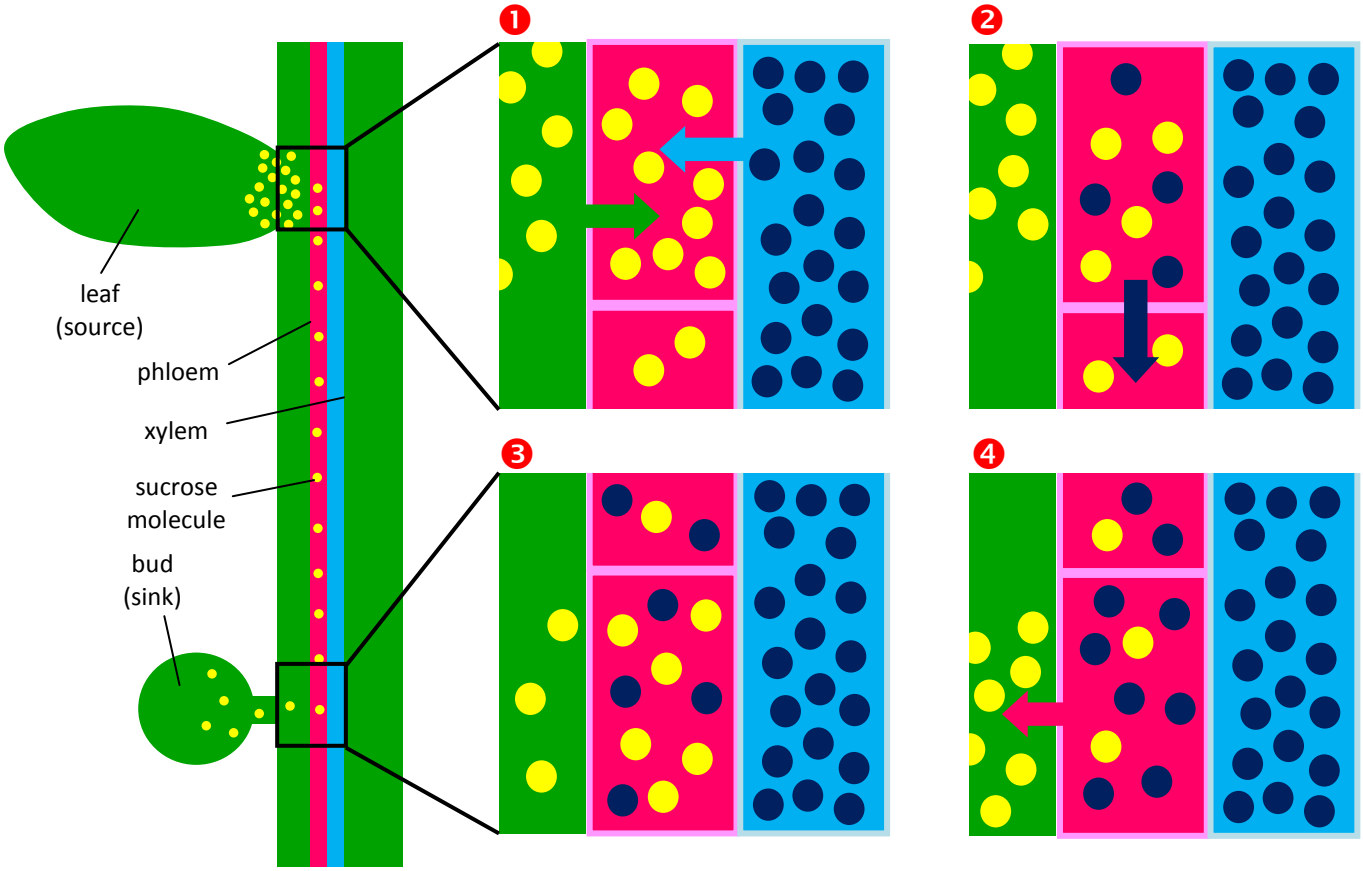
2.14 Translocation

Moving sugars around the phloem tubes of a plant

The process of **translocation** is the movement of **assimilates** (sugars and other chemicals made by plant cells) in the phloem tissue. The sugars are transported around phloem tubes in the form of **sucrose**. A **source** releases sucrose into the phloem, and a **sink** removes sucrose from the phloem.

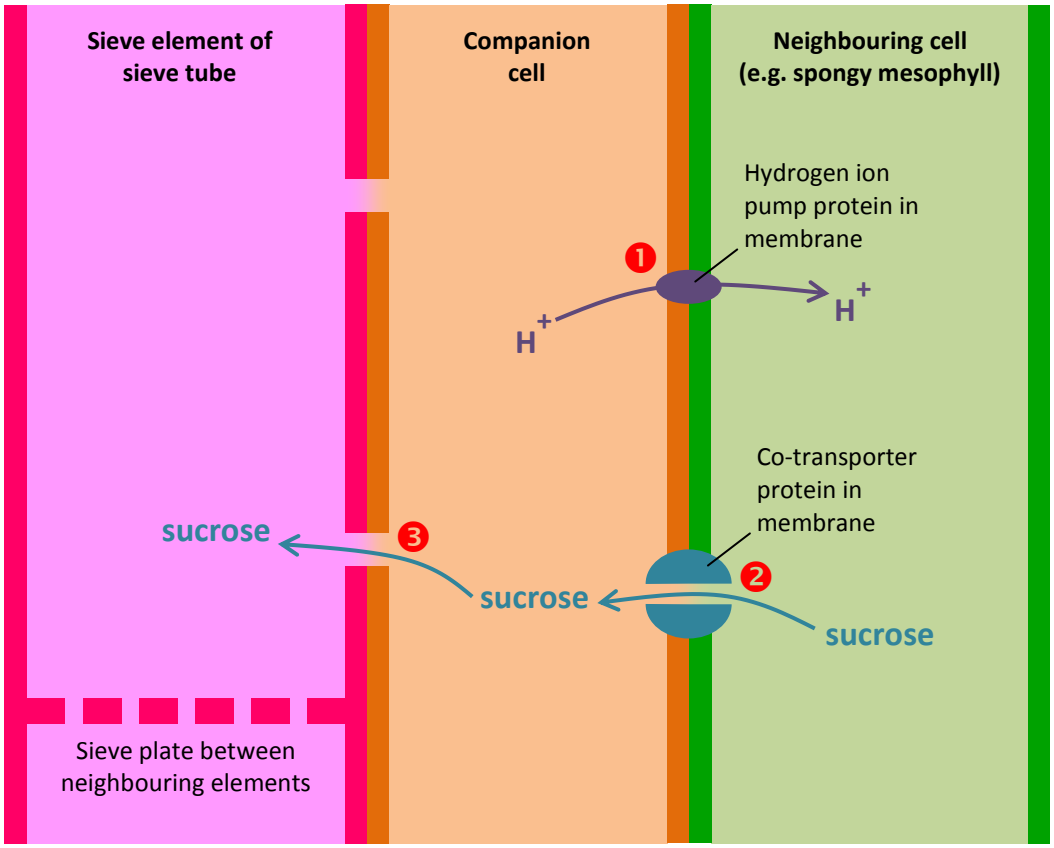


1. The leaf is described as a *source* because it produces sucrose to be transported. The first diagram shows two processes happening: the sucrose molecules are moving from the leaf into the phloem by **active transport** (this is because they are moving from a low-to-high concentration, as even though the leaf produces sucrose, phloem is filled with it); and as the sugar content of the **sap** (phloem contents) increases, its water potential decreases, so water moves into the phloem from the xylem by **osmosis**
2. As water moves into the phloem, the turgor pressure of the phloem increases, and this pushes the contents of the phloem vessel down the sieve elements
3. The contents of the phloem move down to the *sink* (in this case, a bud) where the sucrose is needed, and there is a low concentration of sucrose molecules on the sink's side of the phloem tube
4. The sucrose molecules move into the sink by **diffusion** (it would have to be **facilitated diffusion**, because the molecules are very big and are polar – charged – so would need specific transport proteins). This will increase the water potential of the phloem, and therefore it is usually the case that water molecules will return to the xylem

Generally speaking, because source cells *produce* sucrose, they are **photosynthetic**. Similarly, sink cells cannot produce sucrose, and therefore they are not synthetic. They need the sucrose to convert into glucose for respiration.

How Sucrose is Loaded into the Phloem

For more detail on the structure and function of phloem vessels, see 2.10 Xylem and Phloem. The diagram below shows how sucrose molecules are loaded into phloem.



1 Hydrogen ions are *actively* pumped out of the companion cell, via a transport protein in the membrane

2 The ions diffuse back into the companion cell via **co-transport proteins** (carrying sucrose with them) – this is facilitated diffusion

3 Sucrose moves from a high concentration in the companion cell to low concentration in the sieve tube element by diffusion (mainly through the plasmodesmata)

Co-transport is a process of transport of molecules where two substances are attached together, so they can diffuse at the same time. Sucrose is a good example of a molecule which co-transports alongside the hydrogen ions as above. It uses transport proteins, because the two molecules together are too large for simple diffusion, and are both polar, therefore it is a form of **facilitated diffusion**. It uses no energy so is a passive process.