The Ephemeroptera are the mayflies. The common name of the order means winged for a day and refers to the fact that most of the species live as adults for only a short time, often for only a few days. As such, there is no need to feed as adults, so the mouthparts are usually vestigial, or non-functional. The sole function of the adults is reproduction.

The Ephemeroptera belong in the **Paleoptera** (along with the Odonata) - They cannot fold their wings back over their backs like all the other orders can (the Neoptera).

The metamorphosis is hemimetabolous. The immatures are called nymphs, or more properly naiads (naiads are basically aquatic nymphs).

The adults are small to medium in size; the bodies are fragile and soft, and as such, both adults and immatures should be collected in 70-80% alcohol.

Mayflies have a pair of compound eyes and 3 ocelli; the antennae are short and setaceous. There are usually 2 pairs of membranous wings, with the forewings much larger than the hindwings (hindwings are lacking in some species). The forewings are usually large and triangular, and the hindwings small and rounded. The wings usually contain many veins. The wings are held vertically when at rest. They have 3-5-segmented tarsi which end in 2 claws. They have 2-3 caudal filaments.

The immatures are aquatic, occurring in a variety of habitats. The adults, then, are most often encountered near the bodies of water in which the immatures develop. They are also sometimes attracted to lights.

Mayflies have a very interesting and unique life cycle. They are the only order of insects to have a non-adult stage which has wings. When ready to molt to the adult stage, the mayfly nymph rises to the surface of the water where it molts into a winged form called a **subimago**. This winged form then flies a short distance to the shore where it lands on some upright substrate (vegetation, trees, etc.). It then molts once more (usually the next day) into the adult stage.

Mayflies are an important part of the food chain; both the adults and immatures are eaten by fish and other animals. They are also sometimes used as an indicator of environmental pollution. Species composition of a habitat depends on degree of contamination (some species more sensitive to pollutants than others).

Mayflies will often have huge swarming flights. Because of the short period of time in which they occur in the adult stage, their life cycles must be fairly well synchronized. Most of the individuals of each species will molt to adults within a day or two of each other so there will be huge numbers of individuals at one time. These will then have mating flights. They can pile up along shores or on roads and bridges to the point of making the roads slippery and dangerous (sometimes they will pile up several feet deep).

There are quite a few families of Ephemeroptera, but due to the difficulty in distinguishing them, we will only cover 4 families. You should be aware that you may collect families not covered here. The most important characters for identification are the differences in wing venation. There is no easy way to remember these differences other than looking at the venation and memorizing the differences.

A. Family Baetidae: These mayflies are usually quite small, and as such are commonly called the small mayflies or small minnow mayflies. There are only 3 families of mayflies that commonly have the hindwings reduced or absent: Baetidae, Caenidae, Tricorythidae (also rarely in Leptophlebiidae). You are not required to know Tricorythidae which are mainly tropical with only a few species in the southern U.S. Of the remaining two families, the Baetidae has only 2 caudal filaments while the Caenidae has 3 caudal filaments. Also there are usually 1-2 veinlets between each major longitudinal vein; and the bases of MA_2 and MP_2 are atrophied in the Baetidae. Also, the eyes of the males are divided with the upper portion **turbinate** (more or less stalked). The hind tarsi are 3-

segmented. The nymphs occur in a variety of different habitats. This is the largest family in North America with about 140 species.

B. Family Heptageniidae: This is the 2nd largest family in North America, and these are sometimes called stream mayflies or flat-headed mayflies. The adults are larger in size and the hind wings are well-developed. They have two caudal filaments. They also have 2 pairs of cubital intercalaries that are more or less parallel, and the MA in the hind wing is forked (see fig. 9-6C on p. 188). The hind tarsi are 5-segmented. The immatures often are found on the underneath sides of stones in faster moving streams.

C. Family Ephemeridae: The adults are medium-sized to large. They are sometimes called burrowing mayflies. They have the hind wings well-developed with many cross-veins in both wings; there are 2 pairs of ICu veins, but they are not parallel; the MA is not forked in the hindwings (see fig. 9-6B on p. 188); and the bases of MP_2 and CuA are sharply bent toward CuP. They have 2 or 3 caudal filaments, and the hind tarsi are 4-segmented. The common name comes from the fact that the nymphs tend to burrow into the sand or silt at the bottoms of streams or lakes. The adults of some of these species sometimes emerge in great numbers.

D. Family Caenidae: These mayflies are very small. This is the other family you have to know that has the hindwings absent. It differs from the Baetidae by having 3 caudal filaments. Also the fork of MA is symmetrical, and the IMP_1 and MP_2 extend nearly to the wing base. The nymphs occur in a variety of habitats, but usually in relatively quiet water. Males do not have turbinate eyes.