



## Effect of nickel and Iron stress on photosynthesis and metabolite production of *Heterocapsa* cf. *bohaiensis* (dinoflagellate).

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# Effect of nickel and iron stress on photosynthesis and metabolite production of *Heterocapsa cf. bohaiensis* (dinoflagellate)

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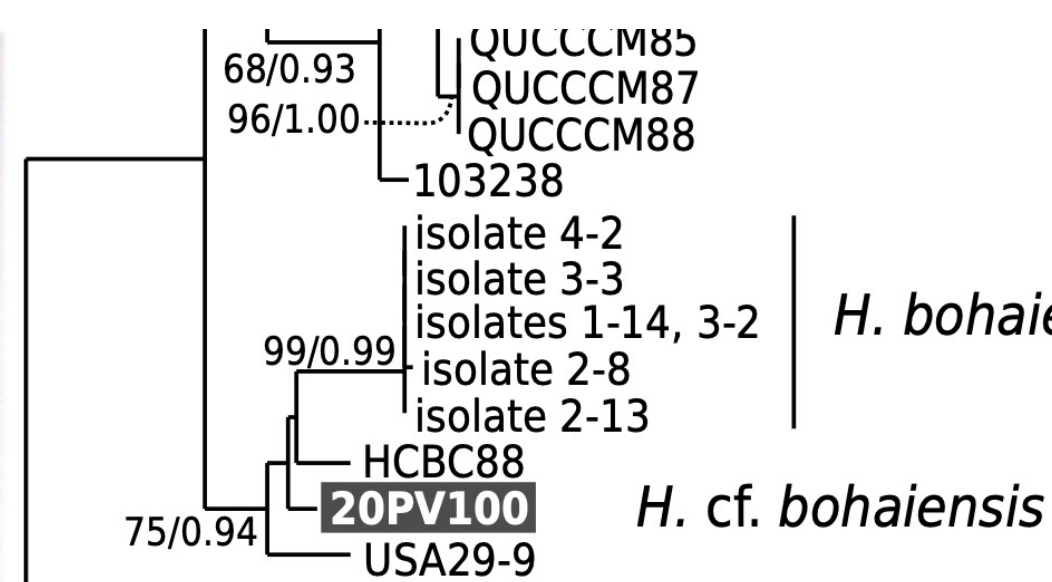
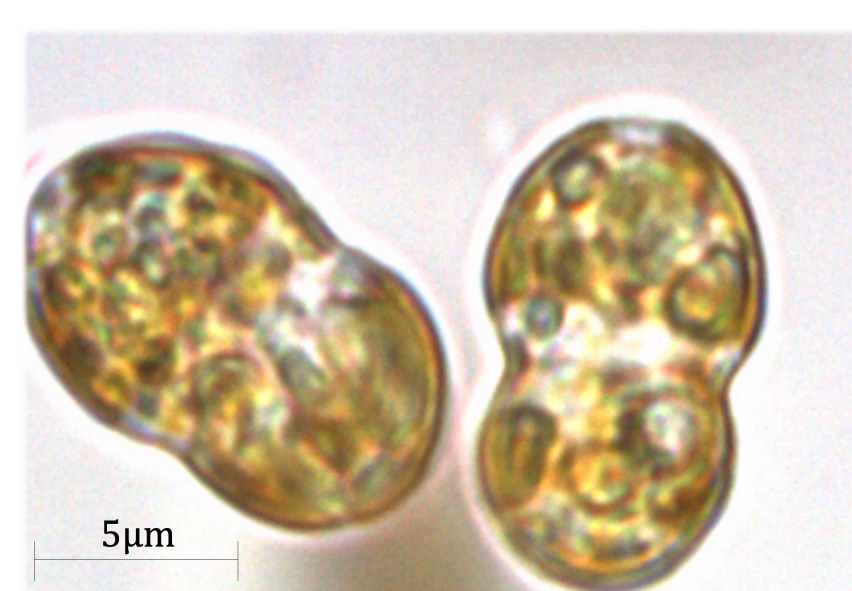
## Introduction

- New Caledonian coastal waters are rich in **Trace Metal Elements** owing to the presence of **ultramafic soils** on 1/3 of its land surface. Trace Metal Elements are naturally present on coastal ecosystems as a result of **leaching** and **natural** erosion but their **concentrations** have **increased** due to **anthropic** activity and **climate change**. (Biscéré *et al.* 2017; Merrot *et al.* 2022)
- The **oxidative stress** induced by an **excess** of metallic inputs has therefore a strong capacity to impact the **physiological** response and the **metabolome** of **microalgae**.
- ***Heterocapsa cf. bohaiensis***, is a dinoflagellate with **haemolytic activity** associated to crab and shrimp **mortalities** and has been isolated in New Caledonia (Xiao *et al.* 2018; Zhang *et al.* 2019).
- Moreover, **dinoflagellates** are known to produce **metabolites of interest** (e.g. carotenoids, mycosporine amino acids, biotoxins...) with interesting bioactivity.

What are the nickel and iron impacts on *H. cf. bohaiensis* photosystems and metabolite production ?

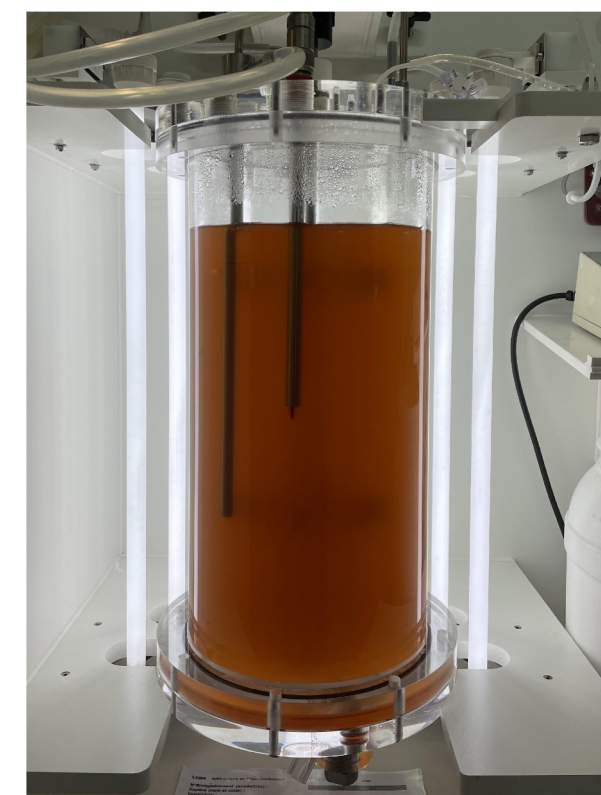
## Methods

### Identification



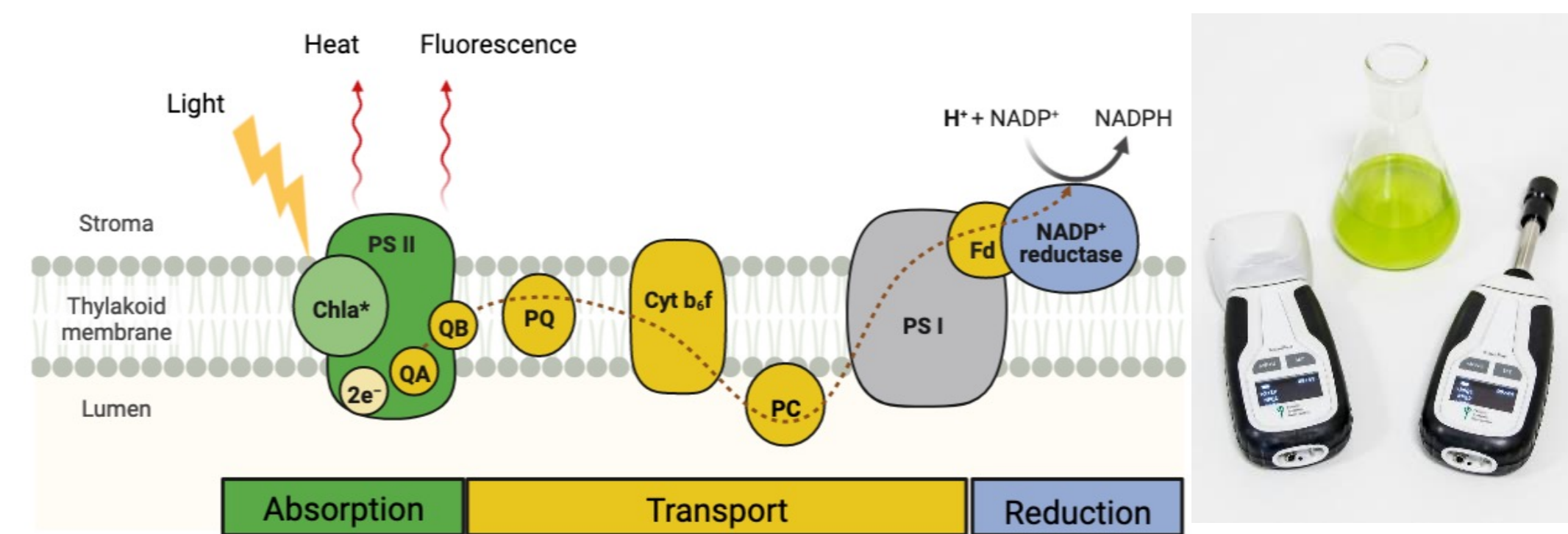
*Heterocapsa cf. bohaiensis*

### Cultivation with metals



Conditions:  
Ni, Fe or Ni-Fe [ $10^{-3}$  M]

### Photosynthetic measurements

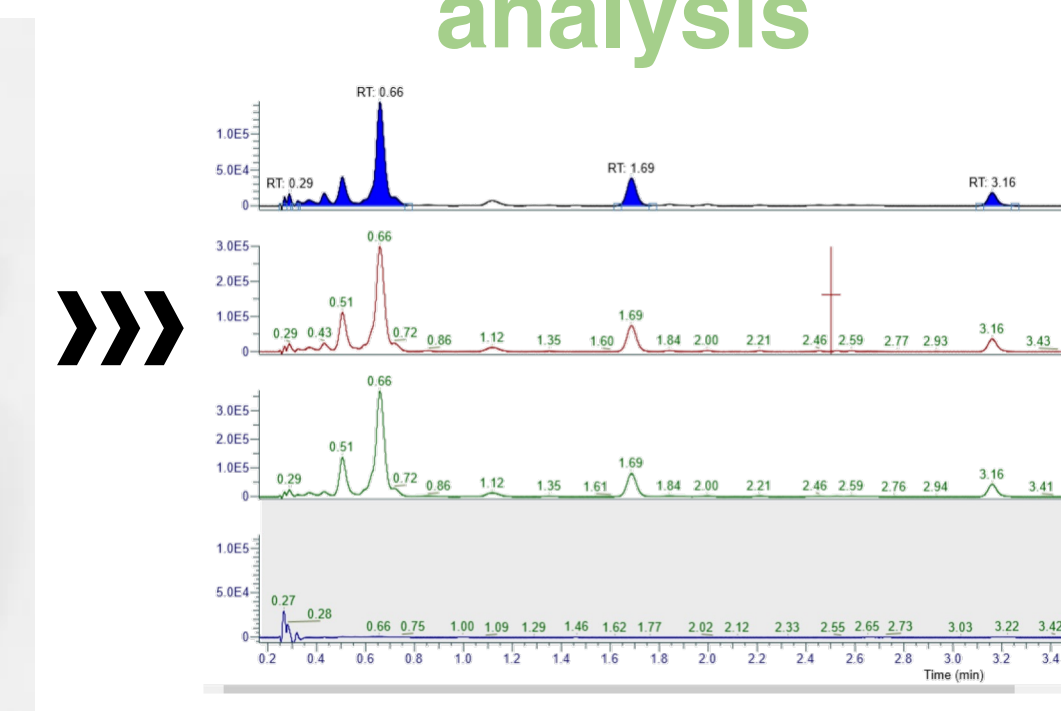


Photosystem I (PSI) and II (PSII)

Fluorometer

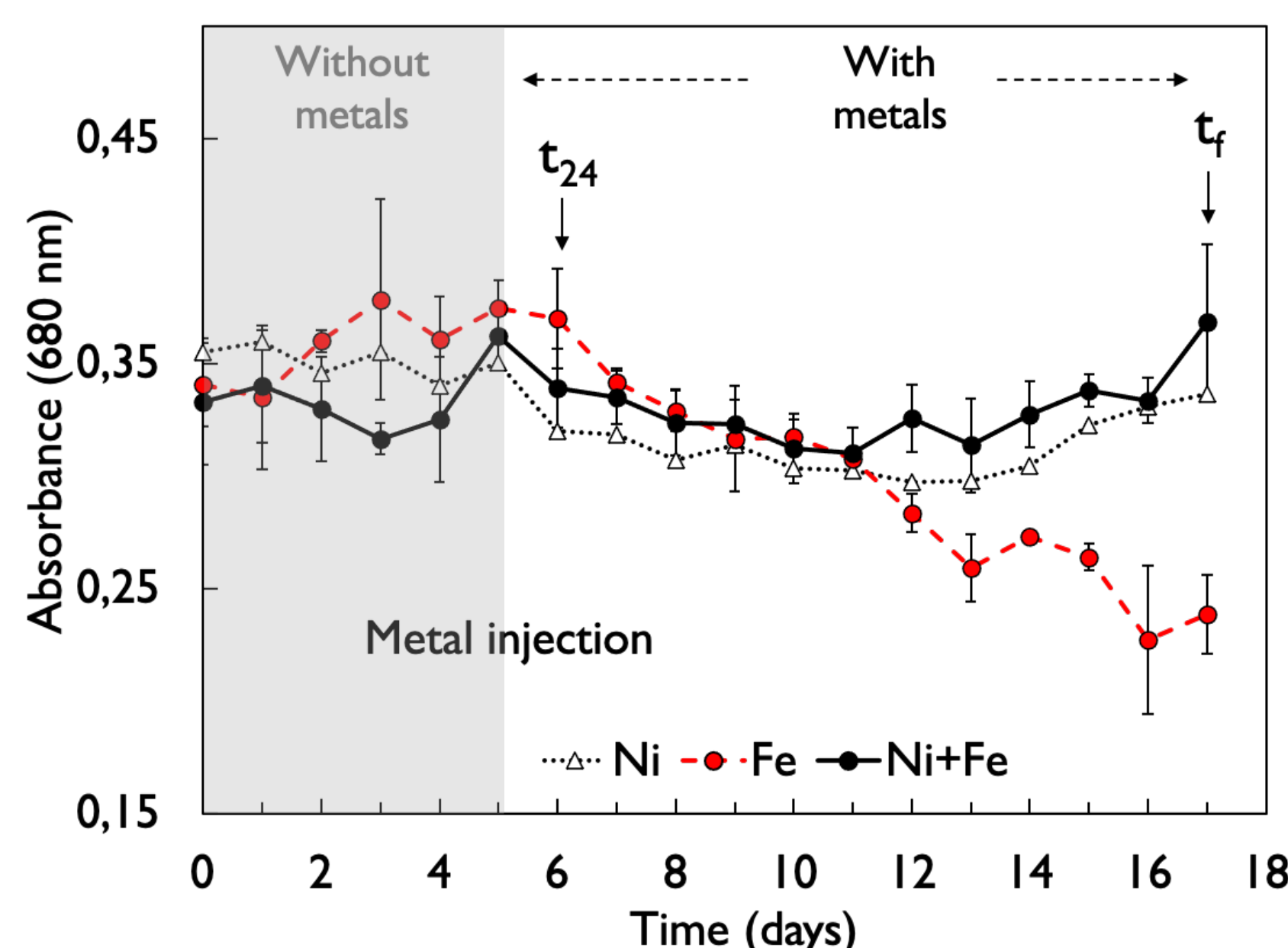
Rapid and non invasive measure of chlorophyll a fluorescence

### Metabolomic analysis



## Results and Discussion

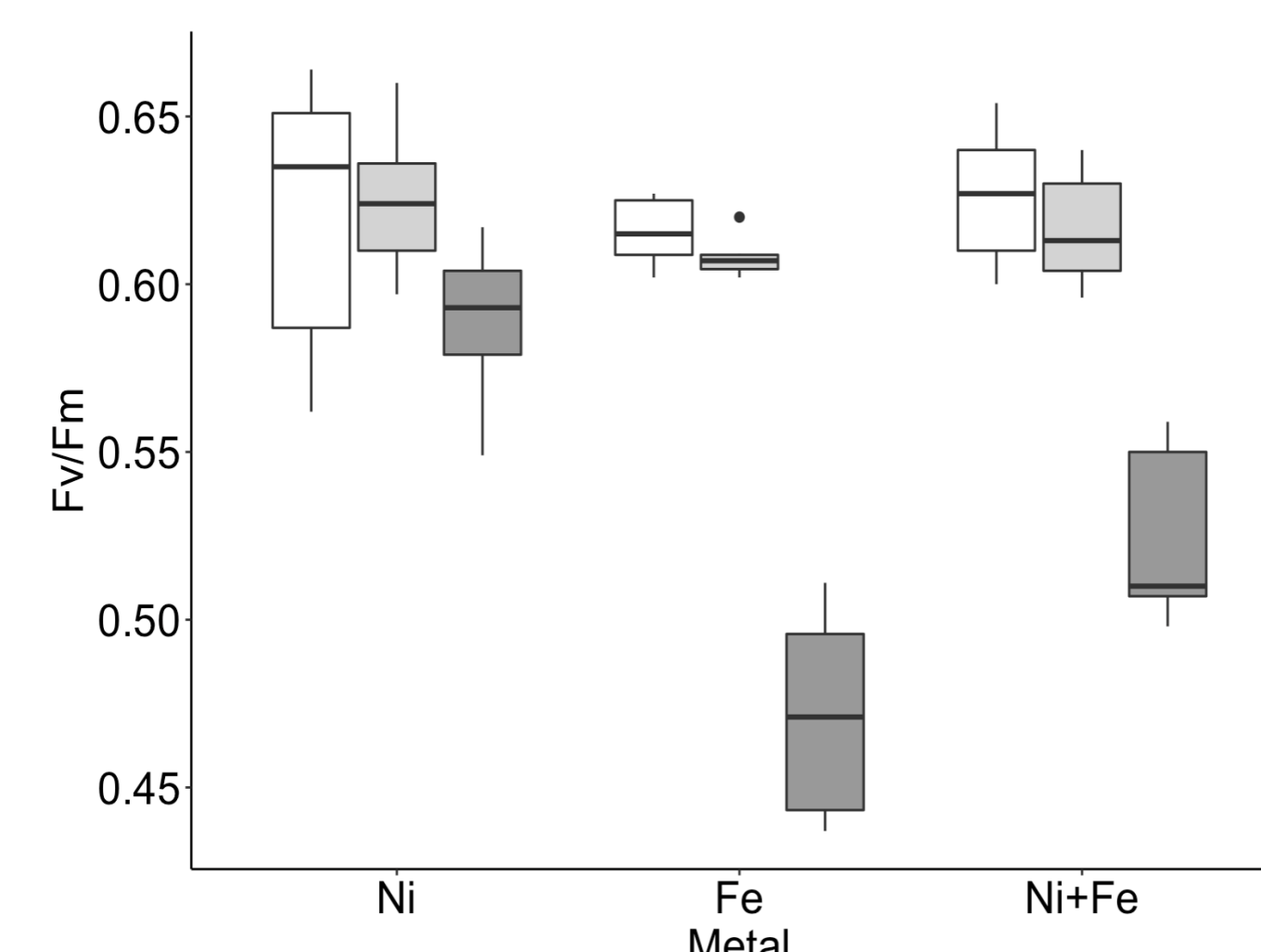
### 1. Growth performance



Growth **decline** in presence of iron

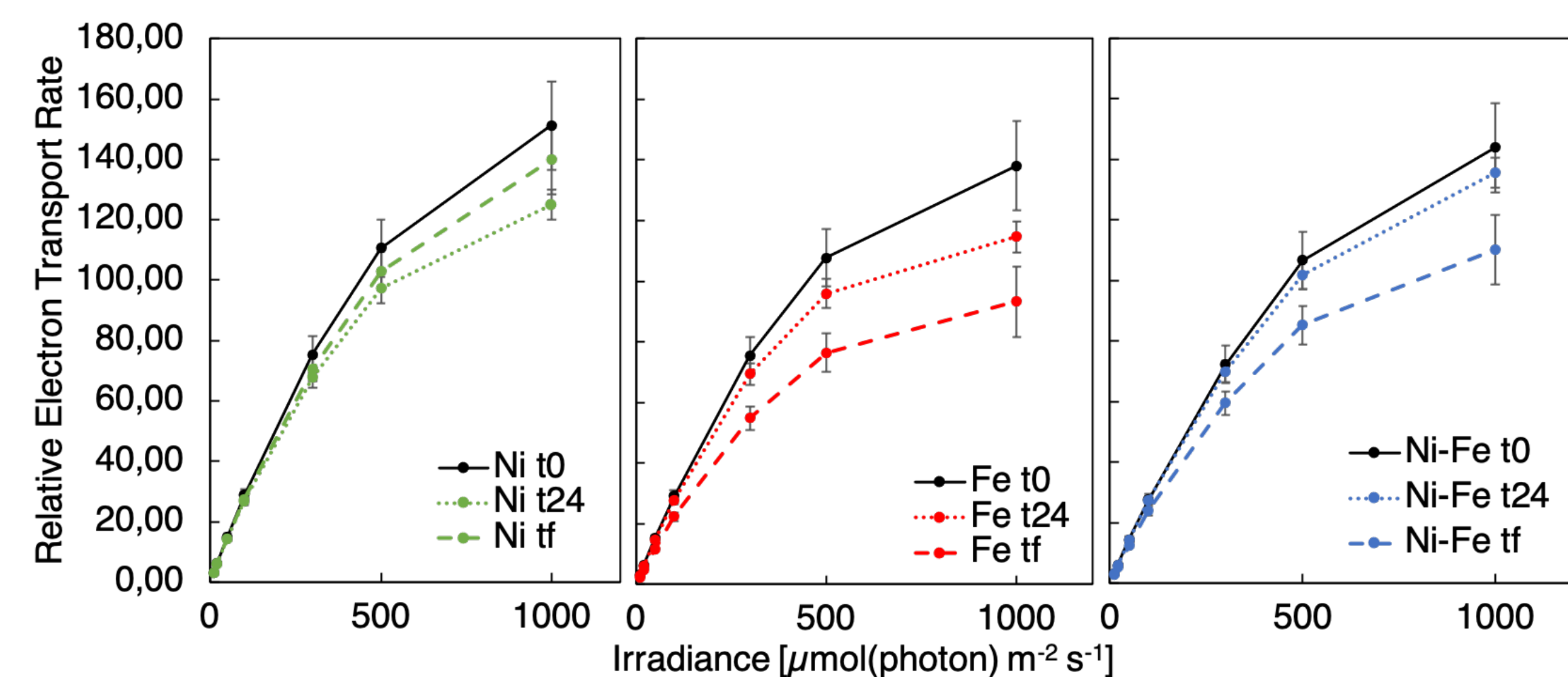
### 2. PSII photosynthetic efficiency

#### Maximum quantum yield



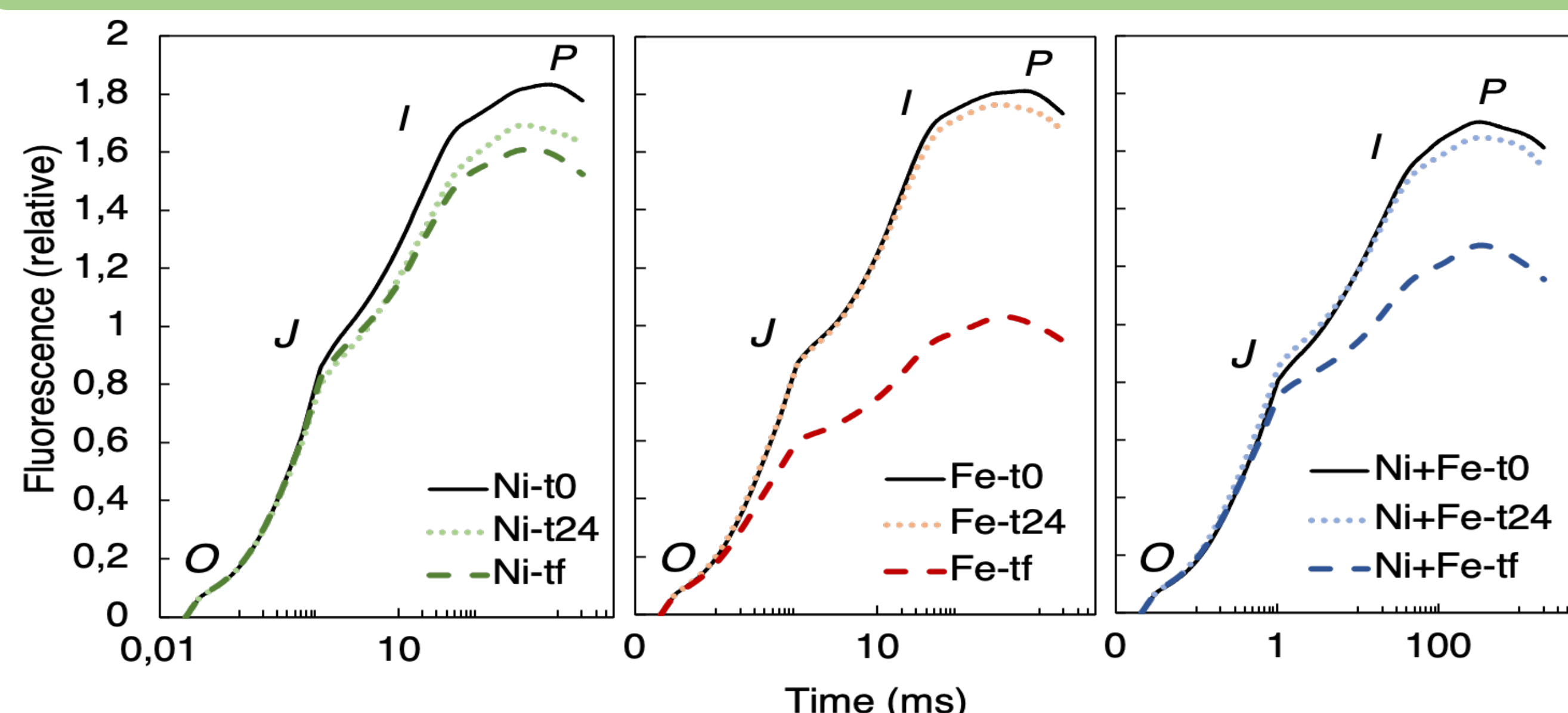
**25% decrease** of the maximum photosynthetic efficiency of the PSII in the presence of iron

#### Photosynthetic activity following light intensity



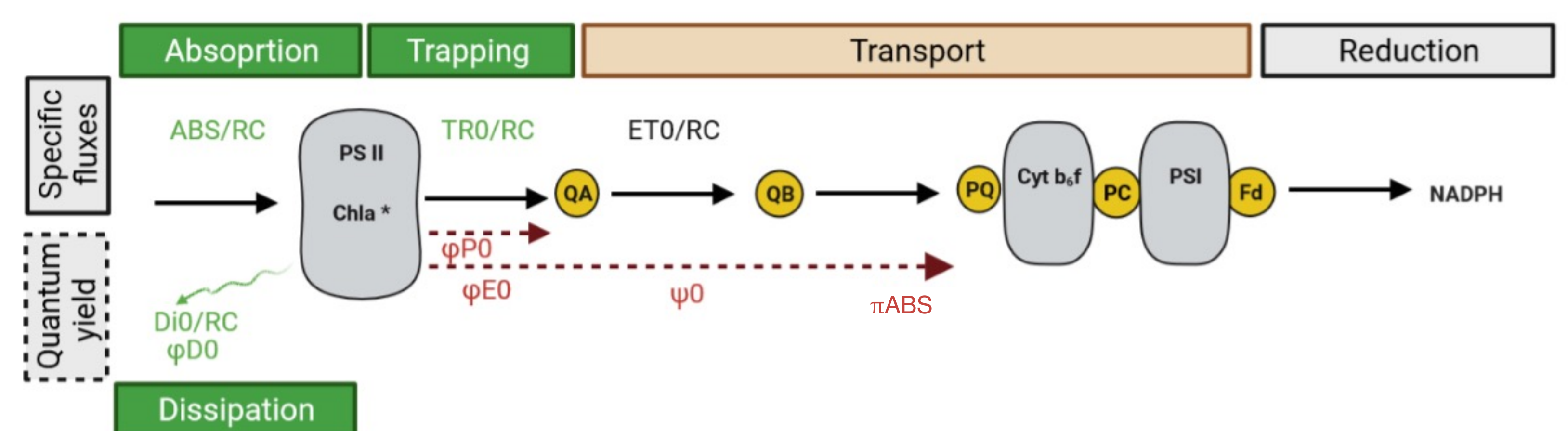
**Negative** impact of iron on the photosynthetic activity (rETR)

### 3. Electron transport chain



**Negative** effect of iron on electron transport chain

### 4. Fluxes and yield variation between compartments



In presence of iron:

The **absorption**, **trapping** and **dissipation** capacities of the energy in the PSII is **increased**; whereas, the electron transfer yields **decreased**.

## Conclusion

- ✓ Contrary to iron, which **reduces photosystem II efficiency at high concentration**, nickel does not influence growth and PSII
- ✓ The **mixture** of nickel and iron **did not** show a **synergistic** effect but showed a **concentration effect**
- ✓ However, **none** of the 2 metals caused the **complete death** of microalgae

## Work in progress

### Metabolite extraction



### Sample analysis

- UV
- HRMS Orbitrap
- GCMS
- NMR

### Data processing



### Molecular networks



### Interpretation

- ✓ **Chemodiversity** assessment
- ✓ Metabolite **families** identification
- ✓ **Structural diversity** depending on metal conditions