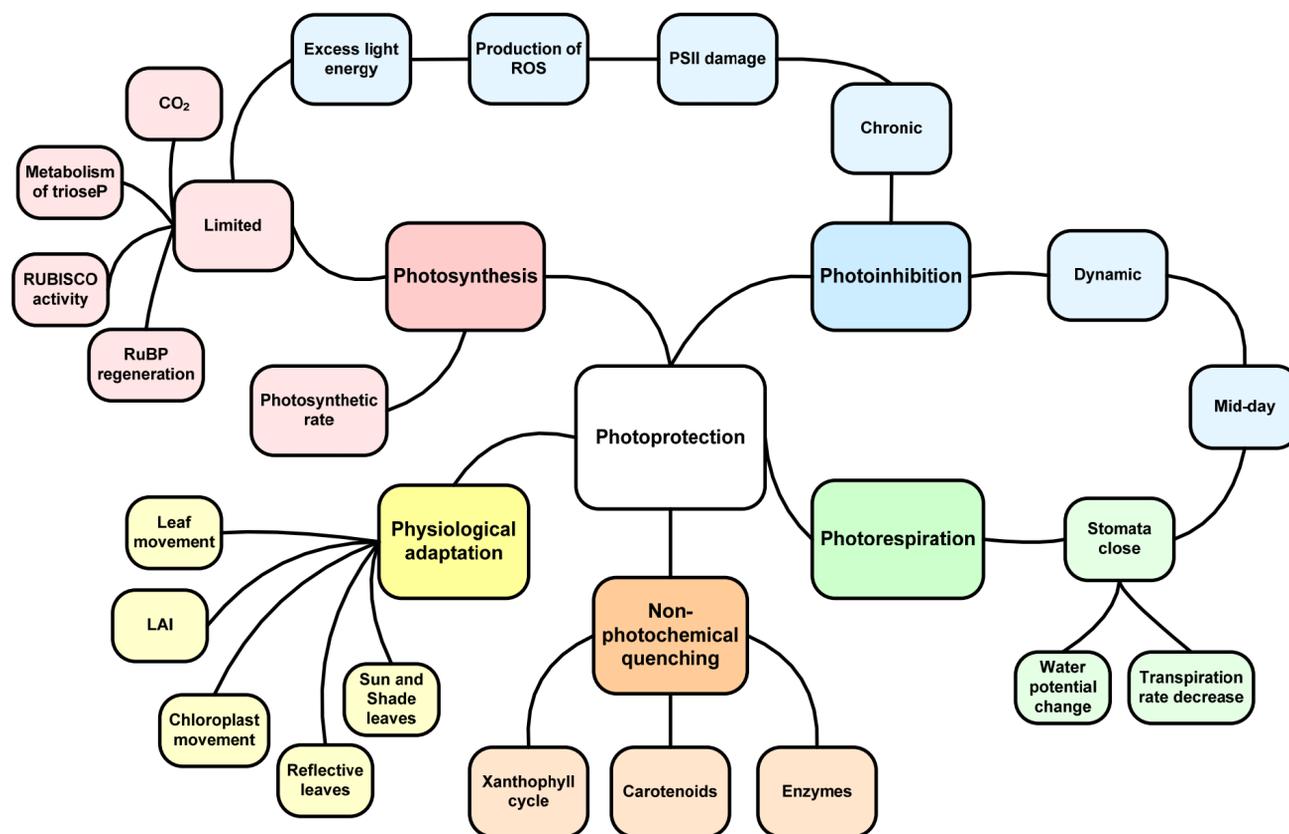


Photoprotection: A Threshold Concept in Plant Sciences

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Photoprotection



Why a Threshold Concept?

- **Transformative:** once understood its potential effect on student learning and behaviour is to occasion a significant shift in the perception of a subject.

Understanding the concept of photoinhibition should lead to an appreciation of the level of adaptability that plants need to survive in changing environments. In order to reduce the effects of photoinhibition, plants have evolved a complex and imperfect system involving photorespiration, non-photochemical quenching and physiological adaptations.

- **Irreversible:** in that the change of perspective occasioned by acquisition of a threshold concept is unlikely to be forgotten.

Once you have opened your mind to the idea that the physiology of plants has evolved as a compromise which is unlikely to be ideal you no longer assume logic in plant design.

- **Integrative:** it exposes the previously hidden interrelatedness of something.

Photoprotection uses a wide range of different processes involving physiological, chemical and genetic adaptations. For example leaf angle, transpiration rate and colour can all be explained as plant environmental adaptations to avoid photoinhibition.

- **Troublesome**

The concept that, although plants need light to survive they can get too much of it is initially troublesome. It is hard to imagine that plants have not found some way of harvesting all the light available to them, and that other factors repress their maximum photosynthetic capacity.

- **Bounded:** any conceptual space will have terminal frontiers, bordering with thresholds into new conceptual areas

Is only a meaningful concept in plants because they can't move! The ability to cope with changes in environment without being able to move to a new environment leads to a greater level of adaptability and sensitivity to environmental change than most animals. Therefore this concept of defence against photoinhibition is only really applicable in the plant sciences.

Teacher Perspectives

General confusion about what photoprotection actually is

Specific questions asked of supervisors:

- What do xanthophylls and carotenoids actually do?
- The photosynthesis and data practicals are not easily understood.
- Some students have the impression that the electron moves during RET; it is the energy that moves, not the electron itself.
- How does the xanthophyll cycle work?

Learner Perspectives

How did you learn about photoinhibition?

- Well laid out in lectures-leads on quite linearly.
- Always break subjects up into biochemical and physiological areas
- ROS is taught in other areas of the course
- Talking about subjects in supervisions helps
- Helps to see concept map

Is photoinhibition a threshold concept?

- Definitely integrative
 - Only from biochemical side
 - Not integrated with ecology
- Once you have learned something you can make it into a threshold concept
- They are probably different to every person – some links will seem more obvious to other people
- Can be affected by personal beliefs about what is most important i.e. belief in evolution
- Can't tie in links without a good knowledge of all facts given in lectures
- Irreversible is a strong term – you are less likely to forget once you understand photoinhibition
- It is possible to think of some of the linking points (on concept map) without mentally referring back to photoinhibition.

Implications

- Some additional resources are needed to elucidate certain links and key issues
- Concept map could be used to link to additional resources (hyperlinks)
- This concept integrates learning from the whole of the Michaelmas term, not just one lecture
- Additional attention should be paid to this topic during supervision time

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