



Taste, Flavor & Quality of Life

At Home With Growing Older

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Sensory Data Science



My Background



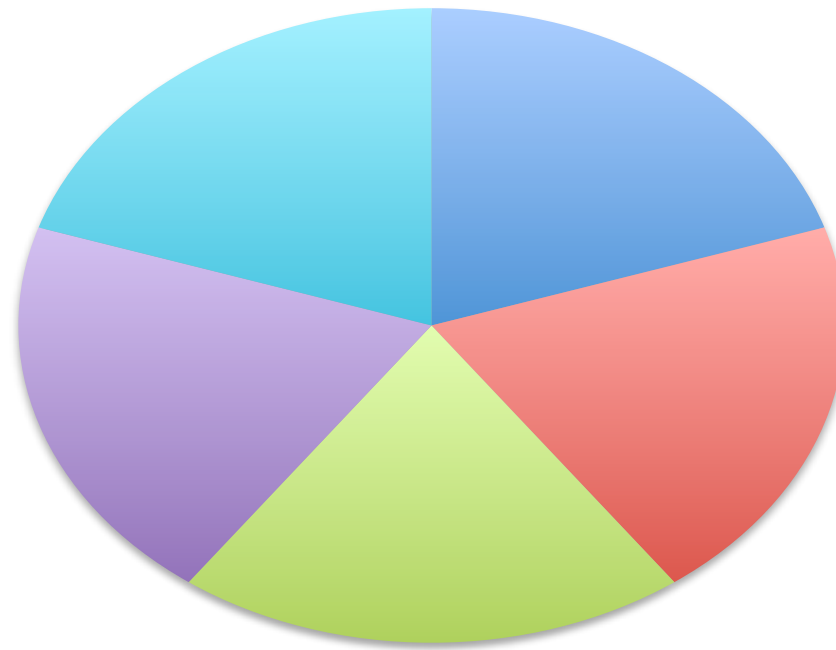
- ▶ Assist people to address problems with enabling technologies
- ▶ Collaborative Gerontechnology
- ▶ Formative evaluation of prototypes
- ▶ National Institute on Aging small business grants
 - ▶ Sensor-Enabled Elder Social Support Platform
 - ▶ Online Psychosocial Assessment Instruments
- ▶ Experience: 39 years software product development & management
- ▶ Education:
 - ▶ BS, MS, PhD Computer Science, MA Counseling, Data Science Certificate
 - ▶ Gerontology, Flavor Chemistry, Food Science Coursework

Basic Tastes

Taste
(Gustation)



Taste Components



- Umami (MSG)
- Sweet (Sugars)
- Sour (Citric Acid)
- Salty (NaCl)
- Bitter (Quinine)

Are there other basic tastes?

Bitter might be sub-divided into different types of bitter flavors.

Flavor Perception

Primary Human Senses

Visual

Olfactory

Gustatory

Chemesthesis

Tactile

Auditory



Major Sensory Properties of Food Material

Appearance

Aroma


Taste

Irritation

Texture



Contextual Inquiry

- Process – in-situ interview
 - Why
 - Users/Personas
 - Problems faced
 - Use cases
 - Obstacles to adoption
 - Pair up and let's do our own
- 



Inquiry Questions

- ▶ Demographic – Age? Gender?
- ▶ Food preferences – 3-5 favorite foods, 3-5 most disliked foods
- ▶ Rate tastes from +5 (really like) to -5 (really dislike); 0 = “take it or leave it”
 - ▶ Sweet, e.g. sugar
 - ▶ Salty, e.g. salt
 - ▶ Sour, e.g. lemon juice
 - ▶ Bitter, e.g. unsweetened baker’s chocolate
 - ▶ Umami, e.g. beef gravy
 - ▶ Hot/spicy, e.g. chili peppers
- ▶ Any problems with taste or smell?
- ▶ Cultural – grow up eating particular cuisine? Still eat it?
- ▶ Eating & cooking habits – where do you do most of your eating? At home? At work? On-the-go? Restaurants? How often do you cook for yourself? Others?



Harvesting

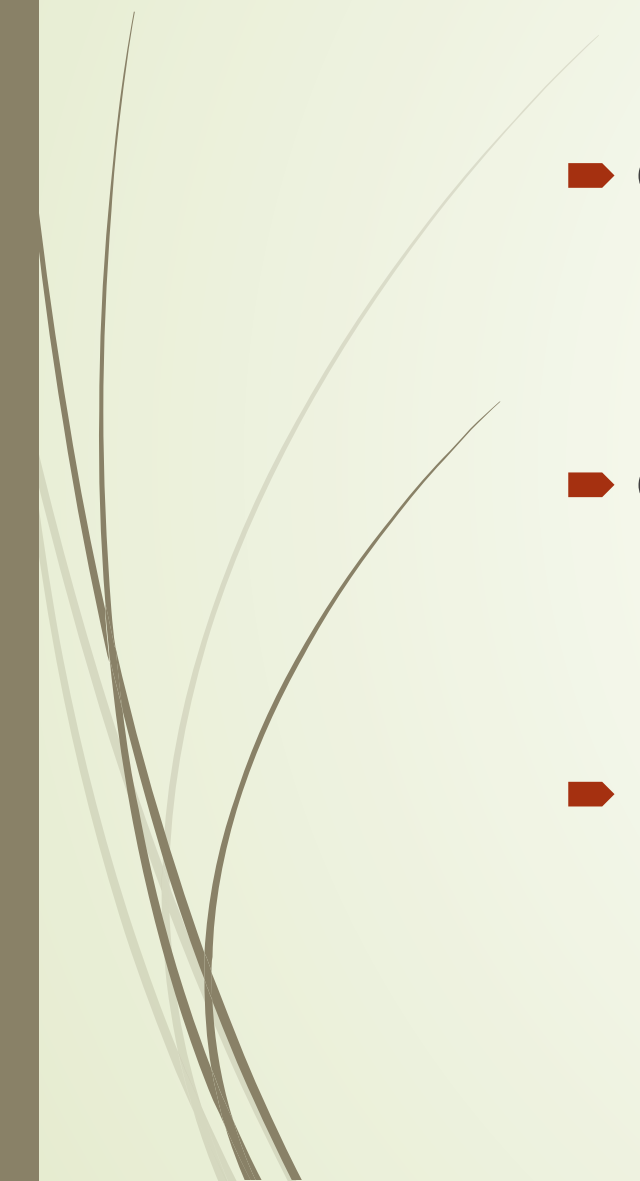
- Most liked foods
 - Most disliked foods
 - Any issues with taste or smell
 - Cultural cuisines
 - Differences between participants
 - Other insights
- 

Gustatory Dysfunction

- ▶ Phantom taste perception
 - ▶ Lingering, often unpleasant taste, though nothing in mouth
 - ▶ Most common taste disorder
- ▶ Hypogeusia – reduced ability to taste
- ▶ Aguesia – inability to detect any tastes
 - ▶ True taste loss rare
 - ▶ Most often, taste loss due to olfactory dysfunction
- ▶ Dysgeusia – distorted sense of taste
 - ▶ Persistent foul, salty, rancid, or metallic taste sensation in mouth
 - ▶ Sometimes accompanied by painful burning sensation in mouth
 - ▶ Burning mouth syndrome most common - middle-aged & older women



Olfactory Dysfunction

- ▶ Quantitative
 - ▶ Hyposmia - reduced ability to detect odors
 - ▶ Anosmia – complete inability to detect odors
 - ▶ Qualitative – Dysosmia
 - ▶ Parosmia - change in normal perception of odors
 - ▶ Phantosmia - sensation of odor that isn't there
 - ▶ Presbyosmia – smell loss due to aging
- 



Prevalence



- ▶ At least 2,000,000 Americans suffer from chemosensory disorders -- number likely to grow as aging segment of population increases
- ▶ More than 200,000 Americans visit doctor each year for help with smell or taste problem
- ▶ Many don't seek doctor's help
- ▶ Scientists believe up to 15% U.S. adults might have smell/taste problem
- ▶ Primary taste disorders less common than problems with smell
- ▶ Problems with smell may be experienced as taste disorders
- ▶ Increases exponentially with age
- ▶ National Health Interview Survey (1994) – > 40% people with smell/taste problems > 65 years old

Self-Reported Problems with Sense of Taste

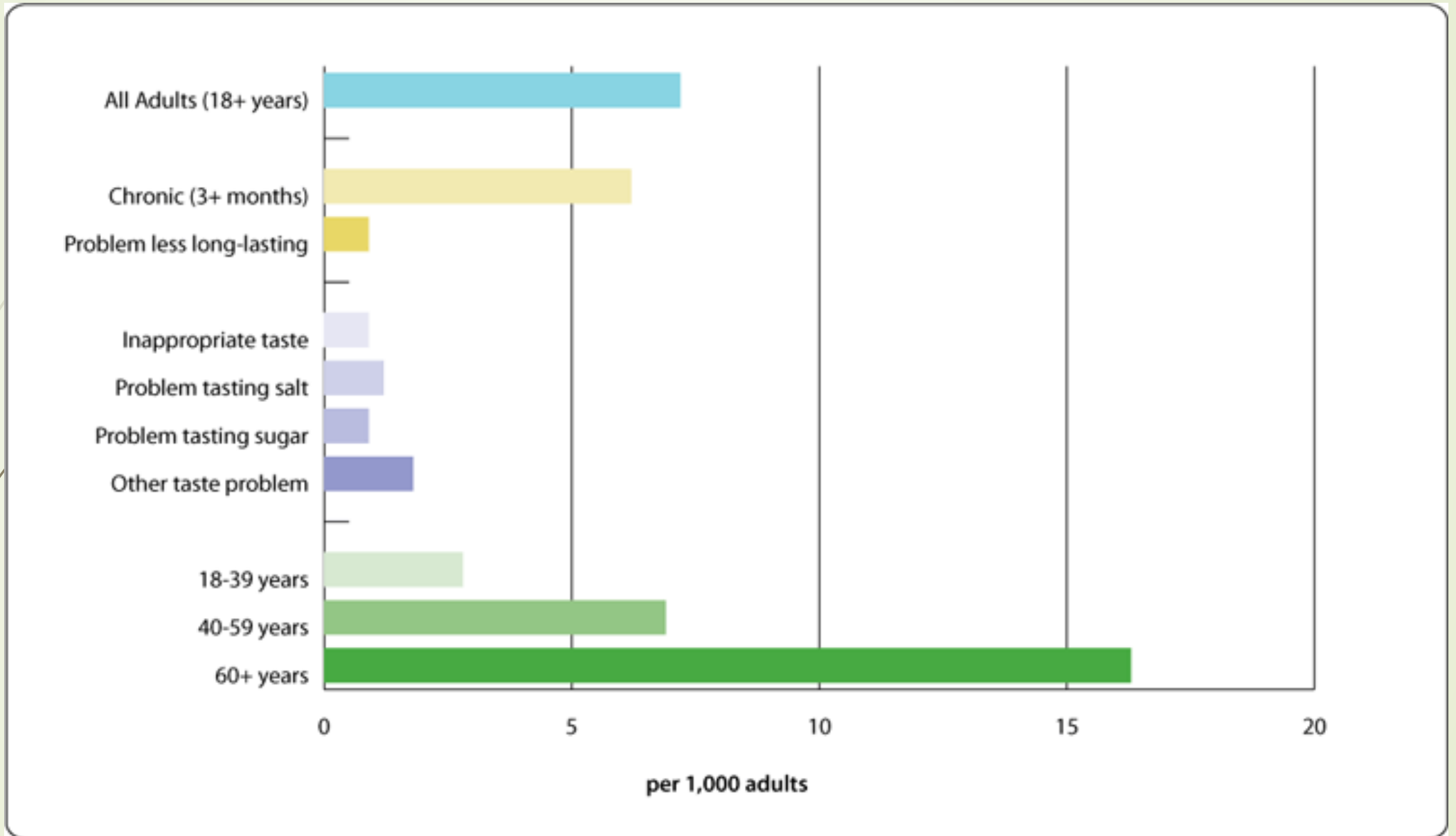
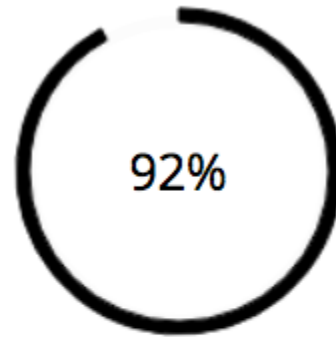
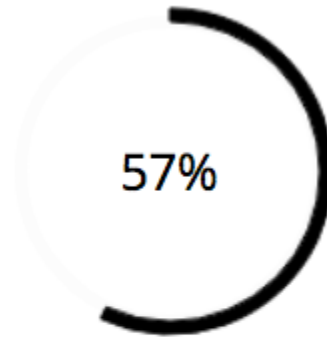


Chart created by the NIDCD Epidemiology and Biostatistics Program, based on questions in the U.S. National Health Interview Survey, Phase I Disability Supplement (NHIS-D), 1994-1995.

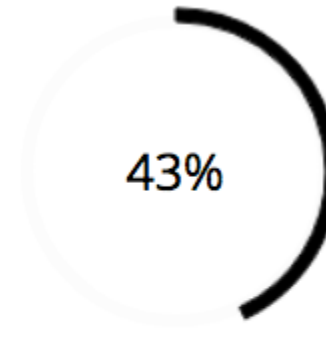
Quality of Life



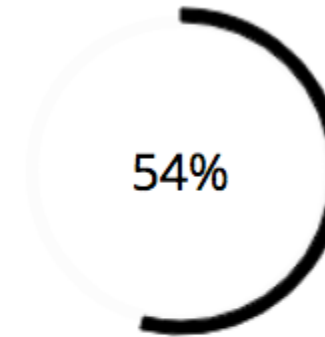
92% of respondents said that their appreciation of food and drink had been reduced



57% say they feel alone and isolated



43% have suffered from depression




54% have experienced difficulties in their relationship with partners, families and/or friends



85% are afraid of being exposed to dangers such as gas or spoiled food



Genetic Differences

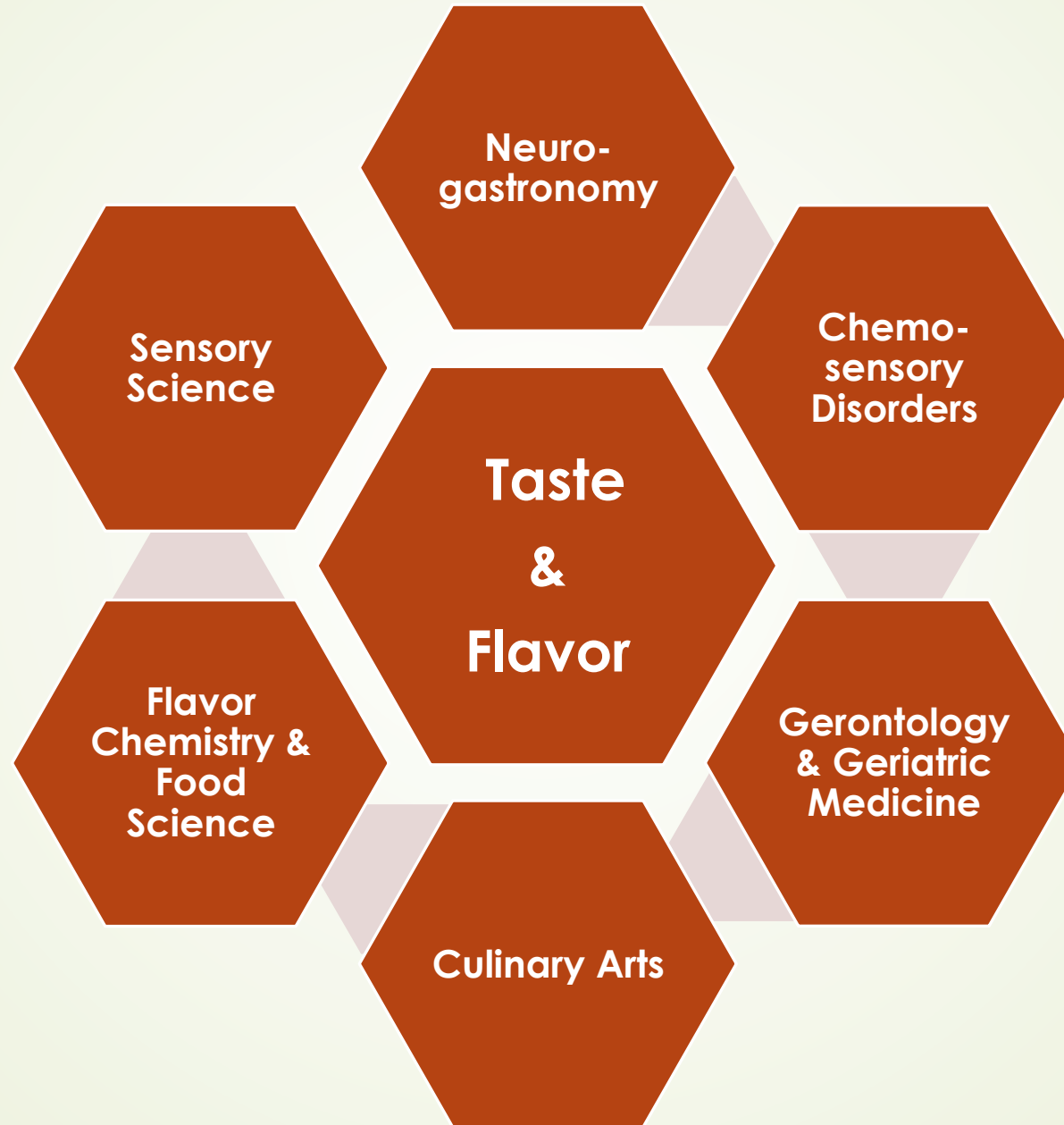
- ▶ Sensory panels – treat everyone same, but individual differences due to genetic & emotional factors
 - ▶ Ability to taste bitterness
 - ▶ Phenylthiocarbamide (PTC) or 6-n-propylthiouracil (PROP)
 - ▶ “Super-tasters” rate PROP extremely bitter tasting
 - ▶ U.S. - approximately 25% non-tasters, 50% medium tasters, 25% super-tasters
 - ▶ PROP super-tasters, medium tasters, or non-tasters proportion varies around world & different ethnic & racial groups
 - ▶ Medium tasters & super-tasters of PROP - more intense appreciation of other bitter, sweet, salty, or acidic tastes
 - ▶ Small variations in genetic code can raise or lower sensitivity to sweet tastes, which might influence desire for sweets
 - ▶ Individual differences influence dietary preferences & overall health status
- 



Food Preferences & Health

- ▶ People eat what they like
- ▶ Not necessarily what is good for them
- ▶ Top three factors underlying food choice
 - ▶ Flavor
 - ▶ Cost
 - ▶ Convenience
- ▶ NIH treats Flavor Chemistry as food industry issue rather than as health issue
- ▶ Missed opportunities from not considering what drives food choices
- ▶ Potential to expand palate, even for older adults (study in Sweden)

Taste & Flavor Ecosystem



Flavor Perception

- **Gerontology & Geriatric Medicine** – Sense of smell may fade causing food to taste bland. Some lose interest in eating & many try to improve flavor by adding more salt or sugar
 - People who have lost some sense of taste may not eat foods needed to stay healthy
 - Possible to introduce older adults to new foods & expand their palates
- **Culinary Arts** – Flavor compass for transformative combinations & dials to fine tune
 - Flavor heightening effects of cooking methods & cooking alchemy with seasonings
- **Flavor Chemistry & Food Science** – Scientists trying to restore taste & nutrition to foods that have had flavor bred out of them in favor of high yield & resilience to travel
 - Rather than looking for something that tastes like foods higher in sugar or salt, industry researchers aiming to concoct healthier combinations that are as tasty
- **Sensory Science** – Experience food through mouth as well as odor, vision, hearing, & touch, which can radically change taste of food or affect food preference
- **Neurogastronomy** – Manipulate variables through science & culinary artistry to help people with changed sense of smell or taste enjoy a meal again
- **Chemosensory Disorders** – Treat smell & taste disorders with clear & reversible causes



Culinary Arts & Sensory Science

- ▶ “With food, there are basically seven different kinds of adjustments you can make to balance what you have created: salt, sweet, sour, bitter, umami, fat, and heat.”
- ▶ “We call them the seven dials. They do not create flavor, but they fine-tune it in a magical way.”
- ▶ “The dials are aspects of taste that can be turned up or down, like the knobs on a stereo, to adjust flavor, in concert with the most important tool of all, your own sense of taste and smell.”



The Seven Dials



► Salt

- Salt pushes down sweet
- Salt pulls up sour
- Salt pushes down bitter

► Sweet

- Sweet pushes down salt, sour & bitter
- Sweet is heavy
- Sweet acts like a seasoning in dessert

► Sour

- Sour energizes
- Sour ingredients can work together
- Sour pulls down all other dials

► Bitter

- Bitter balances sweet
- Bitter is tamed by sour, salt & fat

► Umami

- Umami intensifies
- Salt amplifies umami
- Acid diminishes umami

► Fat

- Fat fixes
- Fat pushes down sour, salt, bitter & heat

► Heat

- Heat creates dynamic, complex flavor
- Heat alleviates richness
- Heat intensifies spices
- Heat works well with every other dial

Personalized Flavor Guide

Taste Preference
Profile

Taste Impairment
Profile

Organoleptic
Properties of Food

Taste Typology Instrument

Food Ontologies

Data Science

Internet of Food



Summary



- Genetic differences influence what tastes good to people
- Individuals have their own likes and dislikes
- Taste Typology Instrument to determine clusters of Taste Preference Profiles
- As people age, smell &/or taste may change
- Medications or treatment may affect smell &/or taste
- Nutritional recommendations should consider preferences & issues
- Personalized Flavor Guide – recommendations based on individual profile
- Introducing new foods can expand options – even for older adults



Resources



- Benay Dara-Abrams, PhD
 - benay@dara-abrams.com
 - Sensory Data Science -- <http://www.sensorydatascience.com>
 - Coming soon -- Newsletter & online discussion forum
- American Chemical Society -- <https://www.acs.org>
- Fifth Sense, UK -- <http://www.fifthsense.org.uk/>
- International Society of Neurogastronomy -- <http://isneurogastronomy.com/>
- Internet of Foods UC Davis -- <https://www.ic-foods.org>
- Monell Chemical Senses Center -- <http://www.monell.org/>
- NIH National Institute on Aging (NIA) -- <https://www.nia.nih.gov/health/smell-and-taste>
- NIH National Institute on Deafness and Other Communication Disorders (NIDCD) -- <https://www.nidcd.nih.gov/health/taste-smell>
- University of Florida Smell Disorders Program -- <http://smellclinic.cst.ufl.edu/>



Selected References



- ▶ “Chemosensory Function and Dysfunction” in *Critical Reviews in Oral Biology and Medicine*, A.I. Spielman
- ▶ *Gastrophysics: The New Science of Eating* by Charles Spence
- ▶ *Neurogastronomy: How the Brain Creates Flavor and Why It Matters* by Gordon M. Shepherd
- ▶ *On Food and Cooking: The Science and Lore of the Kitchen* by Harold McGee
- ▶ *Season to Taste: How I Lost My Sense of Smell and Found My Way* by Molly Birnbaum
- ▶ *Taste Buds and Molecules: The Art and Science of Food, Wine, and Flavor* by Francois Chartier
- ▶ *The Art of Flavor: Practices and Principles for Creating Delicious Food* by Daniel Patterson and Mandy Aftel
- ▶ *The Flavor Bible* by Karen Page and Andrew Dornenburg