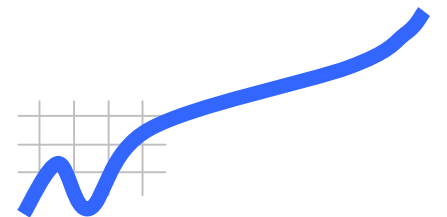
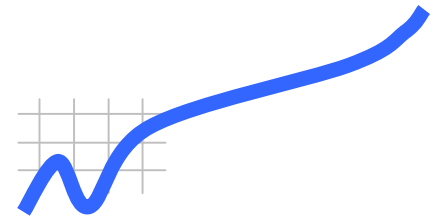
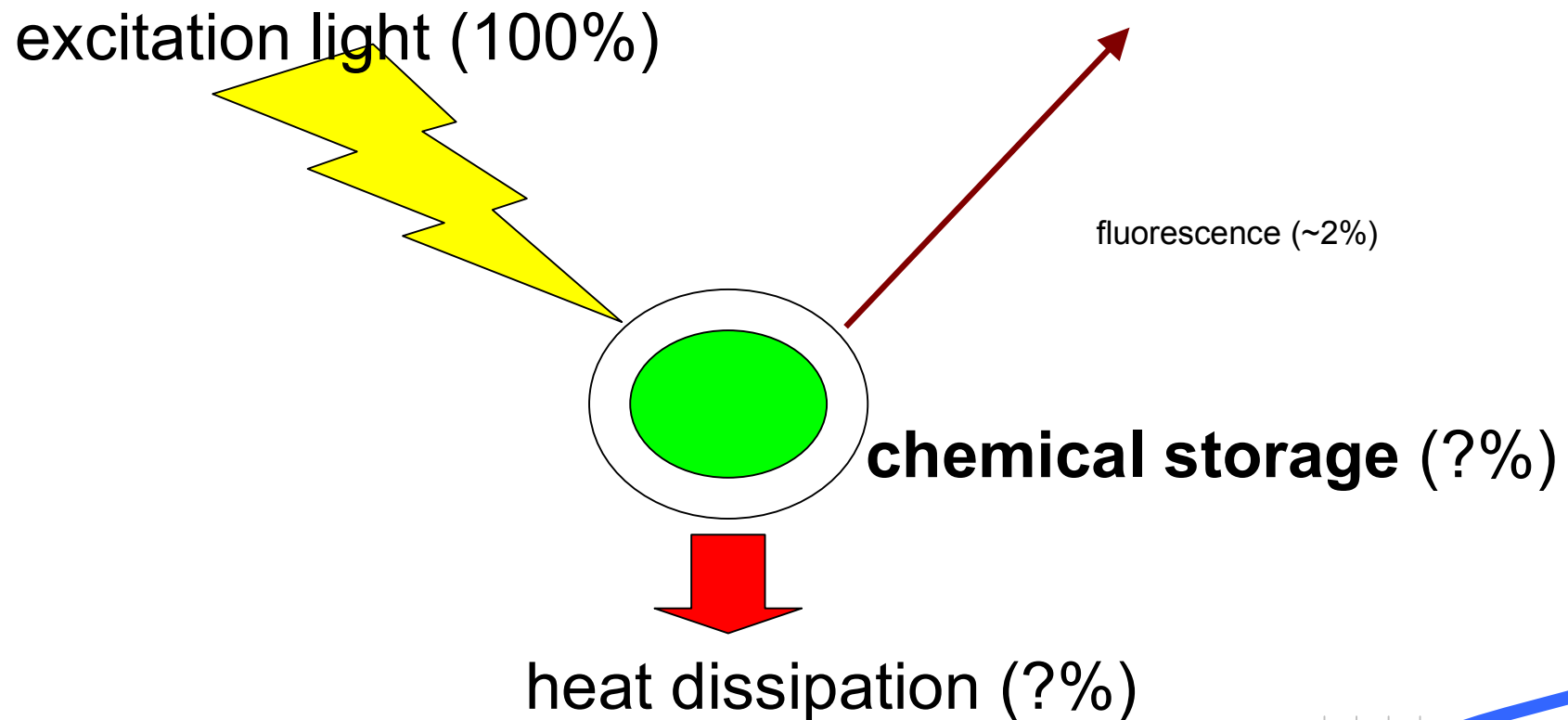


Variable Fluorescence in Algal Cells – Expression of the Physiological Status



Variable Fluorescence in Algal Cells

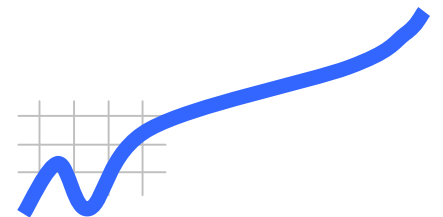
Fluorescence in algal cells?



Variable Fluorescence in Algal Cells

What happens in the algal cell?

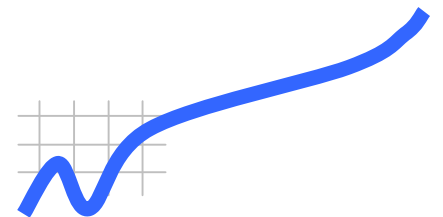
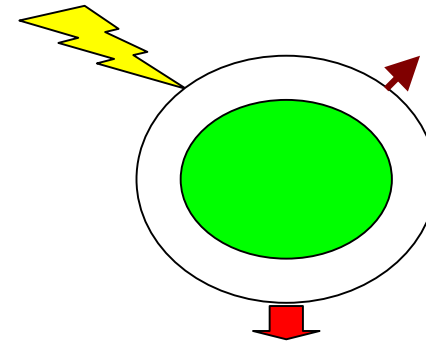
- Light is trapped (very fast)
- Energy is transferred to a reaction center (very fast)
- An electrochemical potential is built up (medium speed)
- The electrochemical potential is used for chemical synthesis (slow)



Variable Fluorescence in Algal Cells

Low light conditions

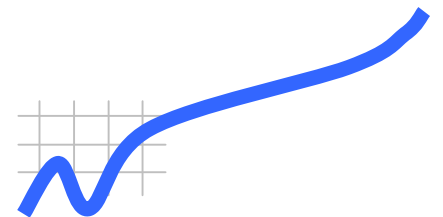
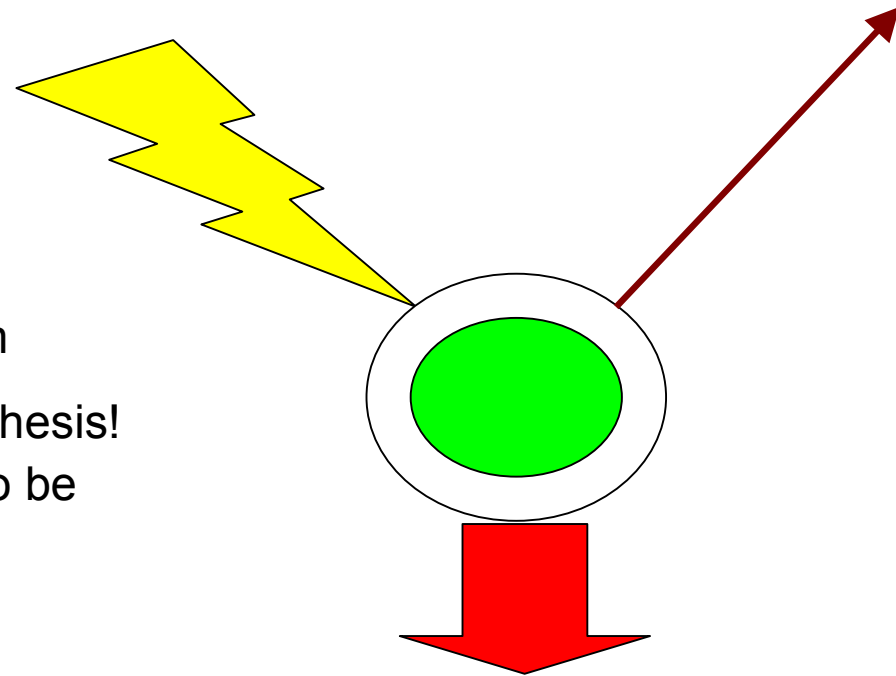
- membrane potential is quite low
- much of trapped energy will be stored in chemical products, system very efficient
- low fluorescence
- low heat dissipation



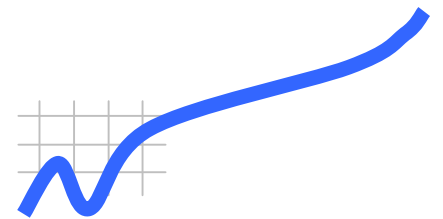
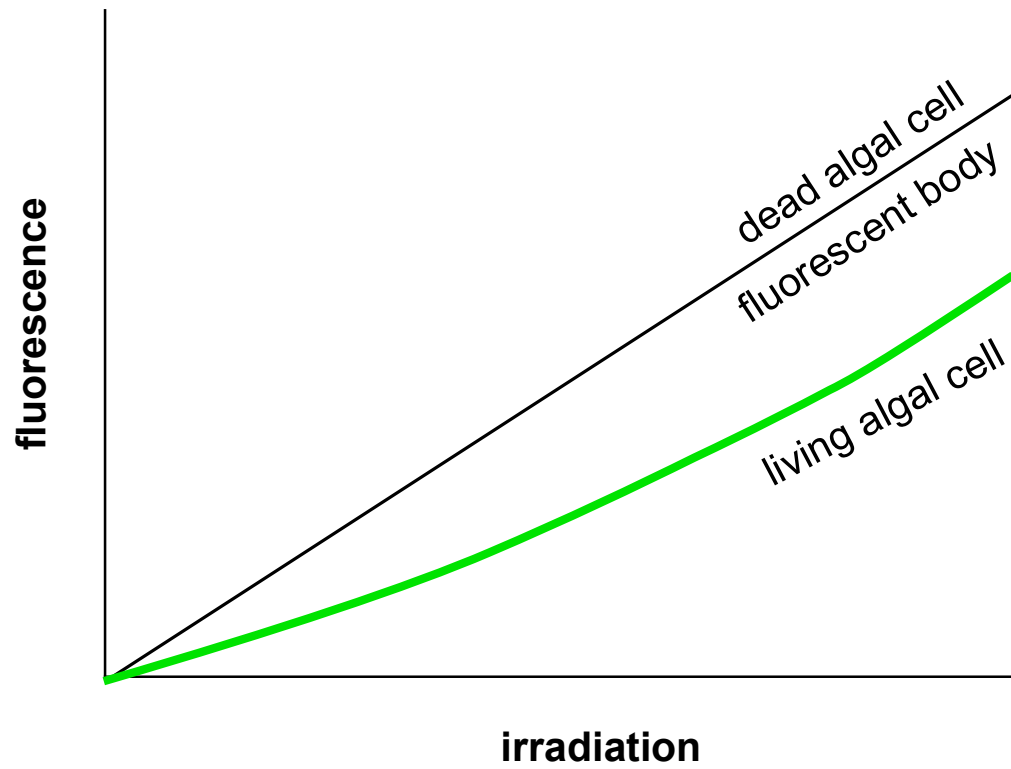
Variable Fluorescence in Algal Cells

High intensity light

- membrane potential is at maximum
- excess of energy for chemical synthesis!
- much of the received energy has to be dissipated to avoid an “overload”
- high fluorescence
- high heat dissipation



Variable Fluorescence in Algal Cells

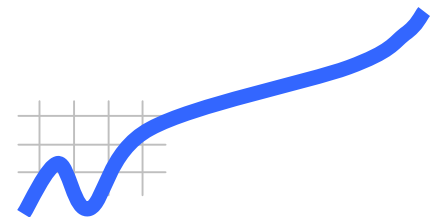


Variable Fluorescence in Algal Cells

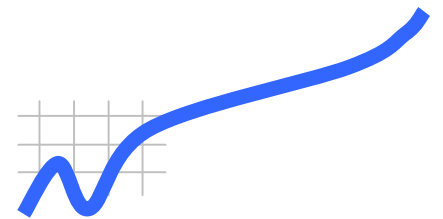
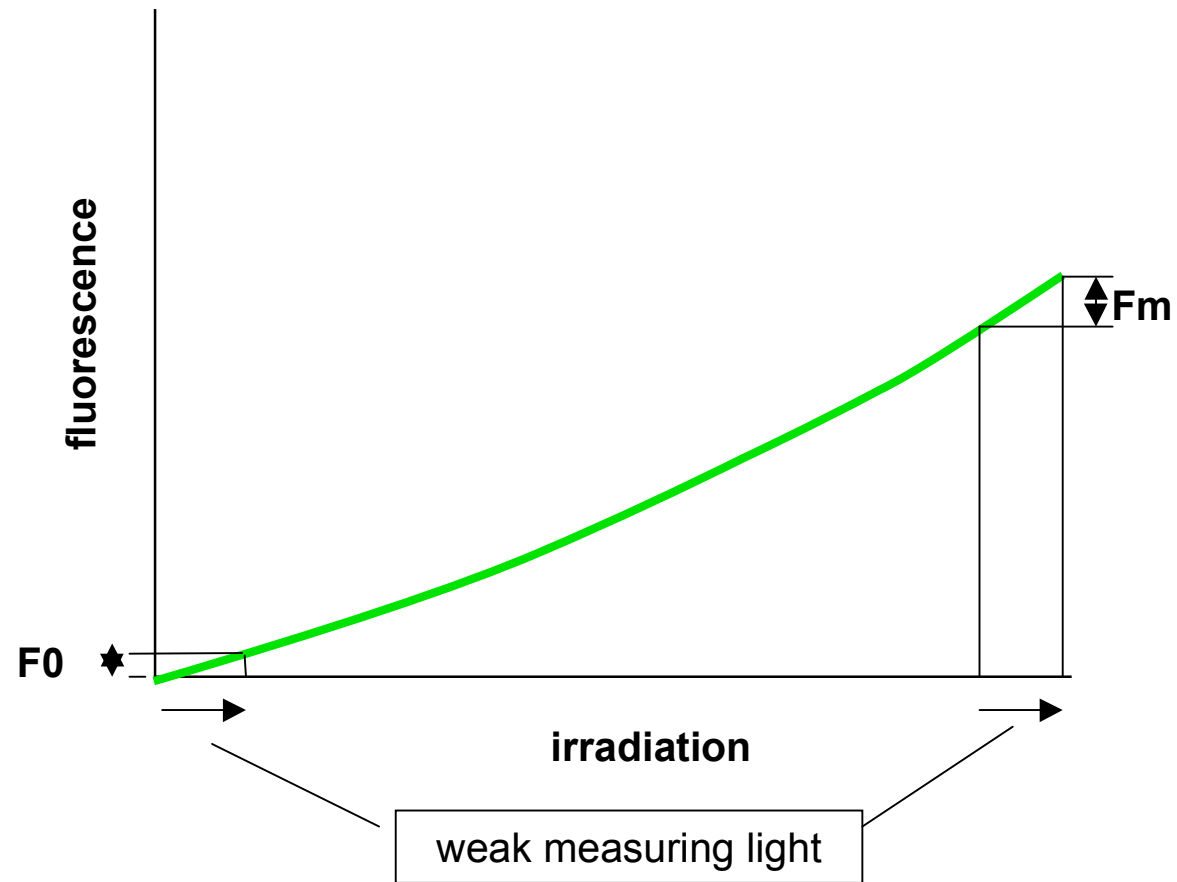
Measuring principle

weak pulses of light (1% of daylight) determine the steepness of the slope

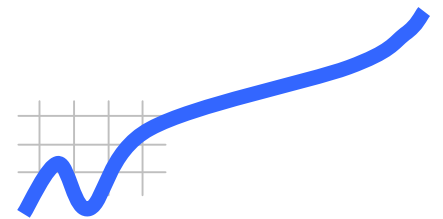
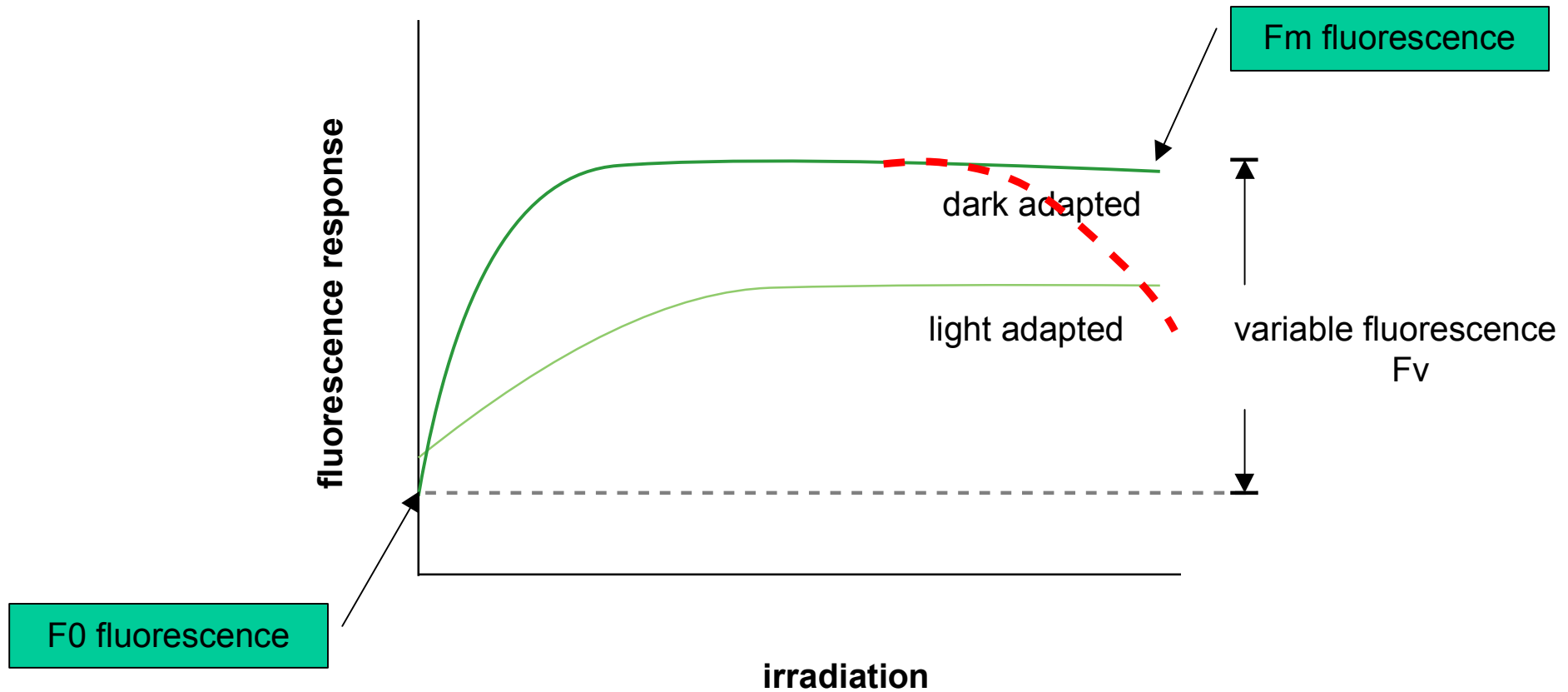
- with no background light
- with saturating background light



Variable Fluorescence in Algal Cells



Variable Fluorescence in Algal Cells



Variable Fluorescence in Algal Cells

ATox - AT-03-01 20070604-0618

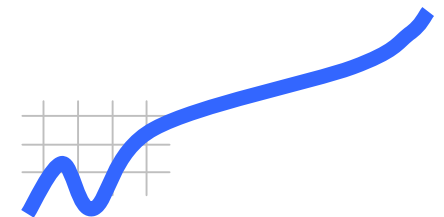
The screenshot shows a dialog box titled "Parameters Measurement Times ..." with the following settings:

Parameter	Value	Unit
LED brightness	20	1/10 s
reduced F0 brightness	100	%
F0 adaptation	60	s
F0 measurement	30	s
FM measurement	1	s
F adaptation	10	s
F measurement	20	s
transmission	1	s
FM integration time	300	1/1000 s

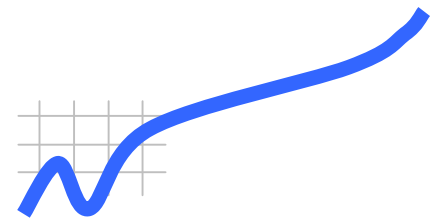
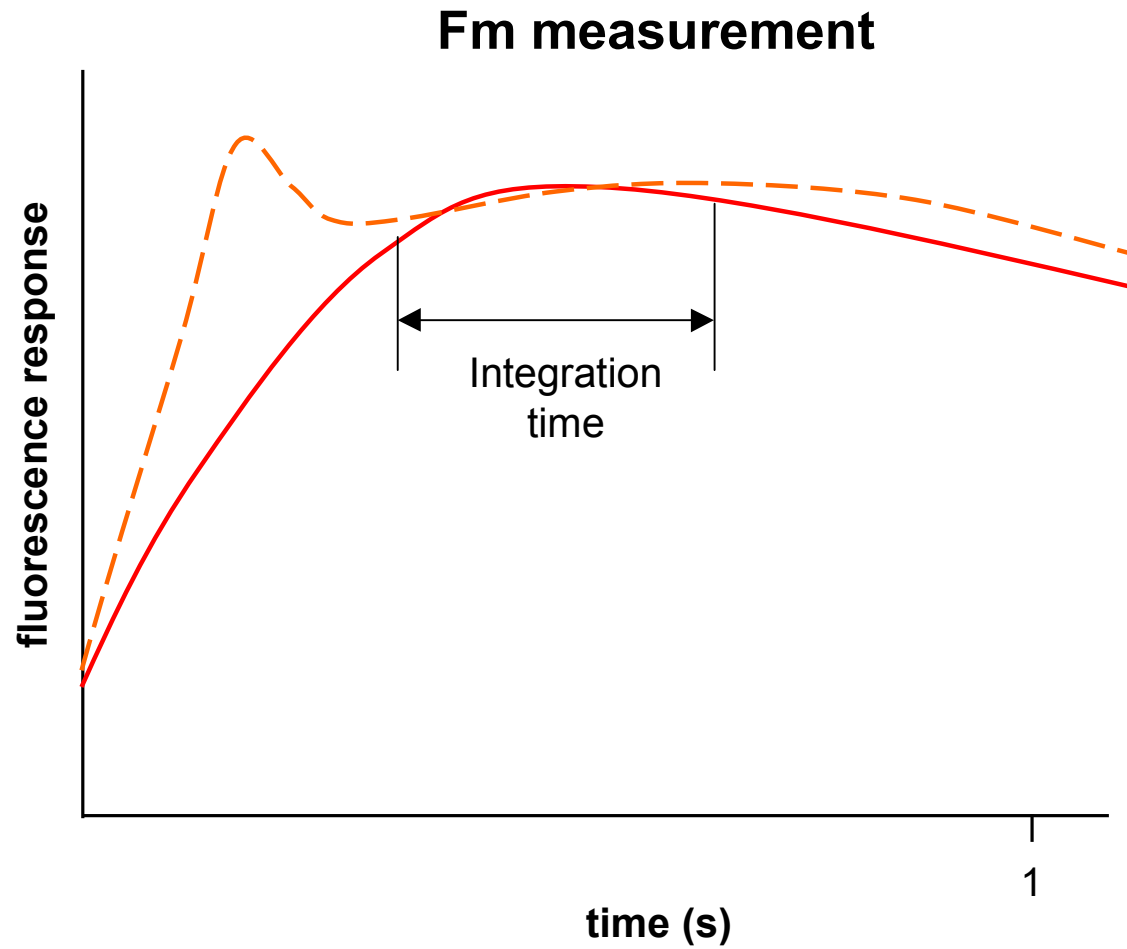
Annotations:

- Red arrows point to "reduced F0 brightness", "F0 adaptation", and "F0 measurement", which are grouped under the label "F0 control parameters".
- Red dashed arrows point to "FM measurement" and "FM integration time", which are grouped under the label "Fm control parameters".

Buttons: OK, Cancel



Variable Fluorescence in Algal Cells



Variable Fluorescence in Algal Cells

Genty

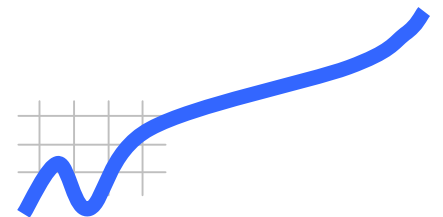
Genty = variable fluorescence / F0 fluorescence

Or

$$\text{Genty} = (f_m - f_0) / f_0$$

$$\text{Activity} = \text{Genty} * 100 [\%]$$

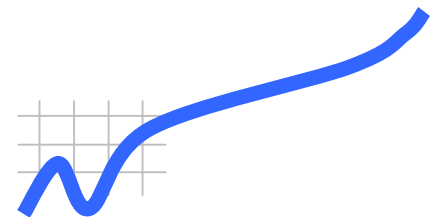
→ The Genty parameter is concentration-independent!



Variable Fluorescence in Algal Cells

Influences on the Genty/Activity

- vitality of the algae culture
- light conditions before the algae were measured
- adaptation times
- taxonomic rank of the alga
- temperature
- **presence of toxins**
- high turbidity
- too high concentration



Variable Fluorescence in Algal Cells

Presence of toxins

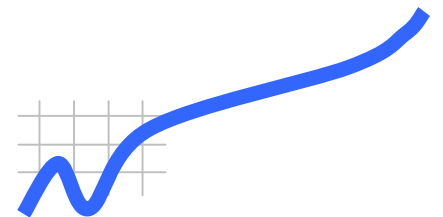
Photosynthesis inhibitors

F_0 → increase strongly

F_m → increase weaker

F_v → decrease

Genty → is reduced



Variable Fluorescence in Algal Cells

Activity values

Good culture of green algae: 60%-70%

Light stress → down to 40%

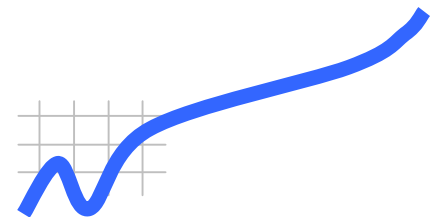
Length of adaptation time → decrease effects of light treatment

Herbicides → down to 30%

Decaying culture → down to 0%, no growth <45%

Temperature effects → shallow optimum curve

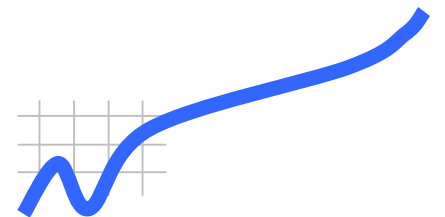
High concentration/High turbidity → dampens Fm-signal



Variable Fluorescence in Algal Cells

Variable fluorescence in algal cells

- Herbicide Tests (ATOX, ALA)
- Algae culture quality control (ALA)
- Scientific studies on light stress etc. of natural algae populations (AOA)



Variable Fluorescence in Algal Cells

Thank you for your attention

