1.3: Fermentation Paper

Topics in Biochemistry: Fermentation Fermentation Paper

Step 1: Choose a Topic

You will write a research paper explaining the production of a fermented product not discussed in class or expanding on a covered topic. There must be significant chemistry/biochemistry in your paper. Additionally, there will be a comparison of the use or production in the US vs another country.

Potential Topics for Review Article on Fermentation:
• Meat preservation
• Bletting of fruit (beyond ripening)
• Olive Fermentation (effects on oleuropein)
• Kimchee
• Tempeh
• Shalgam juice, hardaliye, or boza (Turkish fermented vegetable and grain beverages)
• Injera (organisms, fermentation, and carbohydrates in t'eff)
• Miso and Soy
• Distilled alcoholic beverages
• Impacts of Nitrogen/nutrients on fermentation in a specific product
• Impacts of pH on fermentation in beer or wine
• Effect of local water chemistry on brewing or distilling
• Tannin and polyphenolics in beer production
• Megasphaera cerevisiae effects on beer production (H2S formation)
• Hop content on flavor profiles
• Sulfur compounds in beers (production, regulation, flavor profiles)
• 'Head' or foam on beers
• Wheat ales
• Barley wines
• Cask conditioning of beers
• Production of two short branched-chain fatty acids, 2-methylbutanoic acid and 3- methylbutanoic acid, imparting the “cheesy/sweaty” notes in many cheeses.
• Propionic acid fermentation and the distinctive flavor of Swiss cheese
• Mold Fermentations (e.g. roquefort cheese)
• Buttermilk
• Microbe variability in flavors for a specific fermented product
• Lactic Acid Bacteria and the undesirable flavor products in cider such as 'piqûre acroléique’
• Phenolic variation in wine varietals and flavor profiles
• Impact of oxygen on wine (what happens to chemical profile after you open the bottle?)
• Effects of chemical aging on wine
• Champagne and sparkling wines
• Wine (broad topic -- will need a narrower focus)
• Tej: ethiopian honey wine
• Sulfur compounds in wine (production, regulation, flavor profiles)
• Champagne and sparkling wines
• Malolactic fermentation in wine. This secondary fermentation process is standard for most red wine production and common for some white grape varieties such as Chardonnay, where it can impart a "buttery" flavor from diacetyl, a byproduct of the reaction.
• Use of additives in wine. Ascorbic Acid, lysozyme, fumaric acid, sorbic acid, DMDC, tannins, gum arabic, colors. How do these impact chemistry and flavor?
• Biological aging of wines. Sherry. Use of 'flor'. Chemical byproducts and pathways involved.
• Astringency. Astringency is an important factor in the sensory perception of beers, ciders, and wines. What compounds are responsible for this sensation and how do they interact with tastebuds on a molecular level?

• Sake
• Tea
• Chocolate
• Coffee
• Kombucha
• Bulk chemical production
• Pharmaceuticals
• Wood-Ljungdal pathway for biofuel production
• ABE fermentation
• Enzymes needed for Gluten free bread
• FODMAPs (fermentable oligosaccharides disaccharides, monosaccharides and, polyols) cause IBS and gluten sensitivity -- diets, solutions?
• Microbe variability in flavors for a specific fermented product
• Propose your own topic

Confirm your topic for your research paper that includes these three key ideas:
1. Thesis statement (Purdue Online Writing Lab Tips for Writing a Thesis Statement)
2. Biochemistry/chemistry content
3. Cultural Comparison

Step 2: Outline the Paper

Write a 1-2 page outline of the literature on your topic. It should be in a typical bulleted or numbered form. See Purdue's Online Writing Lab for more details about writing an outline. This outline should contain an introduction and sufficient background biochemical pathway information, key experimental results, topics for discussion (applications/uses, variations), and a possible direction for cultural comparison essay.

Step 3: Annotated Bibiliography

List in your bibliography at least 15 references, 10 of which must be primary references. For each reference, cite it in the appropriate format and write a 2-3 sentence summary of each reference.

Step 4: Literature Review

Complete the background and literature review of your fermentation topic. This section should cover the biochemical pathways involved in your topic. This should be a minimum of five pages.
• Include drawings with structures (in ChemDraw) not clipped from a literature article.

Step 5: Applications Section

This section of the paper should address the applications or uses of your fermentation topic. It should be a complete story with current uses and modifications. This section of the paper should be at least 2-3 pages long.

Some possible topics to cover:
• What food or industrial applications are you exploring?
• Why are people interested in this topic?
• How is this technique or process or food used in US culture?
• What are current concerns/problems with the process?
• How are people attempting to improve this process?
• Is climate change going to affect production?
• Quality control issues?
• Regulatory issues?
• Are there different types of related fermentation products or processes?

Step 6: Cultural Comparisons

Outline or draft of the cultural comparison of your topic.

This last section should be 2-3 pages that looks at cultural differences in either the production or process or use of your topic. This could include cultural differences in consumption or different regulatory processes or production. Compare and contrast differences

between at least two countries or cultures. Please use citations to support your ideas.

Step 7: Final Paper

This is your final Fermentation Paper.

There should be three parts:

1. Literature Review (with edits incorporated).
2. Application Section (with edits incorporated).
3. Cultural comparison of your topic (with edits and insights from Amsterdam and Belgium incorporated).
