

Glucose Storage and Release in Liver Cells

Glucose 6-phosphatase, which is found in mammalian liver cells, is a key enzyme in control of blood glucose levels. The enzyme catalyzes the breakdown of glucose 6-phosphate into glucose and phosphate. These products are transported out of liver cells into the blood, increasing blood glucose levels. The phosphate concentration outside isolated liver cells can be used to indirectly measure glucose 6-phosphatase activity inside the cells.

To investigate the enzyme activity, isolated rat liver cells were placed in a dish with buffer at physiological conditions (pH 7.4, 37°C). Glucose 6-phosphate (the substrate) was added to the dish, where it was taken up by the cells. Then a sample of buffer was removed every 5 minutes and the phosphate concentration determined. The results are shown in Table 1.

Table 1 Phosphate concentration outside liver cells over time

Time (min)	[phosphate] ($\mu\text{mol/mL}$)
0	0
5	10
10	90
15	180
20	270
25	330
30	355
35	355
40	355

- a) Identify the independent and dependent variables and graph the data.
- a) State whether the phosphate concentration increases evenly through the course of the experiment. Justify your response.
b) Identify the time during which enzyme activity is highest. Justify your response.
c) Calculate the rate of enzyme activity during the time it is the highest.
- Propose a biological reason for the pattern observed.
- If your blood sugar level is low from skipping

lunch, identify the reaction that will occur in your liver cells. Write out the reaction and put the name of the enzyme over the reaction arrow. Describe how this reaction will affect your blood sugar level.