

Permeability of the red blood cell

By

BIO1140 Section

Demonstrators:

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Table 1. Measured time^a, in seconds, for red blood cells (RBCs) of sheep to undergo hemolysis in the following solutions: distilled water, Ethanol 0.3M, Triton X-100 2% (v/v), Thiourea 0.3M, and D-Glucose (Dextrose) 0.3M.

Solution	Time to hemolysis (s)					
	Tube 1	Tube 2	Tube 3	Mean	SD ^b	SE ^c
Distilled H ₂ O	<2.0 ^d	<2.0	<2.0	2.0	0	0
Ethanol 0.3M	<2.0	<2.0	<2.0	2.0	0	0
Triton X-100 2% (v/v)	<2.0	<2.0	<2.0	2.0	0	0
Thiourea 0.3M	70.0	57.0	60.0	62.3	6.81	3.93
D-Glucose (Dextrose) 0.3M	>1200 ^e	>1200	>1200	1200.0	0	0

^a. Timer was started when the test tube was reverted and stopped when the solution was translucent enough to clearly see the line on the index card through the test tube from approximately 5 cm away, determining the completion of hemolysis.

^b. SD is standard deviation

^c. SE is standard error

^d. A time of <2.0 indicates hemolysis was almost instantaneous.

^e. A time of >1200.0 indicates hemolysis did not occur within 20 minutes (1200 seconds).

1. There are many factors which affect diffusion of solutes across the selectively permeable plasma membrane of sheep red blood cells in this permeability experiment. The two most prominent factors in this experiment are polarity and size.
2. The polarity of a molecule is critical for diffusion across the plasma membrane due to the composition of the membrane. Since the primary separating component of the phospholipid bilayer is composed of non-polar, hydrophobic lipid tails, non-polar molecules will diffuse through the membrane with ease. This explains the relatively prolonged time required for hydrolysis in solutions of D-Glucose (Dextrose) 0.3 M and Thiourea 0.3 M. Dextrose is very polar as a result of its five hydroxyl groups and thiourea is polar due to the nitrogen and sulfur present in the molecule.

The size of a solute is another pivotal factor for diffusion. A molecule which is non-polar may still take a relatively long time to diffuse across the membrane if the molecule is too large. The fluid plasma membrane presents very small passages within itself between the mosaic of molecules which comprise the membrane. This reasons for the relatively instant hydrolysis of ethanol and distilled water, despite their polarity. The solution of Triton X-100 2% (v/v) also displayed a relatively instant time to hydrolysis due to a similar concept where one factor plays a more significant role than the other. Although the solute is large, it was able to quickly diffuse through the membrane as a result of its amphipathic properties.