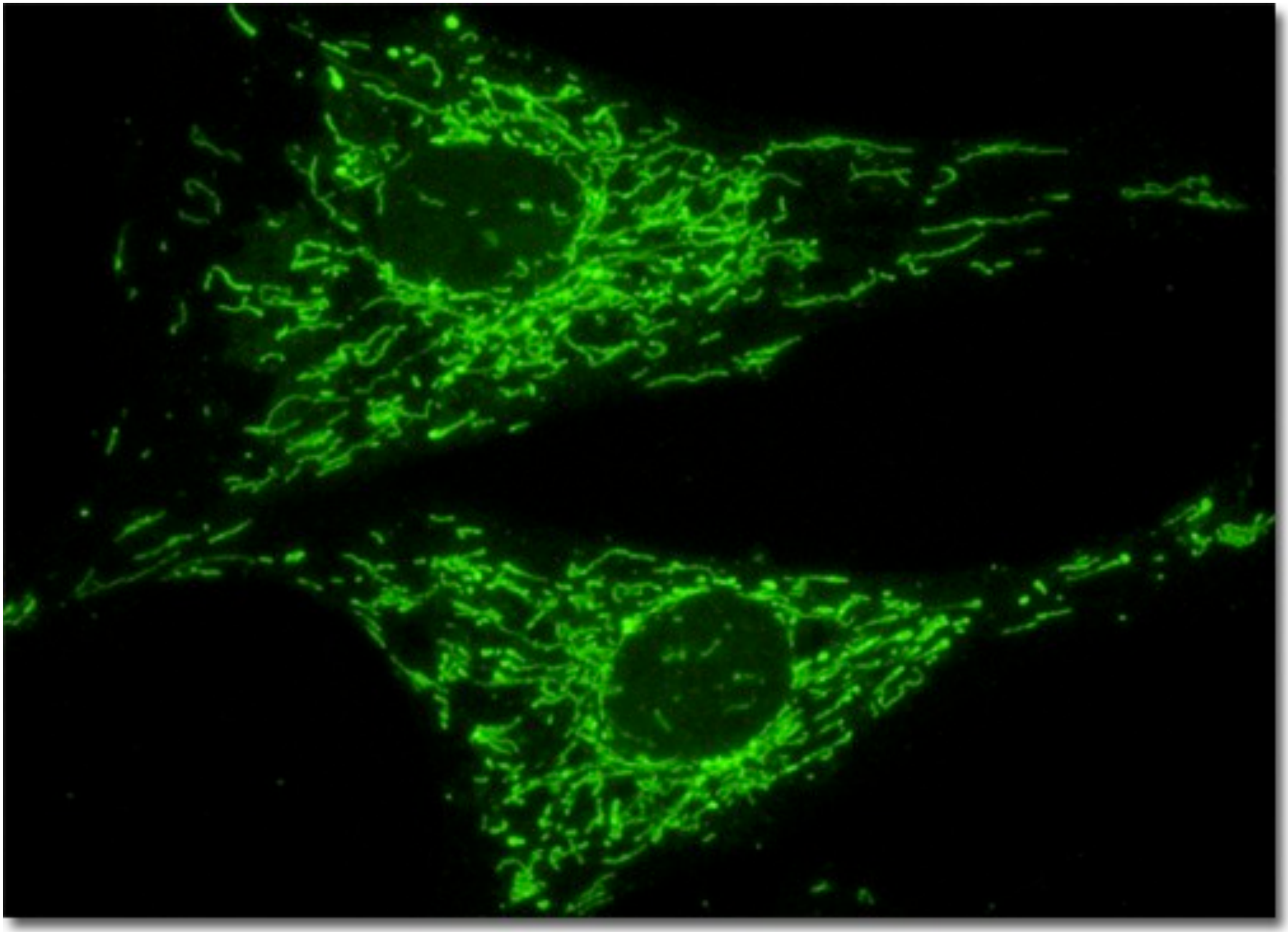
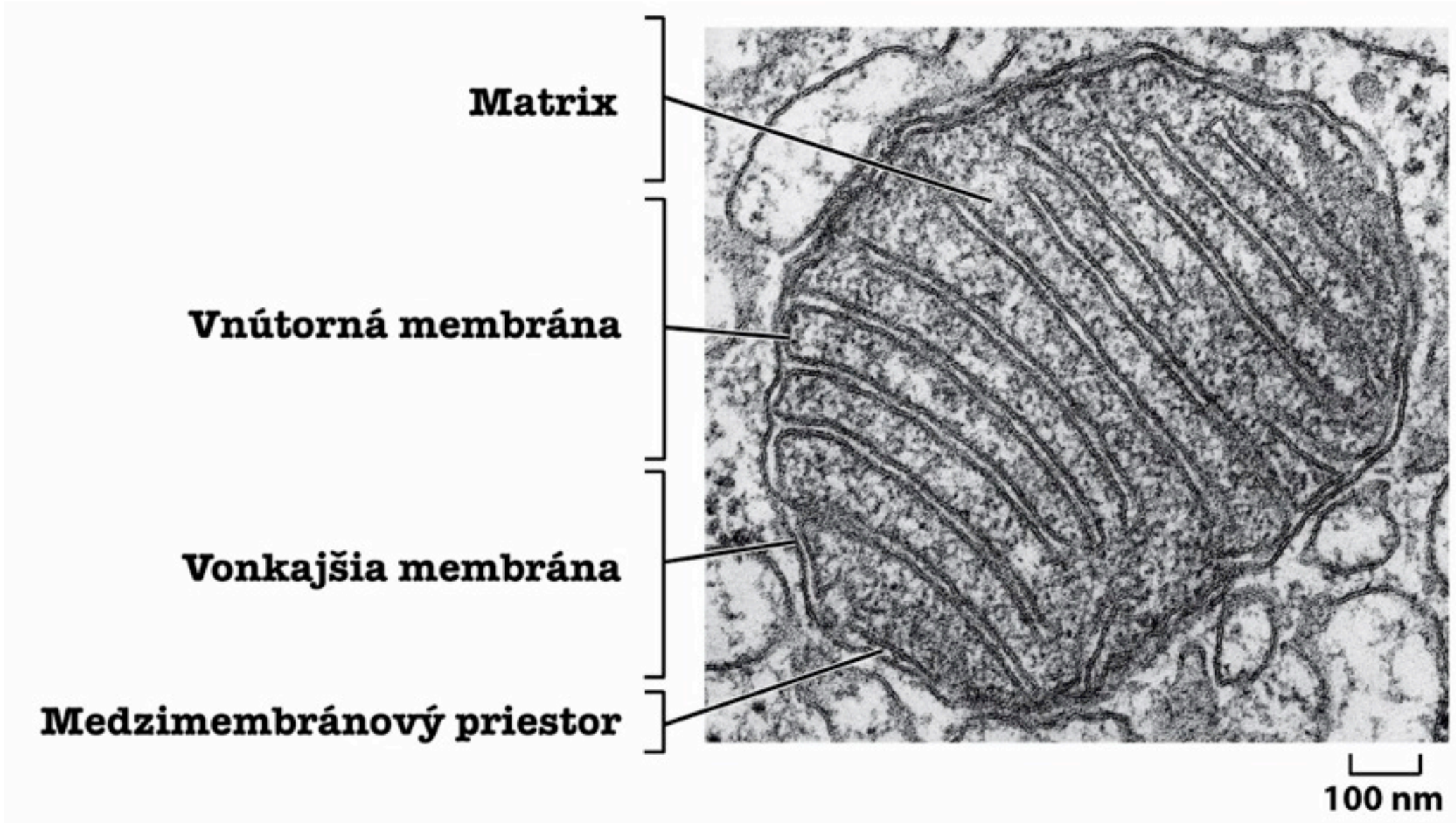
Mitochondrie
a
chloroplasty

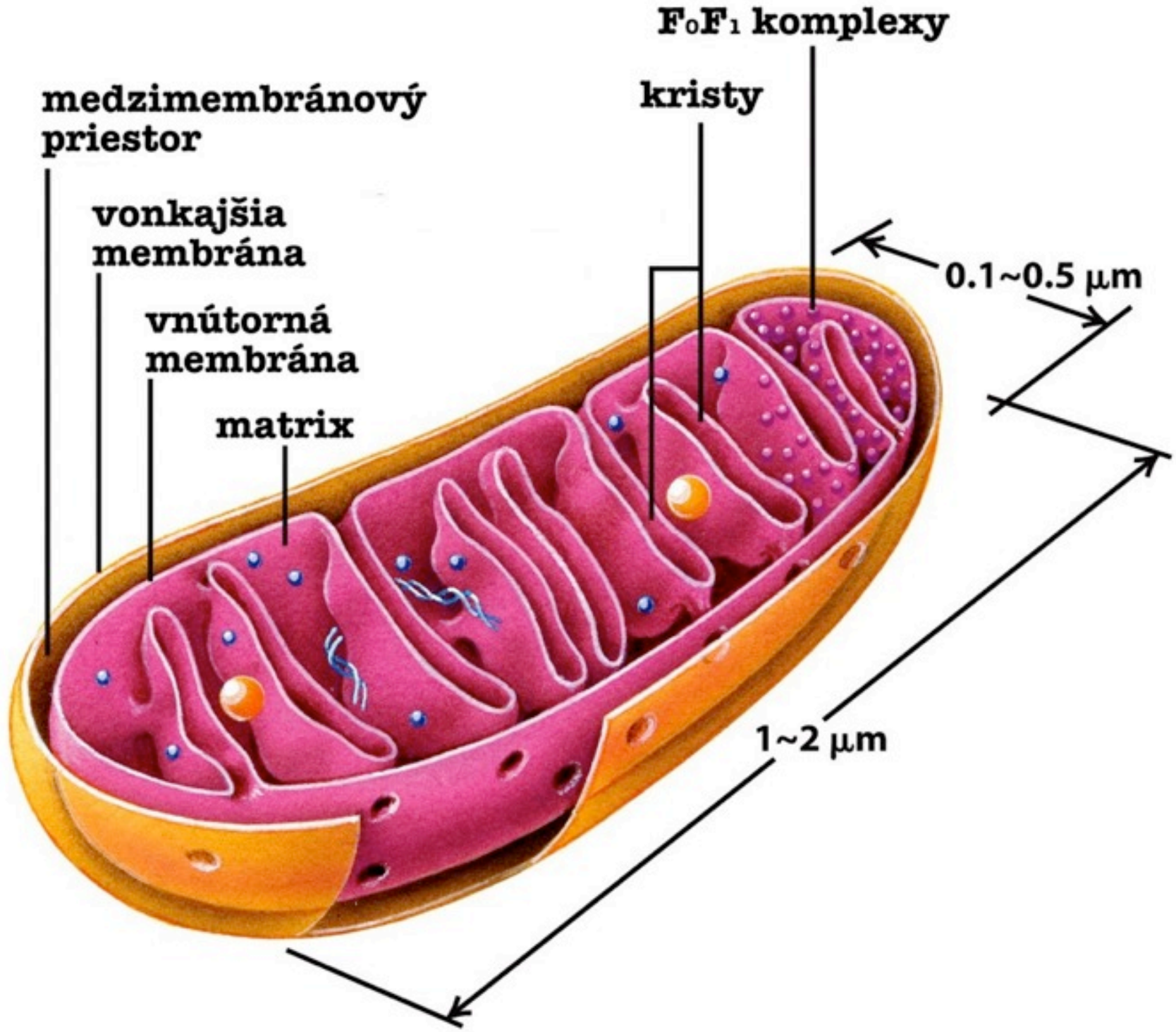


Fluorescenčne farbené mitochondrie fibroblastov.

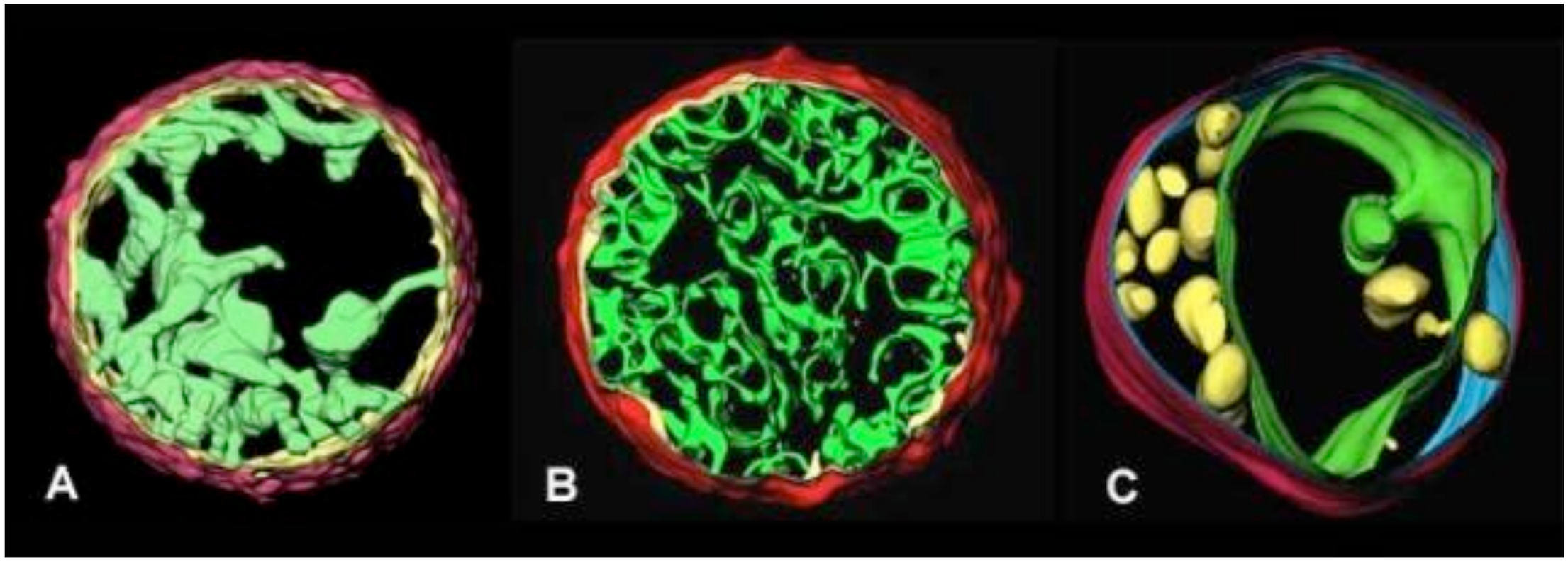
Mitochondrie v TEM

Mitochondrie v TEM



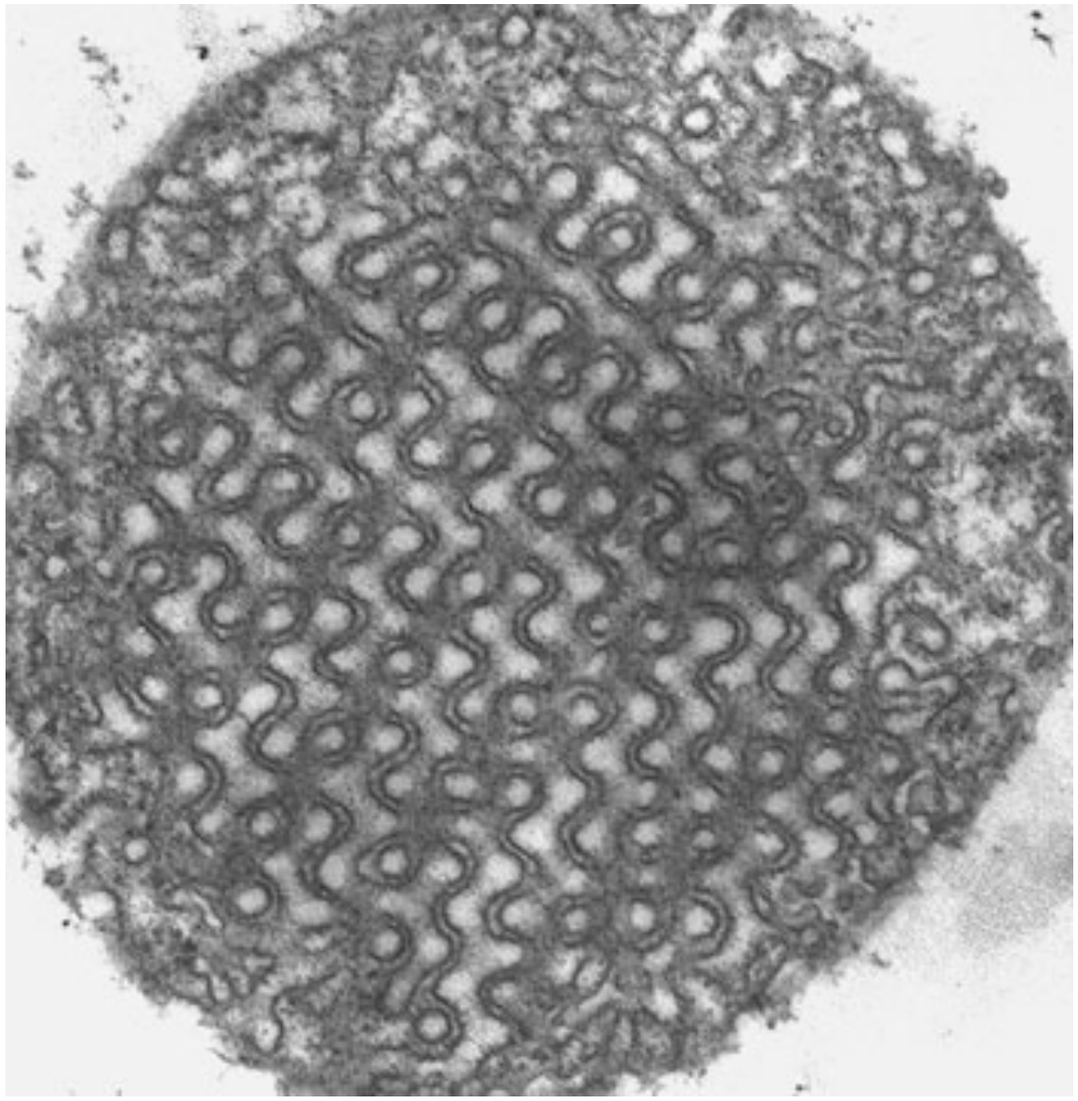

F₀F₁ komplexy
kristy
medzimembránový priestor
vonkajšia membrána
vnútorná membrána
matrix
0.1~0.5 μm
1~2 μm

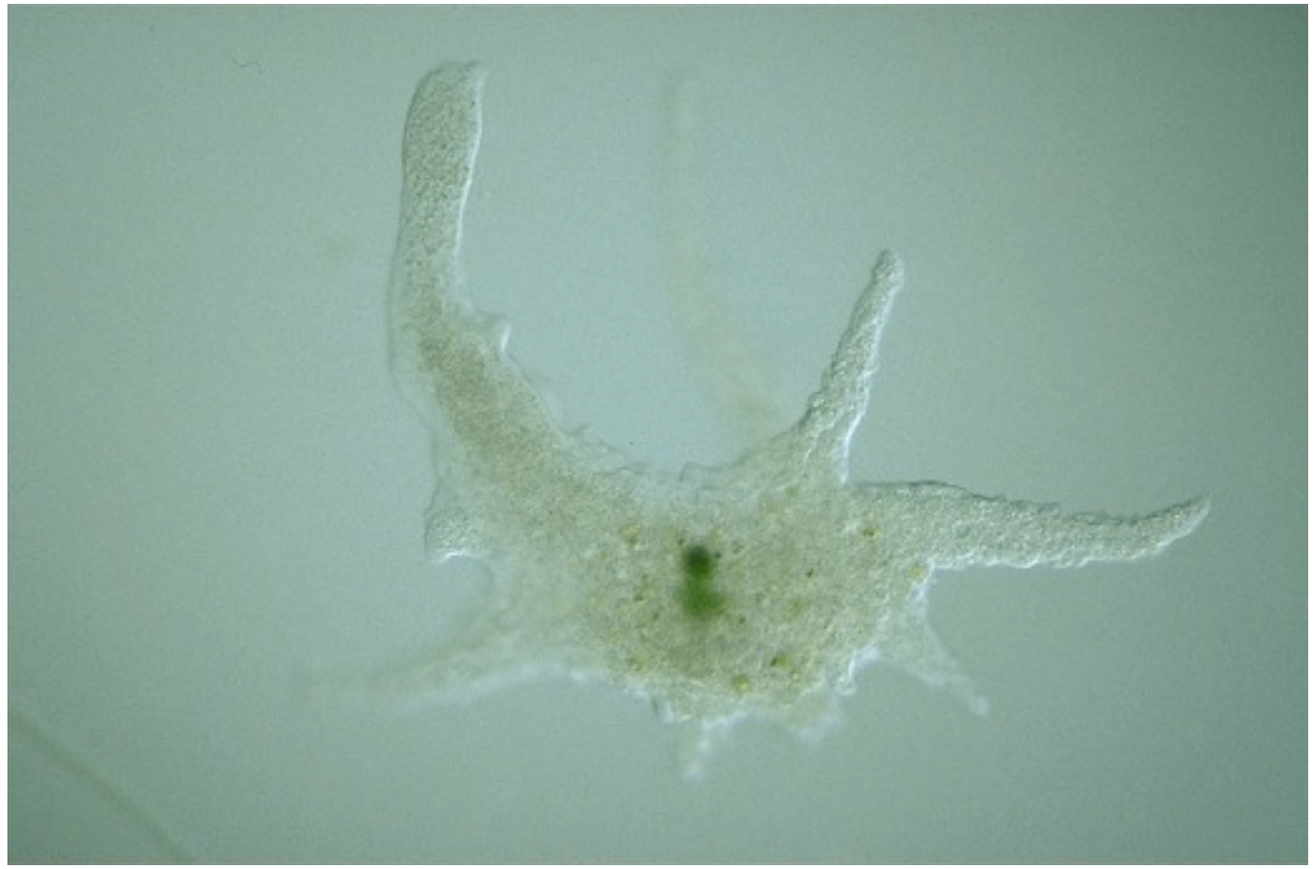
Mitochondrie vizualizované kryo-elektrónovou tomografiou



Changes in internal organization of mitochondria associated with cell death and disease: ***(A)*** *Normal, isolated liver mitochondrion (Mannella et al., 2001),* ***(B)*** *Liver mitochondrion treated with a protein (tBID) that induces programmed cell death or apoptosis (Scorrano et al., 2002), and* ***(C)*** *Mitochondrion from a patient with a mitochondrial myopathy (M. Huizing, 1998, PhD Thesis, Univ. Nijmegen).*

Mitochondrie sú krásne



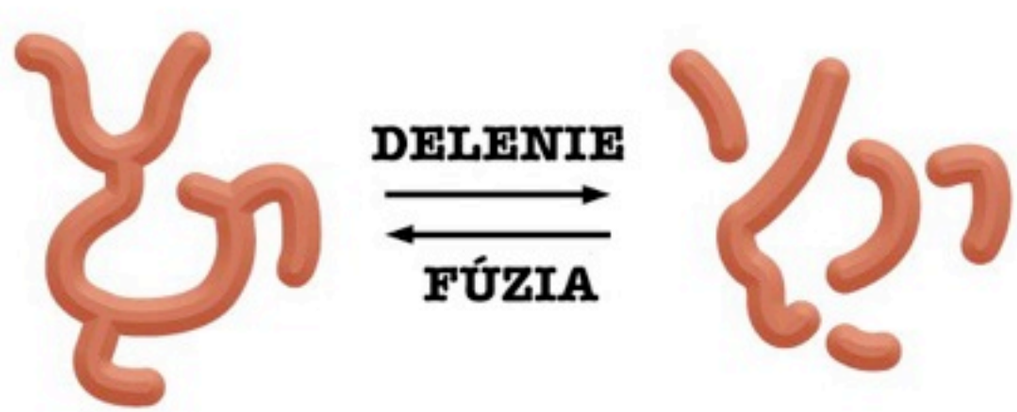


Mitochondrie améby *Chaos carolinense* po hladovaní.

Almsherqi Z et al. J. R. Soc. Interface 2008;5:1023-1029

Mitochondrie sú dynamické štruktúry

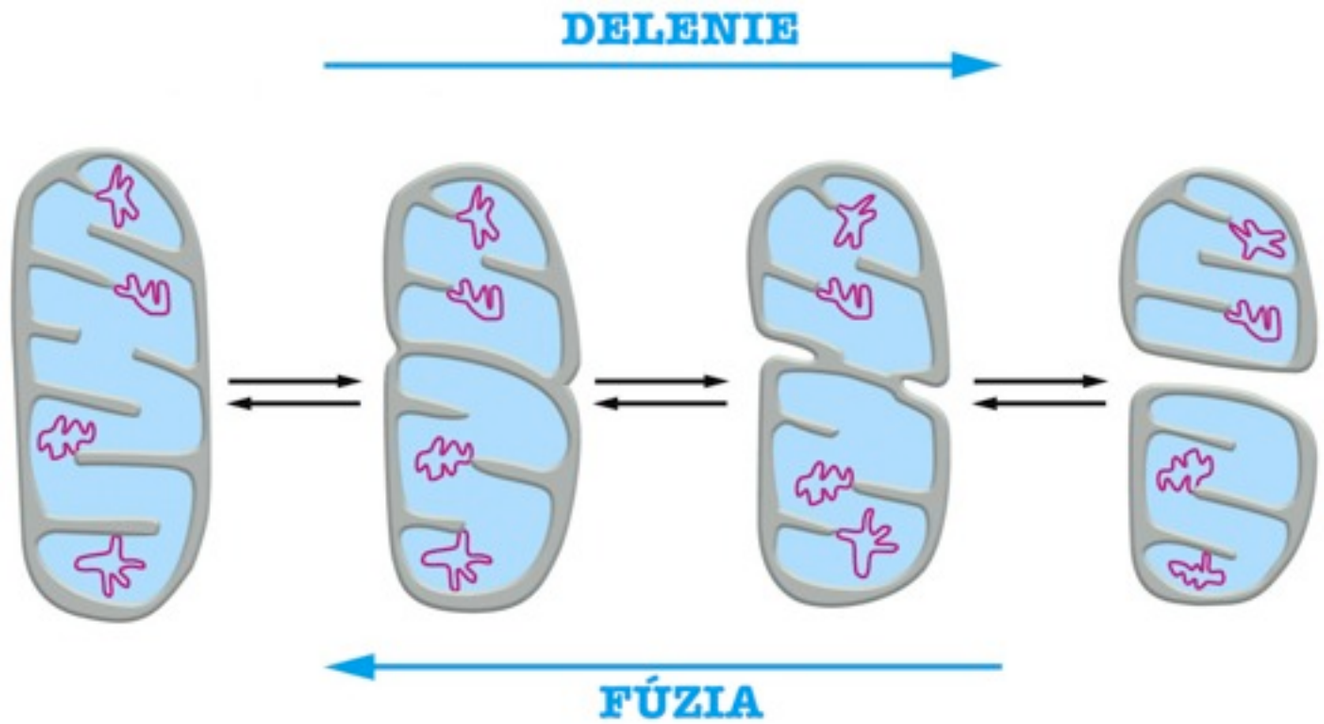
(A)



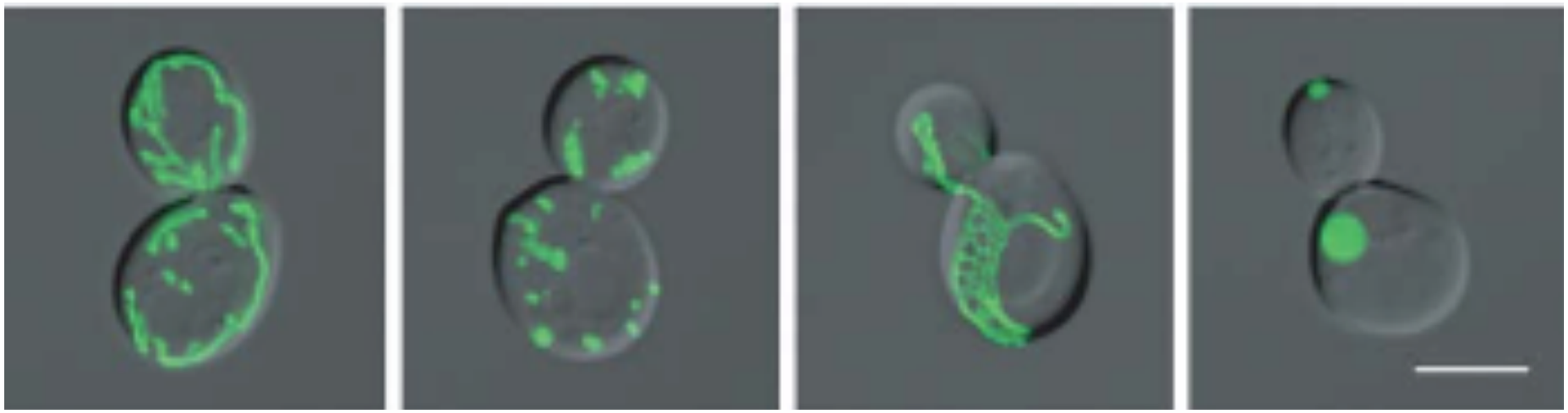
(B)

(C)

Mitochondrie sa spájajú a delia



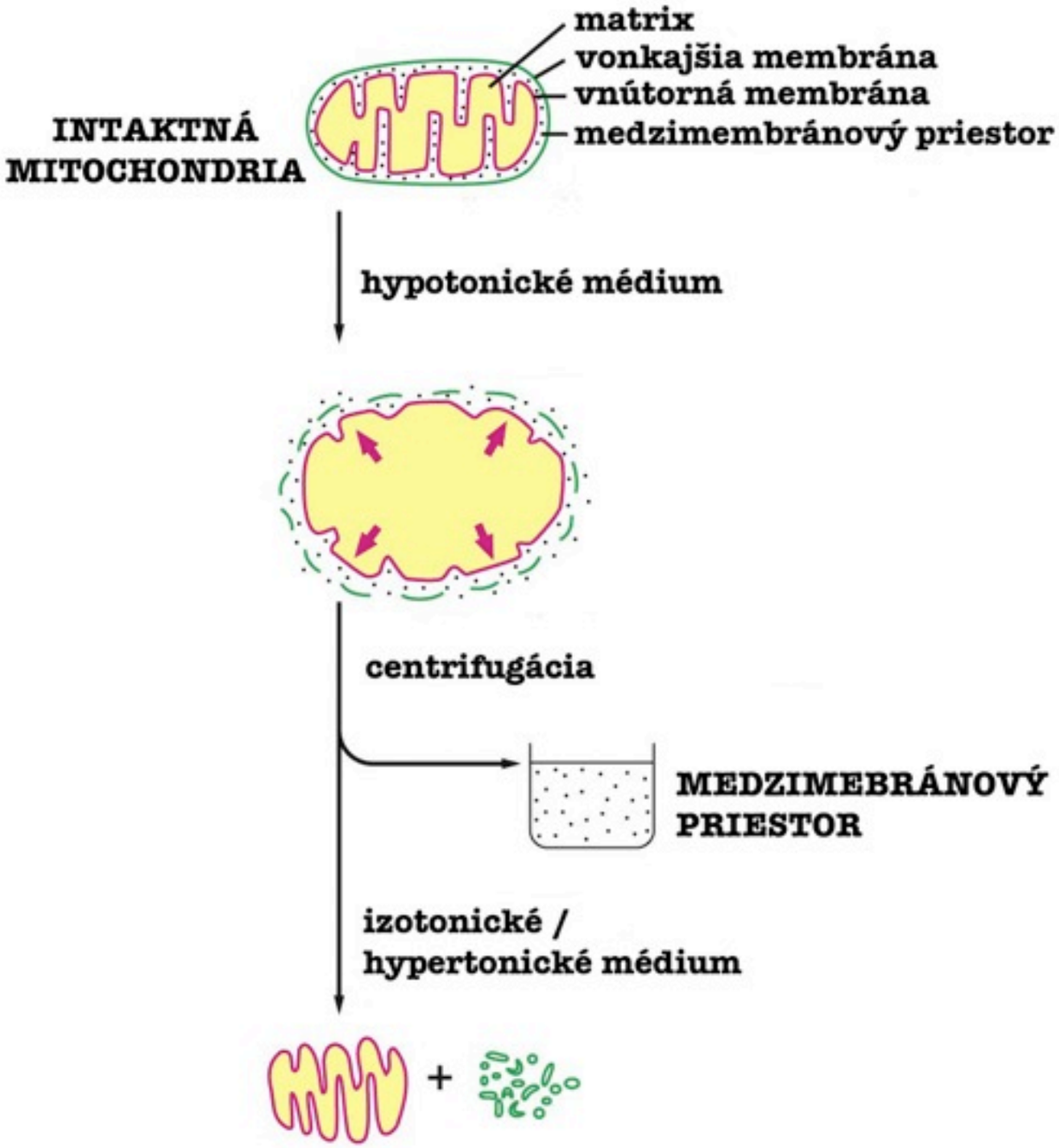
Mitochondrie sa spájajú a delia

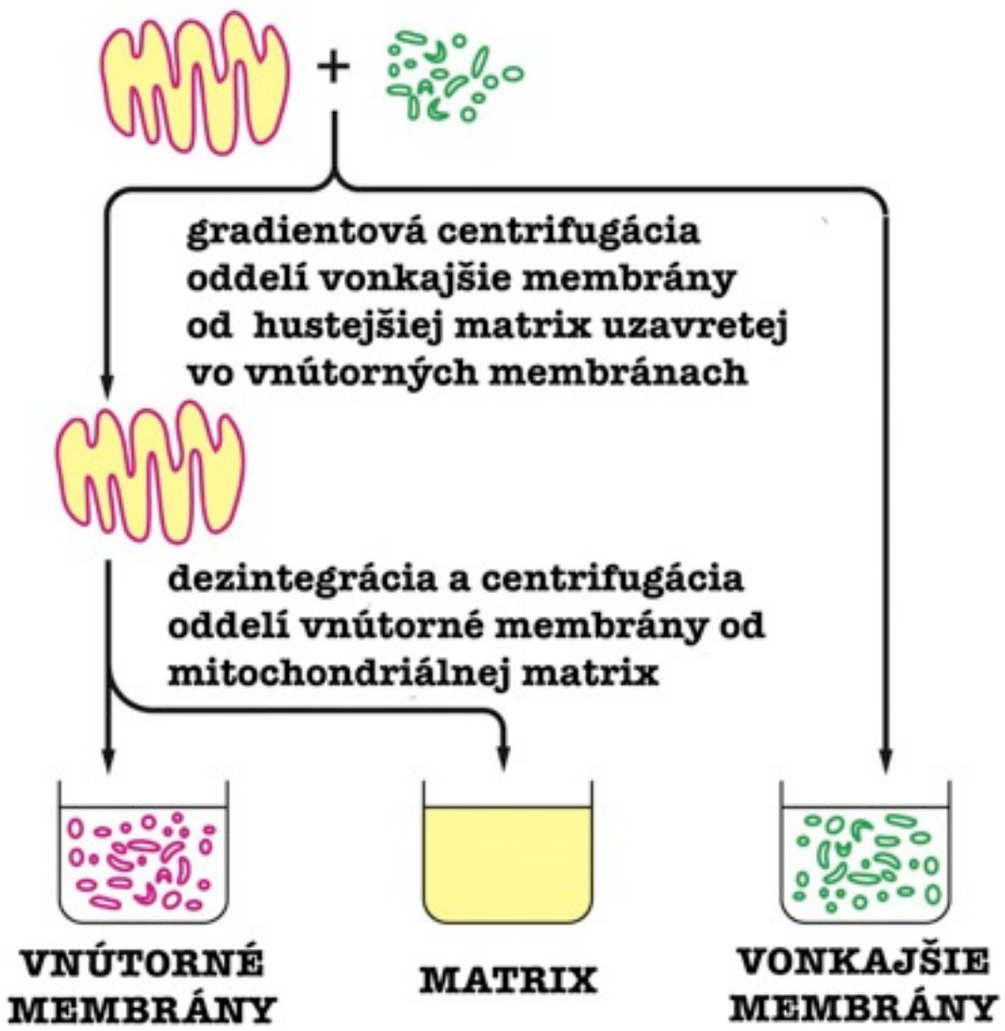


wt Δ*fzo1* Δ*dnm1* Δ*mmm1*

Mitochondriálna morfológia v kvasinkách Saccharomyces cerevisiae. Štandardný typ buniek a mutanty defektné v mitochondriálnej fúzií (Δfzo1), delení (Δdnm1), a tubulácií (Δmmm1). Mitochondrie sú vizualizované pomocou farbenia s fluorescenčnou farbičkou $DiOC_6$ (modifikované podľa Okamoto a Shaw, 2005).

Frakcionácia purifikovaných mitochondrií





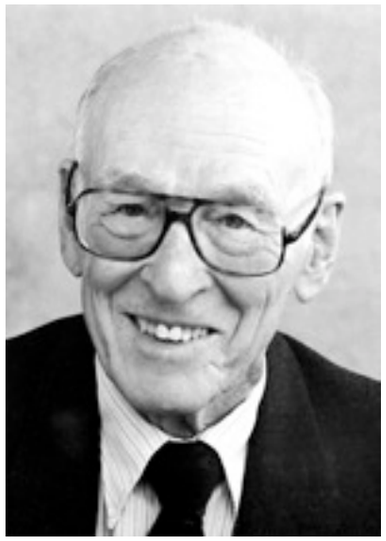
Nobelove ceny

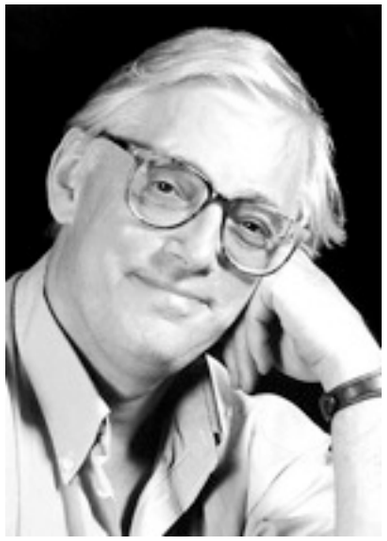
1978 **Peter Mitchel**

Chemiosmotická teória.

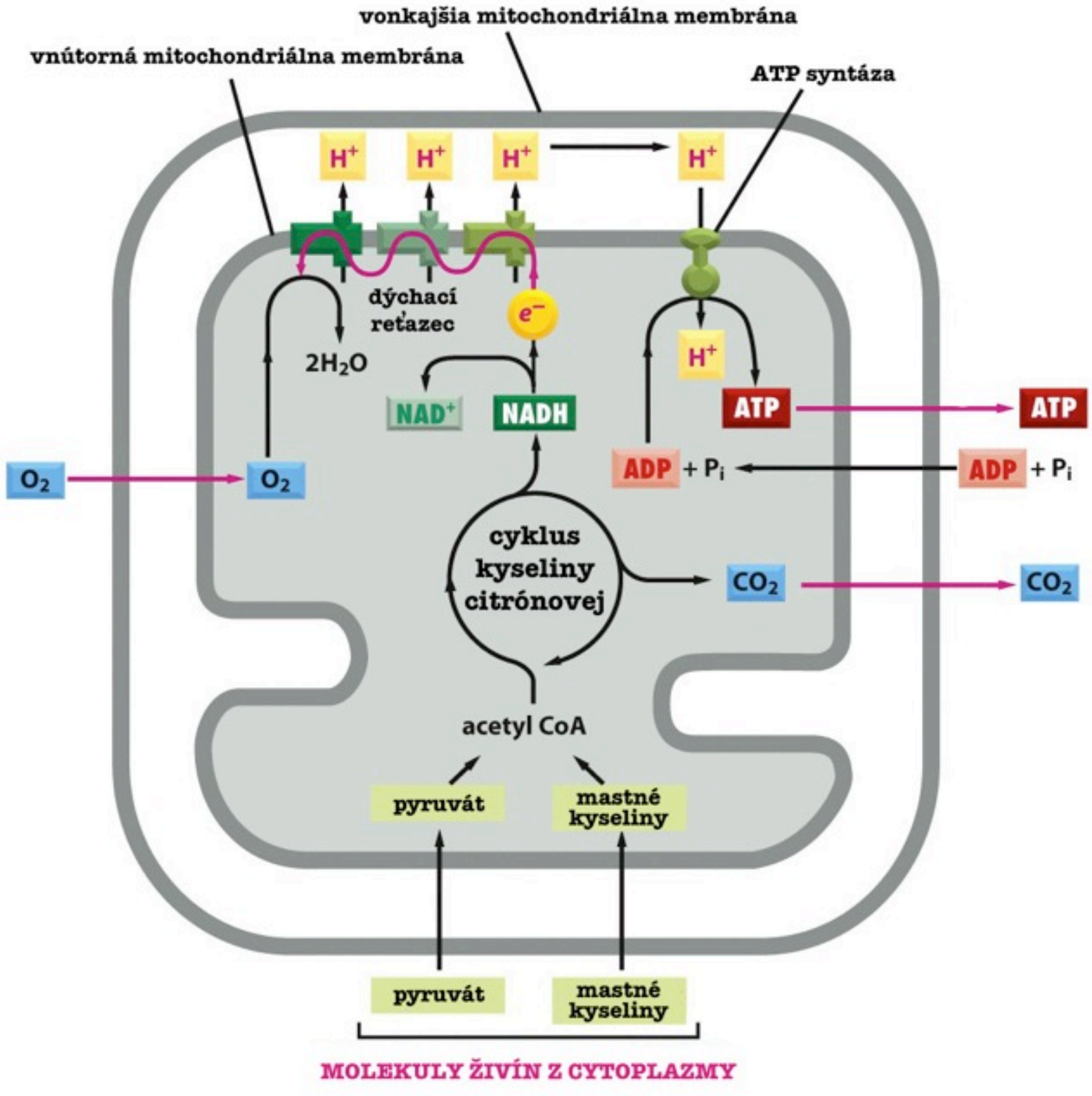
1997 **Paul D. Boyer and John E. Walker**

Mechanizmus ATPsyntázy

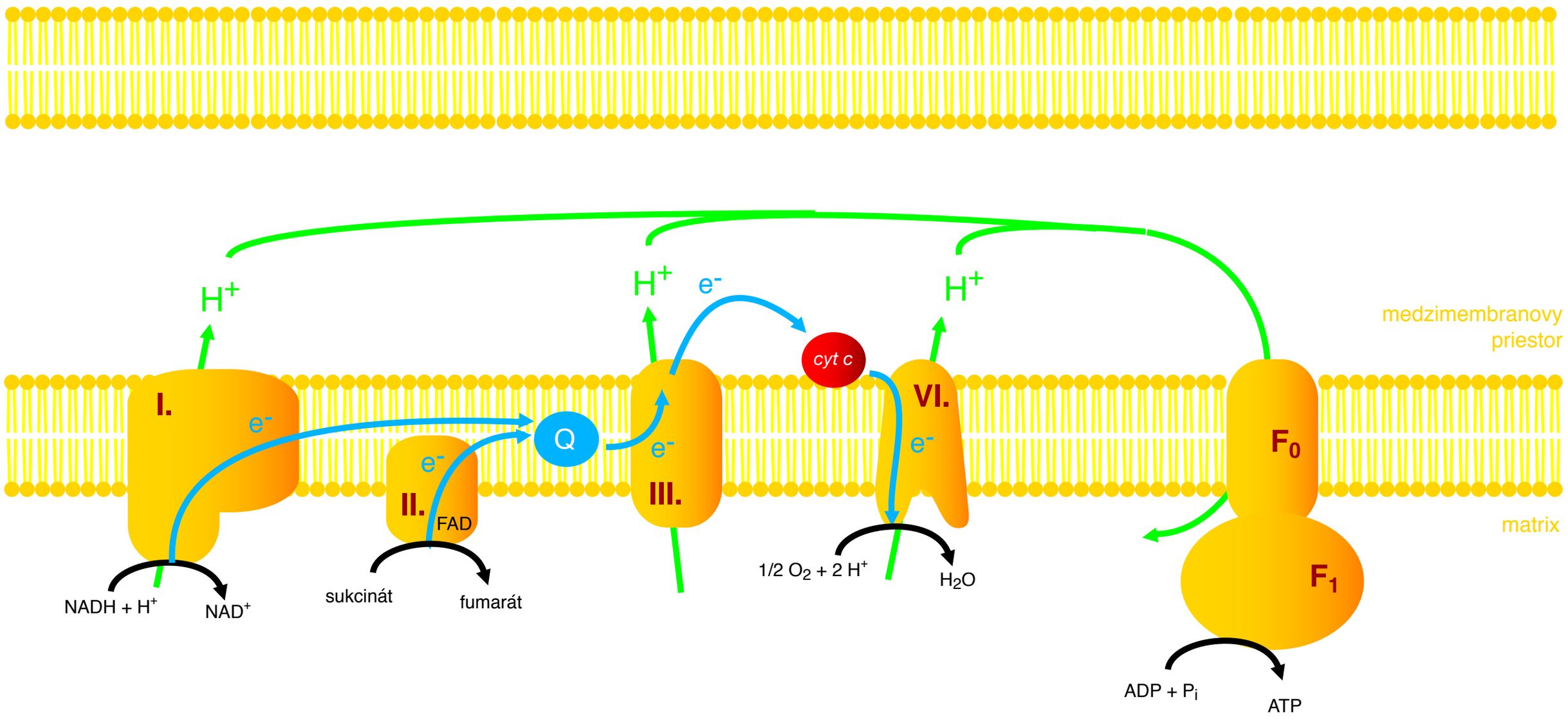




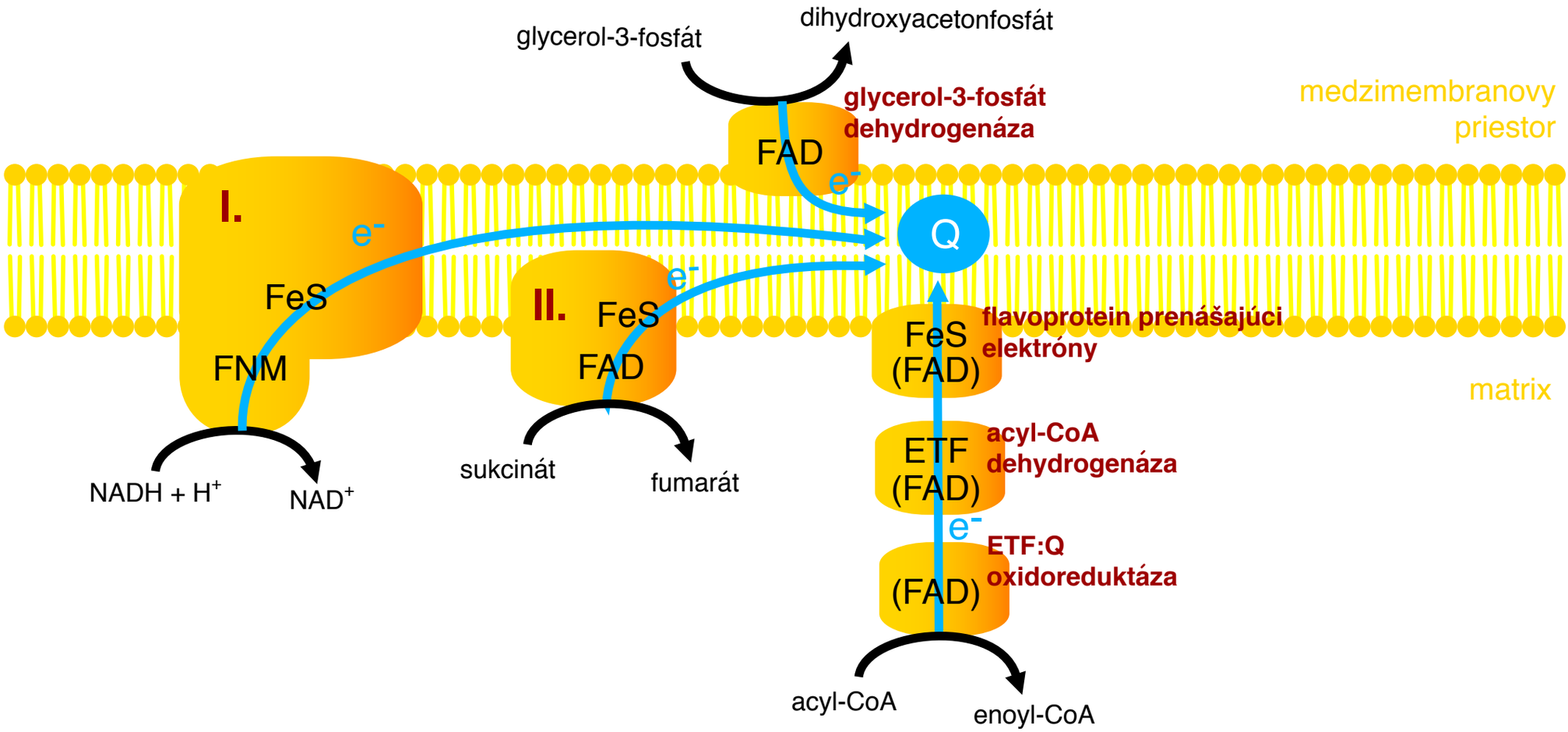
Energetický metabolizmus mitochondrií



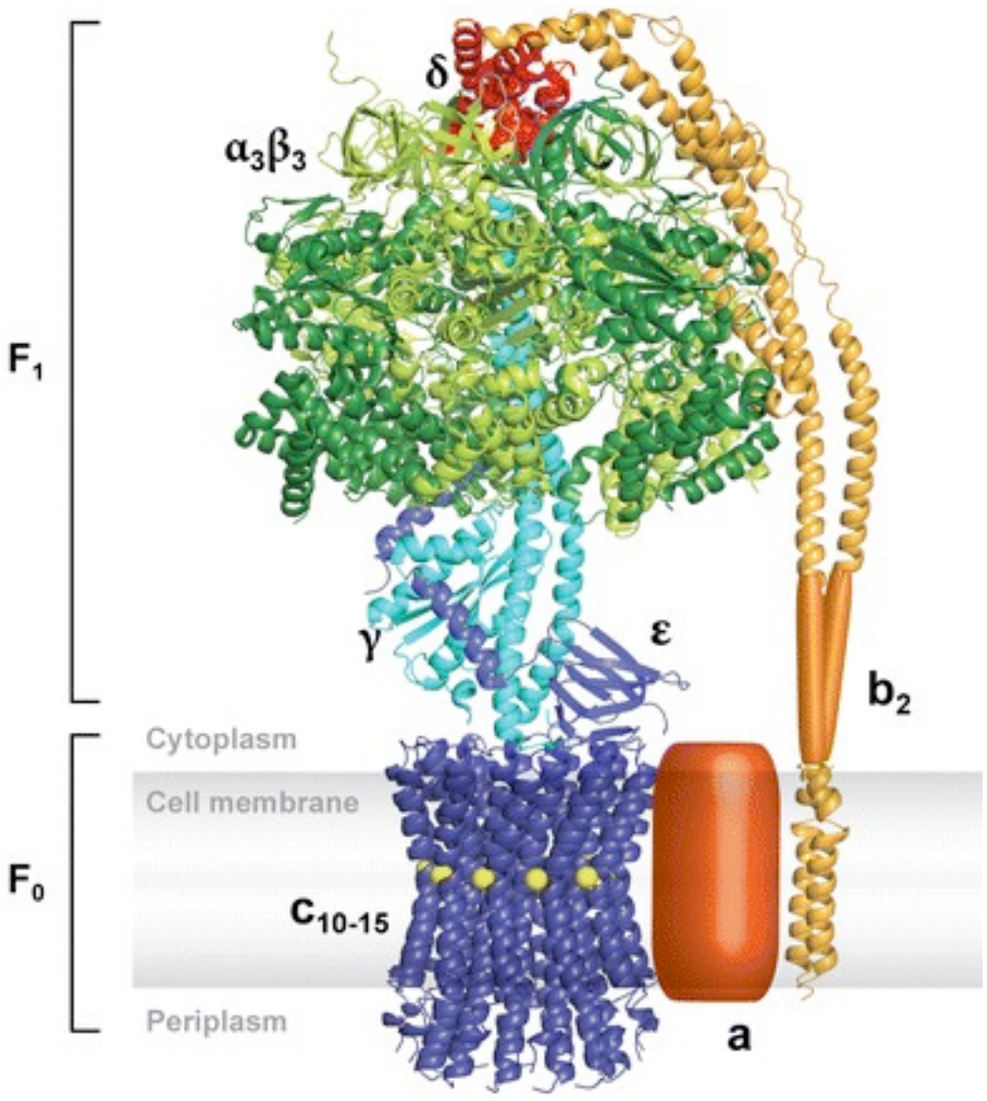
Dýchací reťazec a oxidatívna fosforylácia



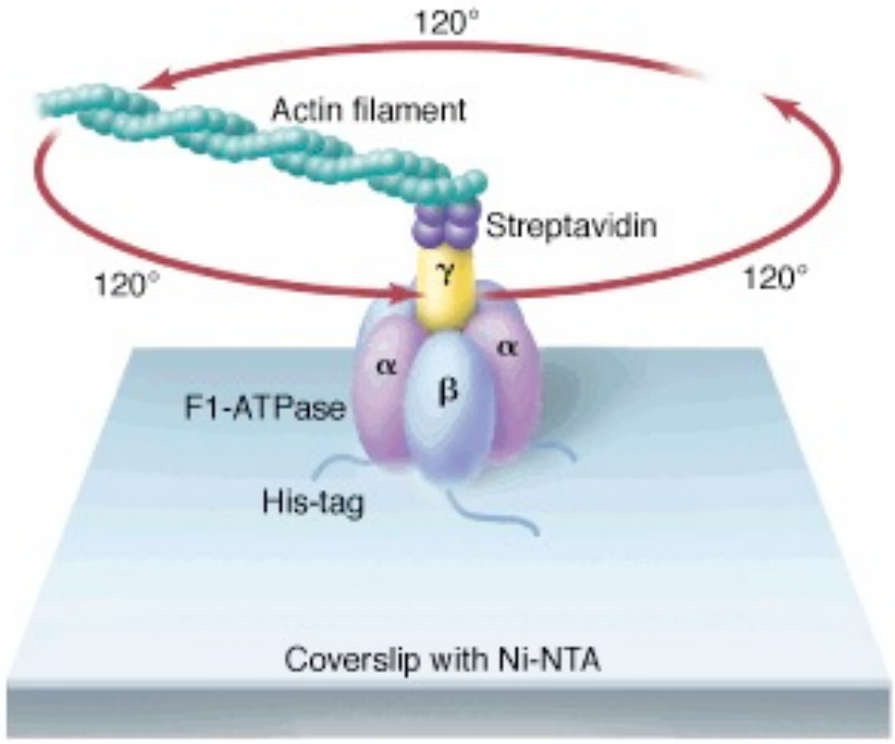
komplex I. - NADH dehydrogenáza
komplex II. - sukcinátdehydrogenáza
komplex III. - ubichinón-cytochróm c oxidoreduktáza
komplex IV. - cytochróm c oxidáza
komplex V. - ATPsyntaza


glycerol-3-fosfát
dihydroxyacetonfosfát
glycerol-3-fosfát dehydrogenáza
FAD
e-
medzimembranovy priestor
I.
e-
FeS
FNM
Q
II.
e-
FeS
FAD
FeS (FAD)
flavoprotein prenášajúci elektróny
matrix
NADH + H+
NAD+
sukcinát
fumarát
ETF (FAD)
acyl-CoA dehydrogenáza
e-
ETF:Q oxidoreduktáza
(FAD)
acyl-CoA
enoyl-CoA

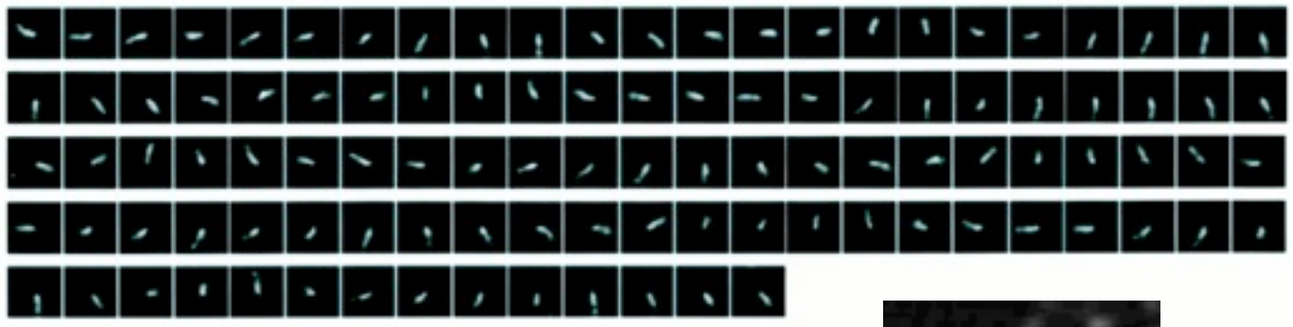
F_1F_0-ATPsyntáza



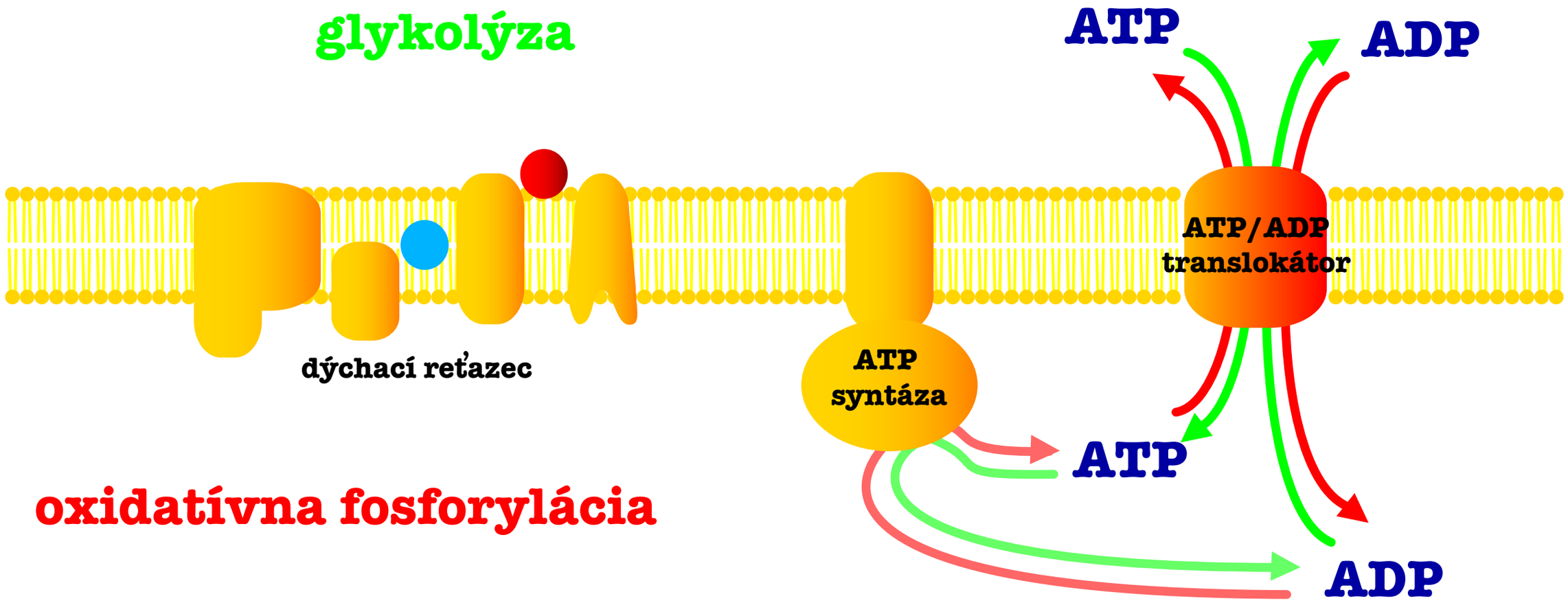
von Ballmoos C, et al. 2008.
Annu. Rev. Biophys. 37:43–64.



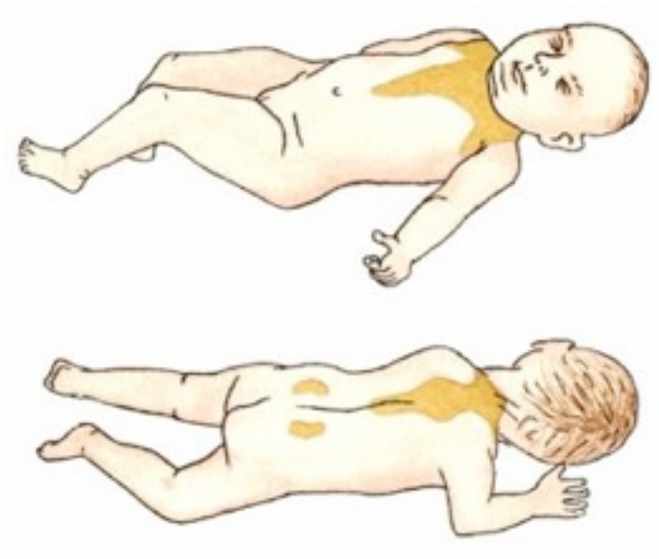
Noji, H.. Science **282**, 1844 (1998)
Copyright (1998) American Association for the Advancement of Science

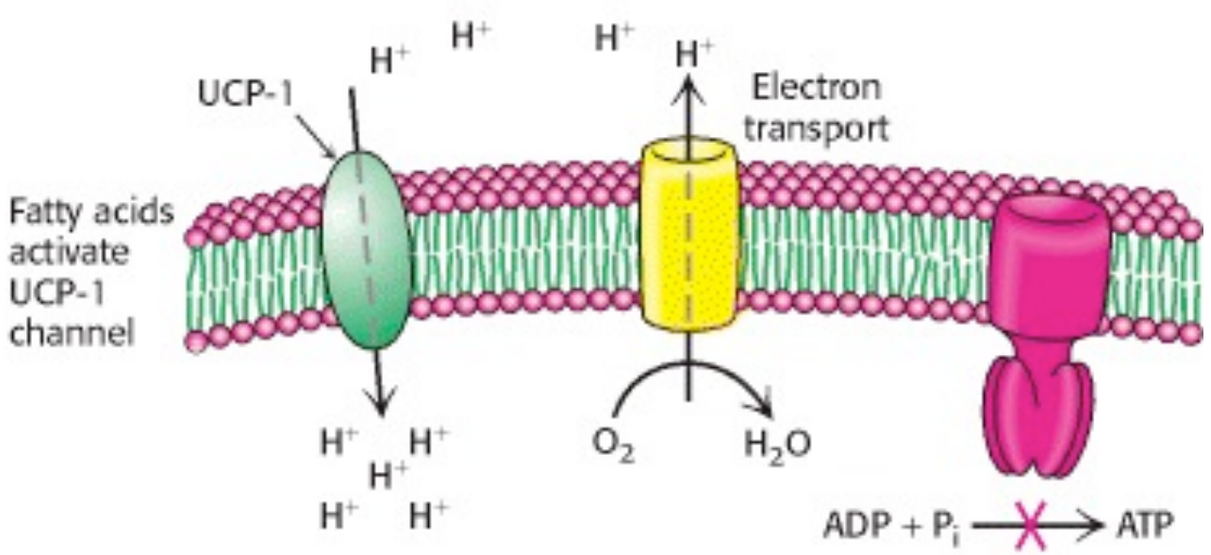


ATP je transportovaný cez mitochondriálnu membrámu výmenou za ADP



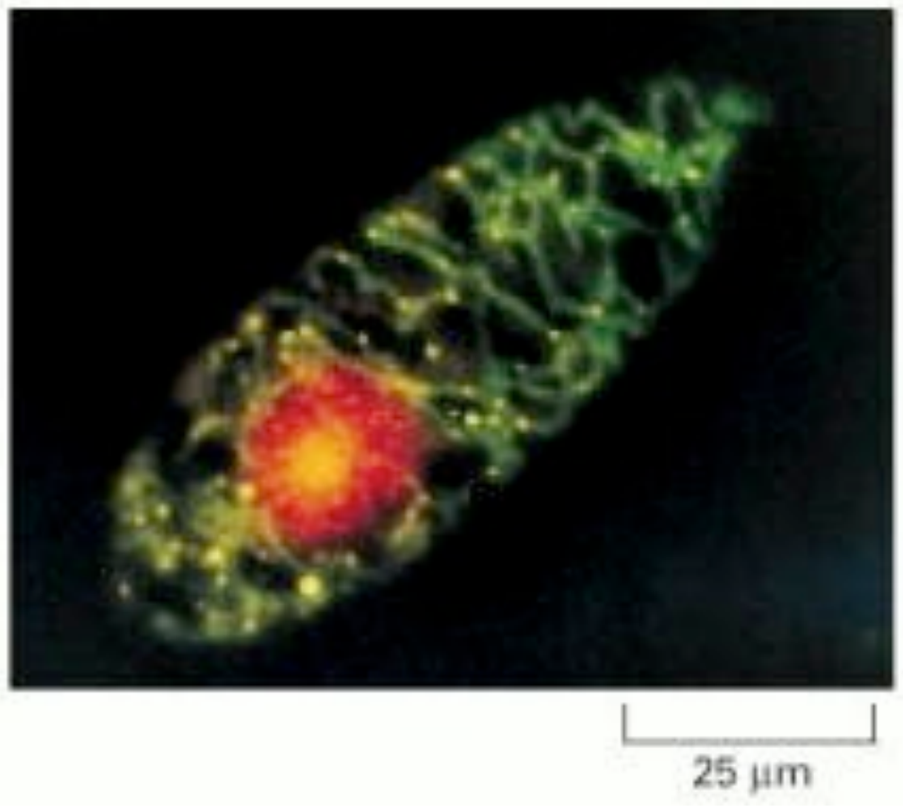
Termogenéza v hnedom tukovom tkanive

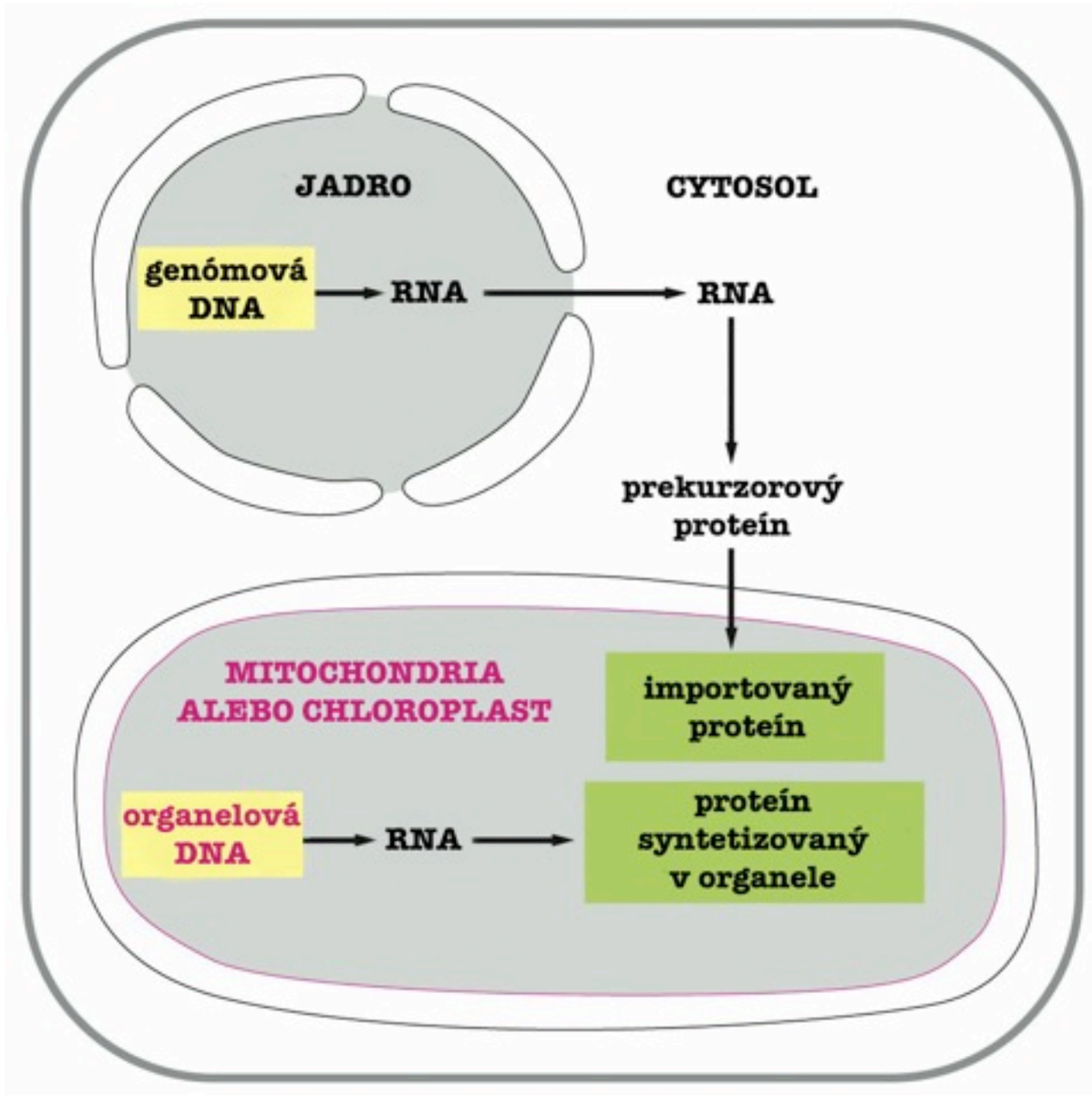




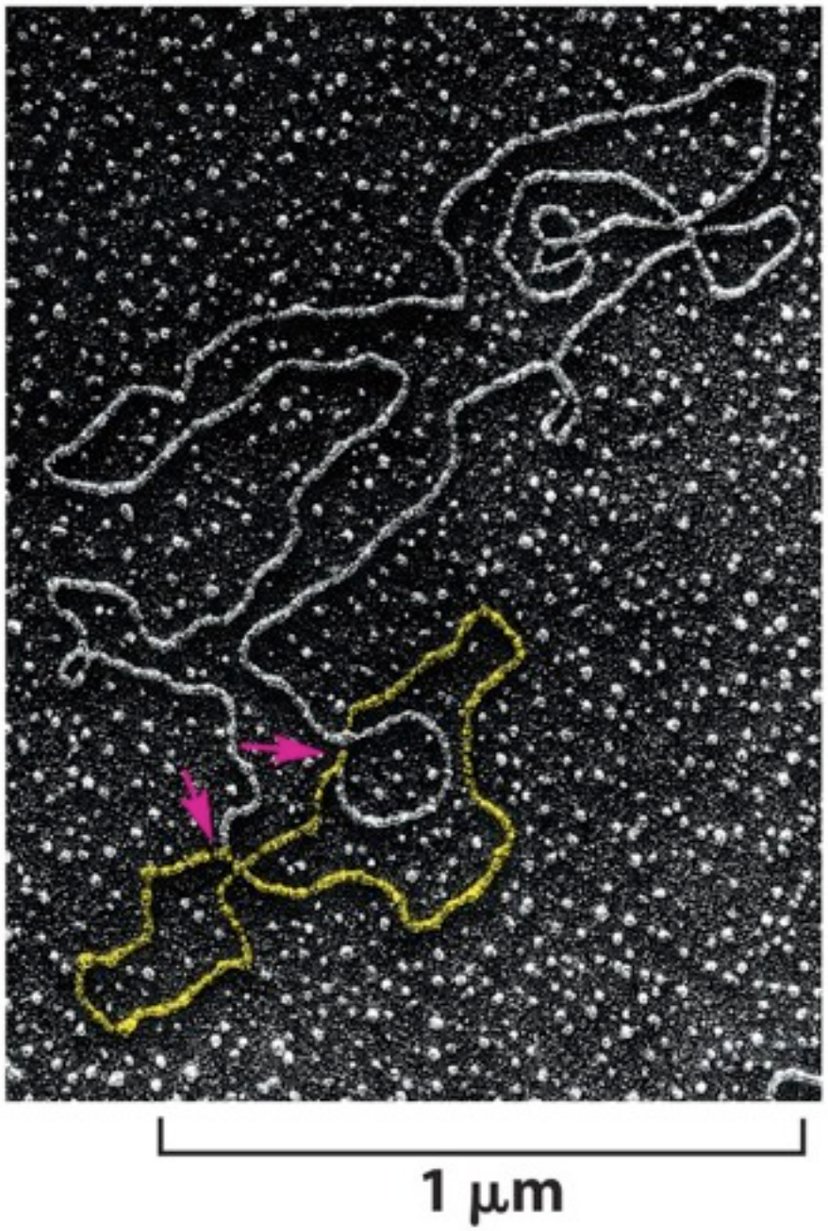
Odpojovací proteín UCP
(uncoupling protein)

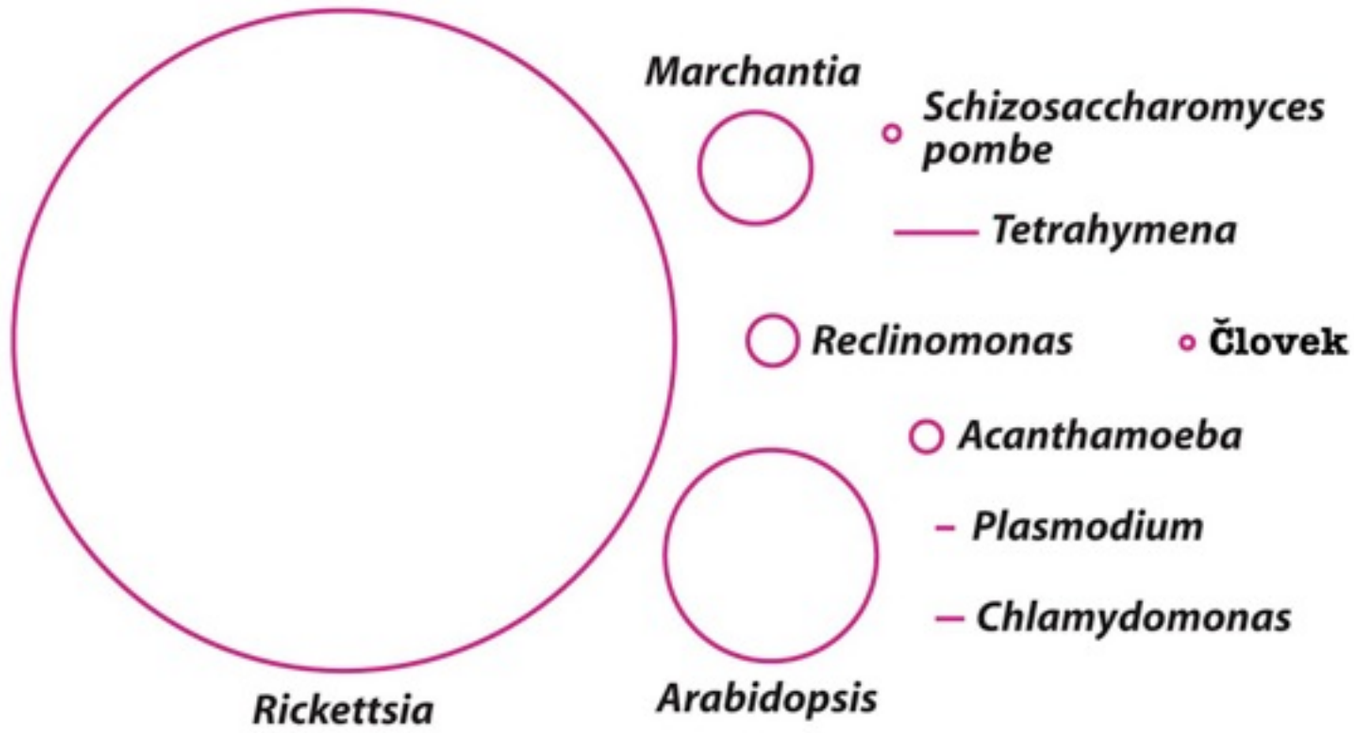
Mitochondrie majú vlastnú DNA a proteosyntetický aparát



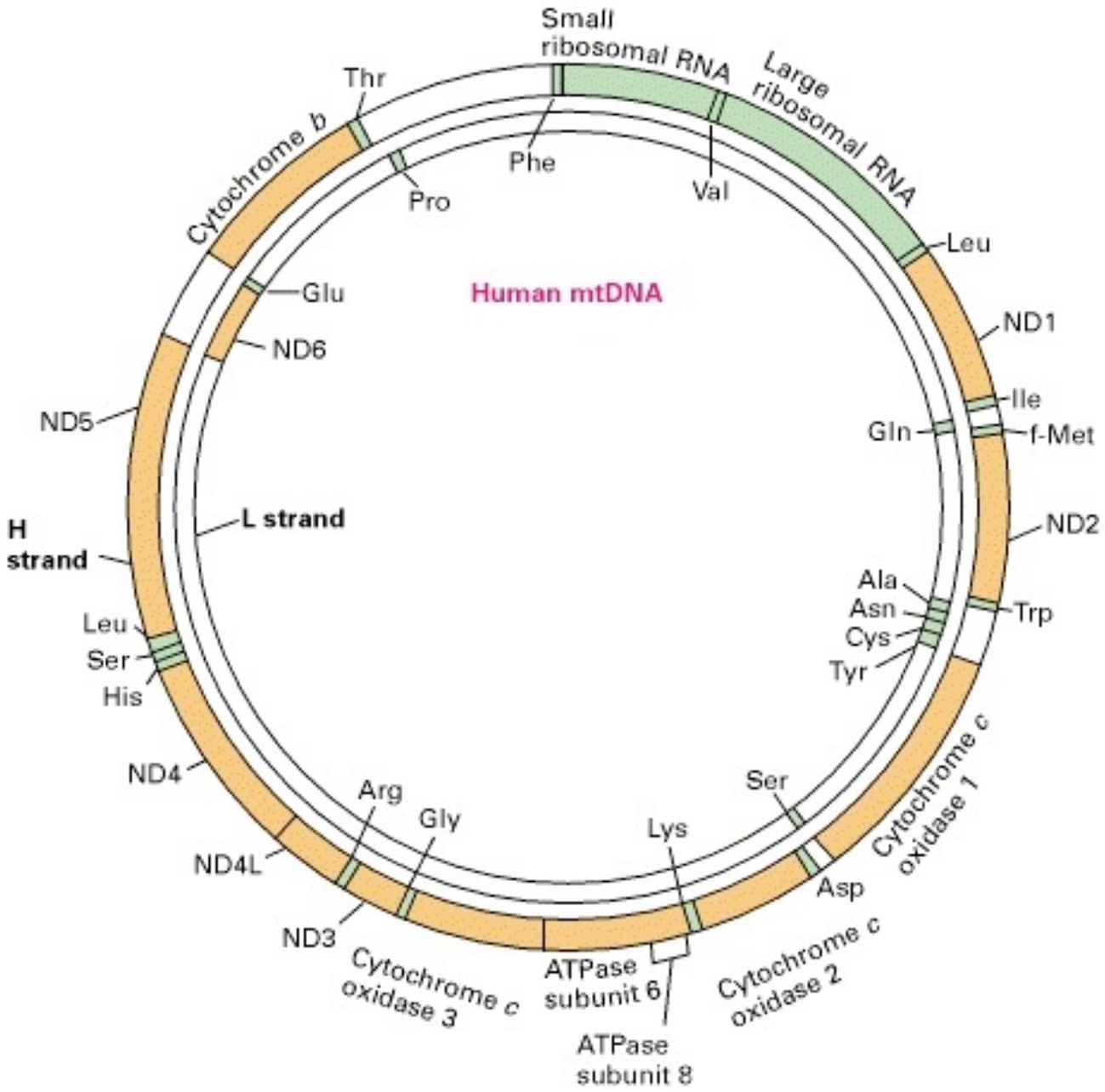


Mitochondriálna DNA





Mitochondriálny genóm



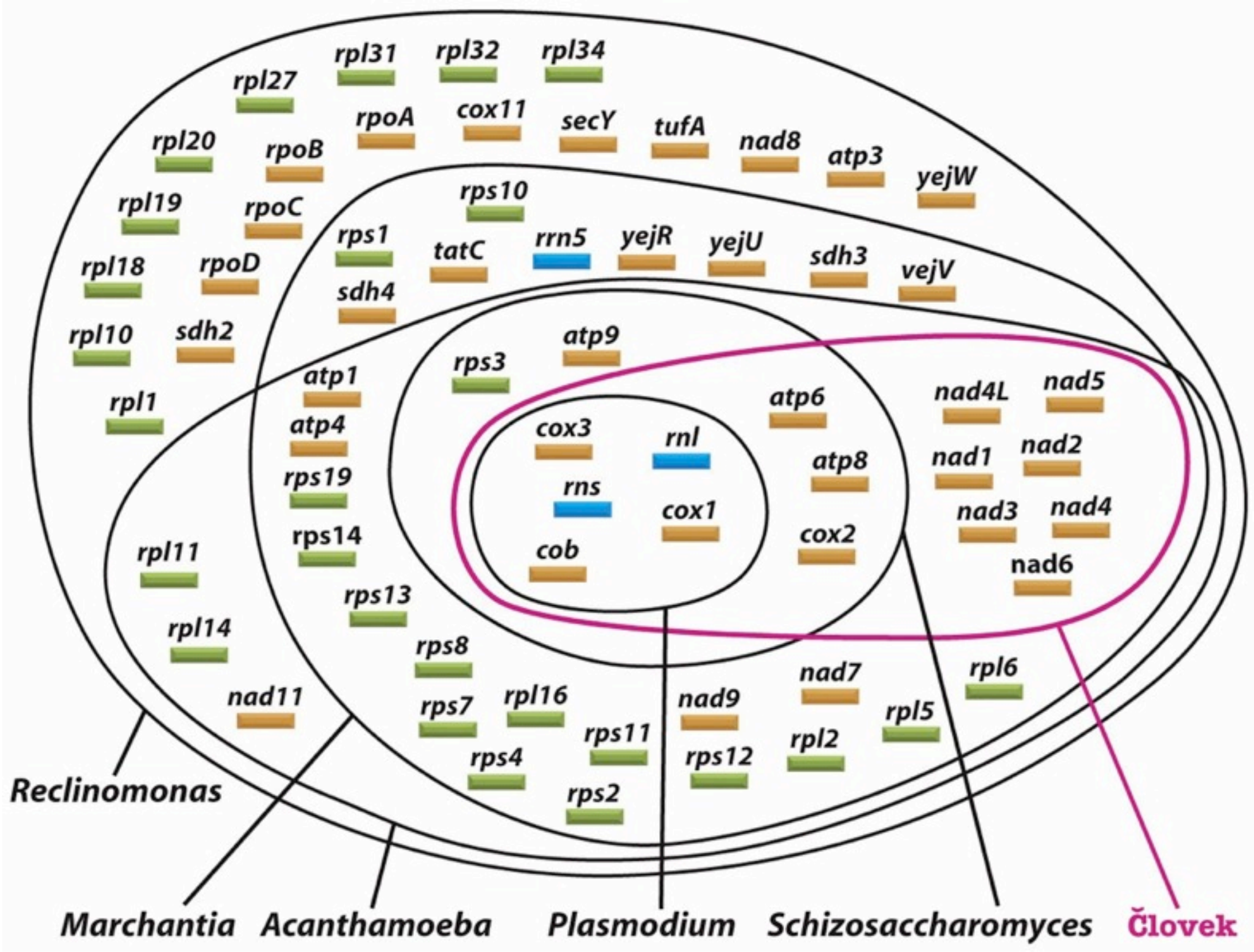
Ľudský mitochondriálny genóm

16 569 bp

Kóduje:

2 rRNA
22 tRNA
13 proteín-kódujúcich génov

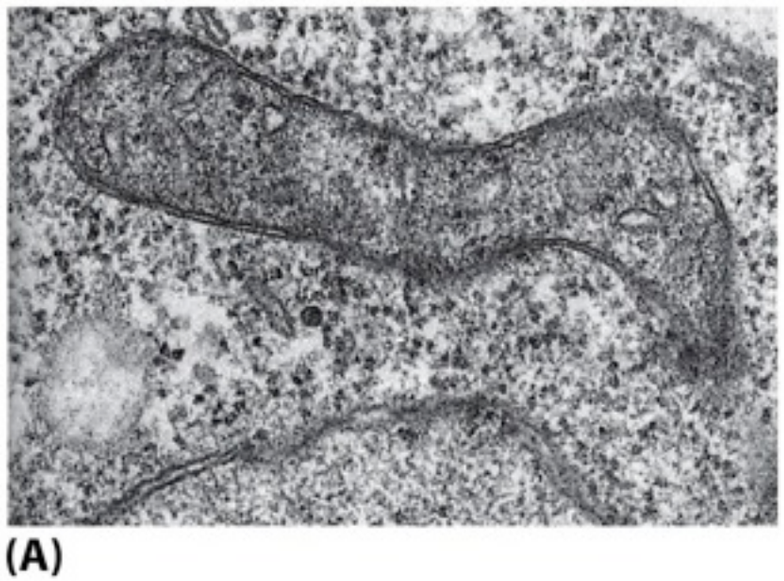
Mitochondriálny genóm



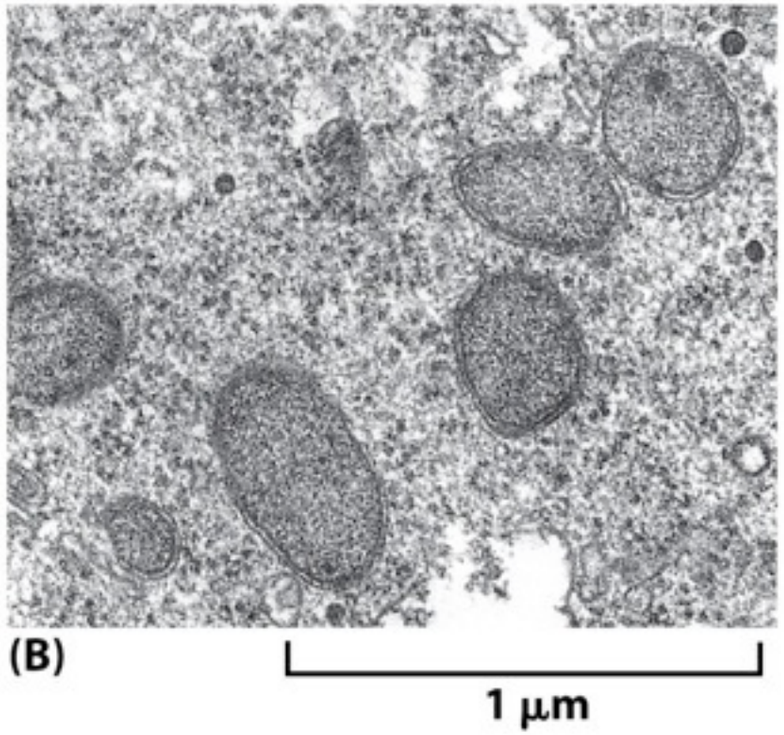
Genetický kód mitochondrií

Kodón	"Univerzálny" kód	Mitochondriálne kódy			
		cicavce	bezstavovce	kvasinky	rastliny
UGA	STOP	*Trp*	*Trp*	*Trp*	STOP
AUA	Ile	*Met*	*Met*	*Met*	Ile
CUA	Leu	Leu	Leu	*Thr*	Leu
AGA, AGG	Arg	*STOP*	*Ser*	Arg	Arg

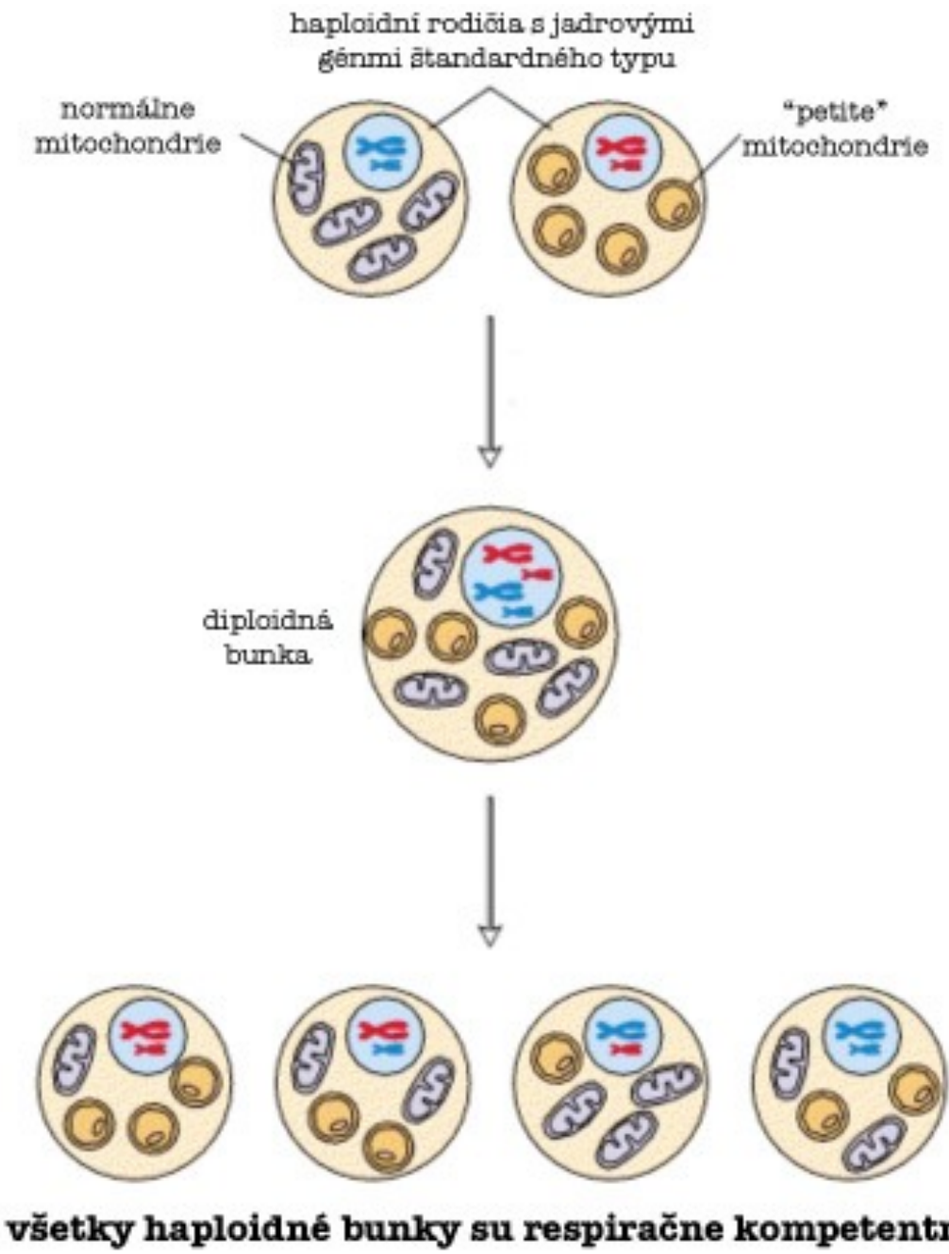
“Petite” mutanty



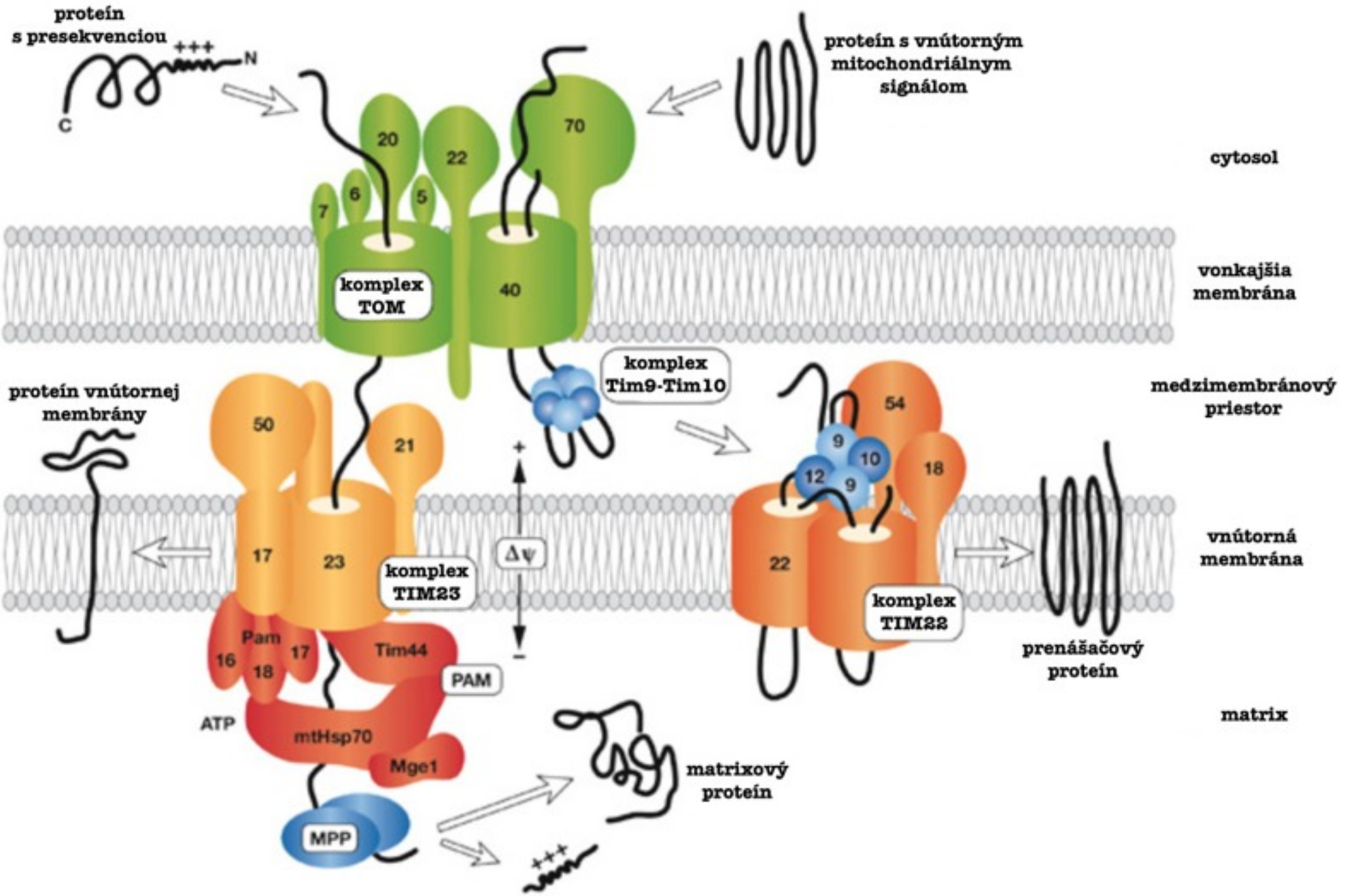
wt



ϱ^o

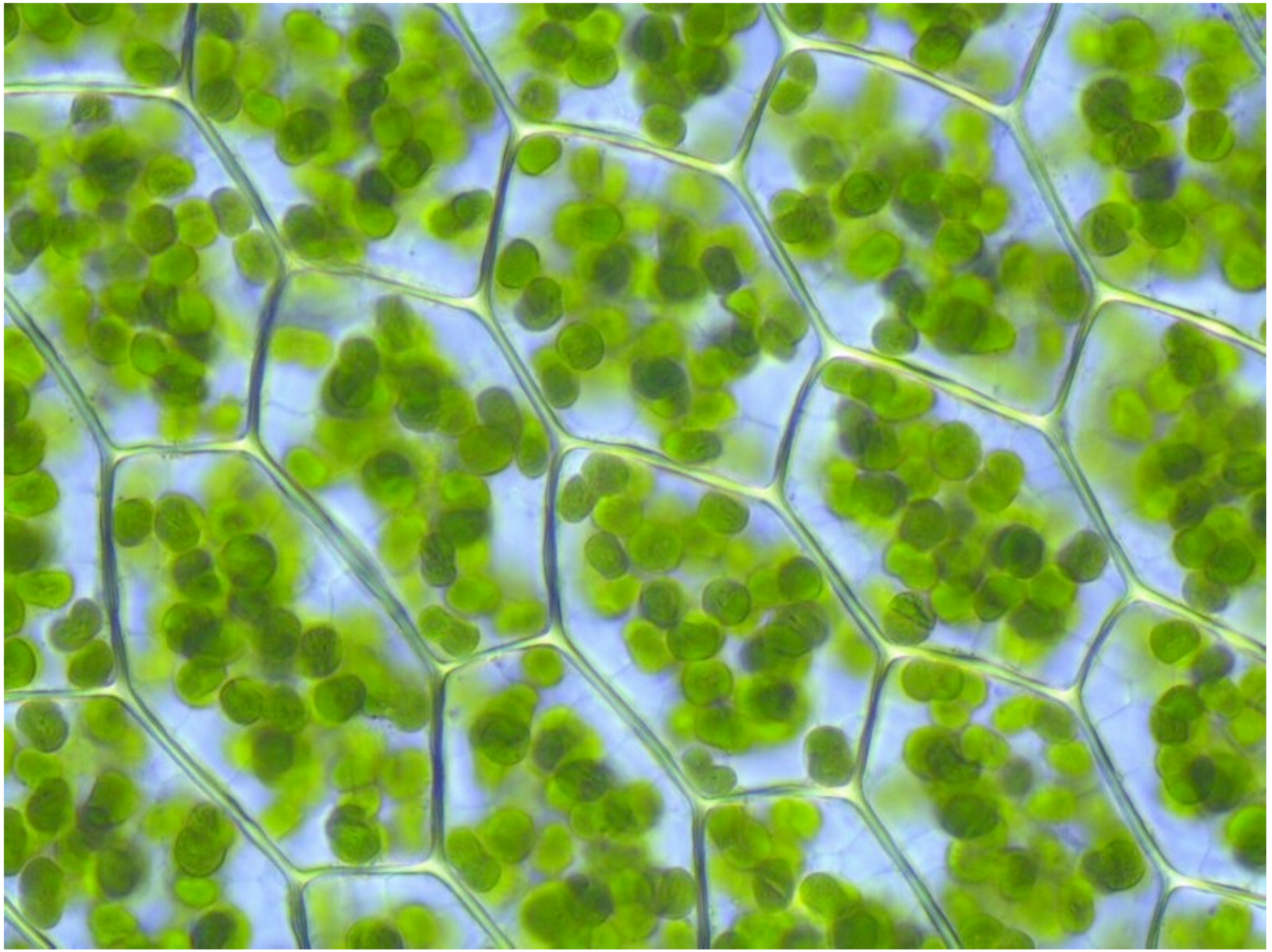


Väčšina proteínov je do mitochondrií importovaná z cytoplazmy

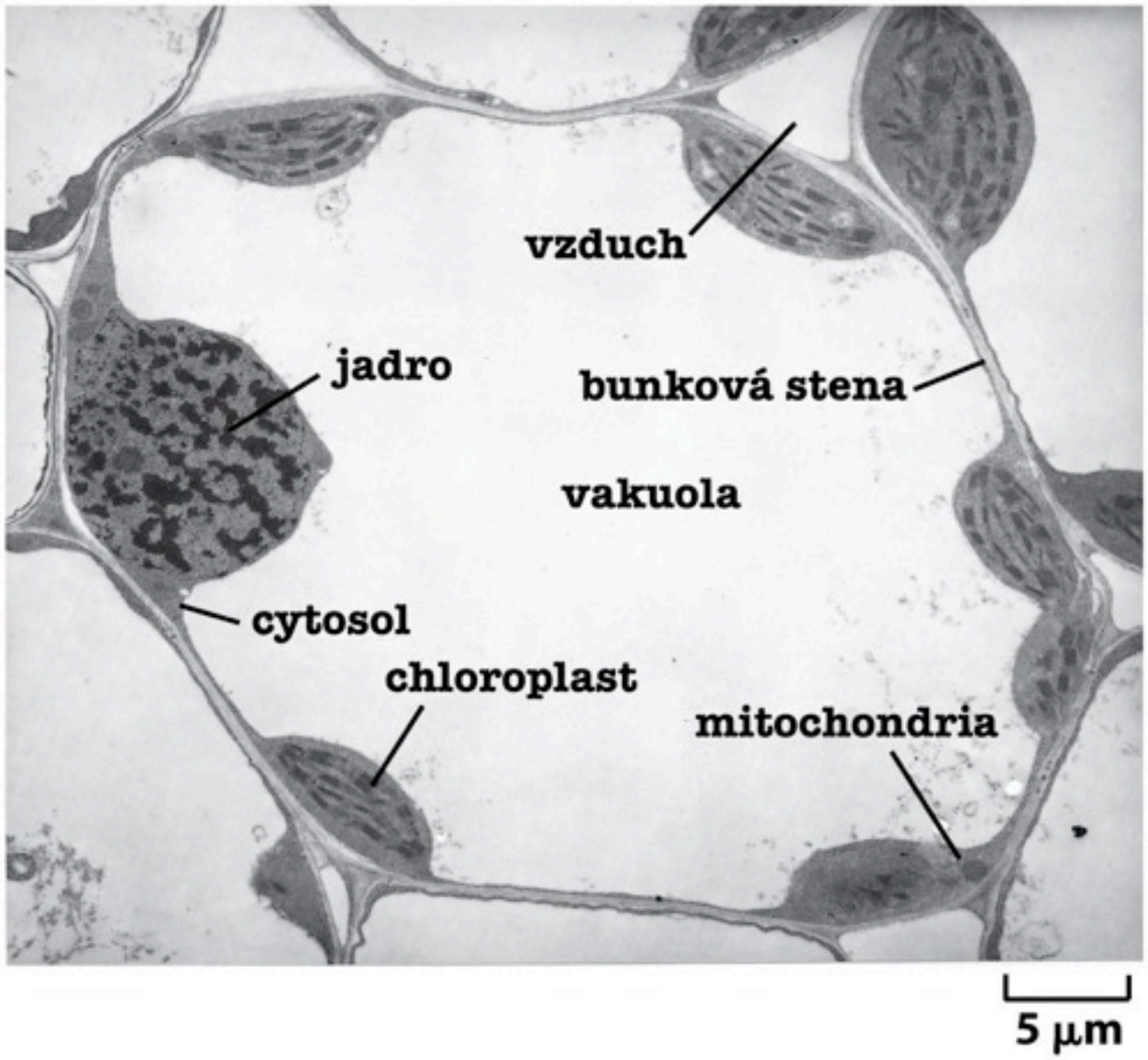


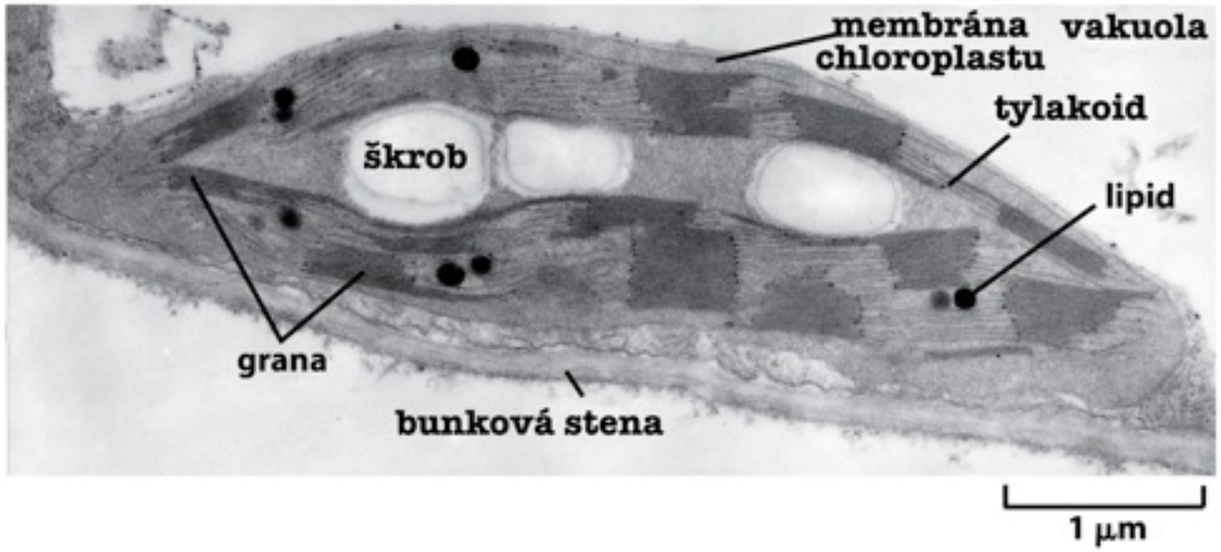
(Bolender a kol. EMBO reports (2008) **9**, 42 - 49)

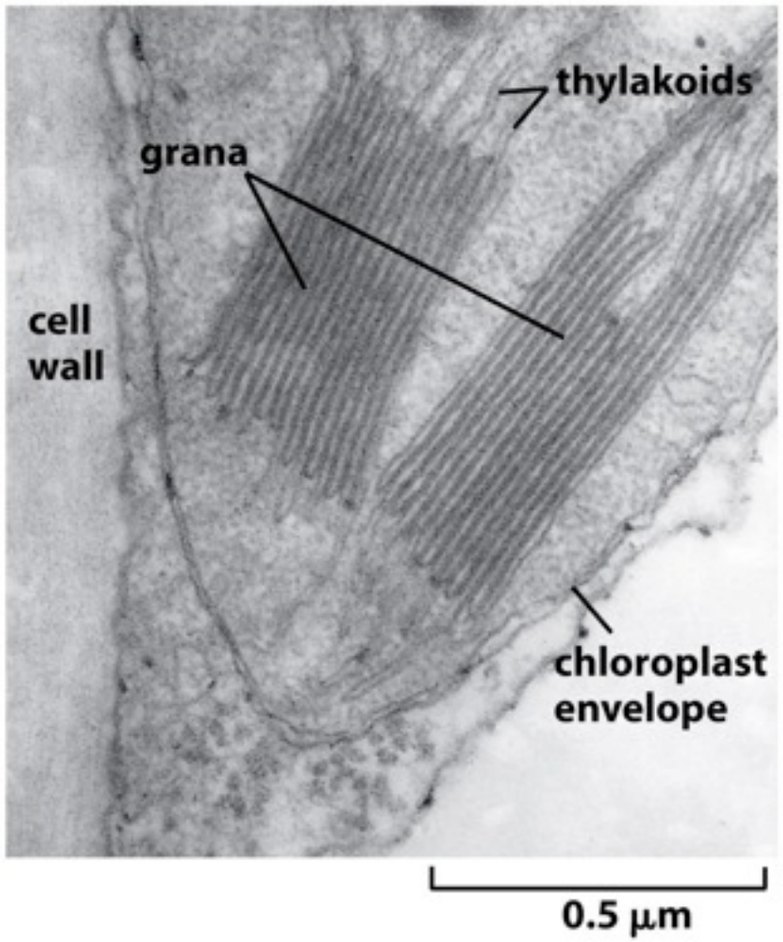
Chloroplasty



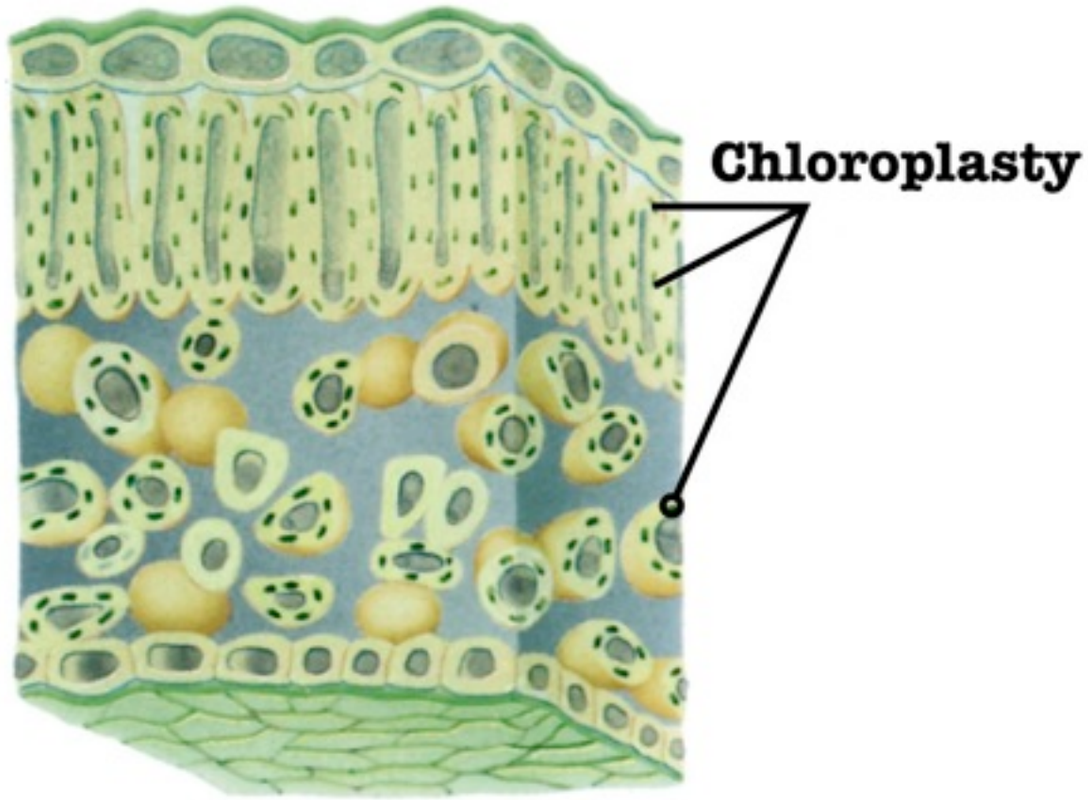
Chloroplasty

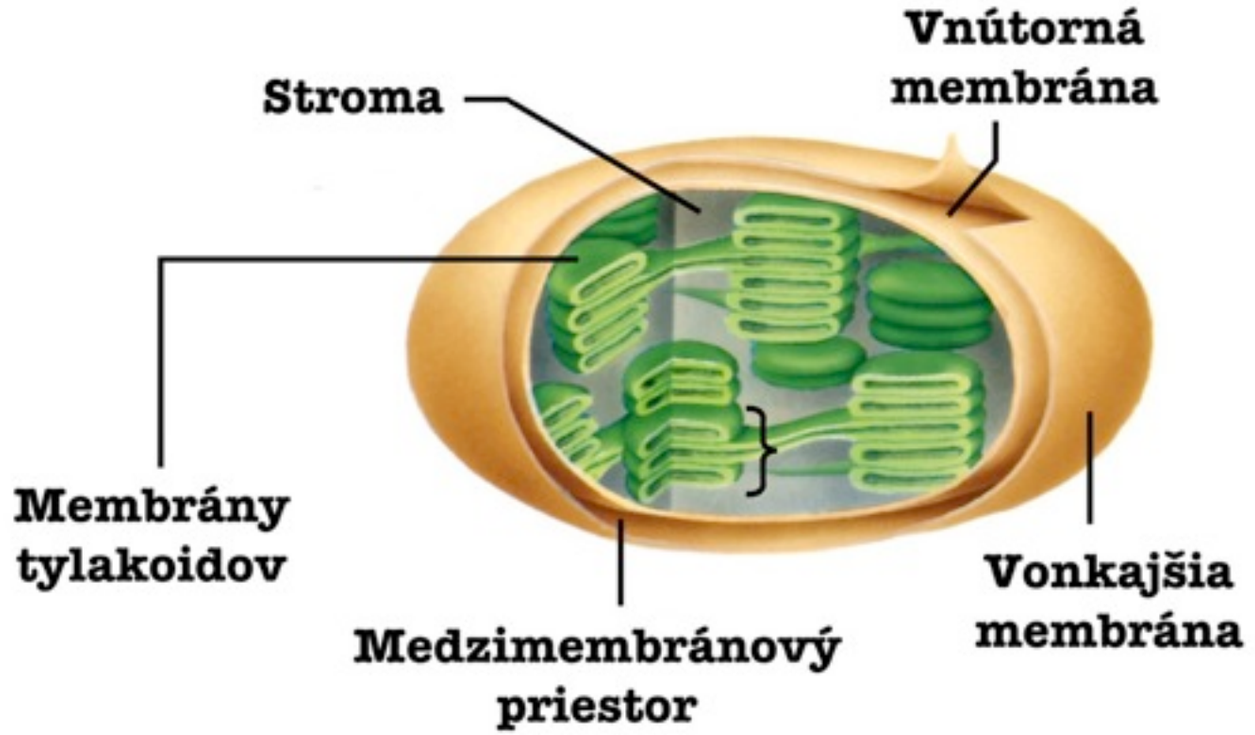




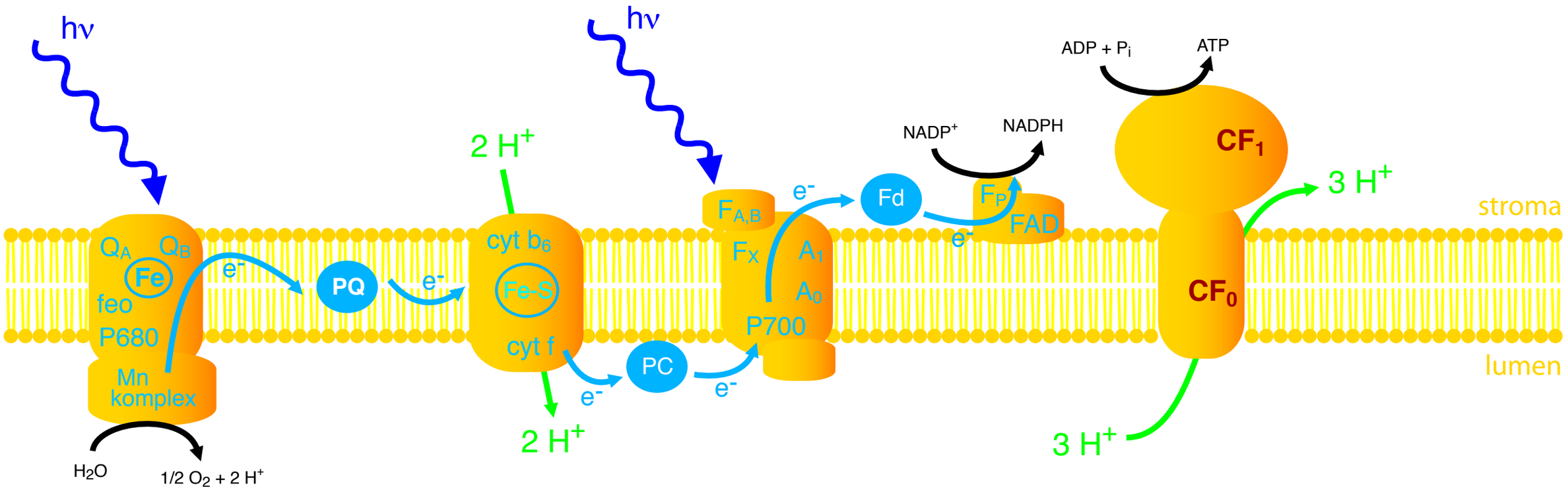


Chloroplasty



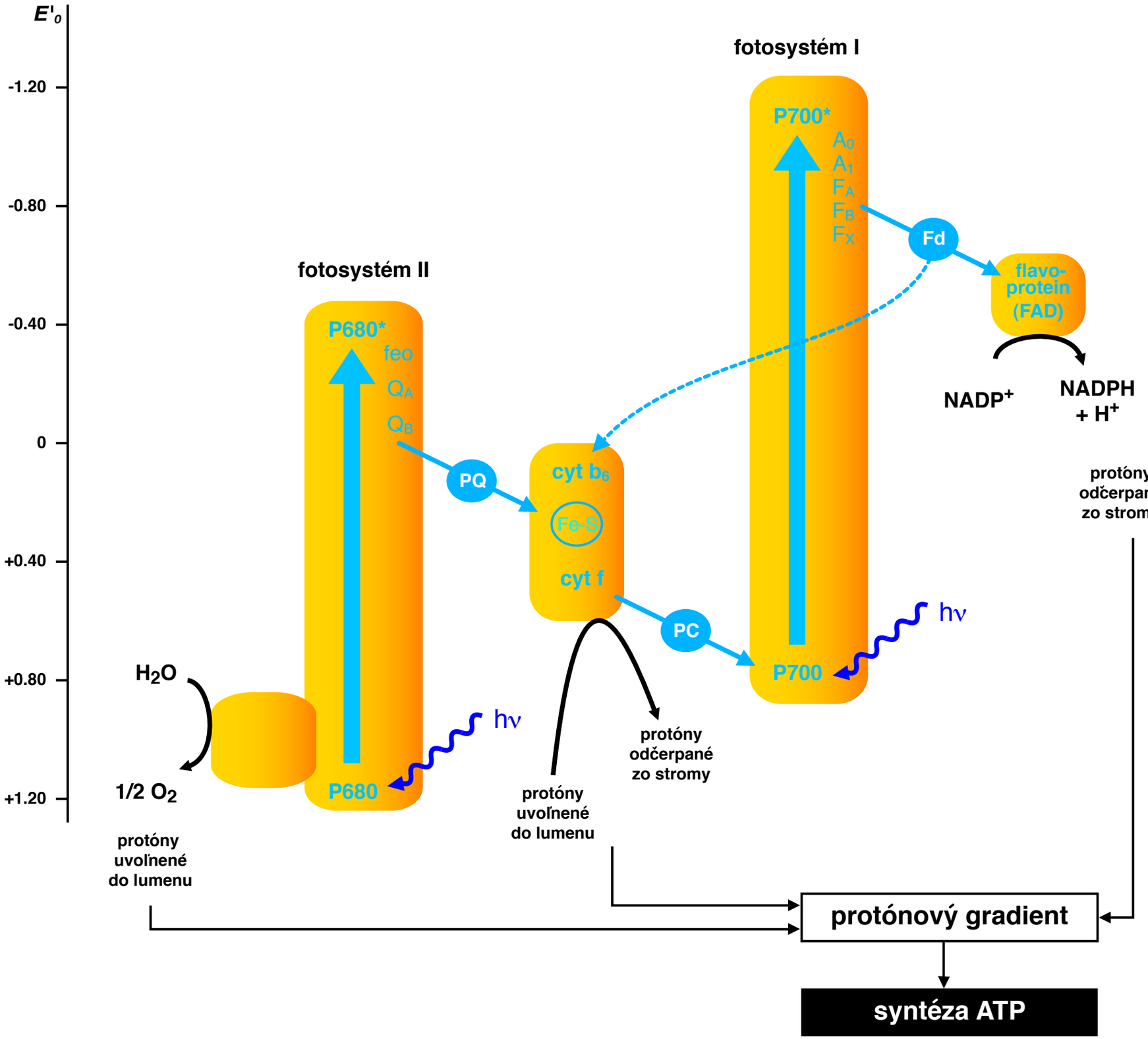


Fotofosforylácia

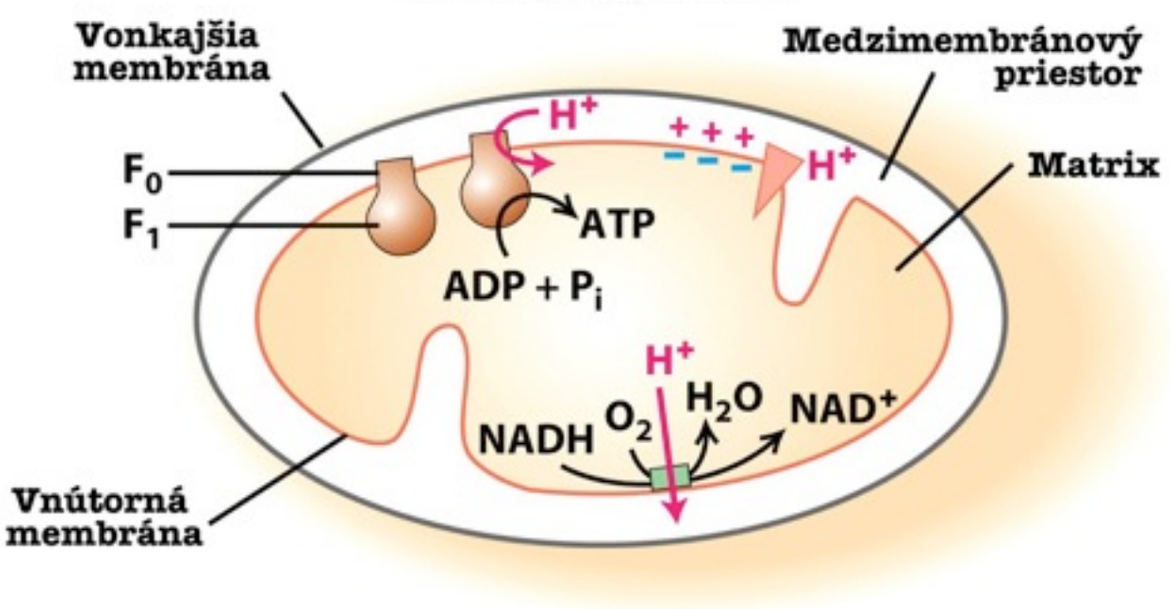


fotosystém II komplex b_6-f fotosystém I NADPreduktáza ATPsyntáza

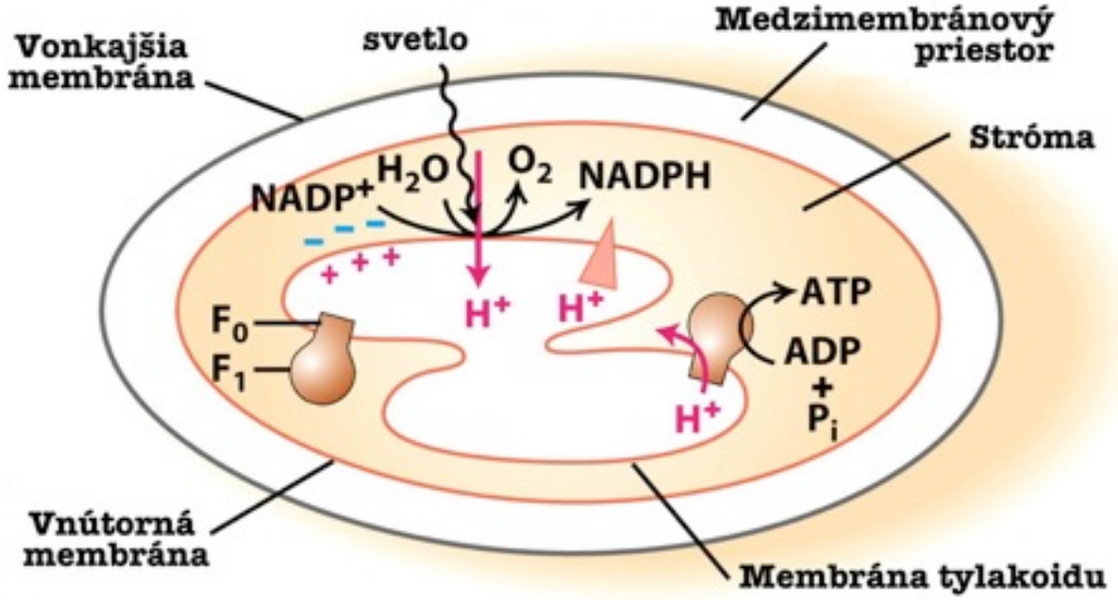
plastochynón plastokynín feredoxín


E'0
-1.20
-0.80
-0.40
0
+0.40
+0.80
+1.20
fotosystém I
P700*
A0
A1
FA
FB
FX
Fd
flavo-protein (FAD)
NADP+
NADPH + H+
protóny odčerpané zo stromy
fotosystém II
P680*
feo
QA
QB
PQ
cyt b6
Fe-S
cyt f
PC
P700
hν
H2O
1/2 O2
P680
hν
protóny odčerpané zo stromy
protóny uvoľnené do lumenu
protóny uvoľnené do lumenu
protónový gradient
syntéza ATP

Mitochondria



Chloroplast



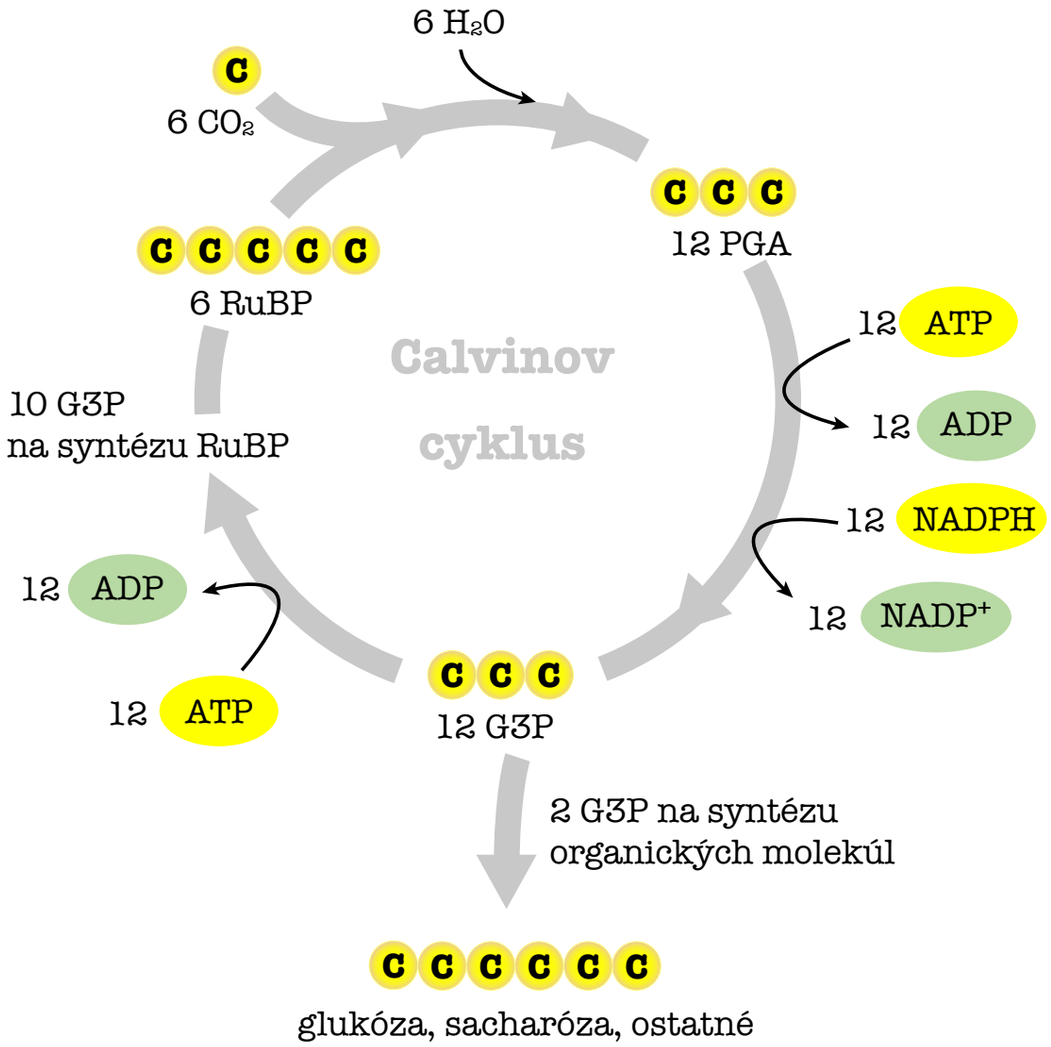
Fixácia CO_2 a jeho konverzia na sacharidy

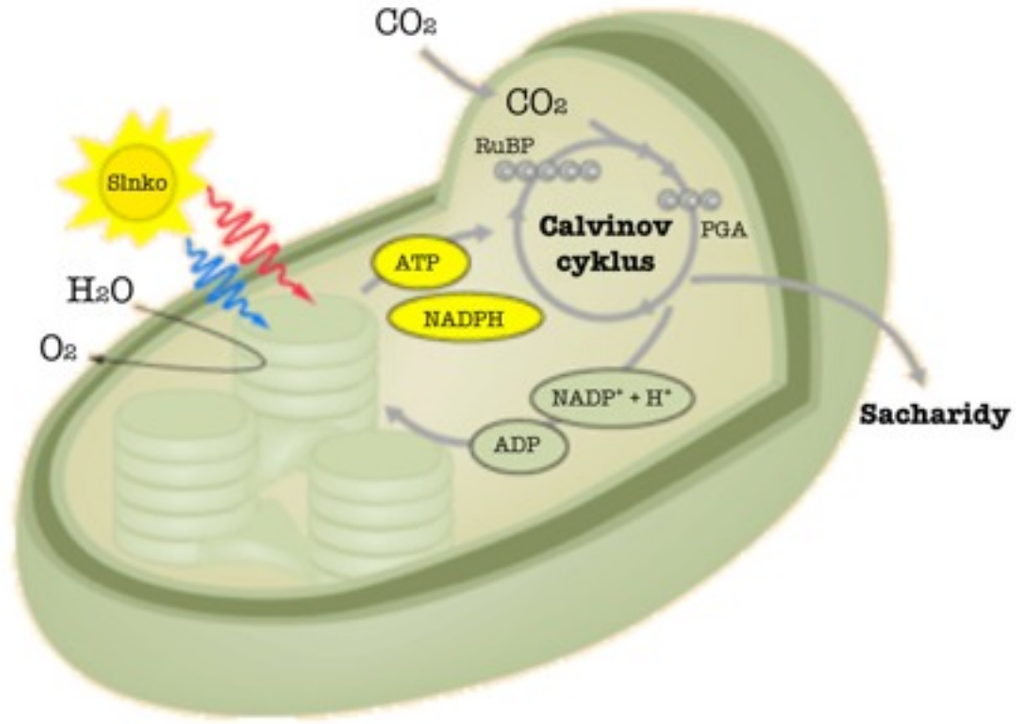
Nobelova cena

1961 **Melvin Calvin**

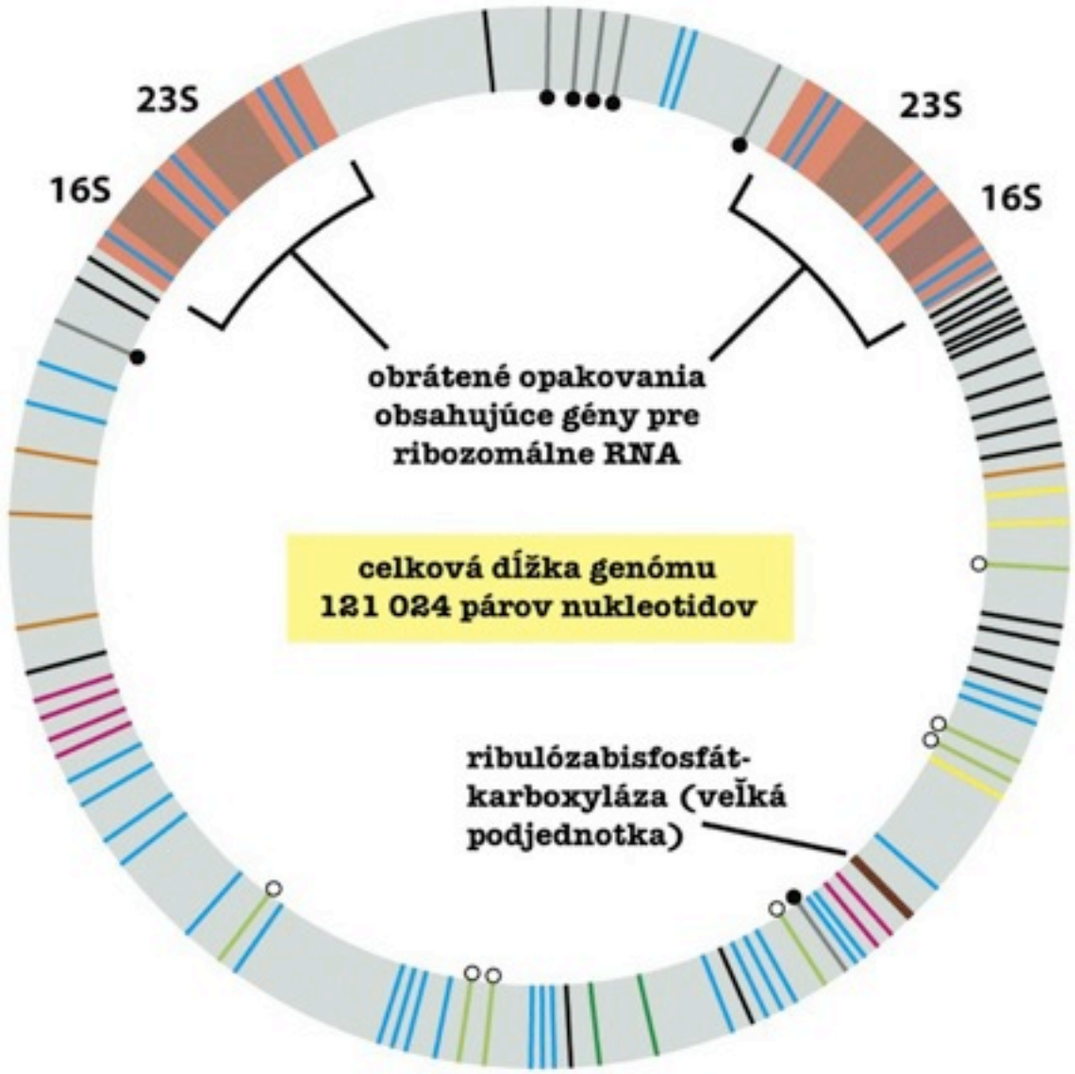
Za výskum asimilácie CO_2 v rastlinách..

Fixácia CO_2 a jeho konverzia na sacharidy





Chloroplasty majú vlastný genóm



mtDNA Pečeňovky

Komponenty kódované plastidovou DNA

Funkcia	Počet génov
Gény pre genetický aparát	
rRNAs (23S, 16S, 5S, 4.5S)	**4**
tRNAs	**30**
Ribosomálne proteíny	**21**
podjednotky RNA-polymerázy	**4**
Gény pre fotosyntézu	
Fotosystém I	**5**
Fotosystém II	**12**
Cytochróm bf complex	**4**
ATPsyntáza	**6**
Ribulózabisfosfátkarboxyláza	**1**

Chloroplastové proteíny syntetizované v cytosole sú do chloroplastov importované