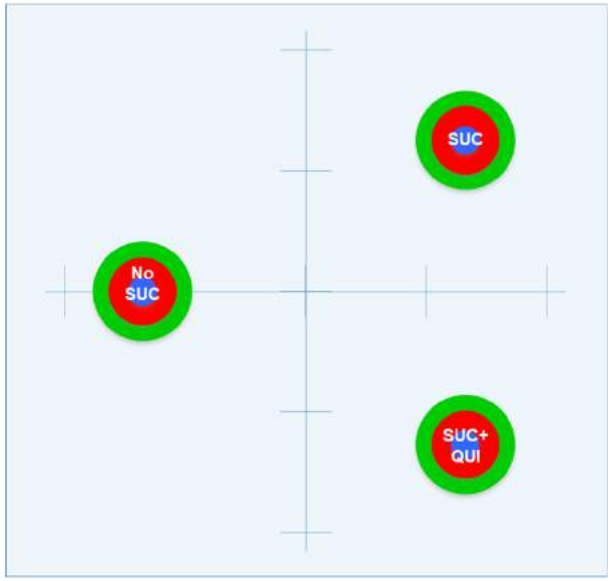


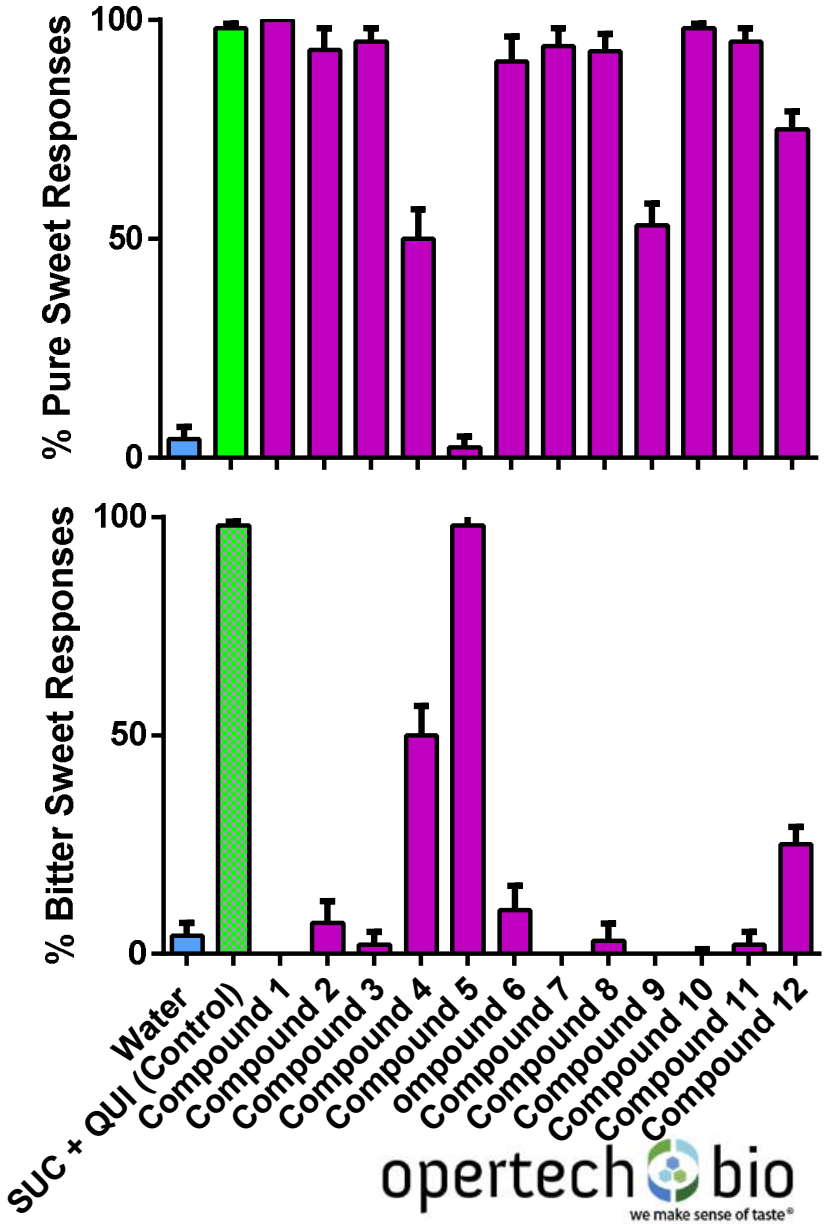


opertech bio
we make sense of taste®

Screening for Complex Taste Properties

"Pure Sweet, Bitter/Sweet, or Not Sweet"





opertech bio
we make sense of taste®

The TāStation® Approach

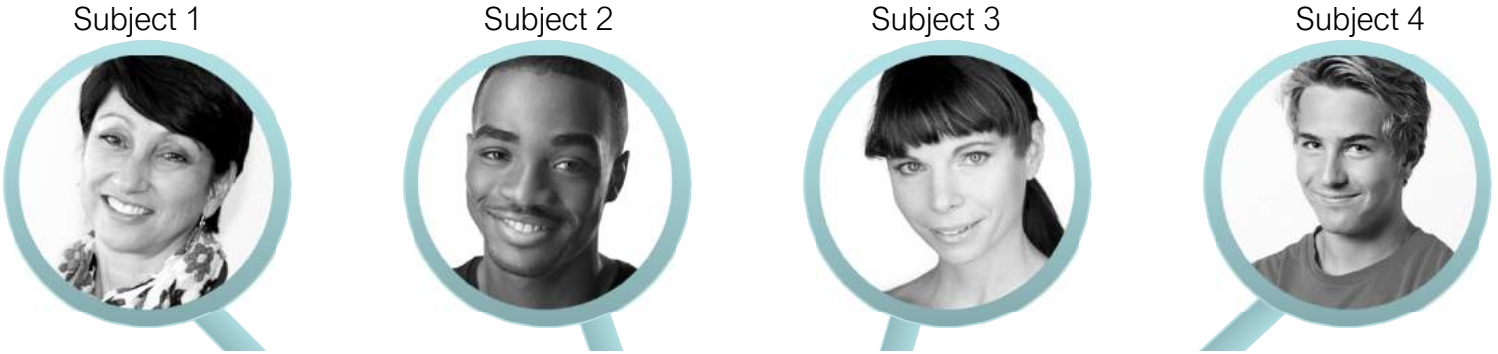
- Automated sample delivery
  - Reduce human errors
  - Reduce variability by increasing consistency
  - Increase throughput
- Small sample volumes
  - Decrease amount of materials
    - Minimizes or eliminates desensitization
    - Lower cost of ingredients
    - Saves on precious NP supplies
    - Decreases exposure lowering risk to subjects
- Interactive algorithms
  - Algorithm operates as a game
  - Consequences are tied to each response
  - Incentivizes accuracy, repeatability
  - Fun for the subject!
- Fewer subjects, more data per subject

opertech bio
we make sense of taste®

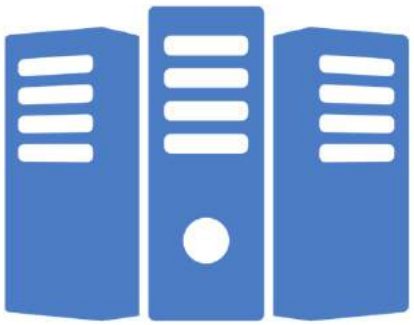
Test Protocol

More Data = Greater Informative Power

Subjects Log-in to Each Test



Each Subject Generates 100s of Data Points Per Test



DATABASE

Retrieval, Mining, Analysis

opertech bio
we make sense of taste®

TāStation® Applications

- **Discovery of novel flavor ingredients**
  - Ideal for evaluation of new tastants, enhancers, blockers
- **Flavor optimization**
  - Combinatorial strategy for development of best-tasting ingredient mixtures
- **Taste acuity**
  - Quantification: Identify who are the best taste testers
  - Training: Improve a person's taste-detection performance
- **Managing Subject Pool**
  - Rapid screening and evaluation of subjects prior to inclusion in a study
  - Tracking individual performances from test to test
- **Data mining**
  - Taste sensitivities and preferences across demographics
- **Preference ('Liking')**
  - Objective measure of preference (in development)

opertech bio
we make sense of taste®

TāStation® Flexible Business Models

Achieve optimal arrangement for client's objective

Fee for service

- Taste evaluation of new tastants, enhancers, blockers, and formulations
- TāStation® is portable
  - Client provides samples for testing at Opertech
  - Opertech brings TāStation® to client for testing at their location
- Taste acuity training and quantification

TāStation® licensing

- Apparatus and software

opertech bio

we make sense of taste®

Thank You.

Scott Horvitz, CEO

R. Kyle Palmer, PhD, CSO

Opertech Bio, Inc.

Pennovation Center Bldg. 176
3401 Grays Ferry Avenue
Philadelphia, PA 19146
Phone: 267-534-3248