

CELL RESPIRATION 1977:

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Explain how the molecular reactions of cellular respiration transform the chemical bond energy of Krebs Cycle substrates into the more readily available bond energy of ATP. Include in your discussion the structure of the mitochondrion and show how it is important to the reactions of the Krebs Cycle and the Electron Transport Chain.

STANDARDS: 1/2 point for each of the following

- ___ Krebs and ETS occur within mitochondria
- ___ Krebs - enzymes freely present in matrix fluid
- ___ ETS - respiratory chain (respiratory assembly) arranged in order inner membrane of mitochondria (Diagram OK)
- ___ more active cells - more respiratory assemblies & more cristae
- ___ Aerobic - O₂ necessary as final H acceptor (-> H₂O)
(most eukaryotic cells all of the time)
- ___ Glycolysis is 1st required (outside mitochondria)
- ___ Glucose (6C) is broken down into 2 Pyruvic Acid (3C) molecules
- ___ Phosphorylation must 1st occur
- ___ Net production: 2 ATP & 2 NADH

MITOCHONDRIA

- ___ Pyruvic Acid & 2NADH enter mitochondria
- ___ 2 NADH will transfer H (electrons) into ETS
- ___ yields 2 x 2 ATP = 4 ATP (some loss due to point of entry into ETS)

KREBS CYCLE SUBSTRATES

- ___ 2 Pyruvic Acid loses CO₂ & H -> 2 NADH & combines w/CoA -> Acetyl CoA
- ___ (2C) Acetyl CoA + (4C) Oxaloacetic Acid -> (6C) Citric Acid
- ___ Citric Acid -> Isocitric Acid
- ___ (6C) Isocitric Acid - DEHYDROGENATION & loss of CO₂ -> (5C) Ketoglutaric Acid
NAD -> NADH
- ___ (5 C) Ketoglutaric Acid - DEHYDROGENATION & loss of CO₂ -> (4C) Succinic Acid
NAD -> NADH
- ___ (4C) Succinic Acid - DEHYDROGENATION -> (4C) Malic Acid
FAD -> FADH₂
- ___ (4C) Malic Acid - DEHYDROGENATION -> Oxaloacetic Acid
NAD -> NADH
- ___ specific mention of 2 x 3 NADH & 2 x 1 FADH₂ produced during Krebs

ATP (1) produced in Krebs

ETS RECEIVES THE FOLLOWING: NADH or FADH₂ WHICH RESULTS IN ATP PRODUCTION

- ___ Glycolysis -> 2 NADH x 2 ATP = 4
- ___ Pyruvic Acid -> Acetyl CoA + 2 NADH x 3 ATP = 6
- ___ Krebs -> 8 NADH (FADH₂) x 3 ATP = 24
- Total = 34

- ___ 34 ATP gained through ETS
- ___ Respiratory Assembly: CoQ, cytochromes b, c, a, a₃
- ___ Ring Compounds w/Fe (porphyrin ring)
- ___ Changing Oxidation states as "go down" assembly
- ___ Fe III -> Fe II change ionic state as accept electrons
- ___ Release energy in "packets" - small amounts sufficient to produce ATP
(about 7 kcal/mole)
- ___ Occurs at 3 places in the chain for each NADH, FADH₂
- ___ mention of various hypotheses: Chemiosmotic, Conformational, Chemical Coupling
- ___ O₂ final acceptor (-> H₂O)

CELLULAR RESPIRATION QUESTION 1982:

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