

## **PYRUVATE DEHYDROGENASE COMPLEX VERY COOL ANIMATION**

[http://www.brookscole.com/chemistry\\_d/templates/student\\_resources/shared\\_resources/animations/pdc/pdc.html](http://www.brookscole.com/chemistry_d/templates/student_resources/shared_resources/animations/pdc/pdc.html)

### ***The bridge between glycolysis and the citric acid (Krebs) cycle: Pyruvate dehydrogenase***

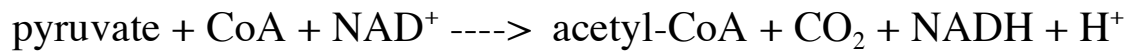
#### **Reaction:**



#### ***Pyruvate dehydrogenase complex:***

- noncovalent assembly of three different enzymes which catalyze successive steps in the conversion of pyruvate to acetyl-CoA
- the active sites of all three enzymes are close to one another
- the product of the first enzyme is the substrate for the second enzyme and is passed directly to the active site of the second enzyme
- no requirement for diffusion of substrates and products through the solution

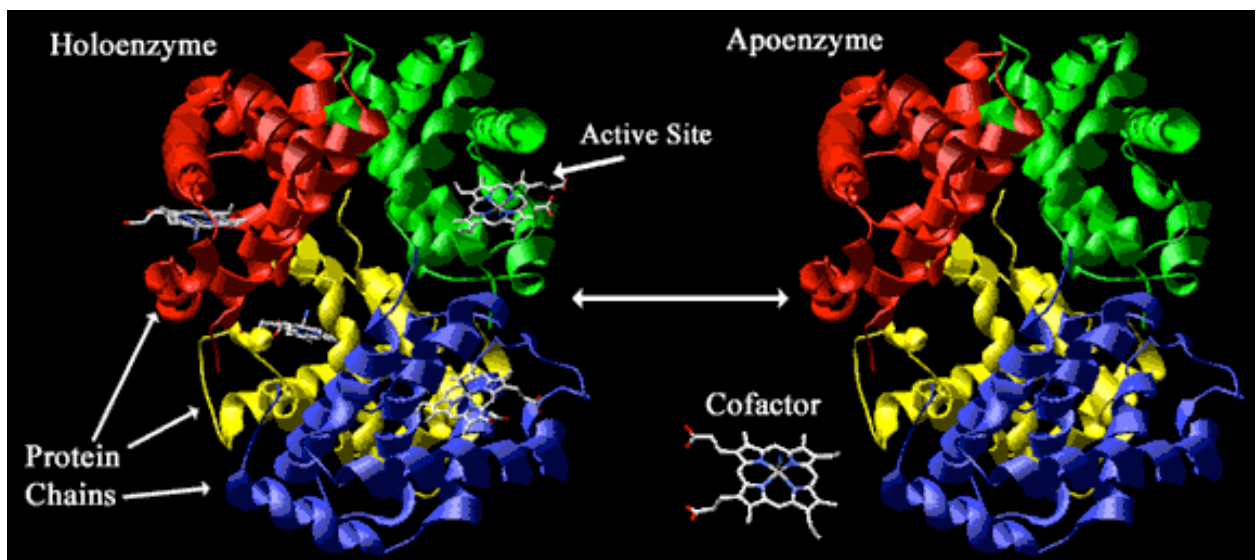
## Reaction:



Requires the 5 coenzymes shown in the table below

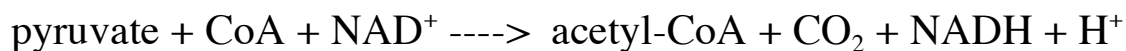
## Coenzyme:

- a small molecule that binds to an enzyme and is essential for its activity
- acts to **extend the chemical versatility** of a protein beyond what is available from the amino acid side chains
- like an enzyme, it is not permanently altered by the reaction



**Coenzymes** often have complex organic structures that cannot be synthesized by some organisms -- mammals in particular.....

*MANY coenzymes are derived metabolically from components in our diet called..... ?*

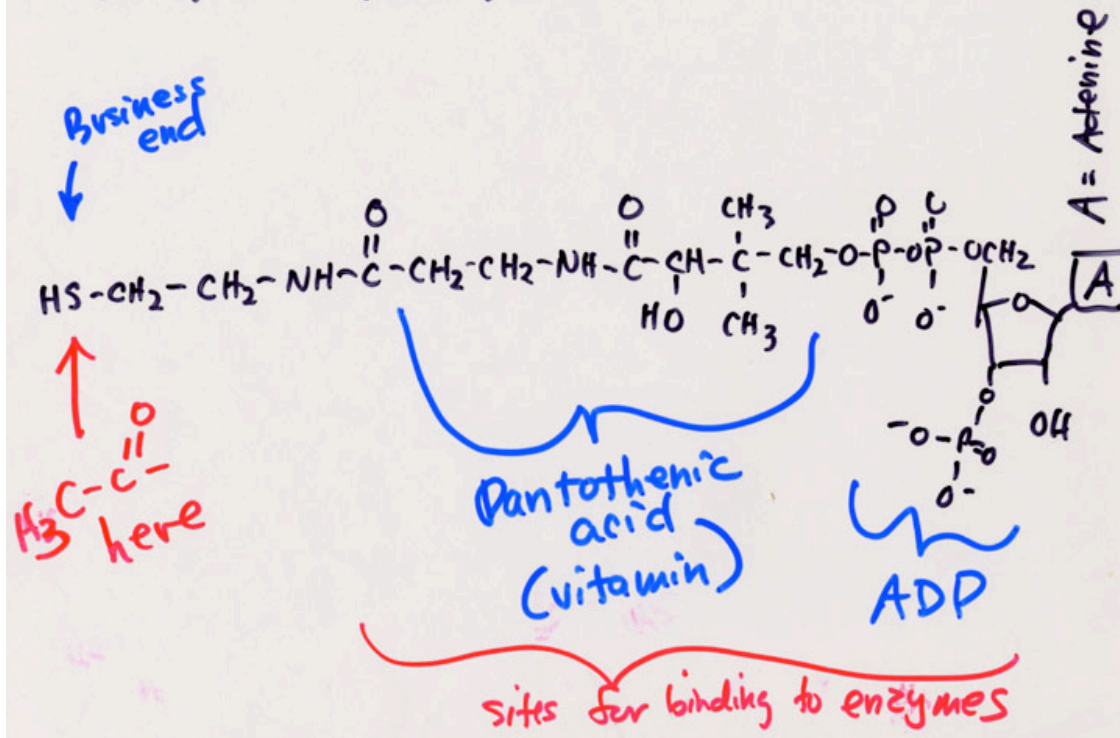
**Reaction:**

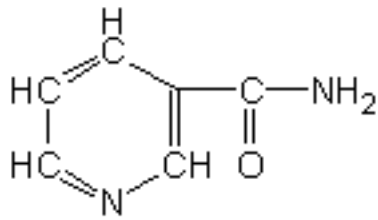
Coenzymes listed in the order that they appear in the animation

Vitamin	Coenzyme	RXN
thiamine (vitamin B1)	thiamine pyrophosphate	activation and transfer of aldehydes
lipoic acid (not required in diet?)	lipoamine	acyl group activation redox
pantothenic acid (vitamin B5)	Coenzyme A [CoA] see below	acyl group activation and transfer
riboflavin (vitamin B2)	FAD	redox
niacin	$\text{NAD}^+$ , $\text{NADP}^+$ see below	redox

acyl = R-C=O

# Coenzyme A (CoA)





Niacin

# Vitamin B<sub>3</sub>



An inability to absorb niacin (vitamin B<sub>3</sub>) or the amino acid tryptophan may cause pellagra, a disease characterized by scaly sores, mucosal changes and mental symptoms

ADAM.

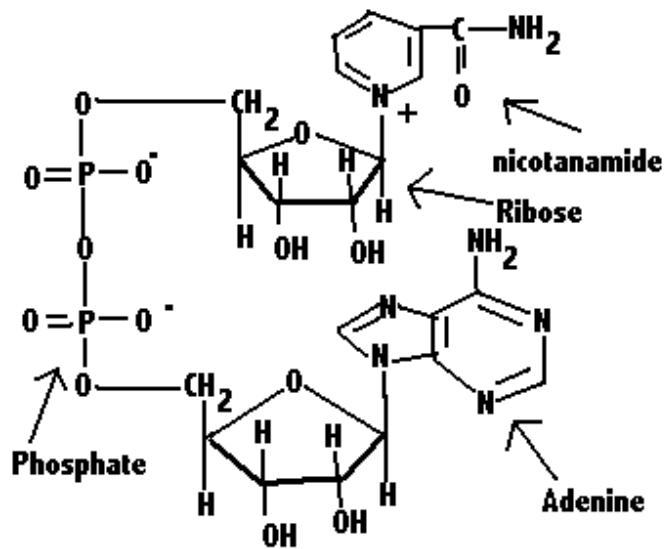


Fig. 4- Nicotinamide Adenine Dinucleotide (NAD<sup>+</sup>)

A footnote on vitamins

**Vitamins** (vitamins= vital amines)

**Andre Lwoff**

- **To multiply, certain bacteria require, in the culture medium, the presence of a particular compound while other bacteria (such as E. coli) can do perfectly well without**
- **These “required factors” necessary for bacteria often proved to be identical to one or another of the vitamins required for the growth and health of mammals, notably of man**

**Andre Lwoff had shown that these required factors, these vitamins required by certain organisms, are in fact constituents of all living things**

- **They are indispensable to *all* life**
- **They play specific roles in specific chemical processes in the metabolism of *all* cells**
- **If certain organisms require the presence of these factors in their food while others can do without them, the reason is simply that the latter manufacture these compounds themselves while the former are incapable of doing so. Hence the necessity of the former to obtain these indispensable substances ready made**

This discovery had enormous implications

- Support by biochemical analysis (of the vitamins) showed for the first time that, at the molecular level, the same structures and functions are found in all living beings; that the whole living world is constructed out of the same materials
- Thus there emerged a new aspect, a hidden face of the evolution of living beings whose study up to then had been based on the analysis of plainly visible forms and features