(32) **Today**

Chap 19.1: ETC

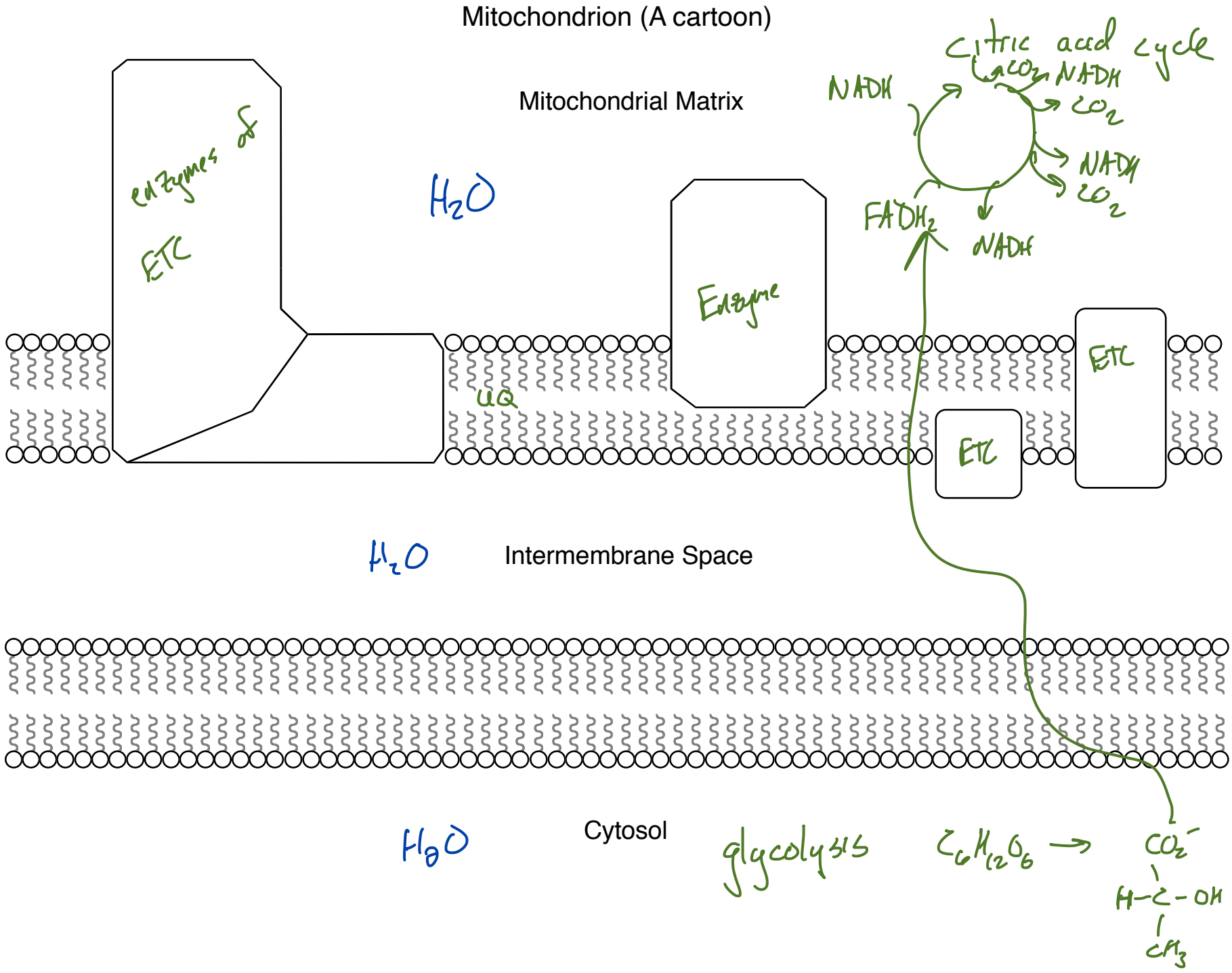
Next Class (33)

Chap 19.1: ETC

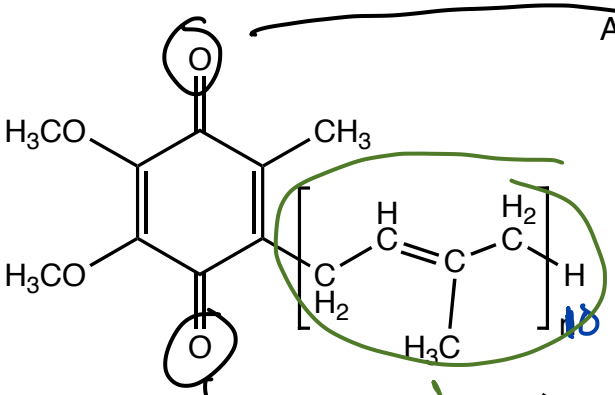
(34) **Second Class from Today**

Chap 19.2: ETC and ATP Synthase

Rework Test 3 and hand in on Monday, May 5.


Mitochondrion (A cartoon)
Mitochondrial Matrix
enzymes &
ETC
H_2O
Enzyme
UQ
ETC
ETC
citric acid cycle
$2CO_2$
NADH
CO_2
NADH
CO_2
NADH
$FADH_2$
H_2O
Intermembrane Space
H_2O
Cytosol
glycolysis
$C_6H_{12}O_6$ →
CO_2^-
H–C–OH
CH_3

A New Electron Carrier: Ubiquinone

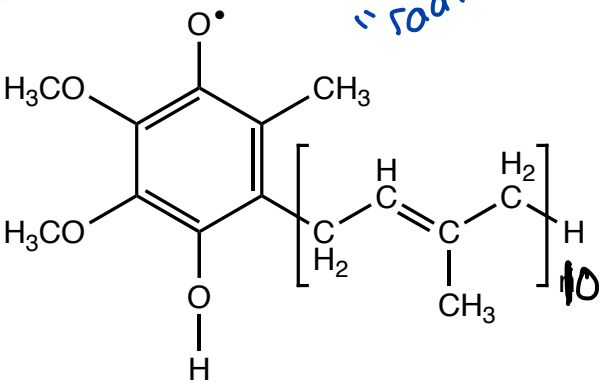


Coenzyme Q_{10}

ubiquinone

oxidized form

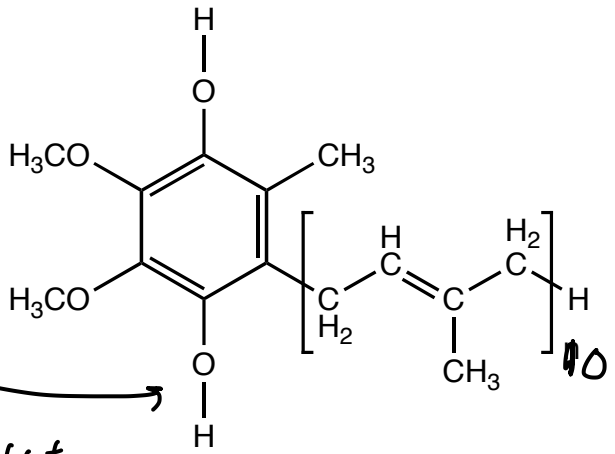
$e^- + H^+$



(odd # of e⁻'s on this O "radical")

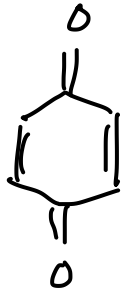
ubisemiquinone

$e^- + H^+$



dihydroubiquinone

reduced form



e^- H^+

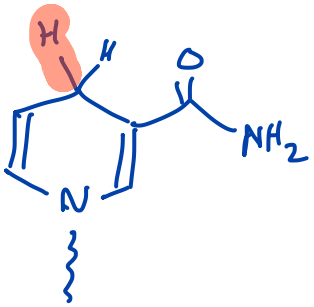
e^- H^+

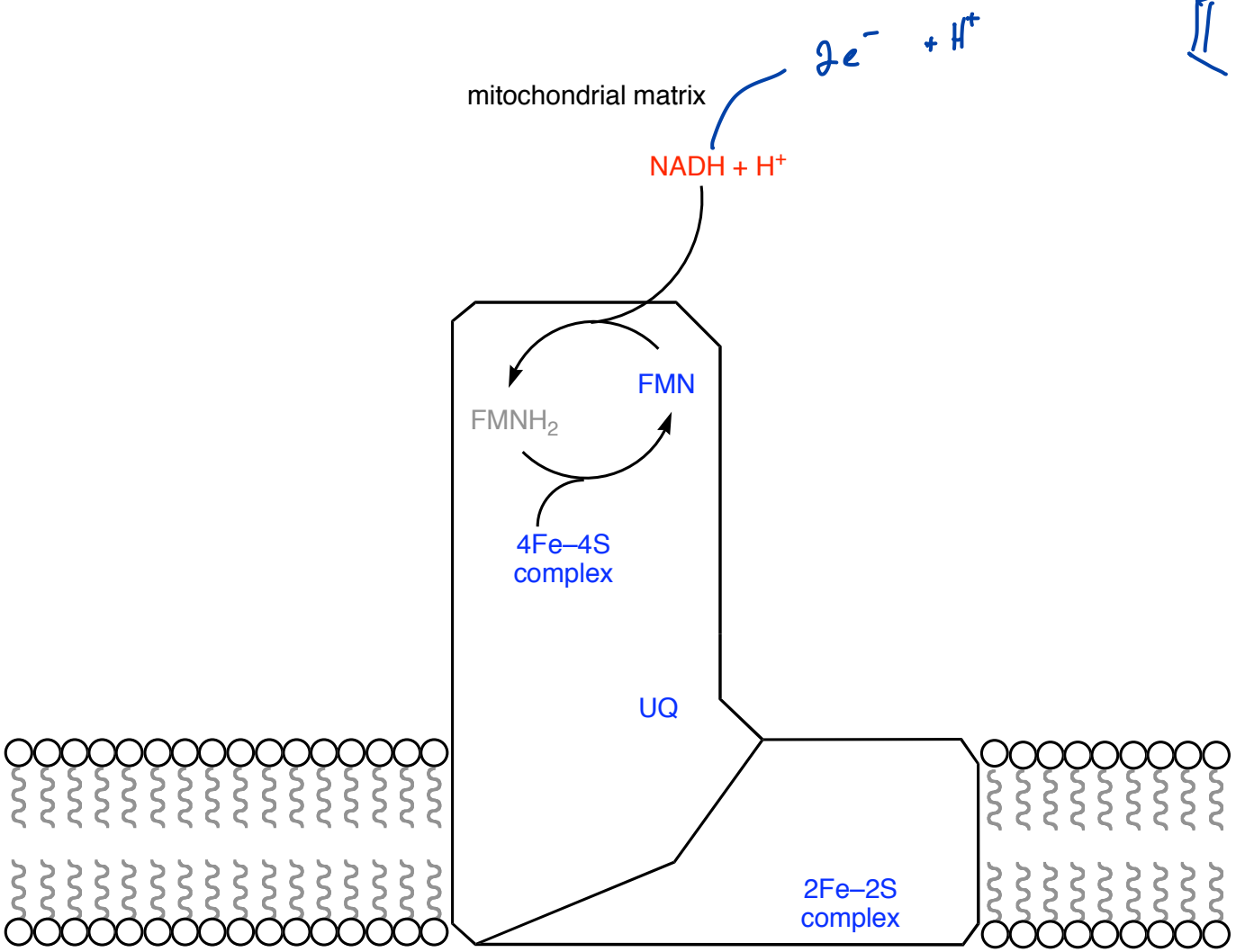
this is a long nonpolar tail

means UQ is found in the membrane... the nonpolar region

Complex I

NADH Dehydrogenase Complex

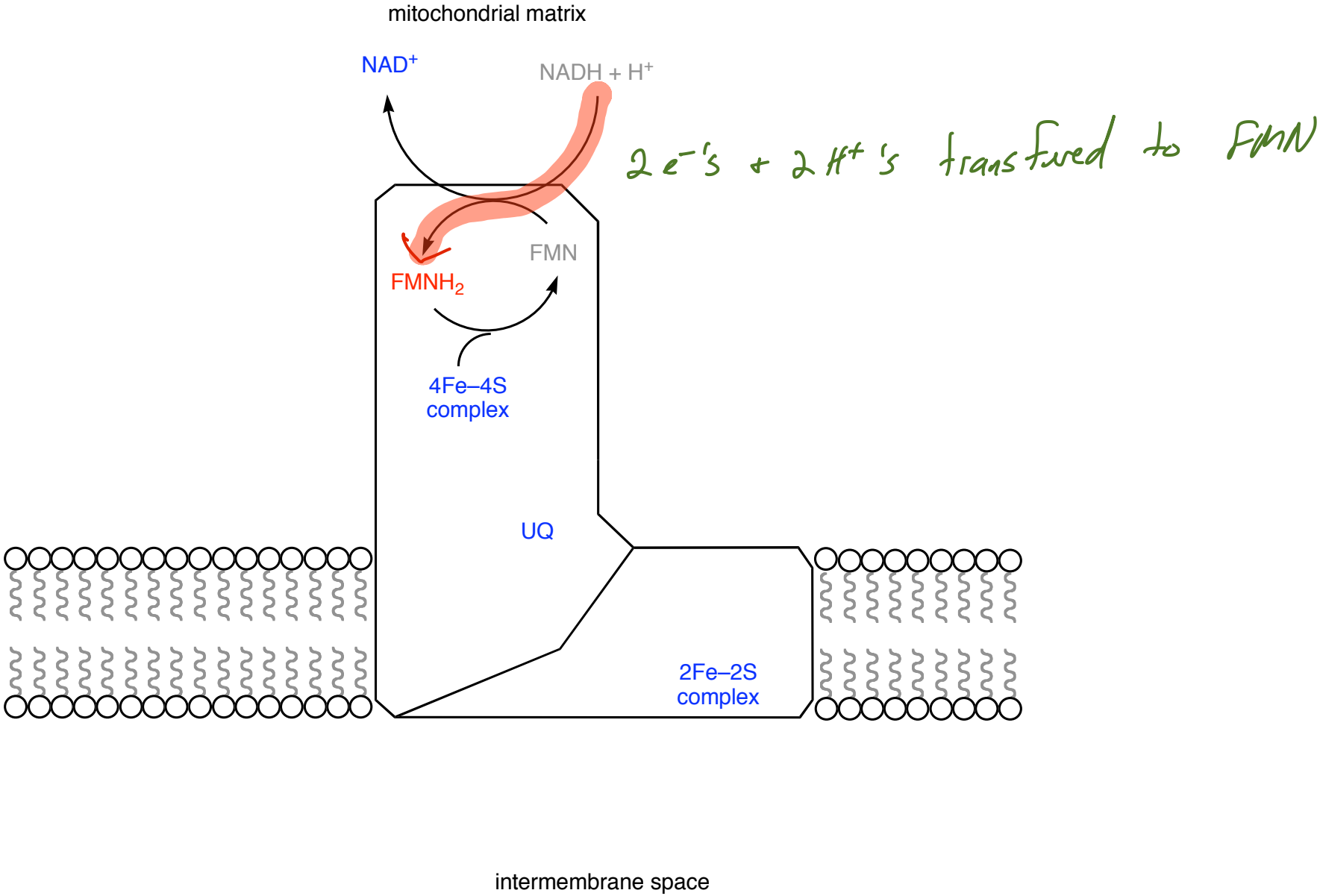




intermembrane space

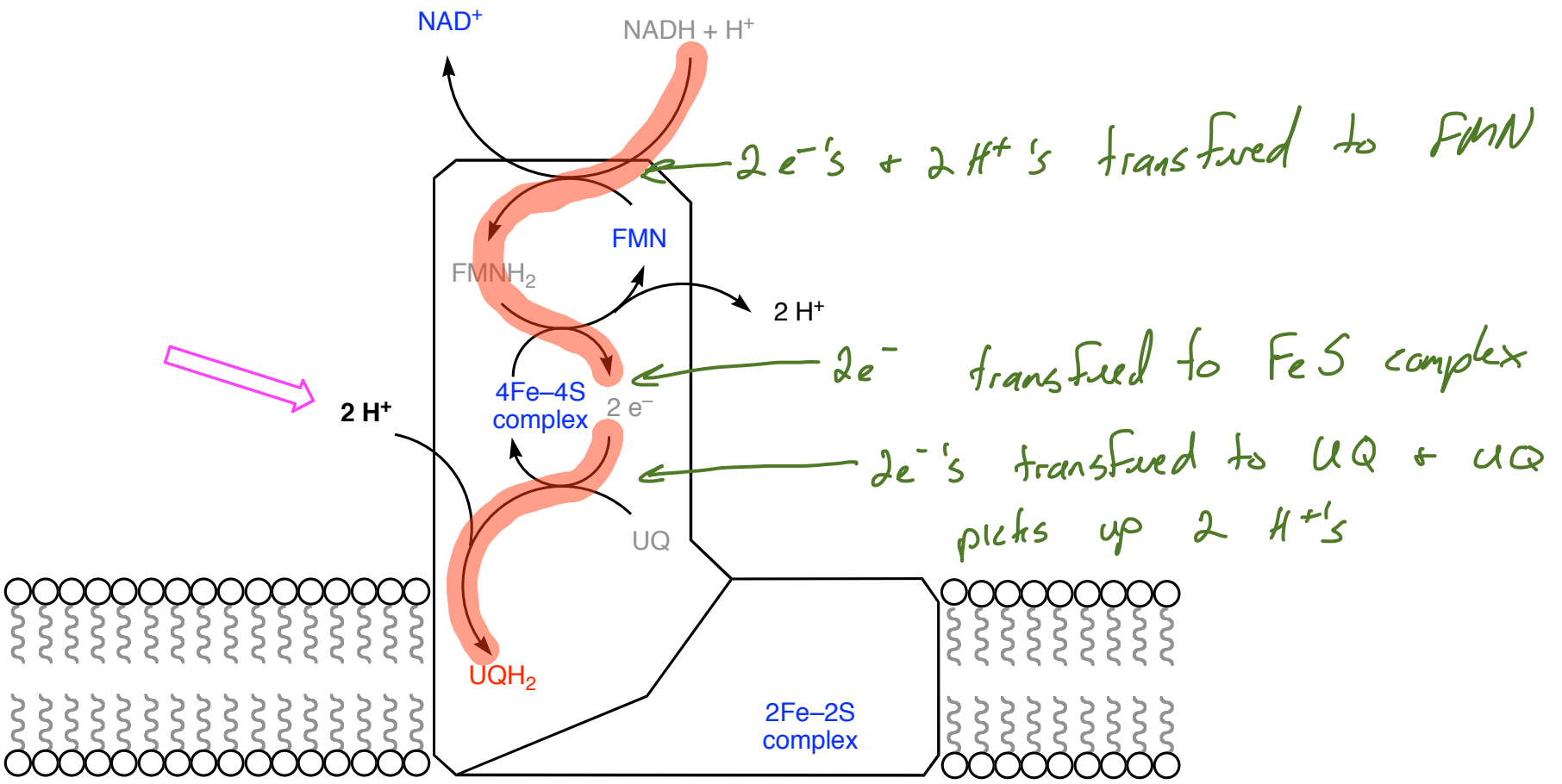
Complex I

NADH Dehydrogenase Complex



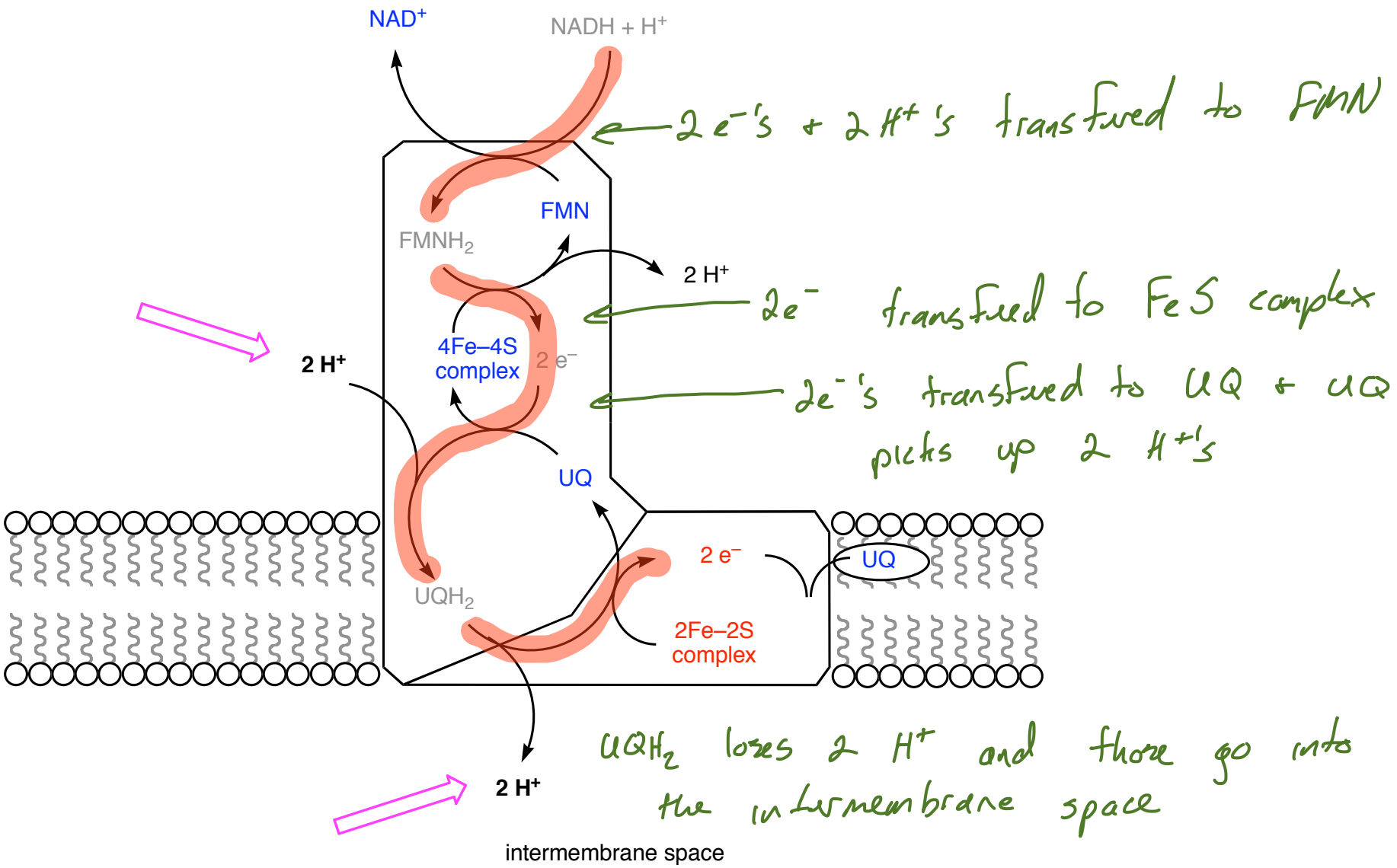
Complex I

NADH Dehydrogenase Complex



Complex I

NADH Dehydrogenase Complex



2 e⁻'s + 2 H⁺'s transfered to FMN

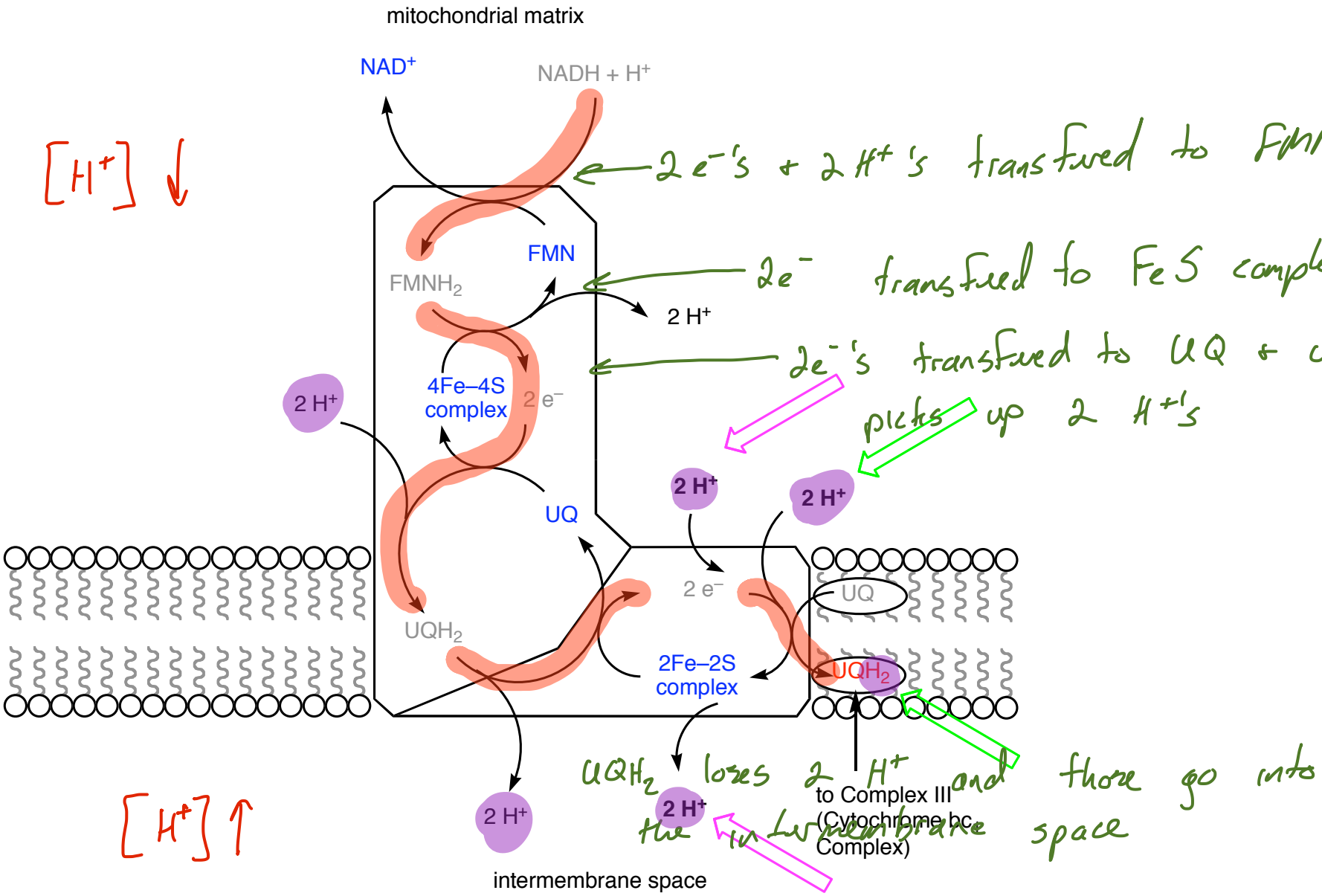
2e⁻ transfered to FeS complex

2e⁻'s transfered to UQ & UQ picks up 2 H⁺'s

UQH_2 loses 2 H^+ and those go into the intermembrane space

Complex I is moving pumping H^+ from the matrix to the intermembrane space

NADH Dehydrogenase Complex



$[H^+]$ ↓

2 e^-'s + 2 H^+'s transfered to FMN

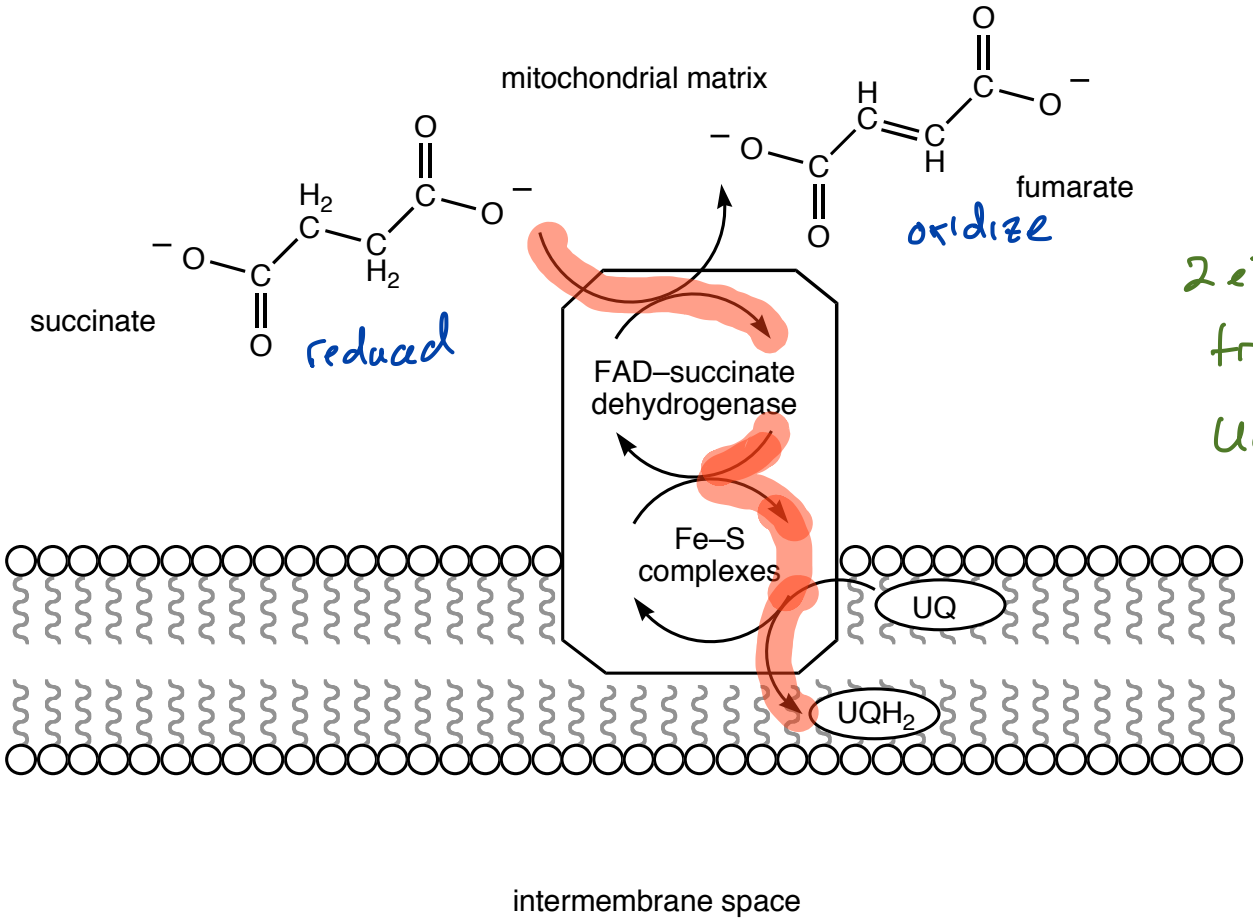
2 e^- transfered to FeS complex

2 e^-'s transfered to UQ + UQ picks up 2 H^+'s

$[H^+]$ ↑

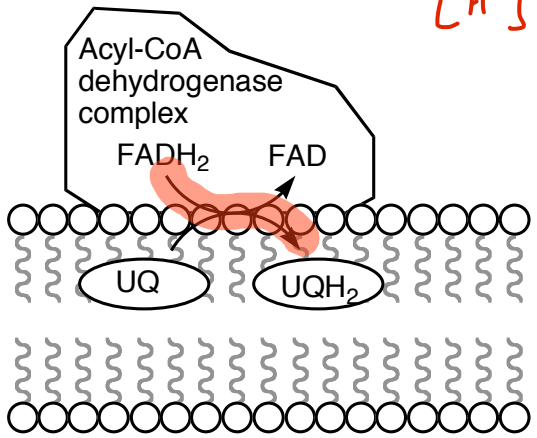
UQH_2 loses 2 H^+ and those go into the intermembrane space

ETC Complex II



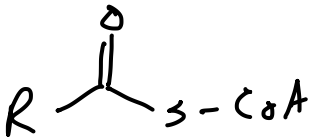
2 e^- from succinate are transfered to UQ & UQ is picking up $2H^+$ from the matrix

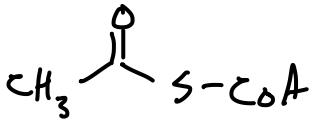
mitochondrial matrix



$[H^+]\downarrow$

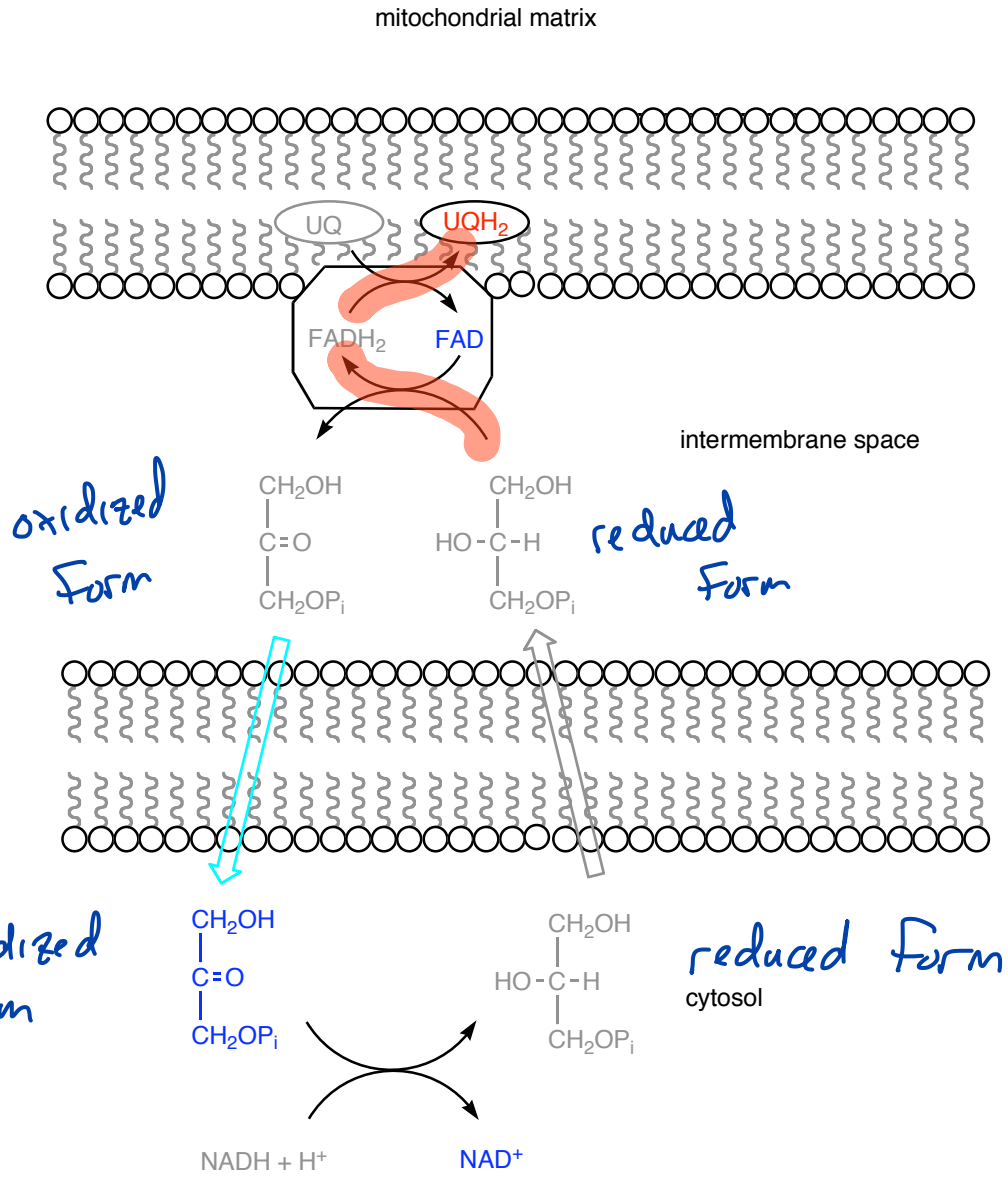
intermembrane space



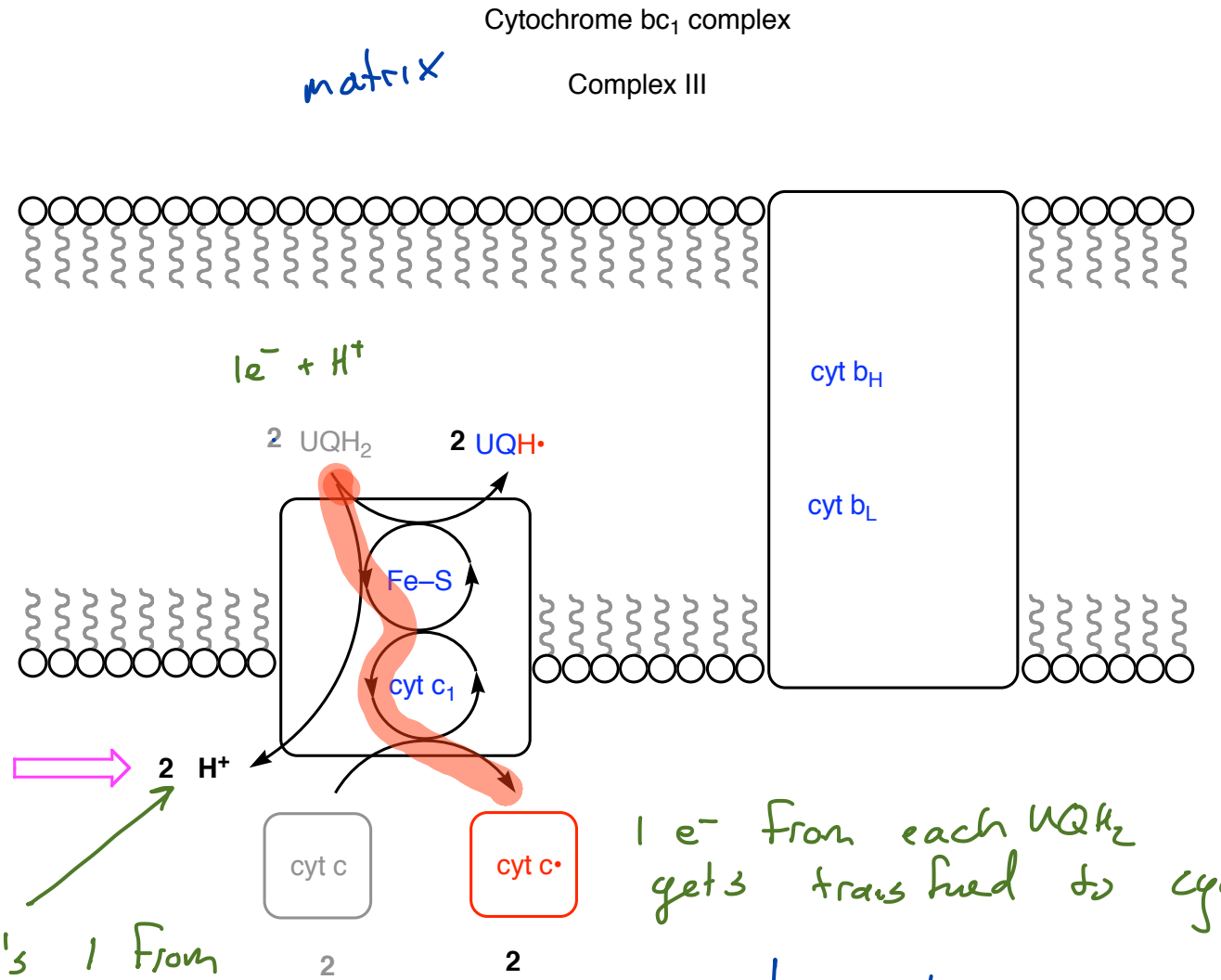


acyl CoA's oxidized and e^-'s transfred to UQ along with 2 H^+'s

Glycerol Phosphate Shuttle



What happens to the UQH_2



↑[H⁺]

2 H⁺'s 1 From each UQH_2 are transfred to the intermembrane space

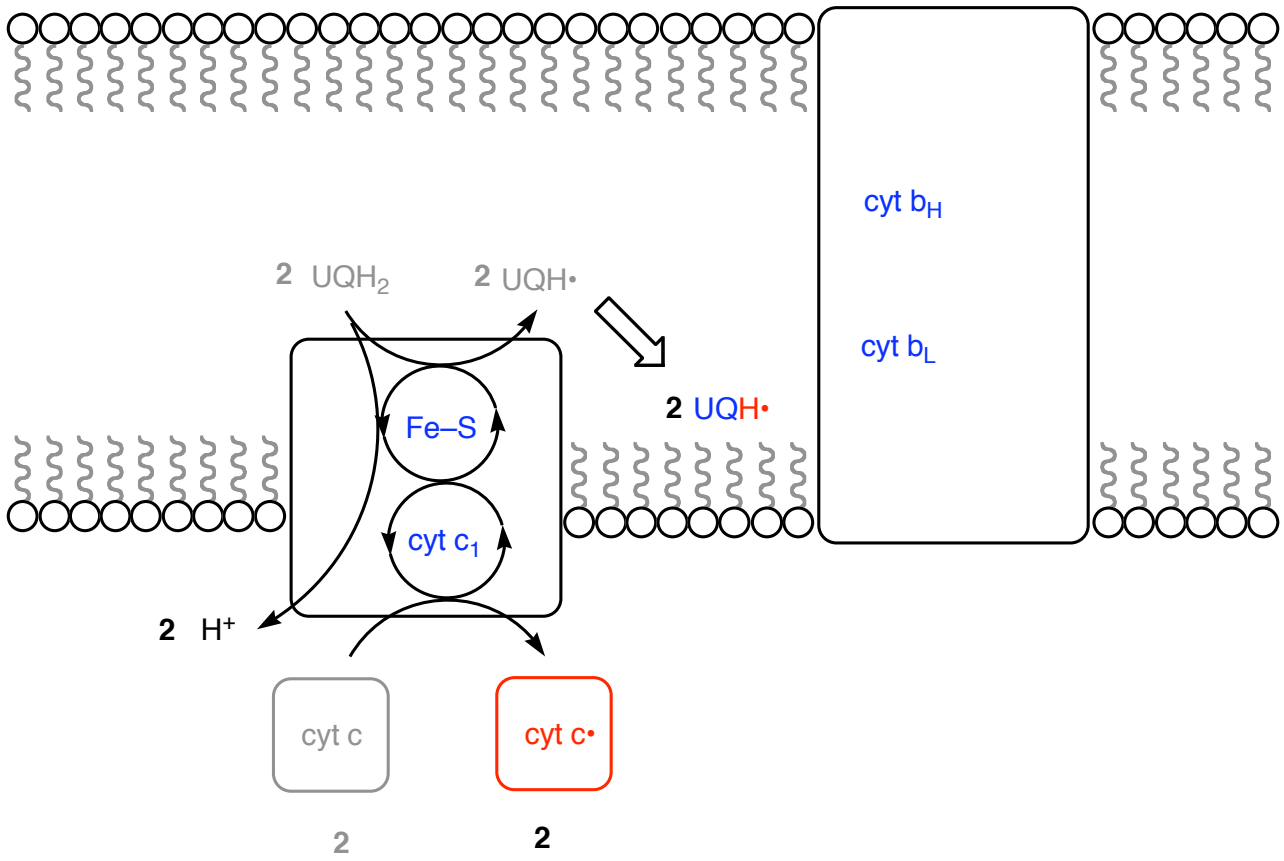
1 e⁻ From each UQH_2 gets transfred to cytochrome C

intermembrane space

What happens to the UQH_2

Cytochrome bc_1 complex

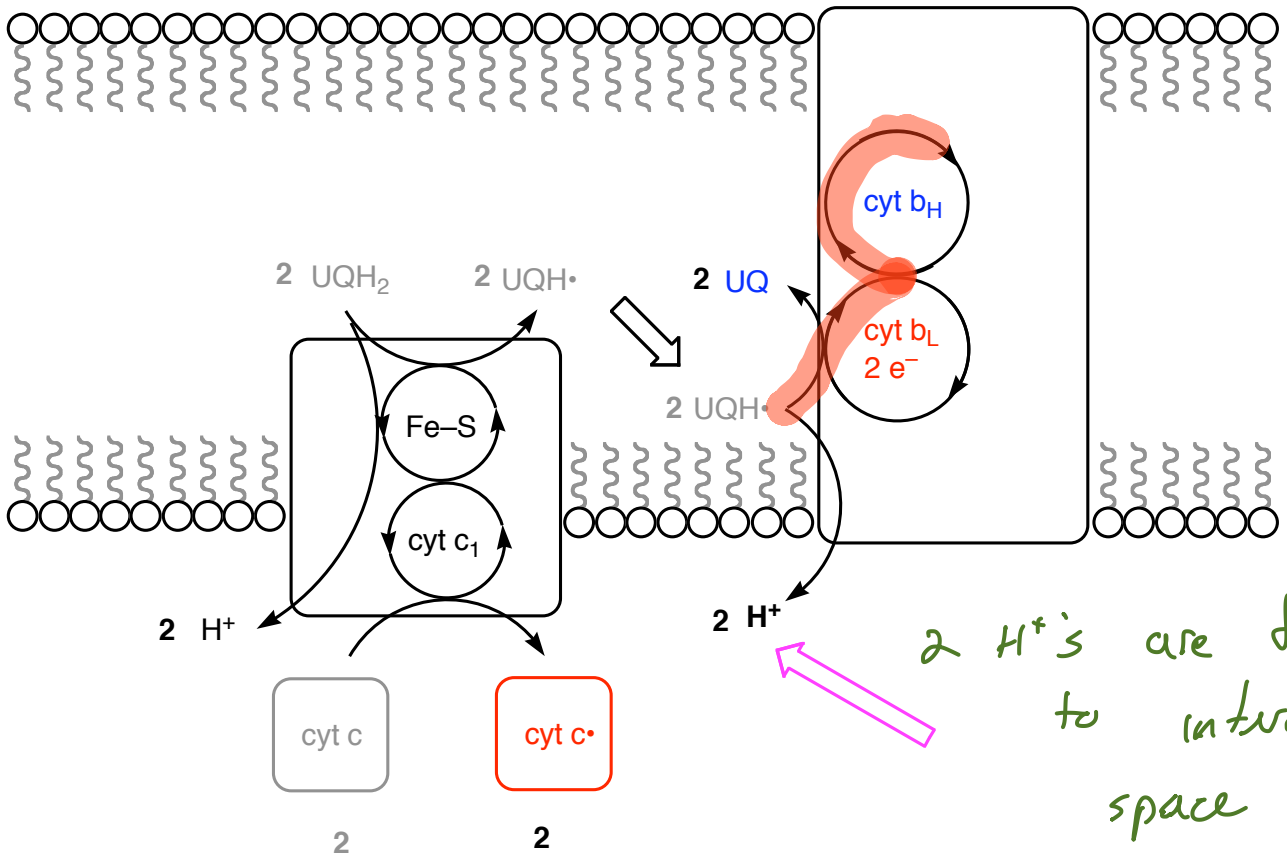
Complex III



What happens to the UQH_2

Cytochrome bc_1 complex

Complex III

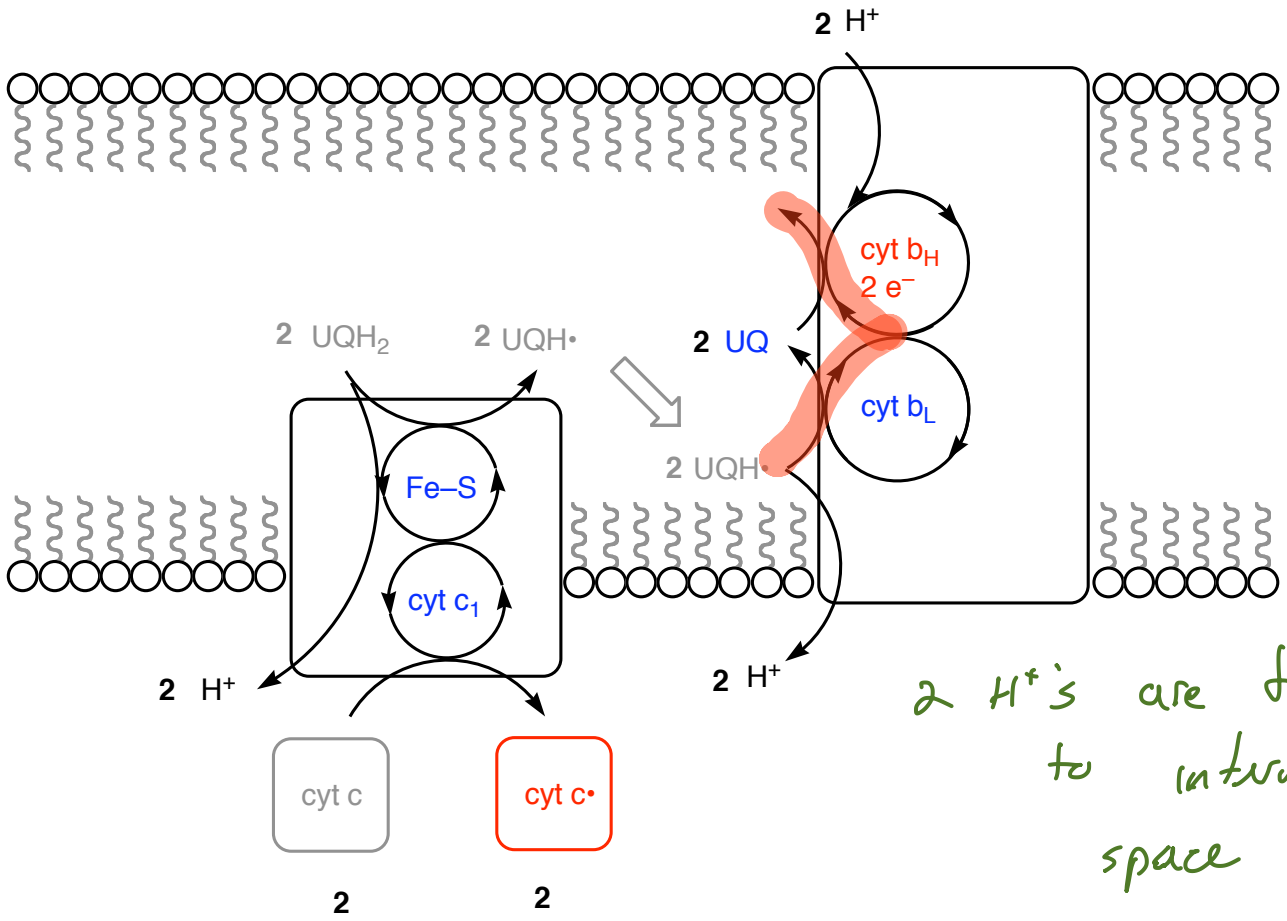


2 H^+'s are transported to intermembrane space

What happens to the UQH_2

Cytochrome bc_1 complex

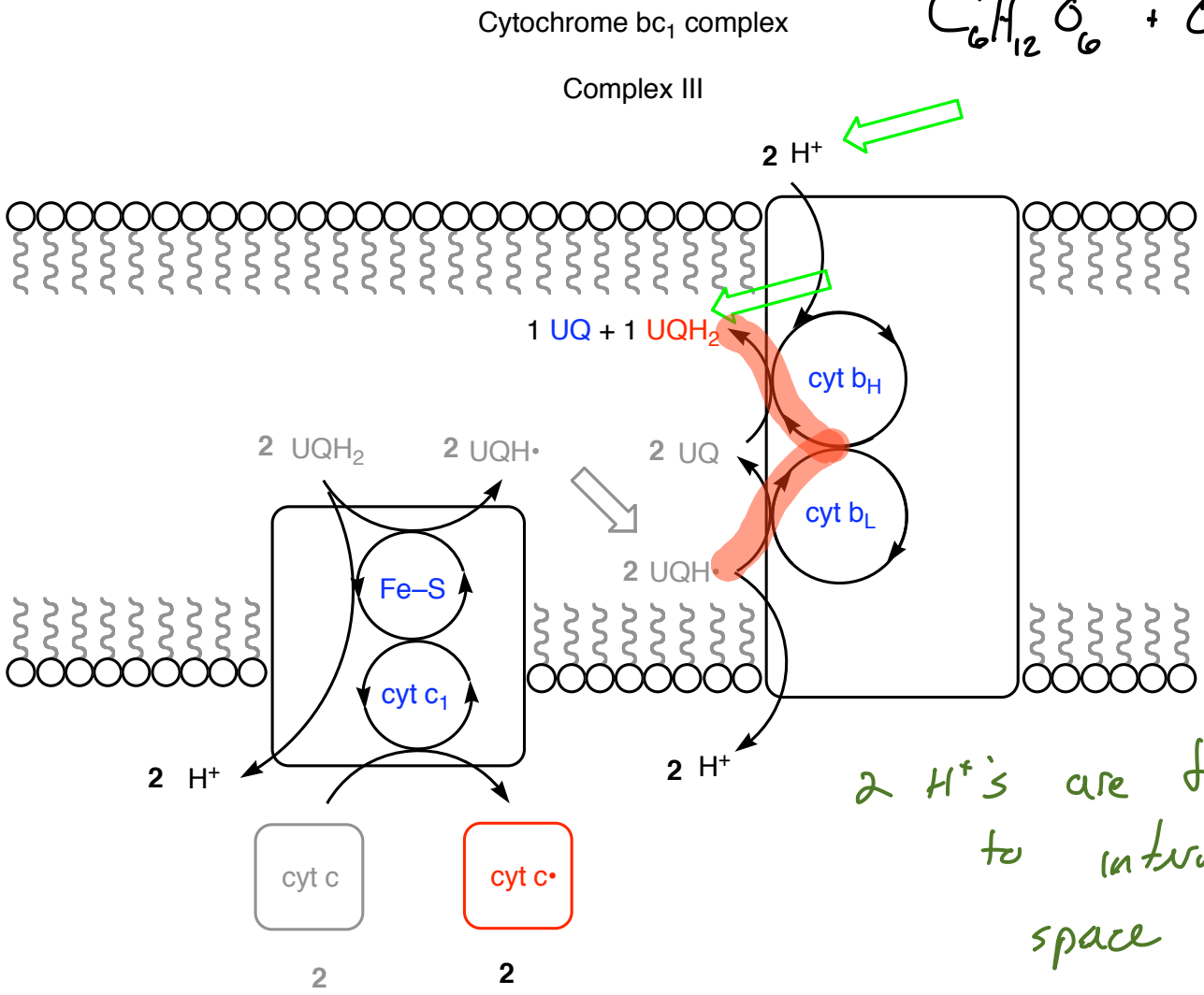
Complex III



2 H^+'s are transported to intermembrane space

What happens to the UQH_2

$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

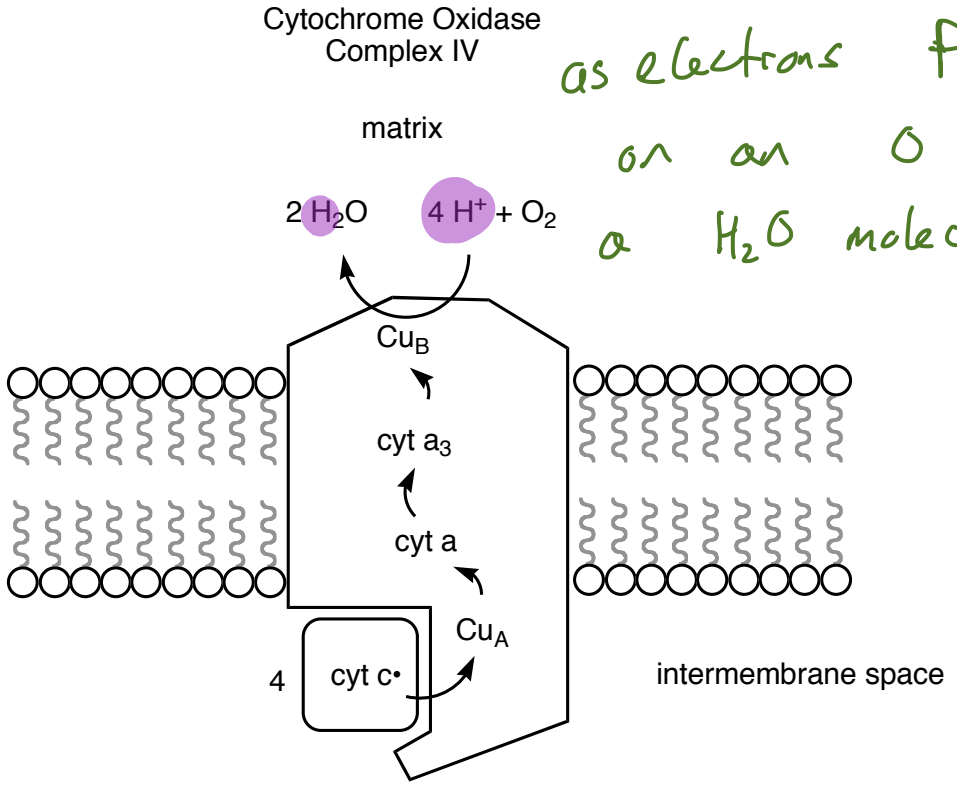


2 H^+'s are transported to intermembrane space

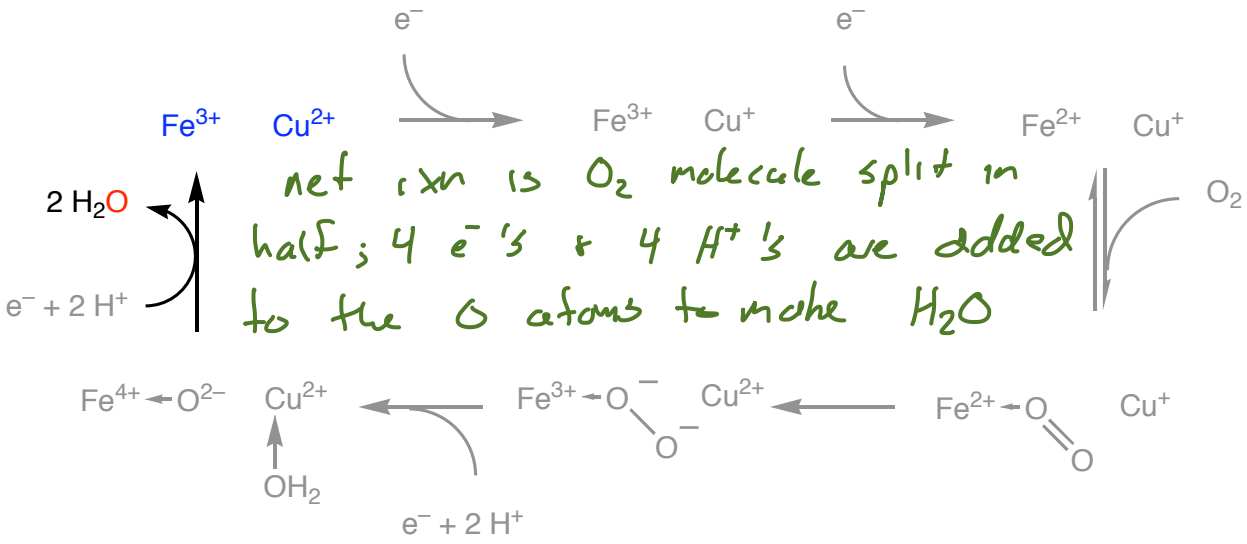
UQH_2's used to transfer H^+ from matrix to intermembrane space

UQH_2's used to move e^-'s from NADH to cytochrome C

And Where Do the e^-'s End Their Journey?



as electrons find their home on an O atom of a H_2O molecule the $[H^+]$ ↓



net rxn is O_2 molecule split in half; 4 e^-'s + 4 H^+'s are added to the O atoms to make H_2O