

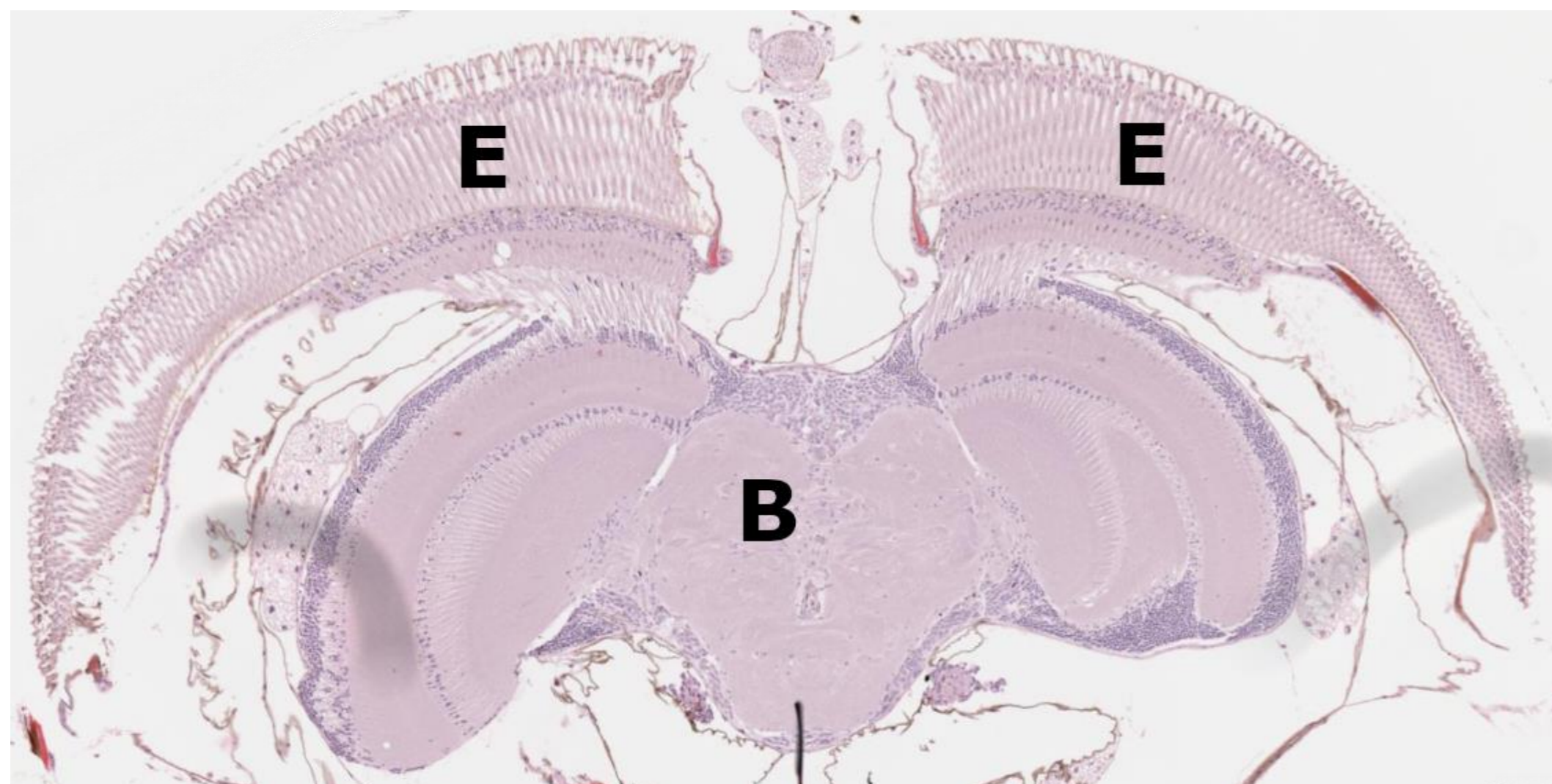
Histopathology as a Diagnostic and Surveillance Tool for Invertebrates

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Introduction

With the intensification of insect farming and increased adoption, the risk of health issues and disease outbreaks looms. Disease expression involves various factors such as infectious agents, genetic predispositions, and environmental influences, which can result in mortality or production loss. To ensure a safe and healthy production system, monitoring the health and quality of farmed insects is essential. This poster serves as an introduction to the concepts of histology and histopathology, and explores their potential applications in assessing the health and quality of farmed insects.



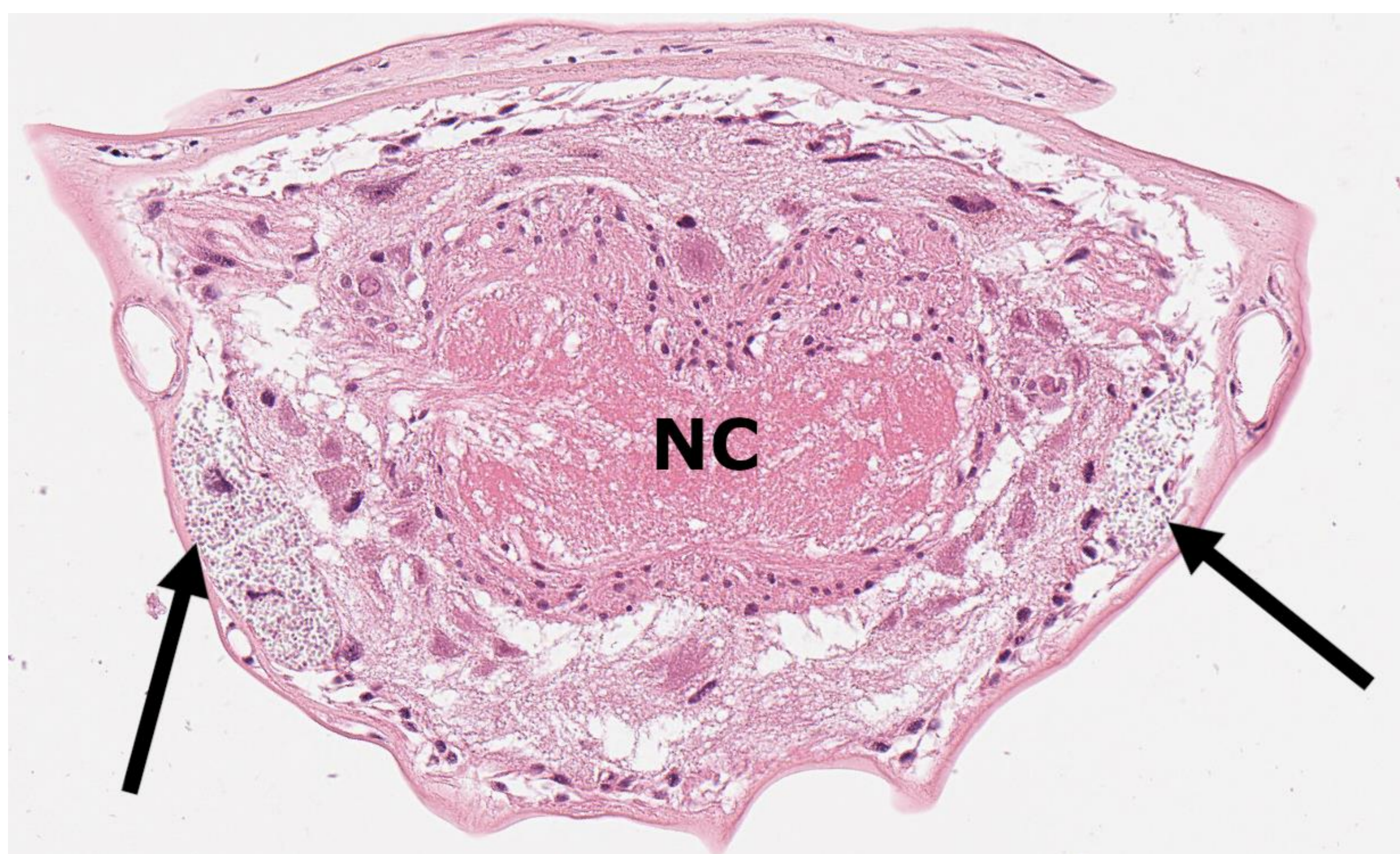
A histologic section of a housefly (*Musca domestica*) showing the eyes and brain

What is Histology?

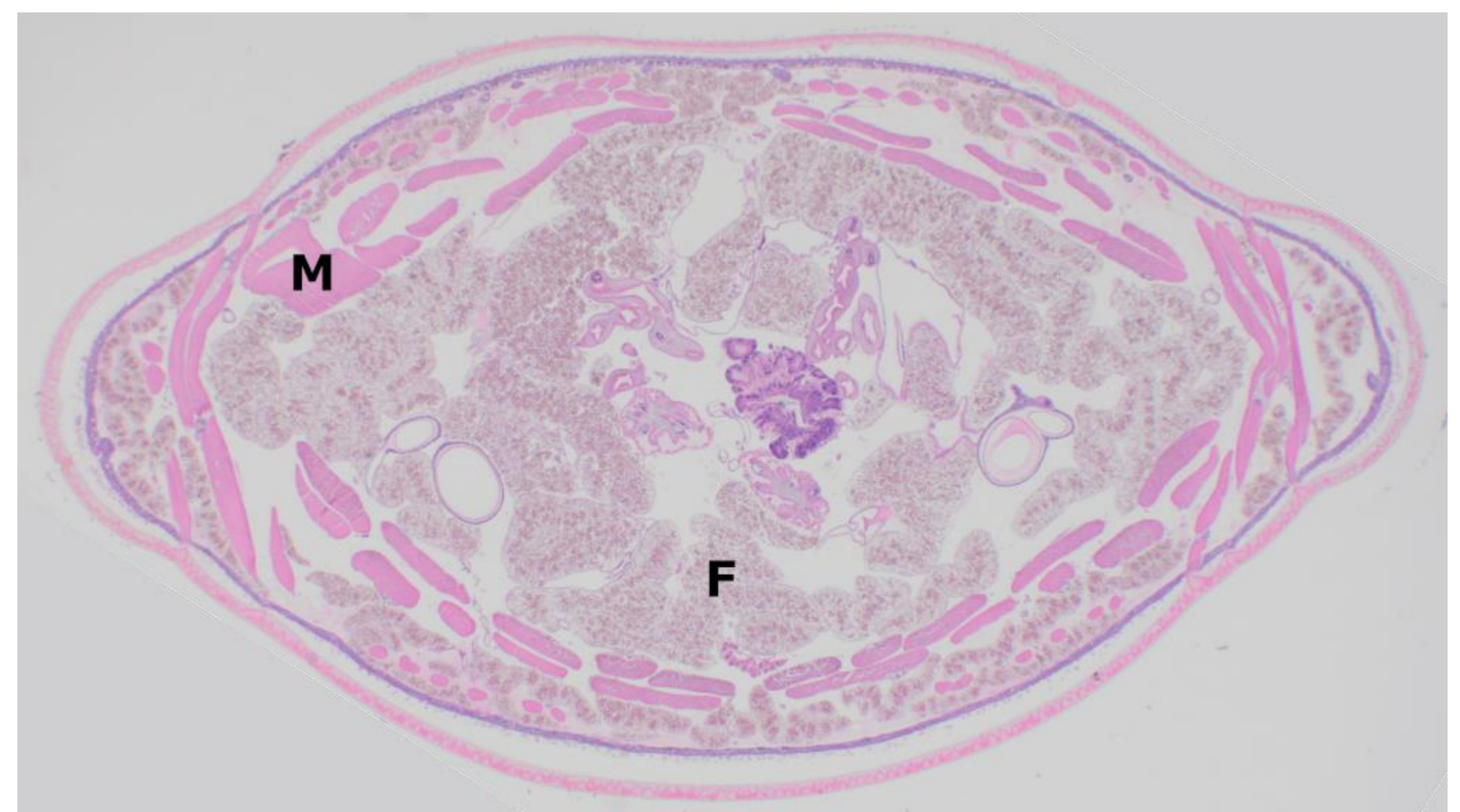
Histology is a technique used to study the microscopic structure of tissues and organs. It involves the preparation of thin slices of tissue which are then stained and examined under a microscope to observe the cellular and structural details of the tissue which can provide insights into their function, and pathology. Histology allows for the identification of normal tissue characteristics, as well as the detection of abnormal cellular changes associated with diseases or conditions.

Diagnostics and Pathogen Research

Histopathology is the study of structural changes to tissue associated with disease. Morphologic changes in tissues can provide valuable insights into the pathologic processes and aetiologies of disease, aiding in the development of control strategies. This is particularly crucial when multiple potential causes of diseases are detected by culture or molecular techniques. Histopathology can help confirm the diagnostic significance of these isolates by visualising typical lesions or active participation of the organism in the disease process. To establish a reliable diagnostic service for farmed insects, perfecting histologic processing of insects in a routine laboratory setting, along with examination of normal tissues from common species, would be an important initial step.



A section from the nerve cord of an Atlas moth caterpillar (*Attacus atlas*) showing intracellular microsporidia (suspected *Nosema*) infection. Accurate diagnosis following mass colony mortality allowed interventions and preventative measures to be put in place.



A transverse section through a black soldier fly larva (*Hermetia illucens*) showing the relative proportions of muscle (M) to fat body (F) tissue.

Body Composition Analysis

Histology can provide insights into the relative proportions of different cellular components within the body of farmed insects, such as skeletal muscle, fat bodies, and oenocytes. Understanding the relative body composition of insects can have implications for their nutritional value, palatability, and overall suitability for farming.

The relative cellular body composition of insects could be influenced by various husbandry factors, including diet, rearing conditions, and disease. For example, histological analysis could reveal the effects of different diets on the muscle-to-fat body ratio or the changes in oenocyte size and number. Body composition will also vary with genetic factors and histologic analysis could aid in the selection of the most suitable insect species or genetic lineages.

Histology could also be used to monitor changes in the relative body composition of insects over a production cycle, providing insights into the impact of different management practices or disease outbreaks on quality and health. This information can be valuable for making real-time informed decisions about adjustments to rearing conditions, nutrition, or health management strategies to optimize the body composition of farmed insects for desired production outcomes.

Biosecurity

The sourcing of new genetic stock from wild insect populations risks the introduction of new disease agents into the farmed population. Histopathology could be used as a tool to monitor the health and quality of introduced stock and detect potential diseases or health issues, alongside molecular and bacteriology techniques.

This concept has been applied to screen endangered snail species from captive breeding programs before release into wild populations to lower the risk of disease introduction and spread.



A parasitic nematode (P) – suspected *Sphaerularia bombi* – adjacent to sections of intestine (I) within the coelom of a wild bumblebee (*Bombus*). This parasite causes infertility in potential queens.

If you would like to discuss the applications of histology in insect farming further please contact me:

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