Causes of Acid-Base Disorders

Metabolic

Alkalosis

Chloride Responsive

Urine Cl^- < 20mEq/L
Loss of H^+

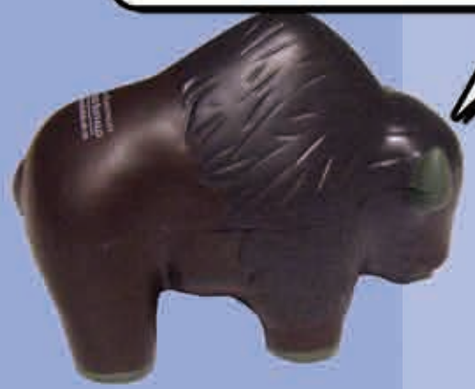
Causes:
- Vomiting
- Diarrhea
- Diuretics
- NG Suction
- Hypoadrenal pathologies

Chloride Resistant

Urine Cl^- > 20mEq/L
Loss of H^+

Causes:
- Conn's Syndrome
- Gitelmann's Syndrome
- Bartter's Syndrome
- Liddle's Syndrome
- Mg^{2+} deficiency
- High doses of penicillin
- Recent diuretic use

Conn's Syndrome → Aldosterone excess
Liddle's Syndrome → Excess reabsorption of Na^+ and secretion of K^+ from collecting ducts
Bartter's Syndrome → Inhibited reabsorption of Na^+, Cl^-, K^+ from the thick ascending limb of loop of Henle
Gitelman's Syndrome → No reabsorption of Na^+, Mg^{2+}, Cl^- or K^+ from the Distal Tubule



Acidosis

Anion Gap

$HA \rightarrow H^+ + A^-$
Causes a change in the anion gap by increasing H^+ (and therefore more A^-)

Causes:
- Toxins
- Drugs
- Physiological Stresses

M - Methanol/Metformin
U - Uremia
D - Diabetic ketoacidosis
P - Propofol/Paraldehyde
I - Iron/Isoniazid
L - Lactate/Linezolid
E - Ethylene glycol
I - Ingestions (cocaine, NMDA)
N - Neuroleptics (haloperidol)
G - Glycols (propylene)
S - Salicylates/Starvation

Also causes UAG

Non-Anion Gap

$NaHCO_3$ loss = HCl gain
Anions are balanced
($\downarrow HCO_3^-$ $\uparrow Cl^-$)

Causes:
- Inability to eliminate acid
- Bicarbonate loss

H - Hyperalimentation (overeating)
A - Acetazolamide
R - Renal Tubule Acidosis (RTA)
D - Diarrhea
U - Ureterosigmoidostomy (ureters surgically attached to sigmoidal colon)
P - Pancreatic Fistula

Type 1 (Distal)
Inability to excrete NH_4^+ (and therefore H^+)
Can cause Hypo- or Normokalemia
Non-drug: SLE, Sjorgren's, multiple myeloma
Drug: amphotericin B, anticonvulsants (phenytoin, topiramate), lithium, cotrimoxazole

Type 2 (Proximal)
Decreased HCO_3^- reabsorption
No effect on potassium
Non-drug: Fanconi syndrome, amyloidosis, multiple myeloma, nephrotic syndrome
Drug: acetazolamide, aminoglycosides, cyclosporine, tacrolimus, didanosine, lamivudine, topiramate, valproic acid

Type 3
Doesn't exist anymore; it was actually a combination of Type 1 and 2!

Type 4
Hypoaldosteronism or impaired K^+ secvretion → Decreased NH_3 synthesis
Causes Hyperkalemia
Non-drug: renin deficiency, primary hypoaldosternism, SLE, diabetes, sickle cell
Drug: spironolactone, NSAIDs, ACEIs, ARBs, Heparin

Respiratory

Alkalosis

Decrease in pCO_2
(Hyperventilation)

Causes:
CNS
- Anxiety
- Pain
- Fever
- CNS Lesions
- Pregnancy
- Progesterone
- Salicylates

Non-CNS
- Pulmonary embolism
- Congestive heart failure
- Hypotension
- Pneumonia
- Sepsis
- Cirrhosis
- Mechanical ventilation

Acidosis

Increase in pCO_2
(Hyporventilation)

Causes:
CNS
- Drugs → Opioids, Benzo's, TCA's
- Trauma
- Stroke
- Infection

Nerve
- Neuropathies
- MS

Neuromuscular Junction
- Drugs → Paralytics
- Myasthenia gravis
- Toxins (e.g. botulinum toxin A)

Muscle
- Damage/weakness

Obstruction
- Foreign body in lungs
- COPD
- Asthma

Restrictive
- Hemothorax
- Pneuomothorax