



# Regulation of volume and water

Osmolality versus tonicity

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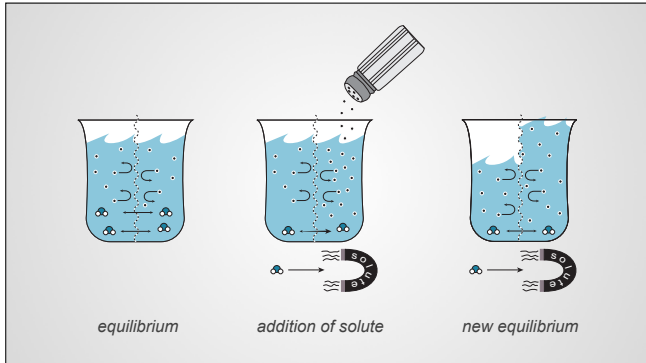
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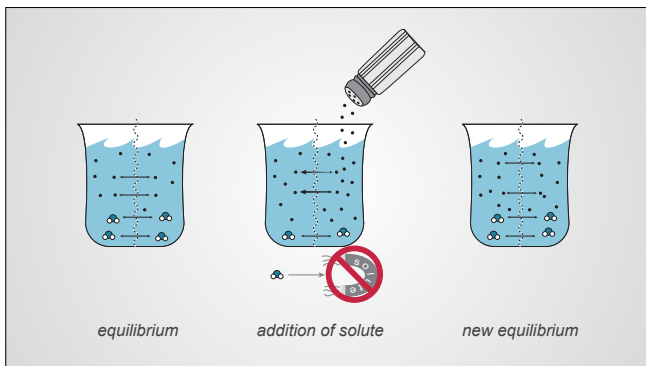
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*osmotically inactive solutes*

Osmolality is the concentration of all the particles in solution

*osmotically active solutes*

Tonicity is the concentration of all the osmotically active particles in solution

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The movement of water causes changes in tissue size, so what is important is tonicity not osmolality

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$K^+$        $Na^+$   
 ATP → AMP  
 3  $Na^+$       2  $K^+$   
 glucose<sup>+</sup>      glucose<sup>+</sup>  
 water      water

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If the patient has hyperglycemia, then they are lacking insulin and so glucose becomes an effective osmole.

glucose\* + insulin = ineffective osmole

glucose\* + ~~insulin~~ = effective osmole

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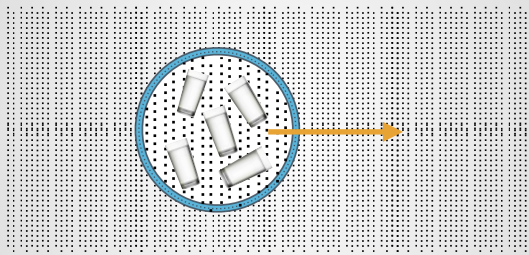
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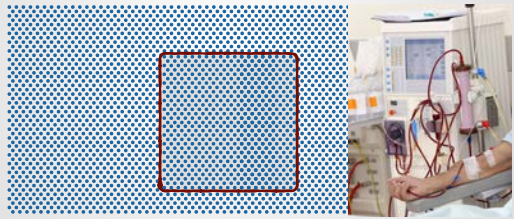
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Urea is a small molecule that can pass through membranes  
Urea should be an ineffective osmole... however



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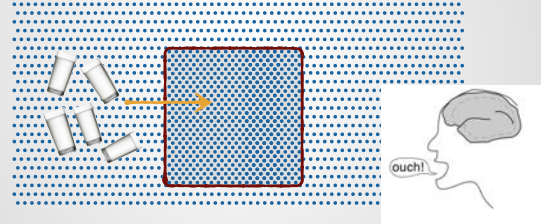
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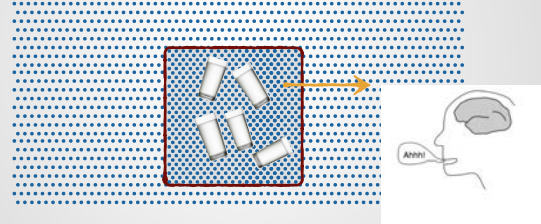
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Urea should be an ineffective osmole...however



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We care about tonicity more than osmolality because we care about water movement

Osmolality is the concentration of all the particles in solution

Tonicity is the concentration of all the osmotically active particles in solution

Sodium is the primary source of tonicity in the extracellular compartment

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We care about tonicity more than osmolality because we care about water movement

Sodium is the primary source of tonicity in the extracellular compartment

Glucose and urea are generally not osmotically active but can become active in certain conditions

Glucose in the absence of insulin  
Urea after rapidly being reduced by dialysis

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