BIOCHEMISTRY AND PHYSIOLOGY OF PLANT HORMONES

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INTRODUCTION

What is the meaning of growth and development ?

Salisbury and Ross (1985) :
Development (or morphogenesis) = growth and differentiation

Growth : as an increase in size

Differentiation : as a process by which cells become specialized

Wareing and Phillips (1981) :
Plant development involves both growth and differentiation

Growth is used to denote quantitative changes occuring during development and is defined as an irreversible change in the size of a cell, organ, or whole plant

Differentiation is applied to qualitative changes

Steward (1968) :
A very general way to include what others consider more explicitly to be growth, differentiation, and morphogenesis

PLANT HORMONES

The plant hormones are extremely important agents in the integration of developmental activities, and they also are concerned importantly in the response of plants to the external physical environment

Environmental factors often exert inductive effects by evoking changes in hormone metabolism and distribution within the plant

Hormone also are the principal agents which otherwise Regulate expression of the intrinsic genetic potential of plants

A plant hormone defined as an organic substance other than a nutrient (a substance which supplies either carbon and energy or essential mineral elements), active in very minute amounts (e.g., < 1 mM, often < 1 μM), which is formed in certain parts of the plant and which usually is translocated to other sites, where it evokes specific biochemical, physiological, and/or morphological responses

A growth regulator is an organic compound which in small amounts promotes, inhibits, or qualitatively modifies growth and development

The commonly recognized classes of plant hormones are auxins, gibberellins, cytokinins, absisic acid, ethylene, brassinosteroids, hypothetical florigens or anthesins

AUXIN

First to be discovered, Greek “auxein”, means to grow

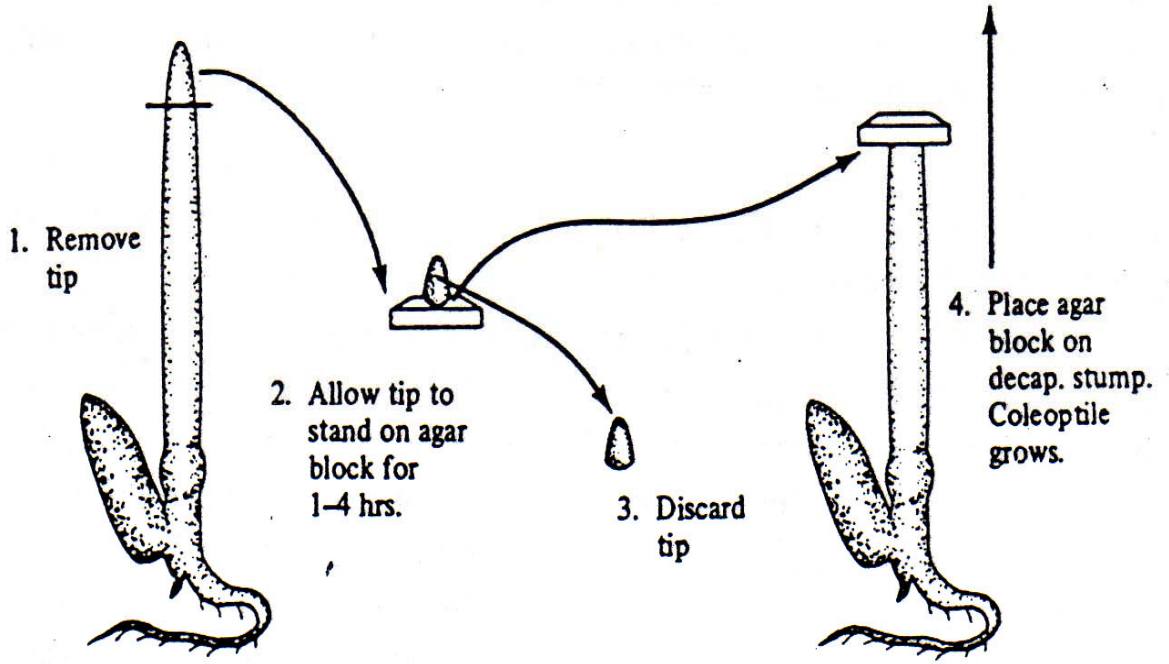
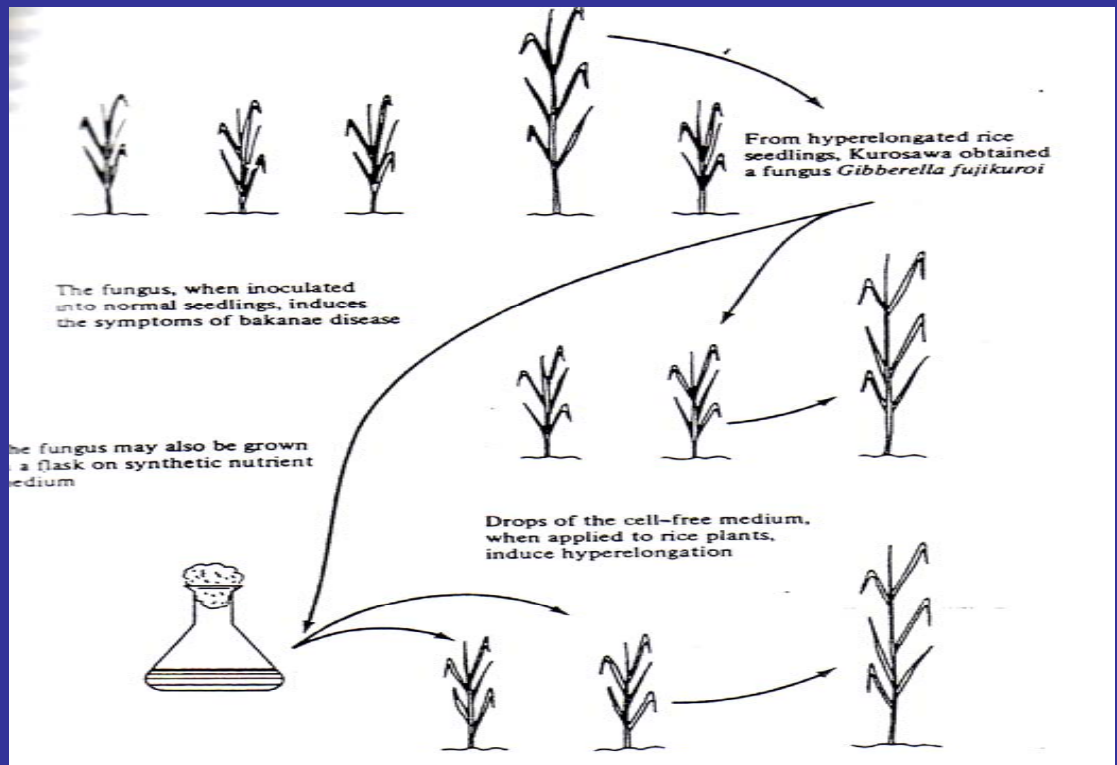


FIGURE 2.2. Basic experiment by F. W. Went that led to the definitive discovery of auxin. (Redrawn, with permission, from Bonner and Galston, 1952.)

GIBBERELLIN

Kurosawa, 1926

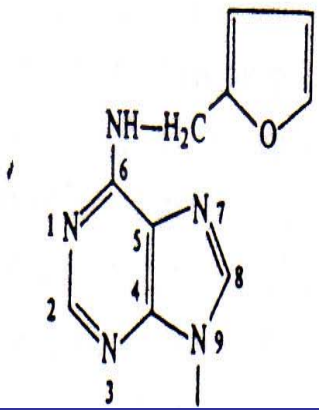


IGURE 3.1. Discovery of GA through investigations of bakanae, a disease of rice aused by *Gibberella fujikuroi* (*Fusarium moniliforme*). (Redrawn from *The Life of he Green Plant* by A. W. Galston. p. 74. Copyright © 1961 by Prentice-Hall, Inc. By ermission of Prentice-Hall, Inc.)

Cytokinins

1955, Miller, Skoog, von Saltza, Strong,
isolated substance called kinetin
(6-furfurylaminopurine, $C_{10}H_9N_5O$)
from an autoclaved sample of herring
Sperm DNA and demonstrated it to be very active
in promoting mitosis and
Cell division in tobacco callus tissue *in vitro*

FIGURE 4.1. Structure of kinetin 6-furfurylaminopurine, the first cytokinin to be discovered.



ABSCISIC ACID

Addicott, 1961

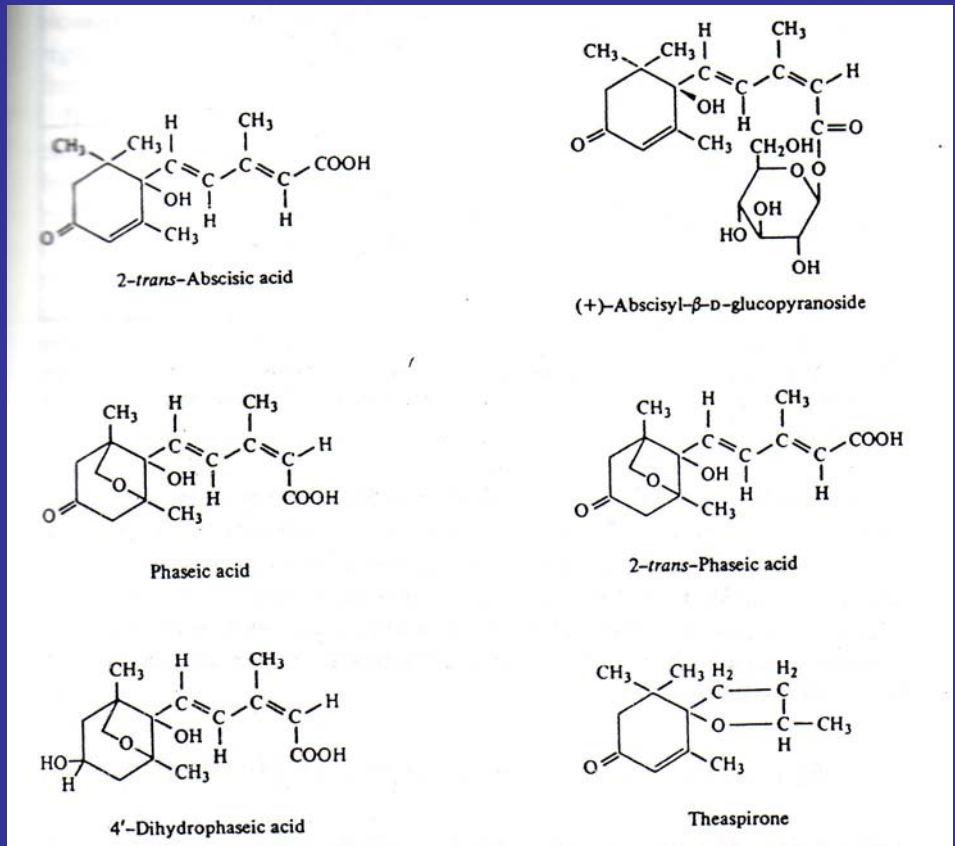


FIGURE 5.3. Some naturally occurring substances related to ABA. (Reproduced, with permission, from the *Annual Review of Plant Physiology*, Volume 20. © 1969 by Annual Reviews Inc. From Addicott and Lyon, 1969.)

Ethylene

Hydrocarbon gas : C_2H_4
Neljubow, Russian physiologist

Brassinosteroids

Grove *et al*., 1979
A novel plant growth regulating steroidal substance called “brassinolide”
was isolated from rape (*Brassica napus*) pollen

Brassinosteroids are synthesized from campesterol, Sitosterol and cholesterol

Campesterol --- campestanol --- …-- castasteron

I

(active) Brassinolide

I

26-hydroxybrassinolide

(inactive)


THANK YOU