COURSE OUTLINE

1. Natural toxicants in foods which constitutes anti-nutritional factors ex. Cyanogenic glucosides; gossypols; aflatoxin; microbial and fish toxins.
2. Chemistry of toxins
3. Elimination of toxins and their interaction with nutrition
4. Hazardous foods
5. Toxic factors induced by processing
6. The use of experimental animals
7. Methods of removal of food toxins
8. Manner of processing of toxic foods
BRANCHES OF TOXICOLOGY

• Toxicology is defined as the study of the adverse effects of chemicals on living Organisms.

• A substance is considered toxic when it causes cellular or tissue injury by mechanisms other than physical trauma. Branches of Toxicology include

  • Clinical toxicology - deals with the prevention, diagnosis, and management of poisoning, usually in a hospital or clinical environment

  • Forensic toxicology - is the application of established techniques for the analysis of biological samples for the presence of drugs

  • Occupational toxicology - seeks to identify the agents of concern in the workplace
Environmental toxicology deals with the potentially deleterious impact of man-made and natural environmental chemicals on living organisms, including wildlife and humans.

Regulatory toxicology encompasses the collection, processing, and evaluation of epidemiological and experimental toxicology data to permit scientifically based decisions.

Ecotoxicology is concerned with the environmental distribution and toxic effects of chemical and physical agents on populations and communities of living organisms within defined ecosystems.

Food toxicology focuses on the analysis and toxic effects of bioactive substances as they occur in foods.
A toxicant is any chemical substance that can elicit a detrimental effect in a biological system. Food toxicant can be subdivided into three groups.

1. Endogenous toxicant
2. Naturally occurring toxicant
3. Synthetic toxicant
Endogenous toxicants

• Are those produced by tissue cells in plants and other biological raw materials.

• These chemical compounds often serve the purpose of protecting plant tissue from pests and pathogenic organisms.

• Transmission to individuals can easily occur through consumption of toxic plants by animals or used for human food.

• Examples: Anti-nutritional constituents - Trypsin inhibitor; Cyanogenic glycoside; aflatoxin etc.
Naturally occurring toxicants

• Toxicants produced by organisms that contaminate the food product. Microorganisms such as bacteria, fungi etc. may produce toxins or not into food matrix. Upon consumption, the toxin can produce disease.

• These toxicants differ in their stability, with some able to withstand heating temperatures used in cooking, while others can tolerate extreme pH without losing activity.

• Examples: Microbial toxin and Marine toxin
Synthetic toxicants

- Toxicants are synthetically produced, which find their way into food supply through contamination of the food processing environment.
- Also include drug residues in foods.
TYPES OF TOXICITY EFFECTS

• Toxicity is the capacity to produce toxic injury to cells and tissues

• Local: Skin irritations due to food toxins. Show external characteristics i.e. rashes, swelling etc.

• General: Causative agent could be microbial or food poisoning. Diarrhea, vomiting, kidney and other organs could be involved and death
THE DOSE-RESPONSE RELATIONSHIP

• The need to establish some criteria to base the relative safety of chemicals is essential

• Several methods are used to obtain data in order to establish safe levels and provide information about the relative toxicity of chemicals

• Acute Toxicological Studies

• Information concerning the toxicity of a substance is obtained primarily from either acute or chronic toxicity studies

• Acute toxicity studies are the most commonly performed studies for obtaining information on the effects of chemical exposure
• Chronic Toxicological Studies

• Chronic toxicity tests may be performed over a period of months, years, or the lifetime of the test animal

• Doses of the toxic substance are selected to assure that most of the animals will survive the entire time the study is performed

• Although acute and chronic studies provide useful information in evaluating chemical toxicity, it is important to understand that they are not truly representative of the environment to which people are exposed in everyday life
Terminology Associated with Toxicity Testing

- **Median Lethal Dose (LD<sub>50</sub>)** - The statistically derived single dose of a chemical that results in death of 50% of the target population.

- **Maximal Tolerated Dose** – The highest dose of a chemical given over a specific period of time which results in minimal non-lethal signs of toxicity.

- **No observed adverse effect level (NOAEL)** – It denotes the level of exposure of an organism, found by experiment or observation, at which there is no biologically or statistically significant increase in the frequency or severity of any adverse effects in the exposed population when compared to its appropriate control.

- **Acceptable Daily Intake (RfD)** - ADI estimated (maximum) amount of an agent, expressed on a body mass basis, to which a subject may be exposed over his lifetime without appreciable health risk. It is an estimate of the daily exposure that is likely to be without appreciable health effect even if continued exposure occurs over a lifetime.