Hypocalcemia
(serum [Ca2+] < 2.1 mmol/L)

- Alters charge balance across the cell membrane
- Voltage-gated Na+ channels on neuronal membranes become more permeable to Na+ influx
- ↑ Neuronal “excitability” (tendency to depolarize/trigger action potentials)

- Altered sensory ability of peripheral nerves
  - Peripheral paraesthesia
  - Peri-Oral Numbness
- Spontaneous action potentials in motor neurons
- Tetanic skeletal muscle contractions
- Spontaneous action potentials in the brain
- Seizures

- Laryngospasm
  (contraction of larynx muscles obstructing airways → Respiratory distress!)

- Chvostek’s sign
  (less specific: tapping in front of the ear causes spontaneous facial nerve depolarizations → triggering ipsilateral facial muscles around the eye and mouth to contract)

- Trouseau’s Sign
  (Tetany in the hand, esp after ↓ perfusion to hand. Often first tetanic sign to develop with hypocalcemia)
Hypercalcemia (serum [Ca2+] > 2.5mmol/L)

- Detected by the Ca-Sensing-Receptor (CaSR) on Thick Ascending Limb (TAL) epithelial cells
- Inhibit ROMK insertion on luminal membrane

Ca2+ precipitates with PO4³⁻ throughout the body

- If precipitation occurs in the urinary tract: Kidney stones (nephrolithiasis)
- ↓ K+ efflux out of TAL epithelial cells
- ↓ K+ in TAL lumen
- Less K+ present to drive Na+/Cl⁻ reabsorption through NKCC
- ↑ Na/Cl in tubule lumen osmotically draws water into lumen
- ↑ Urine volume (polyuria)

Rationale: ECF has enough Ca2+, no need for more K+ to be excreted into the tubule lumen to create a more + charge there that drives Ca2+ reabsorption

- ↑ drinking (polydipsia)
  (Compensatory response; if not, pt becomes dehydrated)

- Alters charge balance across the cell membrane

- Na⁺ channels on neuronal membranes become more resistant to opening (resists Na⁺ influx)
- ↓ neuronal action potential formation
- Sluggish neuronal activity

- Cognitive dysfunction
- Fatigue

- Constipation
- ↓ appetite

- Fatigue

- Dysphoria

- Headache

- Fatigue

Signs and Sx of Hypercalcemia

Guyton and Hall, 2006 (pg 981)
Dr. Kline lecture, May 25th, 2012

Yan Yu, 2012 (www.yanyu.ca)