

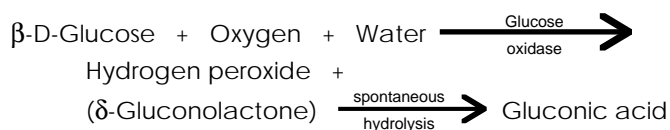
# Glucose detector

**HIGHLY-SPECIFIC** test strips for detecting glucose in urine or blood are commonly used in doctors' surgeries and in the home. All of these tests utilise the enzymes glucose oxidase and peroxidase, immobilised on a paper pad at the tip of the strip. The pad is covered with a thin cellulose membrane which is permeable only to small molecules such as glucose. In the presence of oxygen and glucose, the products of the enzyme activity react with a chemical (also on the paper pad) to produce a colour change. With some tests (such as *Diastix* or *Boehringer Diabur 5000*), the intensity of the colour which develops indicates the glucose concentration.

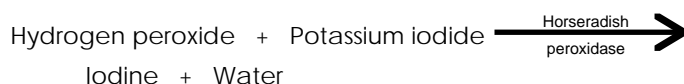
The principles behind these diagnostics are readily demonstrated, using potassium iodide as the chromagen (colour-change reagent). Different sugars can be used to indicate the specificity of the reaction catalysed by glucose oxidase.

## How the test strips work:

- 1) **Glucose oxidase acts specifically on glucose to give hydrogen peroxide and gluconic acid:**



- 2) **Horseradish peroxidase then catalyses the reaction of hydrogen peroxide with potassium iodide. The colourless iodide is oxidised to brown iodine:**



*Note: the reactions shown on the accompanying worksheet have been simplified.*

## Practical details

*Special care should be taken to ensure that cross-contamination of the enzyme mixture, potassium iodide and sugar solutions does not occur. Separate, clearly-marked syringes or pipettes should be used for dispensing each liquid.*

1. Cut out a small square of filter paper, roughly 10 mm x 10 mm.
2. Place a drop of potassium iodide solution on the paper, and allow it to dry slightly.
3. Add a drop of the enzyme mixture to the paper.
4. Add a drop of a sugar solution to the paper and note the colour change (this may take a few minutes, as oxygen has to diffuse into the solutions).

*The reagents may also be mixed in a small test tube, where students may notice that the colour change only occurs near the surface of the liquid, where oxygen can diffuse in. Shaking the tube turns the whole liquid brown.*

## Safety

This activity presents no particular safety problems, although no attempt should be made to use this method for assaying blood glucose! Enzyme spills should be wiped up promptly, using water.

## Further activities

This work is suitable for presentation as a problem-solving activity, if students are given the accompanying worksheet, the reagents and no other information.

## Materials

Thick filter paper or blotting paper  
2% potassium iodide solution  
Glucose oxidase / horseradish peroxidase mixture, *Fermcozyme 952 DM* (available in 50 cm<sup>3</sup> quantities from Hughes and Hughes Ltd, Unit 1F, Lowmoor Industrial Estate, Tonedale, Wellington, Somerset, TA21 0AZ. Tel: +44 (0) 1823 660186)

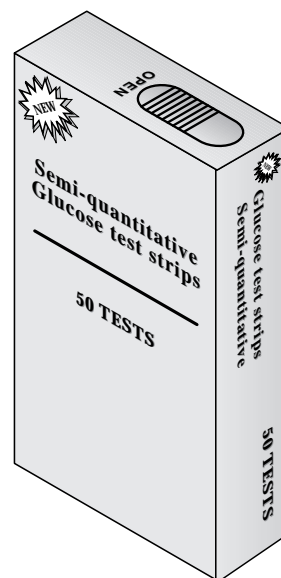
*Note that although this enzyme mixture is expensive, very small volumes are needed.*

Glucose solution } various concentrations  
Fructose solution } in the range 1–4% may  
Sucrose solution } be tested

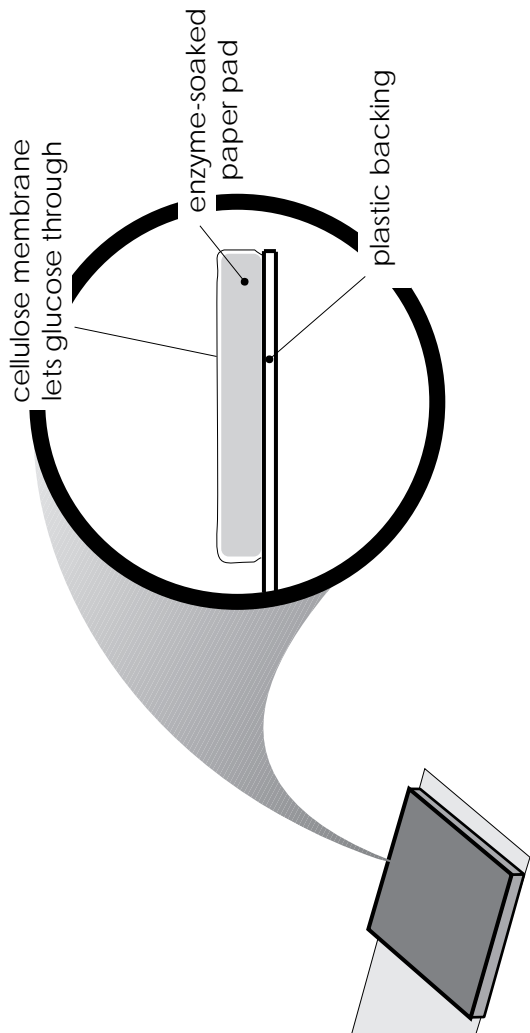
Dropping pipettes or 1 cm<sup>3</sup> plastic syringes (without needles) for dispensing liquids  
Scissors  
Forceps for handling enzyme-soaked paper

## ADDITIONAL INFORMATION

*Enzymes in Industry and Medicine* by Gordon Bickerstaff (1987) Edward Arnold (New Studies in Biology)  
ISBN: 0 7131 2935 2.



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What's going on?

