

[Please submit your answers via the course website.](#)

1. What role does yeast play in the production of beer and wine? **It uses the sugars and vitamins to make CO₂ and ethanol.**
2. What is the difference between anaerobic and aerobic respiration? **Aerobic respiration uses oxygen while anaerobic happens in the absence of O₂.**
3. Why is anaerobic respiration necessary to make beer and wine? **Under aerobic conditions, pyruvate (the product of glycolysis) will preferentially transition into the TCA cycle to make energy. However, in the absence of O₂, the last step in the aerobic respiration cannot happen. Consequently, the pyruvate must detour down a different pathway – one that ultimately regenerates the NAD⁺ that is used up in glycolysis. In yeast, this alternate pathway produces CO₂ and ethanol.**

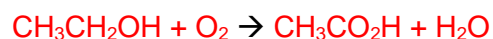


4. Making vinegar happens in two stages – O₂ needs to be present in one stage but not present in the other. Please describe these two stages, including what is made during each, and comment on the role of O₂.

During the anaerobic respiration stage, ethanol is produced from grapes and yeast (...so really you have wine at this point).



During the second stage, the bacteria acetobacter uses the ethanol, along with O₂, to make acetic acid (CH₃CO₂H)



5. Investigate and describe the difference in red wine vinegar as compared to balsamic vinegar – make sure to note the difference in the production process. **Both vinegars are made from red wine using acetobacter. Red wine vinegar takes 1-2 years to make (and very little control is needed to make this vinegar) while balsamic vinegar can take up to 30 years. With traditional balsamic vinegar, a lot of care is taken during the aerobic step – it is placed into sets of wooden barrels (known as families). Water slowly evaporates as the acetic acid is produced. As the volume decreases with evaporation, the liquid is moved to smaller barrels – only vinegar from the smallest family member can be served or sold. You'll be amazed when you see the acetia.**
6. In addition to beer, wine, and vinegar, what are four common foods that rely on fermentation? **Lots of choices here....some cheeses, sauerkraut, bread (yeast), sour dough bread (yeast and bacteria), pickled vegetables, kambucha, kimchi, miso soup, yogurt, soy sauce, sour cream, tobacco sauce, etc.**
7. For each category (geography, culture, food, must see), list two things that you learned about Modena.
8. For each category (geography, culture, food, must see), list two things that you learned about Florence.