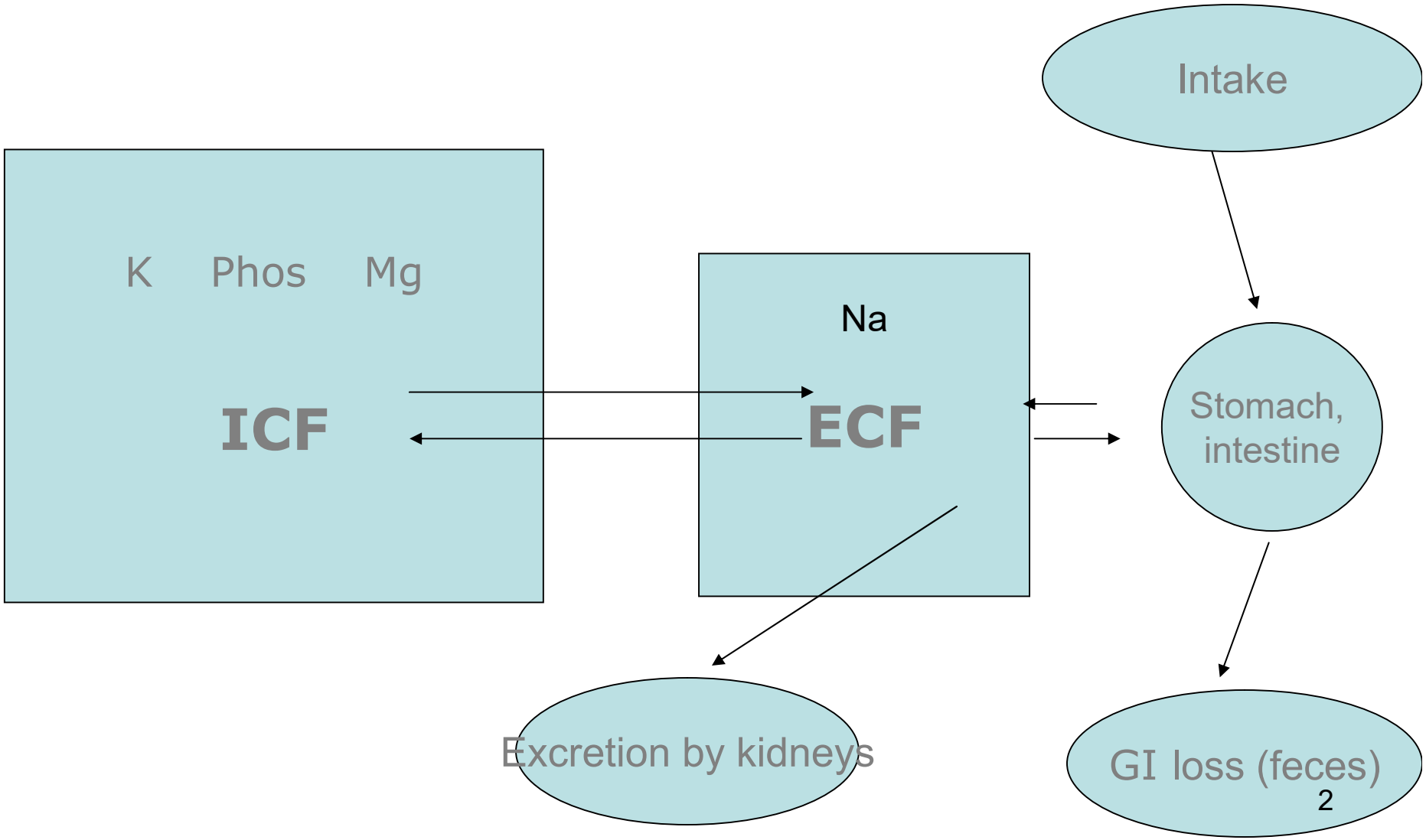
ELECTROLYTES

Extracellular fluid: Na, Cl ve HCO3

Intracellular fluid: K, Mg, PO4

Na,K pump: Maintains high levels of Na and K outside and inside the cell respectively.

Elimination of Intacellular ions



SODIUM:

Serum: 135-145 mmol/L
Excretion with urine: 30-280 mmol/day

Hyponatremia:

<135 mEq/L, (<120 clinical symptoms)

Neurological abnormalities, impaired nausea in mental responses, muscle cramps, dissociation, confusion, convulsions, coma.

Causes of hyponatremia:

It is the most common electrolyte
Increase of body water
Renal insufficiency
Heart failure
Cirrhosis
Decrease of body sodium
Diuretic therapy (thiazide)
Diabetic Ketonuria, Vomiting, diarrhea, sweating burns, Uremia

Hyponatremia ("Water intoxication")

Water intoxication in the use of extacy (MDMA) Water intoxication in running athletes (serum Na <120 mmol / L)

(¼ teaspoon salt to 1 lt water).

Pseudo and Artifact hyponatremia

Increase of some substances in the serum results with changes in the water compartment- dilutional hyponatremia)
Hyperglycemia, (every 100 mg / dl glucose increase leads to 1.6 mmol / L decrease in serum Na)
Mannitol treatment (osmotic diuresis)
Hyperlipemia and hyperproteinemia can also result with hyponatremia.

Hypernatremia:

> 145 mEq / L

Edema, irritability, tremor, confusion, coma

Reasons for Hypernatremia: (loss of water or increase in relative Na)

Fever
Water loss (diuresis, excessive sweating and diarrhea)
Renal diseases,
Heart failure
Cirrhosis and ascit

Sodium (Na^+)

- Normal S_{Na}: 135-145
- Major component of serum osmolality
  - $S_{osm} = (2 \times Na^+) + (BUN / 2.8) + (Glu / 18)$
  - Normal: 285-295
- Alterations in S_{Na} reflect an abnormal water regulation

Serum Osmolality = (2x(Na+K)) + (BUN/2.8) + (glukose / 18)

(2x Na+) + ...

Case :

A patient with IDDM feels hypoglycemiasymptoms in the morning and drinks 2 glasses of sugary drink. She has an appointment in the hospital and does not inject insulin with the scare of hypoglycemia shock.

Test results: Glucose 28 mmol/L (2.8-6.2 mmol/L)

Na 126 mmol/L (135-145 mmol/L)

K, Urea, etc are normal

Reasons for hyponatremia?

Hyponatremia results from dilution. Water shifts from intracellular to extracellular (intravascular) space to balance osmolality.

POTASSIUM: (neuromuscular and muscular irritability)

Plasma: 3.3-4.9 mmol/L,

Low or high K + causes muscle relaxation, irritability and paralysis, tachycardia, cardiac arrest

Hypokalemia:

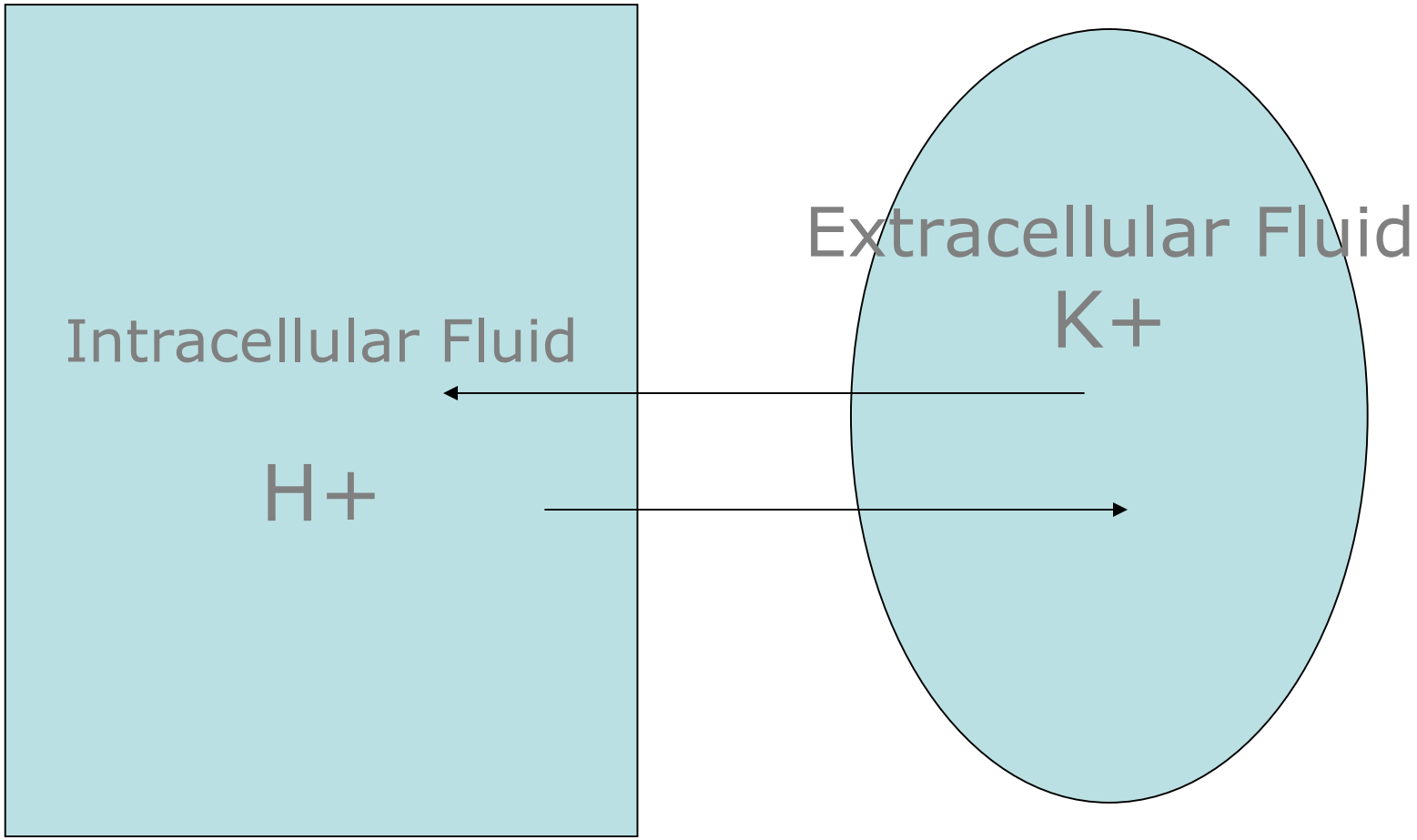
Plasma potassium <3.0 mmol / l.

1. Reduction of dietary intake

2. Disruption of distribution in the body
 insulin
 Metabolic Alkalose
 Dehydration

POTASSIUM

Metabolic Alkalosis and Hypokalemia



3. **Urinary or GI losses**

Kidney failure

Diarrhea, vomiting

Sweating

4. Drugs

a- Urinary loss: aminoglycosides, amphotericin B, corticosteroids, diuretics (thiazide and loop diuretics), levodopa, nifedipine, penicillin, rifampin

b- GI losses: laxatives

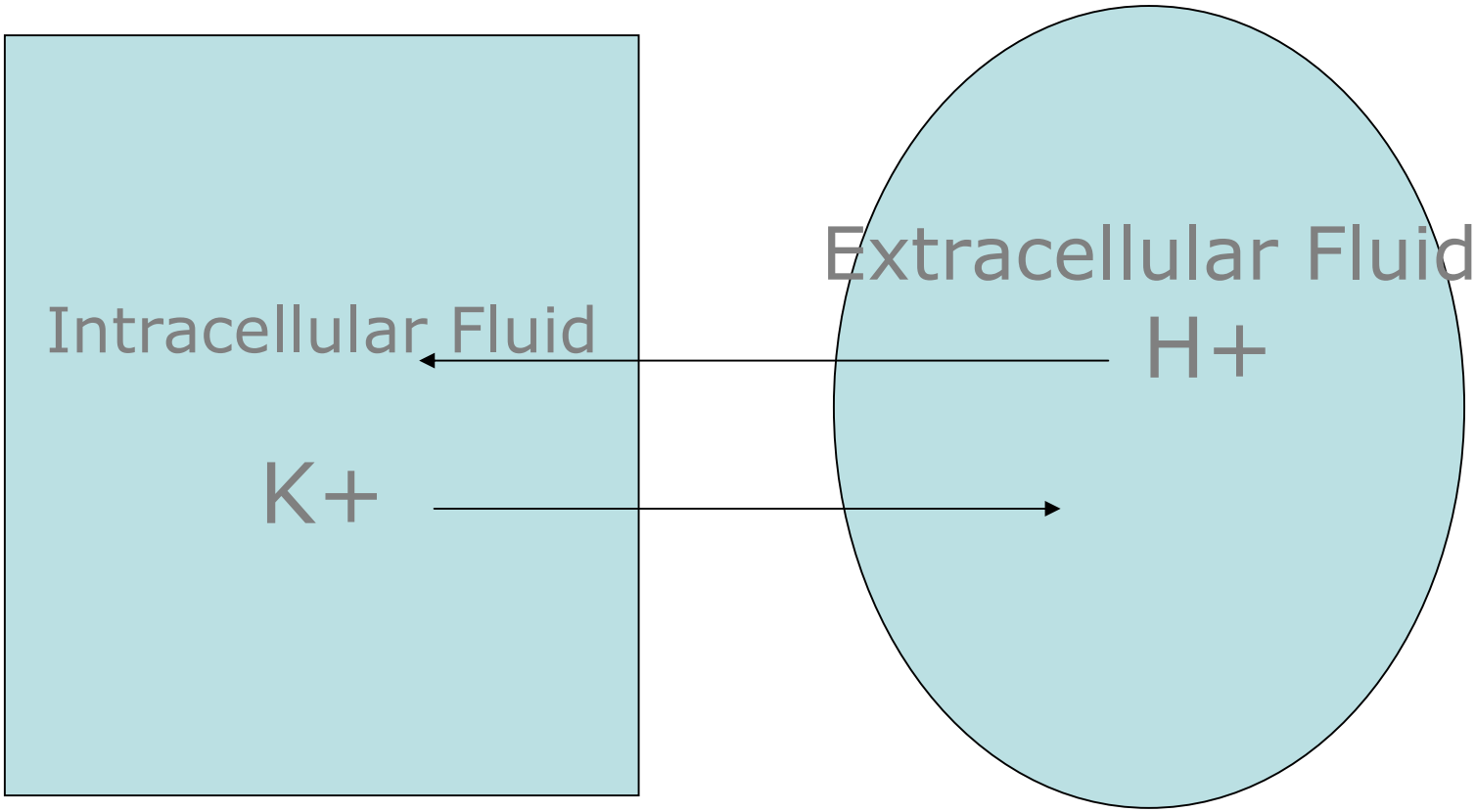
c- Redistribution in the body compartments:
Beta-2 agonists, lithium

Hyperkalemia:

Hemolysis
Metabolic acidosis
Dehydration
Insulin insufficiency
Kidney diseases
Sickle cell disease
rhabdomyolysis
burns
Blood transfusion

Drugs: diuretics lead to K+ retention
(Triamterene, Amiloride
Spironolactone)
Other medicines:
ACE inhibitors, Angiotensin receptor blockers, Digital toxicity, Beta blockers, High dose pensilin

POTASSIUM
Metabolic Acidosis and Hyperkalemia



Because acidosis causes increased H + in the cell, it directs K + to circulation Each 0.1 unit decrease in pH 7.4 raises serum K to 0.6 mEq / L.

Proteinuria:

Kidney disease

Effort proteinuria (Seen in adolescence)

DM

THANK YOU…