Cooking Up Plant-based Meals without Ditching the Omnivore

A Nutrient-Density & Sensory Approach

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PRESENTER
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Disclosures: Michele Redmond, MS, RDN, CC, FAND

- Chef Dietitian & Food Enjoyment Activist at The Taste Workshop
- Board Member/Chair: Food & Culinary DPG: the Academy of Nutrition & Dietetics and The International Association of Culinary Professionals
- Consulting: Arizona Department of Education, Dignity Health, Dairy Councils, Maricopa County, ASU, Glutamate Association, Ajinomoto, AND
- ***Food & Nutrition Magazine*** contributor

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Learning Objectives

1. Apply nutrient-density considerations to food categories and include a diversity of ingredients to offer people flexibility to improve their vegetable intake and diversify towards a more plant-rich diet.
2. Demonstrate how plant-based meals can include a variety of foods and products that range within a nutrient-density continuum.
3. Modify recipes and adapt more meat-centric meals to be more nutrient dense and plant-rich without loss of flavors and textures.

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Plant-Based
Meals?

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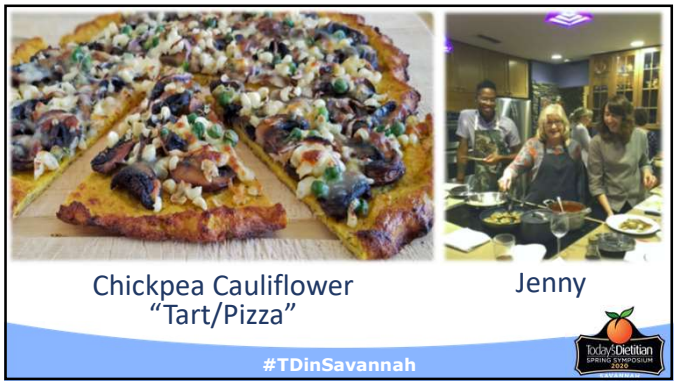
Chickpea Cauliflower
"Tart/Pizza"
Jenny
#TDinSavannah

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"You don't need meat with this?"

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The Omnivore and Diet Diversity

- Over 90% Omnivore
- About 8% other:
  - 3% Vegan
  - 5% Vegetarian

Miki A, Livingston K, Karlsen M, Folta S, McKeown N. Using Evidence Mapping to Examine Motivations for Following Plant-Based Diets. Curr Dev Nutr. 2020 Mar; 4(3) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7042611/

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Consumer Meat & Poultry Intake (U.S.)

Average intake per person:

- 2016: 214 pounds
- 2017: 217 pounds
- 2018: 222 pounds

The Organization for Economic Cooperation and Development (OECD) https://www.weforum.org/agenda/2018/08/these-countries-eat-the-most-meat-03bdf469-f40a-41e3-ade7-7e669b2c3094/ Americans will consume a record amount of meat in 2018 https://www.globalagriculture.org/whats-new/news/en/23221.html03.01.2018

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Vegetable & Fruit Intake

90% of adults didn't meet minimum recommended daily levels

https://www.cdc.gov/nutrition/data-statistics/fruits-vegetables-2018/2018-fruit-vegetable-report.

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Daily Whole Grain Intake
84% of adults didn't meet minimum recommended daily levels
Adams JN, Maddock K, Terry AL, Hughes J. Contribution of Whole Grains to Total Grains Intake Among Adults Aged 20 and Over, United States, 2013–2016. NCHS Data Brief no. 371, July 2019

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Plant-Based Product Popularity
Consumers:
• 23% wanted more plant-based proteins
• 39% tried to eat more plant-based foods
Media mentions:
• 268% increase 2012-2018
• Targeted to omnivores
Plant-based Proteins are gaining dollar share among North Americans. Niesen. CPG, FMCG & RETAIL 09-22-2017
https://www.nielsen.com/us/en/insights/article/2017/plant-based-proteins-are-gaining-dollar-share-among-north-americans/
https://www.washingtonpost.com/news/voraciously/wp/2019/02/15/how-plant-based-rebranded-vegan-eating-for-the-mainstream/

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Popularity is Not a Dietary Pattern
• Not linked to more vegetable intake
• Plant-based product health halo
• Plant-based confusion
• Foods/products vs eating patterns
• What's included?
• Who's included?
How Did We Get to the Term "Plant-Based?" November 12, 2019
https://www.hartman-group.com/newsletters/1515684244/how-did-we-get-to-the-term-plant-based-the-role-of-plants-in-our-diets-language-and-culture

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Why Might Omnivores Feel Ditched or Excluded?

Plant-based Meal Concerns

- Restrictions & giving up foods
- Flexibility

Food Culture and Exclusivity

- Joining a group or changing lifestyle
- Health is not enough?

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Food Culture & Personal Choice

"I was a vegetarian until I started leaning toward the sunlight."

Rita Rudner

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"Meat" as "Essential?"

Survey on "Meat" Perspectives:

- 67% agreed it's essential to a balanced diet
- 51% believed a meal is not complete without meat

Mintel, Food & Drink Pace, Taste is the top reason us consumers eat plant-based proteins, February 15th, 2018

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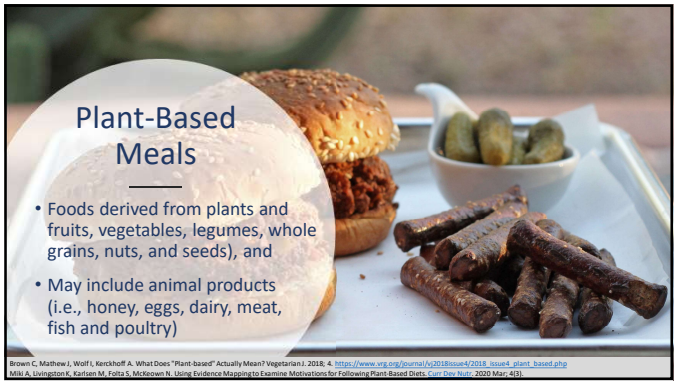
Plant-Based Meals
• Foods derived from plants and fruits, vegetables, legumes, whole grains, nuts, and seeds), and
• May include animal products (i.e., honey, eggs, dairy, meat, fish and poultry)
Brown C, Mathew J, Wolf I, Kerckhoff A. What Does "Plant-based" Actually Mean? Vegetarian J. 2018; 4. https://www.vrg.org/journal/vj2018issue4/2018_issue4_plant_based.php
Miki A, Livingston K, Karlsen M, Folta S, McKeown N. Using Evidence Mapping to Examine Motivations for Following Plant-Based Diets. Curr Dev Nutr. 2020 Mar; 4(3).

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Diverse Plant-Based Meals
• Walnut mushroom sloppy joe
• Niçoise salad
• Parsnip soup
• Smoked gouda cauliflower gratin

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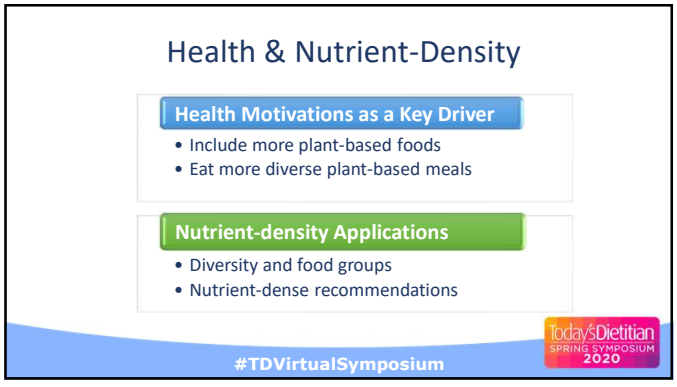
Health & Nutrient-Density
Health Motivations as a Key Driver
• Include more plant-based foods
• Eat more diverse plant-based meals
Nutrient-density Applications
• Diversity and food groups
• Nutrient-dense recommendations
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Nutrient-Dense Foods

"foods and beverages that provide: vitamins, minerals, and other healthful substances that contribute to adequate nutrient intakes or may have positive health effects"
and…
include all vegetables, fruits, whole grains, seafood, eggs, beans, peas, nuts, seeds, lean meats and poultry and ***fat-free*** *and* ***low-fat*** *dairy products groups when purchased, prepared, served and consumed* ***with little or no****:*
saturated fats, added sugars, sodium or refined starches

1. Diet-like language
2. No focus on food acceptability
3. Nutrient-profiling systems vary

The Dietary Guidelines for Americans 2015-2020: page IVX Introduction

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Diversity & Nutrient Opportunities

	Reduce carbs & "starchy" carbs	Reduce carbs & sugar	No-fat or low-fat
Common Diet-like Restrictions			
Food Groups			
Shortfall and Underconsumed Nutrients	Potassium, vitamin C, fiber, magnesium & fortified flour	Potassium, vitamin C, fiber, magnesium & fortified cereal	Calcium, magnesium, choline, potassium, vitamin E, D

Drewnowski A, Dwyer J, King J, Weaver C. A proposed nutrient density score that includes food groups and nutrients to better align with dietary guidance. Nutr Rev. 2019 Jun; 77(6): 404–416. US Department of Health and Human Services 2015-2020 Dietary Guidelines for Americans December 2015. https://health.gov/dietaryguidelines/2015/guidelines/chapter-1/a-healthy-eating-pattern/

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Nutrient-Profiling Variation

Restrictions and Consumer Confusion

% top score	Certain plant-based foods & nutrients score high & calories penalized
100	Kale, collard greens, Swiss chard
50-70	Romaine, arugula, spinach
30-49	Cruciferous veggies
6-13	Tomato, tofu, kidney beans
3-4	Oatmeal, salmon, eggs, 1% milk, whole wheat
2-2.8	Nuts, avocado, brown rice, low-fat plain yogurt, chicken breast, lean beef
<2	Naturally higher-fat foods & refined grains

% top score	Certain proteins score high
100	Liver
58	Herbs & spices
35	Nuts & seeds
28	Fish & seafood
20	Beef, lamb, wild game
18	Raw vegetables
11-15	Legumes, poultry, eggs, dairy
6-7	Grains & cooked vegetables

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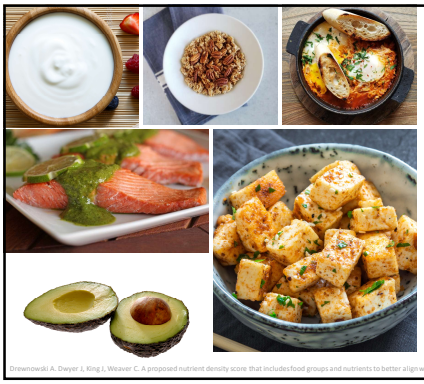

Nutrient-Density, Diversity & Food Acceptability

- Some higher-calorie foods
- No "best" eating pattern: healthy/healthier
- Diversity and nutrient-rich
- Food acceptability:
  - Flavor matters
  - Fat adds/carries flavor
  - Role of salt and sugar

Drewnowski A, Dwyer J, King J, Weaver C. A proposed nutrient density score that includes food groups and nutrients to better align with dietary guidance Nutr Rev. 2019 Jun; 77(6): 404–416.

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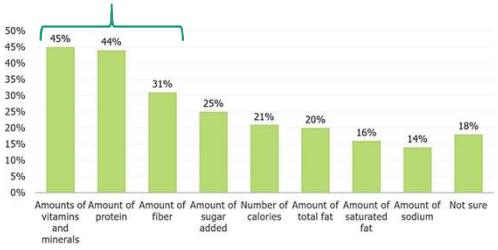
Seeking Nutrient-Dense Foods: People Seek Beneficial Nutrients More than Nutrients to limit

Q6. Thinking about the Nutrition Facts label on packaged foods, which of the following do you feel would best help identify nutrient-dense foods? Please select up to 3 answers.



LC2

A SURVEY OF CONSUMER BEHAVIORS AND PERCEPTIONS OF NUTRIENT DENSITY| IFIC FOUNDATION 2019 | FOODINSIGHT.ORG

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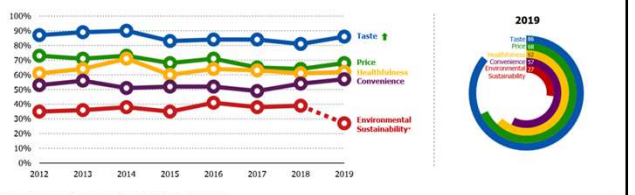
Taste and Price Remain Top Drivers

Taste is more important to older consumers while price is more important to younger ones; the importance of taste has increased since 2018

Purchase Drivers Over Time
(% 4-5 Impact out of 5)



Q8: How much of an impact do the following have on your decision to buy foods and beverages? (n=1,012)
*Prior to 2019, Environmental Sustainability was asked simply as "Sustainability"

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Reprinted from the International Food Information Council Foundation, *2019 Food and Health Survey: Consumer Attitudes*

FOODINSIGHT.ORG

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Slide 23

LC2 MR: Need to cite this graph fully according to the IFIC website. "Reprinted from the International Food Information Council Foundation, (year of publication)" - I couldn't edit the graph otherwise I would have added it in.
Leslie Cimei, 4/30/2020

Food Acceptability and Cooking Up Plant-Based Meals for Omnivores

Food Acceptability
- Social-Environmental
- Palatability
- Flavor Perception

In the Kitchen
- Flavor Sensory Tools: Aromas & Textures
- Strategies and Opportunities

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Influences on Food Acceptability

Social-Environmental
- Memories & emotions
- Surroundings
- Health

Palatability: Acceptance & Pleasure
- Appearance, feel & sounds
- **Flavor Perception**
  - Taste qualities
  - Odors & aromas
  - Physical sensations

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Palatability: Acceptance & Pleasure

- Multi-sensory: how we respond
  - Visual cues: color, shape etc.
  - Feel: tactile, touch
    - Engagement and cooking
  - Sounds, etc.

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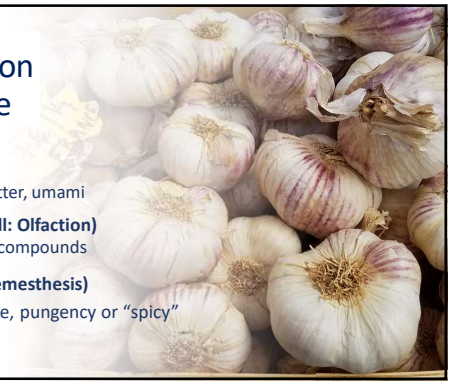
Flavor Perception is All of These



- **Taste (Chemosenses)**
  - Sour, sweet, salty, bitter, umami
- **Aromas (Sense of Smell: Olfaction)**
  - Odors and aromatic compounds
- **Physical Sensations (Chemesthesis)**
  - Texture, temperature, pungency or "spicy"

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Flavor Perception & the "Omnivore's Palate"

- **Taste (Chemosenses)**: Amino acid glutamate example:
  - Aged ham, cheddar, anchovies, Parmigiano reggiano, fish sauce etc.
- **Aromas (Olfaction):** Amino acids, maillard reactions, lipids, esters, lactones, sulfur, furanones etc.
  - Beef: 880 volatile compounds in cooked beef
  - Cheese: Buttery, "meat brothy," maillard reactions, fermented notes
- **Physical Sensations (Chemesthesis)**:
  - Meat: Chew, resistance, juiciness, bounce, cohesiveness, density
  - Cheese: Dollapy, stretchy, crumbly, chalky, creamy, fudgy, supple etc.

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The Taste of Amino Acids

Umami, Sour	Sweet	Bitter
Glutamate	Alanine	Arginine
Aspartate	Asparagine	Cysteine
	Glutamine	Histidine
	Glycine	Isoleucine
	Proline	Leucine
	Serine	Lysine
	Threonine	Methionine
		Phenylalanine
		Tryptophan
		Tyrosine
		Valine

Crab Amino Acids: glutamate, glycine, alanine, arginine

Amino Acids for Delicious Taste. Chart: Ueyama et al., Amino Acids, 43, 2349-2358 (2012) https://www.ajinomoto.com/aboutus/amino_acids/amino_acids

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Meaty Flavors

Beefy Violatile Flavor Compounds	Lexicon Associated with Animal Product
Deca-3(E), 4(E)-dienal	Fatty
Delta-nonalactone	Dairy sweet, waxy notes
3-Hydroxy-2-butanone	Buttery
2-methyl-3-[methylthio] furan	Meaty, sweet, sulfurous
MSG, IMP (Inosine), GMP (guanosine monophosphate)	Savory, brothy, beefy
Bis(2-methyl-3-furyl) disulfide	Roasted meat
2-methyl-3-furanthiol	Roasted meat

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Meaty Flavors

Beefy Violatile Flavor Compounds	Lexicon Associated with Plants
Deca-3(E), 4(E)-dienal	Fried potato
Methylpyrazine, 2,5-(and 2,6-) dimethylpyrazine	Roasted, nutty
1-Octene-3-o1	Mushroom
2-Pentyl furan	Green, earthy, beany
Pyrazines	Nutty, bell pepper, cracker-like

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"It tastes just like meat"

"not?"

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Slide 31

LC3 MR: Should this word be volatile?
Leslie Cimei, 4/30/2020

Slide 32

LC4 MR: Should this word be volatile?
Leslie Cimei, 4/30/2020

Plant-Based "Meat:" Textures & Palatability

- Impossible burger: soy protein & soy leghemoglobin
- Beyond burger: pea protein
- The Awesome burger: pea & wheat proteins
  - 6g fiber
- Tofurky

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Cooking up More Plant-Based Meals

- Flavor Tools: Aromas/Olfaction
  - Ingredients
  - Techniques: Browning reactions
- Texture Tools: Physical Sensations
  - Omnivore experience
  - Ingredients
  - Techniques: Water content

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Meaty-Savory Flavors: Sulfur

Sulfur Flavor-Based Aromatics Include:

- Onions
- Leeks
- Shallots
- Garlic
- Scallions

Technique Tip
- Size
- Heat
- Fat

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Meaty-Savory Umami Ingredient Examples

(Free Glutamate) in Plants mg/100g

1344-3190	Konbu (kelp)	110	Peas
1060	Shiitake (dried)	70-110	Corn
648-1140	Dried tomatoes	70-80	Soybeans
556	Tomato paste	40-176	Broccoli
658	Walnuts	40-100	Cabbage: Napa/Chinese
200-700	Miso	40-110	Mushrooms: Button/cremini
150-250	Tomatoes	30-110	Potatoes

The Umami and Healthy Eating and Umami in Foods Systematic Reviews. 2013 Academy of Nutrition and Dietetics Evidence Analysis Library. https://www.andeal.org/topic.cfm?menu=5280 Umami Info. https://www.umamiinfo.com/umamidb/search/

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Meaty-Savory Flavors: Nucleotides

- Boosts umami
- Mostly in Meat, Poultry, Fish
  - Guanosine-5′-monophosphate (GMP)
  - Inosine- 5′-monophosphate (IMP)
- High in IMP: Dried shiitake mushrooms
  - 15x more than dried Porcini
  - Mushroom powder

The Umami and Healthy Eating and Umami in Foods Systematic Reviews. 2013 Academy of Nutrition and Dietetics Evidence Analysis Library. https://www.andeal.org/topic.cfm?menu=5280 Umami Info. https://www.umamiinfo.com/umamidb/search/

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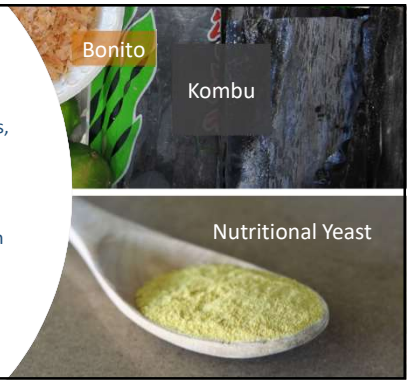
Flavor Enhancers: Savory & Umami

- Fish/Crustacean: Anchovies, oyster sauce, fish sauce, bonito, Worchestershire
- Plant: Soy sauce, tamari, aminos, kombu, mushroom powder
- Yeast-based: Marmite, nutritional yeast, vegemite



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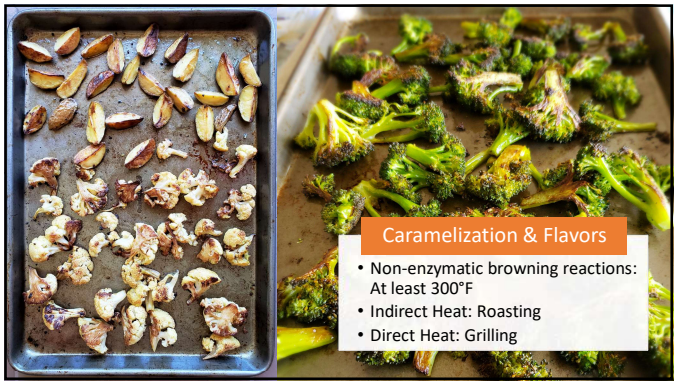

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Tempeh Flavor Development

Non-enzymatic Browning
- Caramelization
- Maillard Reactions
  - Protein plus a reducing sugar
  - A least 300°F

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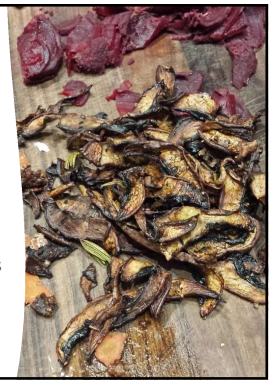
Meaty Texture Variation

- Mouthfeel & Expectations
- Plant products:
  - Seitan: "Wheat meat", Wheat gluten
  - Forms: "sausage", ground, "steaks"
- Plants: Variation in cultivars, seasonality, harvest, moisture content, cooking methods
  - ?Mushroom jerky, mushroom/walnut ragout
  - ?Jackfruit, cauliflower, nuts etc.



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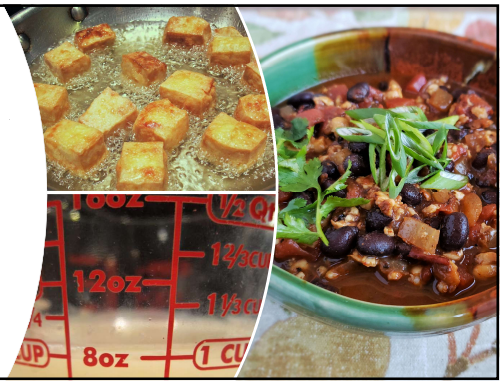
Meaty Textures

Mouthfeel & Expectations

Soy-based
- Tofu
- Tempeh
- TVP etc.



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Walnut Mushroom Ragoût

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Re-Purpose After Getting Feedback

- Ragoût & polenta
- Sloppy Joes
- "Bolognese"
- Stuffed peppers
- "Stroganoff"
- Lettuce wraps
- Tamales, tacos, burritos

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Meal Strategies

- Pick Familiar Meals
  - Not most favorite option
  - Favorite comfort food
- Pick a Liked Plant Ingredient
  - Use in new ways
  - Add a second one--diversify
- Pick Unfamiliar Meals
  - A food acceptability match
- Swap for food acceptance
  - Enjoyment & nutrient dense

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Opportunities Checklist

Assessment:

__ Interest level in more "plantful plates"
- __ Health & wellness
- __ Taste & discovery
- __ Other

__ Support system

__ Prep & cooking interest level
- __ Preparation time
- __ Low-hanging veggies
- __ Plant-based products

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Opportunities Checklist

Meal and Ingredient Strategies:

__ Plant Compatibility/Acceptability:
- __ Social-emotional
- __ Palatability
- __ Flavor perception considerations
  - __ Hyper/super tasters
  - __ Texture issues etc.

__ Diversify plant ingredients

__ "Swapability"

__ Flexing quantities

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Questions?

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