

Fungal Metabolism

Metabolism :is a term that is used to describe all chemical reactions involved in maintaining the living state of the cells and the organism .

Metabolism can be conveniently divided into two categories

1- **Catabolism** - the breakdown of molecules to obtain energy

2- **Anabolism** - the synthesis of all compounds needed by the cells

Primary metabolites: are essential compounds for growth to occur and include proteins, carbohydrates, nucleic acids and lipids. these primary products must be synthesized if they cannot be obtained from the growth medium. These primary metabolites have essential and obvious roles to play in the growth of the fungus. Typically, primary metabolites are associated with the rapid initial growth phase of the organism and maximal production occurs near the end of this phase. Once the fungus enters the stationary phase of growth, however, primary metabolites may be further metabolized. Examples of primary metabolites produced in abundance: enzymes, fats, alcohol and organic acids as well as, low molecular weight compounds.

Primary metabolism is used for:

- 1- Growth and development of hyphal structure
- 2- Energy metabolism
- 3- Regulation of metabolism
- 4- Intermediate in biosynthesis of compound

Secondary metabolism is used for:

- 1- Competition
- 2- antagonism
- 3- self-defense mechanisms against other living organisms to allow the fungus to occupy the niche and utilize the food.

Types of Fungal secondary metabolites

- 1- Strobilurin (antifungal)
- 2- Gibberellins (growth Hormons)
- 3- Herbicides (control weeds)
- 4- Mycotoxins (poisneous)

- 5- Insecticides (control insects)
- 6- Enzymes (proteins)
- 7- Pigments (dyes)
- 8- Antibiotics (drugs)
- 9- Pharmacological drugs

Differences between primary metabolism and secondary metabolism

Primary metabolism	Secondary metabolism
Function are known	Function are usually unknown- lack
Widely distributed in nature	Only found in few species or genera
Usually used for growth, energy and as intermediate	Produced usually after growth has stopped
Examples: Pyruvate, lactic acid, ethanol	Examples: Penicillin, cephalosporin, gibberellin, lovastatin

Importance or the reasons for interest in secondary metabolites

- 1- Industries
- 2- Antibiotic: Penicillin and cephalosporin
- 3- Itaconic acid: cloth industries
- 4- Gibberellin: plant growth regulator
- 5- Animal feed
- 6- Pigment
- 7- Bioluminescence

Mycotoxin:

The term “mycotoxin” describes a chemically diverse group of low molecular weight organic substances produced primarily by moulds, although some yeasts and basidiomycetes (mushrooms) have the capacity to form mycotoxins. Excluding compounds produced by mushrooms, moulds are known to produce about 300–400 compounds that are recognized as mycotoxins.

Mycotoxins form in hyphae where they may remain, be incorporated into conidia during conidiogenesis, or be expelled into the environment. These substances are thought to be produced by fungi as ecologic

survival aids designed to reduce competition for nutrients and living space by other fungi and organisms such as bacteria, insects, and arachnids. Depending on the mycotoxin, various effects on protein, DNA, RNA synthesis or disruption of cell membranes are produced, resulting in either impaired cellular function or death.

There are three primary manners in which humans and animals may be exposed to mycotoxins;

1- eating contaminated food like cereals and grains, by skin contact and subsequent absorption of the mycotoxins, or by inhalation of mycotoxins or fungal elements containing mycotoxin. Of the three, the first is the most common and may result from pre-harvest growth of mycotoxin-producing fungi on the grain, fungal growth during storage.

2- by contamination of surfaces under conditions favorable for fungal growth

Aspergillus spp., which produce aflatoxins and ochratoxins, *Penicillium* spp., which produce ochratoxins, and *Fusarium* spp., which produce trichothecenes and fumosins, are the most relevant species.⁴ A few mycotoxins can be absorbed through the skin or mucous membranes, and may induce necrosis in addition to systemic effects on other rapidly dividing tissues such as the gastrointestinal tract and the hematopoietic system.

Absorption of mycotoxins through the respiratory system, by inhalation of mycotoxin-containing fungal elements, conidia or hyphal fragments, is the route of entry into the human body which has recently become of significant interest.

the effects of mycotoxins are influenced by a large number of factors, including :

- 1- the specific mechanism of action of the specific mycotoxin
- 2- the amount and duration of exposure.
- 3- the general health, age, and sex.
- 4- synergistic effects related to genetics.
- 5- diet, and interaction with other potential pathogenetic facilitators such as alcohol, infectious agents, and deficits in caloric or vitamin intake.