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1. Describe how fat is distributed throughout the volume of milk. In your answer, make sure to consider the role of emulsifiers. **Fat exists in globules that are prevented from interacting with each other by emulsifiers (phospholipids) that coat the outside surface of the fat globule**
2. Why is fat important when considering the nutrient content of milk? **Many vitamins are not soluble in water – removing fat from milk decreases its ability to carry vitamins.**
3. Milk is rich in calcium.
  - a. What role does calcium play in the structure of milk protein? **It serves as a glue to help hold the casein proteins together a micelle (stabilize the negative charges and keeps them from repelling)**
  - b. Investigate the role of calcium in osteoporosis. In your discussion, make sure to include what osteoporosis is. **Osteoporosis is a condition that causes bones to become weak and brittle. It occurs when the creation of new bone does not keep up with the removal of old bone. Calcium is an important element in the structure of bones; consequently, if your diet is calcium deficient, then your body will have a hard time keeping up with bone removal.**
4. Vitamin D is commonly added to milk as a supplement. Why is milk an ideal “delivery” platform? **Two big reasons...**
  - **Vitamin D is fat soluble, so the fat globules in milk ensure delivery of the vitamin**
  - **Vitamin D aids in calcium absorption in the gut.**
5. Lactose is a disaccharide found in high concentrations in milk.
  - a. What is the chemical name for lactose (e.g. cellobiose is  $\beta$ -glucose (1 $\rightarrow$ 4)  $\beta$ -glucose)  **$\beta$ -galactose (1 $\rightarrow$ 4)  $\alpha$ -glucose**
  - b. Adults that suffer from lactose intolerance are often in a lot of pain when they consume lactose because they lack the ability to digest this sugar. Why does this cause pain? **Since your body cannot metabolize this sugar, it gets used by the bacteria in your stomach as a food source. The bacteria, in turn, generate lots of CO<sub>2</sub> which causes gas build up in your stomach, diarrhea, etc.**
6. Describe the structure of casein proteins in milk. **A core of casein proteins come together in a micelle. “arms”, make by kappa-casein, extend away from this core an prevent casein micelles from bumping into each other and merging into larger aggregates.**
7. Adding acid to milk is one way to initiate the coagulation process when making cheese or yogurt. Describe how this works. **It acidifies the casein proteins get neutralized (they lose their negative charge) – this forces the calcium glue to dissociate and allows caseins to aggregate into clumps.**
8. Adding chymosin (aka rennin) is another way to initiate coagulation. Describe how this works. **This enzyme recognizes a sequence in kappa-casein and cuts it off of the casein micelle. Without the repelling force of the “arms”, the micelles can aggregate and clump together.**
9. What are the main ways that cheese can be classified/categorized? **Curd or whey, hard/soft, milk type (e.g. goat or cow), mold, brine, processing**

10. In your own words, describe what brine is as it relates to cheese. **Salt water. Many cheeses get stored in brine to discourage souring.**
11. What role do bacteria and mold have in the cheese making process? **Bacteria can use cheese as an energy source. When they do, they will change the flavor and texture of the cheese. For example, the holes in swiss cheese are made by bacteria producing CO<sub>2</sub> gas during the aging process. Typically, bacteria will make cheese have a more acidic or sour flavor.**