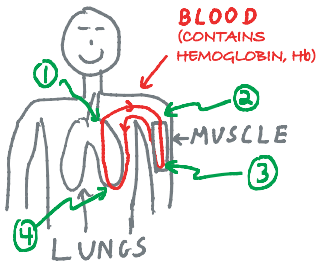
HEMOGLOBIN SCENARIO, PART 2



$$Hb + 4O_2 \rightleftharpoons Hb(O_2)_4 \qquad K = 2.4 \times 10^{-6}$$

$$Q = \frac{[Hb(O_2)_4]}{[Hb][O_2]^4}$$

($[Hb(O_2)_4]$: M; $[Hb]$, $[O_2]$: TORR (OR mm Hg))

TOTAL CONCENTRATION OF HEMOGLOBIN $[Hb] + [Hb(O_2)_4] \approx 240\ \mu M$

$1\ \mu M = 10^{-6} M$

① BLOOD LEAVING LUNGS

$[Hb(O_2)_4] = 239\ \mu M$
$[Hb] = 1.0\ \mu M$
$[O_2] = 100$ TORR

$$Q = \frac{[Hb(O_2)_4]}{[Hb][O_2]^4} = \frac{(239 \times 10^{-6})}{(1 \times 10^{-6})(100)^4} = 2.4 \times 10^{-6}$$

$K = 2.4 \times 10^{-6}$

$Q = K$ SO AT EQUILIBRIUM

② BLOOD ENTERING MUSCLES

$[Hb(O_2)_4] = 239\ \mu M$
$[Hb] = 1.0\ \mu M$
$[O_2] = 5$ TORR

$$Q = \frac{[Hb(O_2)_4]}{[Hb][O_2]^4} = \frac{(239 \times 10^{-6})}{(1 \times 10^{-6})(5)^4} = 0.38$$

$K = 2.4 \times 10^{-6}$

$Q > K$ SO REACTION SHIFTS $\Longleftarrow$

$Hb + 4O_2 \rightleftharpoons Hb(O_2)_4$ SHIFT RELEASES O_2 TO MUSCLES

③ BLOOD LEAVING MUSCLES

$[Hb(O_2)_4] = 0.36\ \mu M$
$[Hb] = 240\ \mu M$
$[O_2] = 5$ TORR

$$Q = \frac{[Hb(O_2)_4]}{[Hb][O_2]^4} = \frac{(0.36 \times 10^{-6})}{(240 \times 10^{-6})(5)^4} = 2.4 \times 10^{-6}$$

$K = 2.4 \times 10^{-6}$

$Q = K$ SO AT EQUILIBRIUM

④ BLOOD ENTERING LUNGS

$[Hb(O_2)_4] = 0.36\ \mu M$
$[Hb] = 240\ \mu M$
$[O_2] = 100$ TORR

$$Q = \frac{[Hb(O_2)_4]}{[Hb][O_2]^4} = \frac{(0.36 \times 10^{-6})}{(240 \times 10^{-6})(100)^4} = 1.5 \times 10^{-11}$$

$K = 2.4 \times 10^{-6}$

$Q < K$ SO REACTION SHIFTS $\Longrightarrow$

$Hb + 4O_2 \rightleftharpoons Hb(O_2)_4$ SHIFT ABSORBS O_2 FROM LUNGS

① BLOOD LEAVING LUNGS