Investigations with the bbe BenthoFluor - Fluorescence Patterns of a (terrestrial) Lichen

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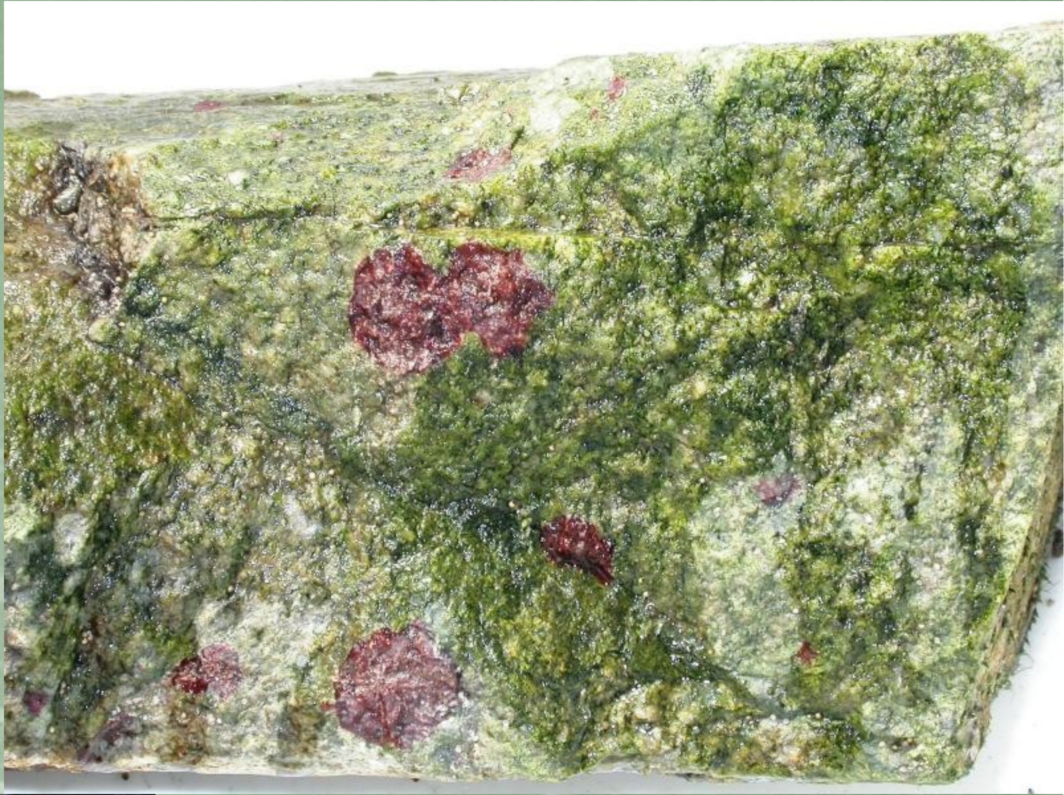
Plan

1. Intention
2. Lichens
    a. Types
    b. Structure
    c. Habitat
2. Fluorescence of lichens
3. Determination of lichens by fluorescence

Algea on stone surface



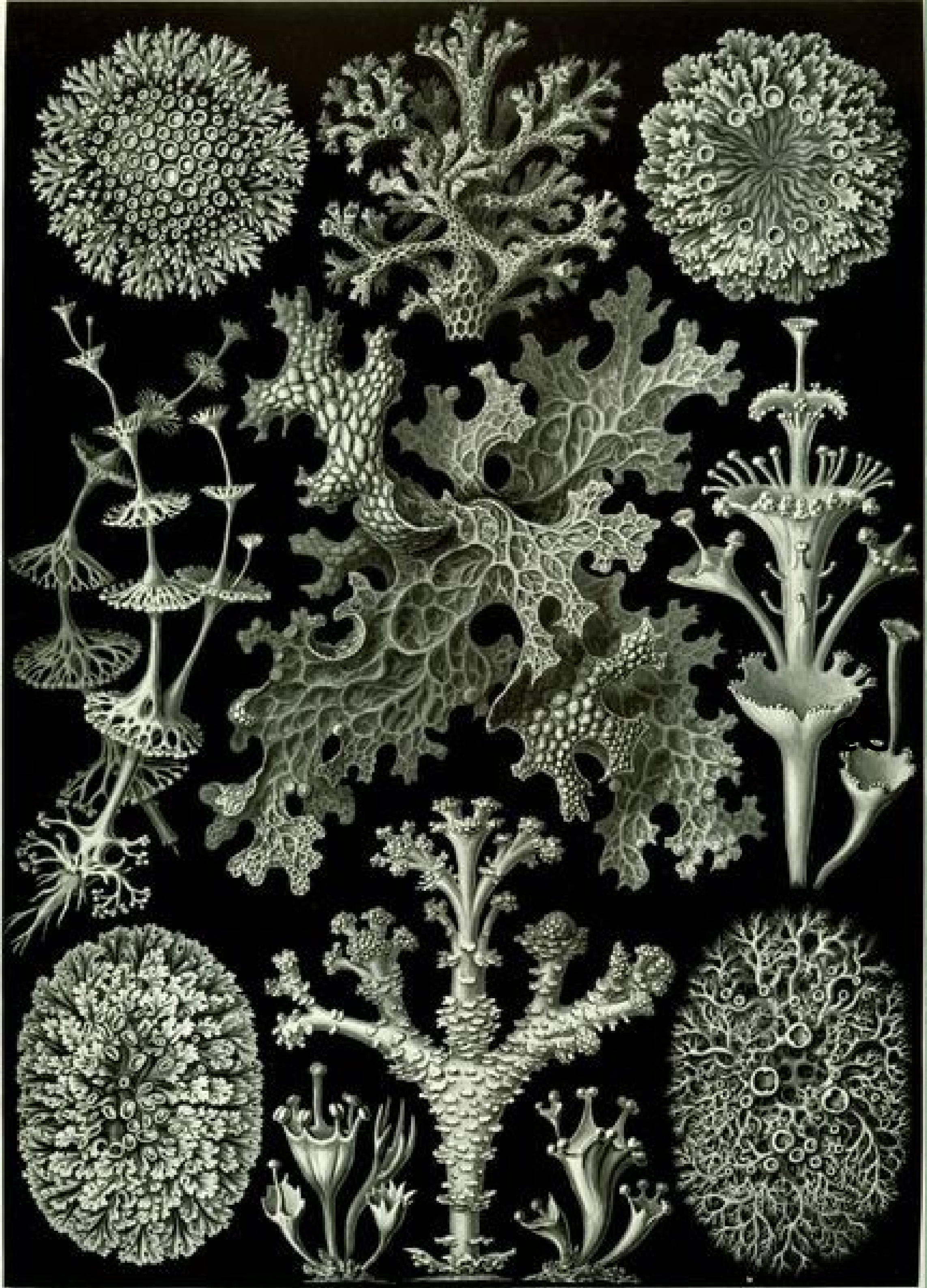
Xanthoria parietina
Lecanora sp.

Water Framework Directive forces the European Member States to determine algae presence in water habitats.

BenthoFluor discriminates between

- Green Algae
- Diatoms
- Blue-Green Algae

- What about Lichens?



Lichen:

=

Mycobiont

+

Photobiont

Lichen

Lichen symbiosis is parasitic or mutualistic?

Lichens "provide" the algae with water and minerals that the fungus absorbs from whatever surface the lichen is growing on, i.e. its substrate. As for the alga, it uses the minerals and water to build assimilates for the fungus and itself.

Lichen Types

crustose - paint-like, flat e.g., *Caloplaca flavescens*

filamentous - hair-like, e.g., *Ephebe lanata*

foliose - leafy, e.g., *Hypogymnia physodes*

fruticose - branched, e.g., *Cladonia evansii, C. subtenuis, and Usnea australis*

leprose - powdery, e.g., *Lepraria incana*

squamulose - consisting of small scale-like structures, lacking a lower cortex, e.g., *Normandina pulchella*

Lichen Thallus

Homeomerous

- no layers can be determined

Heteromerous

– layer structure contains

cortex - consisting of densely packed fungal hyphae

algal layer

medulla - layer of loosely interwoven fungal hyphae without algal cells

lower cortex

Structure

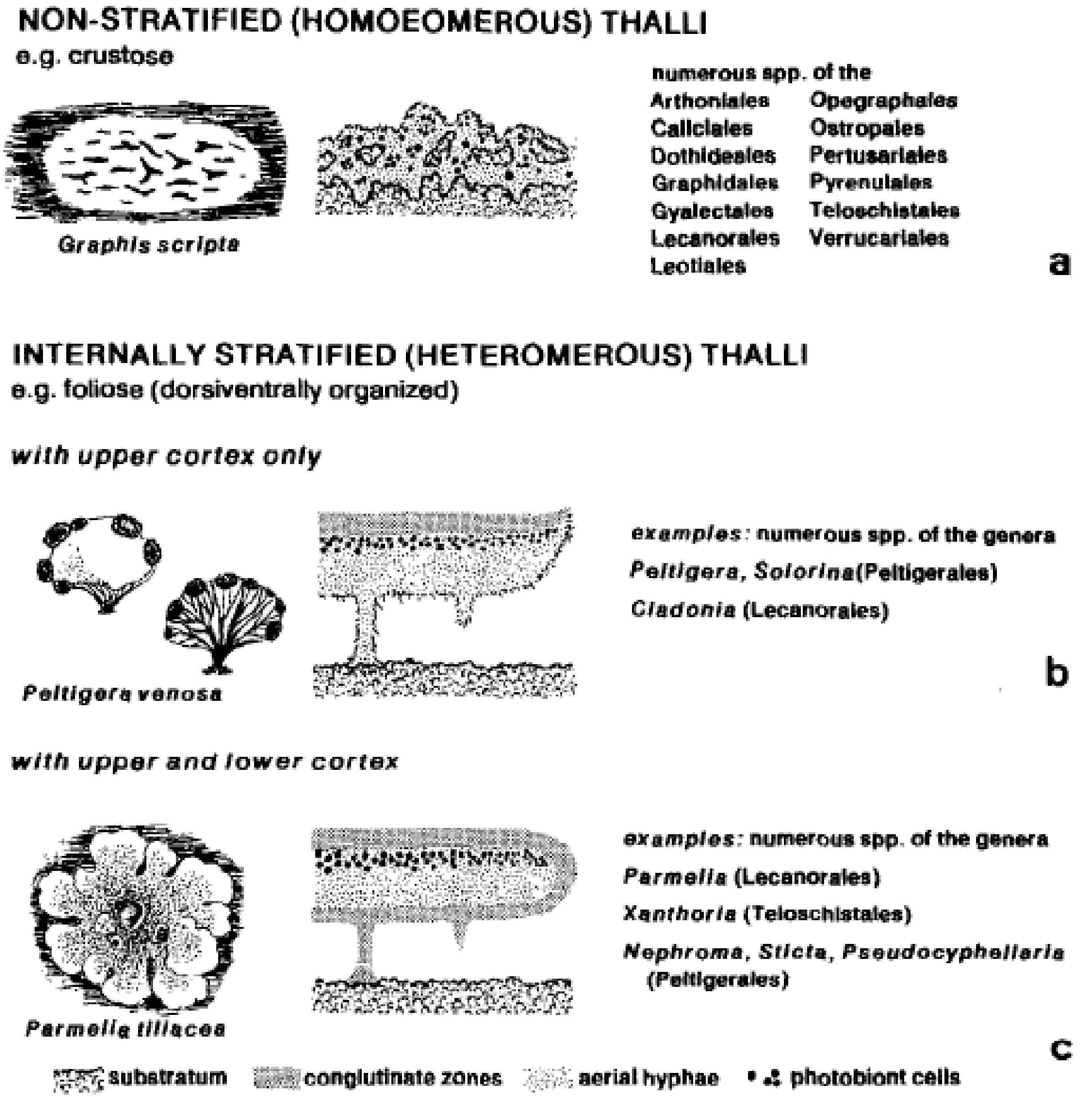


Figure 1 Examples illustrating a small part of the morphological and anatomical diversity in the lichen symbiosis.

Fungi – Algae Relation

Hygroscopic property of lichens

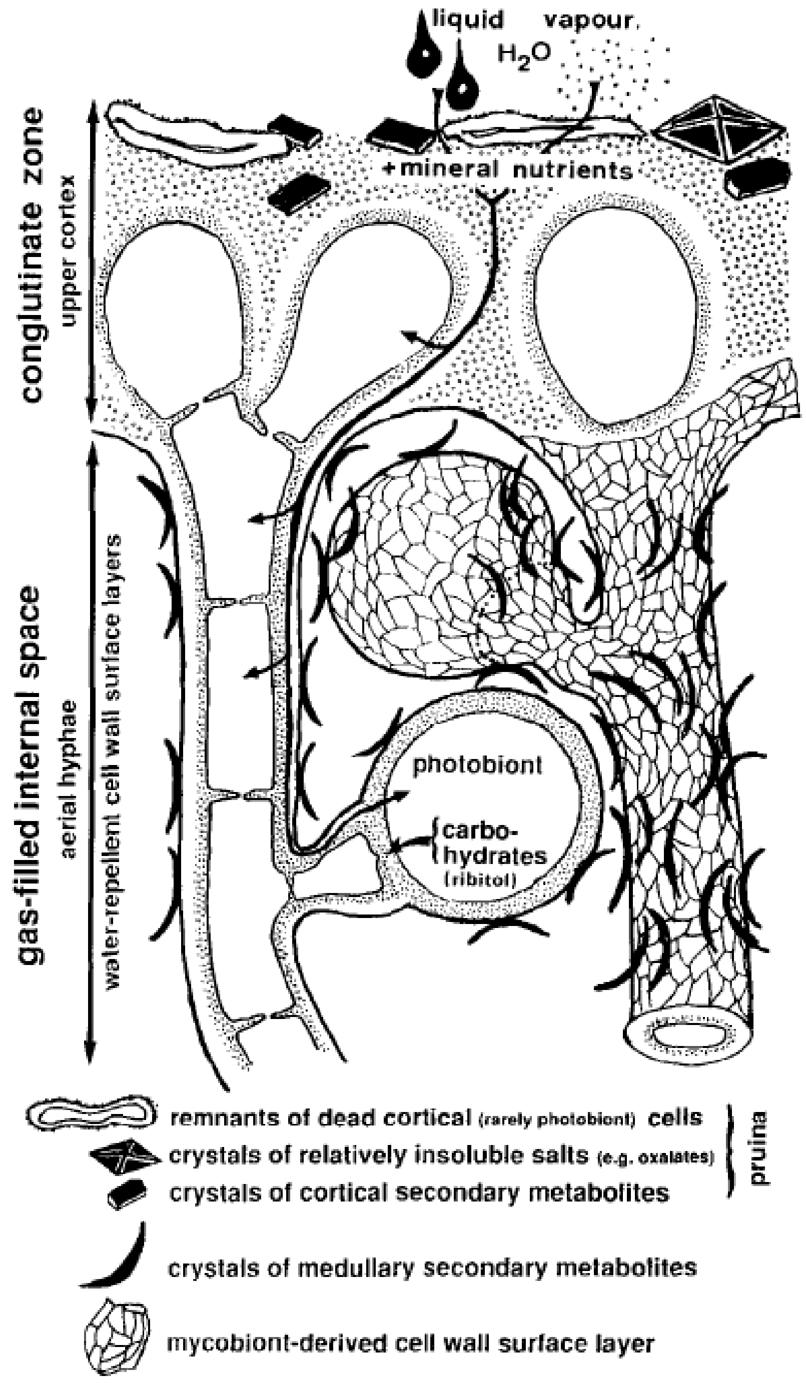


Figure 5 Diagram illustrating functional aspects in Parmeliaceae with *Trebouxia* photobionts. Comparable, horizontally dissected thallus fragments were used in inhibition-technique experiments (94). There is an apoplastic continuum between the fungal partner and the *Trebouxia* cells. After 59.

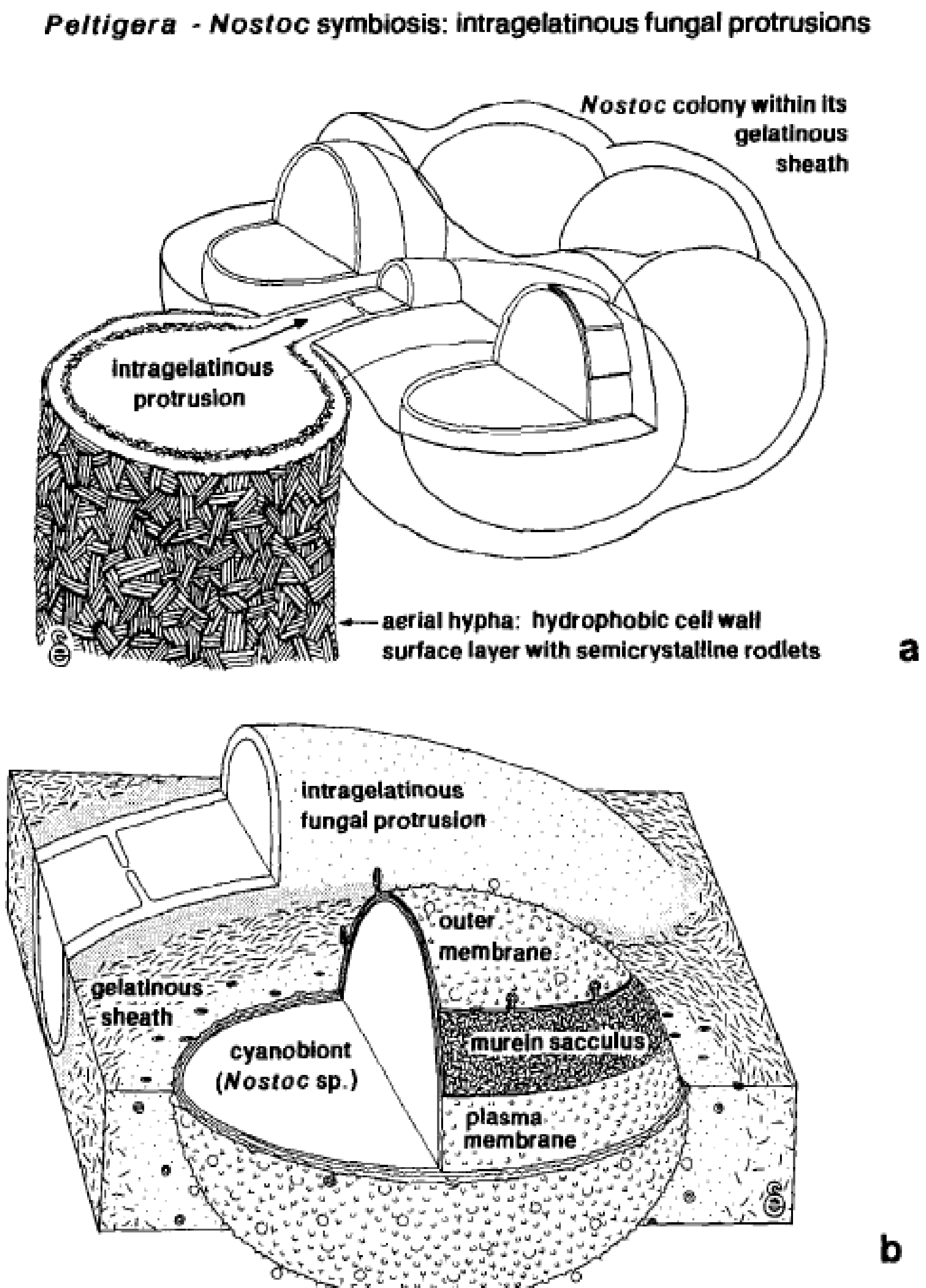
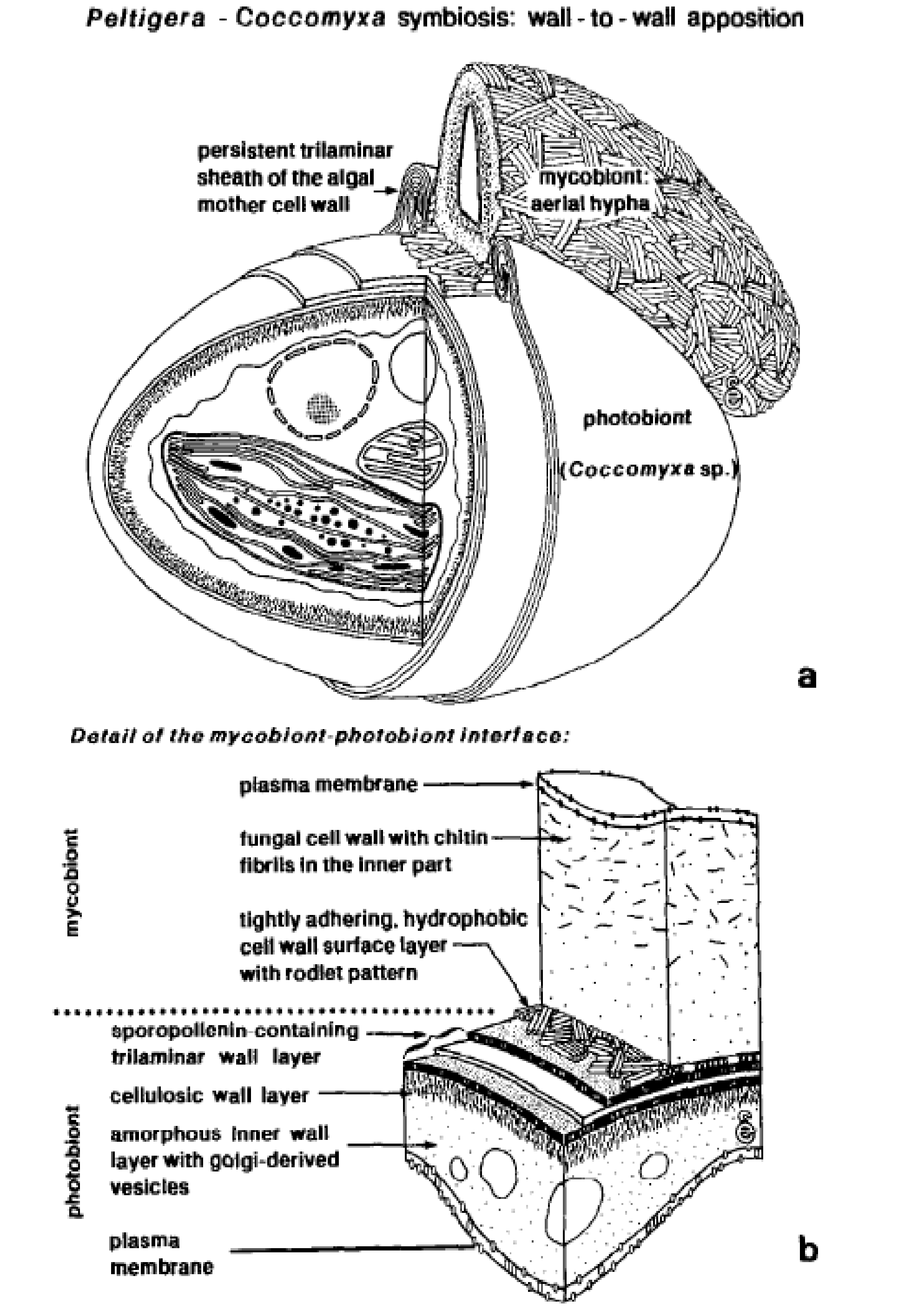


Figure 2 Diagrams illustrating the mycobiont-photobiont interface in *Peltigera* spp. with *Nostoc* cyanobiont. Ultrastructural data from 6, 42, 51; diagrams designed by Sybille Erni.



'gure 3 Diagrams illustrating the mycobiont-photobiont interface in *Peltigera* and *Solorina* ·p. with *Coccomyxa* photobiont. Note: algal cell wall dimensions in Figure 3*a* are not to scale. ata from 10, 11, 49–51, 58, 63; diagrams designed by Sibylle Erni.

Habitat – Surfaces

1. stone surfaces
   - limestone
   - silicate
2. wooden surfaces
   - dead wood
   - live wood
     - e.g. bark

Habitat

1. aquatic (submersed)

   water-tolerant, no direct contact with air

2. terrestrial

   desiccation-tolerant

Fluorescenc of Lichens

Fluorescence of dominant algae in lichens:

- Blue-green algae
- Green algae

Fluorescence of secondary fungal substances

"Fringerprints" of Algae

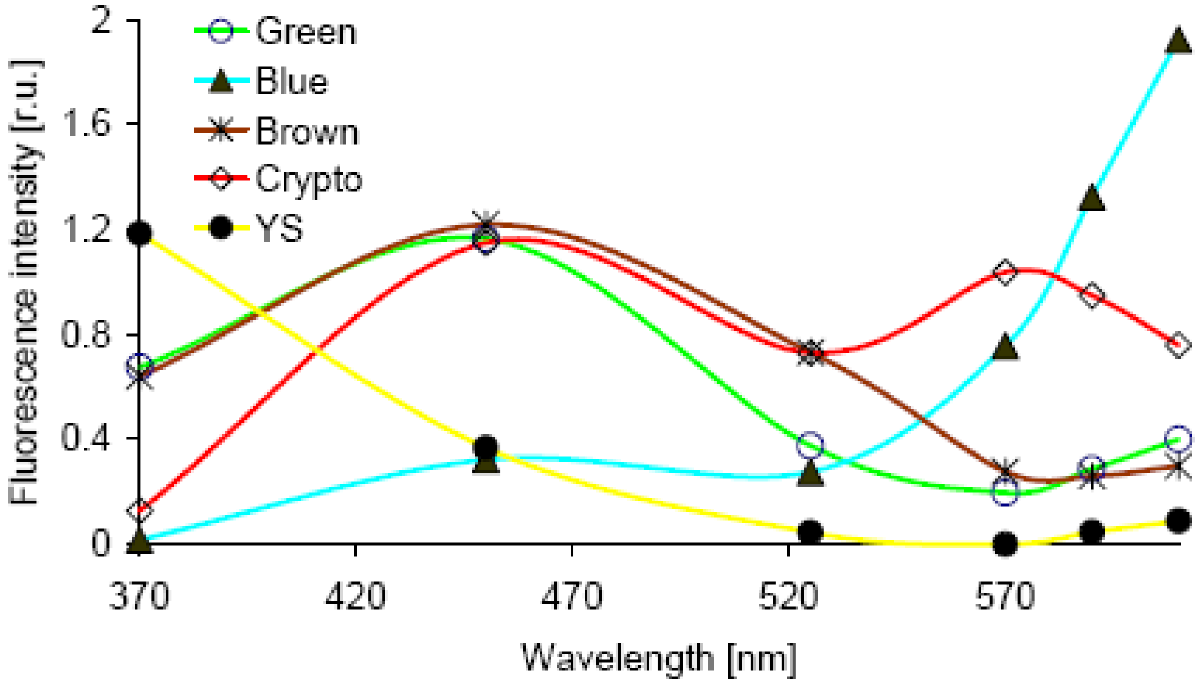
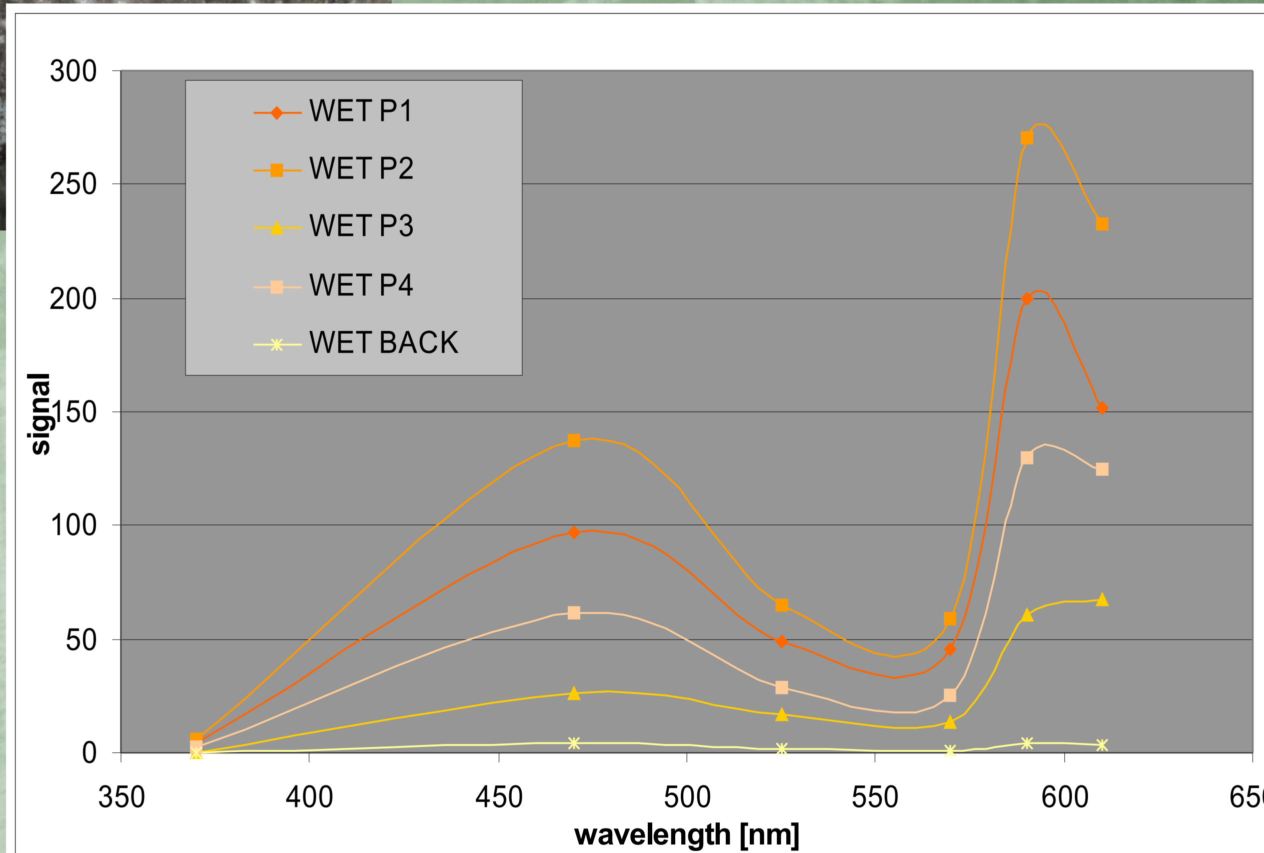
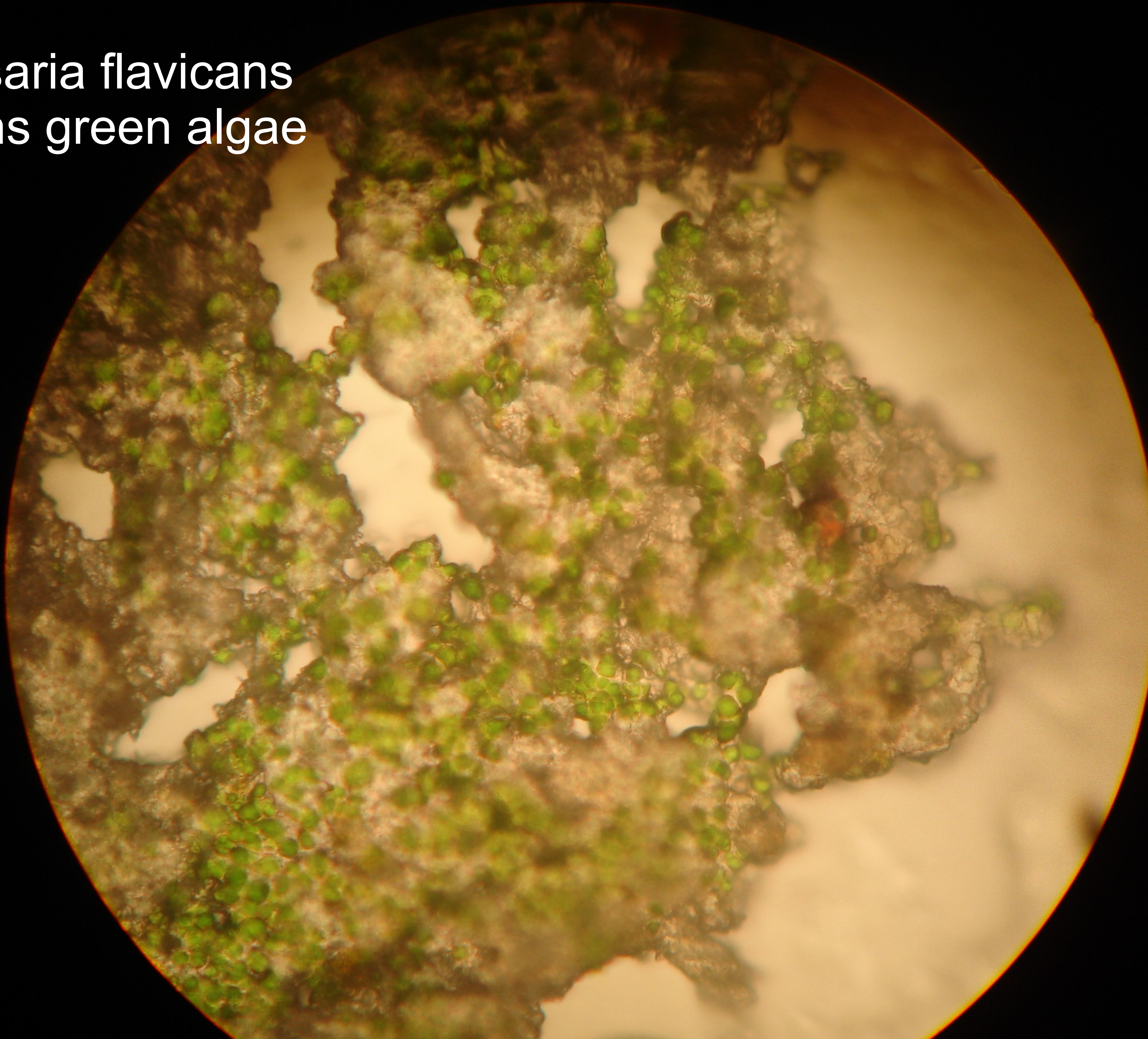


Figure 3.1. Norm spectra of spectral algal groups and YS. Mean fluorescence intensity of four spectral algal groups and YS at six excitation wavelengths in digits (photovoltage at the photomultiplier) normalised to Chl *a* concentration ($\mu g\ l^{-1}$) for spectral algal groups.

The pattern of lichen fluorescence looks like a mixture of blue-green and green algae, but...

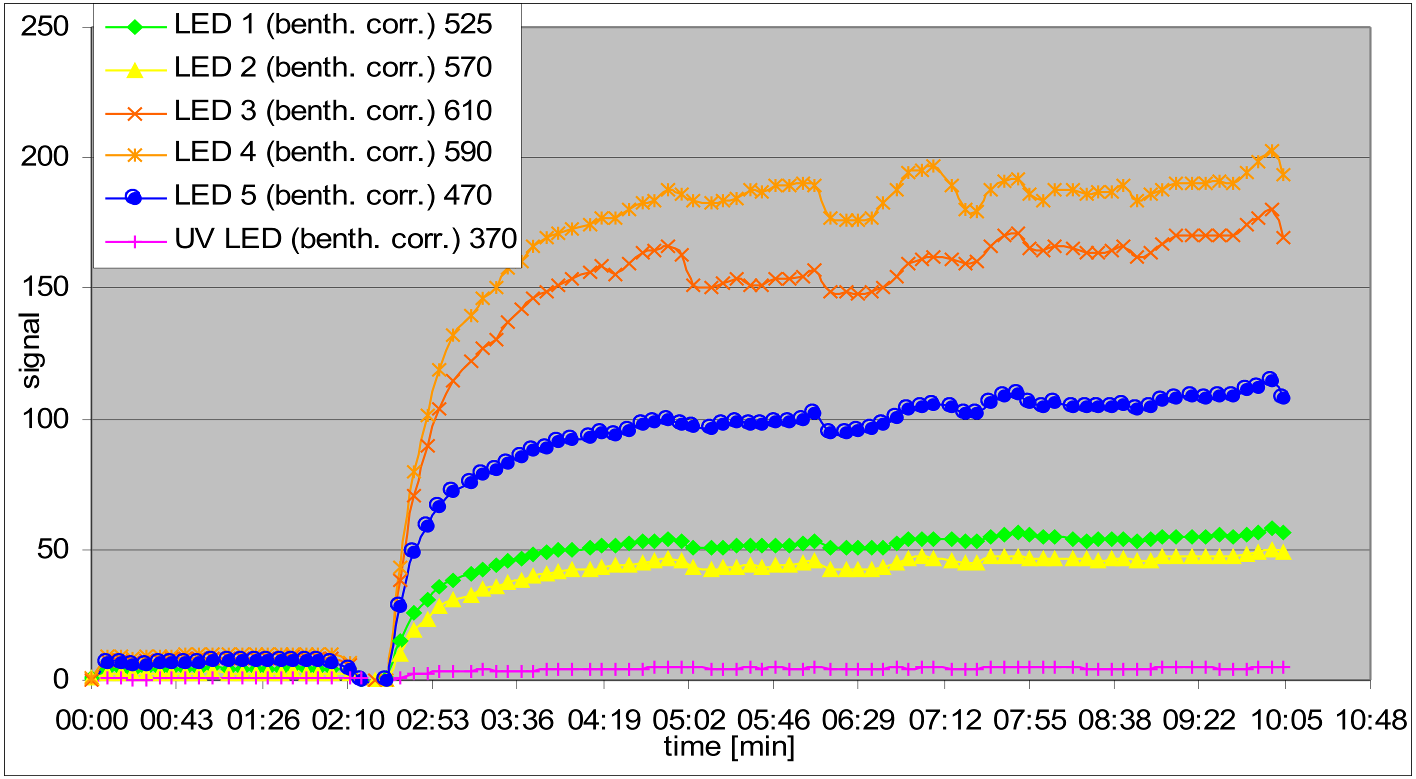


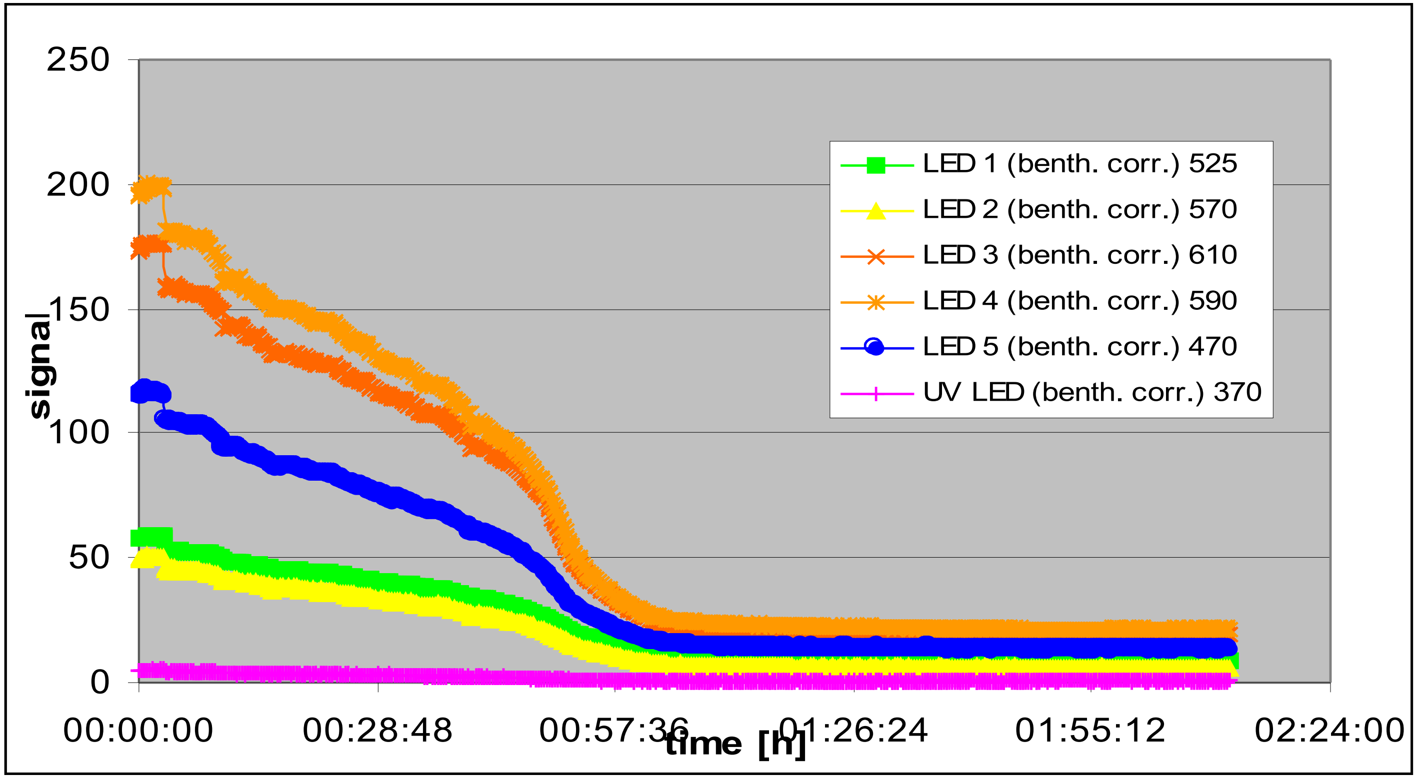
Pertusaria flavicans contains green algae



Conclusion and Theory 1

In our first approach with terrestrical lichens we face problems in identification. We need a more sophisticated model to estimate the right sort of photobiont



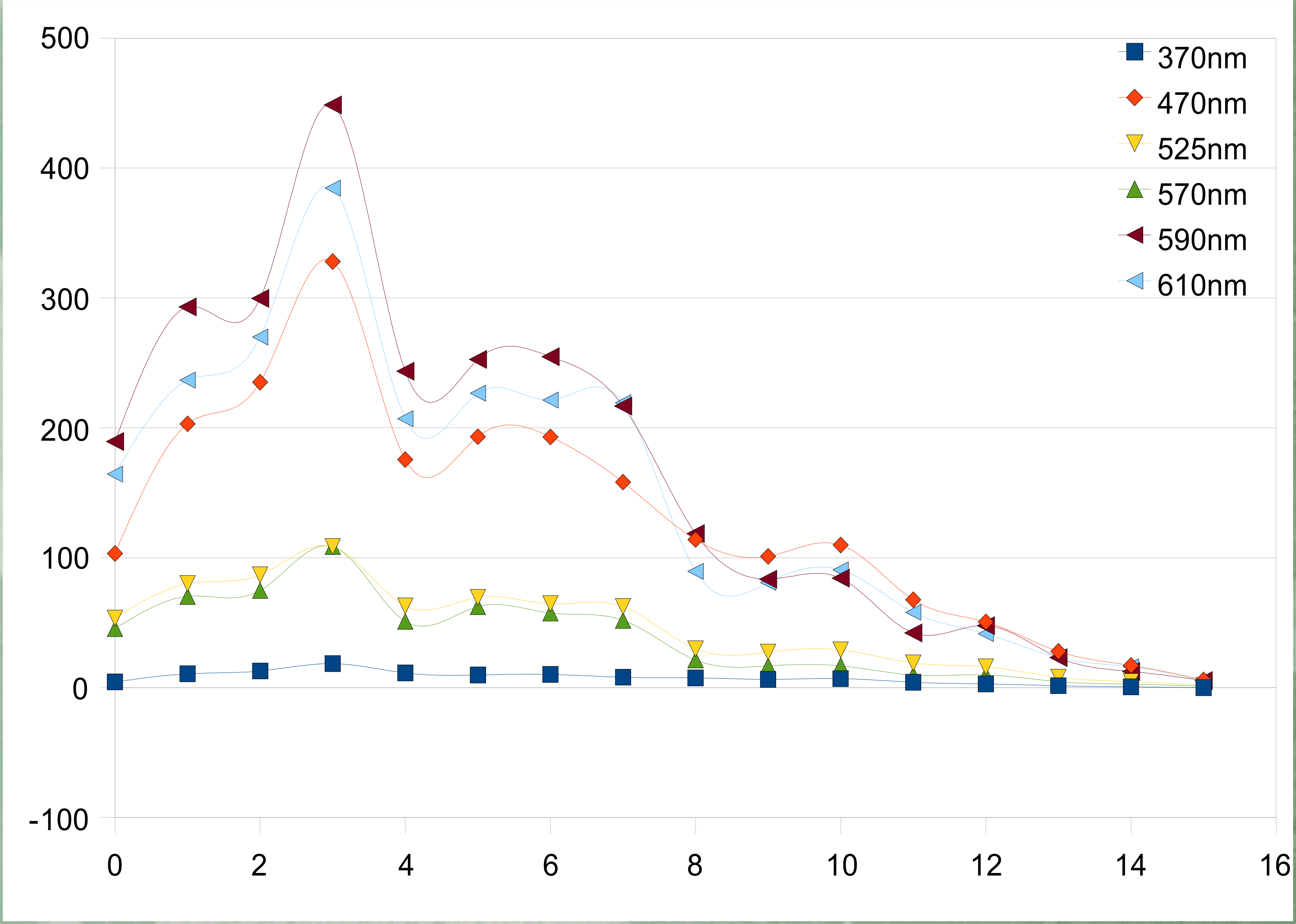


Change of fluorescence while hydrating and drying algae.

Conclusion and Theory 2

Desiccation and re-hydration changes the fluorescence response of the wavelengths of all excitation LEDs.
Because all changes appear to occur in parallel, in this special case we can apply a specific fingerprint.

Fluorescence Profile Through Layers



The profile was done by measuring the fluorescence of a lichen. After every measurement a thin layer of a lichen was scratched off. This diagram shows the change in fluorescence across the thallus of the lichen.

Thank you for your attention!