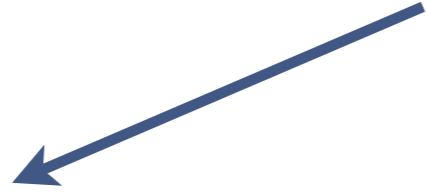


Osmolar Gap

is it worth bothering?

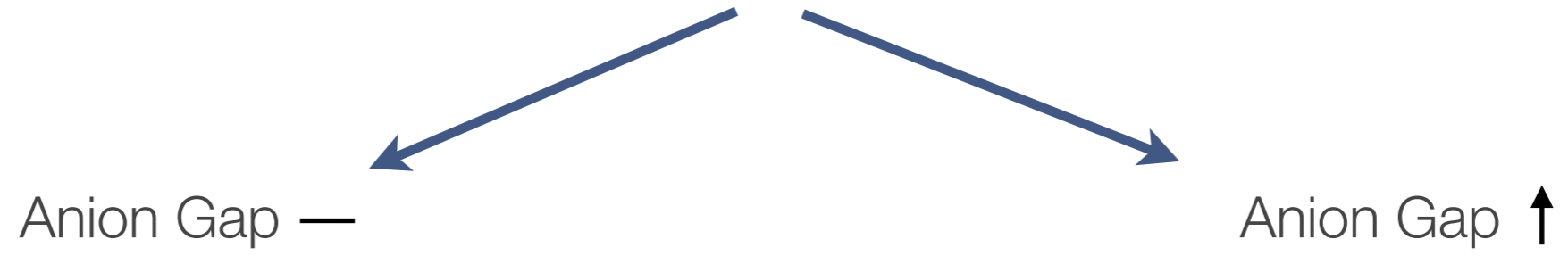
Metabolic Acidosis

Metabolic Acidosis

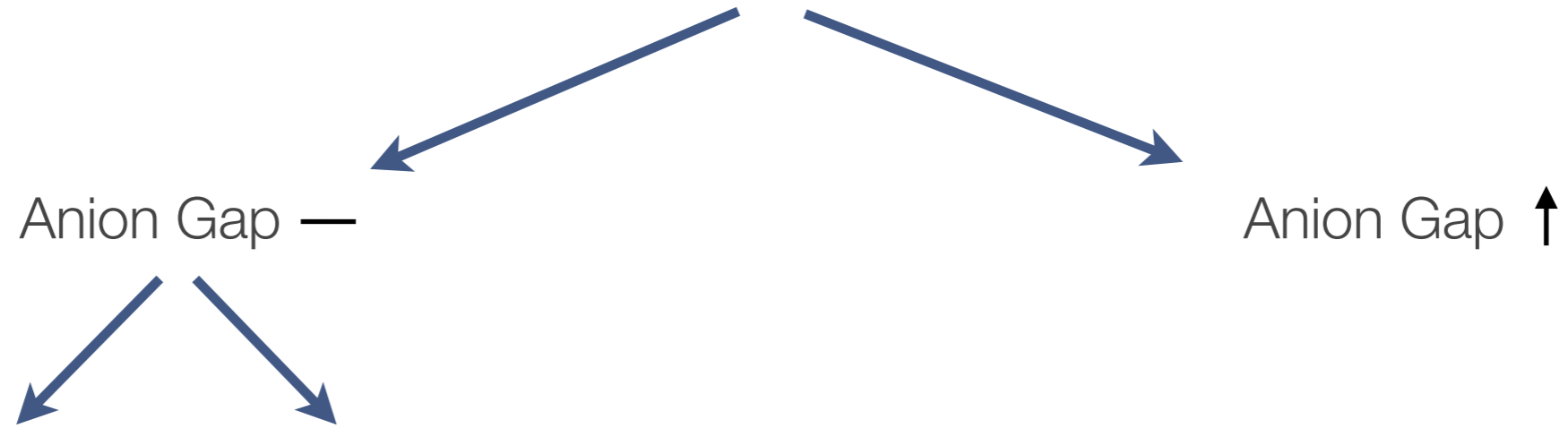


Anion Gap —

Metabolic Acidosis



Metabolic Acidosis



Loss of high SID fluid

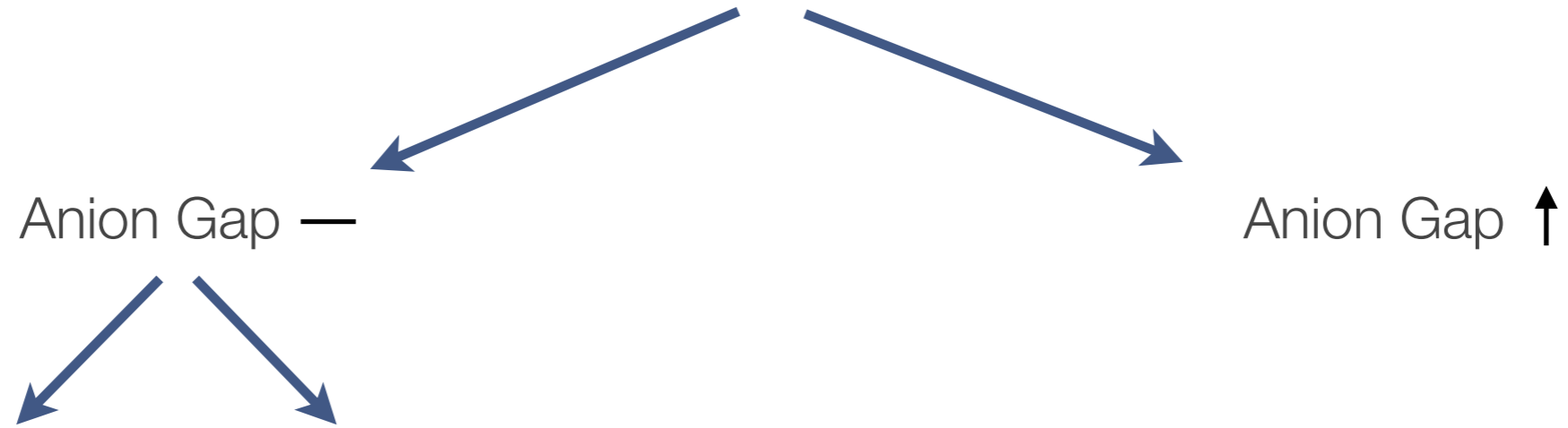
- Gastrointestinal
 - diarrhoea
 - ileostomy
 - ureterosigmoidostomy
- Renal
 - Acetazolamide
 - Renal Tubular Acidosis
 - Hyperparathyroidism
 - Hypoaldosteronism

Addition of low SID fluid

- Normal Saline

Anion Gap ↑

Metabolic Acidosis



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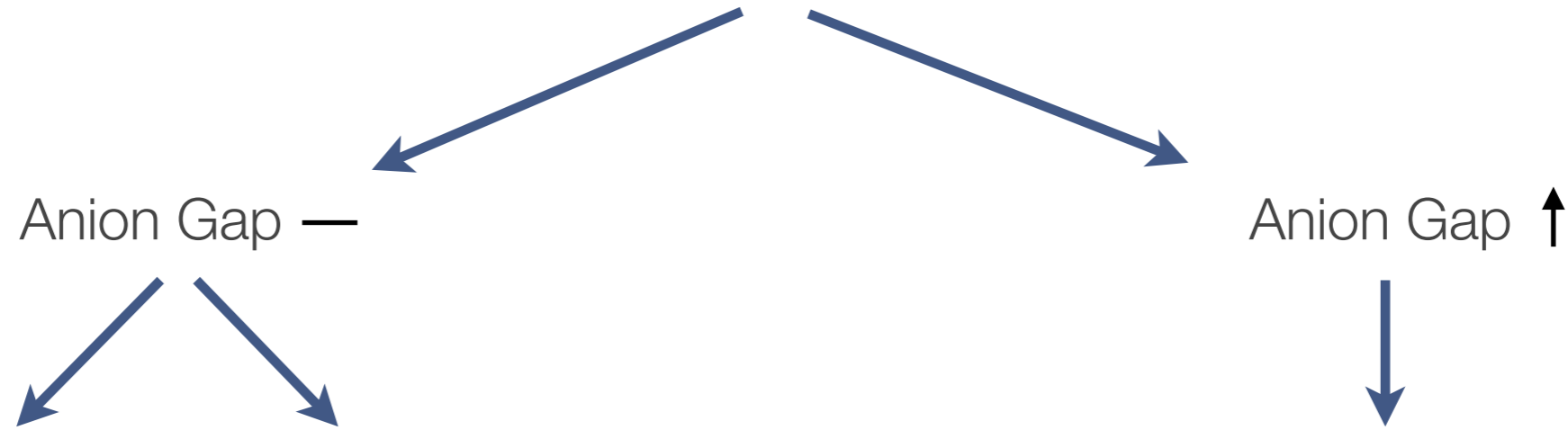
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Relative Hyperchloraemia

Metabolic Acidosis



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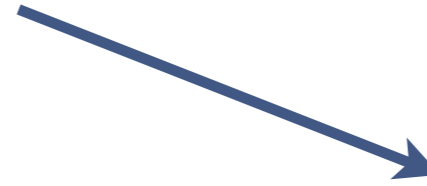
- Normal Saline

Anion Gap ↑

- Lactic Acidosis
 - Type A - increased production
 - Type B - decreased hepatic metabolism
 - insulin deficiency
 - metformin
 - Haem malignancies
 - rare enzyme defects
 - D-lactate - bowel fermentation
- Ketoacids
 - DKA
 - Starvation
- Exogenous Acid
 - Salicylate
 - Methanol
 - Ethanol Glycol

Relative Hyperchloraemia

Metabolic Acidosis

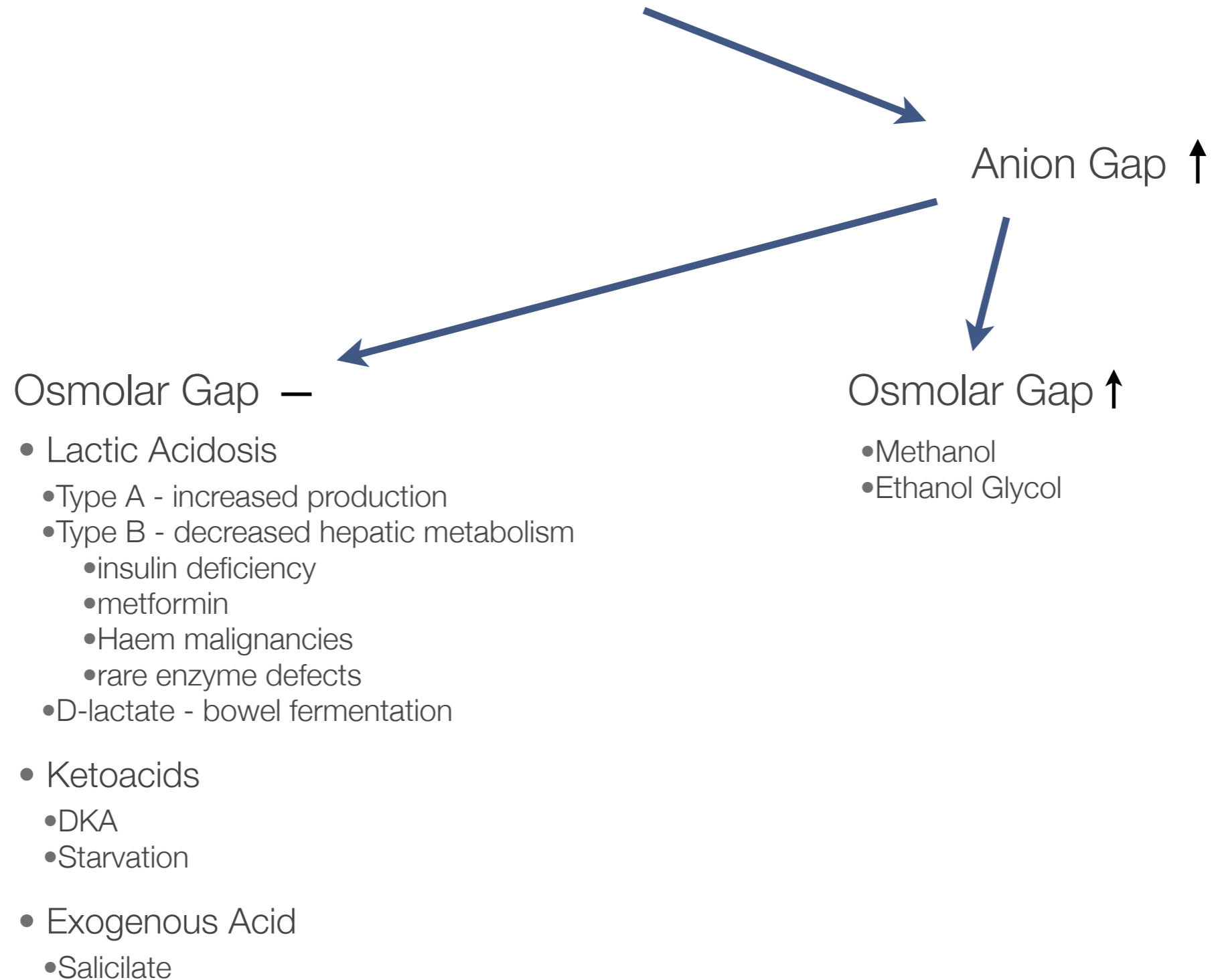


Anion Gap ↑



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Metabolic Acidosis



Not Such a Good Time

Methanol

- drowsiness, confusion & ataxia
- nausea, vomiting & abdominal pain

Ethelene Glycol

- drowsiness, confusion & ataxia
- nausea, vomiting & abdominal pain

Not Such a Good Time

Methanol

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- blurred vision or changes in colour perception
- hypotension and cardiac arrest
- permanent blindness
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Tax Evasion is a Crime !

Not Such a Good Time

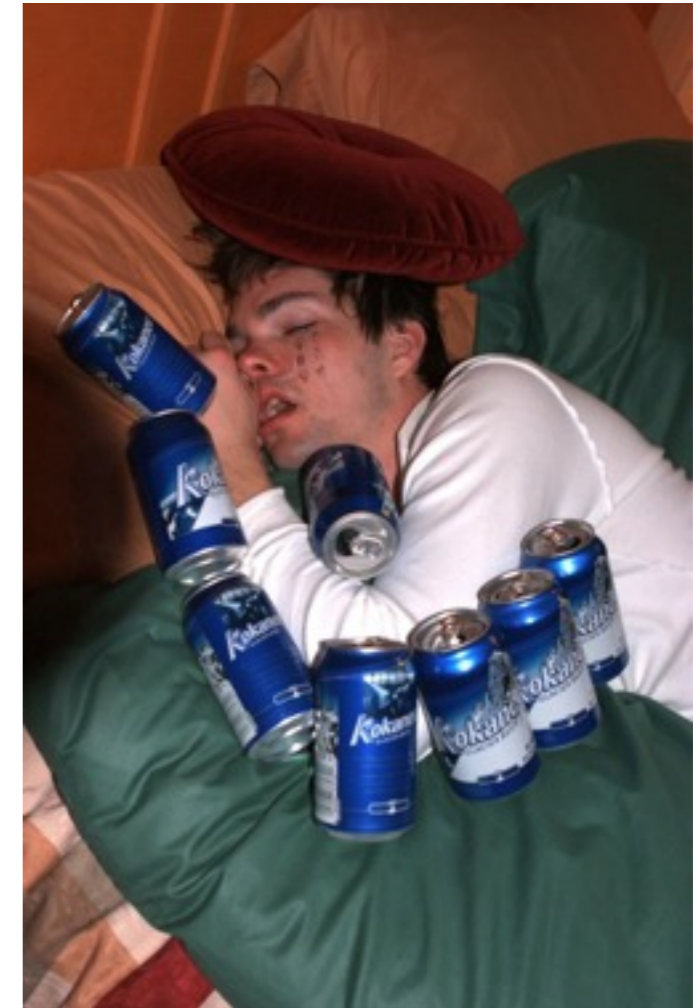
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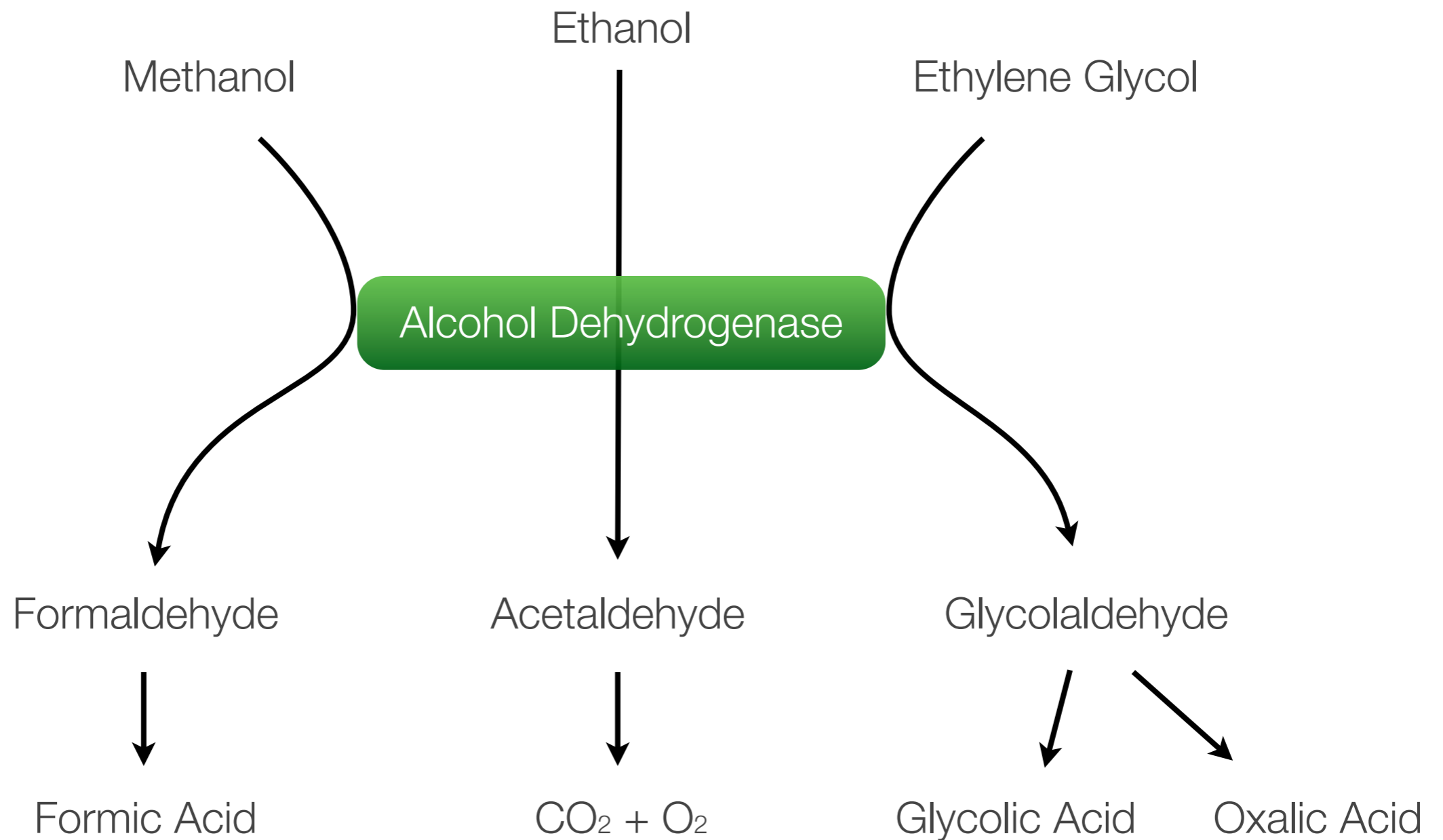
Ethanol



Tax Evasion is a Crime !

Acidosis?

Acidosis?



Treatment

- 100% Ethanol infusion - BSL↓ in children
- Fomepizole - occupies alcohol dehydrogenase without the side effects

Osmolar Gap

$$\text{Osmolar Gap} = \text{Calculated Osmolarity} - \text{Measured Osmolarity}$$

Normal less than 10

osmolarity = osmoles of solute per litre of solution - Calculated

osmolality = osmoles of solute per kilogram of solvent - Measured

osmole = an Avagadro's number of particles (6.022×10^{23}) in solution

Measuring Osmolality

Colligative properties depend only on the ratio of the number of particles of solute to solvent in the solution, not the identity of the solute

- vapour pressure depression
- freezing point depression
- boiling point elevation
- osmotic pressure

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- osmotic pressure

An osmole is the amount of a substance that yields, in ideal solution, that number of particles (Avogadro's number) that would depress the freezing point of the solvent by 1.86K

Calculating Osmolarity (properly)

$$\text{Osm/L} = \sum_i \varphi_i n_i C_i$$

φ = osmotic coefficient - accounts for the degree of non-ideality of the solution.

n = number of particles into which the molecule dissociates

C = molar concentration of the solute

i = represents the identity of a particular solute

Estimating Osmolarity

Osmolarity = Cations + Anions + non-ionized Solutes

Estimating Osmolarity

Osmolarity = 2 Cations + ~~Anions~~ + non-ionized Solutes

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- Na
- K
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Osmolarity = 2 Cations + ~~Anions~~ + non-ionized Solutes

- Na
- ~~K~~
- ~~Ca~~
- ~~Mg~~

- glucose
- urea
- lipids

Estimating Osmolarity

Osmolarity = 2 Cations + ~~Anions~~ + non-ionized Solutes

- Na
- ~~K~~
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- ~~lipids~~

Estimating Osmolarity

$$\text{Osmolarity} = 2 \text{ Na} + \text{glucose} + \text{urea}$$

Osmolarity Estimations

- 2 Na
- 2.1 Na
- $2 \text{ Na} + 7$
- $2.63 \text{ Na} - 65.4$
- $2 \text{ Na} + \text{Urea}$
- $2 \text{ Na} + \text{Glucose}$
- $2 \text{ Na} + \text{Glucose} + \text{Urea}$
- $2 (\text{Na} + \text{K}) + \text{Glucose} + \text{Urea}$
- $1.86 \text{ Na} + \text{Urea} + \text{Glucose}$
- $1.86 \text{ Na} + \text{Urea} + \text{Glucose} + 9$
- $2 \text{ Na} + 0.933 \text{ Urea} + 0.9 \text{ Glucose}$
- $1.75 \text{ Na} + \text{Glucose} + \text{Urea} + 10.1$
- $1.85 \text{ Na} + 1.84 \text{ K} + \text{Glucose} + \text{Urea} + \text{Ca} + 1.17 \text{ Mg} + 1.15$

Dorwart WV, Chalmers L. Comparison of Methods for Calculating Serum Osmolarity from Chemical Concentrations, and the Prognostic Value of Such Calculations. *Clin Chem* 1975; 21/2:190-194

Osmolarity Estimations

- 2 Na
- 2.1 Na
- 2 Na + 7
- 2.63 Na - 65.4
- 2 Na + Urea
- 2 Na + Glucose
- 2 Na + Glucose + Urea
- 2 (Na + K) + Glucose + Urea
- 1.86 Na + Urea + Glucose
- 1.86 Na + Urea + Glucose + 9
- 2 Na + 0.933 Urea + 0.9 Glucose
- 1.75 Na + Glucose + Urea + 10.1
- 1.85 Na + 1.84 K + Glucose + Urea + Ca + 1.17 Mg + 1.15

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- $2 \text{ Na} + \text{Glucose} + \text{Urea}$
- $1.86 \text{ Na} + \text{Urea} + \text{Glucose} + 9$

Using the Osmolar Gap

Using the Osmolar Gap

- Normal is roughly below 10

Using the Osmolar Gap

- Normal is roughly below 10
- Less sensitive for Ethelene Glycol

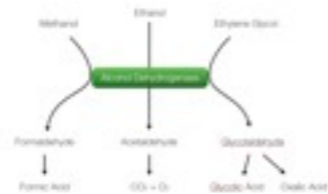
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- Normal is roughly below 10
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- Type of osmometer

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- Normal is roughly below 10
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- Type of osmometer

- Time course

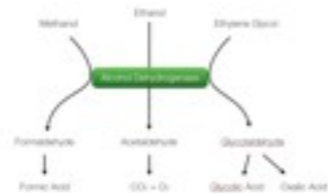


Osmolar Gap \uparrow \longrightarrow Acidosis

Using the Osmolar Gap

- Normal is roughly below 10
- Less sensitive for Ethelene Glycol
- Type of osmometer

- Time course



Osmolar Gap ↑ → Acidosis

- Ethanol Cloaking

2 Na + Glucose + Urea + Ethanol

Osmolar Gap

is it worth bothering?