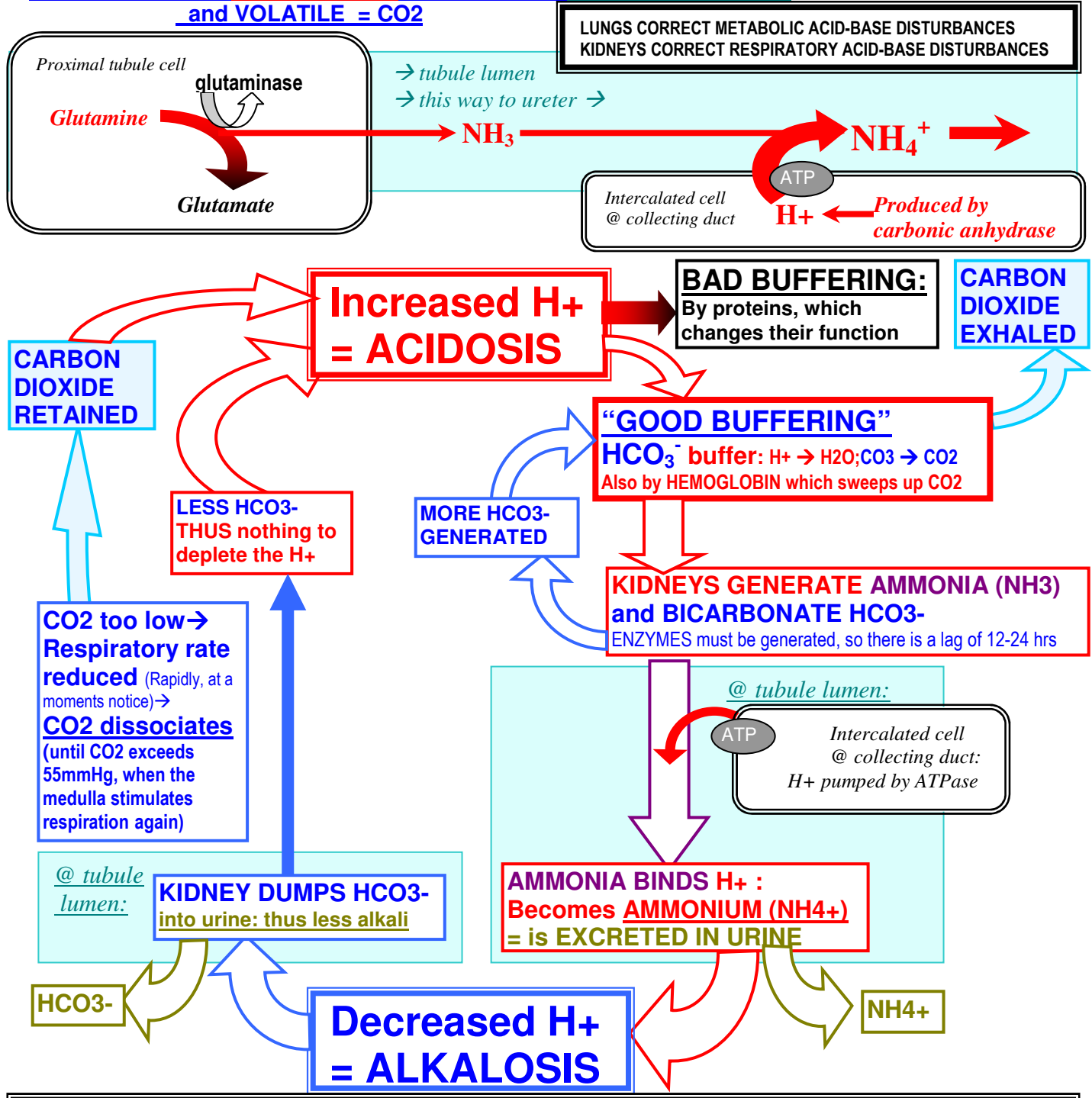


# ACID-BASE BALANCE and the kidney's two cents in it

Two kinds of acid: **NON-VOLATILE** =  $\text{NH}_4^+$  (60%), **titratable acids** (40%)  
and **VOLATILE** =  $\text{CO}_2$



**BONE is a buffer for chronic acidosis: makes up as much as one third of the total buffering!**  
= release of mineral bicarbonate and mineral phosphate (MAINLY BICARBONATE)  
**THIS IS DANGEROUS: depletes integral elements of the hydroxyapatite matrix**

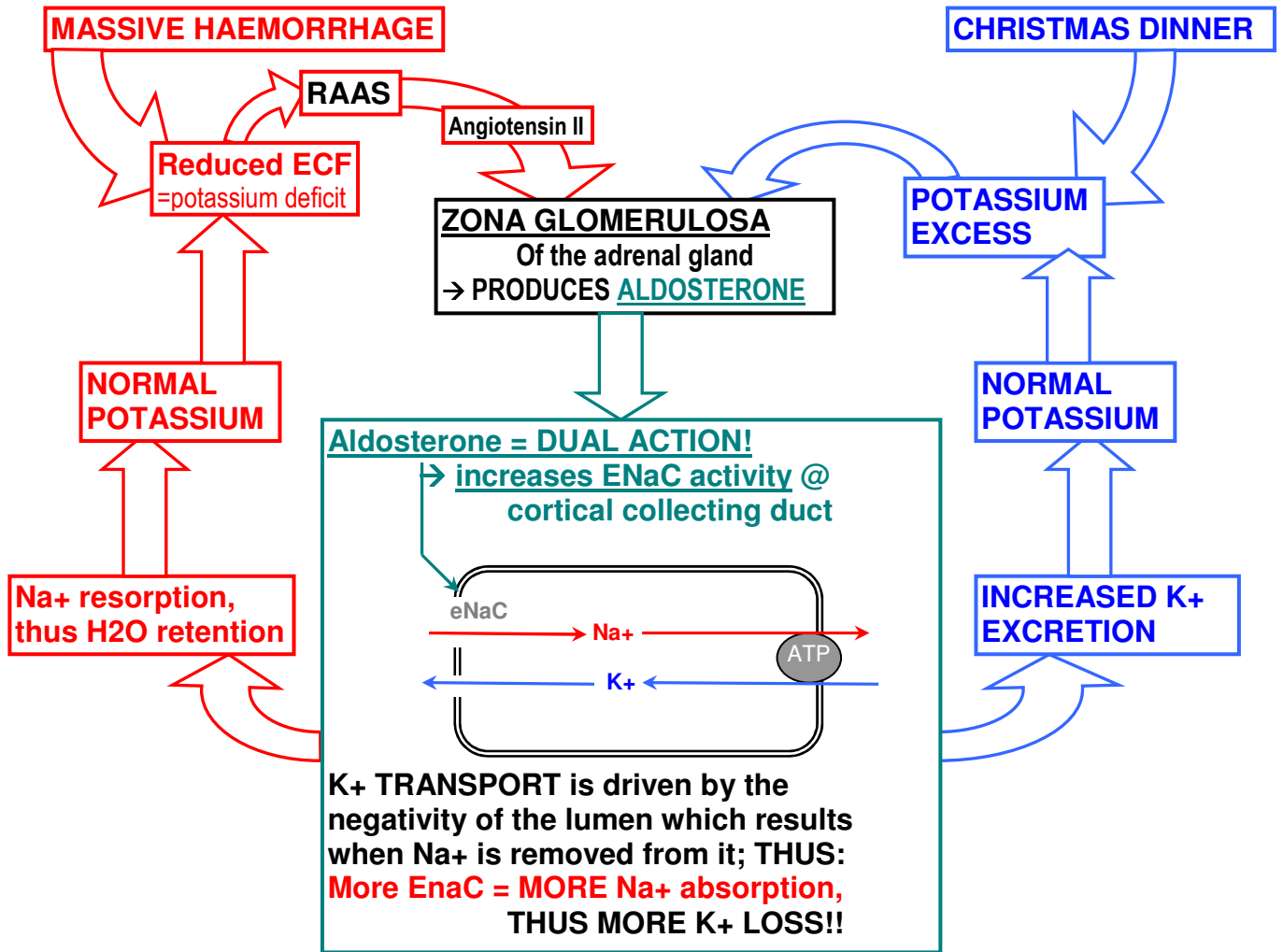
Type of Imbalance	Arterial Blood Conditions			Partial Compensation
	pH shift	$\text{HCO}_3^-$	P $\text{CO}_2$	
Respiratory Acidosis	↓	↑	↑	Kidney - increase $\text{H}^+$ secretion & increase $\text{HCO}_3^-$ reabsorption
Metabolic Acidosis	↓	↓	↓	Alveoli - hyperventilation; faster, deeper breathing than normal
Respiratory Alkalosis	↑	↓	↓	Kidney - increase $\text{HCO}_3^-$ secretion & increase reabsorption of $\text{H}^+$
Metabolic Alkalosis	↑	↑	↑	Alveoli - hypoventilation; slower, shallower breathing than normal

- Reading Arterial Blood Gases:**
- Acidaemia or alkalaemia?**  
Neither = mixed disorder or compensated
  - $\text{HCO}_3^-$  and  $\text{PCO}_2$ :** both change  
**IN DIRECTION OF pH = METABOLIC**  
**OPPOSITE TO pH: = RESPIRATORY**  
Change in opposite directions = mixed dz
  - BASE EXCESS:**  
**excess or deficit = METABOLIC**  
**normal = RESPIRATORY**

# REGULATION OF POTASSIUM

2 to 8 mmol/L: this range is COMPATIBLE WITH LIFE

8.01



## WHAT IS THE ANION GAP?

= figuring out how much extra anion there is;

Add concentrations:  $Na + K - Cl - HCO_3 = 15 \pm 4$

i.e all those anions not mentioned in the equation- Mg, Ca, etc... (measured in milliequivalents, mEq) plus the blood proteins which are negatively charged and thus anionic

## HOW COULD THIS POSSIBLY BE USEFUL?

→ IT HELPS DIAGNOSE ACIDOSIS

### Causes of Low Anion Gap

- Paraproteinemia (Multiple Myeloma)
- Spurious Hyperchloremia (Bromide toxicity)
- Hyponatremia
- Hypermagnesemia
- **Hypoalbuminemia** : decreases 2.5 meq per 1 g/dl Albumin drop

### Causes of High Anion Gap

- Metabolic Acidosis (without increased Serum Chloride)  
Eg. lactic acidosis, kidney failure, etc.

**Low gaps are very rare.** Usually due to hyponatremia (sodium being the major cation)  
**High gap?** Means there's lots of anions coming from somewhere. WHERE?... Normally, the excess anions are buffered by HCO<sub>3</sub>, so a high gap means that there has been a loss of HCO<sub>3</sub> and therefore a METABOLIC ACIDOSIS of some kind.