Lecture 2

Medicinal Plant

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Plant Metabolites

- Plant metabolites are frequently distributed differently among a few taxonomic groups in the plant kingdom.

They also offer unique materials that are used in different fields. The chemical synthesis of those natural compounds or their possible derivatives can be carried out not only through a direct extraction from plants but also by using **plant cell culture, which becomes a promising alternative for manufacturing**

- metabolites that are challenging to obtain through chemical synthesis or plant extraction

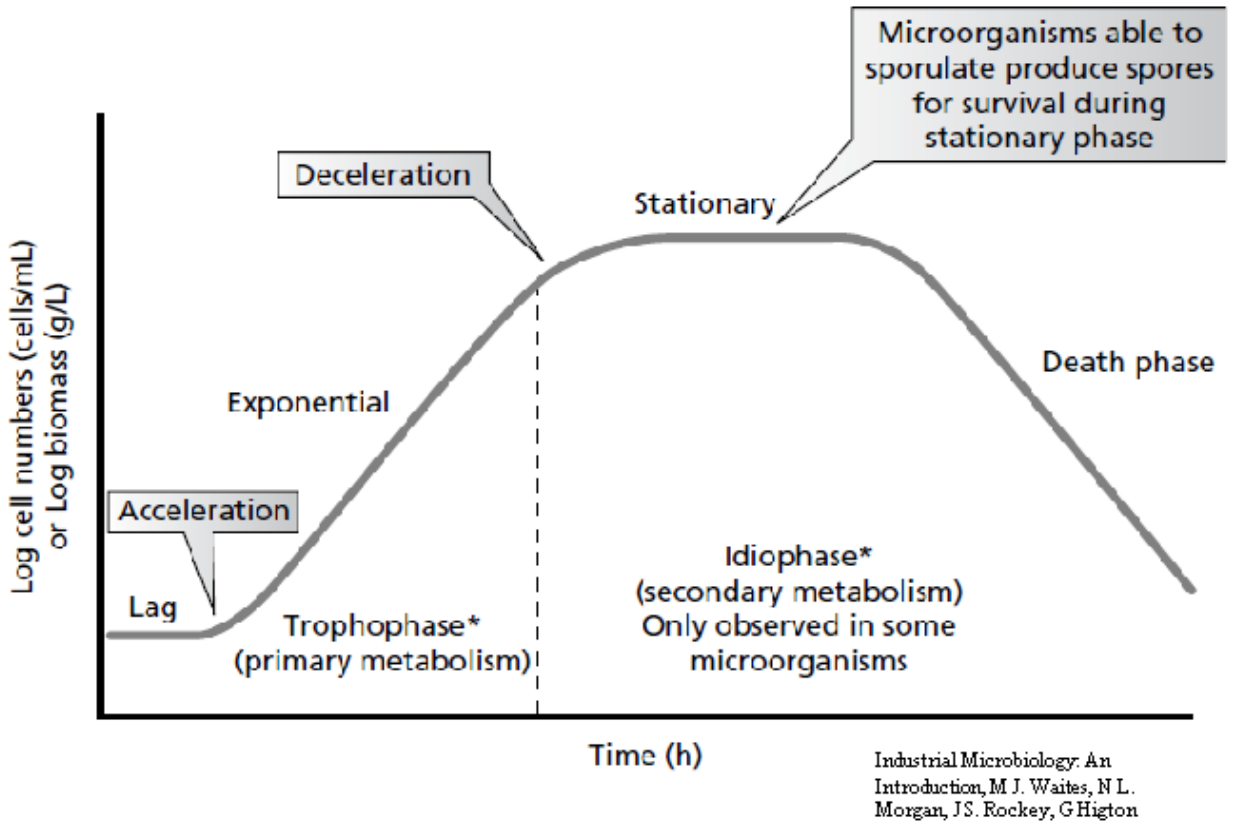
Classification of Plant Metabolites

- **Plant cells produce two types of metabolites:**

1. **Primary metabolites (PMs):** involved directly I plant growth and metabolisms, such as carbohydrates, lipids anf proteins
2. **Secondary metabolites (SMs):** the end products of primary metabolites but not involved in metabolic activity, such as alkaloids, phenolics, steroids, essential oils, tannins, ect.

Primary metabolites (PMs)

Production of PMs occurs during the active growth phase (**trophophase**) and begins in the presence of required nutrients in a growth medium.



Industrial Microbiology: An Introduction, M J. Waites, N L. Morgan, J S. Rockey, G Higton

Functions of Primary metabolites (PMs)

1. Primary metabolites are the main products of metabolic processes involved in different living functions required for life, such as cellular functions, growth and reproduction.

2. Plant PMs are also involved in **energy production, including respiratory and photosynthetic enzymes**.

3. PMs are also the main components of the basic cell structures, such **as phospholipids for cell membranes, peptidoglycan and chitin for cell walls, and proteins for cytoskeletons** [78].

Functions of Primary metabolites (PMs)

4. Nucleic acids for DNA and RNA synthesis which transmits genetic information.

2. Function as signal molecules to trigger defense response by signal transduction and pathogen recognition processes

signaling molecules such as hormones and other growth factors are composed of peptides, biogenic amines, steroid hormones, auxins and gibberellins, etc.

Secondary metabolites (SMs)

- Plants SMs attracted the interest of many scientists from different research fields in plant biology and biotechnology. **They studied, in vitro and in vivo, bioactive molecules extracted from several plants with the aim to isolate, analyze and biochemically characterize new phytochemicals and evaluate their biological activity and eventual toxicity.**

Secondary metabolites (SMs)

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants,

Plant PMs *VS.* Plant SMs

Plant primary metabolites	***Plant Secondary metabolites (Plant natural products)***
1. Organic compounds produced in the plant kingdom	1. Organic compounds produced in plant kingdom
2. Have metabolic functions essential for plant growth and development	2. Don't have apparent functions involved in plant growth and development
3. Produced in every plant	3. Produced in different plant families, in specific groups of plant families or in specific tissues, cells or developmental stages throughout plant development.
4. Include carbohydrates, amino acids, nucleotides, fatty acids, steroids and lipids	4. Include terpenoids, special nitrogen metabolite (including, non-protein amino acids, amines, cyanogenic glycosides, glucosinolates, and alkaloids), and phenolics.

Functions of Secondary metabolites (SMs)

- **Phytochemicals**

1. which provide health benefits for humans further than those attributed to macronutrients and micronutrients[1].
2. Protects plants from disease, pathogen attack, and damage and contribute to the plants color and aroma and flavor.
3. Contribute to the plants color and aroma and flavor.
4. Protects plant cell from environmental hazards such as pollution, stress, drought and UV exposure

Functions of Secondary metabolites (SMs)

5. Antioxidant activity
6. Antimicrobial effect
7. Modulation of detoxification and enzymes
8. Stimulate the immune system
9. Decrease the platelet aggregation
10. Modulation of hormone metabolism and anticancer property
11. Protect human against disease
12. Reduce the risk of heart disease by preventing the oxidation of coronary

Functions of Secondary metabolites (SMs)

13. Reducing the synthesis or absorption of cholesterol leading to low density lipoprotein (LDL) cholesterol

Phytochemicals: where to find?

In wide-ranging dietary phytochemicals are found in fruits, vegetables, legumes, whole grains, nuts, seeds, fungi, herbs and spices[3]. Broccoli, cabbage, carrots, onions, garlic, whole wheat bread, tomatoes, grapes, cherries, strawberries, raspberries, beans, legumes, and soy foods are common sources[6].

Accumulation of Phytochemicals

in different parts of the plants, such as in the roots, stems, leaves, flowers, fruits or seeds. Many phytochemicals, particularly the pigment molecules, are often concentrated in the outer layers of the various plant tissues.

Phytochemicals Levels

from plant to plant depending upon the **variety,**

processing, cooking and growing conditions[8].

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THANKS
FOR
LISTENING