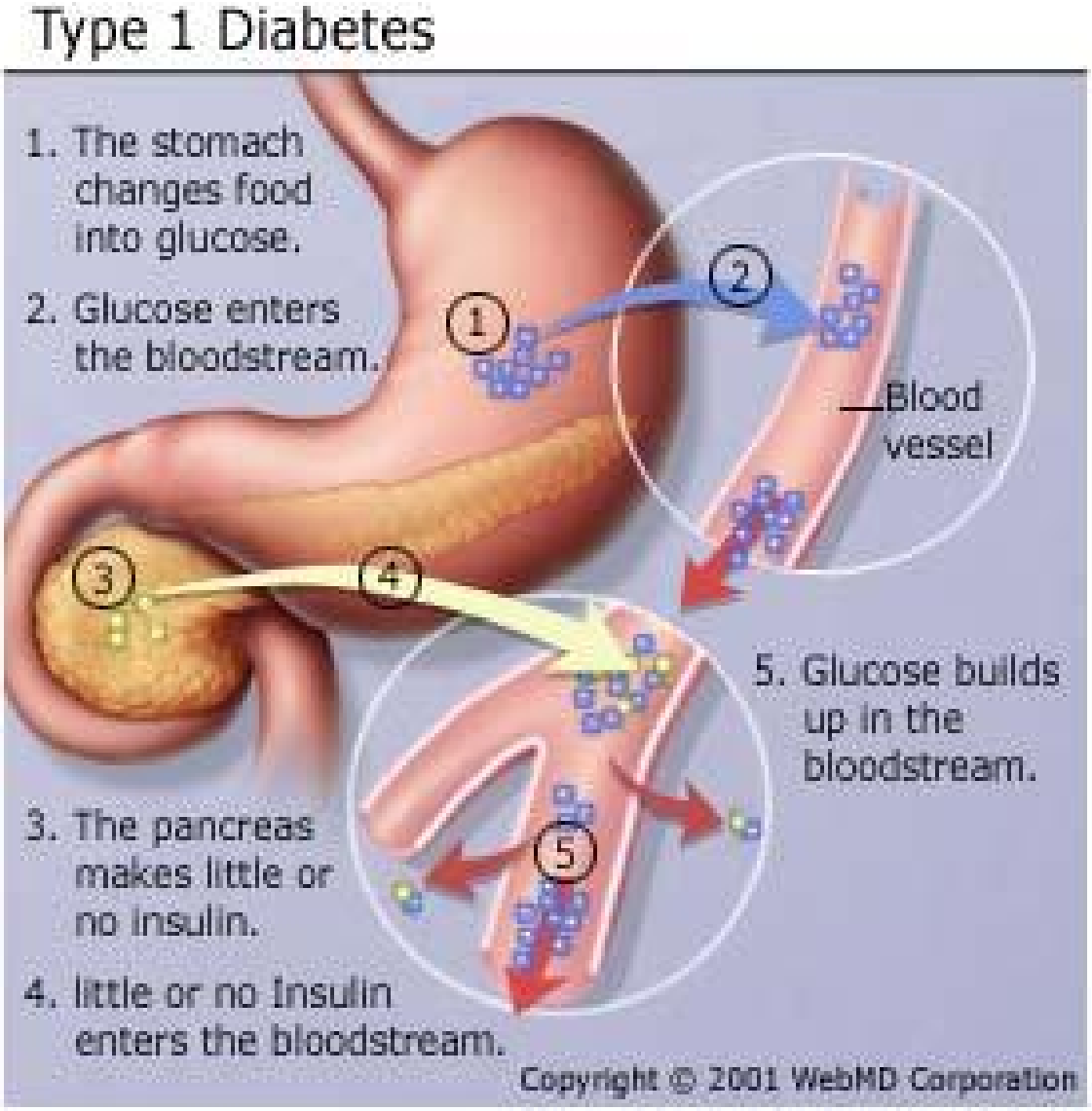
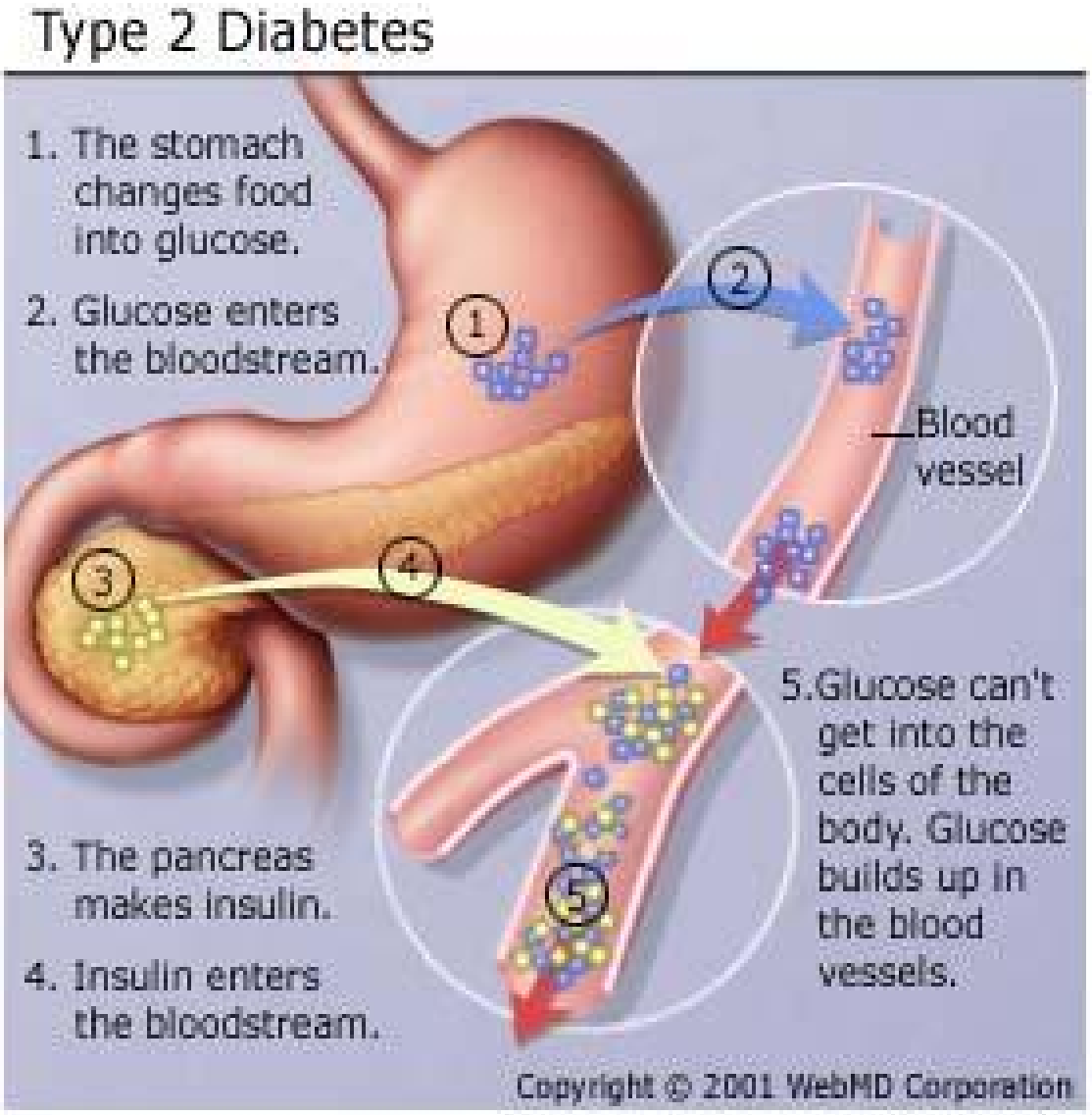
UNIT 2 DIABETES REVIEW

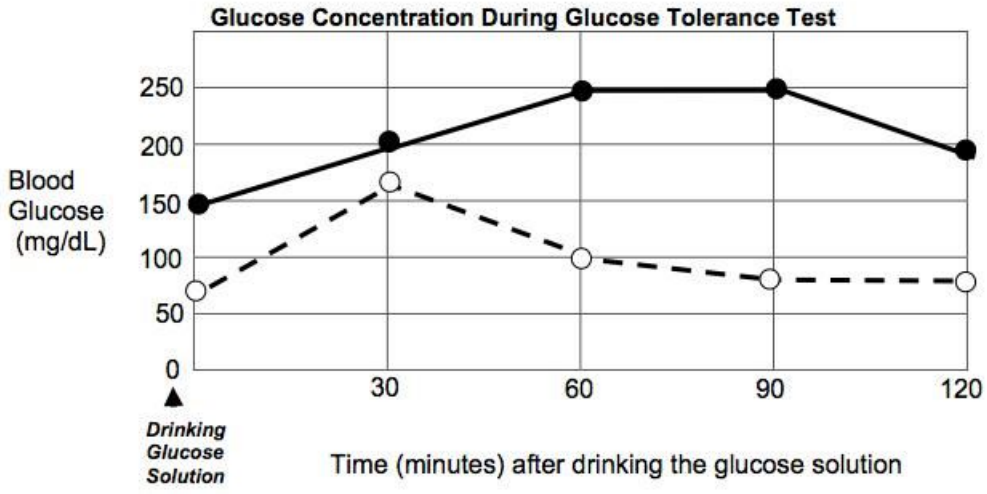


Pancreas is unable to make insulin. Therefore, **glucose cannot get into the cells for energy.**



Insulin is made, but cell **receptors** do not work at getting recognizing that insulin. Therefore, glucose cannot get into the cells for **energy**.

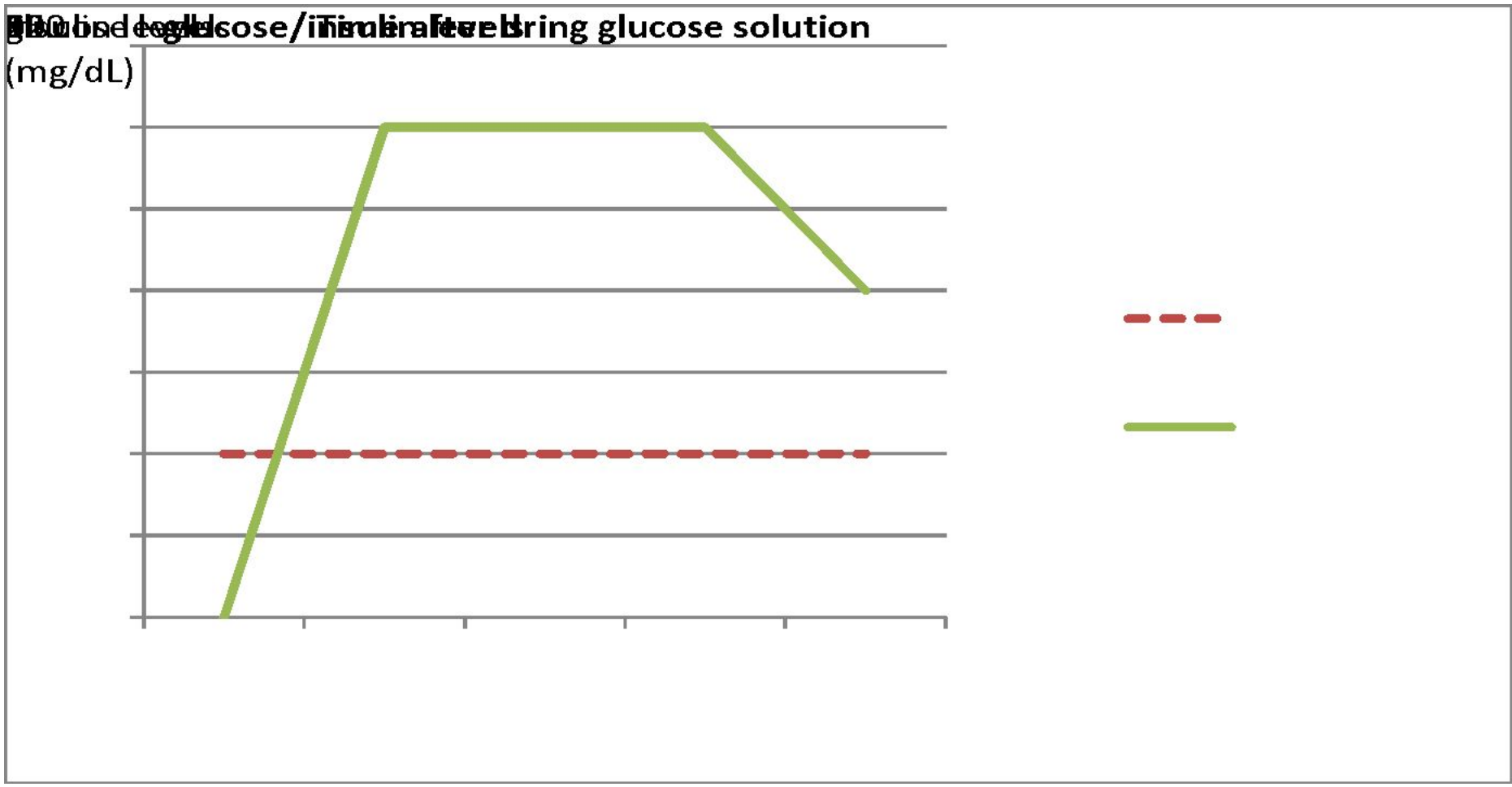
Glucose tolerance testing



Examples:

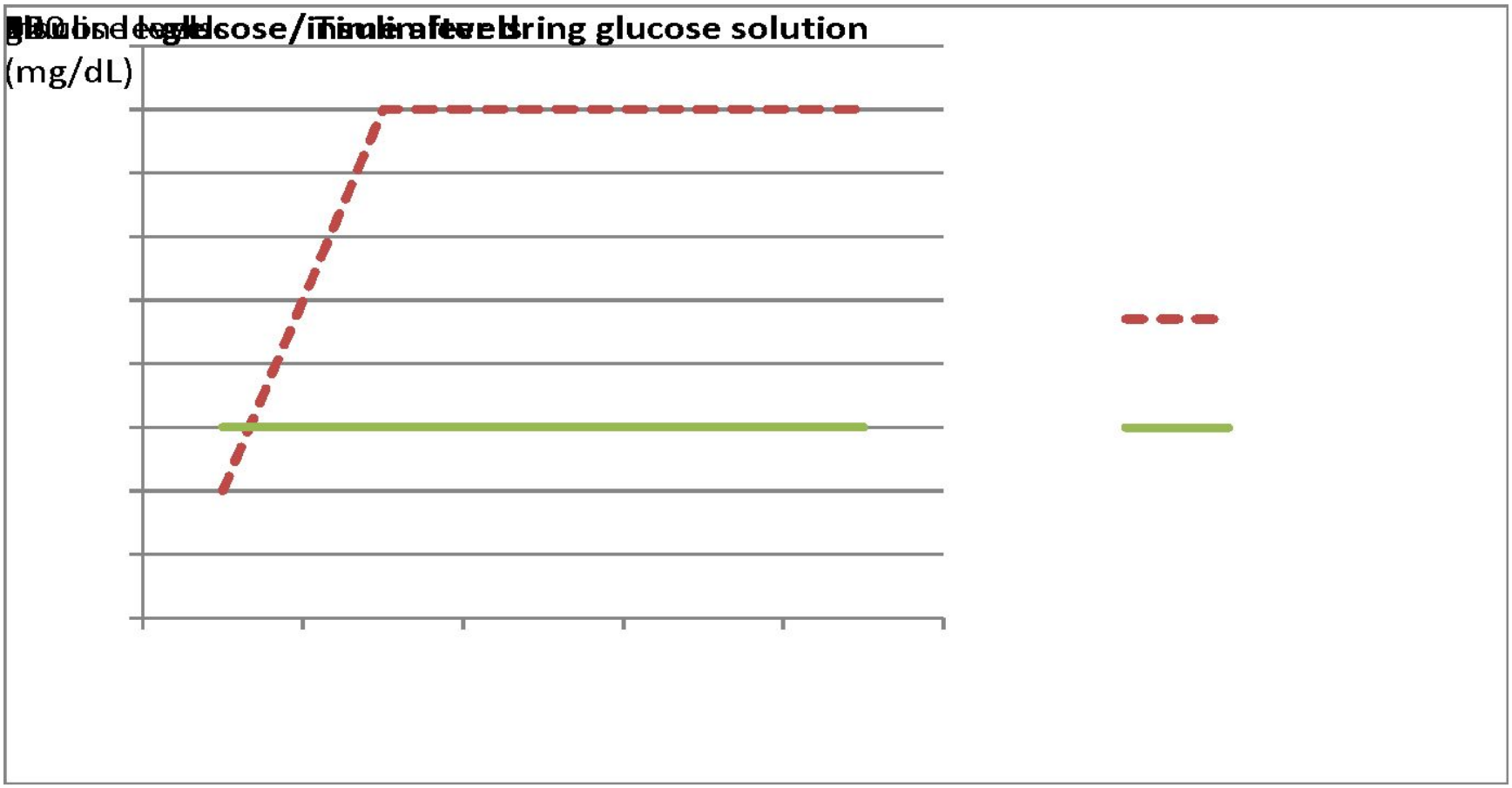
1. Solid line: **glucose** is high and remains high for several minutes after drinking the glucose solution. This patient has diabetes. We cannot tell what type yet, we would have to do insulin testing to determine this.
2. Dotted line: glucose goes up immediately after drinking the glucose solution and then goes down shortly afterward. This patient does not have diabetes because **insulin** is bringing their blood glucose levels down, like it should.

Insulin Testing: No Diabetes



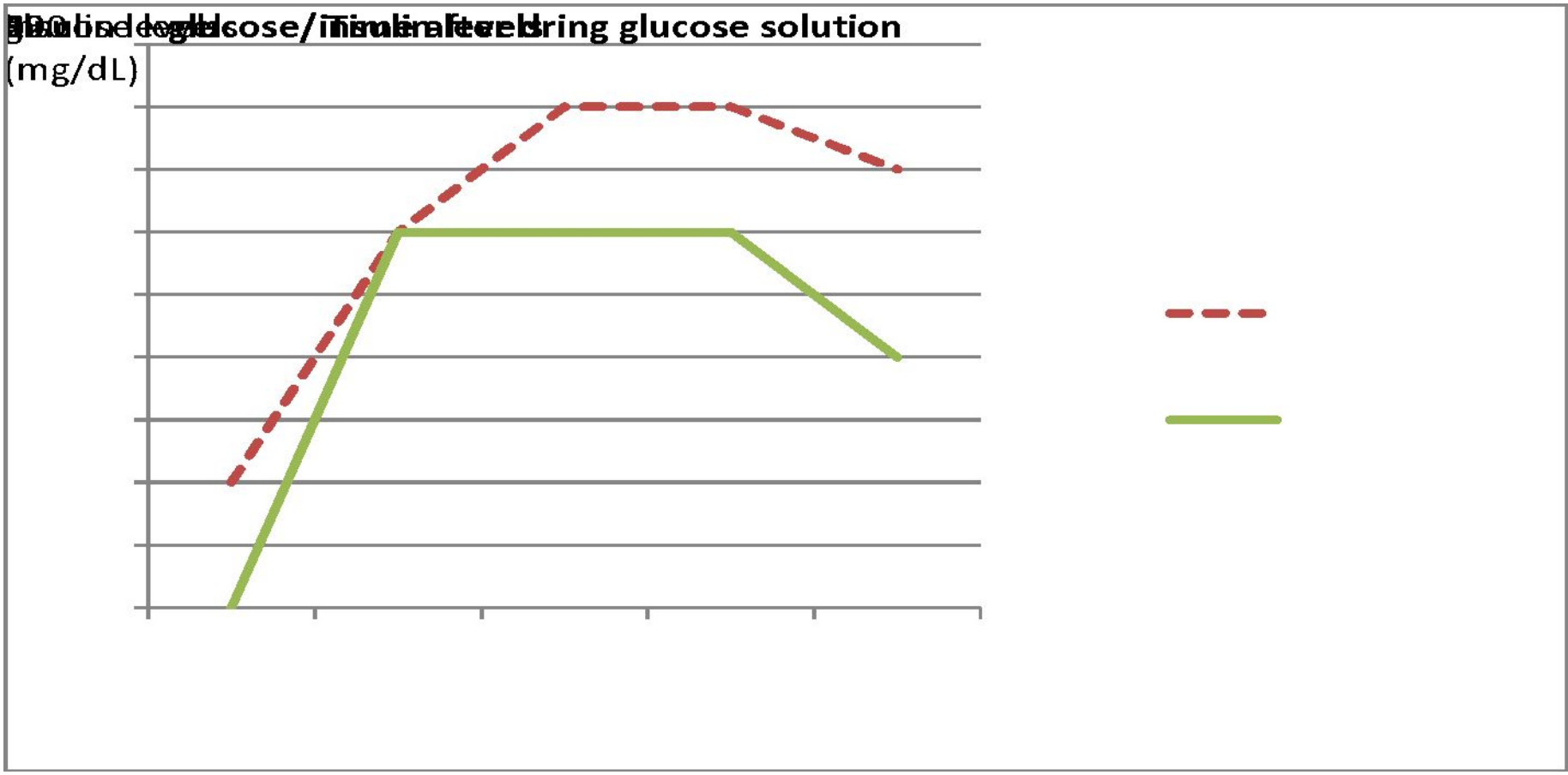
Glucose levels remain **low** while insulin levels are **high** . After drinking the glucose solution, insulin increases to keep the glucose levels low in the bloodstream.

Insulin Testing: Type 1 Diabetes



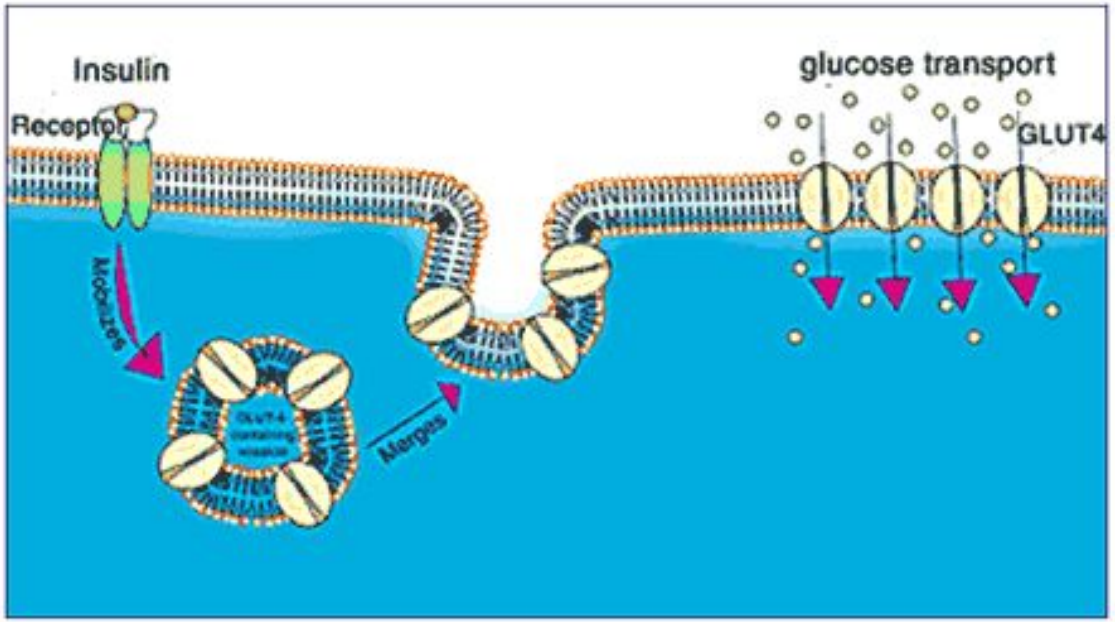
High Glucose, very **low** and no increase to insulin levels. Insulin is not being made in type 1 diabetes.

Insulin Testing: Type 2 Diabetes



Glucose and insulin are both **high**. The insulin is being made, but the cells do not know how to use it. Therefore, the insulin is not helping lower the blood sugar because it is not allowing the cells to take in the excess glucose.

How Does Insulin Help Glucose Enter the Cells?

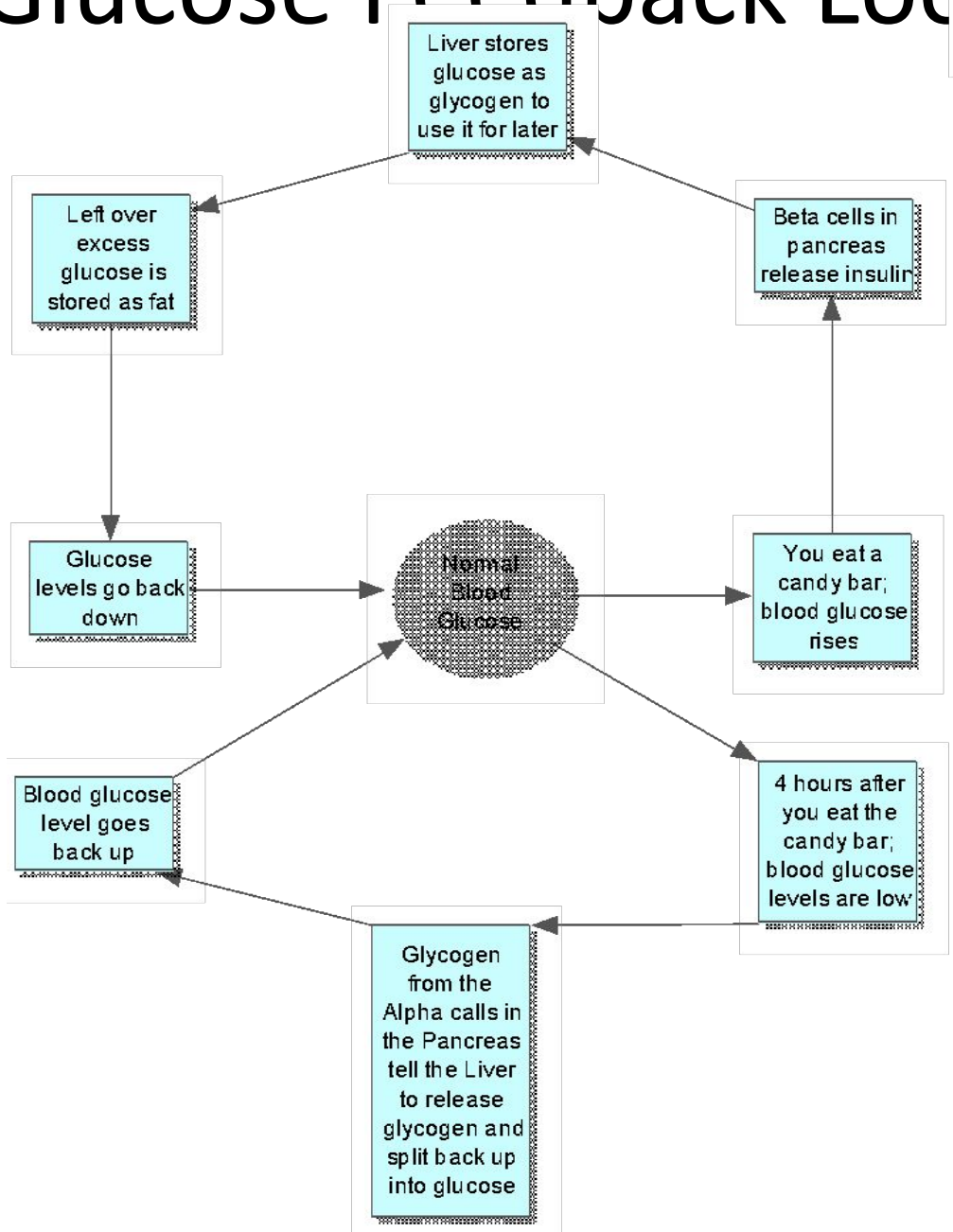


1. After **eating**, the glucose levels increase in the bloodstream.
2. Insulin is released from the **pancreas**.
3. Insulin attaches to insulin **receptors** on the cell membrane.
4. This sends a **message** to the glucose transporters inside the cell to attach its channel proteins into the cell membrane.
5. Glucose then enters the cell through these **transport** proteins.

Negative vs. Positive Feedback

- The human body maintains ***homeostasis***, a steady state, by monitoring changes in the internal and external environment and feeding this information back to the body so that it can make necessary change. The control of body temperature, heart rate, and the concentration of sugar in the blood are all regulated by these *feedback mechanisms* or ***feedback*** *loops*. There are actually two types of feedback mechanisms: **negative** feedback and **positive** feedback. In this instance, the terms positive and negative do not infer good or bad. Instead, the terms refer to the effect the input of information (feedback) has on the output (action) of the system**. Positive feedback causes a reinforcement of the original action, so the input causes the reaction to increase. Negative feedback causes the system to stop doing the original action and to either take no action or to perform an opposite action.**

Glucose Feedback Loop

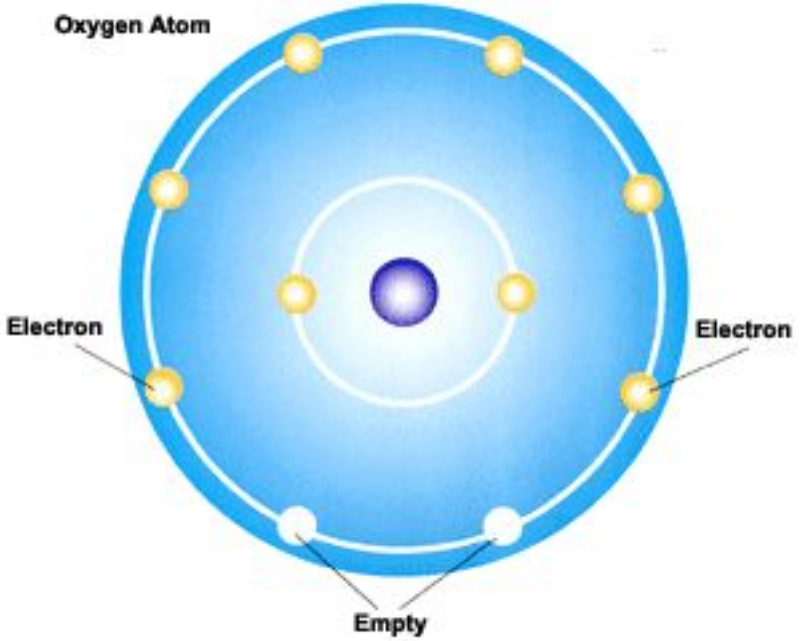


Unit 2.2 Review PBS

Basic Chemistry

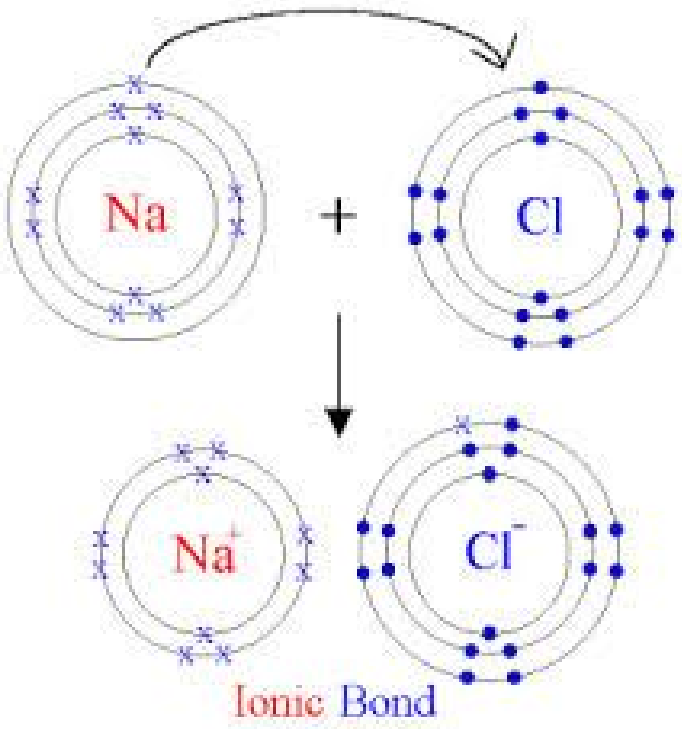
- **Protons** – Positive charged particles in the nucleus of an atom
- **Neutrons** – Neutral charged particles in the nucleus in an atom
- **Electrons** – Negative charged particles in the orbits of an atom
- Atomic number – Number of protons in an element and number of electrons in an element with no charge

Oxygen atomic number – 8
8 protons
8 electrons



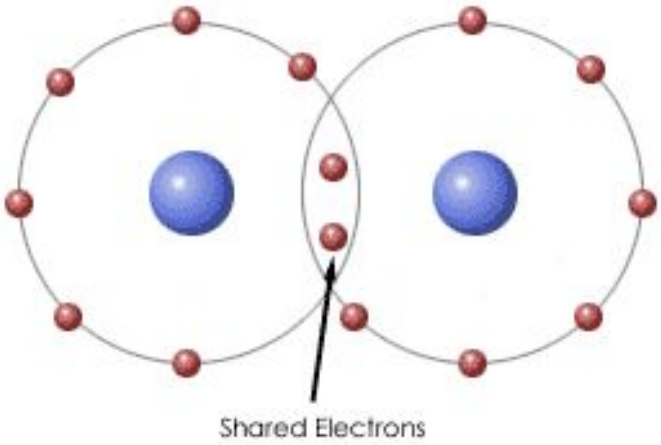
Basic Chemistry

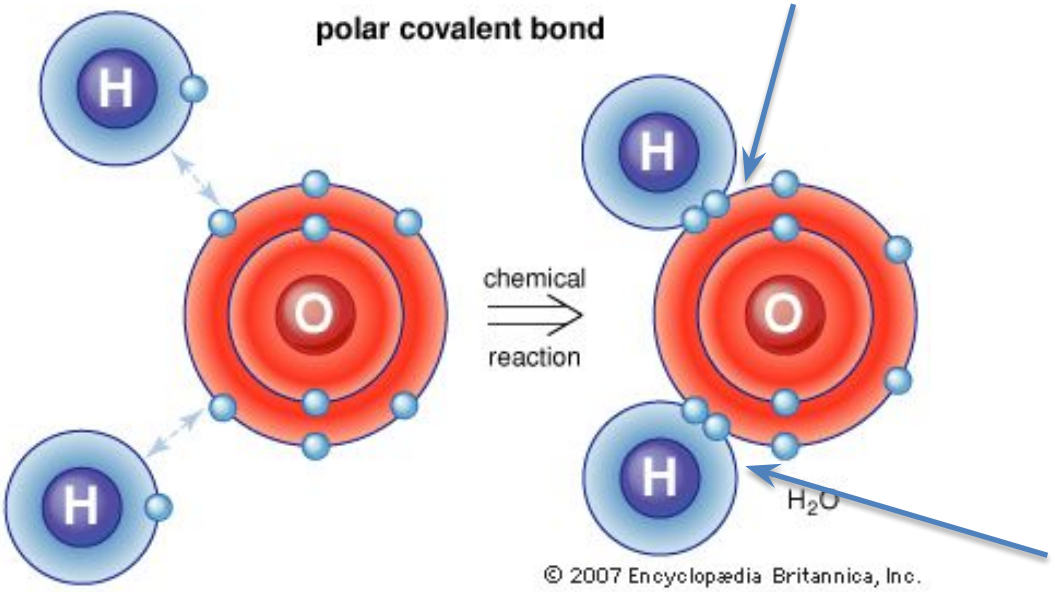
- Ionic Bond – **<u>weaker</u>** bond formed when electrons are **<u>transferred</u>** from one atom to another.
  - An element with only 1 or 2 electrons in the outer shell will donate electrons to another element. This will give it a positive charge because it now has more protons than electrons
  - The element with 7 or 6 electrons in the outer shell that receives the electrons to fill the outer shell with 8 now has a negative charge because it has more electrons than protons.
  - The positive and negative charges attract and form an ionic bond



Basic Chemistry

- Covalent Bond – **<u>stronger</u>** bond formed when electrons are **<u>shared</u>** between atoms.
  - Two elements need more electrons to fill their outer shell so they share electrons
  - This causes a covalent bond



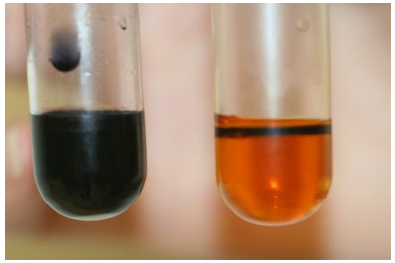


What are the main nutrients found in food? What role do basic nutrients play in the function of the human body?

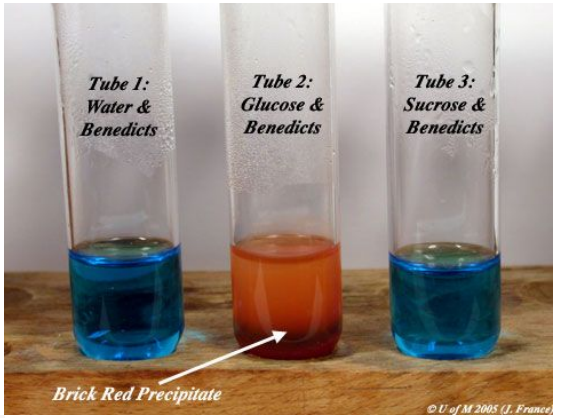
- Carbohydrates
  - Fiber – Helps regulate digestion
  - Sugar – Provides **energy**
- **Protein** – provides essential molecules for structure and support
- Fat
  - Saturated – unhealthy, solid fat, with straight fatty acid chains
  - Unsaturated – healthy, liquid fat, with bent fatty acid chains
  - Cholesterol – important molecule for cell membranes and cell communication, but too much leads to heart disease
- **Calories** – amount of energy in food
- Sodium – amount of salt in food, leads to high blood pressure
- Vitamins – C- healing, K – blood clot, A – Retina health, D – bone growth
- Minerals – Calcium – bone growth, Iron – carrying oxygen in blood

How can carbohydrates, lipids, and proteins be detected in foods ?

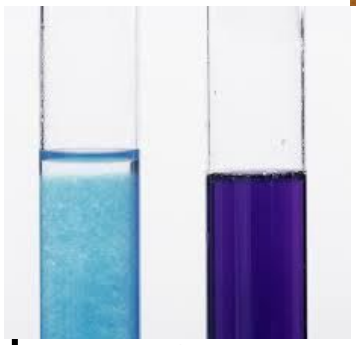
- Use of chemical **indicators** (positive and negative controls)
- Iodine
  - Starch turns black



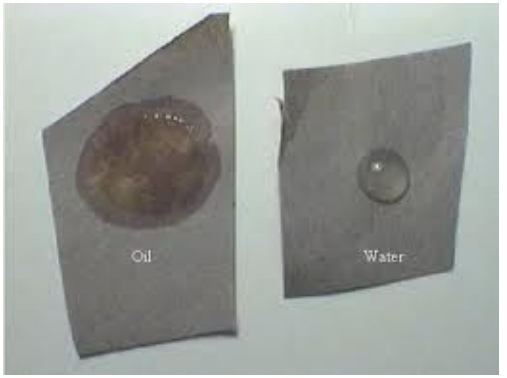
- Benedict's
  - Glucose turns **orange**



- **Biuret**
  - Protein turns purple



- Lipids
  - Paper **bag** turns translucent

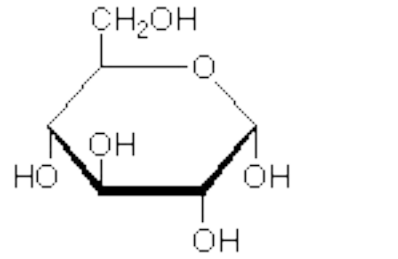


What types of foods supply sugar, starch, proteins and lipids? How can food labels be used to evaluate dietary choices? What are basic recommendations for a diabetic diet?

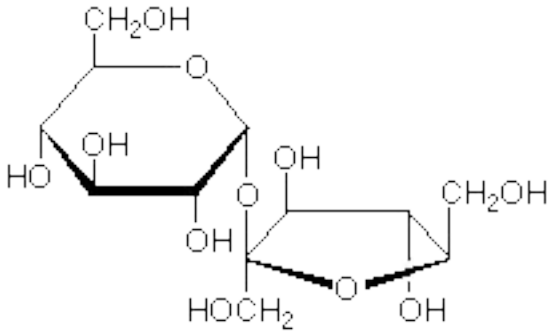
- Starch – Potatoes, Pasta, breads, and any other complex carb
- Protein – Meat, dairy, and legumes (beans, nuts)
- Lipids – Oils, butter, meat
- Food labels can be used to evaluate the amount of nutrients and unhealthy molecules you consume in one day.
- Diabetics should have foods high in protein, omega fat, complex carbs, high fiber

What are the main structural components of carbohydrates, proteins and lipids?

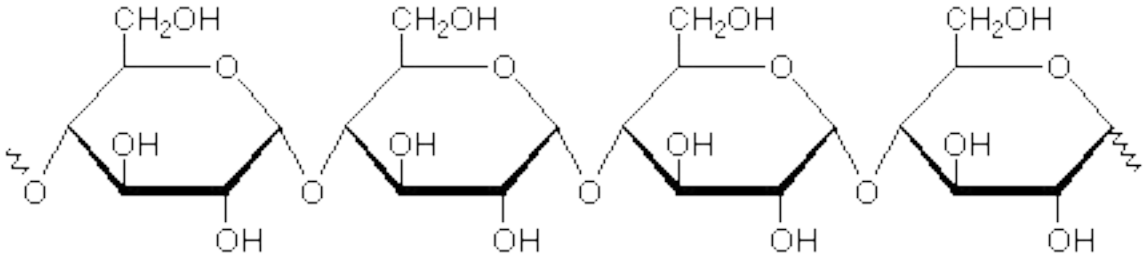
- All three are made of **Carbon**, Hydrogen, and Oxygen
- Carbohydrates
  - Monomers – Monosaccharides
  - Two monosaccharides – **Disaccharides**
  - Many monosaccharides - Polysaccharides



monosaccharide (glucose)



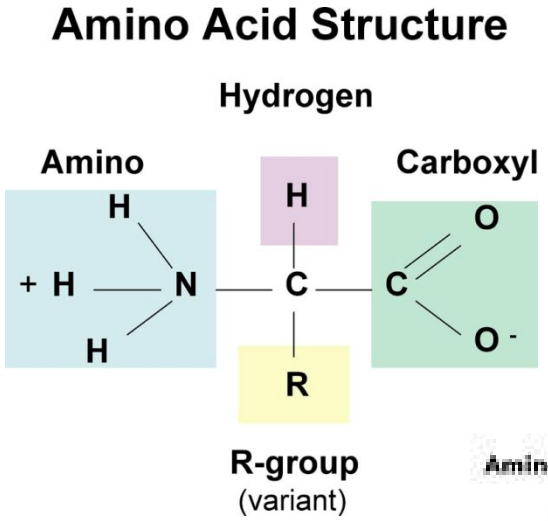
disaccharide (sucrose)

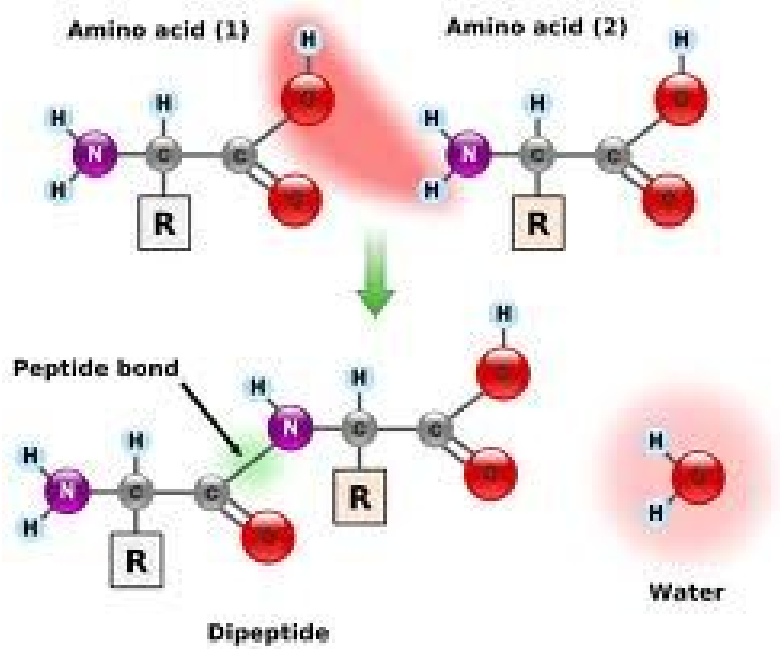


polysaccharide (amylose starch)

What are the main structural components of carbohydrates, proteins and lipids?

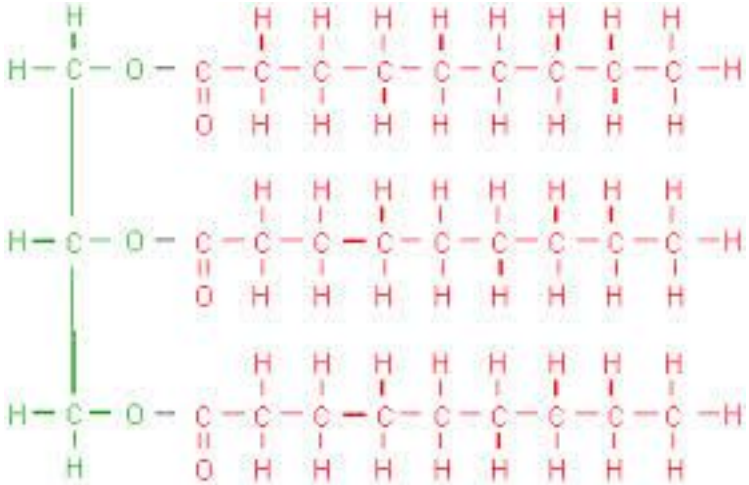
- Proteins
  - Monomers – **Amino Acids**
    - Made of amino group, carboxyl group, and variable group
  - Two Amino Acids– Dipeptides
  - Many Amino Acids- Poly peptides

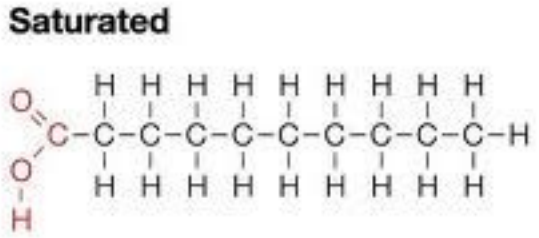


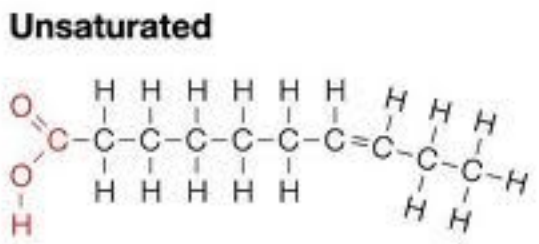


What are the main structural components of carbohydrates, proteins and lipids?

- Lipids
  - Made of glycerol and three fatty acid chains
  - **Saturated**
    - All hydrogen atoms present on chains and **straight**
  - **Unsaturated**
    - Missing hydrogen atoms and chains **bent**

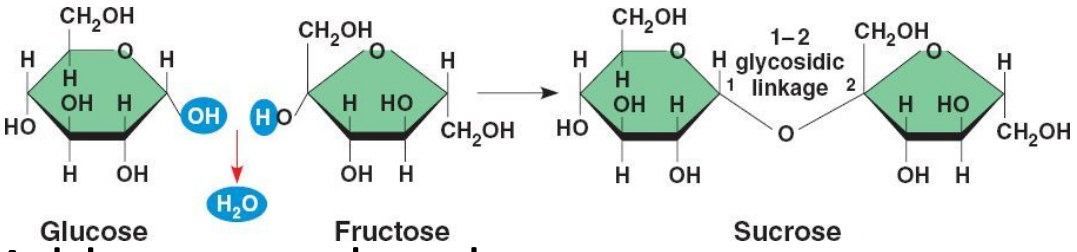




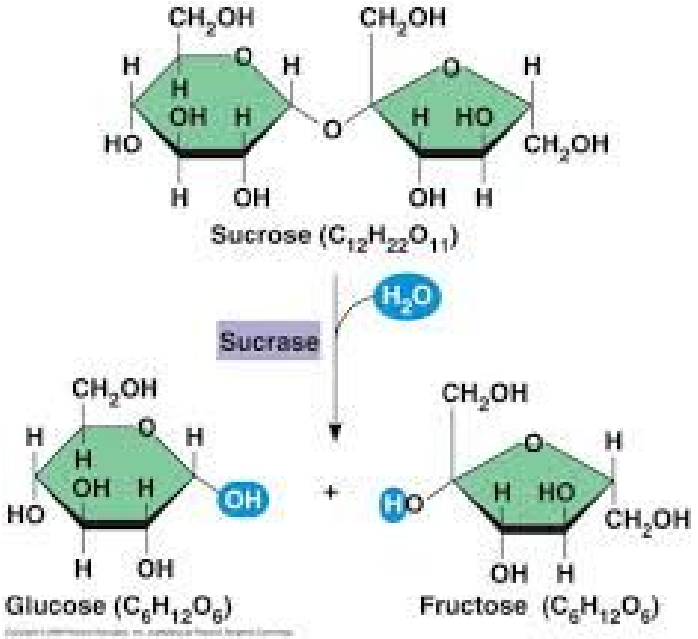


What is dehydration synthesis and hydrolysis? How do dehydration synthesis and hydrolysis relate to harnessing energy from food?

- **<u>Dehydration</u>** synthesis – Remove water to connect two monomers together to store energy



- **<u>Hydrolysis</u>** – Add water to break two monomers apart to release energy



How is the amount of energy in a food determined?

- Set the food on **fire** and the heat that is released can be measured by seeing how much the **temperature** of water increases.
- This is measured in chemistry calories, which are 1,000 in one Calorie.

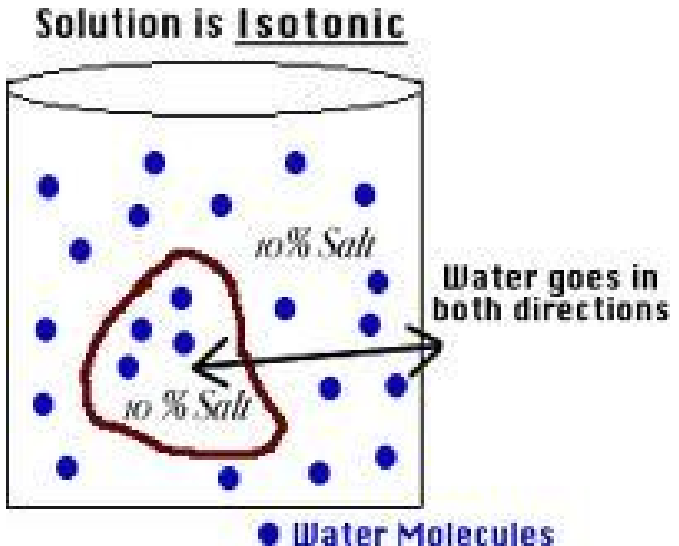
2.3 Review PBS

What are several ways the life of someone with diabetes is impacted by the disorder?

- **Diet** – have to watch the amount of carbohydrates they eat and eat mainly complex carbs when they do
- **Exercise** – need to maintain a strict exercise regiment to control sugar and limit complications that may occur from diabetes
- **Sugar** – Check blood sugar often to maintain healthy level
- Insulin **shots** and pumps are required for type 1 diabetes
- **Doctor's** – Required to see various doctors often to help manage lifestyle and to ensure there are no complications

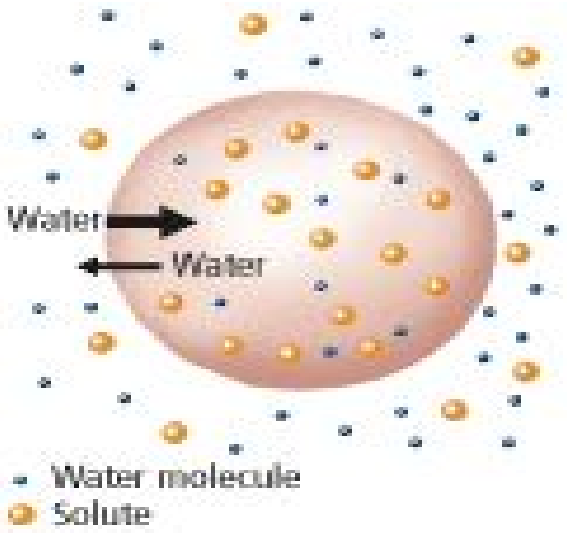
Osmosis Background

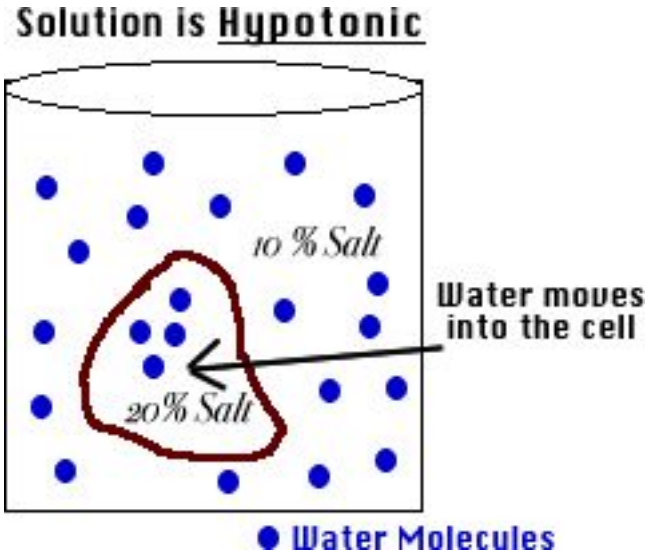
- Solvent – liquid (usually water) that **dissolves** the solute.
- **Solute** – what is dissolved in the solvent. In the case of diabetes it is sugar
- **Solution** – A liquid mixture that contains a substance dissolved into it
- Osmosis – The movement of water from **high** concentrations to **low** concentrations
- **Isotonic** – The same amount of solutes inside and outside the cell



How do the terms hyperglycemia and hypoglycemia relate to diabetes? What might happen to cells that are exposed to high concentrations of sugar? What is the importance of checking blood sugar levels for a diabetic?

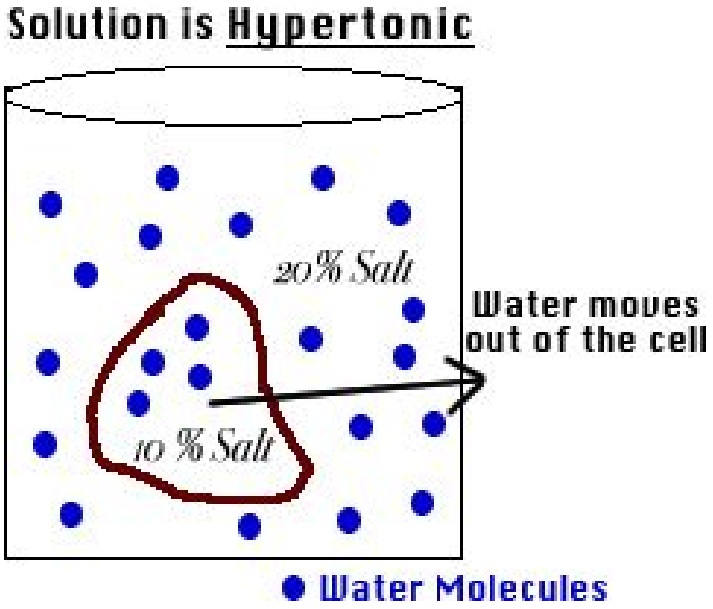
- **<u>Hypoglycemia</u>** – **<u>low blood sugar</u>**, causes water to enter cells by osmosis
- This leads to dizziness, lethargy, and **<u>hunger</u>** because cells are not getting enough sugar for **<u>energy</u>**

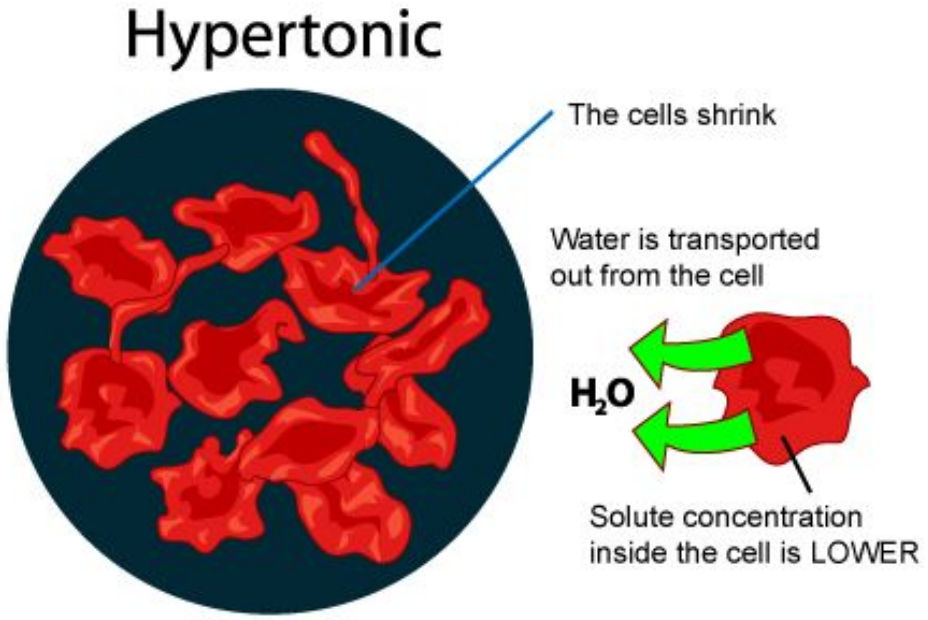




How do the terms hyperglycemia and hypoglycemia relate to diabetes? What might happen to cells that are exposed to high concentrations of sugar? What is the importance of checking blood sugar levels for a diabetic?

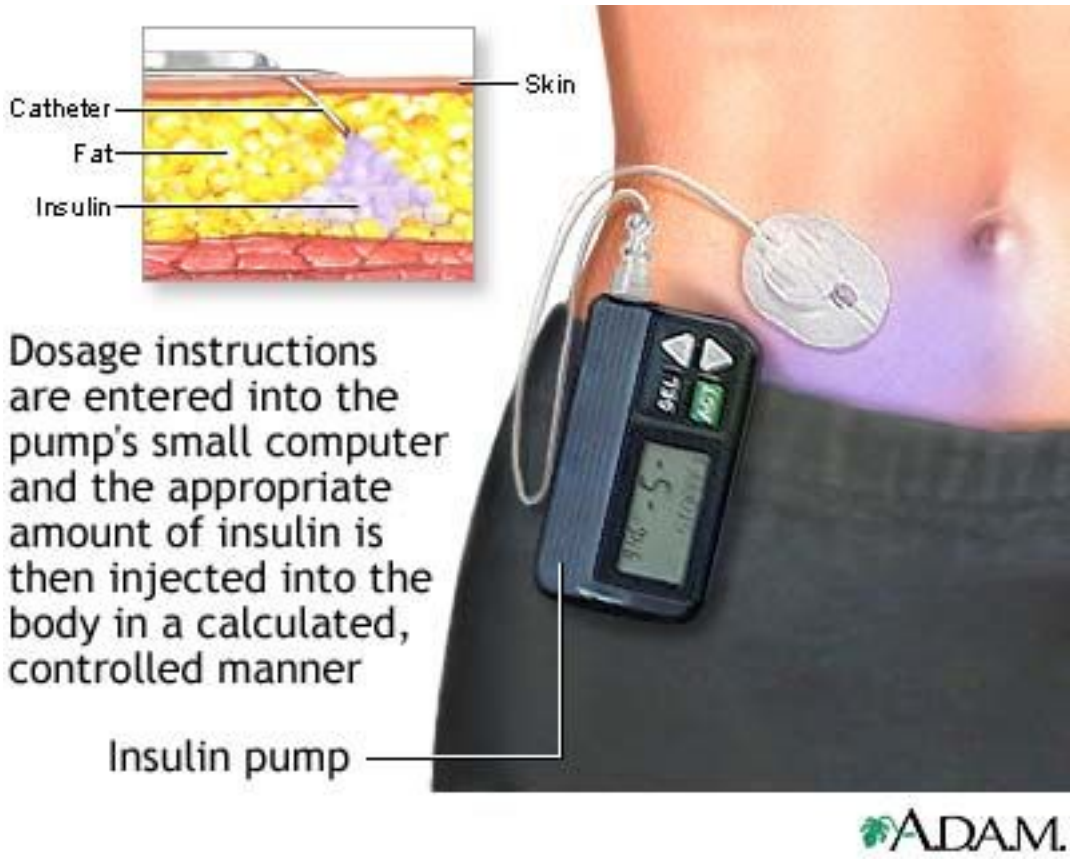
- **<u>Hyperglycemia</u>** – **<u>high blood sugar</u>**, causes water to leave cells by osmosis
- This leads to dehydration, thirst, and excessive **<u>urination</u>**





How can an insulin pump help a diabetic?

- Insulin pumps use a **catheter** that is inserted into fatty tissue
- They can be used to deliver insulin **constantly** so that insulin is always present to help control glucose
- They can also be used deliver more insulin around meals to help counteract the influx of glucose.
- These still require that you check your **blood** sugar often



How do Type I and Type II diabetes differ?

- Type 1: Genetic, No insulin, **need** insulin shots and pumps
- Type 2: Genetic/due to overweight, insulin is there, but is not working, regulated by **diet** and **exercise**, possibly medicine or insulin

Comparison of type 1 and 2 diabetes		
Feature	**Type 1 diabetes**	**Type 2 diabetes**
Onset	Sudden	Gradual
Age at onset	Any age (mostly young)	Mostly in adults
Body habitus	Thin or normal	Often obese
Ketoacidosis	Common	Rare
Autoantibodies	Usually present	Absent
Endogenous insulin	Low or absent	Normal, decreased or increased
Concordance in identical twins	50%	90%
Prevalence	Less prevalent	More prevalent - 90 to 95% of U.S. diabetics

What are potential short and long-term complications of diabetes?

- **Vision impairment, hearing loss, skin condition, gums disease, high blood pressure all due to blood vessel and nerve damage**
- **Peripheral Arterial Disease** causes lack of blood flow to the feet, which could lead to amputation
- **Neuropathy** is nerve damage and often leads to numbness in feet
- **Kidney** failure due to excessive filtration of the blood
- **Stroke** due to **blood clots** in vessels to the brain
- Stress of monitoring blood sugar
- **Ketoacidosis** – poisoning from breaking down fat instead of glucose

What are the current treatments for Type I and Type II diabetes? What innovations are available to help diabetics manage and treat their disease?

- Type 1
  - Check blood glucose using Hemoglobin A1C
  - Insulin Pumps
- Type 2
  - Pills
  - Exercise and Diet
  - Injectable medications
- **Innovations**
  - Artificial Pancreas
  - Inhaled Insulin
  - Sensor Augmented Pump
  - *Glucose Monitor Temporary Tattoo*