TUGAS 1: MK. ENTOMOLOGI PERTANIAN

1. Tugas ini diselesaikan oleh kelompok (dhi. adalah kelompok praktikum), di tulis dengan tangan, pada kertas folio garis yang sudah dibagikan, dikumpulkan pada praktikum pekan depan.
2. Pada penugasan ini, disajikan suatu gambaran tentang matakuliah yang mempelajari serangga (serupa dengan matakuliah ini), yang tercantum pada 5 halaman berikutnya sesudah halaman ini, dan jawablah beberapa pertanyaan berikut:

a. Apa nama lengkap mata kuliah ini.

b. Sesuai dengan *website* nya, di universitas mana – dan di negara mana matakuliah ini diberikan.

c. Sebutkan nama-nama pengasuh mata kuliah dalam penugasan ini.

d. Buatlah resume singkat tentang poin-poin pokok mengenai Bab Eksoskeleton, Kepala, dan Antena, sebagaimana yang tercantum pada lembar penugasan ini.

NC STATE UNIVERSITY

General Entomology

Contact | GO | Dr. John Meyer

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Welcome to Entomology Resources at North Carolina State University.

Entomology is the study of insects and related arthropods. This website contains an assortment of educational resources that were developed for students at North Carolina State University. It is freely available to anyone interested in learning more about insects or the science of entomology.

If you are a current student who is formally enrolled in the traditional or distance education sections of General Entomology (ENT 425) at NCSU, you should access these resources through your Wordpress website at https://genent.cals.ncsu.edu/. That site will link you to course-specific materials not available through this public gateway.

If you are visiting this website in search of information about the biology of insects, start by selecting the "Tutorials" tab on the top menu bar. There you will find a table of contents listing all major lecture topics. Each reading is an interactive summary of basic information -- sort of a "Cliff's Notes" for General Entomology students.

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Contact Information

Instructors:

Dr. John R. Meyer
john_meyer@ncsu.edu
2107 Gardner Hall
919-515-1659 (office)

Dr. David Orr
dorr@ncsu.edu
1110D Grinnells Lab
919-515-4684 (office)

Teaching Assistant:

Alex Ko
aeko@ncsu.edu
3321 Gardner Hall
919-515-3784 (office)

Meyer, John Home

Professor of Entomology

Program area:

Undergraduate and Post Graduate Instruction

Office:

2107 Gardner Hall

Box 7613, NCSU, Raleigh, NC 27695-7613

Phone: 919.515.1659
Fax: 919.515.7746
john_meyer@ncsu.edu

Education:

B.S. University of Illinois (1969), M.S. Cornell University (1973), Ph.D. Cornell University (1976)

Teaching:

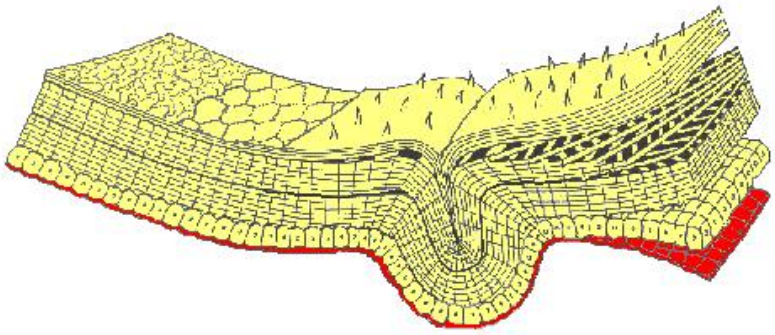
ENT 425 - General Entomology, ENT 525 - Entomology for Educators

Bug Bytes - Dr. Meyer's homepage

The Exoskeleton

An insect's exoskeleton (integument) serves not only as a protective covering over the body, but also as a surface for muscle attachment, a water-tight barrier against desiccation, and a sensory interface with the environment. It is a multi-layered structure with four functional regions: epicuticle, procuticle, epidermis, and basement membrane.

The epidermis is primarily a secretory tissue formed by a single layer of epithelial cells. It is responsible for producing at least part of the basement membrane as well as all of the overlying layers of cuticle. The basement membrane is a supportive bilayer of amorphous mucopolysaccharides (basal lamina) and collagen fibers (reticular layer). The membrane serves as a backing for the epidermal cells and effectively separates the hemocoel (insect's main body cavity) from the integument.



The procuticle lies immediately above the epidermis. It contains microfibers of **chitin** surrounded by a matrix of protein that varies in composition from insect to insect and even from place to place within the body of a single insect.

As the procuticle forms, it is laid down in thin lamellae with chitin microfibers oriented at a slightly different angle in each subsequent layer. In some parts of the body, procuticle stratifies into a hard, outer exocuticle and a soft, inner endocuticle.

Differentiation of exocuticle involves a chemical process (called **sclerotization**) that occurs shortly after each molt. During sclerotization, individual protein molecules are linked together by quinone compounds. These reactions "solidify" the protein matrix, creating rigid "plates" of exoskeleton known as **sclerites**. Quinone cross-linkages do not form in parts of the exoskeleton where resilin (an elastic protein) is present in high concentrations. These areas are **membranes** -- they remain soft and flexible because they never develop a well-differentiated exocuticle.

The epicuticle is the outermost part of the cuticle. Its function is to reduce water loss and block the invasion of foreign matter. The innermost layer of epicuticle is often called the cuticulin layer, a stratum composed of lipoproteins and chains of fatty acids embedded in a protein-polyphenol complex. An oriented monolayer of wax molecules lies just above the cuticulin layer; it serves as the chief barrier to movement of water into or out of the insect's body. In many insects a cement layer covers the wax and protects it from abrasion.

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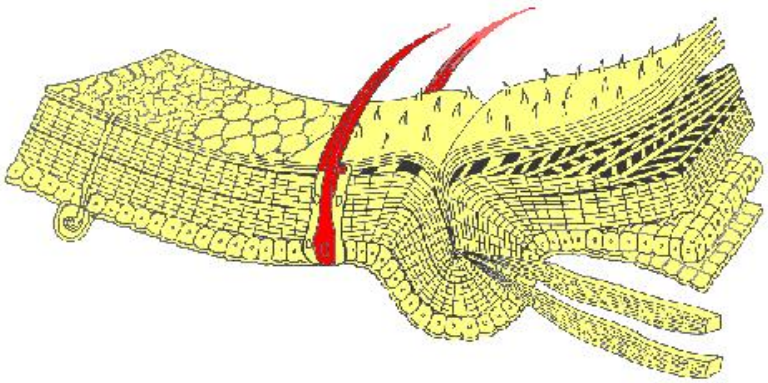
The Exoskeleton

In many insects, certain epidermal cells are specialized as exocrine glands. These large, secretory cells produce compounds (e.g. pheromones, repellants, etc.) that are released on the surface of the exoskeleton through microscopic ducts.

Tiny hair-like projections or surface sculpturing of the cuticle are known as microtrichae or pile (PILL-EE). These acellular structures consist of a solid core of exocuticle covered by a thin layer of epicuticle. Larger hairs, bristles, and scales (called setae or macrotrichae) are the product of two specialized epidermal cells: a trichogen cell (the hair shaft) and a tormogen cell (the socket). Multicellular projections of the exoskeleton are called spines (or spurs, if movable). They are lined with epidermis and contain both procuticle and epicuticle.



Skeletal muscles attach to the inner surface of the integument. Despite small body size, insects have many more muscles than vertebrates because the exoskeleton affords a larger surface area than an endoskeleton (relative to body volume) for muscle attachment. An insect owes its incredible strength to the geometry of its musculature -- providing optimal leverage for movement of appendages.

Invaginations (inward folds) of the exoskeleton add to its strength and rigidity. They also provide increased surface area for attachment of muscles. Ridge-like invaginations are called **apodemes**. They are usually visible externally as a groove (suture). Finger-like invaginations are called **apophyses**. A tiny pit usually marks their location externally.

The colors found in the integument of insects are produced either by pigment molecules, usually located in the cuticle, or by physical characteristics of the integument that cause scattering, interference, or diffraction of light. Pigments that are frequently present include the pterines, melanins, carotenoids, and mesobiliverdin.

Color patterns may change over time. Rapid, temporary changes may occur in response to daily environmental conditions or to the threat of danger. Slower, more permanent changes are usually related to seasonal changes in the environment or hormonal influences.

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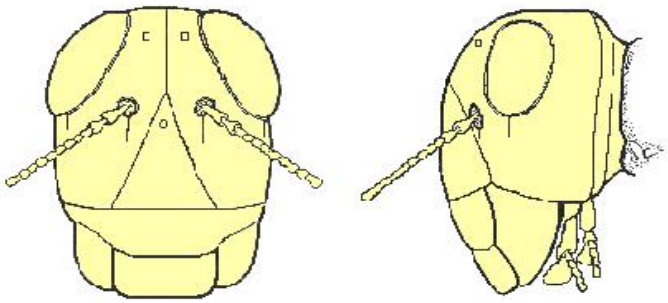
The Head

In most insects, the head capsule is a sturdy compartment that houses the brain, a mouth opening, mouthparts used for ingestion of food, and major sense organs (including antennae, compound eyes, and ocelli). Embryological evidence suggests that the first six body segments (three pre-oral and three post-oral) of a primitive worm-like ancestor may have fused to form the head capsule of most present-day insects.

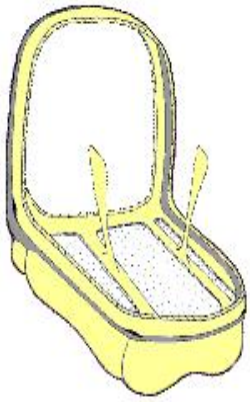
The surface of the head is divided into regions (sclerites) by a pattern of shallow grooves (sutures). The uppermost sclerite (dorsal surface) of the head capsule is known as the vertex. A coronal suture usually runs along the midline of the vertex and splits into two frontal sutures as it extends downward across the front of the head capsule. The triangular sclerite that lies between these frontal sutures is called the frons. The epistomal suture is a deep groove that separates the base of the frons from the clypeus, a rectangular sclerite on the lower front margin of the head capsule.

The genae ("cheeks") are lateral sclerites that lie behind the frontal sutures on each side of the head. Below each gena there may be another sclerite (the **subgena**), separated from the gena by a subgenal suture. A pair of compound eyes, sockets for two antennae, and one or more ocelli (simple eyes) also may be found on the front, top, or sides of an insect's head.

Near the back of the head, an occipital suture circumscribes the head capsule at the posterior margin of the vertex and genae. This suture marks the location of an internal sclerotized ridge (apodeme) that strengthens this part of the head capsule. Just behind the occipital suture lie the occiput and postgenae, tiny sclerites that are probably remnants of the fifth primitive segment that fused to form the insect's head. At the posterior-most margin of the head, a vestige of the sixth primitive



The insect's neck is known as the cervix. This is a membranous area that allows considerable freedom of movement for protraction and retraction of the insect's head. The cervical membrane extends from the posterior portion of the postocciput to the prothorax, and it represents a transitional zone between the head and thorax. Small cervical sclerites serve as points of attachment for muscles that control head movements.



Cut-away view of head capsule

Inside the head, a structure called the tentorium serves as an internal "truss" that reinforces the head capsule, cradles the brain, and provides a rigid origin for muscles of the mandibles and other mouthparts. The tentorium forms during development when pairs of apophyses (finger-like invaginations of exoskeleton) fuse internally to create a "bridge". In most hemimetabolous insects, the tentorium is constructed from a pair of anterior arms and a pair of posterior arms (each "arm" represents a single apophysis). In some holometabolous insects, there are also a pair of dorsal arms that contribute to the structure. Externally, the location of each apophysis is often visible as a (anterior, posterior, or dorsal) "tentorial pit".

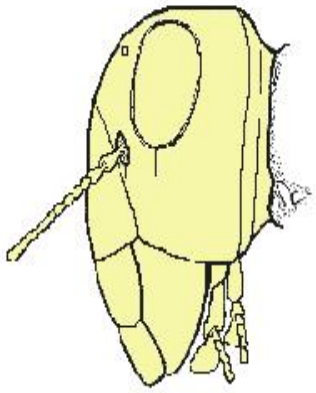
Go to
ANTENNAE

Antennae

The **antennae** are a pair of sense organs located near the front of an insect's head capsule. Although commonly called "feelers", the antennae are much more than just tactile receptors. They are usually covered with olfactory receptors that can detect odor molecules in the air (the sense of smell). Many insects also use their antennae as humidity sensors, to detect changes in the concentration of water vapor. Mosquitoes detect sounds with their antennae, and many flies use theirs to gauge air speed while they are in flight.

Although antennae vary widely in shape and function, all of them can be divided into three basic parts:

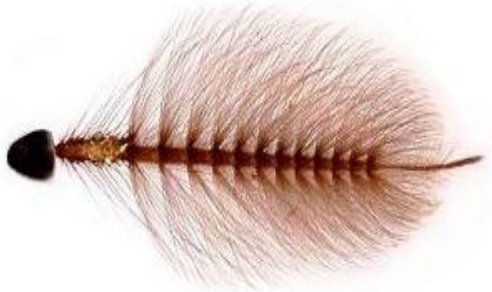
1. scape -- the basal segment that articulates with the head capsule
2. pedicel -- the second antennal segment
3. flagellum -- all the remaining "segments" (individually called **flagellomeres**)



Types of Antennae:

The antennae of insects are modified in many ways. Some of these modifications just provide greater surface area for sensory receptors, while others are unique adaptations that bestow special sensory capabilities, such as detecting sound vibrations, wind speed, or humidity. The most common antennal types are listed below:

A. Filiform = thread-like
B. Moniliform = beaded
C. Serrate = sawtoothed
D. Setaceous = bristle-like
E. Lamellate = nested plates
F. Pectinate = comb-like
G. Plumose = long hairs
H. Clavate = gradually clubbed
I. Geniculate = elbowed
J. Aristate = pouch-like with one lateral bristle
K. Capitate = abruptly clubbed
L. All of these



Plumose

Example: Mosquitoes