Certificate Programme in Molecular Entomology

Insect Physiology and Biochemistry

Insect Physiology and Biochemistry Terms and Vocabulary

Insect physiology and biochemistry are essential fields in understanding the biological functions and processes of insects. This course focuses on the molecular aspects of insect physiology and biochemistry, providing a detailed understanding of how insects function at the cellular and molecular levels. To fully grasp the concepts covered in this course, it is crucial to be familiar with key terms and vocabulary related to insect physiology and biochemistry. Below are some of the essential terms that you will encounter throughout this course:

1. Metabolism: Metabolism refers to all the chemical reactions that take place within an organism to maintain life. It includes processes such as energy production, growth, and reproduction.

2. Enzyme: Enzymes are biological molecules that catalyze biochemical reactions in living organisms. They speed up chemical reactions by lowering the activation energy required for the reaction to occur.

3. Respiration: Respiration is the process through which organisms obtain energy from organic molecules. In insects, respiration involves the exchange of gases through specialized structures such as spiracles and tracheae.

4. Circulatory system: The circulatory system in insects is responsible for transporting nutrients, hormones, and waste products throughout the body. Insects have an open circulatory system, where hemolymph is pumped through the body cavity.

5. Neurotransmitter: Neurotransmitters are chemical messengers that transmit signals between neurons or from neurons to other cells. They play a crucial role in regulating various physiological processes in insects, such as muscle contraction and behavior.

6. Hormone: Hormones are signaling molecules produced by endocrine glands that regulate various physiological processes in insects. They control growth, development, reproduction, and behavior in insects.

7. Neurohormone: Neurohormones are hormones produced by neurons that act as chemical messengers in the nervous system. They play a role in regulating physiological processes such as molting and metamorphosis in insects.

8. Molting: Molting is the process through which insects shed their exoskeleton to allow for growth and development. During molting, insects secrete enzymes that break down the old exoskeleton, allowing for the formation of a new, larger exoskeleton.

9. Metamorphosis: Metamorphosis is the process through which insects undergo drastic changes in form and structure during development. There are two main types of metamorphosis in insects: complete

metamorphosis (holometabolous) and incomplete metamorphosis (hemimetabolous).

10. Phenoloxidase: Phenoloxidase is an enzyme that plays a crucial role in the insect immune response. It catalyzes the production of melanin, which helps to encapsulate and kill pathogens in insects.

11. Antioxidant: Antioxidants are molecules that protect cells from damage caused by free radicals and oxidative stress. Insects produce antioxidants to counteract the harmful effects of reactive oxygen species generated during metabolism.

12. Pheromone: Pheromones are chemical signals that insects use to communicate with each other. They play a vital role in mating behavior, territory marking, and alarm signaling in insects.

13. Detoxification: Detoxification is the process through which insects eliminate or neutralize toxic substances from their bodies. Insects have evolved various detoxification mechanisms, such as enzymatic detoxification and sequestration of toxins.

14. RNA interference (RNAi): RNA interference is a mechanism through which double-stranded RNA molecules silence the expression of specific genes. RNAi has been widely used in insect research to study gene function and develop novel pest control strategies.

15. Endosymbiont: Endosymbionts are microorganisms that live inside the cells or bodies of insects and form symbiotic relationships with their hosts. They can provide essential nutrients, confer resistance to pathogens, or influence host reproduction.

16. Juvenile hormone: Juvenile hormone is a key regulator of insect development and reproduction. It plays a crucial role in controlling metamorphosis, caste differentiation, and reproductive behavior in insects.

17. Chitin: Chitin is a polysaccharide that forms the structural component of the exoskeleton in insects. It provides rigidity and protection to the insect's body and is synthesized by enzymes called chitin synthases.

18. Gut microbiota: Gut microbiota refers to the community of microorganisms that inhabit the digestive tract of insects. These microorganisms play a vital role in digestion, nutrient metabolism, and immune defense in insects.

19. Antibiotic resistance: Antibiotic resistance is the ability of bacteria to resist the effects of antibiotics. Insects can develop resistance to microbial pathogens through various mechanisms, posing a challenge to pest control strategies.

20. Epigenetics: Epigenetics refers to changes in gene expression that are not caused by alterations in the DNA sequence. Epigenetic mechanisms play a crucial role in regulating gene expression during insect development and adaptation to environmental changes.

21. RNA sequencing: RNA sequencing is a high-throughput technique used to analyze the transcriptome of an organism. It provides valuable insights into gene expression patterns, alternative splicing events, and non-coding RNA molecules in insects.

22. Signal transduction: Signal transduction is the process through which extracellular signals are transmitted into the cell to trigger a cellular response. Insects use signaling pathways to regulate various physiological processes, such as growth, development, and immune response.

23. Phosphorylation: Phosphorylation is a common post-translational modification in which a phosphate group is added to a protein by kinases. It plays a crucial role in regulating protein activity, stability, and subcellular localization in insects.

24. Microbiome: The microbiome refers to the collective genomes of microorganisms that inhabit a particular environment, such as the gut or the surface of an insect. The insect microbiome plays a vital role in nutrient acquisition, immune defense, and overall health.

25. Oxidative stress: Oxidative stress occurs when there is an imbalance between the production of reactive oxygen species (ROS) and the antioxidant defense mechanisms in insects. Oxidative stress can lead to damage to proteins, lipids, and DNA, affecting insect health and longevity.

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38. Phytochemical: Phytochemicals are bioactive compounds derived from plants that have beneficial effects on insect health. They can act as antioxidants, antimicrobials, or growth regulators in insects.

39. Neurotoxin: Neurotoxins are substances that specifically target and disrupt the nervous system of insects. They can interfere with neurotransmitter function, ion channels, or neuronal signaling pathways, leading to paralysis or death in insects.

40. RNA virus: RNA viruses are a type of virus that use RNA as their genetic material. They can infect insects and cause diseases such as viral encephalitis, yellow fever, or dengue fever.

41. Protein synthesis: Protein synthesis is the process through which cells make proteins using the information encoded in messenger RNA (mRNA). It involves transcription, translation, and post-translational modifications of proteins in insects.

42. Immune response: The immune response in insects is a complex system of defense mechanisms that protect insects from pathogens, parasites, and other foreign invaders. It involves physical barriers, cellular responses, and humoral immune factors.

43. Feeding behavior: Feeding behavior in insects refers to the mechanisms and strategies that insects use to acquire and process food. It includes foraging, feeding preferences, and feeding strategies to maximize nutrient intake.

44. Heat shock protein: Heat shock proteins are a group of molecular chaperones that help protect cells from stress-induced damage. They are induced in response to environmental stressors such as heat, cold, or toxins in insects.

45. Detoxification enzymes: Detoxification enzymes are a group of enzymes that insects use to metabolize and eliminate toxic compounds from their bodies. They include cytochrome P450s, glutathione S-transferases, and esterases.

46. Carbon metabolism: Carbon metabolism in insects refers to the processes involved in the breakdown and synthesis of carbon-containing molecules such as sugars, fats, and amino acids. It plays a crucial role in energy production, growth, and development in insects.

47. Nitrogen metabolism: Nitrogen metabolism in insects involves the assimilation, recycling, and excretion of nitrogenous compounds such as amino acids, proteins, and waste products. It is essential for protein synthesis, energy production, and waste elimination in insects.

48. Endocrine system: The endocrine system in insects consists of glands that produce hormones to regulate various physiological processes. It plays a crucial role in growth, development, reproduction, and behavior in insects.

49. Antioxidant defense: Antioxidant defense mechanisms in insects protect cells from oxidative damage caused by reactive oxygen species. They include enzymes such as superoxide dismutase, catalase, and glutathione peroxidase.

50. Reproductive physiology: Reproductive physiology in insects involves the processes and mechanisms that control reproduction, mating behavior, and sexual differentiation. It includes hormone regulation, gamete production, and reproductive strategies in insects.

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