

Plant Physiology

De An Jiang

- 1.<http://www.cls.zju.edu.cn/sub/classroom/physiology/content/ketang.htm>**
- 2.<http://jpkc.zju.edu.cn/k/437/content/ketang.htm>**

Textbooks

- 1.Introduction to Plant Physiology(3rd edition)
- William G.Hopkins &Norman P.A.Hüner.
- John Wiley & Sons Inc. , 2004
- 2.植物生理学. 曾广文、蒋德安.中国农业科技出版社,2000
- 3.植物生理学实验指导.蒋德安、朱诚.四川成都科大出版社,1999

- **Introduction**
- **1. Task and significance for study on plant physiology**
- What is plant physiology?
- *Plant physiology is a science to study the law of the life activity of plant.
- **The study of plant function, encompassing the dynamic processes of growth, metabolism and reproduction in living plant (Taiz L and Zeiger E 1991).

- *****Plant physiology is about how plants use the energy of sun to assimilate carbon, and how they convert that carbon to stuff of which they are made. It is about how plants obtain and distribute nutrients and water, how they grow and develop, how they respond to their environment, how they react to stress, and how they reproduce. In short, plant physiology is about how plants work.**

- ****Plant physiology is for students who are curious about what plants do and what physical and chemical factors cause them to respond as they do(Salisbury and Ross 1992) .
- **Object of study:** Lower plants and higher plants, **mainly higher plants** .
- **Purpose of study?**

- **Purpose of study:** To understand and uncover the law of life activity of plant, to protect and utilize plant in the agricultural and industrial practice according to the law.

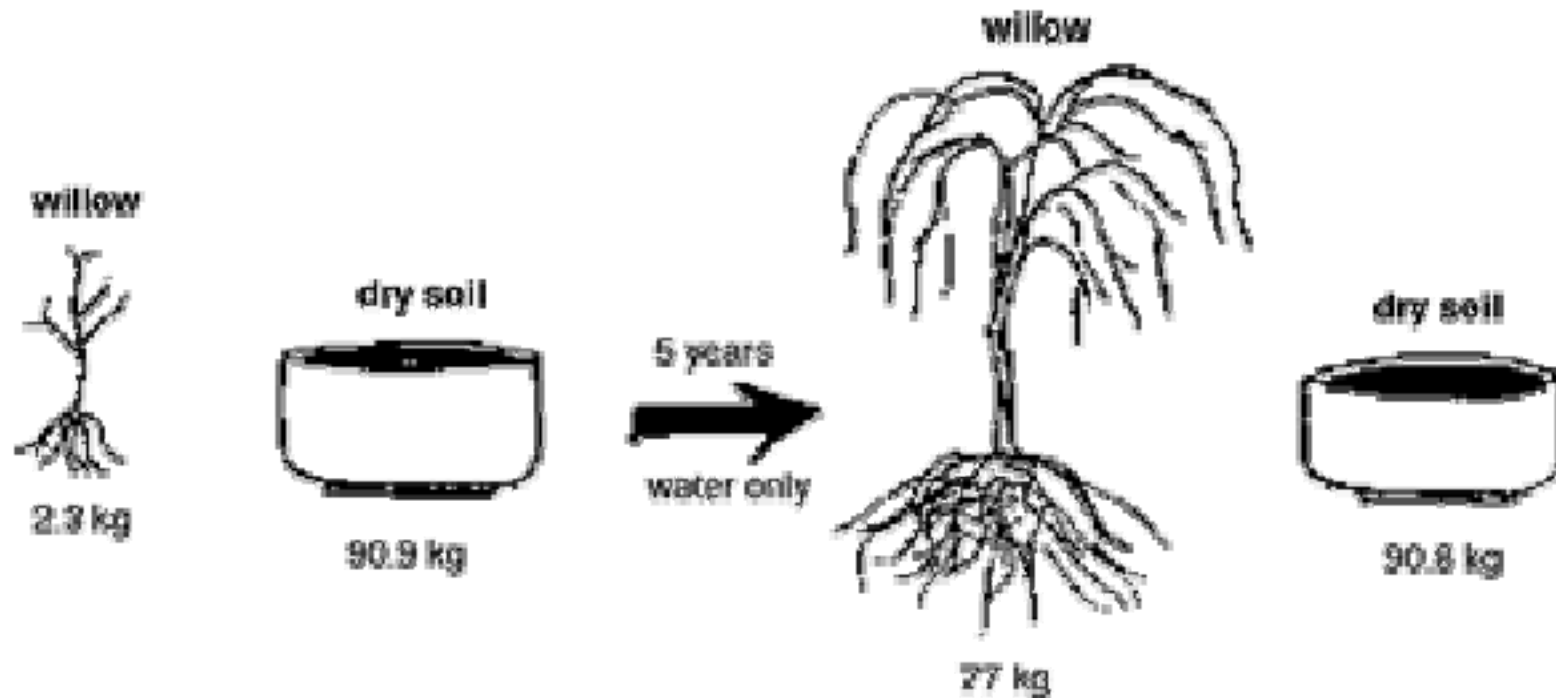
- **2. Birth and development of plant physiology**

- **(1) Initiation (萌芽阶段)**

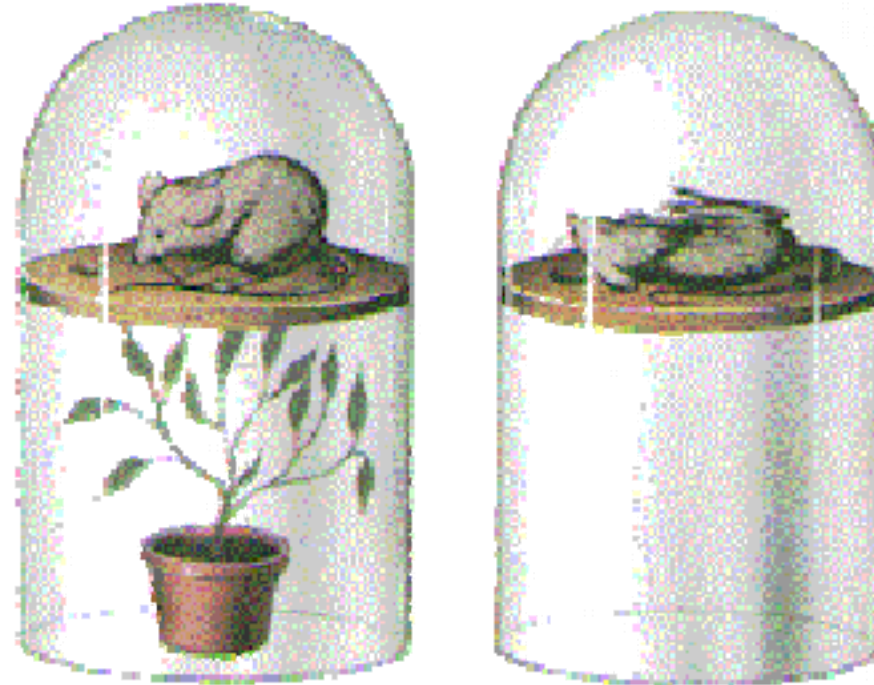
- 《汜胜之书》：application of manure (fertilizer): basal manure, seed manure and top dressing.
- “美田之法绿豆为上”——fertilize the soil with legume.
- “曝使极燥”——dry the seed for storage longer.
- “粪水溲种”——use seed manure.
- “七九闷麦”——vernalization.
- In western Europe and the ancient Roman, the excreta of man and animal, loam and ash etc were used as fertilizer.

- **(2) Formation**

- **Van Helmont** (1577-1644): willow test (1627)



- **S. Hales** (1672-1761), Plant transpiration
- **J. Priestley** (1733-1804), mouse and green plant test



- **J. Von Liebig** (1803-1873) :Application of chemistry I agriculture and physiology (1840)
- **Knop & Pfeffer** :successful solution culture for land plants (1859)
- **J. Von Ssches** (1832-1897) 《lecture for plant physiology》 (1882)
- **W Pfeffer** 《Plant Physysiology》 (1904)

- **(3)development:**
- Since 20 century, achievements in Biochemistry, biophysics, cell biology, isotop technology, molecular biology etc enhance development of plants physiology both in theory and application.

- Theory: **Nobel Prize relative to plant physiology**
- **Wilstatter(1915)**: purification and structure of chlorophyll.
- **Fischer(1930s)**: chlorophyll chemistry。
- **Calvin等(1962)**: photosynthetic carbon cycle。
- **Woodward(1965)**:synthesis of chlorophyll molecule.
- **Mitchell(1978)** ATP synthesis——chemical osmosis theory.
- **Deisenhofer :(1988)** structure of PSII reaction center
- **Marcus(1992)**: electron transport in life system.
- **Walker (1997)**: reaction mechanism and kinetic structure of ATPase.

- **Application :** Fertilizer application; Plant tissue culture, devirus and rapid propagation.



- Plant regulators;



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- Antisense: ACC synthase in tomato;
- Resistant plants: D1 protein and herbicide resistance.

- **3 Prospect and challenge of plant physiology**
- The characteristics of plant physiology: more and more extensive, deeper and deeper in the level of research, facing to combine with other disciplines, from the micro to the macro, molecule to ecology, theory to application.
- The most challenge is from plant biochemistry and plant molecular biology.

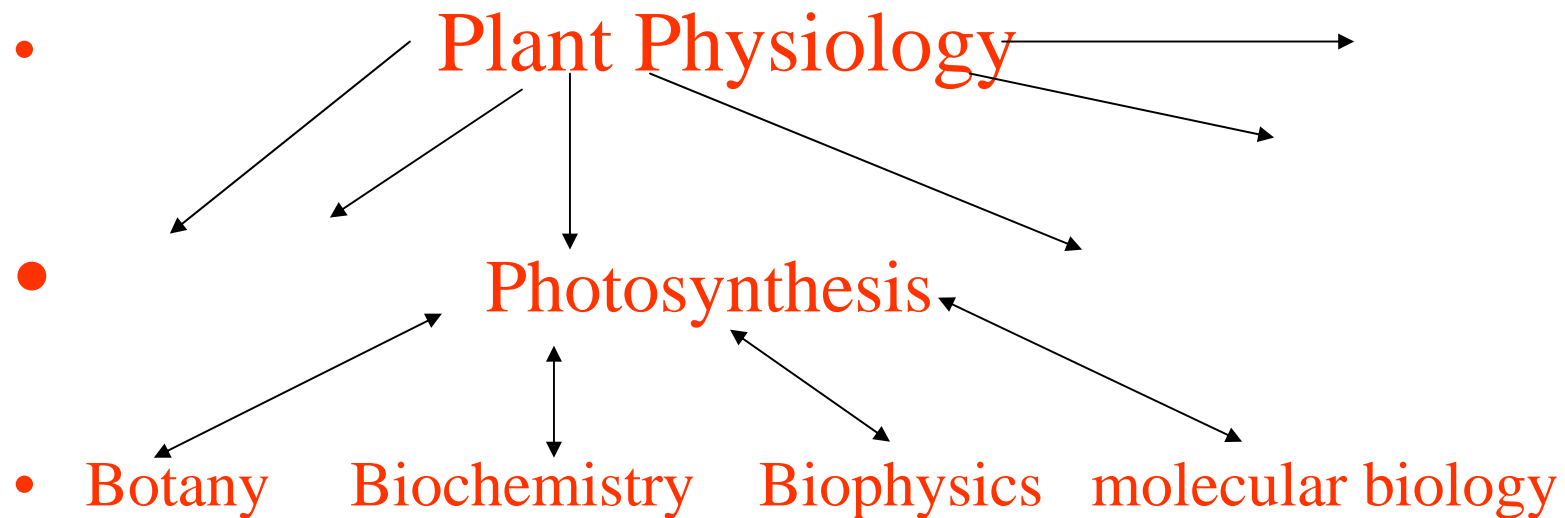
- **Fundamental theory :**

- Photosynthesis and N-fixation by organism, energy transformation and regulation of enzymes.
- Development regulation——flowering , senescence.
- Signal transduction——abiotic and biotic factors.
- Stress physiology ——expression and regulation of genes for resistance to extreme stresses.

- **Application:**
- Promotion of yield and quality in agriculture and industry.
- New food, new commercial flower with tissue culture
- Delay fruit ripeness, regulator application, environmental protection.
- Information technology, space technology and bioenergy.

- **4. Relationship between plant physiology and other subjects.**
- **Basic sciences:** botany, biochemistry, biophysics, molecular biology, computer science.
- **Relative subjects:** genetics, cell biology, ecology, chemistry.
- **Later subjects:** function genomics of plant, gene transform in plant, plant culture and breeding etc.

- How does plant physiology differ from its sister disciplines?



5.how to study plant physiology better

(1)Review and preview, understand in the class, **keep in your memory in the basis of understanding.**

(2)Distinguish the first to other, study for use.

(3)Read relevant book and reference.

- Reference book:

- Taiz L, Zeiger E. **Plant Physiology**. Sinauer Associates, Inc. (4th 2006),
- Buchaman BB, Grussem W, Jones RL. **Biochemistry and Mole-cular Biology of Plant**, Courler companies, Inc, 2000
- 武维华.**植物生理学**. 科学出版社2003.
- 潘瑞炽等.**植物生理学**. 高等教育出版社2004(第五版).

- Journals:
- 植物生理学通讯
- 植物学通报
- 植物生理与分子生物学学报
- Integrates of plant biology (*Acta planta sinica*).
- Plant physiology,
- *Planta*
- Plant and cell physiology
- *physiologium plantarum*
- ...