PLANT PHYSIOLOGY Lecture 24 - Photomorphogenesis

I. Definition and importance of photomorphogenesis
- **A. Morphogenesis - development (origin) of form**
- **B. Photomorphogenesis - control of morphogenesis**
- **C. Examples of photomorphogenesis**
  - **1. Chlorophyll production stimulated by light**
  - **2. Leaf expansion promoted by light**
  - **3. Stem elongation inhibited by light**
  - **4. Root development promoted by light**
- **D. Pigments involved with photomorphogenesis**
  - **1. Phytochrome (red and far-red)**
  - **2. Cryptochrome (violet and blue)**

II. Phytochrome - "a bluish-green plant protein that, in response to variations in red light, regulates the growth of plants"
- **A. How does it work?**

  P_r ==========> P_{fr} ----------> physiological response

- **B. What does phytochrome look like?**
  - **1. Open tetrapyrrole - isomerizes when wavelength shifts**
- **C. How are physiological responses invoked?**
  - **1. Possible mechanisms: assume phytochrome is membrane bound**
    - **a) Control of active transport via ATPase**
    - **b) Control of membrane-bound hormones (i.e., gibberellin)**
    - **c) Modulating activity of membrane-bound proteins**

III. Research perspective - phytochrome and calmodulin
- **A. Calmodulin - Ca^{2+}/calmodulin complex activates various enzymes....calmodulin role is not completely worked out.**
  - **1. Current research (Bossen, Kendrich, Kreig, Stenz, Wong, etc)**
    - **a) Phytochrome changes membrane characteristics**
    - **b) Causes a change in [Ca^{2+}]**
    - **c) Calmodulin gets activated and causes a physiological response**

IV. Application: factors affecting branching
- **A. Genotype - breeding for more compact plants**
- **B. Growth hormones - gibberellin (internode elongation) and auxin (apical dominance)**
- **C. Temperature - higher temperature decreases branching**
- **D. Water and minerals - change leaf/stem ratio**
- **E. Clipping or grazing - stimulates branching (remove apical meristem)**
- **F. Light & plant density - more light gives more branching**
- **G. Photoperiod - longer photoperiod gives LESS branching (due to timing of light and bud dormancy)**