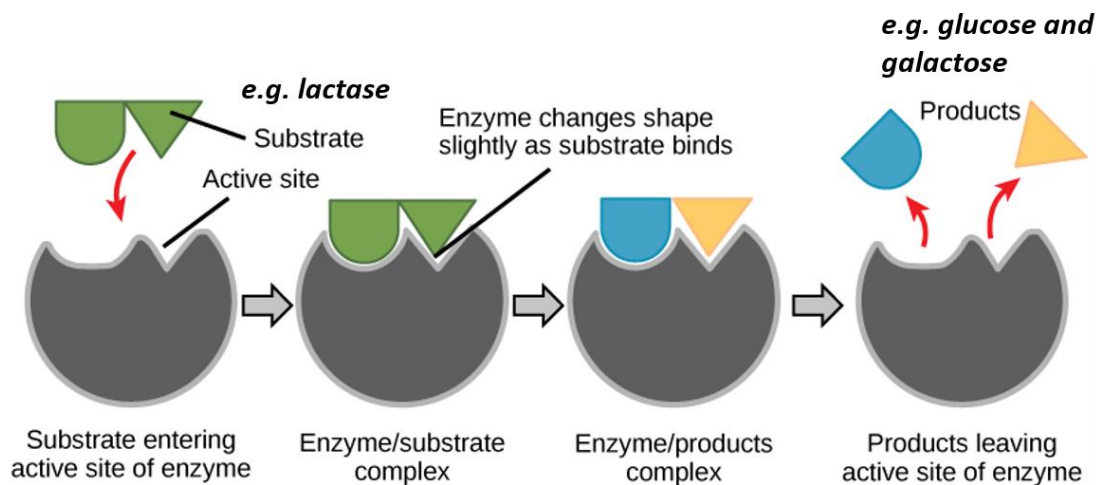


7. Lactase enzyme and lactose intolerance

7.1 Enzyme lactase and lactose intolerance

What does lactase do and how?

In a way, enzymes are the main “workhorses” of metabolism: they catalyse all the life-sustaining chemical reactions, allowing them to proceed much faster than they otherwise would. You might have learned the basics of how enzymes work in your studies. Here we will consider a specific example, a well-known enzyme, lactase.



Adapted from OpenStax Biology; License: CC BY 4.0.
https://cnx.org/contents/GFy_h8cu@9.87:MnC6GuJi@7

7.2 Lactase in action in “real life”

Please see below a description of an experiment involving lactase and two different types of milk, as well as the photo results of the experiment. Answer the questions to interpret results.

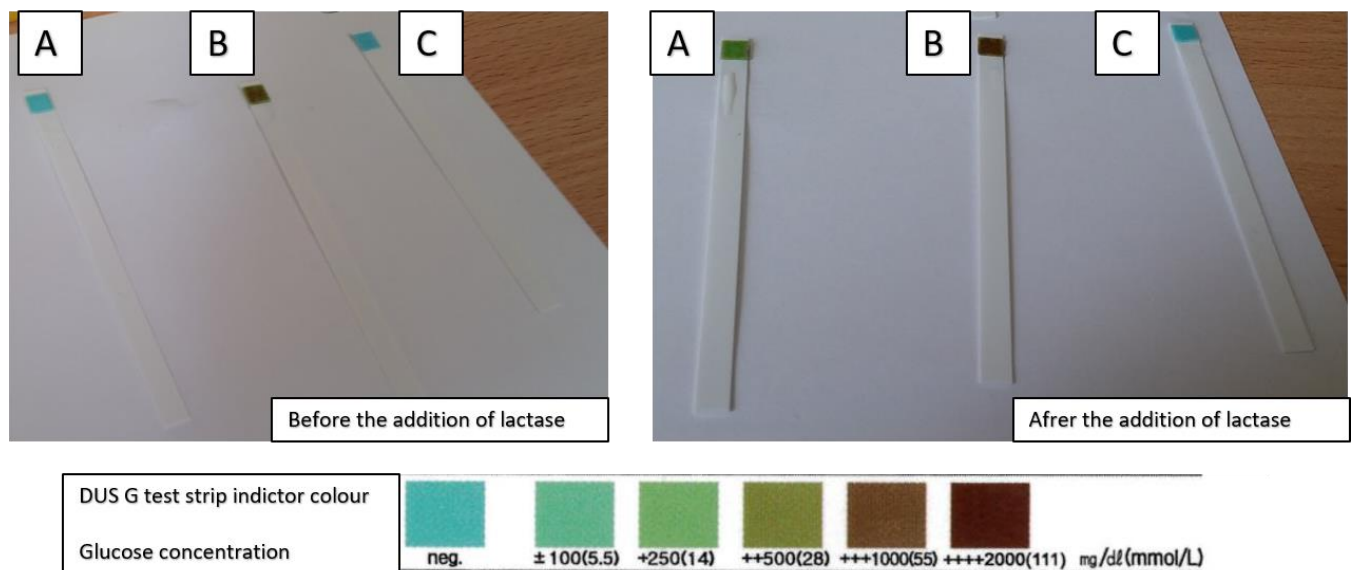
Materials:

- 1) Sugar (sucrose) solution in water, 25g/L
- 2) Milk, ordinary semi-skimmed
- 3) Milk, lactose-free
- 4) Lactase solution, 20g/L
- 5) Glucose test strips

Experimental procedure:

- 1) 10ml of sucrose solution, ordinary milk and lactose-free milk were poured into separate test tubes.
- 2) A new glucose indicator test strip was submerged into each test tube for 30 sec. The strips were taken out onto a white piece of paper, and photos of them taken 1 min afterwards.
- 3) 1ml of lactase solution was added to each test tube and the solution gently mixed
- 4) Step 2) was repeated to measure glucose concentration after the addition of lactase.

Results:



1. Identify which sample (sucrose solution, ordinary milk or lactose-free milk) correspond to letters A, B, C.

- A.
- B.
- C.

2. Interpret the results: for each sample. Why do you think we see these levels of glucose before and after the addition of lactase? Why do they change upon the addition of lactase in some cases and stay constant in others?

a) For ordinary milk:

(Hint question: which sugar(s) does milk contain – based on your knowledge and the experiment?)

b) *For lactose-free milk:*
(Hint question: *How do you think this milk is made?*)

c) *For sucrose solution:*
(Hint questions: *Why was sucrose solution chosen to be tested in an experiment focused on lactase? What does it tell us about the enzyme?*)

Lactose intolerance: additional resources

As you know, lactose-free milk and other lactose-free dairy products are manufactured primarily for lactose intolerant people. Lactose intolerance, or lactase non-persistence, is an interesting case study both from a human metabolism perspective, as well as from a population genetics prospective. Visit these resources to explore this topic further:

- 1) A 5-min video cartoon on lactose intolerance, with great introduction on how lactase works, and why you get specific symptoms when it does not:
<https://www.youtube.com/watch?v=i2ccIGYPx0>

- 2) A short article explaining lactase persistence and several population and evolutionary genetics findings on this topic:
<https://www.ucl.ac.uk/mace-lab/gallery/lactase>