

Value-Added Processing and Safety of Shelf-Stable Foods

DATE: Tuesday, January 23rd, 2024

TIME: 9:00 to 11:00 a.m. (Alaska)
break for 15 minutes around 10:00-10:15 a.m.

Food Safety and Sanitation Program
Alaska Department of Environmental Conservation
Division of Environmental Health



WASHINGTON STATE UNIVERSITY
EXTENSION

Presentation Outline

- **Overview of Value-Added Food Products and Processing Techniques**
- **Product Concept and Kitchen/Lab Scale Product Development**
- **Basic Overview of Food Safety**
- **Food Safety for Shelf-Stable Foods**
- **Food Safety Regulations**
- **Food Safety Plan**

Overview of Value-Added Food Products and Processing Techniques

Value-added Products



Value-added Products



Value-added Products



Ref: Google Images

Value-added Products



Ref: WA Local Stores

Value-added Products



Ref: WA Local Stores

Value-added Products



<https://www.bowhillblueberries.com/>

Categorization of Product

- What category do you want to sell your product in?
- Refrigerated or Frozen or Shelf stable
- Acid, Acidified, or Low Acid
- High moisture or dry
- Organic or not
- Natural or not, etc

Processing Techniques

- Drying/Dehydration
- Smoking
- Canning
- Hot-fill-hold
- Others

Drying/Dehydration

- Direct or Indirect heating
- Hot air
- Temperature and humidity
- Rate of heat transfer
- Rate of moisture transfer
- Final product moisture and water activity

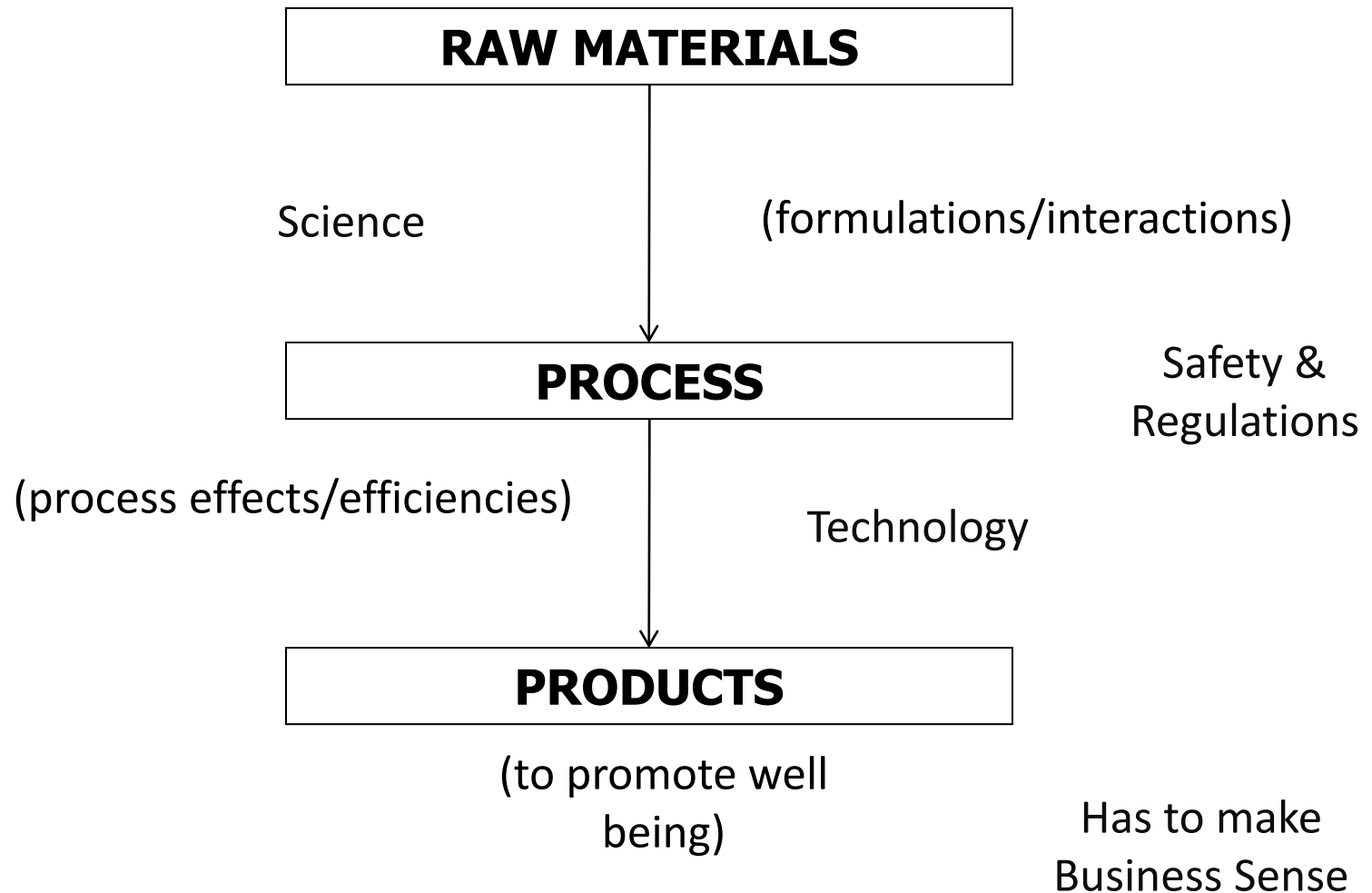
Thermal Processing

- Hot-Fill-Hold
- Water-bath processing
- Steam tunnels
- Retorts

Smoke Processing

- Salt
- Moisture Control
- Drying
- Smoke flavoring

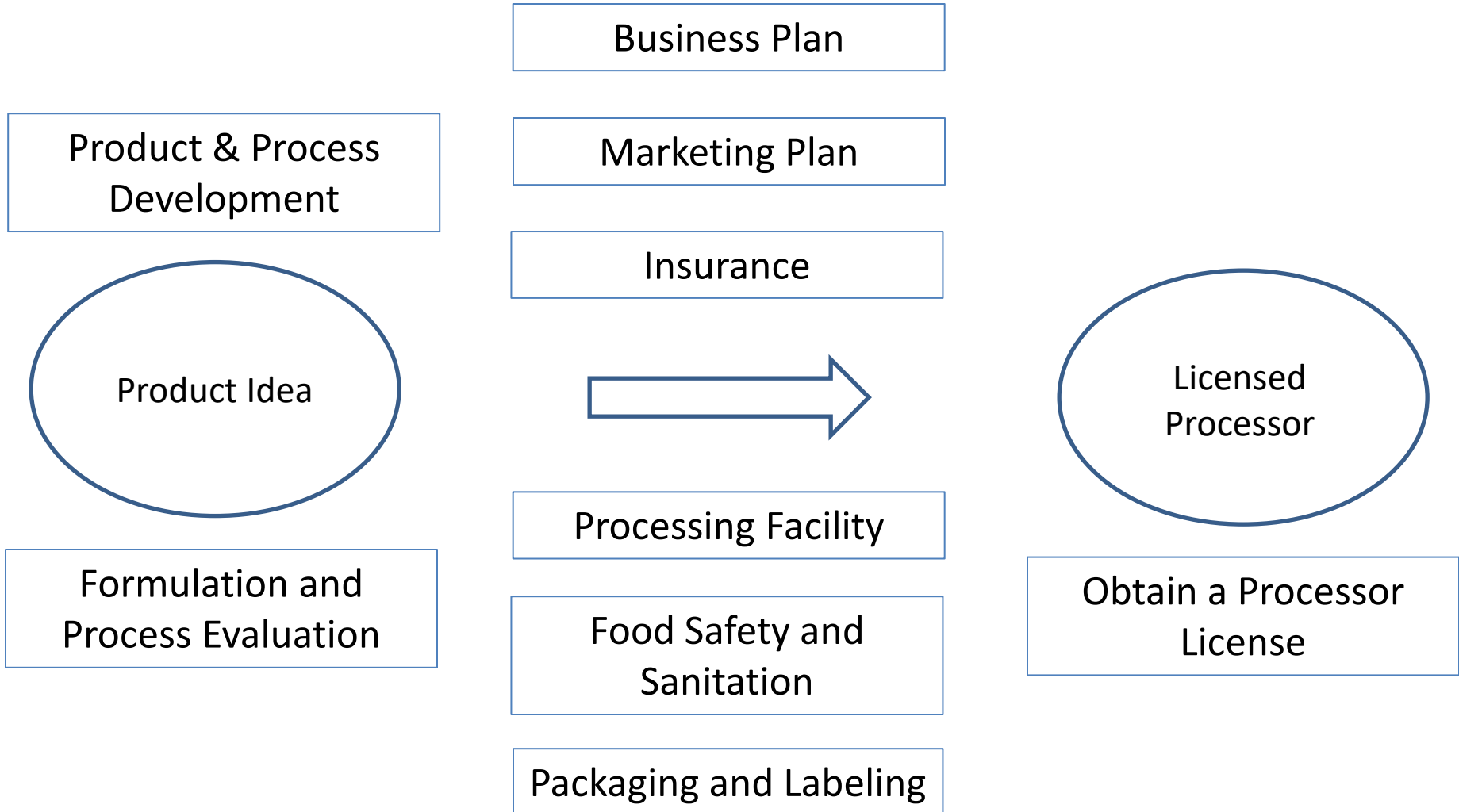
Overview



Current Trends

- Health and Wellness
 - Clean label
 - Nutrition
 - Functional products
 - Fruits and vegetables
 - Whole grains
 - Ancient grains
 - etc
- Partially cooked meals
 - Home cooking experience
- Customization

Summary



Product Concept and Kitchen/Lab Scale Product Development

Concept of the Product

- Define your product
- Why should somebody need you product?
- Who will buy this product?
- Where will you market this product?
- What is in it?
- What is the identity?

Categorization of Product

- What category do you want to sell your product in?
- Refrigerated or Frozen or Shelf stable
- Acid, Acidified, or Low Acid
- High moisture or dry
- Organic or not
- Natural or not, etc

Ingredients and Ingredient Functionality

- List out all the ingredients used in making your product
- Initially try to make the best product you can and document everything
 - ✓ Ingredients (form, source, manufacturing info, quantities, percentages)
 - ✓ Sequence of the use of ingredients (including any pre-processing)
 - ✓ Process (steps, time of each step, etc)

Kitchen Recipe

- Make the product a few times in your kitchen (record everything each time)
- Keep a close eye on the variability of the raw materials (This is very critical)

Kitchen Recipe

- Ingredients
 - Types (including detailed info of the source)
 - Components
 - Quantities (for a batch)
 - Nutritional information
 - Functionality
 - Quality
 - Pre-processing information
 - Specification sheets and all other relevant identity information

Kitchen Recipe

- Pre-processing details
 - cleaning, sorting, size reduction, pre-cooking, etc
 - time of treatment
 - size of the utensils/cooking pots used
 - keep very good records

Kitchen Recipe

- Processing
 - size of the cookware used
 - process parameters (temperatures, times, mixing, pH, water activity etc)
 - quality of the finished product before packing (pH, water activity, texture, taste etc)
 - quality after the estimated shelf life period

Kitchen Recipe

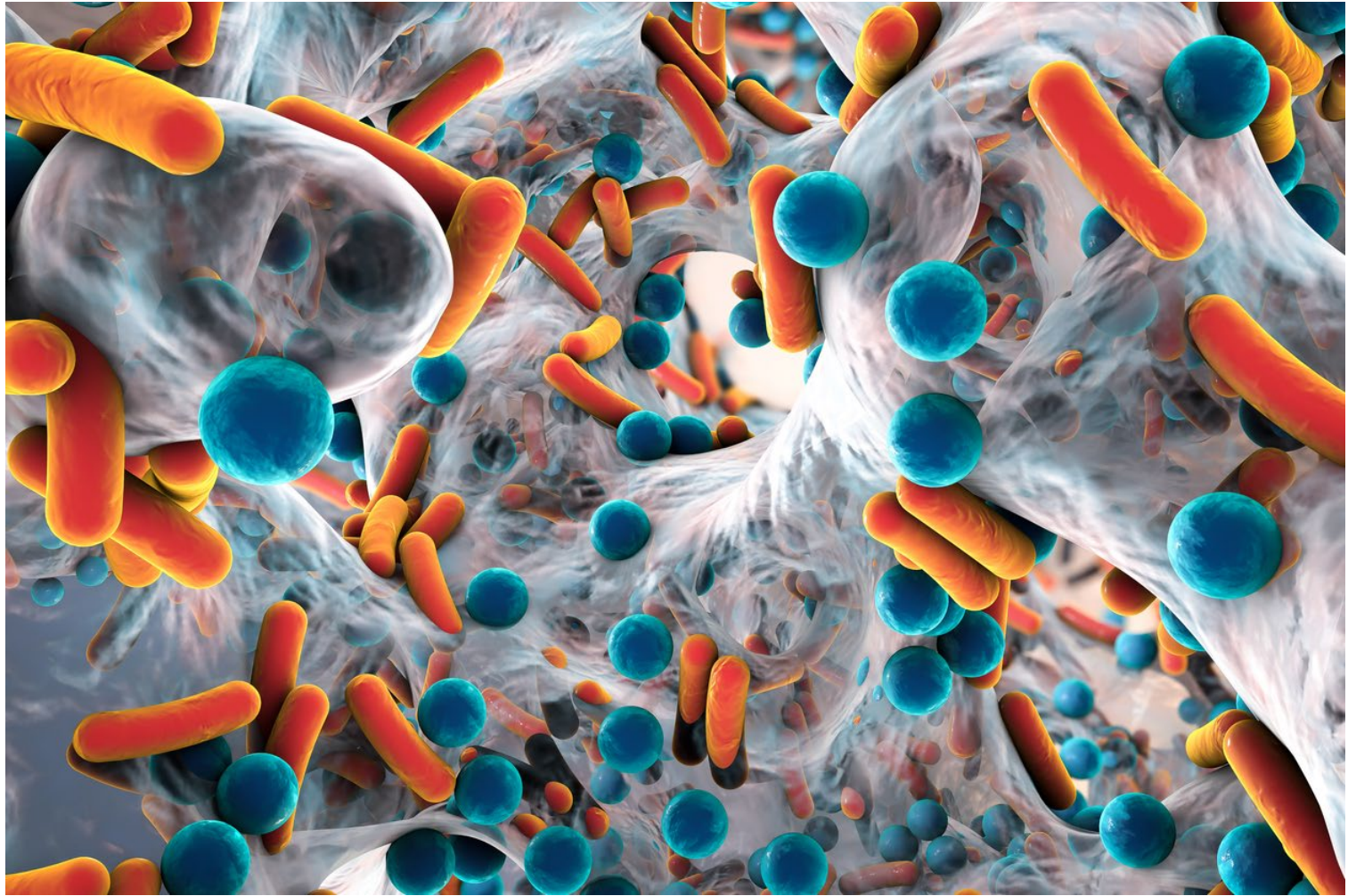
- Taste tests (Sensory evaluation)
- Evaluate the final product for its sensory attributes
- Develop an identity for the product
- Make sure to evaluate this every time you make the product to ensure consistency

FDA/USDA Regulations

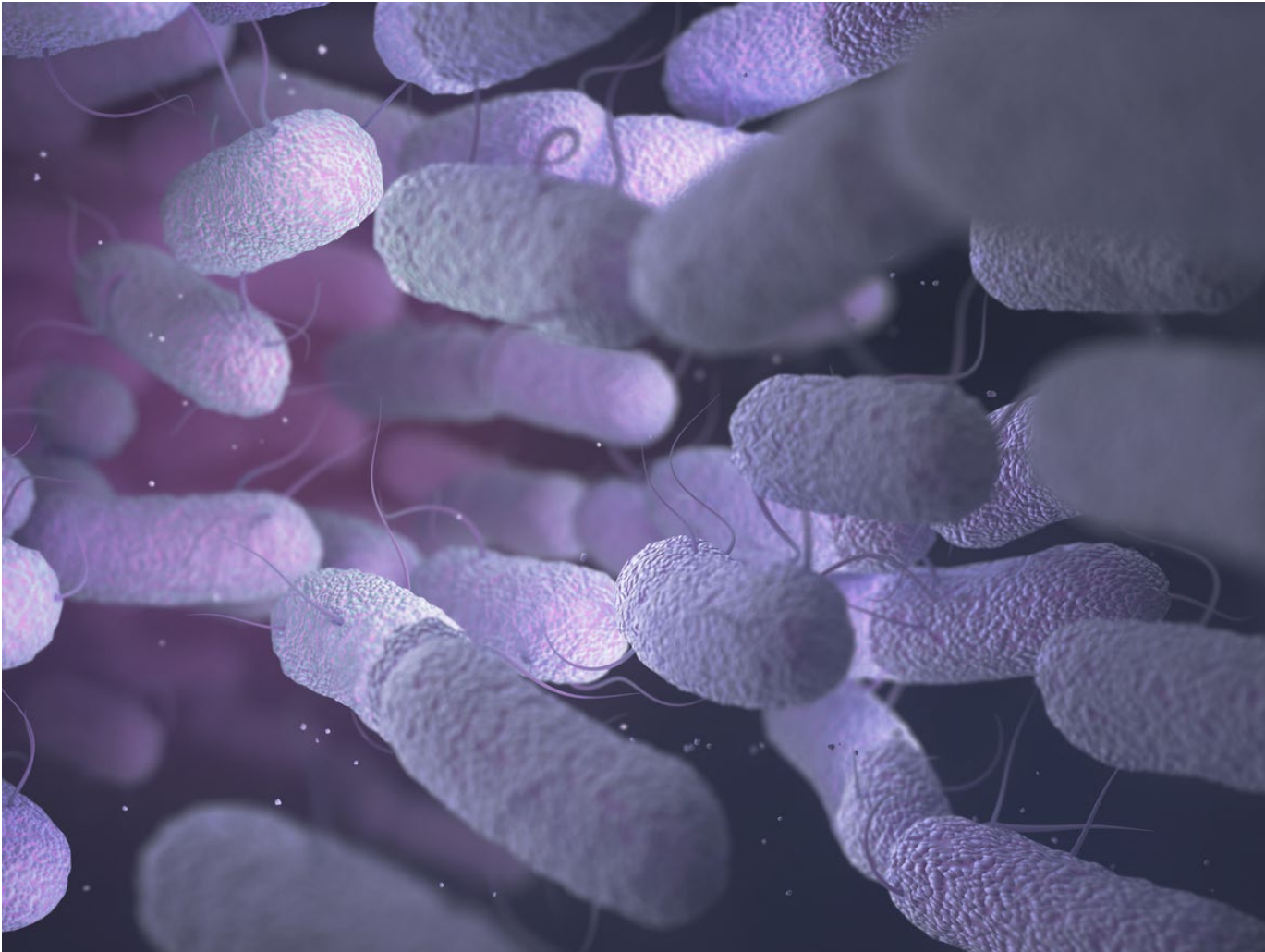
- Check all the ingredients you are using in your product
- If your product needs testing, make sure to get the testing done by an appropriate authority
- Verify the classification of your product
- Make sure you have kept good records of all the ingredients and processing

Basic Overview of Food Safety

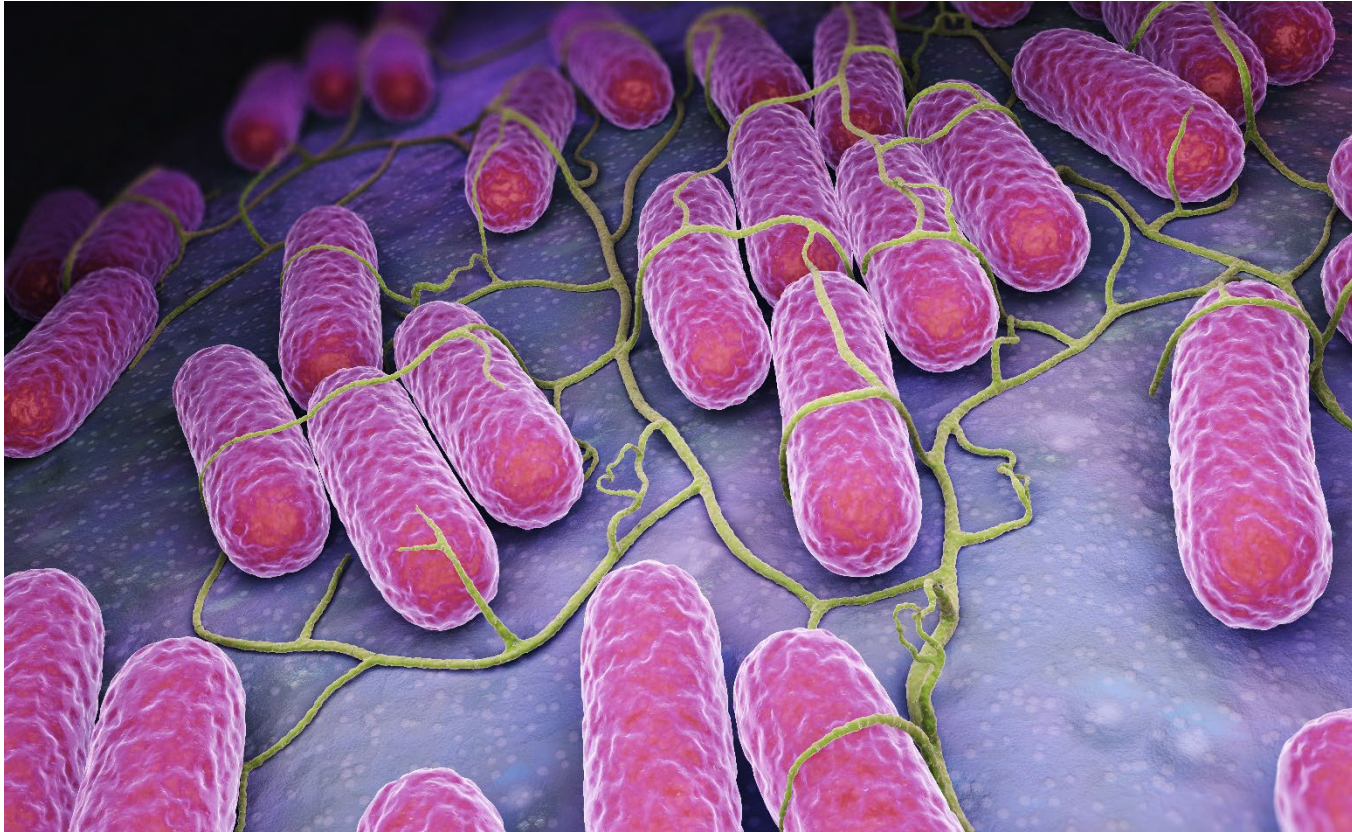
Microbes



Microbes



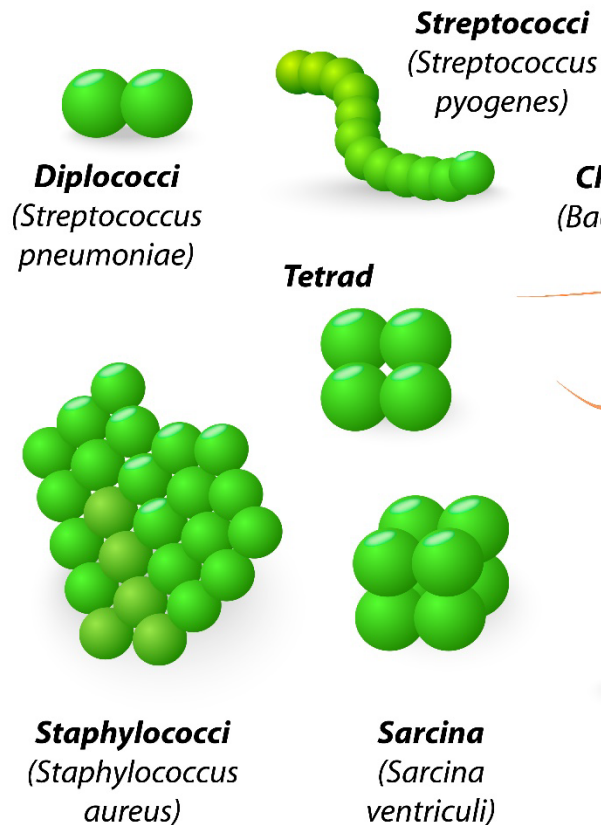
Microbes



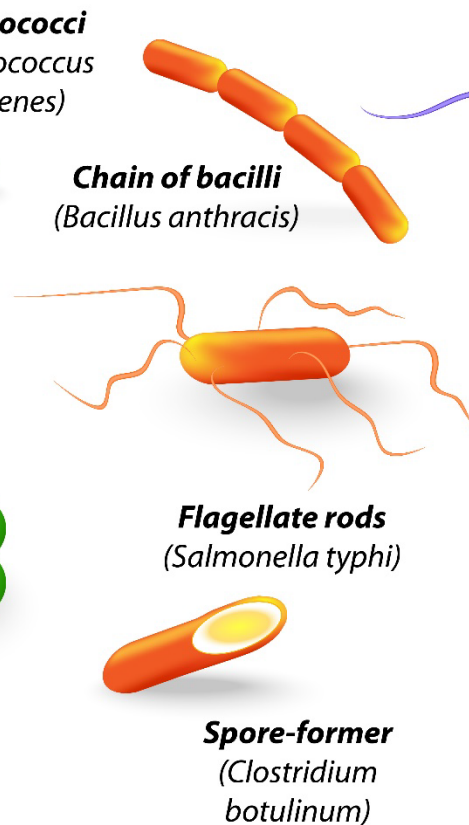
Microbes

SHAPES OF BACTERIA

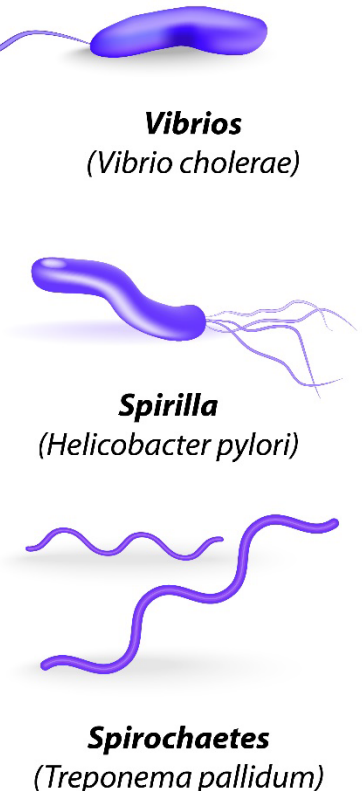
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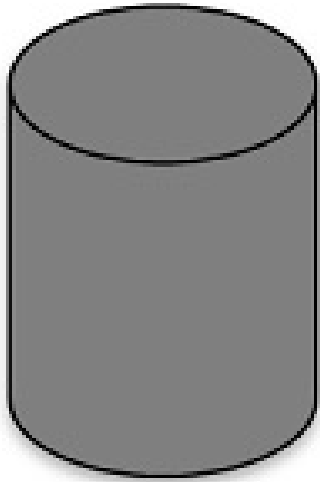
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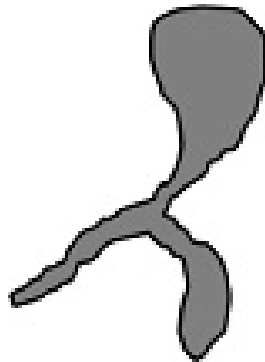
OTHERS



Microbes



Human Hair: 17 μM



Fungus: 1-40 μM



Bacterium: 1-5 μM



Virus: 0.02-0.3 μM

Preventing Growth of Microorganisms

- How

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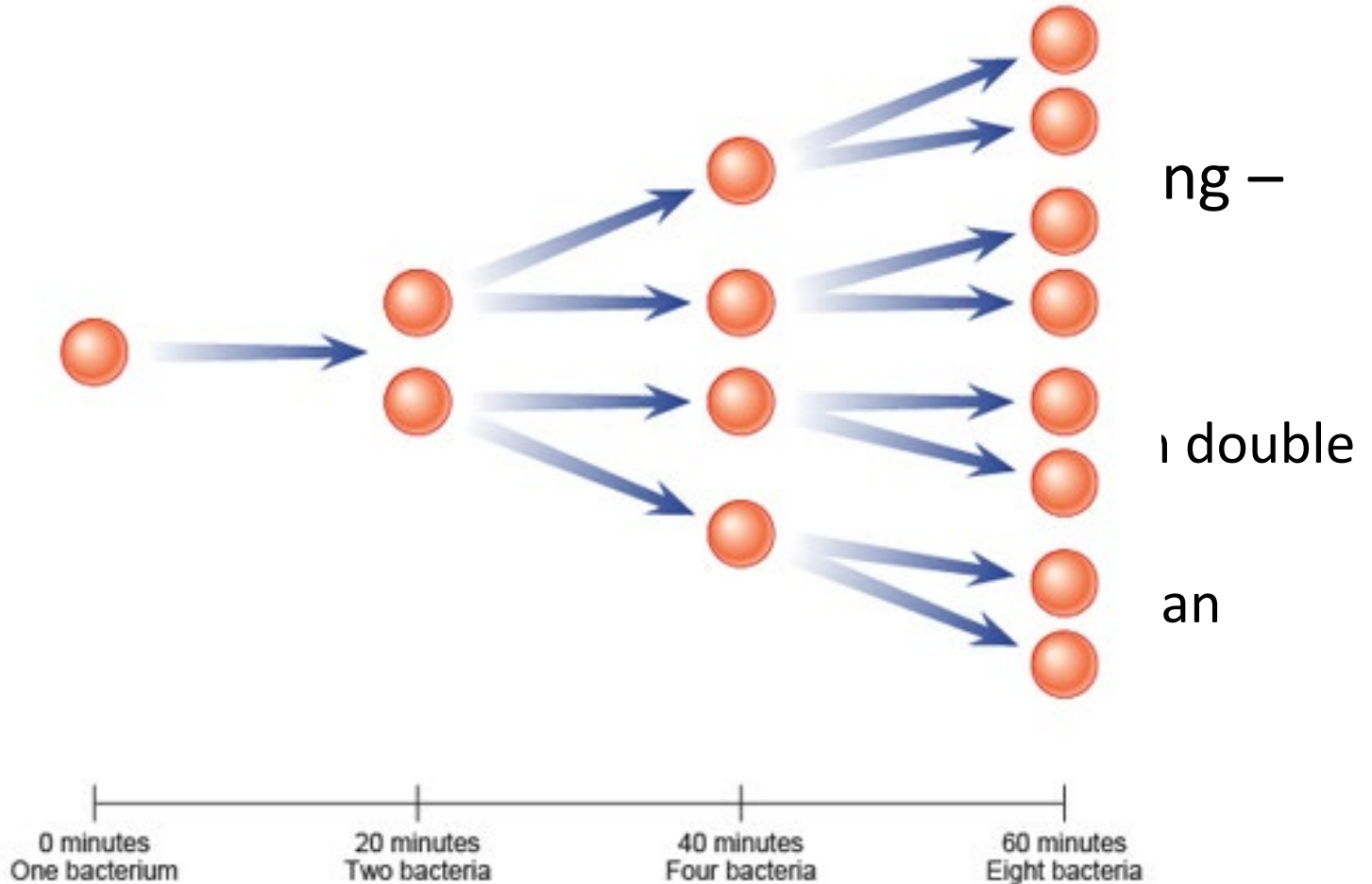
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- Pot

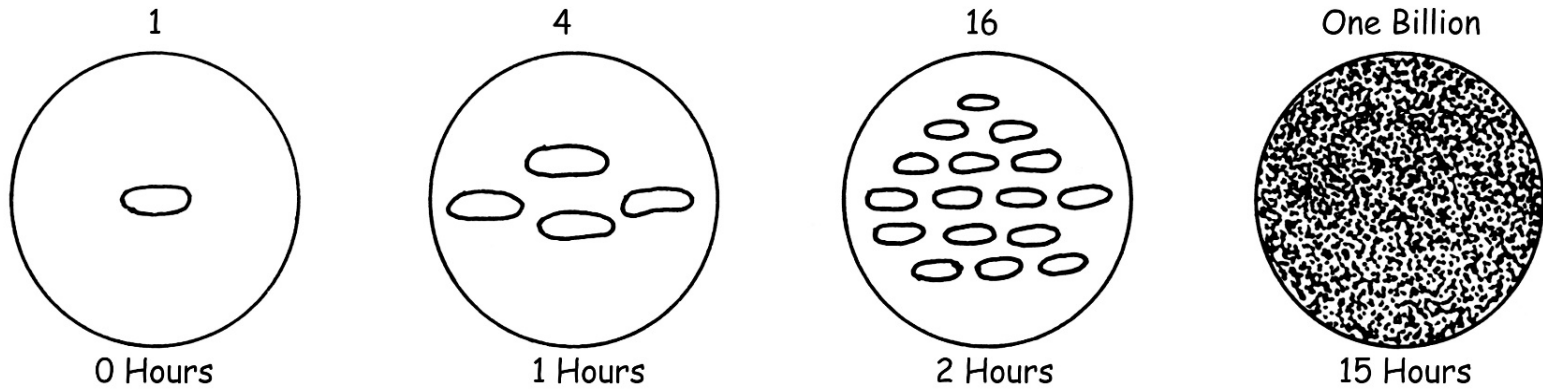
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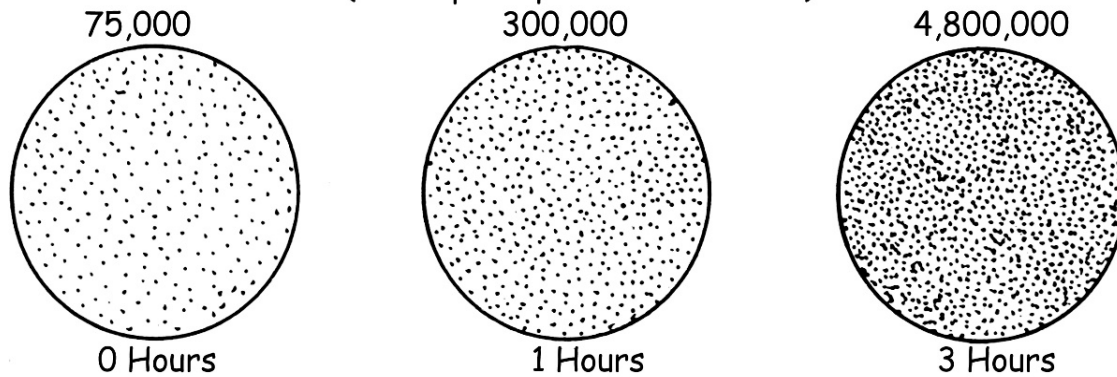


Preventing Growth of Microorganisms

Reproduction of a single cell.



Bacterial build-up on a conveyor belt.
(Count per square inch of belt.)



Ref: BPCS Handbook, GMA

What do microbes need?

Water

Nutrients

Right Temperature

Right pH

Oxygen

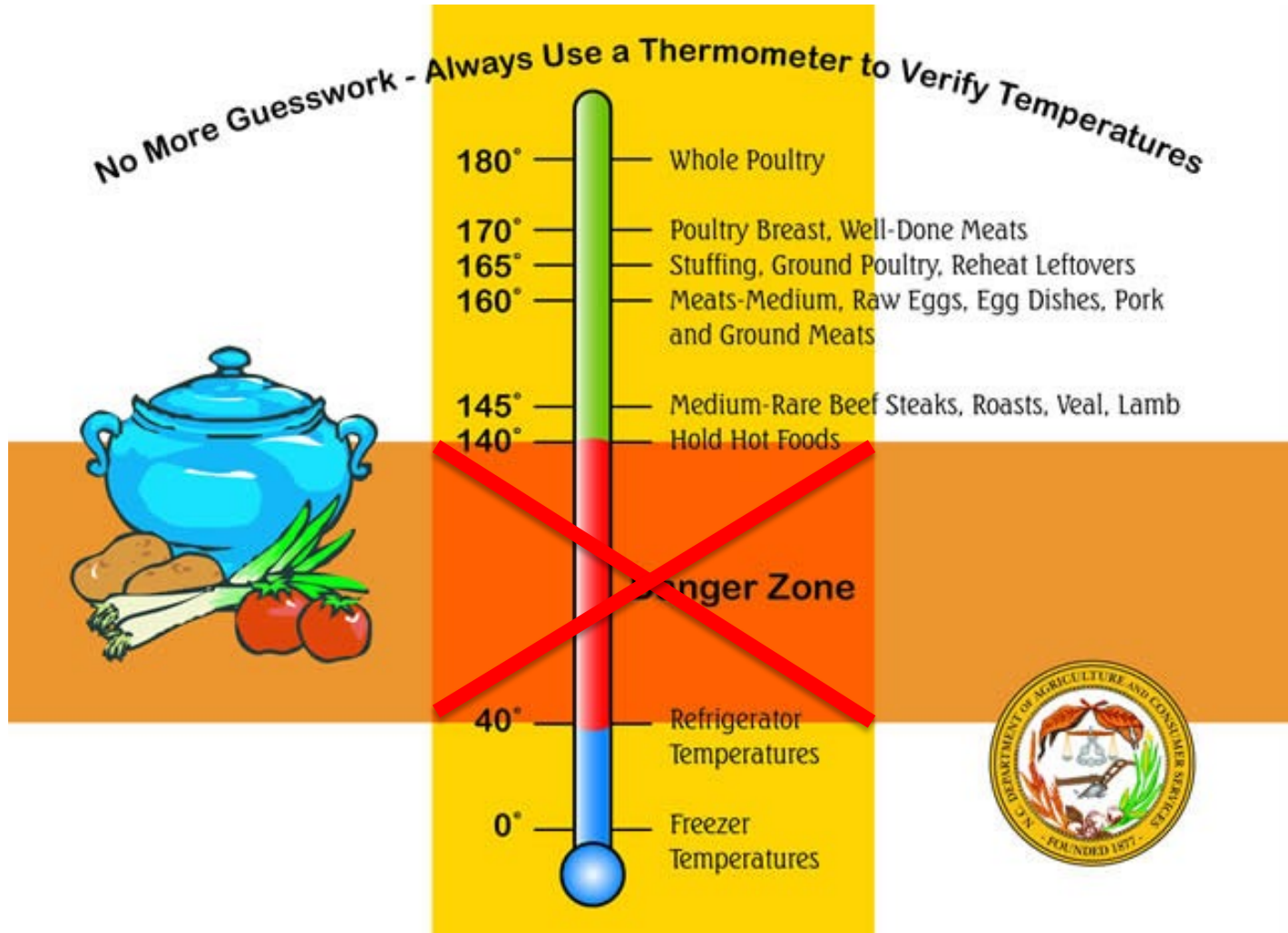
Shelf Stable Foods

HEAT

pH

Water Activity

Heat – Safe Zone and Danger Zone



Ref: <http://ncfoodsafety.com/foodforthought/temperature.htm>

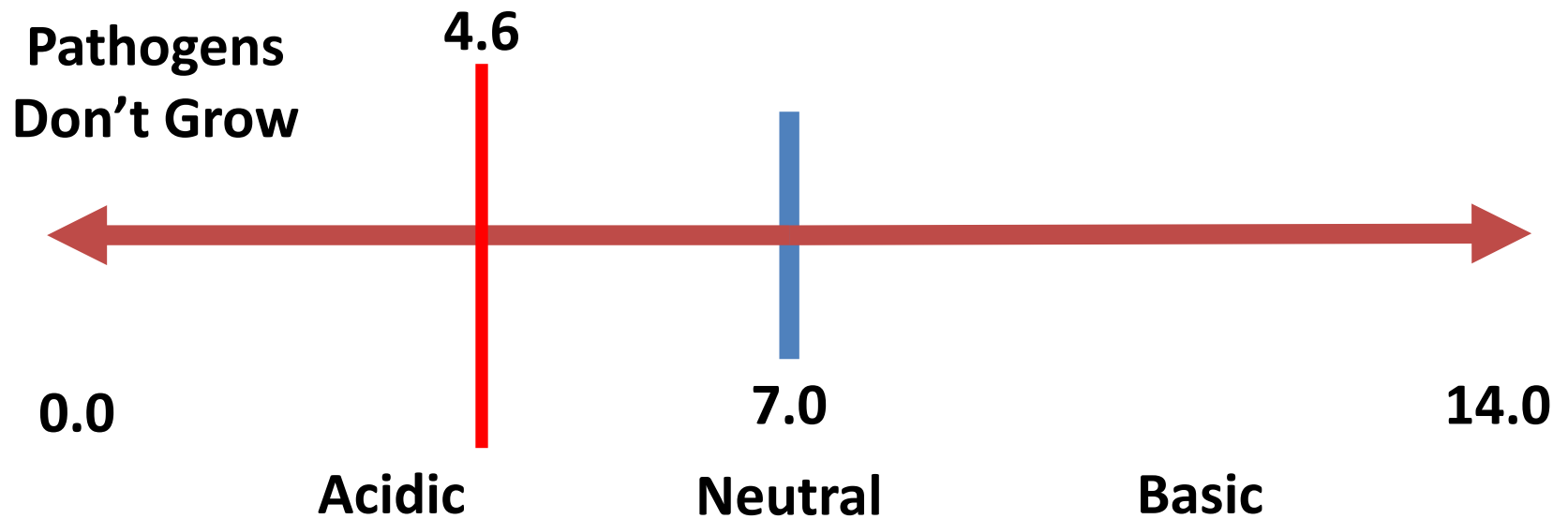
Food Safety for Shelf Stable Foods

Shelf Stable Foods

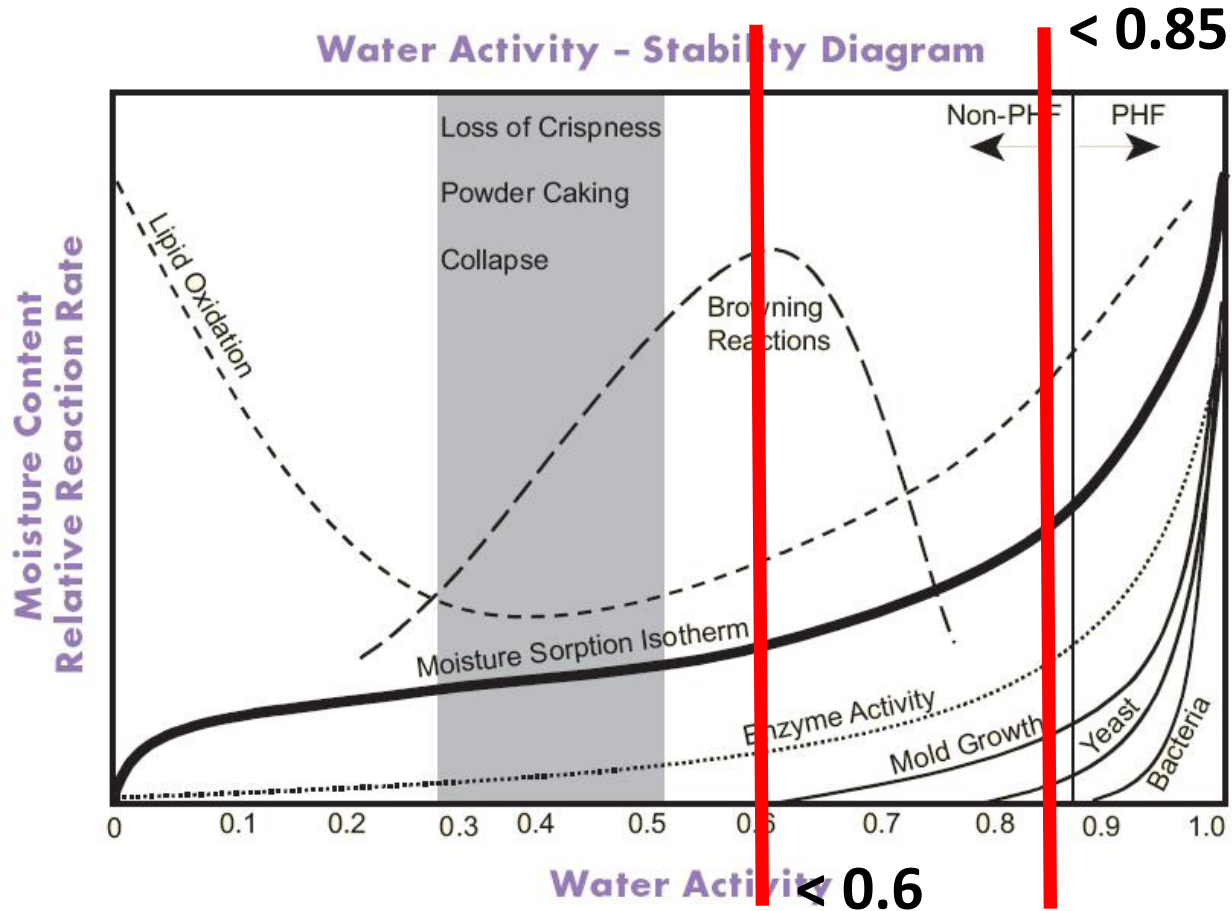
HEAT



pH



Water Activity



Ref: <http://www.aqualab.com/education/water-activity-for-product-safety-and-quality/>

Shelf Stable Products

FDA CFR Title 21
Part 113/114
Pat 108
117 – Subpart B

Water Activity (<0.85)
(preferably <0.68)

**Shelf
Stable**

Water Activity
(>0.85)

Acid
(Naturally Acid)

Acidified
(pH < 4.6)

Low Acid
(pH > 4.6)

Tomatoes - pH Values



Roma Tomatoes
4.34



Beefsteak Tomato
4.54



Red Roma Tomatoes on Vine
4.42



Yellow Tomatoes
4.45



Tomatillo
3.81

Peppers - pH Values



Pasilla
6.65



Anaheim
5.47



Jalapeno
5.63



Habanero
4.94



Serrano
5.59

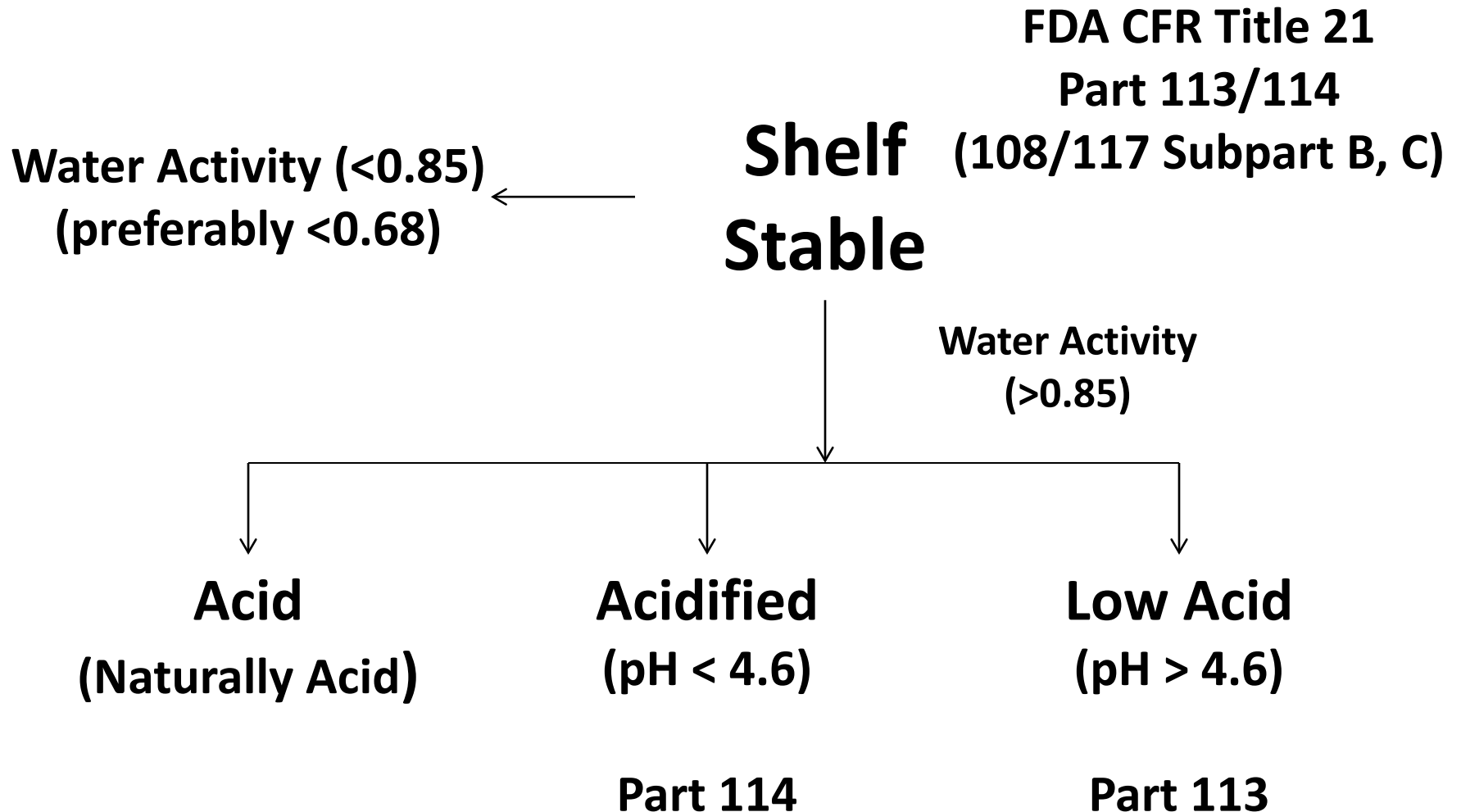


Yellow Bell
4.91

pH values of Foods

Description	pH, Average \pm Std. Dev.
Roma Tomatoes	4.34 \pm 0.08
Tomatillo	3.81 \pm 0.03
Carrot	6.22 \pm 0.03
Green String Beans	6.18 \pm 0.06
Brussels Sprouts	6.59 \pm 0.06
Broccoli	6.54 \pm 0.04
Ginger rhizome	6.04 \pm 0.04
Zucchini	6.48 \pm 0.03
Cucumber	5.92 \pm 0.03
Celery	5.89 \pm 0.02
Garlic Bulb	6.16 \pm 0.00
Shallots	5.67 \pm 0.02
White Onion	5.56 \pm 0.00
Red Onion	5.60 \pm 0.02
Pasilla Peppers	6.65 \pm 0.04
Anaheim Peppers	5.47 \pm 0.02
Red Bell Peppers	4.75 \pm 0.01

Thermally Processed Shelf-Stable Food Products



Safe Process

- Once the concept of the food product has been developed, the recipe must be evaluated to ensure that a safe process is followed.
- A “Process Authority” must be used to review the formulation and processing steps of an acidified or low-acid product.
- BPCS (Better Process Control School)
 - The Better Process Control Schools (BPCS) certify supervisors of thermal processing systems, acidification, and container closure evaluation programs for low-acid and acidified canned foods. Each processor of low-acid or acidified foods must operate with a certified supervisor on hand at all times during processing.
 - http://www.gmaonline.org/file-manager/Events/Bro_BPCS-011411.pdf

Recent Recall

- **Dukarani** February 2

- The Minnesota for products contaminate bacteria can vegetable-b illnesses hav

- MDA can't v potential bo product (Be an unappro

Ref: <https://food-recalled-for-bot>



for Botulism

[consumer advisory](#)

they may be luced by this fish- and nspection. No

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essing-products-

Recent Recall

- Homemade of Washington is recalling pickle and sauce products because they...
- The recall includes German Town's... (12 oz./3 oz. jars) from Washington state.



Ref: <https://foodpoisoningbulletin.com/2015/homemade-brand-pickles-and-sauces-recalled-for-botulism/>

References

- Food Processor Licensing (<http://agr.wa.gov/FoodAnimal/FoodProcessors/licensing.aspx>)
- Food Business in New Mexico, Nancy C. Flores and Jay Lillywhite. Guide E-510
- Food Processing Industry (SHARP) - <http://www.ini.wa.gov/safety/research/healthyworkplaces/food/default.asp>
- Agriculture in Washington State (<http://agr.wa.gov/AgInWa/>)
- Washington Economy (http://www.netstate.com/economy/wa_economy.htm)
- WSU Food Processing (<http://www.foodprocessing.wsu.edu/links.html>)
- UGA Extension (http://www.caes.uga.edu/departments/fst/extension/EFS_SNFB.html)
- NDSU Extension (<http://www.ag.ndsu.edu/foodent/entrepreneur/modules.htm>)
- http://collaborate.extension.org/wiki/How_to_Start_a_Food_Processing_Business
- <http://www.nyssfpa.com/>
- <http://county.wsu.edu/pierce/agriculture/business/Pages/default.aspx>
- How to Start a Food Processing Business: http://collaborate.extension.org/wiki/How_to_Start_a_Food_Processing_Business

References

- Creating new foods: The product developer's guide (<http://www.nzfst.org.nz/creatingnewfoods/project1.htm>).
- Earle, M.D. (1997) 'Changes in the food product development process', *Trends in Food Science and Technology*; 8 (1) 19-24.
- Aaron L. Brody, John B. Lord. 2000. Developing new food products for a changing marketplace. CRC Press.
- H. R. Moskowitz, I. S. Saguy, T Straus. 2009. An Integrated Approach to New Food Product Development. CRC Press.
- Stage Gate Process: http://mootee.typepad.com/innovation_playground/2008/03/the-problem-wit.html
- Washington State Department of Agriculture (<http://agr.wa.gov/>)
- Oregon Department of Agriculture (<http://www.oregon.gov/oda/Pages/index.aspx>)



Food Processing Extension & Research



- Food Processing Extension & Research
- Contact
- Extension**
- Research
- Links & Resources
- Consumer Food Safety ↗
- Produce Food Safety ↗
- School of Food Science ↗
- Cider Production & Fermentation ↗
- CAHNS ↗
- WSU Extension ↗

Food processing extension and research programs at the Washington State University are designed to assist the food processors of all types and sizes in the State of Washington, the Pacific Northwest region and the Nation.

News & Announcements

- [Read \(PDF\)](#) our latest Fact Sheet on Developing a Food Safety Plan: An Overview.
- [Read more](#) about Building a Better Puff.

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UNIVERSITYFood Processing
Extension & Research

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Extension

Overview

Training Programs

Product Evaluation

Research

Links & Resources

Consumer Food Safety ↗

Produce Food Safety ↗

School of Food Science ↗

Cider Production &
Fermentation ↗

CAHNRS ↗

WSU Extension ↗



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Product Evaluation

Processing Shelf Stable Acidified Foods in Sealed Containers

Disclaimer: If you manufacture and/or sell/market any other product(s) that contain cannabis as an ingredient, our lab cannot assist you even if that new product does not contain cannabis.

Food products packaged in hermetically sealed (air tight) containers are subject to regulations equivalent to the Code of Federal Regulations, Title 21, Parts 108, 113, and/or 114 (21 CFR 108, 113, and/or 114). Of course, all food products also must comply with a number of other regulations including labeling, net contents, good manufacturing practices, etc.



Group of homemade preserved vegetables and fruits

Low acid foods have finished equilibrium pH greater than 4.6. Acid foods have a natural finished equilibrium pH of 4.6 or less. Acidified foods also have a finished equilibrium pH 4.6 or less but have a significant low acid component. Acidified foods include pickled vegetables, most salsas, and many other formulated products. Exceptions

For basic microbiological testing, please visit Washington Animal Disease Diagnostic Laboratory [website](#).

For non-traditional microbiological testing, please [email](#) Dr. Stephanie Smith.

Helpful Document for Product Evaluation Testing & Useful Links:

[FDA Code of Federal Regulations Title 21 Part 114](#)

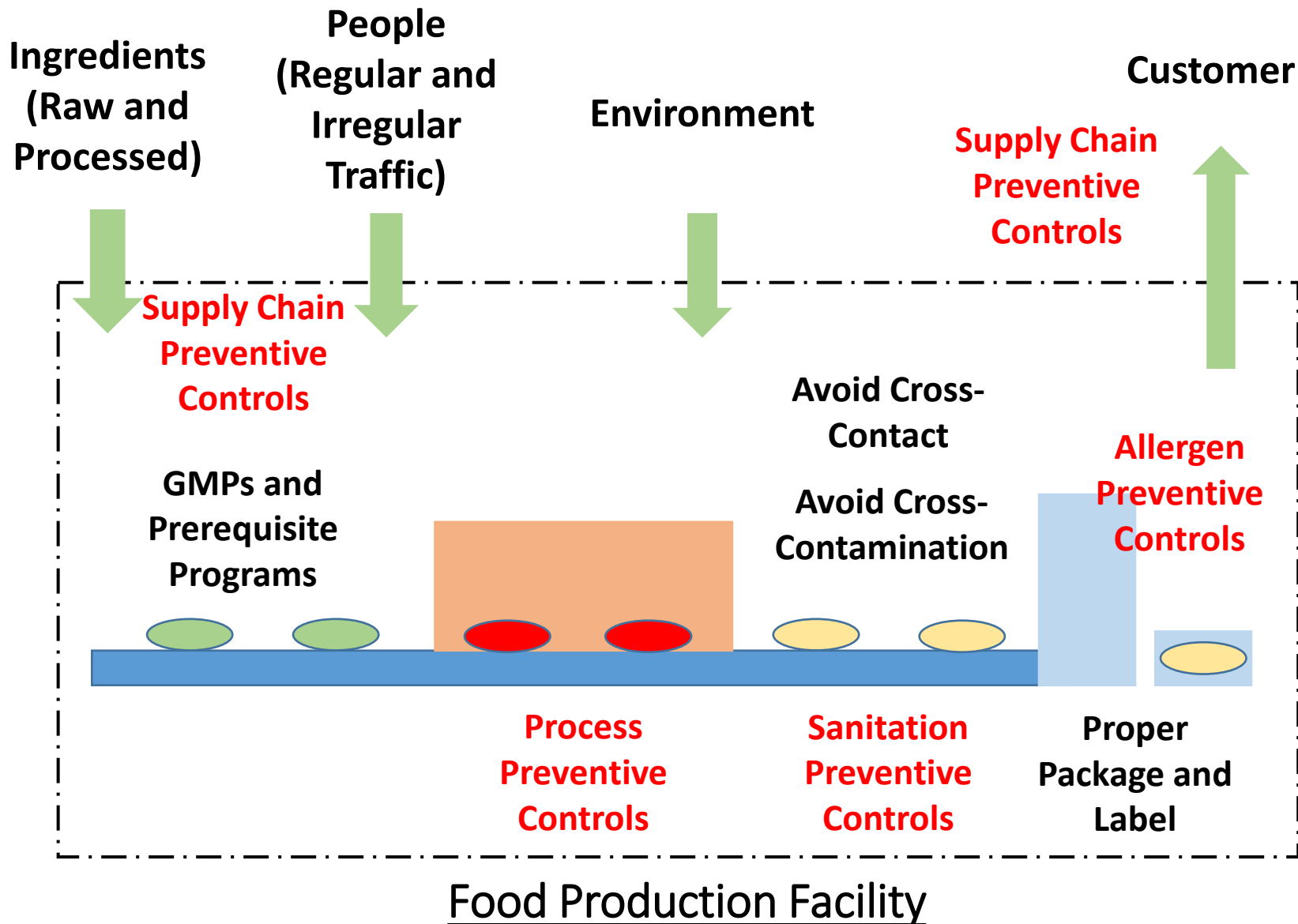
[FDA Code of Federal Regulations Title 21 Part 113](#)

[FDA Code of Federal Regulations Title 21 Part 117 Sub-part B](#)

[FDA Code of Federal Regulations Title 21 Part 108](#)

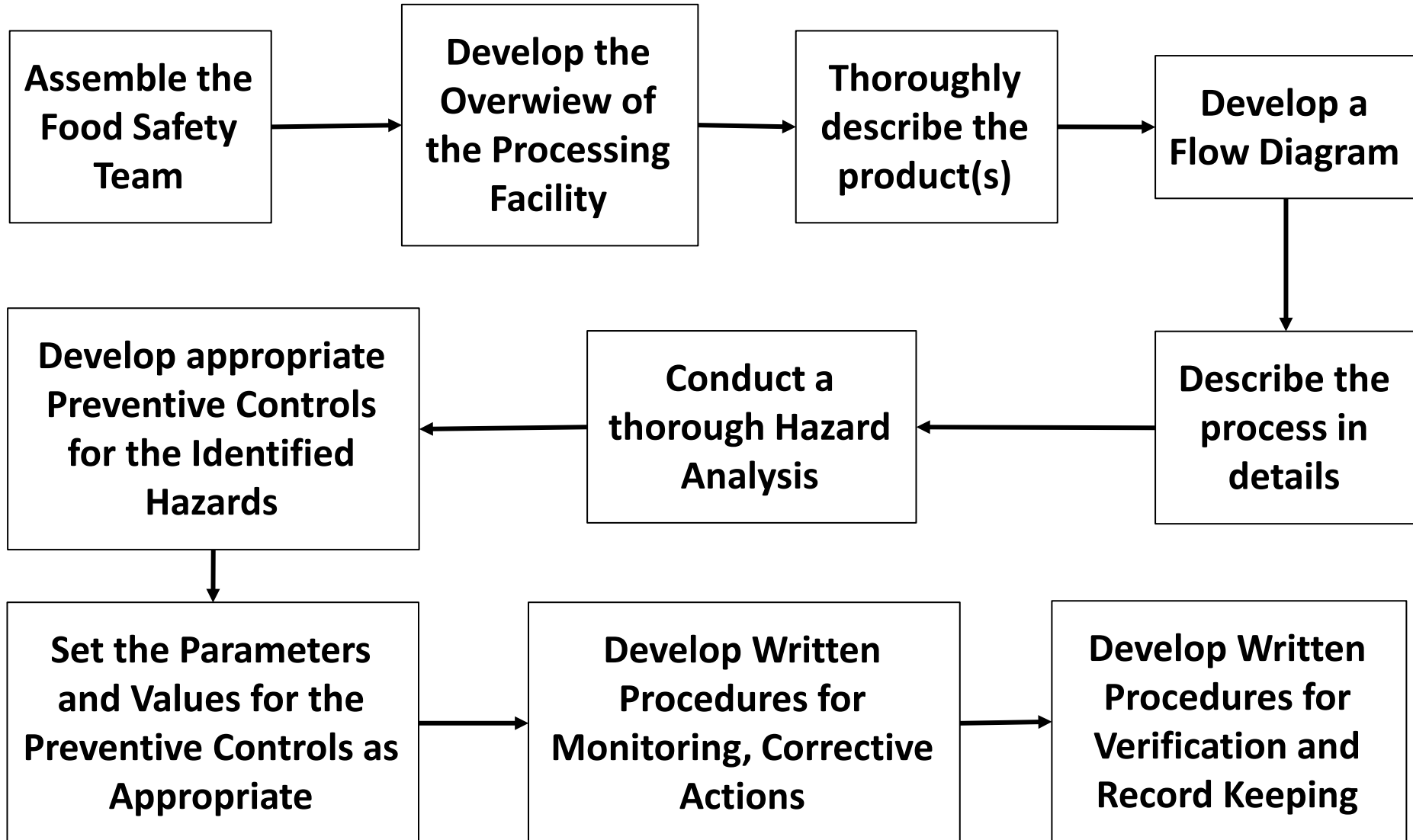
[FDA Draft Guidance Hazard Analysis and Risk-Based Preventive Controls for Human](#)

Food Safety Plan and Basic GMPs



Ref: Ganjyal and Coles. 2017. Preventive Controls for Human Food: An Overview. WSU Extension. Fact Sheet FS282E. <https://research.libraries.wsu.edu/xmlui/handle/2376/12232?show=full>

Developing the Food Safety Plan



Contents of a Food Safety Plan

Required

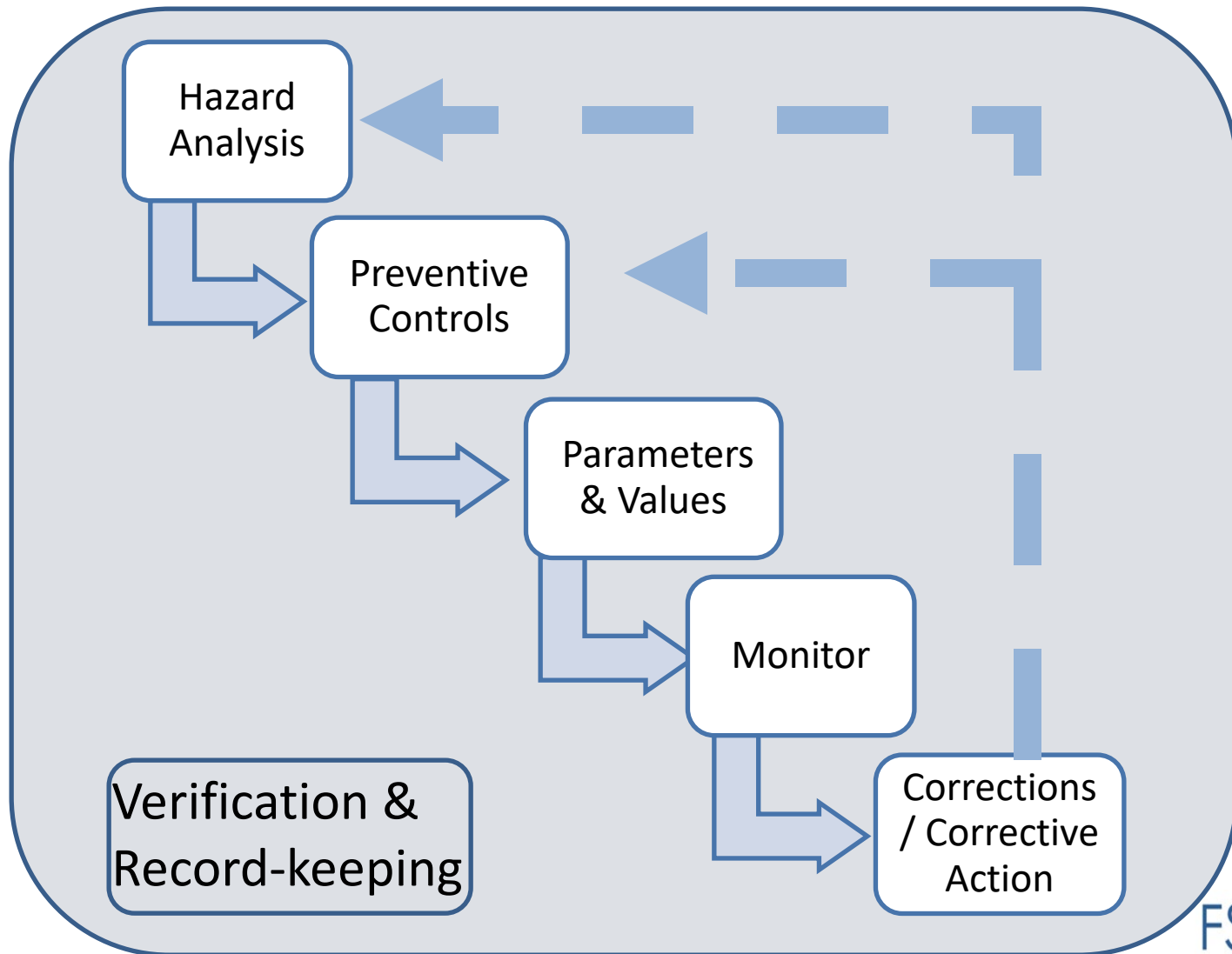
- Hazard analysis
- Preventive controls*
 - Process, food allergen, sanitation, supply-chain and other
 - Recall plan*
- Procedures for monitoring, corrective action and verification*

Useful

- Facility overview and Food Safety Team
- Product description
- Flow diagram
- Process description

* Required when a hazard requiring a preventive control is identified

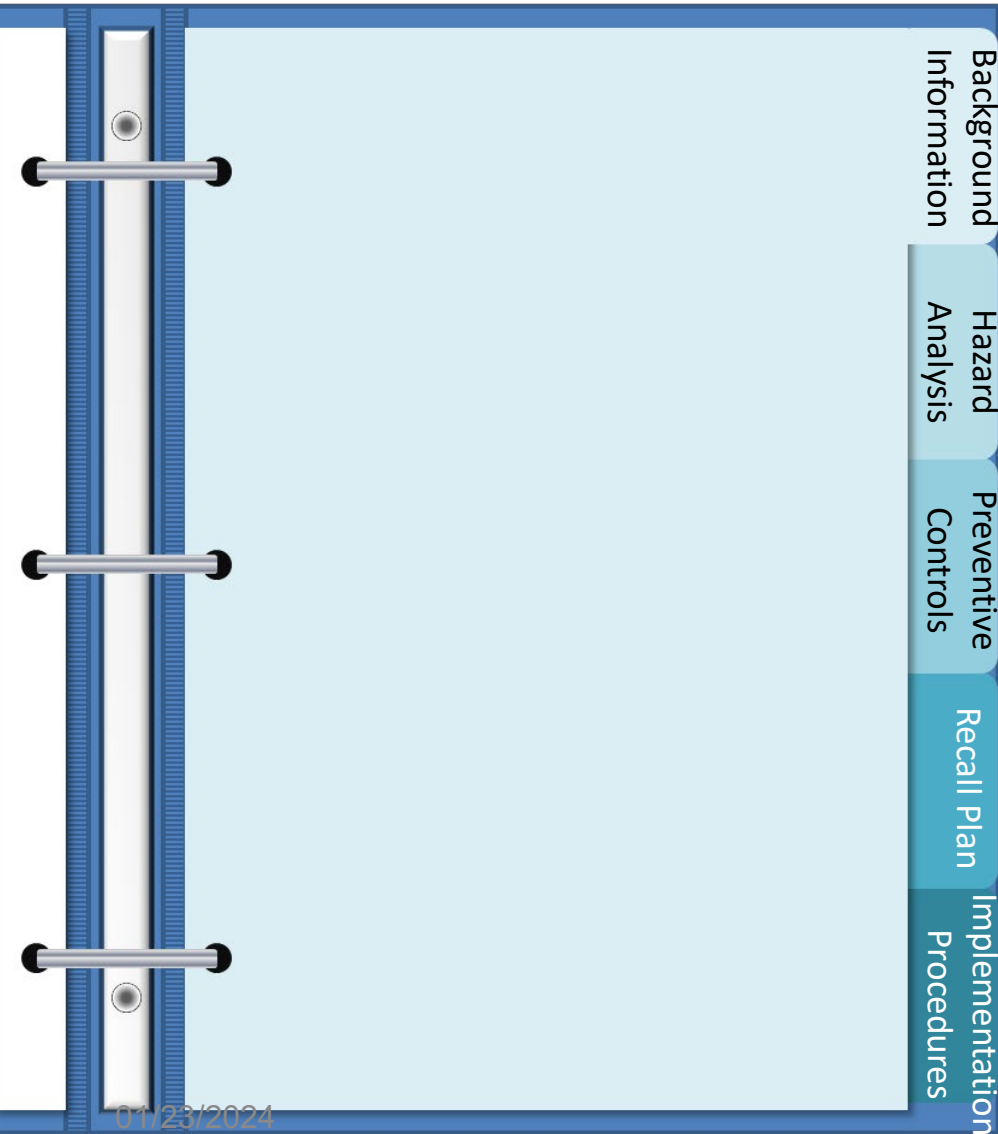
Determining Preventive Controls is Systematic



Food Safety Plan Format is Flexible



Main Organizational Sections



1. Background information - optional
2. Hazard analysis
3. Preventive controls
4. Recall plan
5. Implementation procedures

Thank You

girish.ganjyal@wsu.edu

509-335-5613

www.foodprocessing.wsu.edu