water potential gradient. Water potential is lowered by the presence of solutes, and raised by high pressures.

2) **The Blood Pressure**

Inside the capillaries in the glomerulus, the blood pressure is relatively high, because the diameter of the afferent arteriole is wider than that of the efferent arteriole, causing pressure inside the glomerulus.
This tends to raise the water potential of the blood plasma above the water potential of the contents of Bowman's capsule.

3) **Concentration of Solutes in the blood**

However, the concentration of solutes in the blood plasma in the capillaries is higher than the concentration of solutes in the filtrate in the Bowman's capsule.
This is because, while most of the contents of the blood plasma can filter through the basement membrane and into the capsule, the plasma protein molecules are too big to get through, and so they stay in the blood.
This difference in solute concentration tends to make the water potential in the blood capillaries lower than that of the filtrate in the Bowman's capsule.

Overall, the effect of differences in **pressure** outweighs the effect of the differences in **solute concentration** so that the **water potential of the blood plasma** in the glomerulus is higher than the water potential of the filtrate in the capsule. As a result, water continues to move down the water potential gradient from the blood into the capsule as blood flows through the glomerulus.

Selective Reabsorption

Many of the substances in the glomerular filtrate **need** to be kept in the body, so they are reabsorbed into the blood as the fluid passes along the nephron. As only certain substances are reabsorbed, the process is called **selective reabsorption**.

Reabsorption in the proximal convoluted tubule

Most of the reabsorption takes place in the proximal convoluted tubule. The lining of this part of the nephron is made of a single layer of cuboidal epithelial cells. These cells are adapted to their function of reabsorption by having:

- **many microvilli** on the surface facing the lumen (the luminal membrane) of the nephron to increase the surface area for reabsorption of substances from filtrate in the lumen.
- many **co-transporter proteins** in the luminal Membrane.
- **tight junctions that hold adjacent** (neighbouring)

cells together firmly so that fluid cannot pass between the cells (all substances that are reabsorbed must go through the cells).

- many **mitochondria** to provide energy for sodium–potassium (Na+–K+) pump proteins in the basal membranes of the cells.

Blood capillaries are very close to the outer surface of the tubule. The blood in these capillaries has come directly from the glomerulus, so it has much **less** plasma in it than usual and has lost **much of its water** and many of the **ions** and other small solutes.
The basal membranes of the cells lining the proximal convoluted tubule are those nearest the blood capillaries. Sodium–potassium pumps in these membranes move sodium ions out of the cells.
The sodium ions are carried away in the blood. The pumping of sodium ions **out** of the cells lowers the concentration of sodium ions **inside** the cells, so that sodium ions in the filtrate diffuse down their concentration gradient through the luminal membranes.
However, sodium ions **do not** diffuse freely through the membrane: they can only enter through special co-transporter proteins in the membrane. This is the same method of membrane transport that moves sucrose into companion cells in phloem tissue.

The passive movement of sodium ions into the cells down their concentration gradient **provides the energy** to move glucose molecules in this way into the cells, even **against** a concentration gradient. This movement of glucose and amino acids is an example of indirect or secondary active transport, since the energy **(as ATP)** is used in the pumping of sodium ions, not in moving these solutes.
Once inside the cell, glucose **diffuses down** its concentration gradient, through a transport protein in the basal membrane,