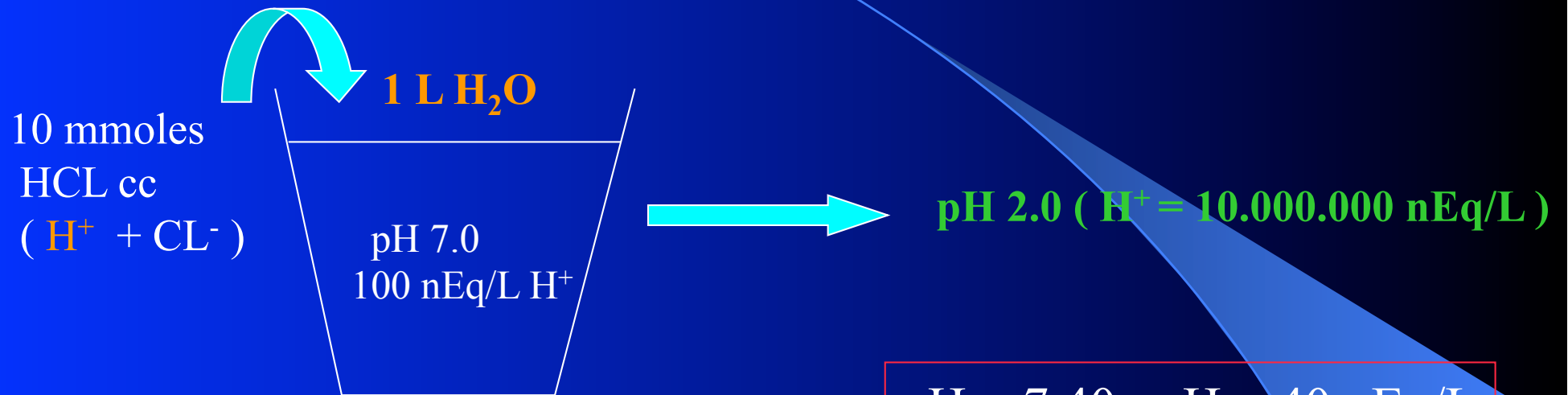
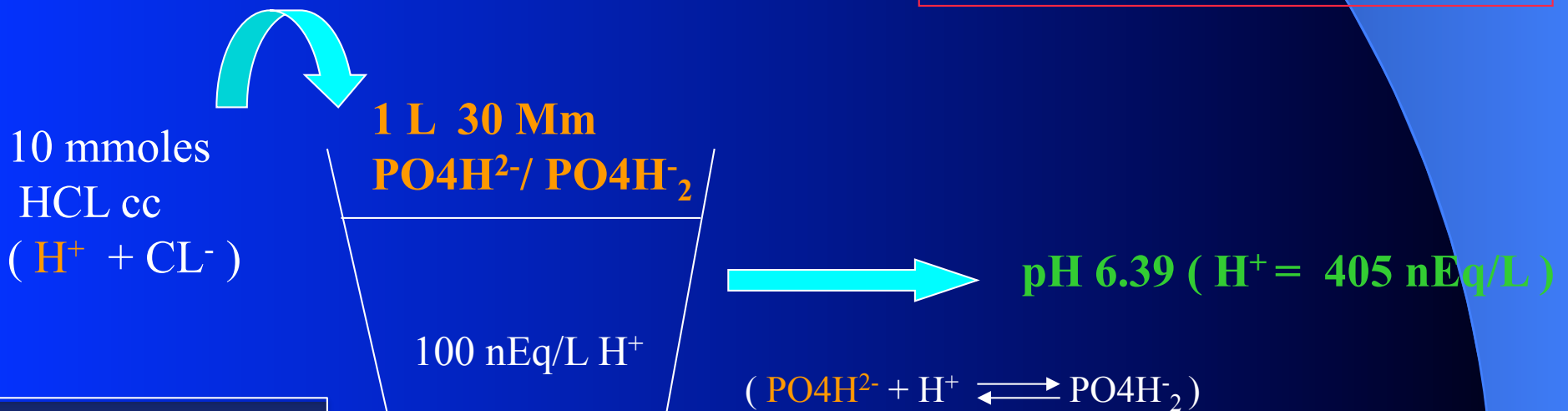


# IMPORTANCIA DE LOS SISTEMAS BUFFERS



pH = 7.40    H = 40 nEq/L



## SISTEMA CERRADO VS ABIERTO

➤ **SISTEMA ABIERTO:** AH y A<sup>-</sup> SON INDEPENDIENTES ENTRE SI

➤ **SISTEMA CERRADO:** ↑ AH es proporcional ↓ A<sup>-</sup> ( o viceversa )



$$\uparrow\uparrow \text{pH} = \text{pK} + \log \frac{\text{BASE}}{\text{ACIDO}_-}$$

Ejemplo: adición de 5 mmoles HCL

pH = 7.40, H = 40 nEq/L, pCO<sub>2</sub> = 40 mmHg,  
CO<sub>3</sub>H<sup>-</sup> = 24 mmoles/L, CO<sub>3</sub>H<sub>2</sub> = 1.2 mEq/L

### SISTEMA CERRADO

CO<sub>3</sub>H<sup>-</sup> = 19 mEq/L

CO<sub>3</sub>H<sub>2</sub> = 6.2 “

pCO<sub>2</sub> = 206 mmHg

H = 257 nEq/l

pH = 6.59

### SISTEMA ABIERTO

CO<sub>3</sub>H<sup>-</sup> = 19 mEq/L

CO<sub>3</sub>H<sub>2</sub> = 1.2 “

pCO<sub>2</sub> = 40 mmHg

H = 50 nEq/L

pH = 7.30

# PRINCIPIO ISOHIDRICO

SANGRE: SOLUCION HOMOGENEA DE n BUFFERS ( **UNICO pH** )



$$K_1 = \frac{[A_1^-][H_1^+]}{[AH_1]}$$

$$[H_1^+] = K_1 \frac{[AH_1]}{[A_1^-]}$$



$$K_2 = \frac{[A_2^-][H_2^+]}{[AH_2]}$$

$$[H_2^+] = K_2 \frac{[AH_2]}{[A_2^-]}$$



$$K_3 = \frac{[A_3^-][H_3^+]}{[AH_3]}$$

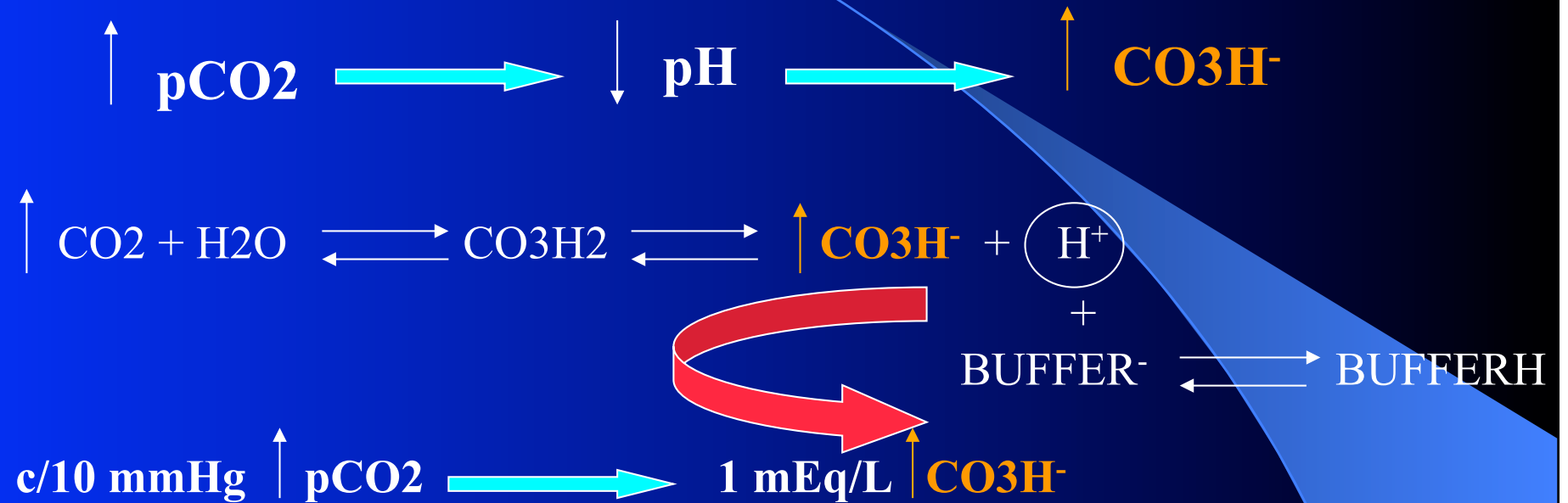
$$[H_3^+] = K_3 \frac{[AH_3]}{[A_3^-]}$$

$$[H_1^+] = [H_2^+] = [H_3^+] = [H_n^+]$$

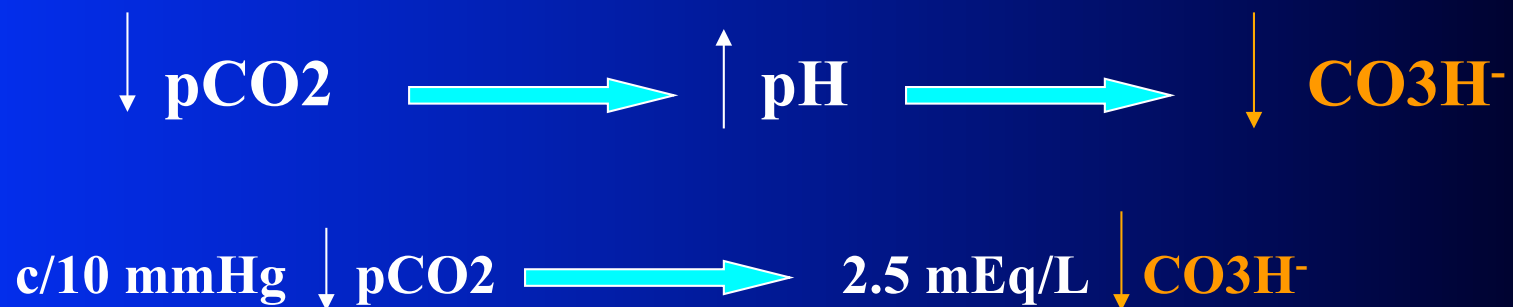
$$[H] = K_1 \frac{[AH_1]}{[A_1^-]} = K_2 \frac{[AH_2]}{[A_2^-]} = K_3 \frac{[AH_3]}{[A_3^-]} = K_n \frac{[AH_n]}{[A_n^-]}$$

# ACCION BUFFER EN ALTERACIONES RESPIRATORIAS

## ➤ ACIDOSIS RESPIRATORIA AGUDA:



## ➤ ALCALOSIS RESPIRATORIA AGUDA



# TRANSPORTE DE CO<sub>2</sub>

## TEJIDO

↑ **CO<sub>2</sub> (g)**  
(10-15 Mol/dia)

## PLASMA

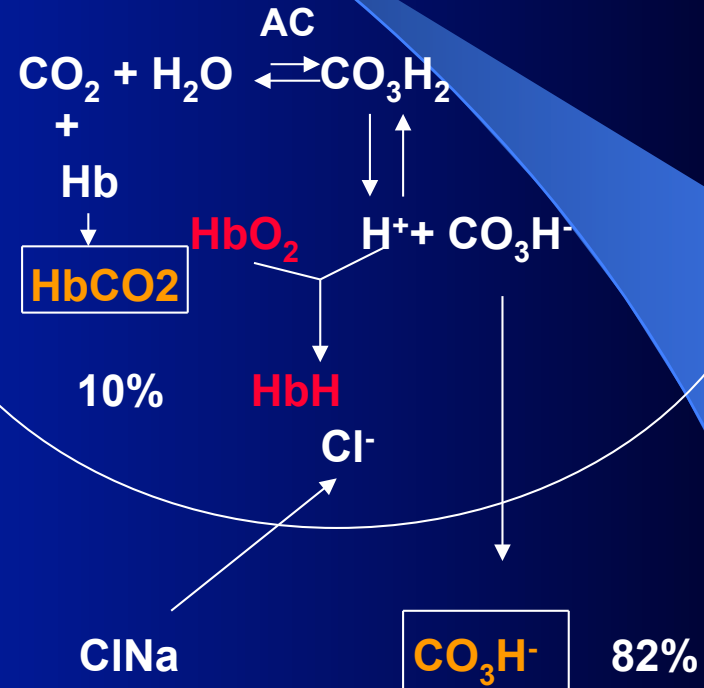
CO<sub>2</sub> (g) →

$\alpha \times p\text{CO}_2 = \text{CO}_2 \text{ (d)}$  8%

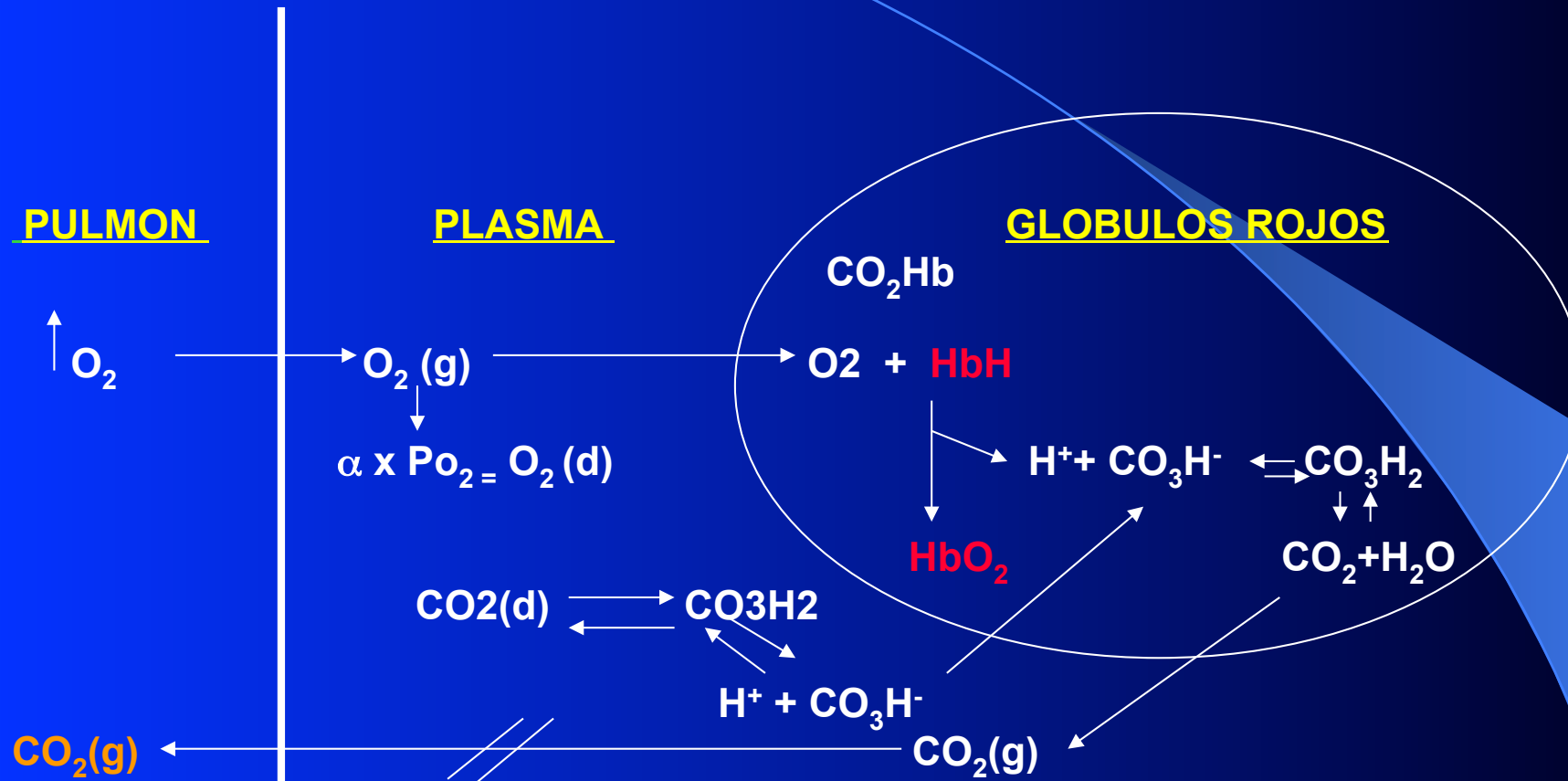
0.03      40

1.2 mEq/l

## GLOBULO ROJO



# ELIMINACION DE CO<sub>2</sub>



AC. RESP.  $\rightleftharpoons$

ALC. RESP.  $\leftarrow$

BALANCE NETO CO<sub>2</sub> = 0

# FUENTES DE ACIDOS Y BASES ENDOGENAS

## ➤ ACIDOS ENDOGENAS:

- Aa sulfurados  $\xrightarrow{\text{O}_2}$   $\text{H}_2\text{SO}_4 + \text{UREA} + \text{CO}_2 + \text{H}_2\text{O}$
- Acidos de fosfoesteres  $\xrightarrow{\text{H}_2\text{O}}$   $\text{H}_3\text{PO}_4$
- Glucosa  $\longrightarrow$  Ac. Lactico / Piruvico
- TG  $\longrightarrow$  Acidos grasos
- Nucleoproteinas  $\longrightarrow$  Ac. Urico

## ➤ BASES ENDOGENAS:

- Aniones organicos  $\xrightarrow{\text{O}_2}$   $\text{CO}_3\text{H}^- + \text{UREA} + \text{CO}_2 + \text{H}_2\text{O}$
- Sales de fosfoesteres  $\xrightarrow{\text{H}_2\text{O}}$   $\text{CO}_3\text{H}^- + \text{H}_2\text{PO}_4^-$

# FUENTES DE ACIDOS Y BASES ENDOGENAS

## ➤ ACIDOS ENDOGENAS:

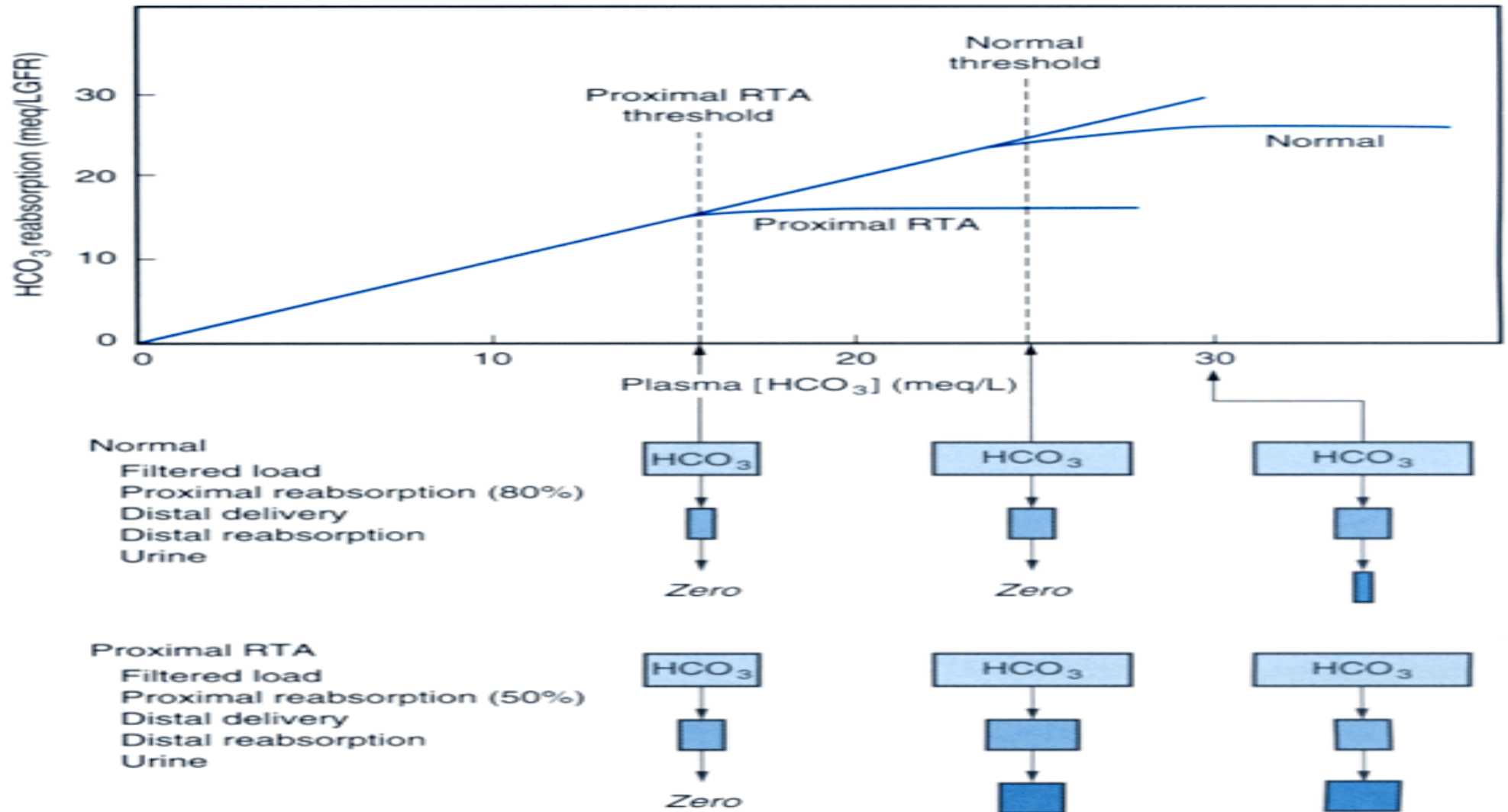
- Aa sulfurados  $\xrightarrow{\text{O}_2}$   $\text{H}_2\text{SO}_4 + \text{UREA} + \text{CO}_2 + \text{H}_2\text{O}$
- Acidos de fosfoesteres  $\xrightarrow{\text{H}_2\text{O}}$   $\text{H}_3\text{PO}_4$
- Glucosa  $\longrightarrow$  Ac. Lactico / Piruvico
- TG  $\longrightarrow$  Acidos grasos
- Nucleoproteinas  $\longrightarrow$  Ac. Urico

## ➤ BASES ENDOGENAS:

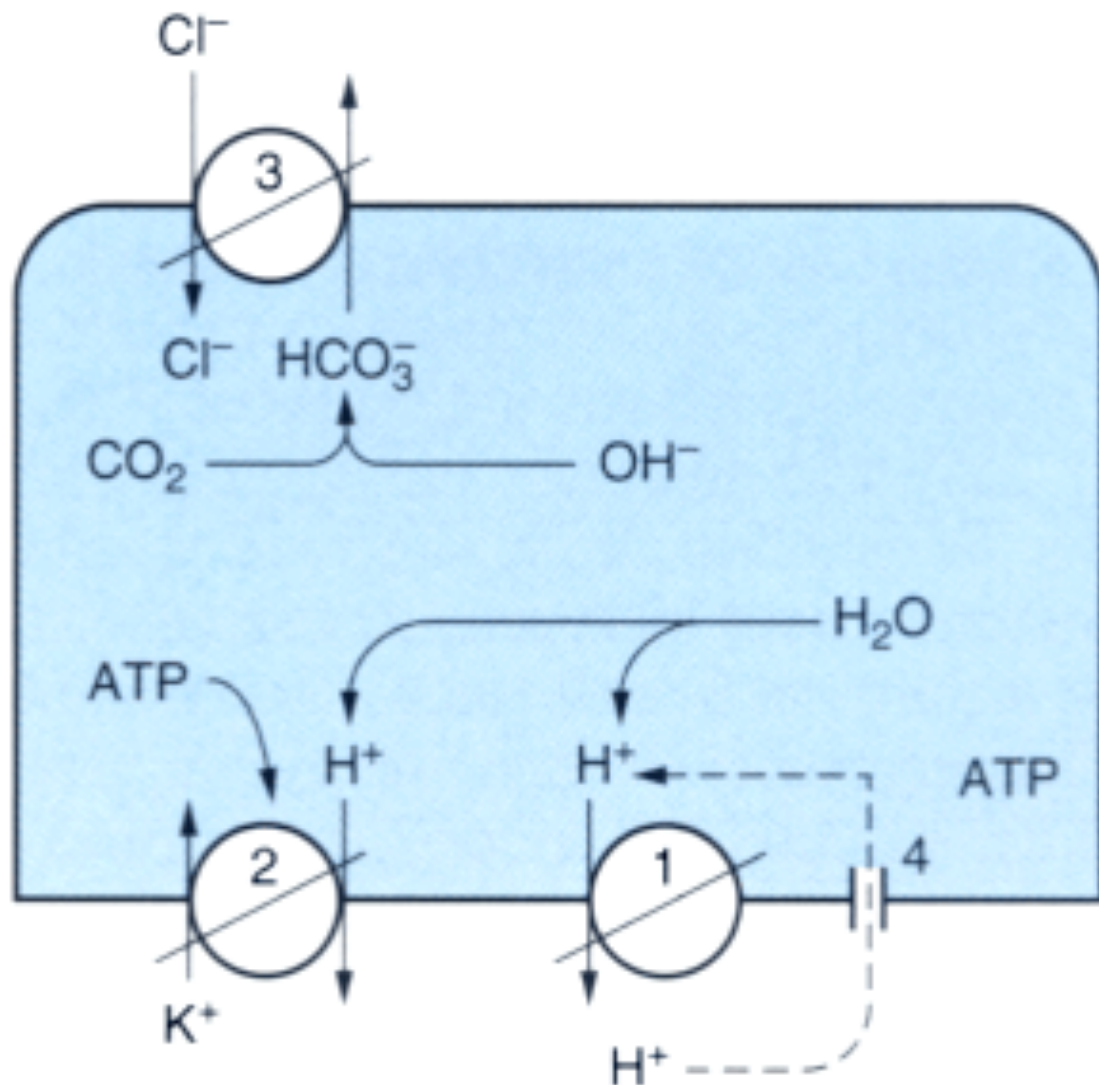
- Aniones organicos  $\xrightarrow{\text{O}_2}$   $\text{CO}_3\text{H}^- + \text{UREA} + \text{CO}_2 + \text{H}_2\text{O}$
- Sales de fosfoesteres  $\xrightarrow{\text{H}_2\text{O}}$   $\text{CO}_3\text{H}^- + \text{H}_2\text{PO}_4^-$



# ACIDOSIS TUBULAR PROXIMAL



# DEFECTOS DE ACIDIFICACION RENAL y ATR DISTAL



## ACIDEZ TITULABLE Y FOSFATOS

VN Ppl = 4.0 mg/dl

$Ppl \text{ ( mg/dl )} = \frac{4.0}{31} \times 10 = 1.33 \text{ mmol/l}$   $\longrightarrow$  25% UNIDO A ALB. = 1.0 mM

Carga filtrada de P = IFG x Ppl filtrable  
= 180 L/dia x 1.0  
= 180 mmol/dia

Reabsorción proximal P = 75 %

$180 \times 0.25 = 45 \text{ mmol /dia}$

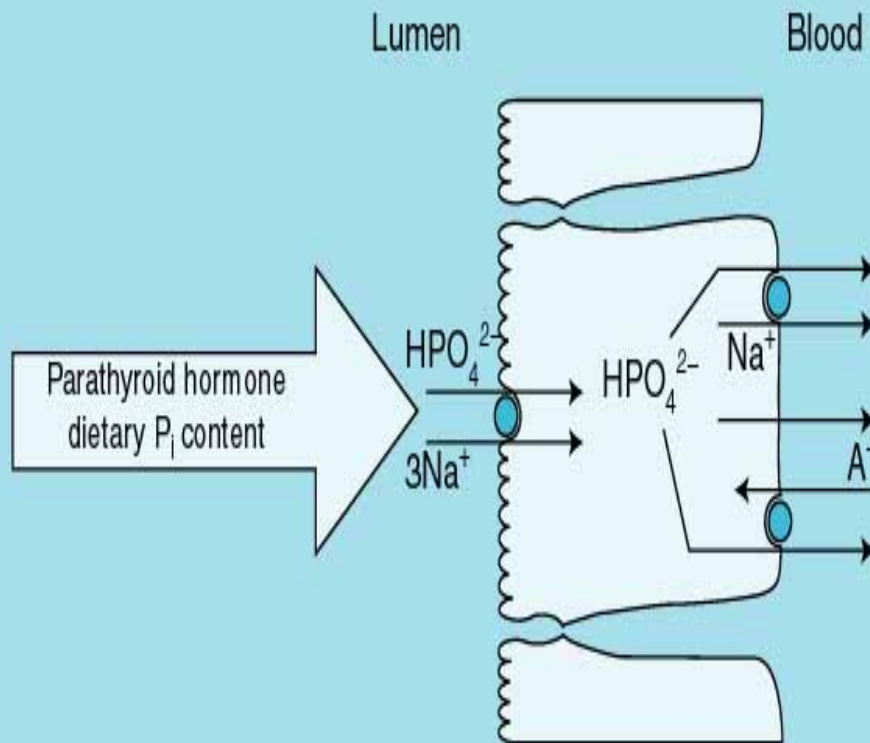
$PO_4H^{2-} : PO_4H^{-}_2$  pH = 7.40  
80 %      20%

AT. ( $PO_4H^{2-}$ ) =  $0.8 \times 45 = 36 \text{ mmol/dia} + ( 5 \text{ mmol/dia Citrato } )$

AT total = 40 mmol/dia

# REABSORCION PROXIMAL DE FOSFATOS

Cellular model of proximal tubule  $P_i$ -reabsorption



## AUMENTA EL TRANSPORTE

- ALC. METABOLICA CRONICA
- HIPERKALEMIA
- BAJA DIETA DE P
- STANIOCALCINA
- HORMONAS TIROIDES

## DISMINUYE EL TRANSPORTE

- AC. METABOLICA CRONICA
- ACIDOSIS RESPIRATORIA AGUDA
- HIPOKALEMIA
- ALTA DIETA EN P
- PTH

# RESPUESTA RENAL A LA CARGA FILTRADA DE FOSFATOS

