

The Oroboros Ecosystem
High-Resolution Respirometry HRR



The NextGen O2k all-in-one: Q-Module, NADH-Module, and PhotoBiology-Module

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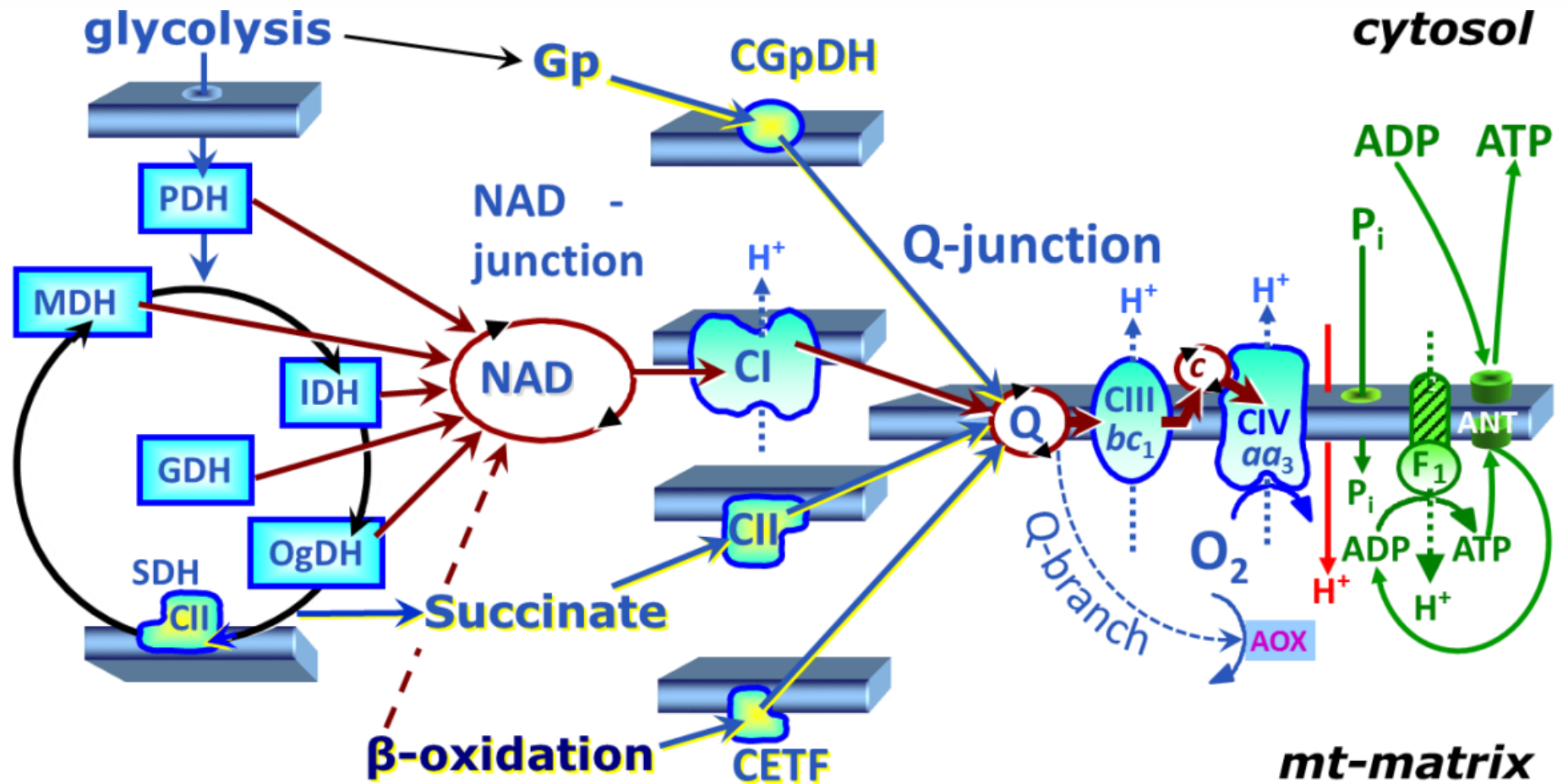


Schröcken 2023-10-06

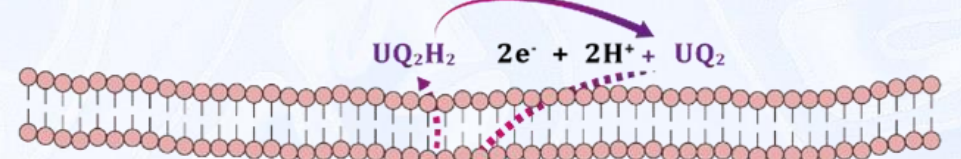
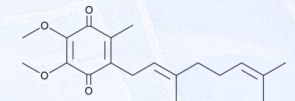
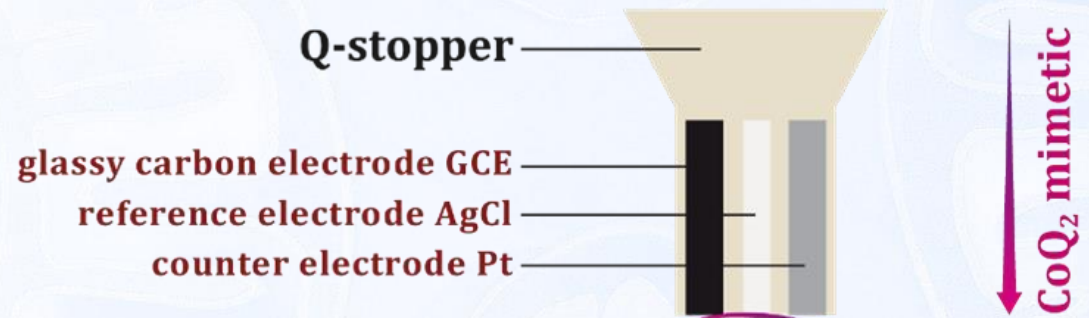
Q-Module

Analysis of coenzyme Q redox state

Q-junction

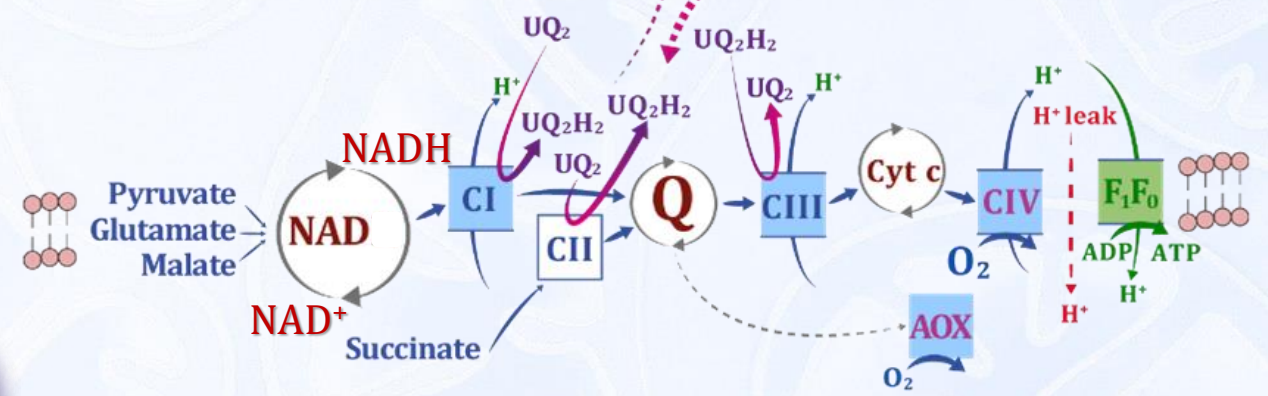


Q-Module



Q-Module

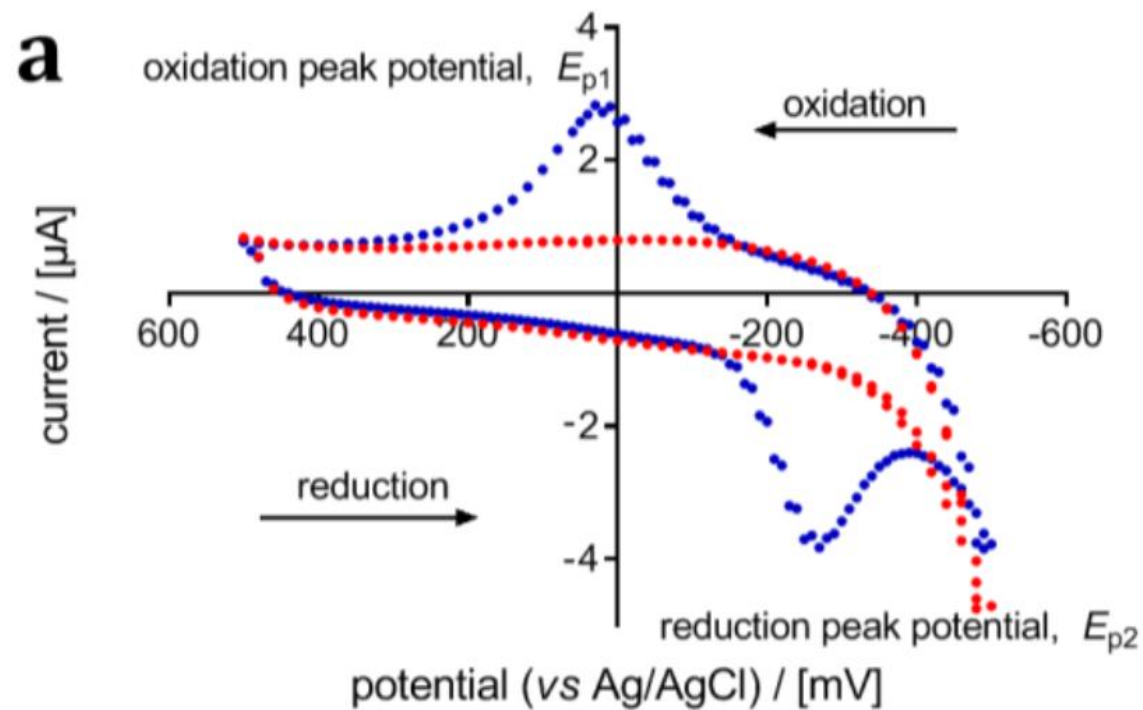
Q-stopper



Q-Module Polishing



Cyclic voltammetry

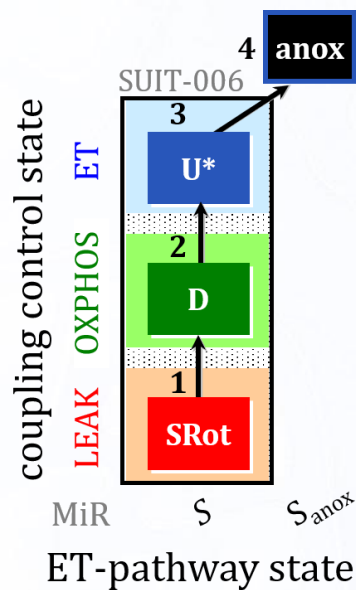


Simultaneous HRR and Q redox state S-pathway

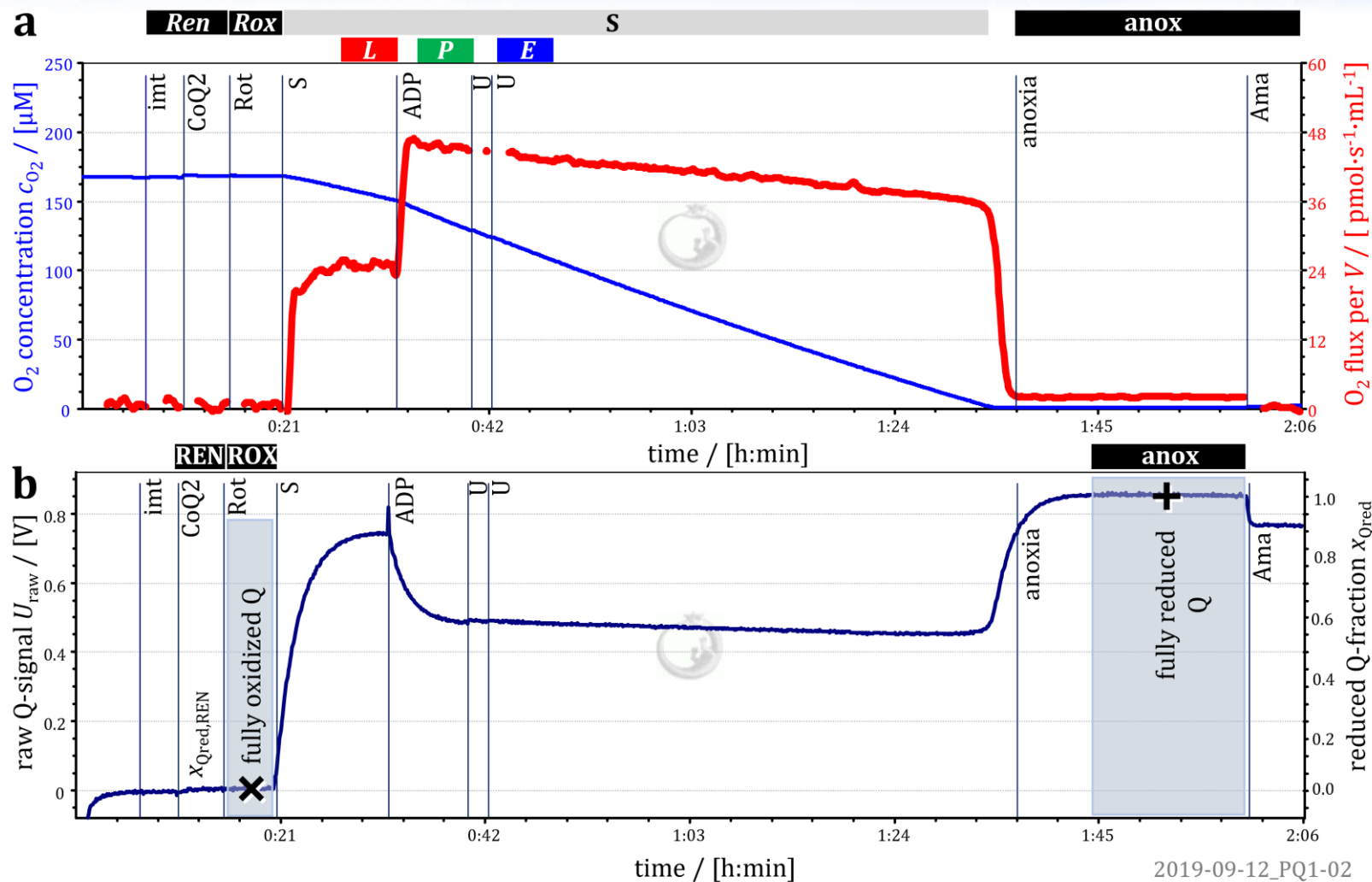


SUIT-031 Q mt D071

Isolated cardiac
mitochondria

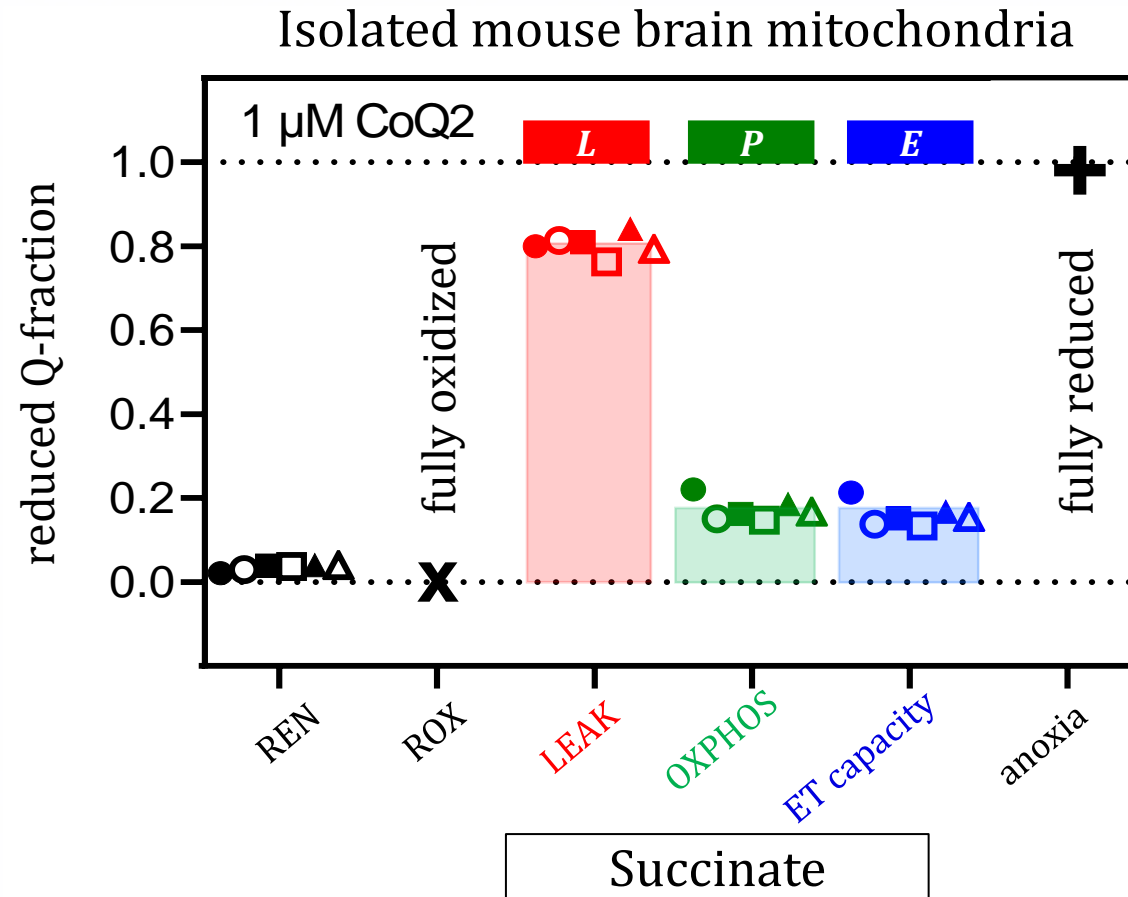


MiR06



Reduced Q fraction in different coupling control states

High reproducibility in different coupling control states



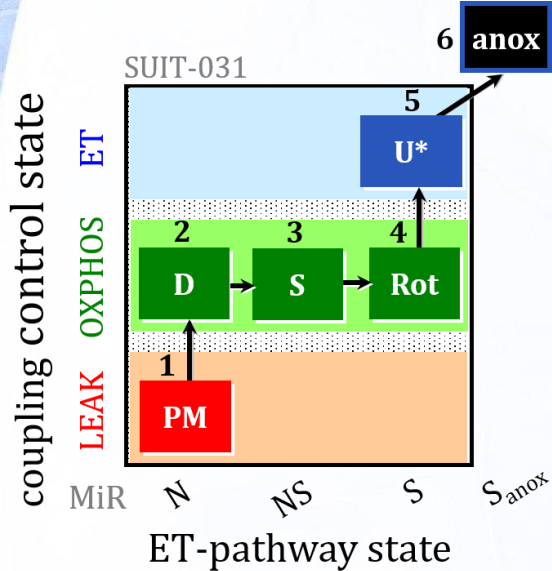
Simultaneous HRR and Q redox state

N-pathway



SUIT-031 Q mt D072

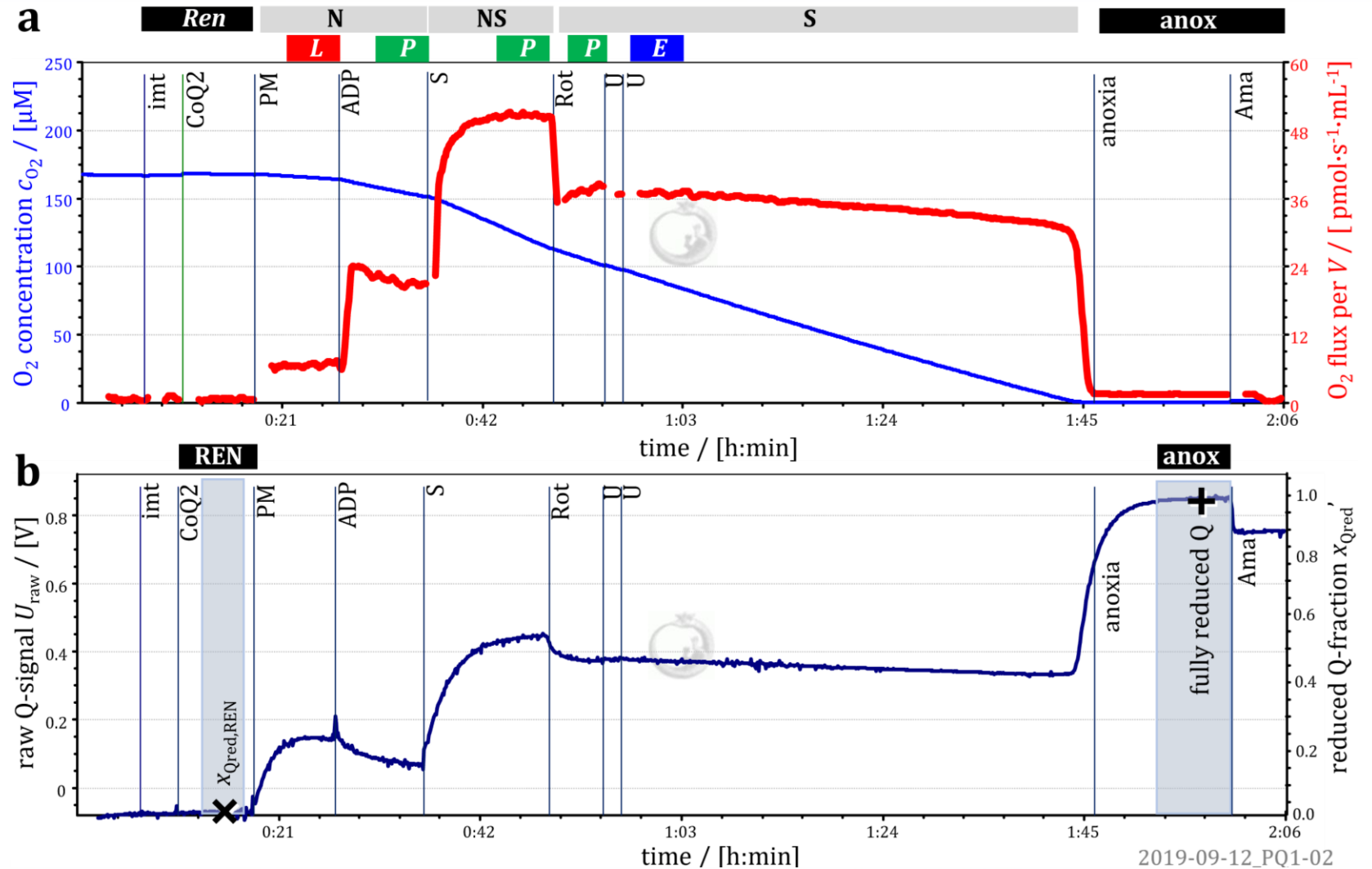
Isolated **cardiac** mitochondria



MiR06

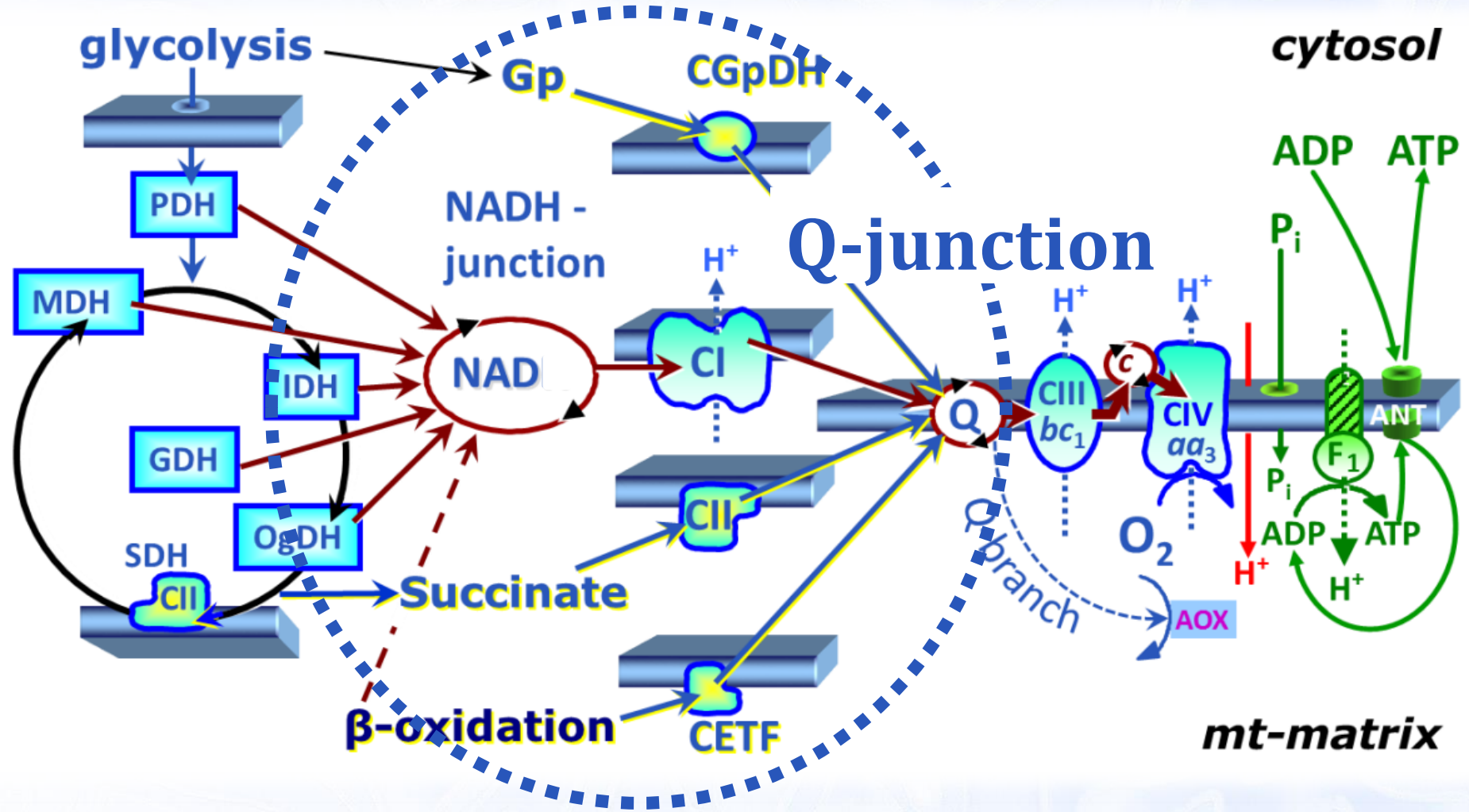


Komlodi T, Cardoso LHD, Doerrier C, Moore AL, Rich PR, Gnaiger E. *Bioenerg Commun* 2021.3.



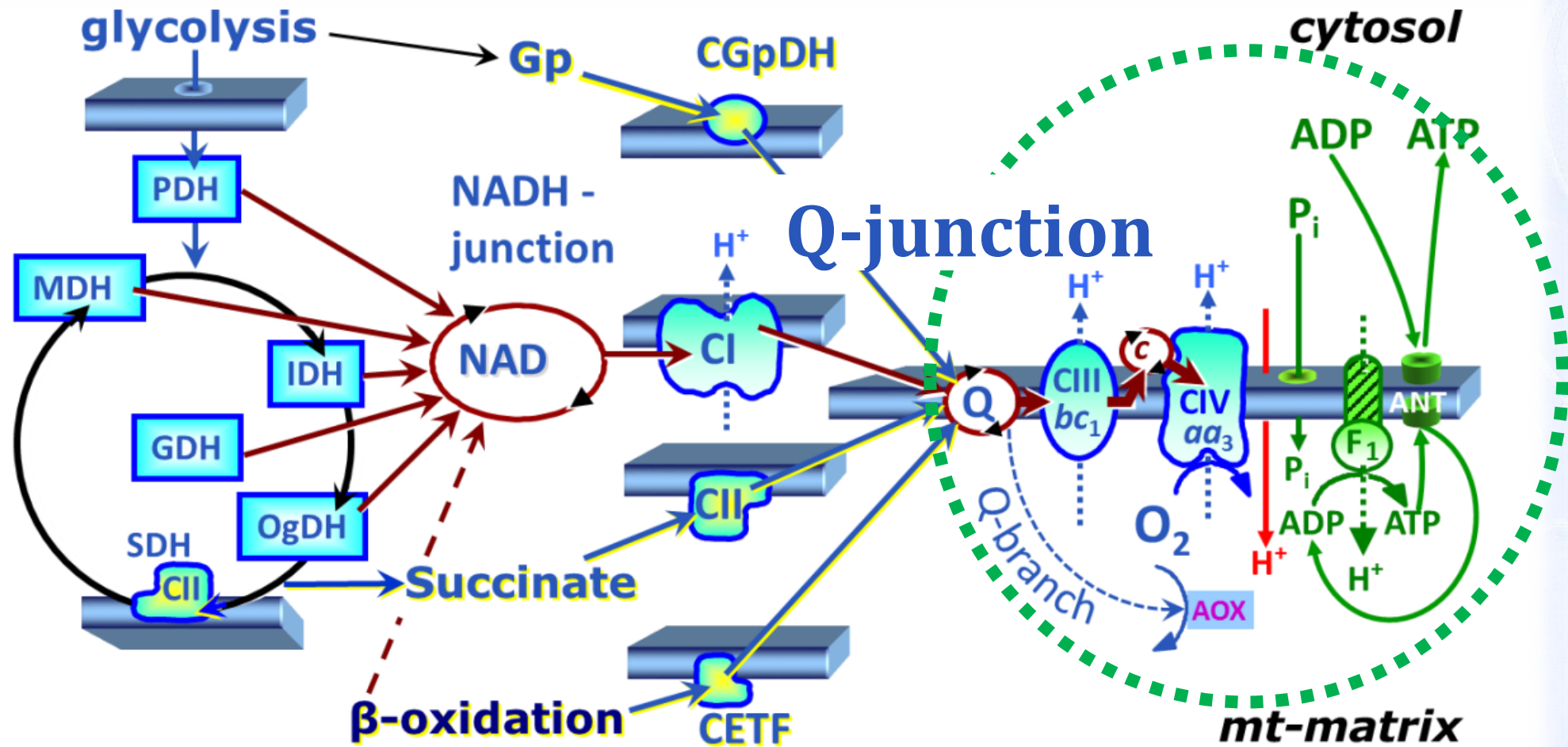
ET-pathway control and the Q junction

e⁻ push



Coupling control and the Q junction

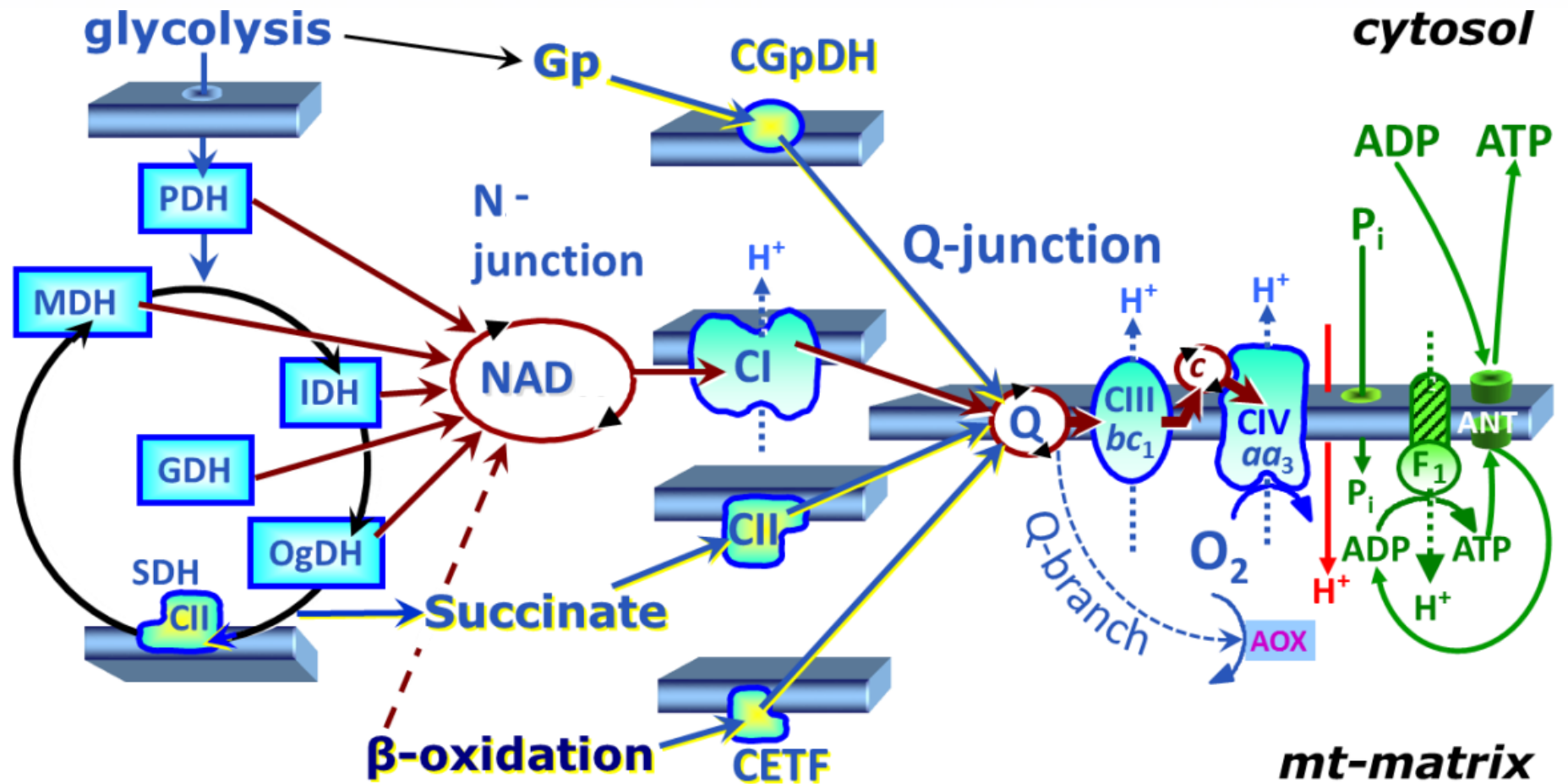
→ **H⁺ pull**



NADH-Module

Analysis of NAD redox state

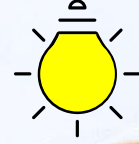
N-junction



NADH-Module



Integrated UV
light



NADH-sensor

NADH-
Module

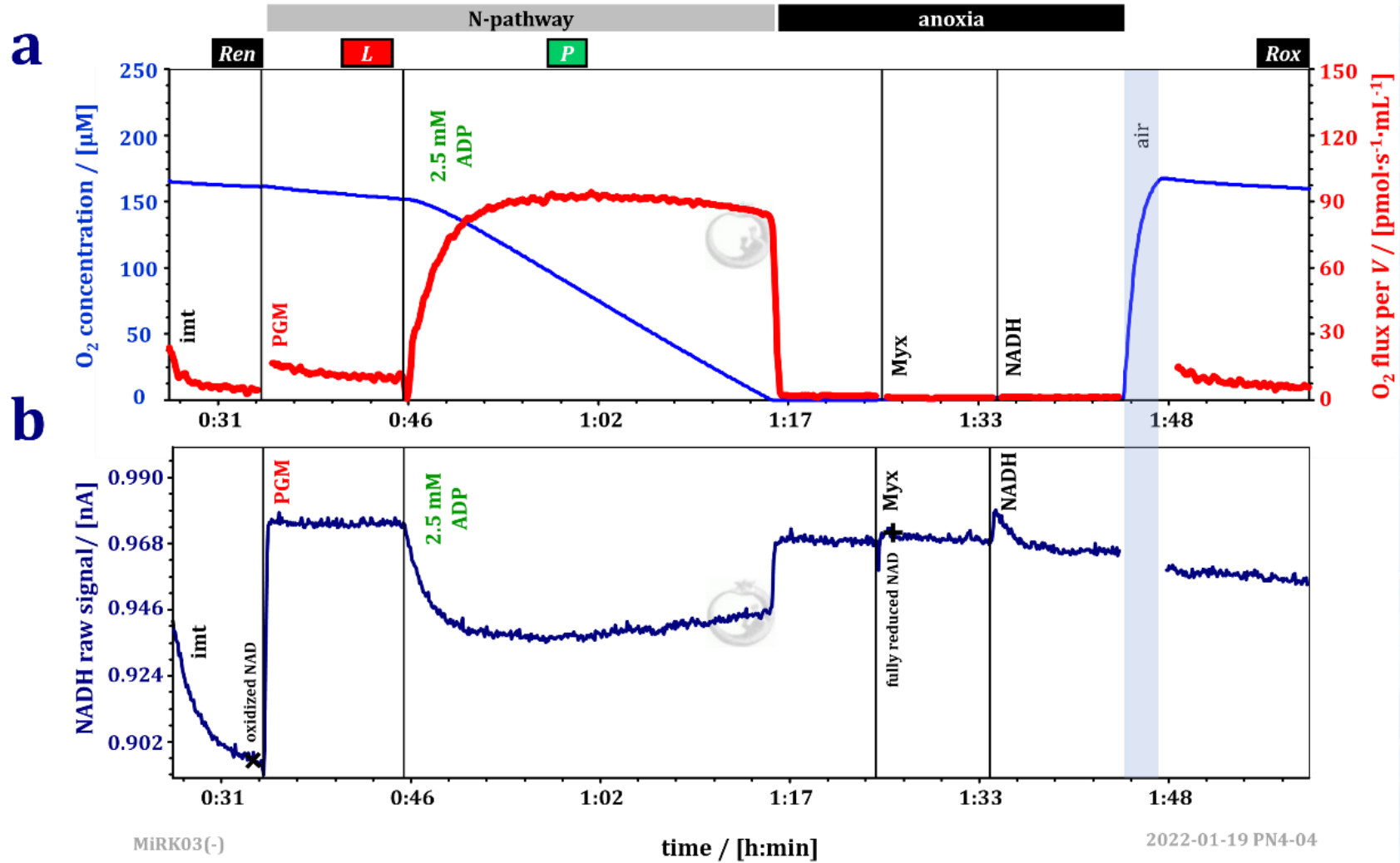


Simoultaneous HRR and N-redox state



Mouse liver isolated mitochondria

SUIT-032 NADH mt D078



MiRK03(-)

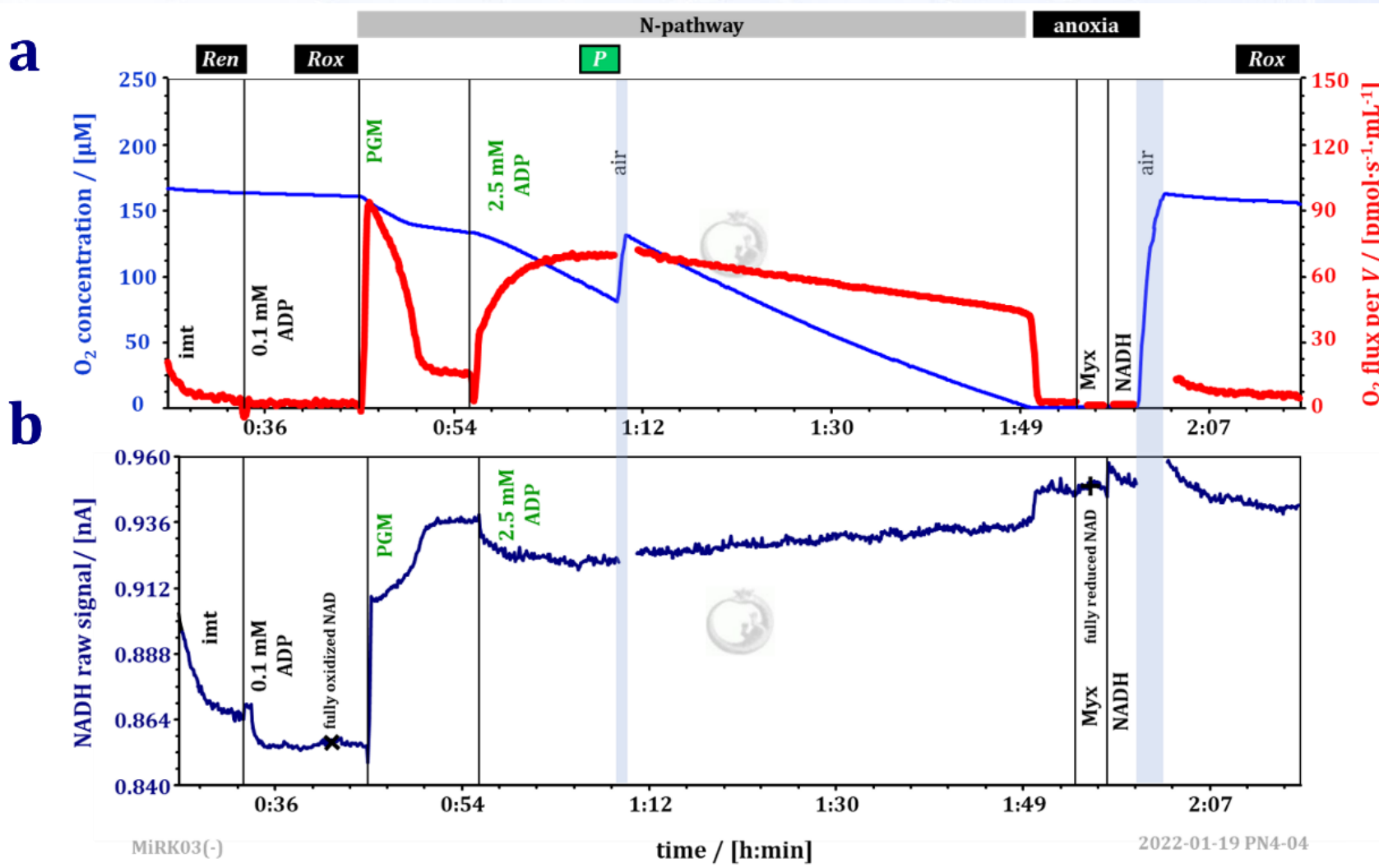
REN: residual endogenous substrates

Simoultaneous HRR and N-redox state



Mouse liver isolated mitochondria

SUIT-033 NADH mt D081



MiRK03(-)

REN: residual endogenous substrates

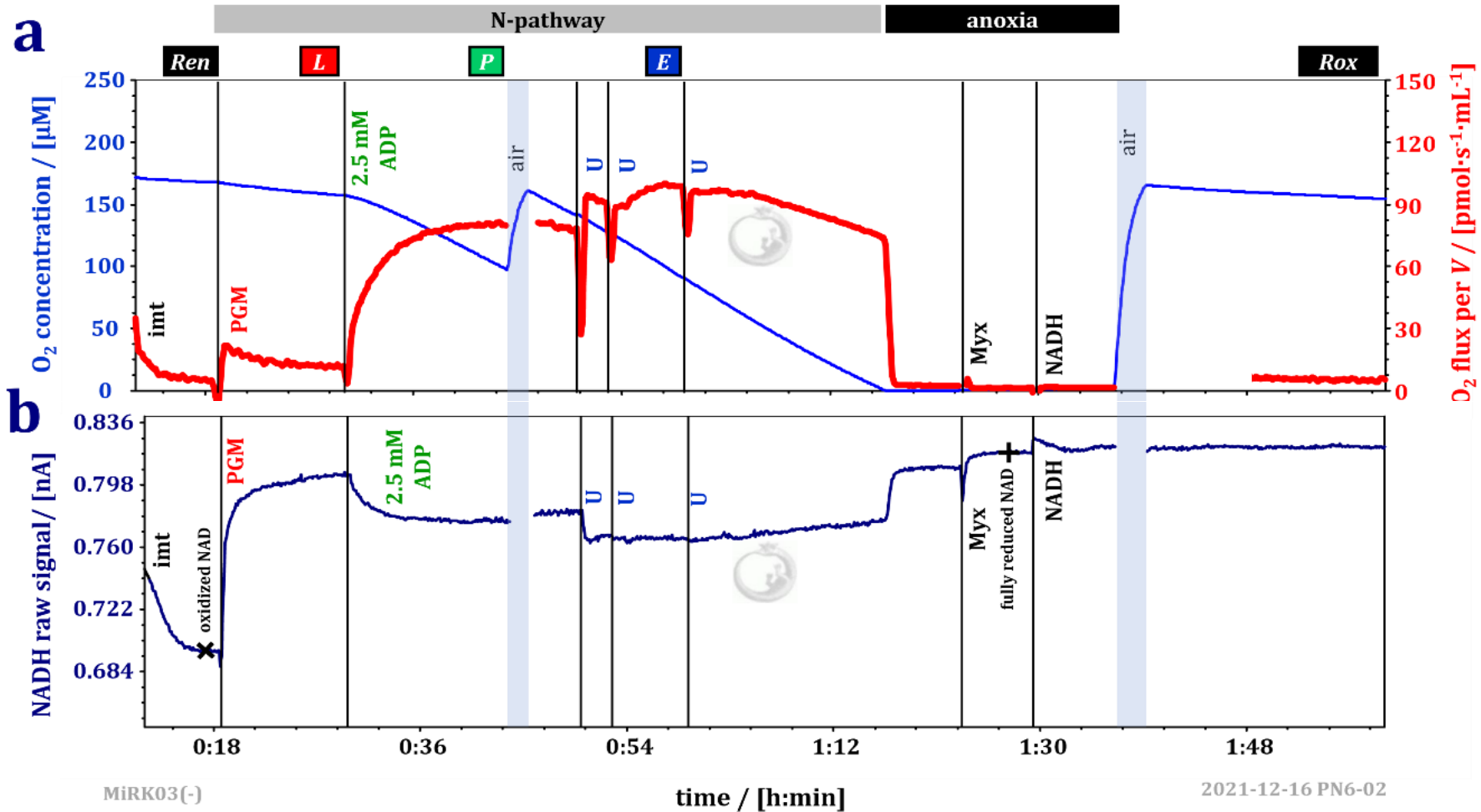
2022-01-19 PN4-04

Simultaneous HRR and N-redox state



Mouse liver isolated mitochondria

SUIT-006 NADH mt D084



SF6847

MiRK03(-)

MiRK03(-)

2021-12-16 PN6-02

REN: residual endogenous substrates

Analysis: reduced NADH-fraction

OROBOROS INSTRUMENTS

7 NADH calibration: Chamber

O₂ calibration
 O₂ calibration
 NADH calibration
 NADH calibration

Fully oxidized

State	Select mark	NADH raw [μ A/1000]
REN	1mt	0.9020
<input type="button" value="Update mark value"/>		

Fully reduced

State	Select mark	NADH raw [μ A/1000]
ROX_anoxia	3Myx	0.9700
<input type="button" value="Update mark value"/>		

[MitoPedia: NADH calibration](#)

REN: residual **e**ndogenous substrates

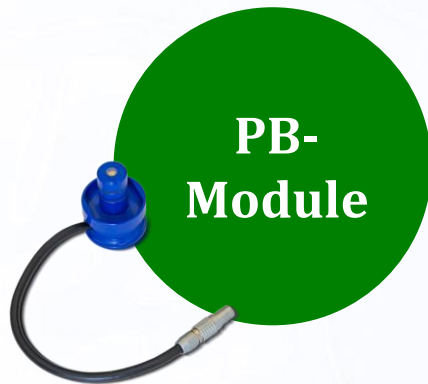
PhotoBiology-Module

Photosynthesis and beyond

PB-Module

Controlled light intensities

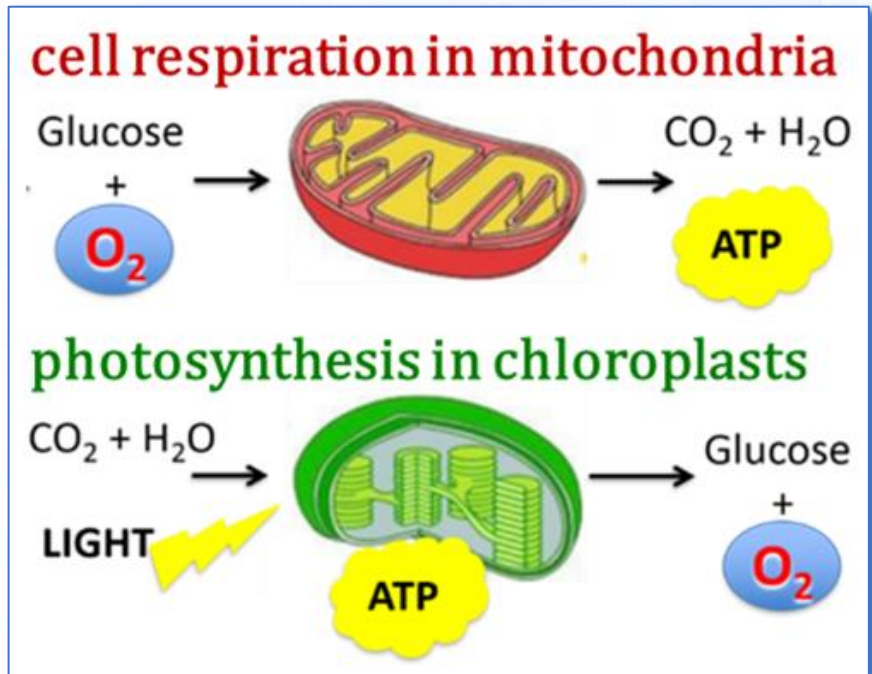
○ ● ● 10 to 2700 $\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$



Algae bioenergetics

Mitochondria and Chloroplasts

Respiration { **Dark respiration *DR***
Light enhanced dark respiration *LEDR*

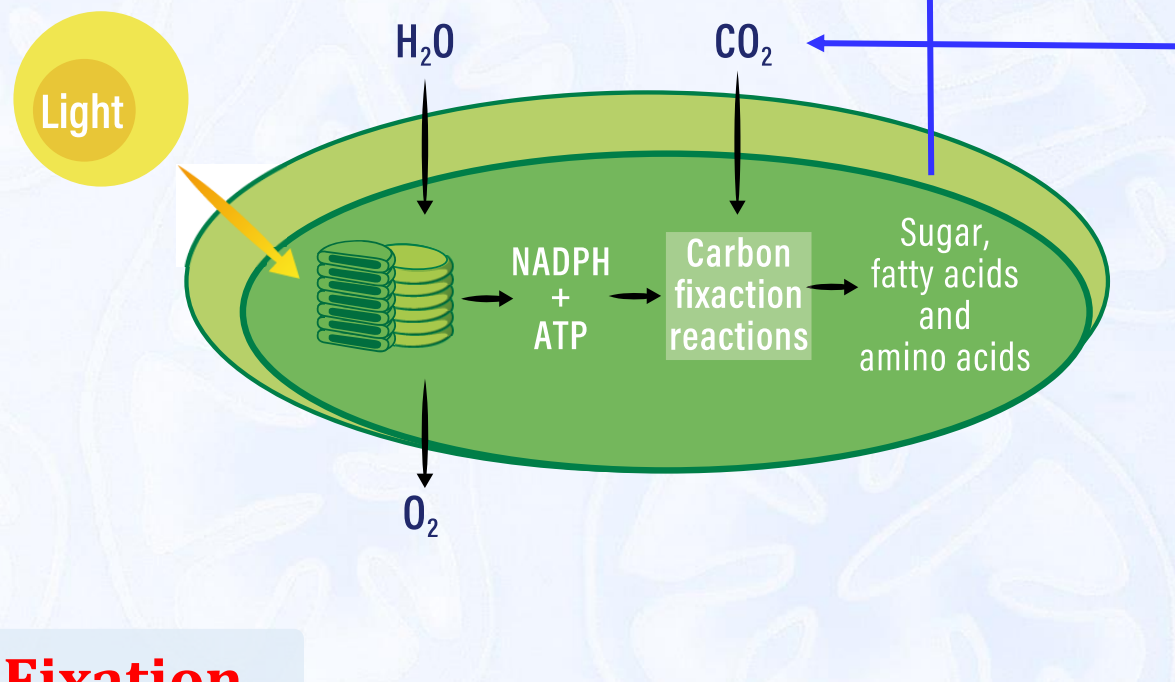


Went et al (2021) MitoFit Preprints 2021.5.

Photosynthesis

CO_2 Fixation

Bioproducts



Setting light intensity

PhotoBiology ✕

Set light intensity for both chambers

$\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$ Apply Switch off

Set light intensity program for both chambers

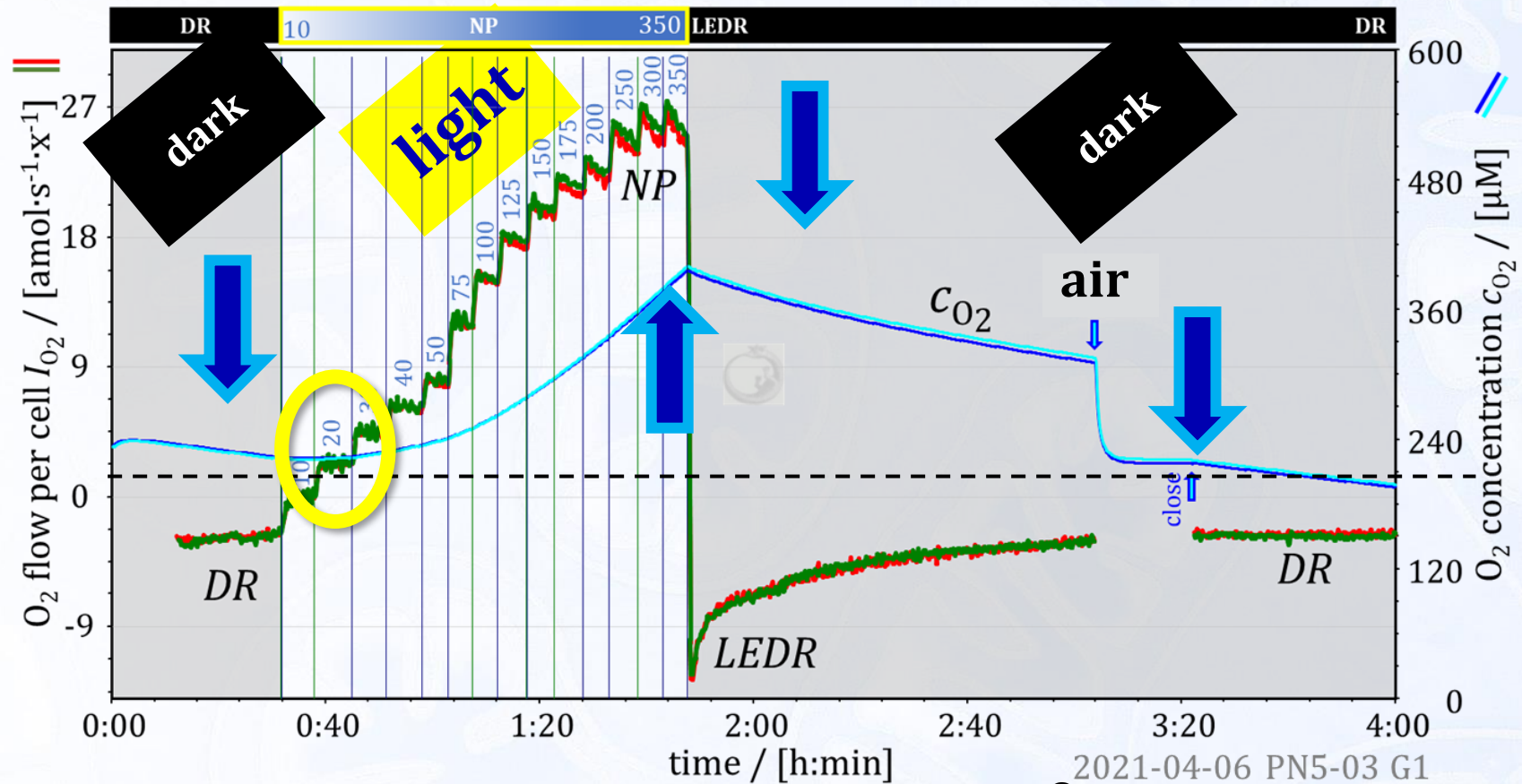
Program: Open Save

	Step duration [s]	Intensity [$\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$]
1	30	10
2	30	20
3	30	40
4	30	60
5	30	100
6	30	125
7	30	150
8	30	200
9	30	250
10	30	300
11	0	0
12	0	0

Start light intensity program Stop light intensity program Reset light intensity program

[? MitoPedia: PhotoBiology](#) Quality control Close

Net photosynthesis NP and light enhanced dark respiration $LEDR$



O_2 ↓
dark
respiration

O_2 ↑
net
photosynthesis

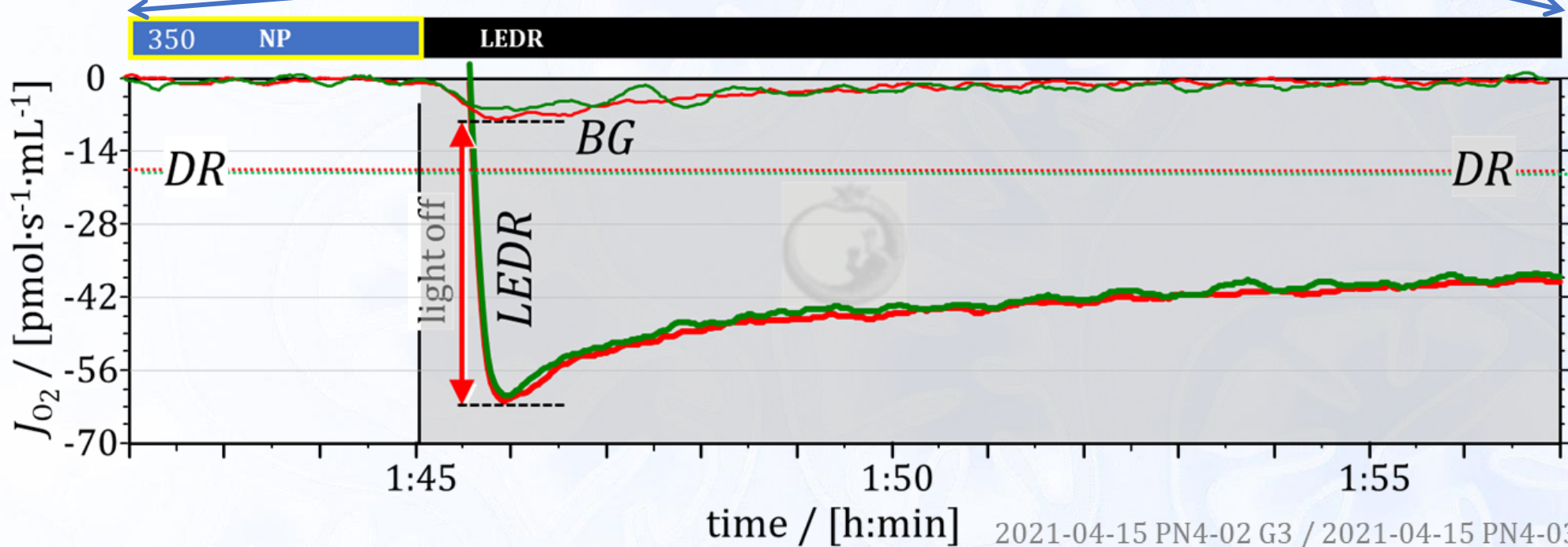
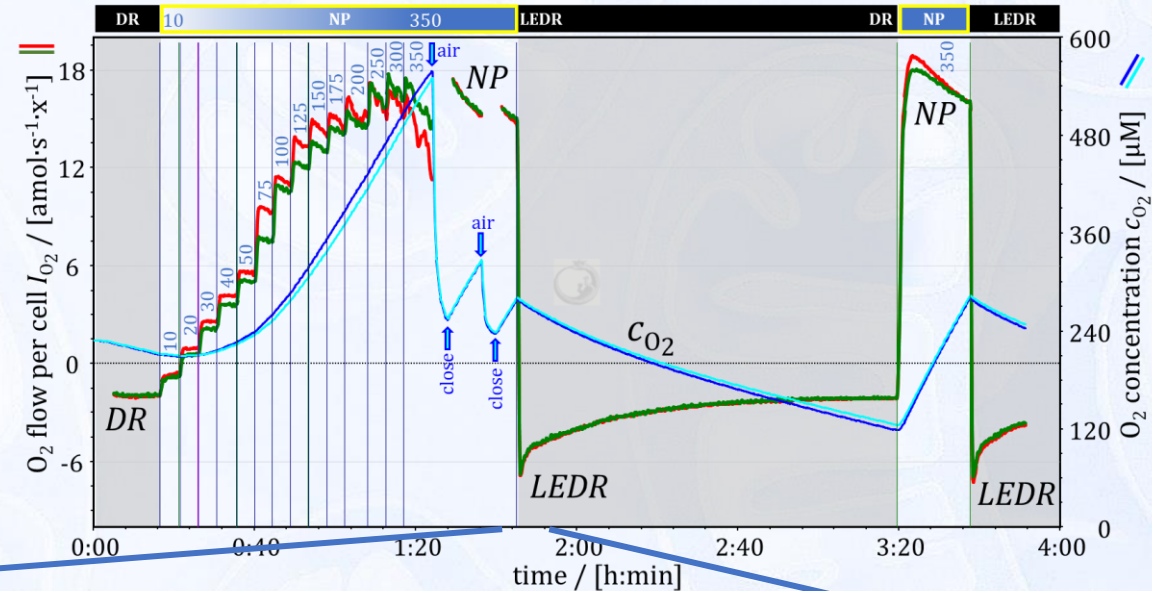
O_2 ↓
light-enhanced
dark respiration $LEDR$

blue LED, 10 to 350 $\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$

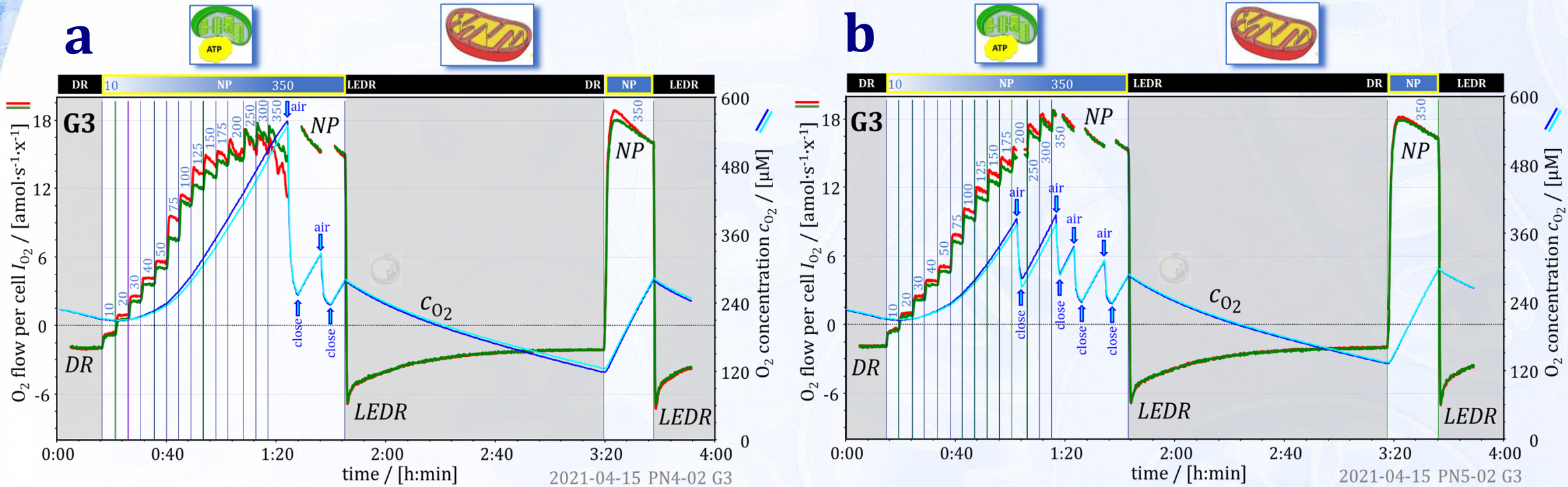
LEDR

Light-enhanced dark respiration

high time resolution
and background correction BG



Net photosynthesis NP under controlled O_2 levels



Went et al (2021) Oxygen dependence of photosynthesis and light-enhanced dark respiration studied by High-Resolution PhotoRespirometry. MitoFit Preprints 2021.5.

Thank you!



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