



Diagnosing Diabetes

Teacher information

Summary:

Students analyze simulated blood plasma samples collected during a glucose tolerance test for diabetes. They test glucose and insulin levels to determine if the patient has Type 1 or Type 2 diabetes.

Core concepts:

- To maintain homeostasis the internal environment must be kept stable - within normal limits that are favorable for cell activities.
- Homeostasis in an organism is constantly threatened. Failure to respond effectively can result in disease or death.
- Organisms detect and respond to change in a variety of ways both at the cellular and at the organismal level.
- Blood sugar levels are maintained by insulin from the pancreas.
- Receptor molecules and hormones play an important role in the interactions between cells.
- If hormone signals are blocked, cell communication is disrupted and the organism's stability is affected.

Class time required:

Two 40-minute class periods + homework. Part 1 may be done as pre-lab homework

Teacher preparation:

Each student will need:

- 1 *Diagnosing Diabetes*
- 1 *Graphics for What you should know about Diabetes and the Glucose Tolerance Test*. May be done as gray scale or color copy. Consider laminating one color copy per team and one grayscale copy for each student.
- Scissors
- Glue or tape
- Safety goggles

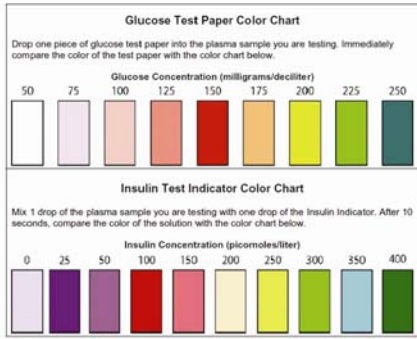
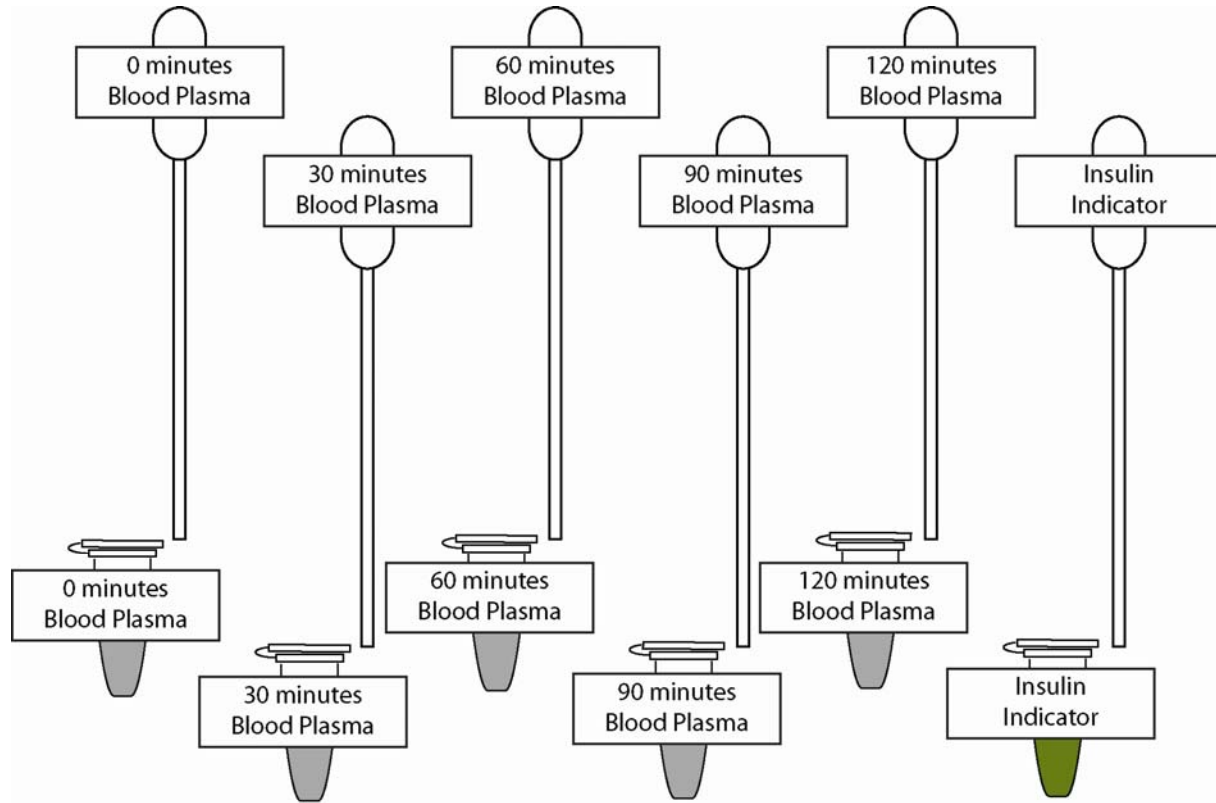
Each team of students will need:

- 1 color *Glucose and Insulin Test Color Chart* (may be laminated for reuse)
- 1 transparency *Glucose Tolerance Testing Sheet*
- 5 strips of pH 1-12 paper. Order Hydrion Paper pH 1-12 from Microessential Labs (www.microessentiallab.com, Catalog # 50 Hydrion Single Roll pH Paper). Cut into 1 inch strips.
- 1 dropping bottle labeled *Insulin Indicator Solution* containing at least 1ml of indicator mixture. To make indicator mixture: Prepare 0.05% methyl red solution. Prepare 0.05% bromothymol blue solution. Mix 1:1 methyl red/bromothymol. Alternatively, you can dispense these solutions in labeled droppers or in microtubes with droppers.
- 5 dropping bottles labeled as in first column and filled with at least 1 ml of the buffer solutions indicated in the second column. Alternatively, you can dispense these solutions in labeled transfer pipets or in microtubes with droppers.

| Label on Dropper | Contents of Dropper |
|-------------------------|----------------------------|
| <i>Plasma 0 min</i> | Buffer pH 3 |
| <i>Plasma 30 min</i> | Buffer pH 7 |
| <i>Plasma 60 min</i> | Buffer pH 9 |
| <i>Plasma 90 min</i> | Buffer pH 9 |
| <i>Plasma 120 min</i> | Buffer pH 7 |

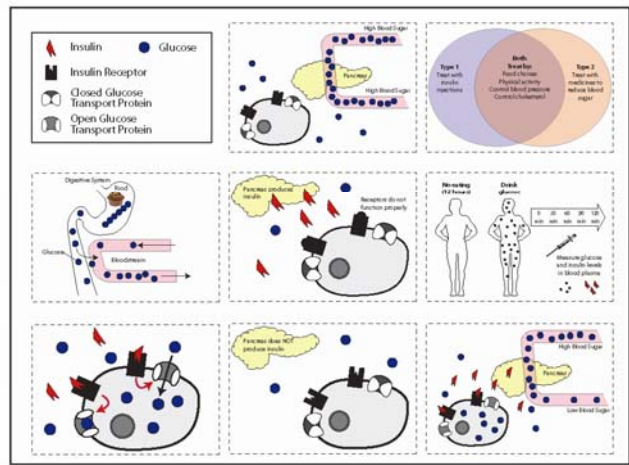
This project was generously funded by Science Education Partnership Award R25RR023285 from the National Center for Research Resources. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Center for Research Resources or the National Institutes of Health.

Quick Guide:



Glucose Test Paper

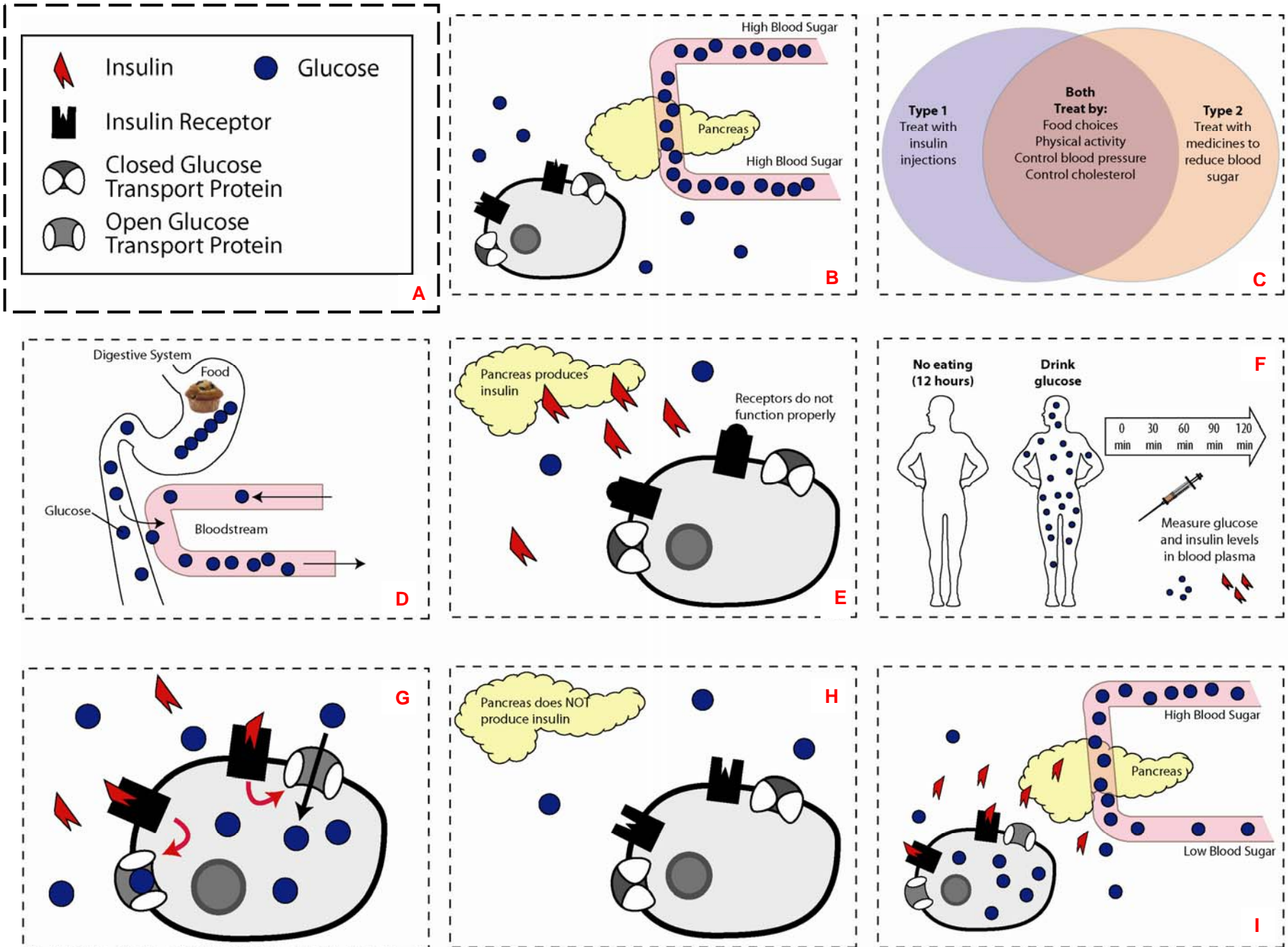
| Time of Blood Collection Minutes After Drinking Glucose Solution | Column 1 | Column 2 |
|---|---------------------------------------|---------------------------------------|
| | Drop of Blood Plasma for Glucose Test | Drop of Blood Plasma for Insulin Test |
| 0 (fasting) | <input type="text"/> | <input type="text"/> |
| 30 | <input type="text"/> | <input type="text"/> |
| 60 | <input type="text"/> | <input type="text"/> |
| 90 | <input type="text"/> | <input type="text"/> |
| 120 | <input type="text"/> | <input type="text"/> |



During Class:

1. Group students into lab teams of 2-4 students.
2. Distribute *Diagnosing Diabetes* to each student.
3. Read *The Case* aloud to the entire class. Ask students what they know about diabetes. List what they know on the board.
4. Read *The Tasks* aloud to the entire class.
5. Ask students to work with their team members to complete the *Diagnosing Diabetes* activity.
6. Ask teams (or the class) to make a list of what they learned about diabetes and what questions they have about diabetes. Students who have diabetes may want to share their expertise and their experiences with the class.

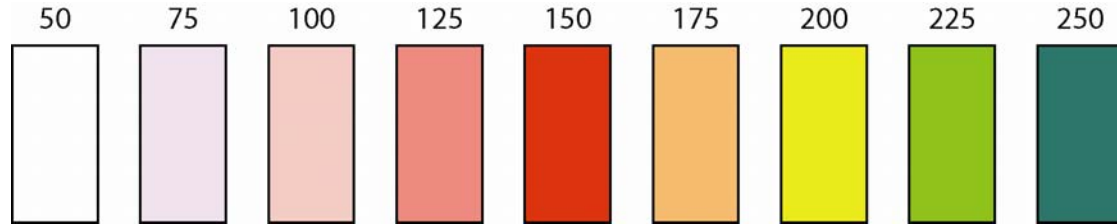
Graphics for *What you should know about Diabetes and the Glucose Tolerance Test*



Glucose Test Paper Color Chart

Dip one end of a glucose test paper into the plasma sample you are testing. Immediately compare the color of the test paper with the color chart below.

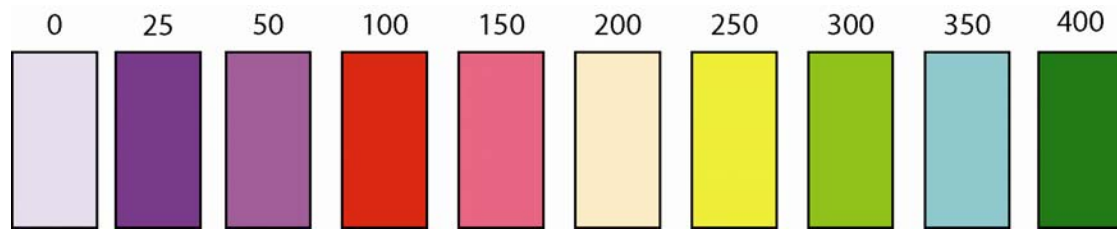
Glucose Concentration (milligrams/deciliter)



Insulin Test Indicator Color Chart

Mix 1 drop of the plasma sample you are testing with one drop of the Insulin Indicator solution. After 10 seconds, compare the color of the solution with the color chart below.

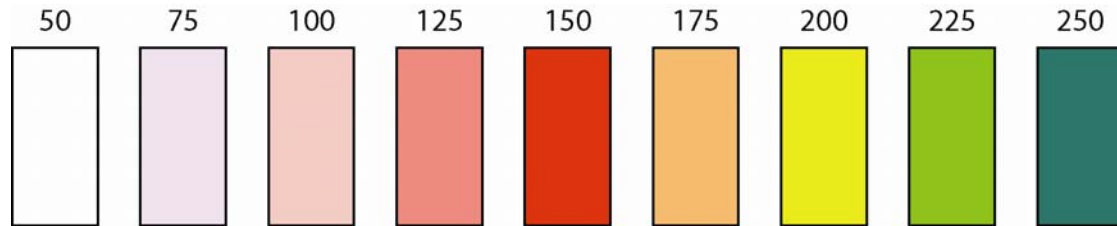
Insulin Concentration (picomoles/liter)



Glucose Test Paper Color Chart

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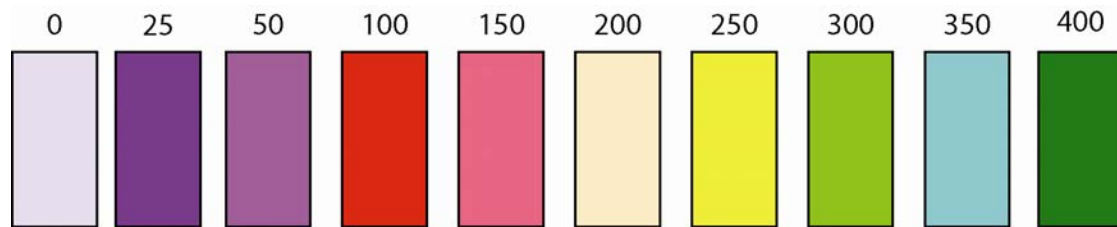
Glucose Concentration (milligrams/deciliter)

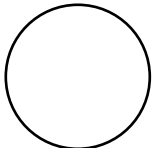
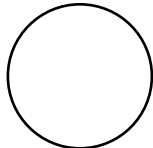
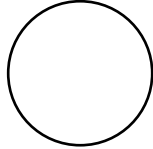
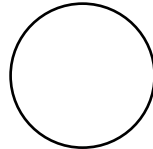
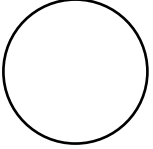
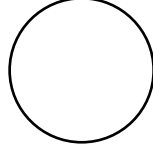
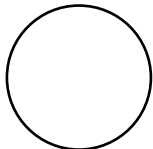
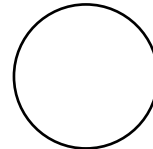
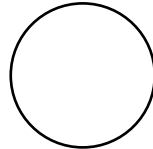
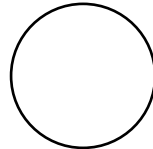


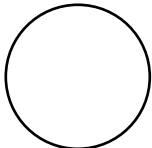
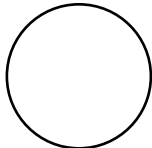
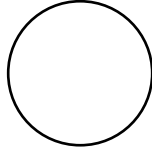
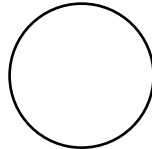
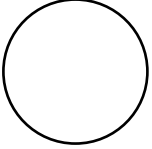
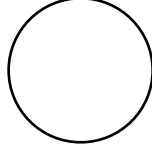
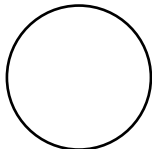
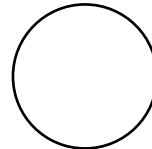
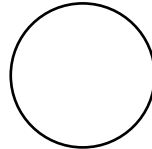
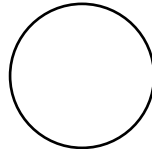
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