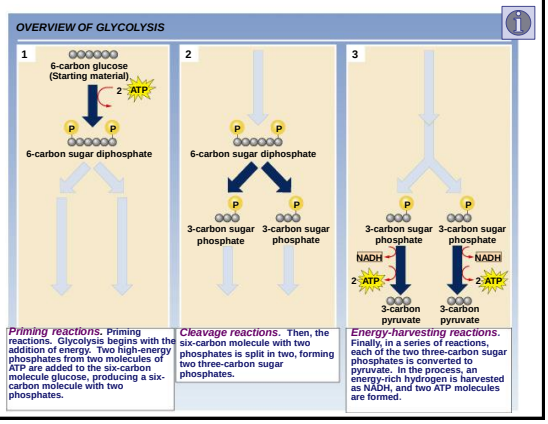
Chapter 7
Cellular Respiration: Pyruvate Oxidation & Citric Acid Cycle



Glycolysis is only the start

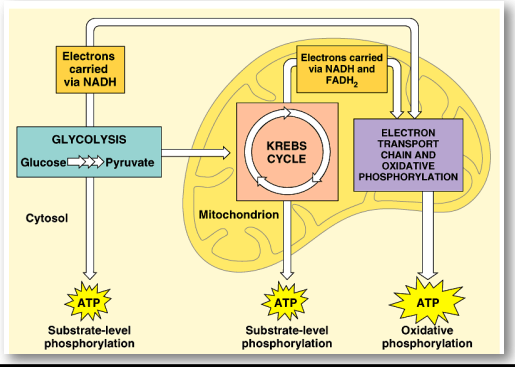
- Glycolysis

glucose → → → → → → pyruvate
6C 2x 3C

- but pyruvate has more energy to yield!
  - 3 more C to strip off (to oxidize)
  - if O_2 is available, pyruvate enters mitochondria
  - enzymes of Krebs cycle complete oxidation of sugar to CO_2

pyruvate → → → → → → CO_2
3C 1C

Cellular Respiration



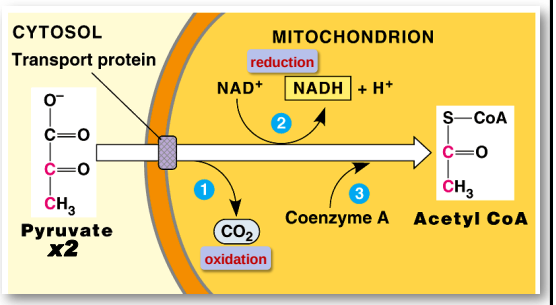
Oxidation of Pyruvate

- Pyruvate enters mitochondria

2x [pyruvate → → → acetyl CoA + CO_2]
3C 2C 1C
NAD NADH

  - 3 step oxidation process (on next slide)
    - releases 1 CO_2 (count the carbons!)
    - reduces NAD → NADH (stores energy—endergonic)
    - 2C combines with CoA, producing acetyl CoA
- Acetyl CoA enters Krebs cycle
  - where does CO_2 go?

Pyruvate oxidized to Acetyl CoA



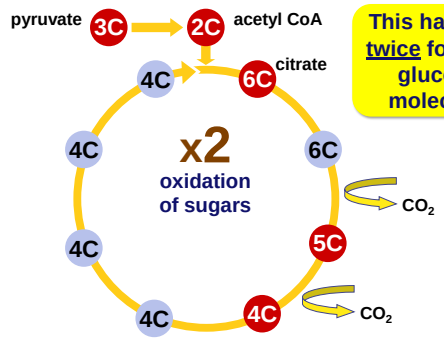
Yield = 2C compound + CO_2 + NADH x2

Krebs cycle


Hans Krebs
1900-1981

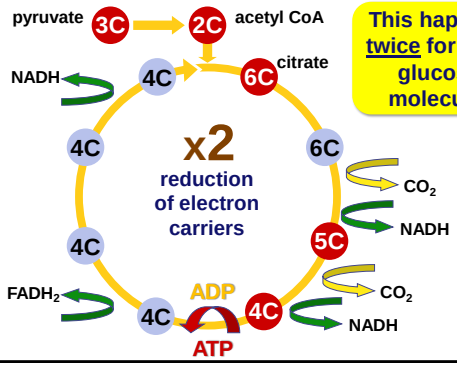
- a.k.a. Citric Acid Cycle
  - in mitochondrial matrix
  - 8 step pathway
    - each catalyzed by specific enzyme
    - step-wise catabolism of 6C citrate molecule
- Evolved after glycolysis
  - does that make evolutionary sense?
    - bacteria →3.5 billion years ago (glycolysis)
    - free O_2 →2.7 billion years ago (photosynthesis)
    - eukaryotes →1.5 billion years ago (aerobic respiration)

Count the carbons!



This happens twice for each glucose molecule!

Count the electron carriers!



This happens twice for each glucose molecule!

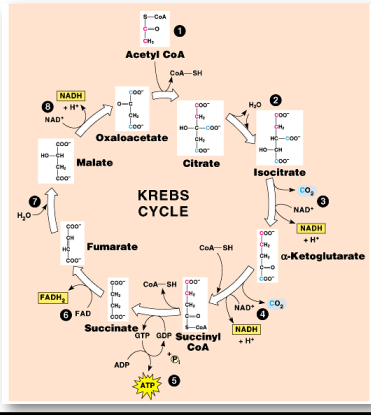
So we fully oxidized glucose

$C_6H_{12}O_6$

↓

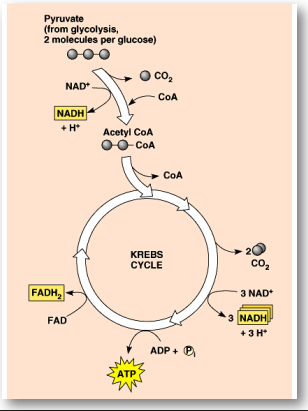
CO_2

& ended up with a net gain of 4 ATP!

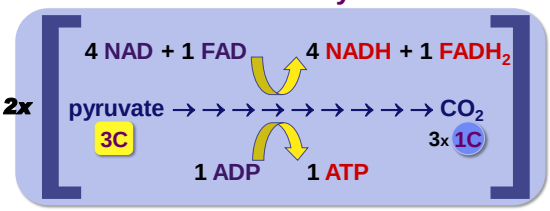


$NADH$ & $FADH_2$

- Krebs cycle produces large quantities of electron carriers
  - NADH
  - $FADH_2$
    - stored energy!
    - they go to ETC



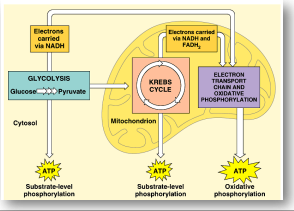
Energy stored from Pyruvate Oxidation and Krebs Cycle



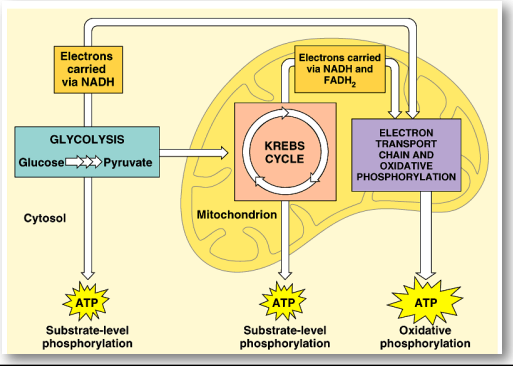
Net gain = 2 ATP
= 8 NADH
= 2 $FADH_2$

So why the Krebs cycle?

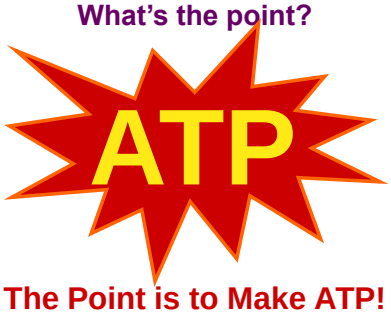
- If the yield is only 2 ATP, then why?
  - value of NADH & $FADH_2$
    - electron carriers
    - reduced molecules store energy!
    - to be used in the Electron Transport Chain



Cellular Respiration



What's the point?



The Point is to Make ATP!

Any Questions??