Carbohydrates

1. Carbohydrates
2. Discussion Question: *Is it true that we are what we eat??*
   1. Give at least 2 specific examples of something you eat and how you think it contributes to your structure or function.
3. What are the main types of molecules that living things are made of?
4. What is a carbohydrate?
5. Many Biological Molecules, like Carbohydrates, Stack or Connect to Form Large Molecules
6. Carbohydrate Monomers Monosaccharides (simple sugars)
   1. Mono = single, sacchar = sugar. Carbon is in all of these.
   2. Fructose and glucose are both monosaccharides - simple sugars. AND isomers = have the exact same molecular formula but have a different arrangement.
   3. Fructose- found in honey, fruit, veggies (beets sweet pots, parsnips, onions
   4. Galactose - found in bananas, berries, cherries. Broccoli cabbage, cauliflower, cucumber, mushrooms, pumpkin, etc
7. Carbohydate Polymer
   1. Sucrose- in table sugar. One glucose and one fructose
   2. Lactose - in milk and dairy products. 1 glucose and 1 galactose.
   3. Maltose- mysterious disaccharide. In malted shakes, candies, and liquors. 2 glucoses.
8. Lactose Intolerance
9. Lactose Intolerance
   1. Genetic - loss of function of enzyme lactase. Lactase not broken down - not absorbed.
   2. Lactose enters large intestine where it cannot be digested. Bacteria then ferment the lactose and produce lactic acid and gas. Draws water into large intestine by increasing osmotic pressure. Fermentation - gas production. Bloating and flatulence.
   3. In Abdominal surgery, parts of small intensine removed - can be cells turned on for lactase production. Also, medications can inhibit lactase production. Many from African and Asian descent and even southern European synthesis of enzyme decreases dramatically.
10. So give up lactose all together???
    1. Some people can consume 24 oz milk throughout the day. Some can only consume 8 oz. Find threshold.
    2. In some products, lactose broken down ahead of time.
    3. Sweet acidopholus milk, buttermilk, and soy milk low in lactose.
    4. Yogurts with live cultures have bacteria that will aid with breakdown.
    5. Soy, rice, almond milk are lower in calcium and may lack other nutrients unless fortified. Yogurts can also be digested by LI individuals
11. What’s an Enzyme?
12. Carbohydrate Polymers
    1. Fiber - nonstarch carb
    2. Polysaccharides - many sugars. Starch is basically a bunch of sugars strung together.
    3. In picture, starch consists of glucose molecs strung together => used by plants as sugar stockpile. Humans able to digest starch = water in body breaks down chains. Potatoes and pasta
    4. In humans = starch is converted to glycogen. Some starch present in muscle. Glycogen found in liver and muscle.
13. Which is Healthier?
14. General Recommendations for Carbs
    1. According to DRIs: Breads, pasta, vegetables, legumes, potatoes, cassava
15. What do carbs exactly do?
    1. Energy!!
    2. Source of fiber
    3. Sweetens food
16. Energy
17. Can Carbs make you fat?
18. 1900s to 1970s to Now
    1. Sucrose intake: went from 12 -> 25% of total calories in diet.
    2. Since the 1970s, sucrose intake has gone down significantly.
    3. However, now FRUCTOSE supplies ~ 16% of our calories.
19. What is HFCS?
    1. About half and half – half glucose, half fructose
    2. The most widely used varieties of high-fructose corn syrup are: HFCS 55 (mostly used in soft drinks), approximately 55% fructose and 42% glucose; and HFCS 42 (used in many foods and baked goods), approximately 42% fructose and 53% glucose.[[6]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-5) HFCS-90, approximately 90% fructose and 10% glucose, is used in small quantities for specialty applications, but primarily is used to blend with HFCS 42 to make HFCS 55
    3. Critics of the extensive use of HFCS in food sweetening argue that the highly processed substance is more harmful to humans than regular sugar, contributing to weight gain by affecting normal appetite functions, and that in some foods HFCS may be a source of mercury, a known neurotoxin.[[8]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-7)[[9]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-8)[[10]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-9) The [Corn Refiners Association](http://en.wikipedia.org/wiki/Corn_Refiners_Association) disputes these claims and maintains that HFCS is comparable to table sugar.[[11]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-10) Studies by The [American Medical Association](http://en.wikipedia.org/wiki/American_Medical_Association) suggest "it appears unlikely that HFCS contributes more to obesity or other conditions than sucrose" but call for further independent research on the subject.
    4. A system of sugar tariffs and sugar quotas imposed in 1977 in the United States significantly increased the cost of imported sugar and U.S. producers sought cheaper sources. High-fructose corn syrup, derived from corn, is more economical because the domestic U.S. and Canadian prices of sugar are twice the global price[[28]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-27) and the price of [corn](http://en.wikipedia.org/wiki/Maize) is kept low through government subsidies paid to growers.[[29]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-28)[[30]](http://en.wikipedia.org/wiki/High-fructose_corn_syrup%23cite_note-29) HFCS became an attractive substitute, and is preferred over cane sugar among the vast majority of American food and beverage manufacturers. Soft drink makers such as [Coca-Cola](http://en.wikipedia.org/wiki/Coca-Cola) and [Pepsi](http://en.wikipedia.org/wiki/Pepsi) use sugar in other nations, but switched to HFCS in the U.S. in 1984
    5. The metabolism of glucose and fructose is similar. However, fructose can induce numerous abnormalities that include fatty liver, which in turn could eventually lead to impaired liver function, cell damage, and fibrosis. Fructose metabolism has the ability to induce generation of reactive oxygen species due to increased activity of xanthine oxidase and generation of glyceraldehyde, which is an inducer of free radicals. The liver may be exposed to oxidative stress following the consumption of fructose.
20. Examples
21. Recommendations for Simple Sugar Intake
    1. Even though the total carbohydrate intake of Americans is close to the recommended level, most Americans get too many empty calories from sugar. Much of this sugar comes from sweetened beverages. For example, soda consumption in the United States has increased from 23.2 gallons per person in 1970 to 49.2 gallons in 2004, a 122% increase!
    2. This is a great place to have students discuss what they drink and how many calories are in the beverages they consume. Have them write down what they drank in the last 24 hours. Then have them add up how many calories they consumed just from beverages. Many are astonished to learn they could cut many calories from their diet without eating less!
    3. Soda consumption has increased, and milk consumption has decreased in schools. Should schools ban soda? Should colleges? Why?
22. What are Whole Grain Carbs?
    1. Eating whole grains (whole wheat bread) or cereal is good because of kernels of grains - add many nutrients (including fiber)
    2. The germ of a grain kernel (innermost part) is rich in protein, oils, vitamins, minerals. The endosperm is high in starch. The bran is high in dietary fiber. The husk is the outermost part is not edible.
    3. When whole grains of wheat are milled in the production of white flour, the outer husk and bran layer (sometimes even germ) are removed. Therefore product is lower in dietary fiber and other nutrients.
    4. White flour super high in starch.. Whole wheat breads have more fiber and other nutrients that white enriched bread lacks.
23. Types of Fiber
    1. Soluble fiber is dissolvable in water and forms a jelly-like substance, sort of like the aloe gel you can buy in a bottle. Lowers blood cholesterol (will talk about cholesterol next week). Insoluble fiber cannot be digested by humans because it is the plant wall, or the “stalk” part of the plant. Insoluble fibers decrease transit time and help decrease the risk of colon cancer. Insoluble fiber holds onto water in the gut and softens stools and decreases transit time.
24. What are the Health Benefits of Fiber?
    1. Gives bulk to stool - improves food moving along. Transit time decreased (in US seventy hours -sometimes two weeks!). Shorter time is better - closer to 45 hours). Also US, 110g/day of feces. In other countries more like 500g/day)
    2. Dilutes toxic materials - moves them along.
    3. Fiber holds onto water -softer stools
    4. Aids in weight control - feeling of fullness and displaces carbs and fat.
    5. Can bind with bile acids and enhance excretion. This foces liver to pull cholesterol from GI tract to make more bile. Lower blood cholesterol.
25. How Much Fiber?
    1. 25–35 g per day **from food**
26. How Much Fiber per Calories Consumed?
    1. **At least** 2 gramsof fiber per 100 calories
    2. **5** gramsof fiber per 100 calories is considered an “excellent” source
27. So What foods should I
28. Avoid…
    1. Soda and other sugared drinks
    2. Canned fruits that are packed in high fructose corn syrup (look for natural juices)
    3. Use fresh/frozen fruits for dessert
    4. Limit intake of ice cream, sugary cereals, candy, etc
    5. Decrease use of added sugars, honey, syrups
29. What do carbs do again?
    1. **Spare protein (prevent gluconeogenesis)**
    2. **Burn fat and prevent ketosis**
    3. **Regulate blood sugar**
30. Diabetes
    1. Disease affects 7% of Americans - inability of body to regulate blood glucose levels within normal limits.
    2. ｧ Many of us know people who need to test their blood often with these machines that use a pin prick on their finger
    3. ｧ Sometimes people give themselves injections many times a day
    4. o Risk Factors
    5. ｧ Genetic – ethnic background
    6. ｧ Obesity
    7. ｧ Abdominal Fat
    8. There are an estimated 23.6 million people in the U.S. (7.8% of the population) with diabetes with 17.9 million being diagnosed,[2] 90% of whom are type 2.
31. Diabetes
32. Hyperclycemia
    1. Glucose spills over into urine. Causes body to pull extra water from blood to make more urine. Frequent urination and thirst.
    2. No carbs - body starts to rely on fat, but fat cant be fully metabolized without carbs = ketones [Acidic fat derivatives that arise from the incomplete breakdown of fat] are made (sweet, fruity odor to them)
    3. Acidosis - buildup of acids in body fluids - fatty acid. Leads to nausea and rapid breathing.
    4. When proteins break down excessively, demands on kidney for increased excretion of nitrogen. Muscle atrophy can also occur.
33. Diabetes Review: Normal Function
    1. Add insulin to put glucose into cells (out of blood)
       1. Insulin is like a key to the door that lets glucose in membrane
       2. Add glucagons to release glucose back to blood - can regulate blood glucose if it’s too low
       3. Mechanism is to bind to membrane protein (non-steroid)
34. Diabetes: Pancreas
    1. Pancreas is gland involved
       1. Monitors blood glucose itself
       2. Produces hormone called insulin
       3. Once absorbed, glucose goes to the liver where it can be released into the blood, stored as glycogen, or made into fat (in that order). When it is released into the blood and blood glucose levels increase, the pancreas is stimulated to release insulin.
       4. The insulin bonds with cell receptors, allowing glucose to be brought inside cells. The glucose is then converted to the usable form of energy, ATP (which we will cover in more detail in Chapter 6).
       5. When blood glucose level falls, the pancreas stop releasing insulin and release glucagon. This stimulates the breakdown of glycogen to glucose, which increases the breakdown of fat and may increase the conversion of protein to glucose.
35. Abnormal Function
36. Treatment
    1. Oral glucose lowering drugs and insulin may be prescribed. Losing weight improves insulin function dramatically!!!
37. Lecture Practice Questions
38. Ways to Make Food Sweeter
    1. It is important to point out to the student that a nonnutritive sweetener is not necessarily healthier just because it does not have calories.
39. Sugar Alcohols
    1. Can be natural but many derived from industrial processes.
    2. Sugar alcohols do provide calories, but not as many as table sugar and fructose. Beware of products that contain these sweeteners, as they can cause gastrointestinal distress.
    3. Sorbitol found in candies, frozen deserts, and baked goods. Mannitol found in candy and chocolate flavored coating agent - used on ice cream. Xylitol found in mouthwashes toothpaste. And candy.
40. Glycemic Index
    1. Notes on glycemic index: The glycemic index is the basis for the “good carb” or “bad carb” classification contained in many popular diet books. These diets often claim that “bad carbs” are unhealthy because they cause higher blood glucose levels, which increases insulin production and, consequently, more fat to be stored. The logic behind the labeling is false. The glycemic index is developed by measuring the blood glucose response of 50 g of a food when consumed alone. However, we do not usually eat foods without at least a sauce or topping, and a food is usually part of a meal. Also, if we eat more or less than 50 g of a food, the response will be different. The index was originally used for diabetics.
41. Glycemic Index
    1. This is an extremely abbreviated version of a glycemic index; the text has a more detailed one. It does show how foods are categorized, however. A high-glycemic food is one that obtains a score of 85 or more on a scale of 0–100.
42. Okinawa Diet for Longevity
    1. Notes on Okinawa diet: The Okinawa diet was developed after extensive research of the diets of people living in Okinawa, Japan. These people have a life expectancy much higher than normal. They consume 40 percent less calories than Americans, high levels of soy, fish, and vegetables, and low levels of alcohol. They consume less saturated fat and sodium. They also engage in higher levels of physical activity and experience less stress.