

Física do Corpo Humano (4300325)



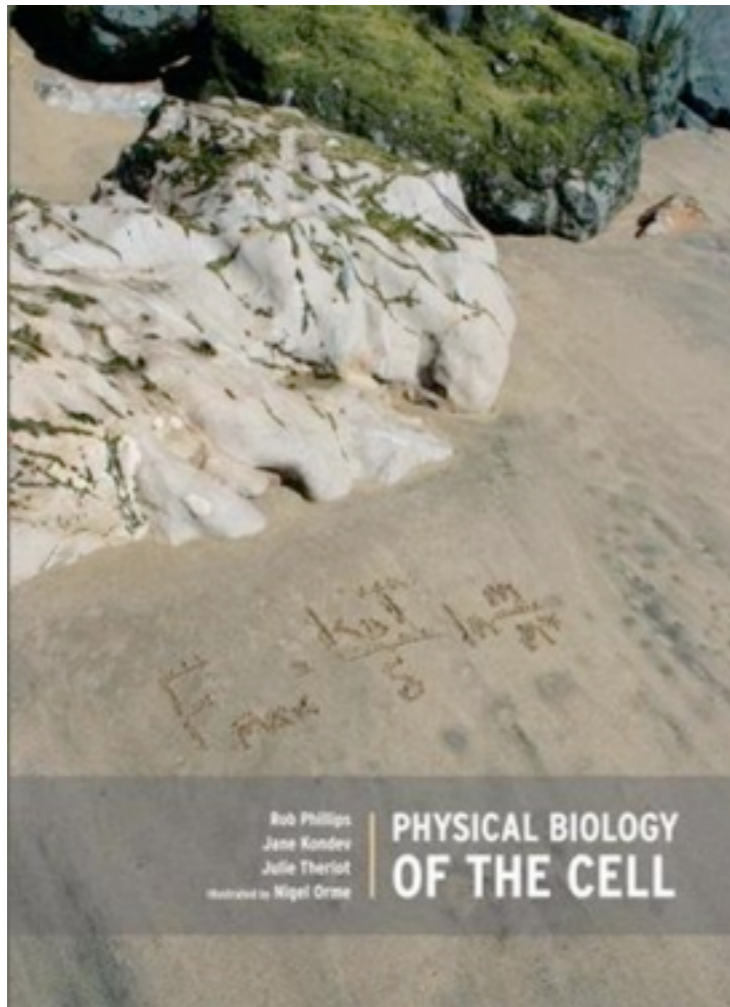
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Dep. Física Geral
Instituto de Física da USP

B08

**Enzimas e Mitochondria
Aula 13 e 14**

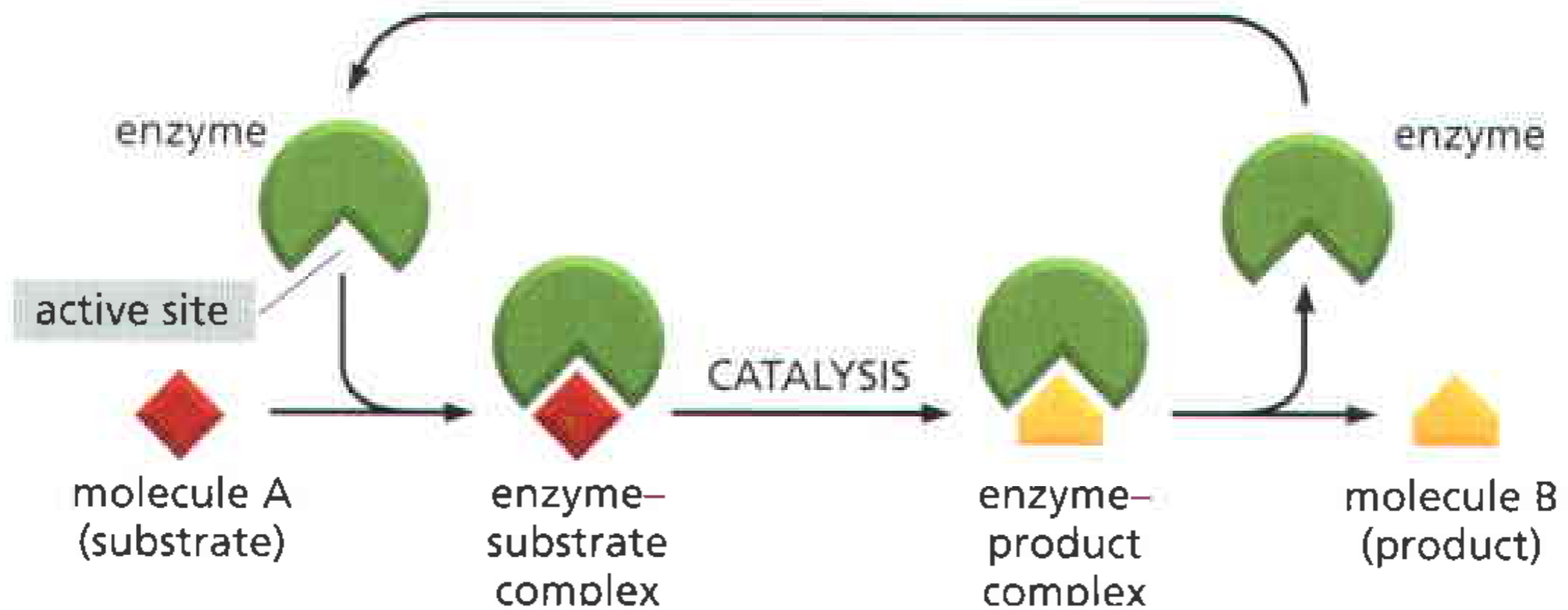


Princípios Físicos Aplicados à Fisiologia (PGF5306-1)

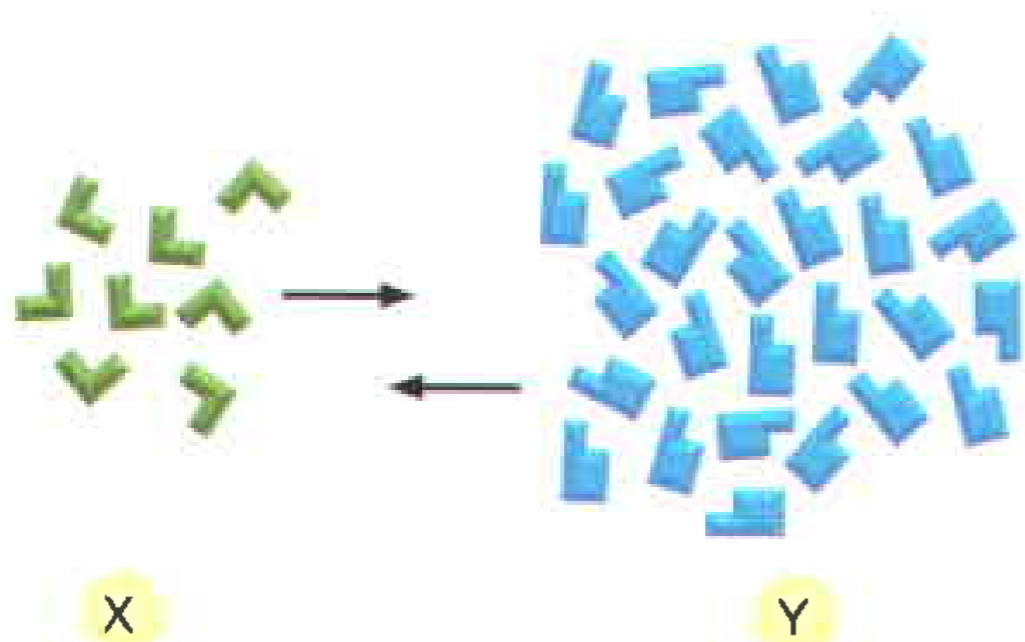


Metabolismo

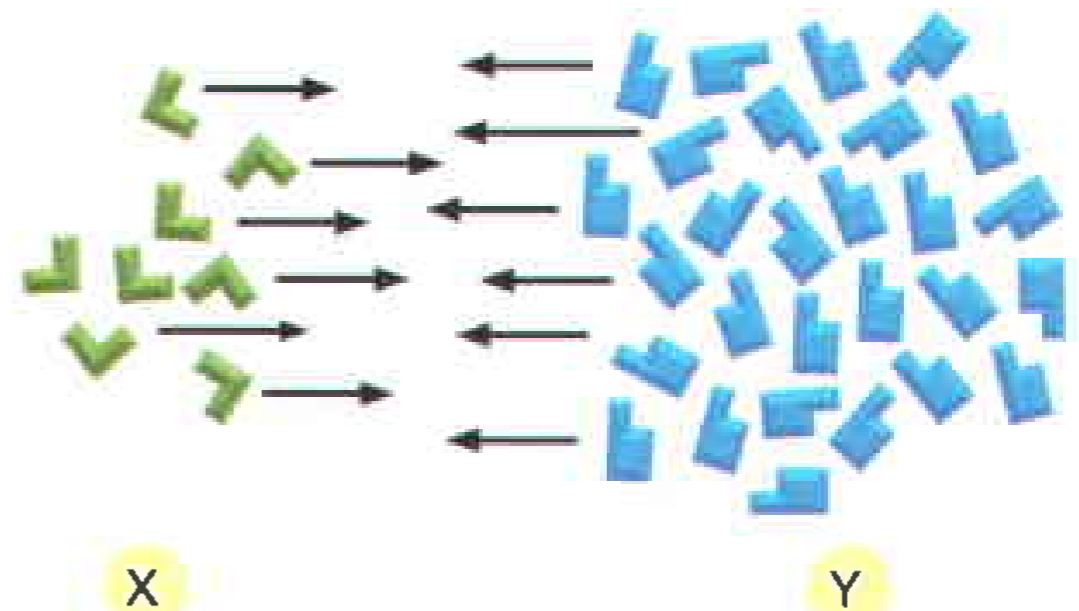
Enzimas



Enzimas

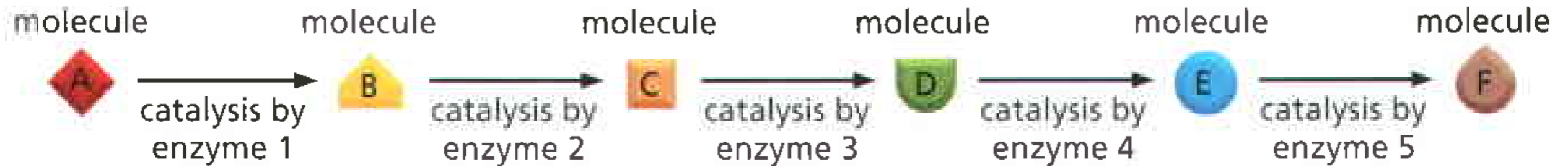


UNCATALYZED REACTION

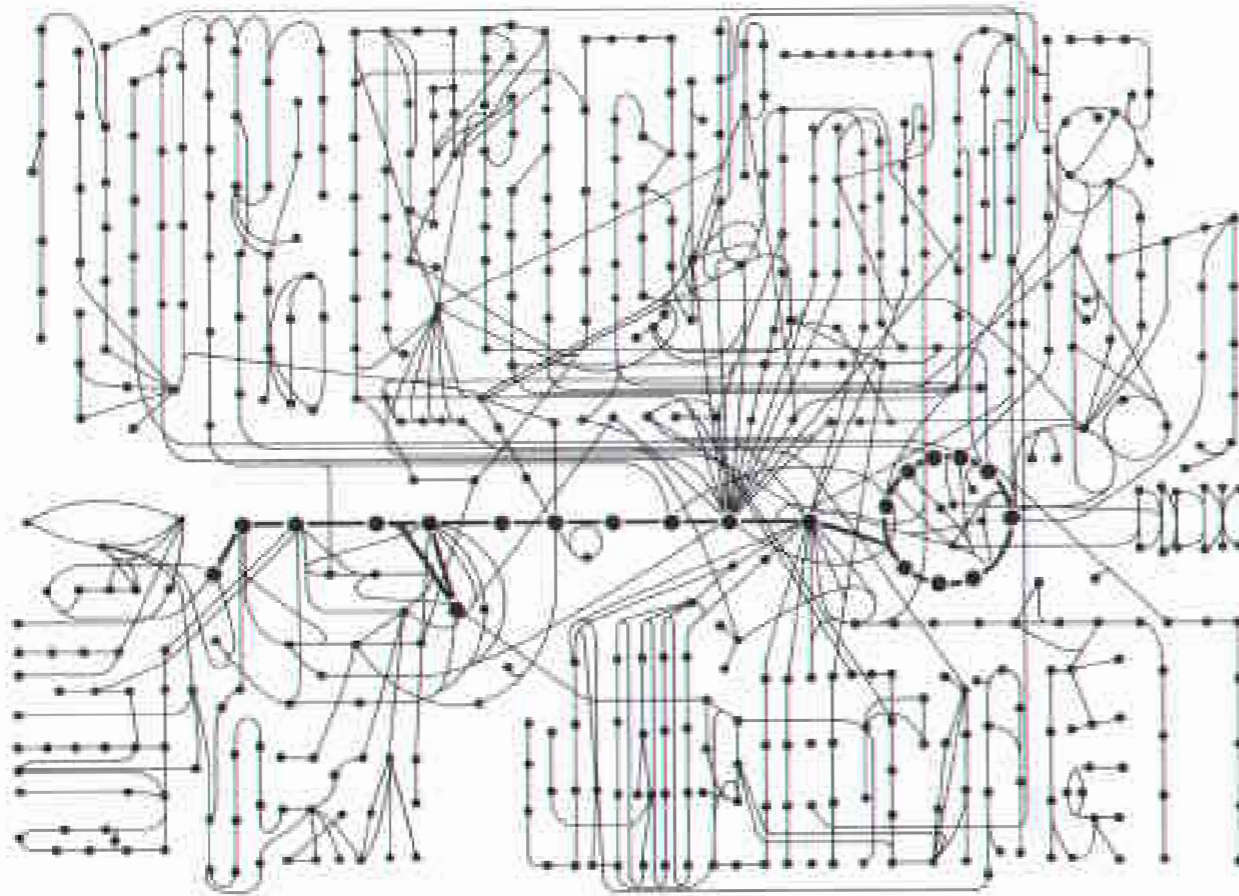


ENZYME-CATALYZED REACTION

Enzimas

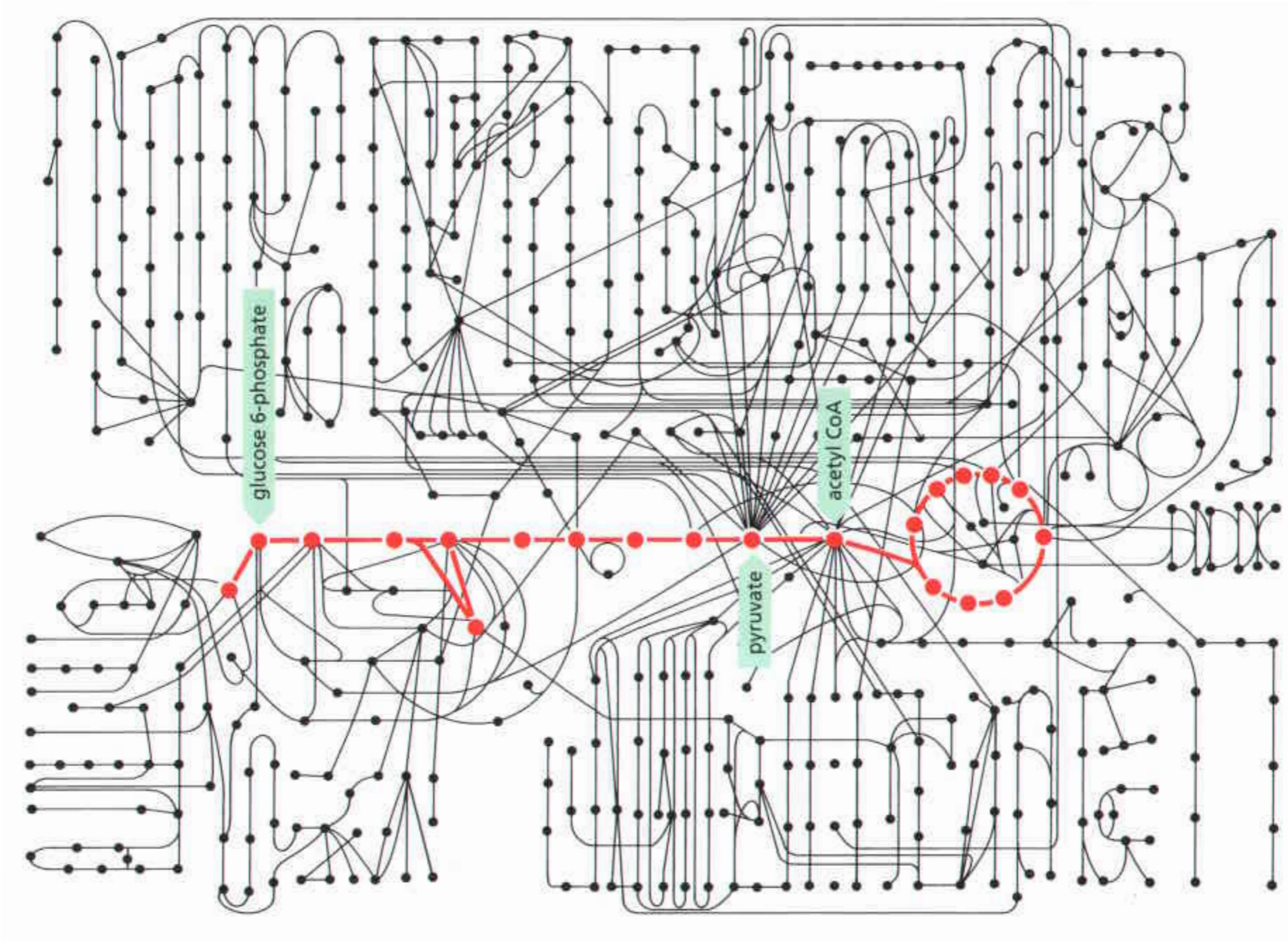


ABBREVIATED AS

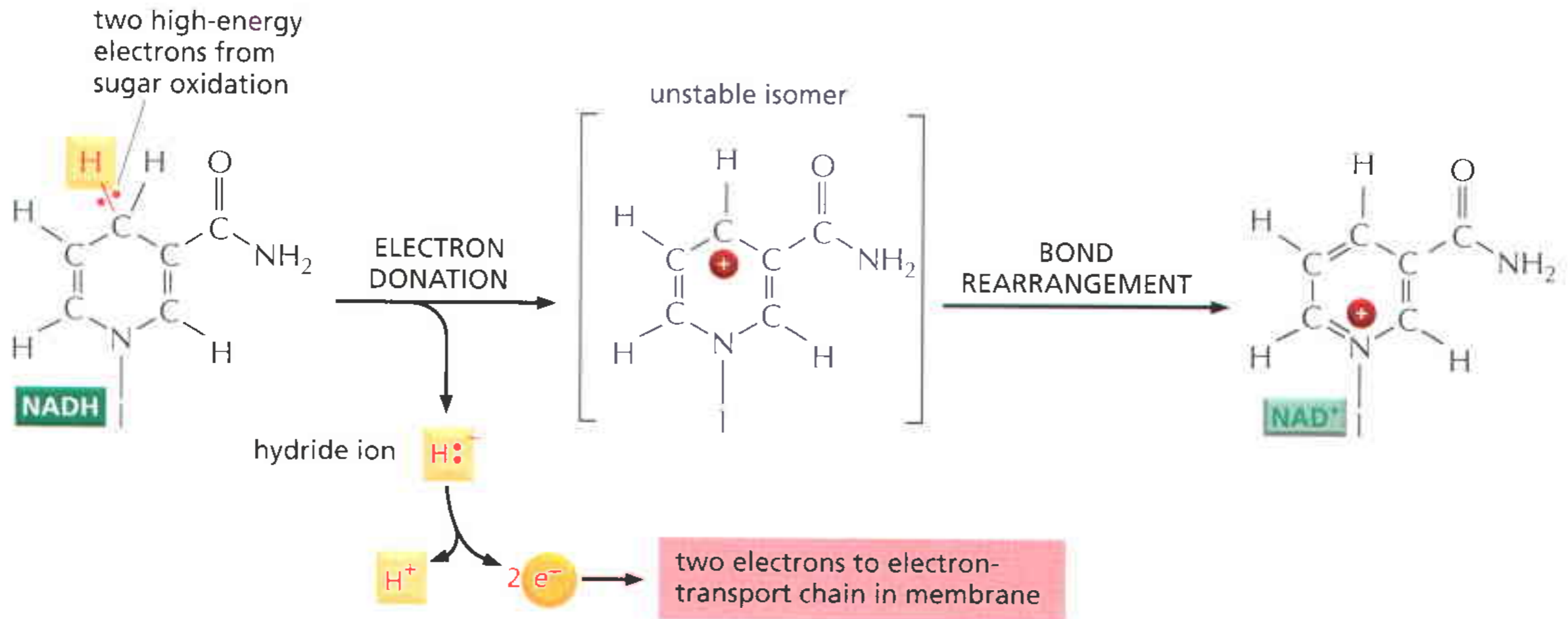
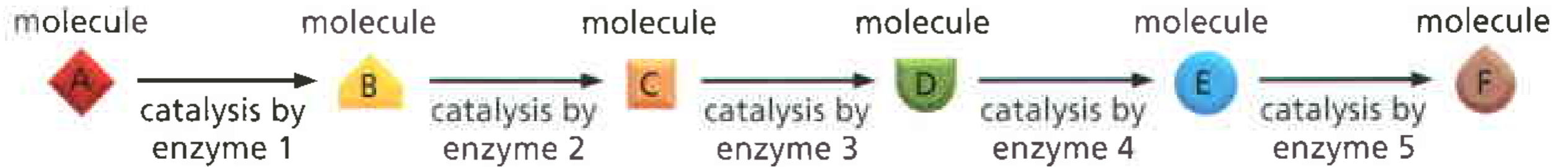


Alguns caminhos
metabólicos de uma
célula típica

Enzimas



Mitochondria - Geradores de energia



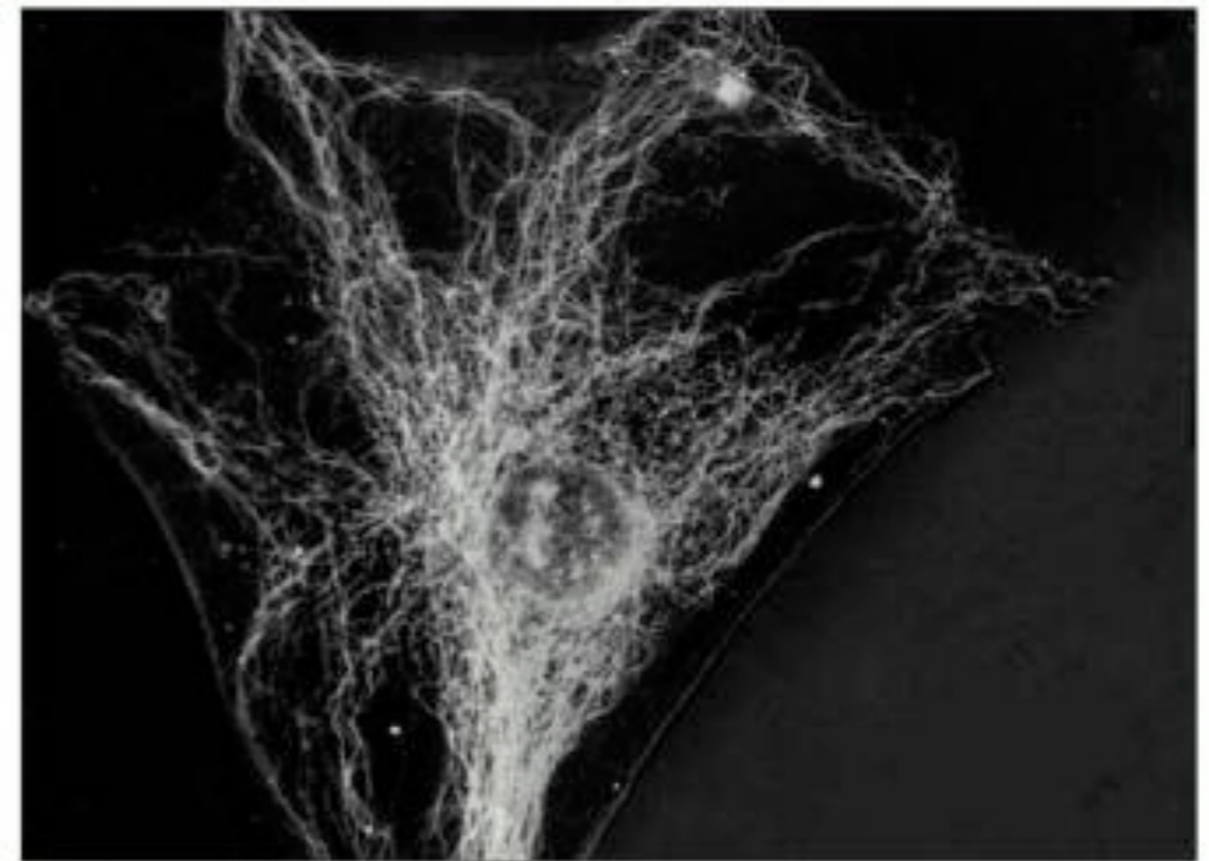
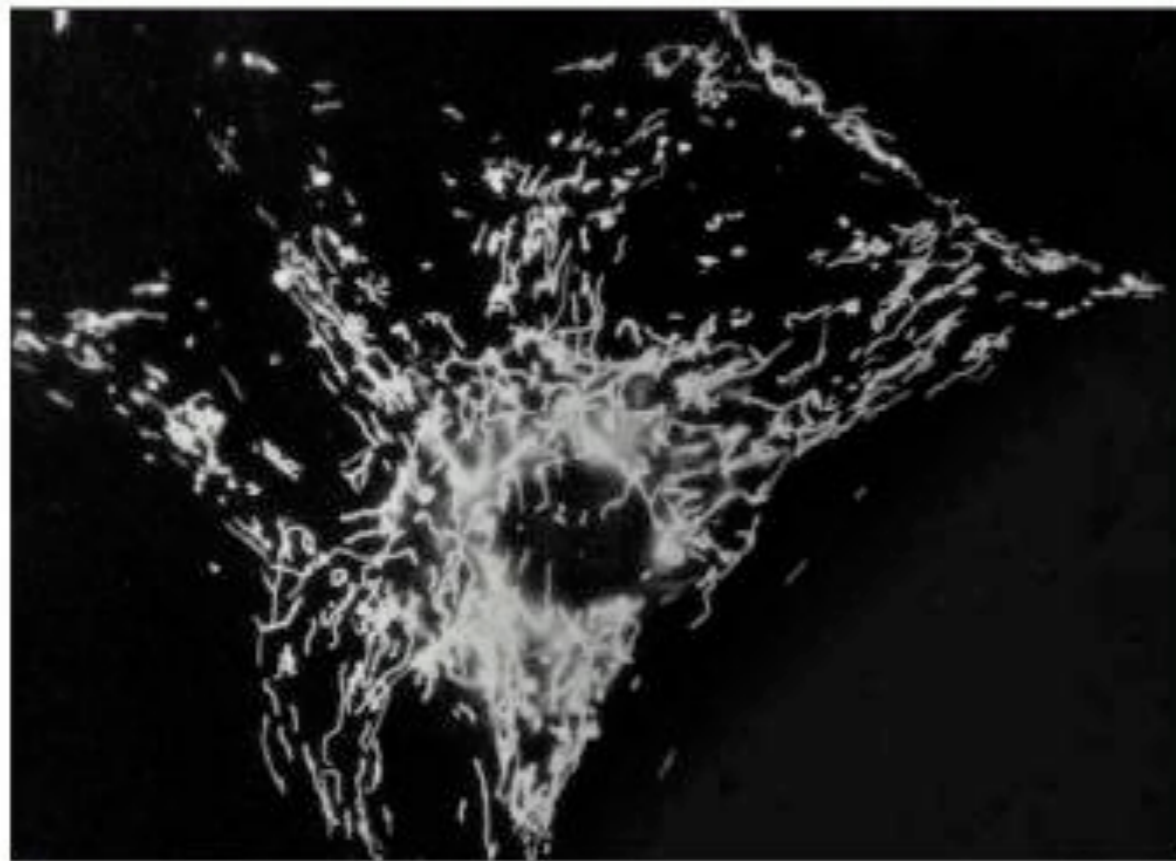
Mitocondria - Geradores de energia

1. Mitocondria são organelas atípicas
2. Elas se duplicam independentemente das células que residem (seres unicelulares procarionte)
3. Ocupa um volume substancial do citoplasma
4. Acredita-se que houve uma simbiose em um passado remoto. Nesse caso, a célula invasora se protege dentro da hospedeira que passa a contar com uma fonte de energia
5. São nosso gerador de energia
6. A mitocondria permite 15 vezes mais energia que o ciclo de glicólise (respiração anaeróbia)

<http://www.nature.com/scitable/topicpage/mitochondria-14053590>

Capítulo 14 do Livro de Molecular Biology, Alberts

Mitochondria - Geradores de energia



(A)

(B)

10 μm

(A) A light micrograph of chains of elongated mitochondria in a living mammalian cell in culture. The cell was stained with a fluorescent dye (rhodamine 123) that specifically labels mitochondria in living cells. (B) An immunofluorescence micrograph of the same cell stained (after fixation) with fluorescent antibodies that bind to microtubules. Note that the mitochondria tend to be aligned along microtubules. (Courtesy of Lan Bo Chen.)

Molecular Biology of the Cell. 4th edition.

Mitochondria - Geradores de energia

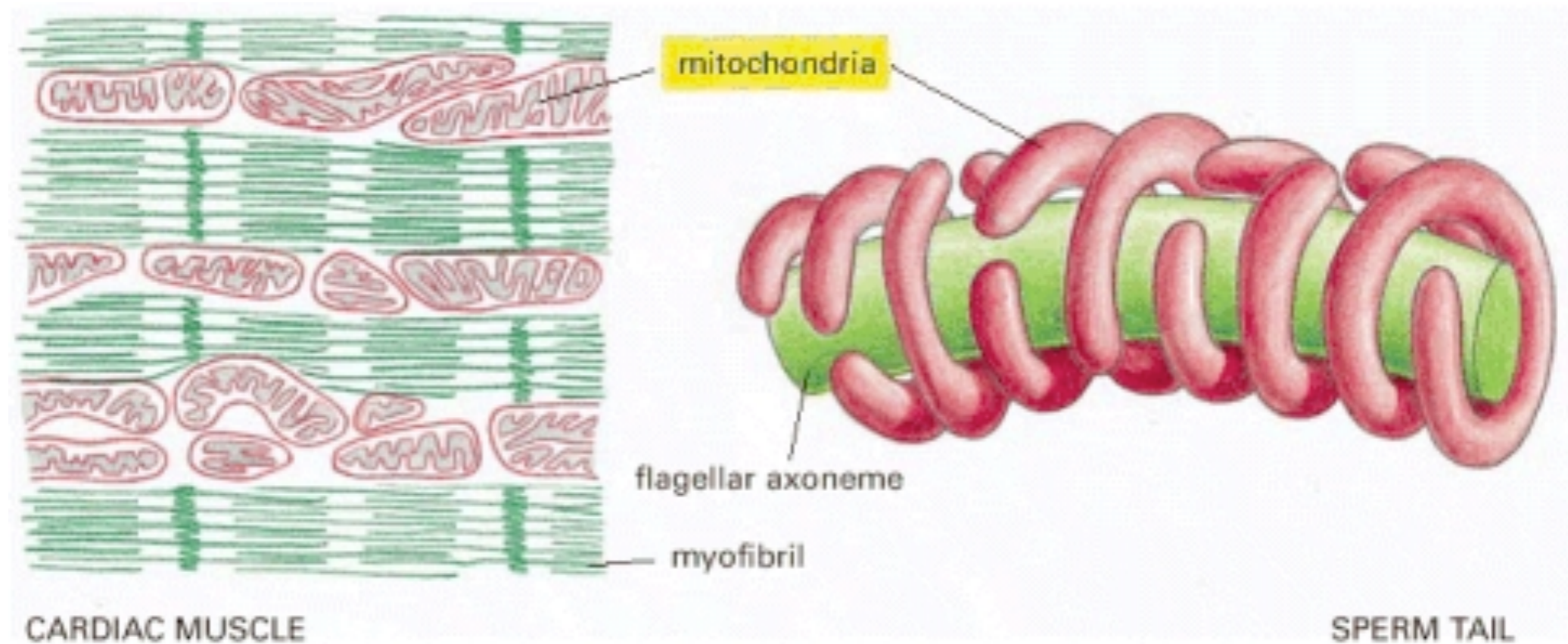
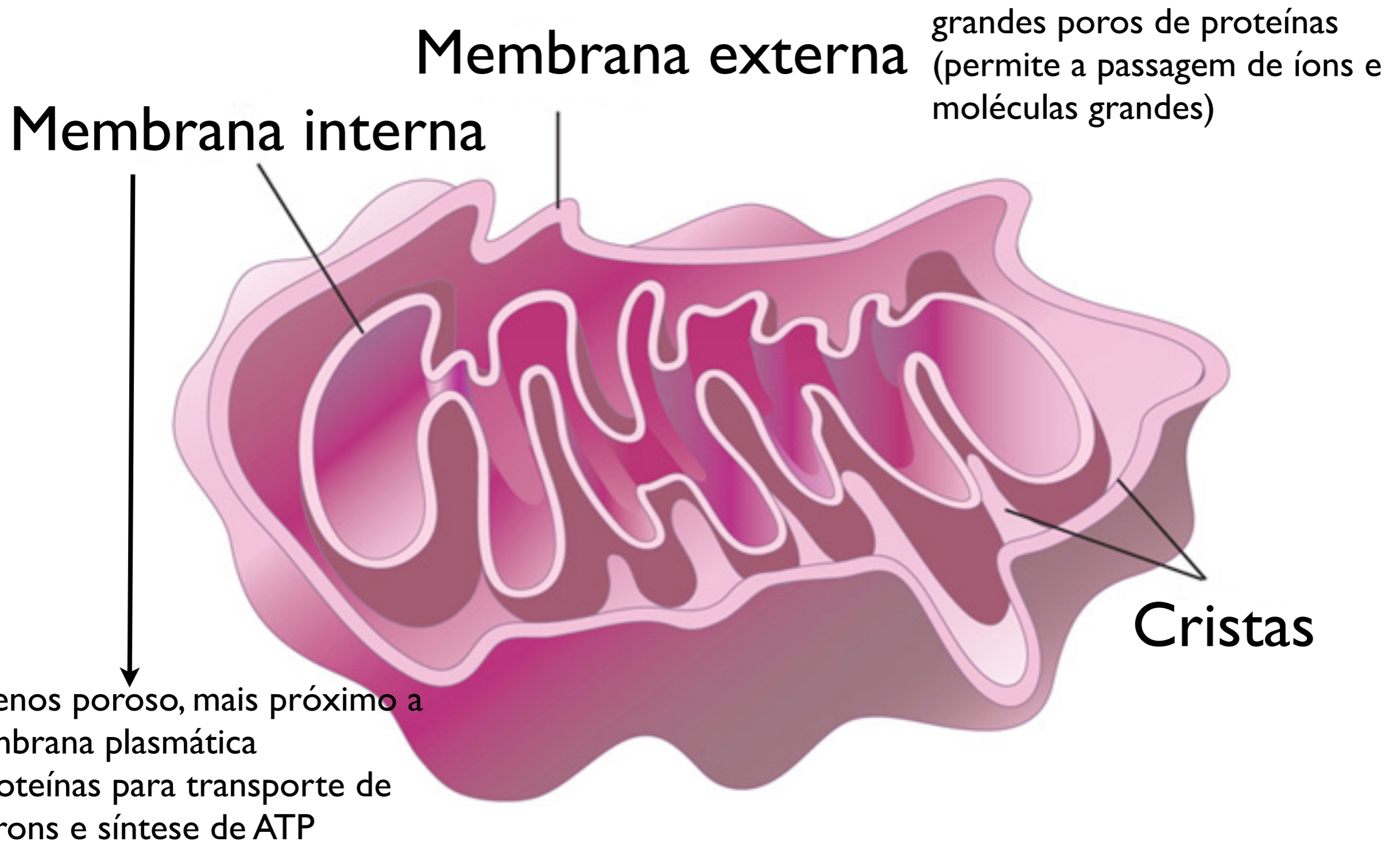


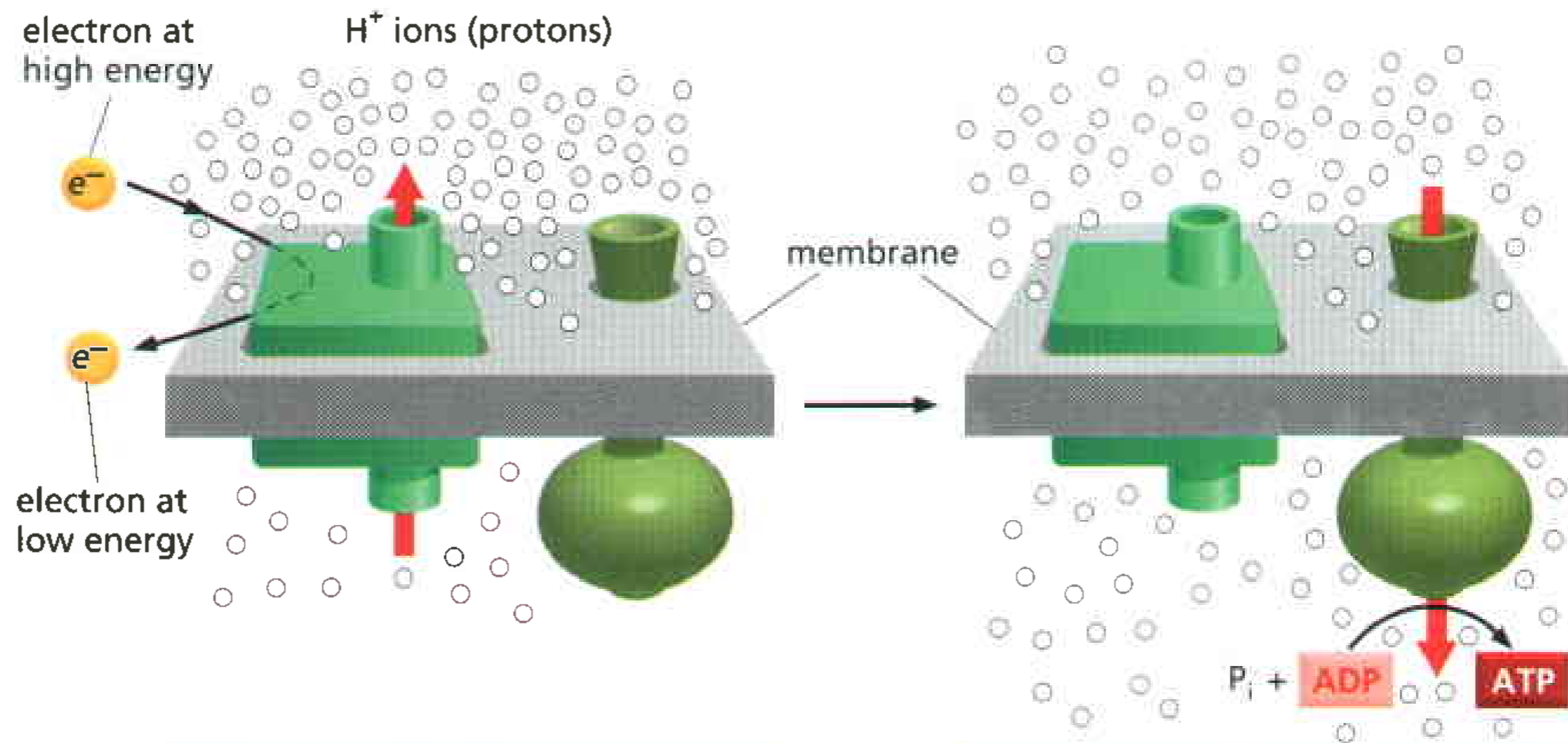
Figure 14-6 Localization of mitochondria near sites of high ATP utilization in cardiac muscle and a sperm tail:

During the development of the flagellum of the sperm tail, microtubules wind helically around the axoneme, where they are thought to help localize the mitochondria in the tail; these microtubules then disappear, and the mitochondria fuse with one another to create the structure shown.

Mitocondria - Geradores de energia



Mitochondria - Geradores de energia



STAGE 1: ELECTRON TRANSPORT
DRIVES PUMP THAT PUMPS
PROTONS ACROSS MEMBRANE

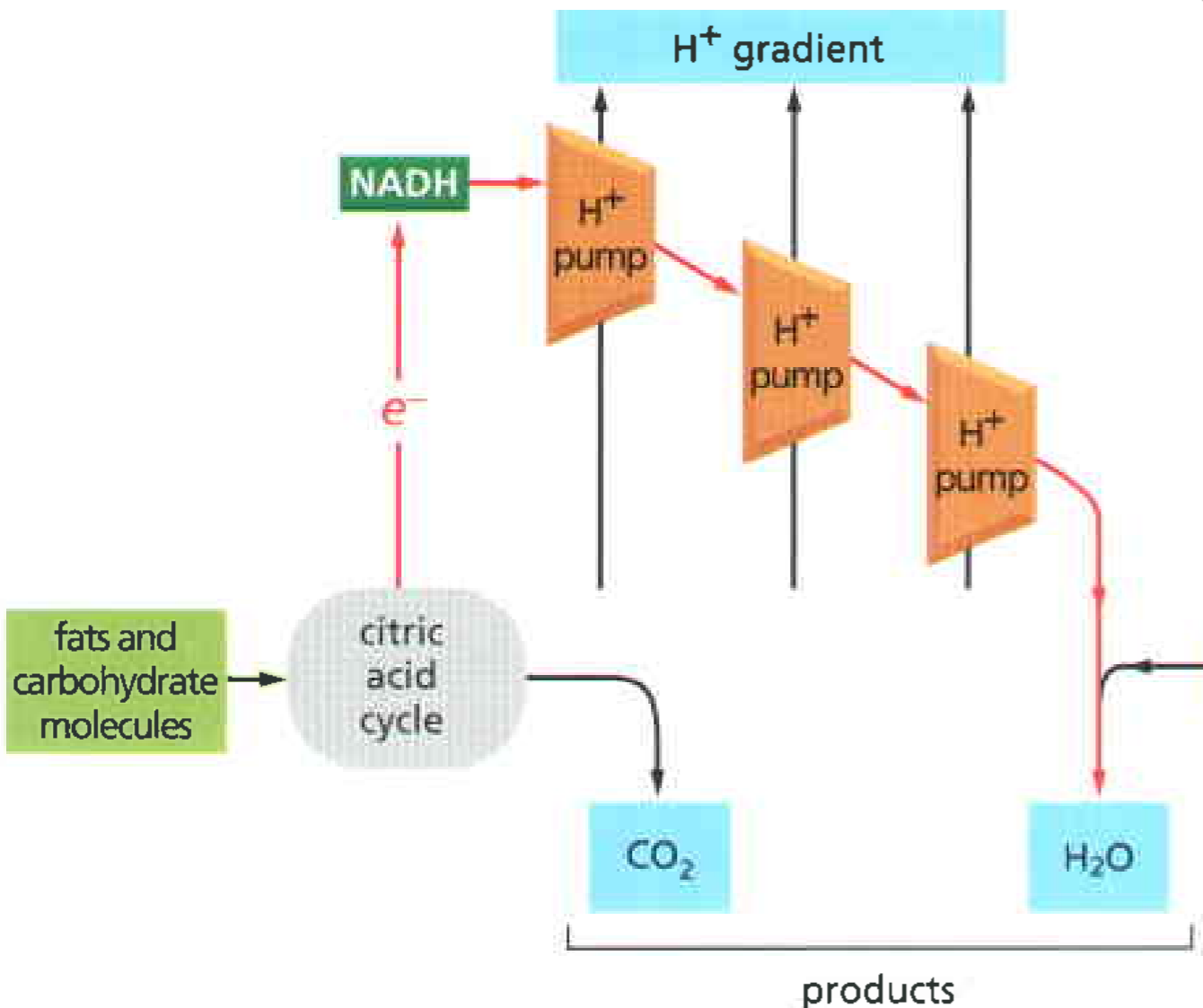
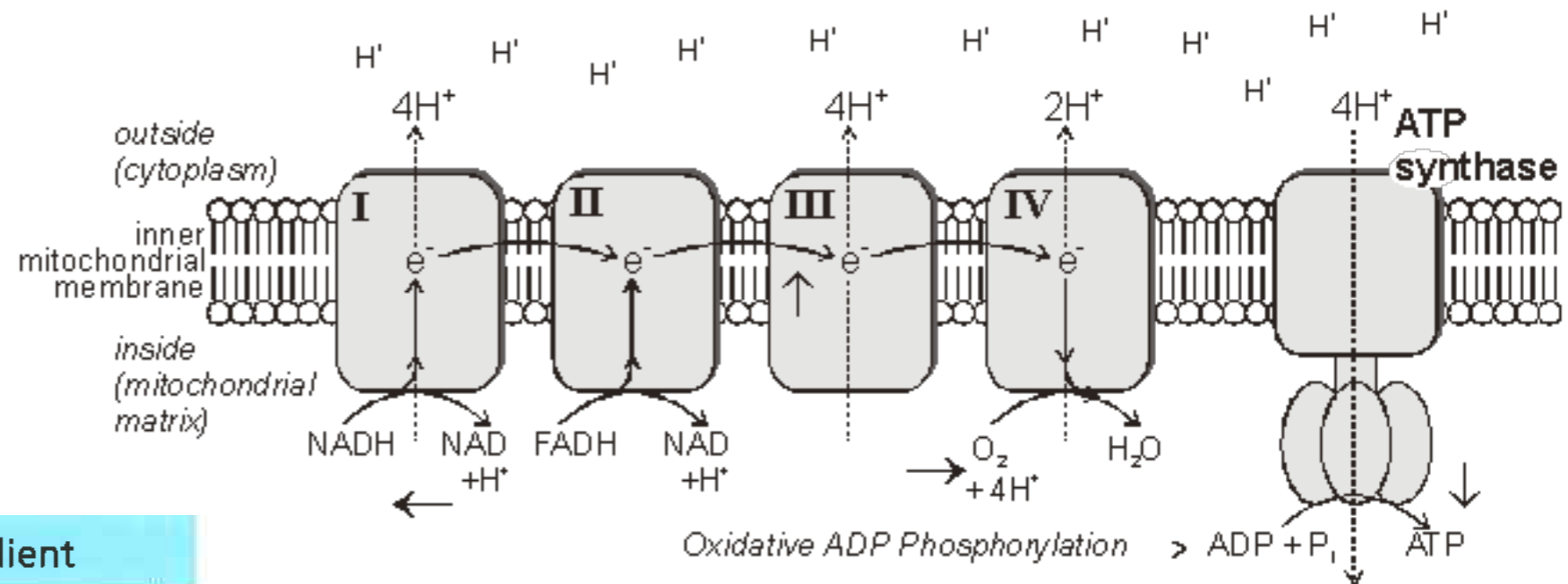
(A)

STAGE 2: PROTON GRADIENT IS
HARNESSED BY ATP SYNTHASE
TO MAKE ATP

(B)

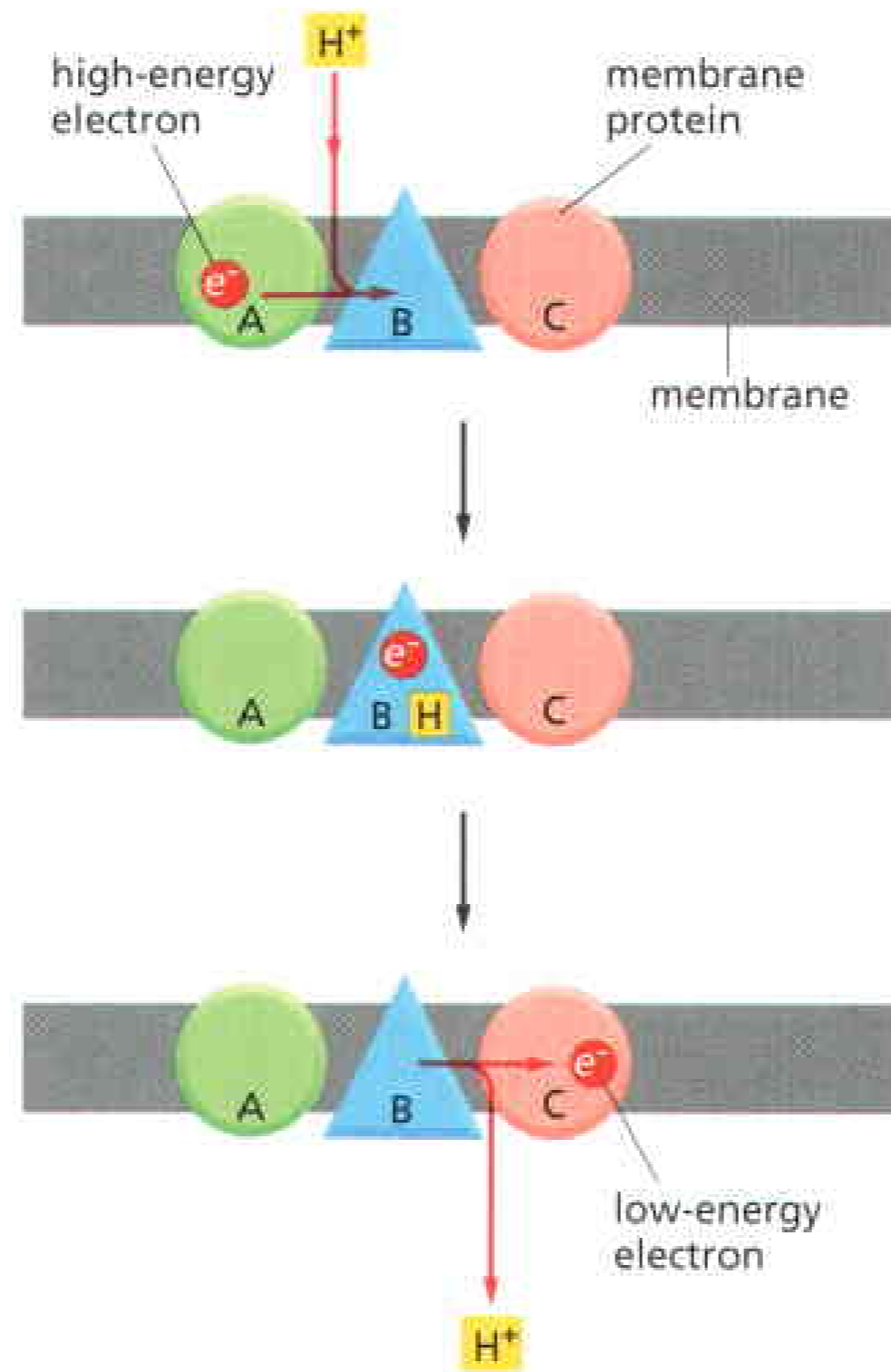
Mitochondria - Geradores de energia

(A) MITOCHONDRION



1. NADH se liga com o Complexo I, e libera um átomo de Hidrogênio (H^+) e um elétron (e^-), e retorna para o ciclo de Krebs.
2. Mesmo para FADH no complexo II
3. elétrons passa pela cadeia de complexos proteicos, cada complexo, o elétron fica mais fortemente ligado. Nos complexos I, III e IV o elétron doa parte de sua energia para transportar prótons
4. No complexo IV o elétron se combina com O_2 e H^+ para formar H_2O , produto final da respiração.

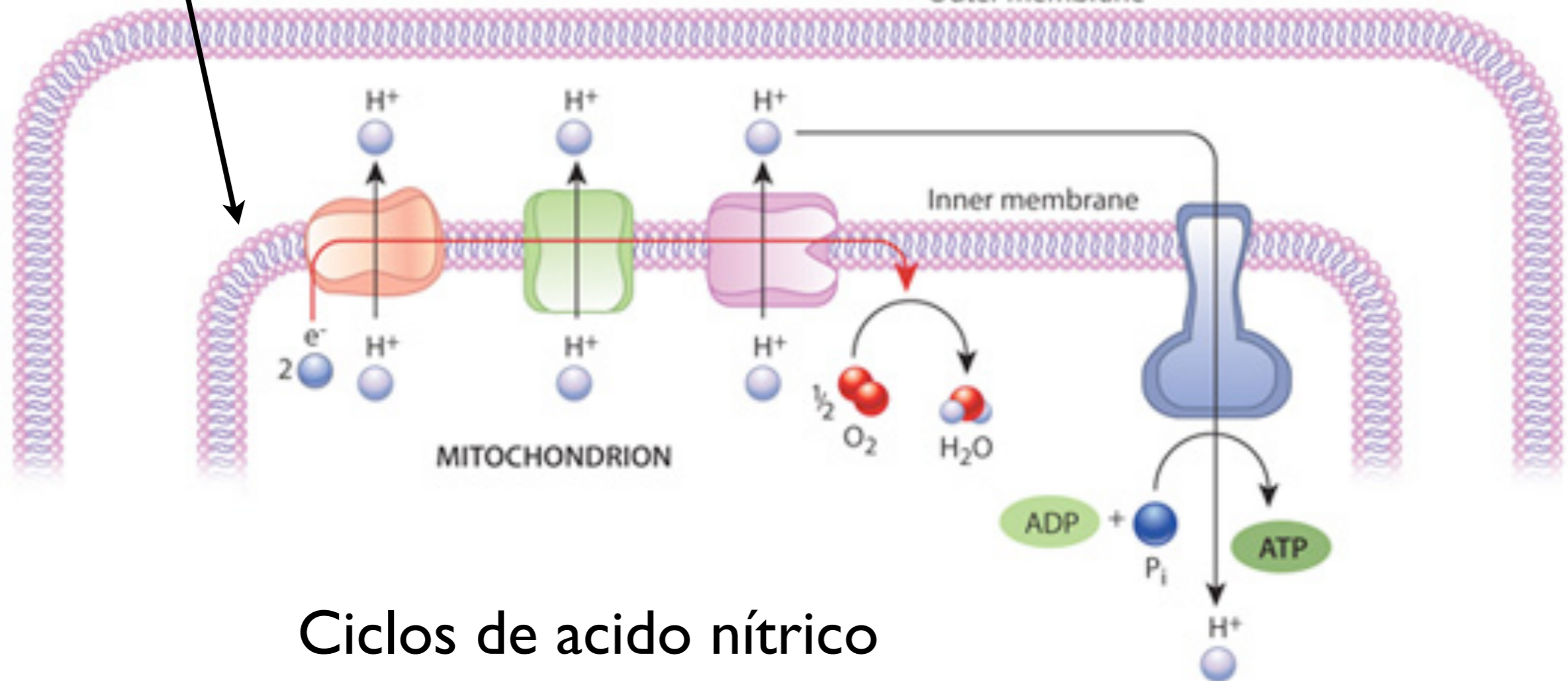
Mitochondria - Geradores de energia



Mitocondria - Geradores de energia

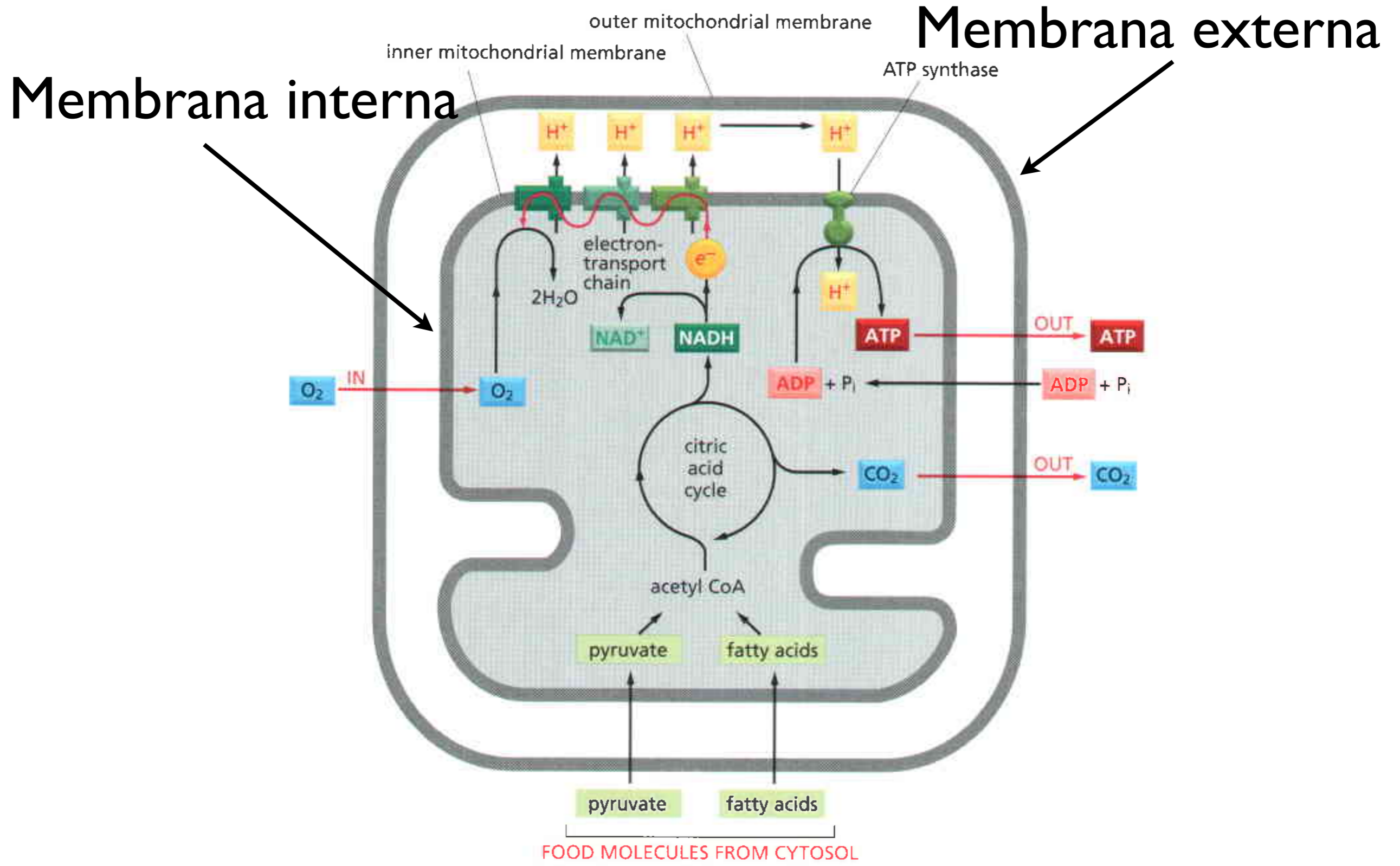
Membrana interna

Membrana externa



Ciclos de ácido nítrico
produzem elétrons livres

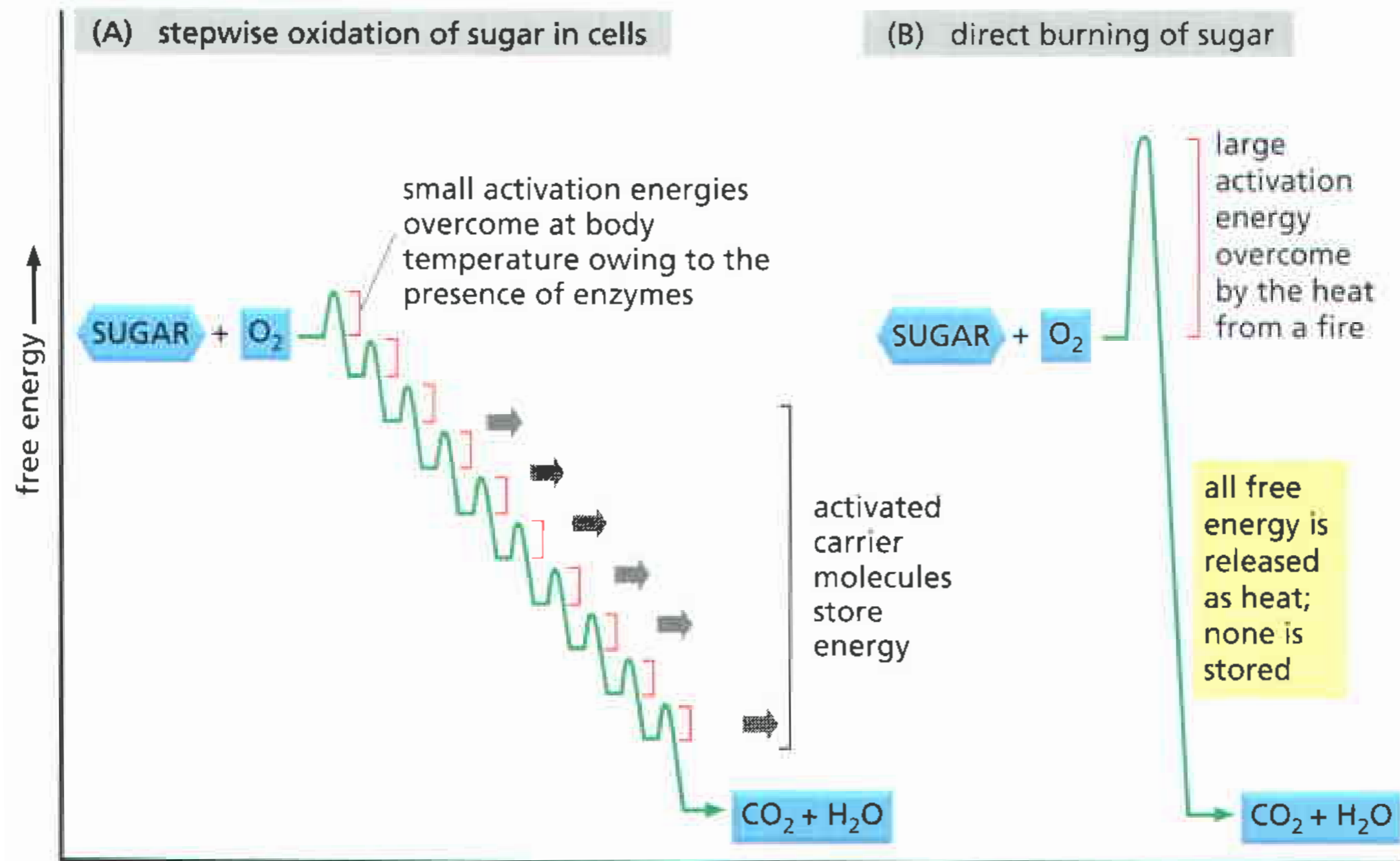
Mitochondria - Geradores de energia



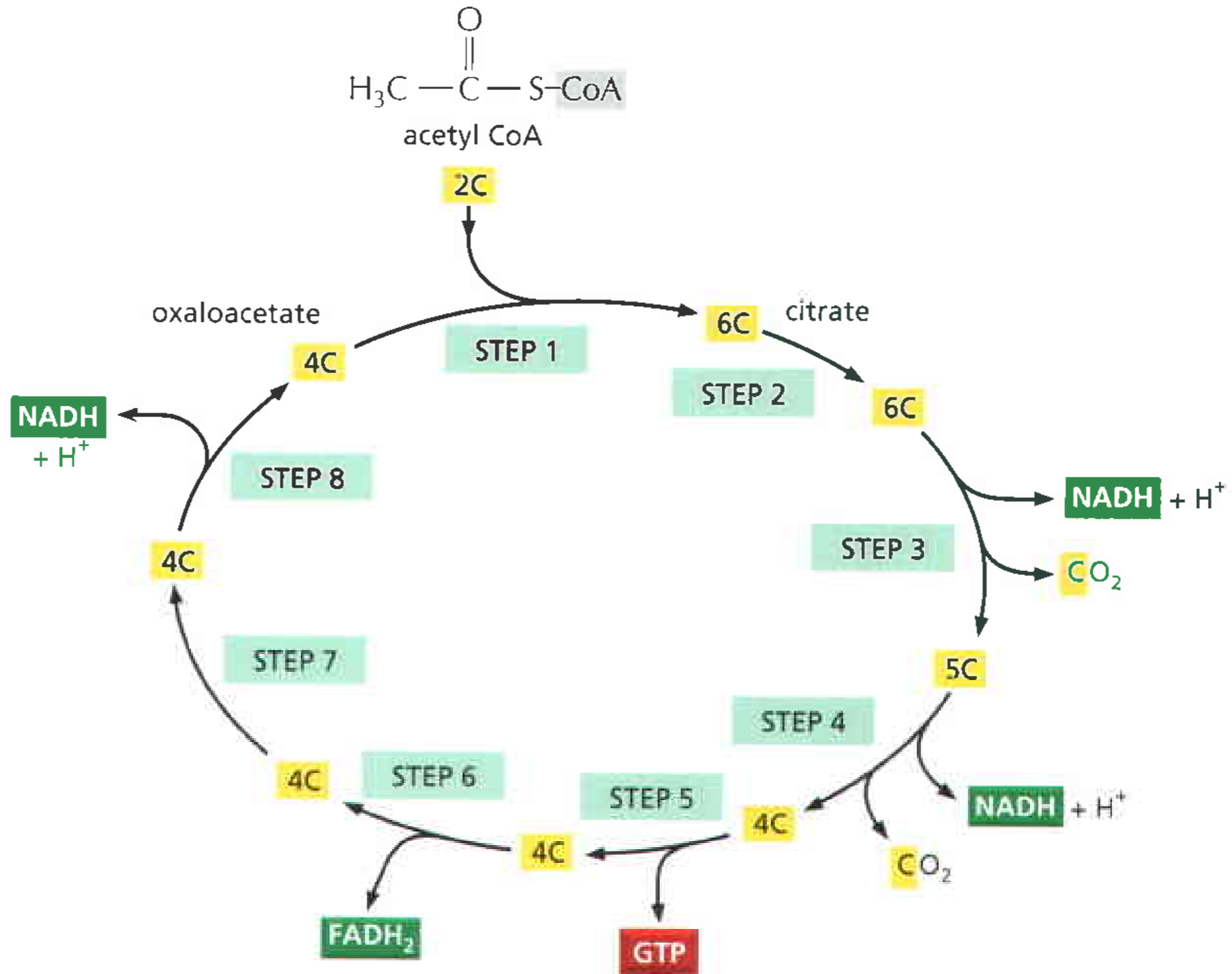
Mitochondria - Geradores de energia

STAGE	MOLECULES PRODUCED PER GLUCOSE	FINAL ATP YIELD OLD METHOD (INTEREST ONLY)	FINAL ATP YIELD NEW METHOD (INTEREST ONLY)
Glycolysis	2 ATP used	-2	-2
	4 ATP produced (2 per triose phosphate)	4	4
	2 NADH produced (1 per triose phosphate)	6	5
Link Reaction	2 NADH produced (1 per pyruvate)	6	5
Krebs Cycle	2 ATP produced (1 per acetyl coA)	2	2
	6 NADH produced (3 per acetyl coA)	18	15
	2 FADH produced (1 per acetyl coA)	4	3
Total		38	32

Mitochondria - Geradores de energia



Mitochondria - Geradores de energia



NET RESULT: ONE TURN OF THE CYCLE PRODUCES THREE NADH, ONE GTP, AND ONE FADH_2 , AND RELEASES TWO MOLECULES OF CO_2

Mitocondria - Geradores de energia

1. Mitocondrias precisam de produtos manipulados pelo gene da célula (a maioria de suas proteínas)
2. Duplicação similar a duplicação assexuada de bactérias
3. Células que necessitam mais energia tem mais mitocondrias, e elas se multiplicam dependendo da necessidade da célula
4. Glicólise anaeróbia (nosso recurso do nosso DNA) produz aproveita 1/15 da energia do açúcar, obtido pela mitocondria.