


# Food Science and Nutrition

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## Session Outline

**Definitions...**

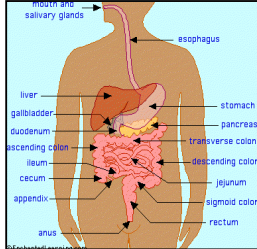
- Food science
  - The classroom experience
- Sensory perception
  - Interactive in-class experiences


## What is Food Science?



## What Food Science is not...




**Nutrition**



**Culinary Arts**

## Goal of Food Science



**“To transform perishable, unpalatable, or hardly edible raw materials into tasty, nutritious, stable and enjoyable foods.”**

Flores, Food Tech 62 (5): 11

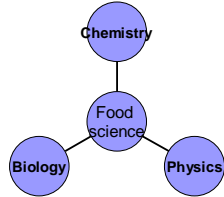
## Food Scientists...

- Study the makeup of food
  - Physical
  - Microbiological
  - Chemical
- Develop ways to **process, preserve, package, and store** food, according to **industry specifications and government regulations.**



## Food science is...

... a  
**multi-  
disciplinary  
applied science.**



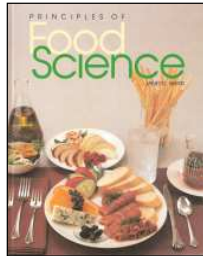
*Puts scientific knowledge to practical use!*

## Food Science involves...

- **Experimentation**
- Experimentation involves **measurements**
  - Chemical measurements
  - Physical measurements
  - Physicochemical measurements
  - Sensory (human) measurements
- **Reliable measurements** involve the **Scientific Method**

## Food Science is...

- The study of the nature of food and the principles of its production, processing, preservation and packaging.



Ward, 2002

## Food Science is...

a discipline concerned with all technical aspects of **food**, beginning with **harvesting** or **slaughtering**, and ending with its **cooking** and **consumption**.



Wikipedia, 2008

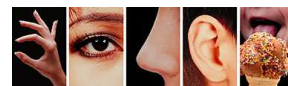
## Food Science involves...

- **Experimentation**
- Experimentation involves **measurements**
  - Chemical measurements
  - Physical measurements
  - Physicochemical measurements
  - **Sensory (human) measurements**
- **Reliable measurements** involve the **Scientific Method**

## Sensory analysis in a nutshell

*"Study of how food is perceived by the senses"*

- A key aspect of food quality assessment
- Centered around measuring human perception and applying the learning





## The sensory characteristics of food

- Appearance
- Flavor
- Texture
- Overall Acceptability



## Flavor


Involves the basic senses of taste and smell

The interactions in the mouth of...

- basic tastes
- smell
- mouthfeel sensations


## Taste



- Properties perceived through the taste buds.
- Bitter, sour, salty, sweet and umami

*“Essentially the basic tastes can be perceived on all loci where there are taste receptors”* (Bartoshuk, 1993)

## Foods high in umami



- Peas
- Parmesan cheese
- Bonito flakes
- Shitake mushrooms
- Sardines
- Tomato juice
- Dried seaweed (nori)
- Green tea
- Soy sauce
- Fish sauce

## The 5<sup>th</sup> basic taste modality-- Umami or savory

- Detection requires...
  - Free glutamic acid
- Perception effects...
  - Enhances inherent flavor
  - Adds...
    - fullness
    - complexity
    - balance

- Levels in food are affected by...
  - Stage of ripeness
  - Aging
  - Drying
  - Fermentation
- All processes... breakdown foods into smaller units

## The 5<sup>th</sup> basic taste modality-- Umami or savory

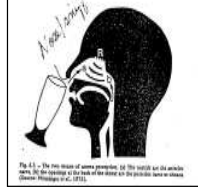
- Sampling...
  - Miso soup



## Smell

The perception of volatiles by the cells in the nasal area

- Odor– sniff, perceived through nose
- Aromatics– volatiles perceived as food is masticated in the mouth



## Mystery Granules Procedure

1. Uncap vial at arm's length
2. Manipulate tongue to stimulate saliva flow
3. Pinch nose tightly
4. Tip head back and stick out tongue
5. Pour granules on tongue and manipulate with tongue

*Think– what do I perceive now?*  
Close mouth, release nose and inhale

*Think– what do I perceive now?*



## Mystery Granules

- What is the **basic taste**?  
SWEET!
- What is the **aromatic**?  
CINNAMON!



## Mouthfeel

Sensations perceived by the nerves in the skin of the mouth cavity.

### ■ Thermal

Hot



Cold

### ■ Chemical

Warm



Cool

## Mouthfeel

Sensations perceived by the nerves in the skin of the mouth cavity.

### ■ Burning



### ■ Astringent



## Trigeminal sensations

### Sampling...

- Crystallized ginger
- Cinnamon Altoids



## Trigeminal verbal descriptors

- Pungent
- Burning
- Painful
- Sharp
- Astringent
- Furry
- Scratching
- Tickling
- Prickling
- “Sneeze’
- Cool
- Warm

(Laska, 2001)

## Texture

- Involves the senses of sight, touch and hearing. The sense of touch involves both the skin and the muscles.



- Perception of the structure or inner make-up of foods...
  - Mechanical Characteristics
  - Geometrical Characteristics
  - Moisture and Fat Influences

## Texture Terms- Mechanical Characteristics

Primary	Secondary	Popular Terms
hardness	-----	soft > firm > hard
cohesiveness	brittleness	crumbly > crunchy > brittle
-----	chewiness	tender > chewy > tough
-----	gumminess	short > mealy > pasty > gummy
viscosity	-----	thin > thick
springiness	-----	plastic > elastic
adhesiveness	-----	sticky > tacky > gooeey

## Texture Terms- Geometrical Characteristics

Particle Size and Shape		Particle Shape and Orientation	
smooth	grainy	flaky	foamy
fine	coarse	fibrous	puffy
powdery	lumpy	stringy	crystalline
chalky	beady	pulpy	glassy
gritty	mealy	cellular	gelatinous
		aerated	spongy

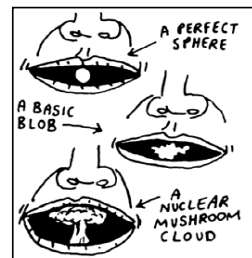
## Texture— Fat and Moisture

Moisture Content			Fat Content		
wetness			oiliness		
moisture release			greasiness		
rate of moisture release					
moisture absorption					
Popular terms related to mouthfeel and mouthcoating					
dry	wet	watery	oily	waxy	creamy
moist	juicy		greasy	slimey	mushy

## Texture



- Perception of texture changes with mastication
- Sequential...
  - initial impression
  - first bite
  - during chewing
  - residual phase



## Appearance

A visual manifestation of color, gloss, size and shape

### ■ Determines your initial opinion of a food product...

- Flavor Recognition
- Perceived Flavor Intensity
- Initial Assessment of Texture



## Appearance

- **Sampling**– virgin Jello shots
- Make Jello and manipulate the color
  - Lemon– green
  - Orange– red
- Sample and identify the flavor present



## “IS THIS FOOD ACCEPTABLE?”



### ■ Consumer decision-making...

- 60% Food Quality
- 40% Other Factors
  - Health
  - Nutrition
  - Religion
  - Ethnicity
  - Economics
  - Advertising
  - Lifestyle
  - Regional influence

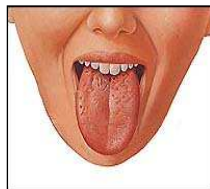
## Taster status– individual differences

Are you  
or  
are you not  
a  
**supertaster?**



## Identification of Supertaster Status

- Sensitivity to:
  - PTC– phenylthiocarbamide
  - PROP– 6-n-propylthiouracil
- US population is:
  - 25% nontasters
  - 50% medium tasters
  - 25% supertasters



- Testing method:
  - 1 suprathreshold concentration

**PTC– phenylthiocarbamide; PROP– 6-n-propylthiouracil**

## Supertaster??



### ■ Bag filter paper strips in coded bags

- Control (plain) (orange dot)
- PTC (green dot)

- Provide... water, cracker, carrots/apple as palate cleansers



## Supertaster??

### Procedure...

1. Wet tongue
2. Place appropriate strip on tongue for 20 sec



3. Record response on scorecard

Scorecard for Taste Test					
Paper 1 Orange Dicit					
Taste Present:	No Taste	Slight Taste	Moderate Taste	Strong Taste	Very Strong Taste
Take a sip of water --- repeat with paper 2					
Paper 2 Green Dicit					
Taste Present:	No Taste	Slight Taste	Moderate Taste	Strong Taste	Very Strong Taste
Take a sip of water, bite of cracker or carrot if you would like to clean your mouth.					

## Supertaster??

### Interpretation...

•Paper 1 is the control-- should only taste like paper

•Paper 2 is PTC paper-- bitter

•Non-taster-- no taste, slight taste

•Medium taster-- moderate or strong taste

•Supertaster-- very strong taste (strongest taste imaginable)

Scorecard for Taste Test					
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## Bitterness perception-- sensitivity

- Genetically linked
- Women more likely to be sensitive
- Asian, African, Native American heritage > than European heritage
- Related to differences in taste bud density

(Duffy and Bartoshuk, 2000; Bartoshuk, 1993)

## PTC/PROP sensitivity

- More sensitive to all basic tastes
- Affects perception of other food components  
*With increased PROP sensitivity...*
  - Liking of sweet and high-fat foods decreased with among women; increased among men
  - Increased burn from capsaicin
  - Increased warmth from alcohol
  - Frequency of consumption of dark green vegetables, grapefruit, black coffee decreased

(Duffy and Bartoshuk, 2000; Bartoshuk, 1993)

## Product Identification Integrating it all!

## Pureed Product Identification-- Demo

1. Blindfold student
2. Open food container
3. Present to nostrils  
*Identify by smell*
4. Present to mouth  
*Identify by taste + smell*
5. Cleanse palate
  1. Water
  2. Crackers
  3. "X" cup/ napkins

- green beans
- squash
- rice
- chicken
- pureed cottage cheese



