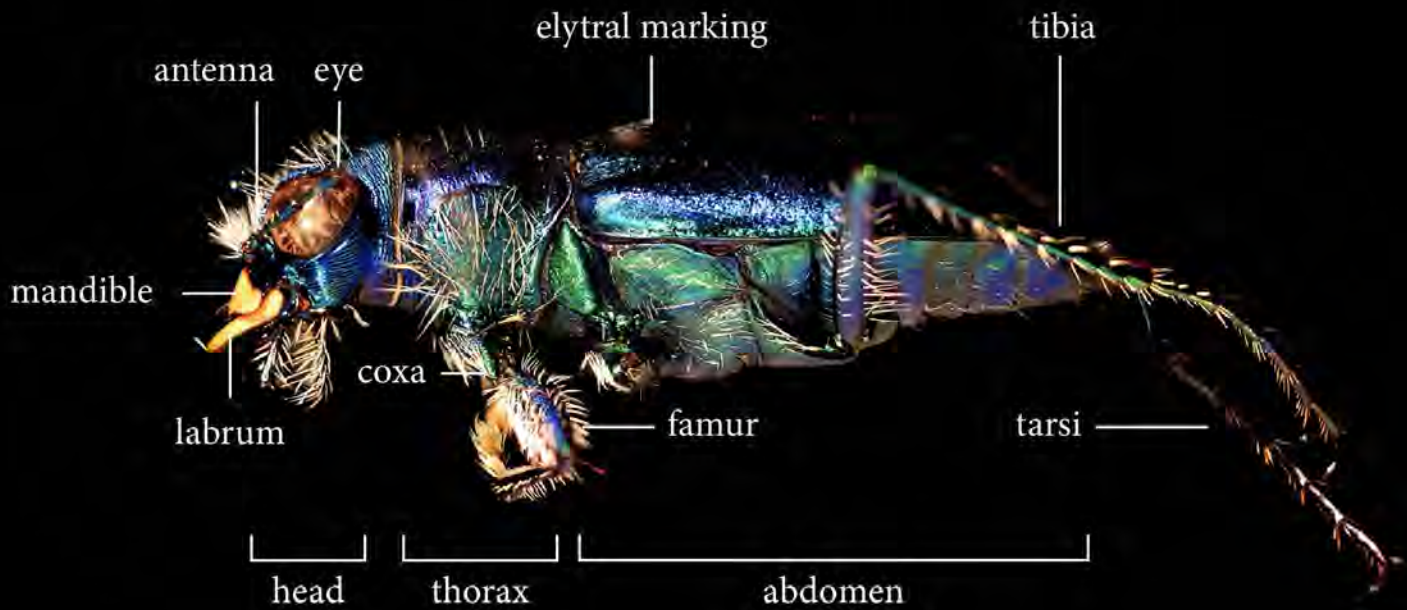


# TIGER BEETLES

Different parts of tiger beetles and how it hunts utilizing its body parts.



# Anatomy



The Tiger beetle, also called Cicindelidae, is a family of beetles. They are small to medium-sized predatory beetles. Approximately 2,600 species and subspecies were known with the most diversity in the Oriental region, followed by Neotropics. They are found in green, blue, orange, and red colors.

Tiger beetles have body parts found on most insects - six legs and two pairs of wings, and the body consists of a head, thorax, and abdomen. They have distinct characteristics from other beetles. Tiger beetles have large bulging eyes, long and slender legs, and large curved mandibles.

The head consists of the eye, antennae, palpi, mandibles, and labrum. The large eyes are susceptible to movement along with the antennae that detect barriers and food. The palpi serve as fingers to manipulate food into the mouth. The mandibles process the food while the labrum helps.

Thorax is dedicated to locomotion. Six legs and two pairs of wings are attached. Trochanter and coxa connect the body and the legs functioning like hinges. This allows the tiger beetles' running movement. Spurs on the legs are for grooming and adhering against the ground. The tarsi touches the ground and help the beetle to move forward while running.

The forewings serve as protective covers for the back wings. When it is extended forward, the back wings are unfolded to their full length. Each species of tiger beetle has a different colored forewing to camouflage into its surroundings.

The abdomen is made up of many pieces, including the organs for breathing, digesting and reproduction.

# Mandibles

Tiger beetles are named for their voracious eating habits. They use their formidable speed and large mandibles to hunt smaller insects and other terrestrial arthropods. Tiger beetles are characterized by diurnal activity using their sight to locate their fast-moving prey. However, they can also capture in complete darkness using chemoreception, audio reception, and mechano-reception. Hunting behavior differs based on the type of prey and its movement ability and escape potential.

The Tiger beetles' hunting strategies consist of four main phases: identification, pursuit interspersed by short stops, attack, and consumption or abandonment. In some cases, they release the prey and then follow with secondary attack.

Tiger beetles could also wait in a shaded area to attack when prey is approaching.

Once the attack is successful, the beetle grabs the prey with its mandibles. Before consuming, the beetle tests the prey to check whether it is edible. It test the prey in terms of size, hardness, and noxious chemicals. The prey is abandoned if it is too large or inedible due to some kind of chemicals.

If it is edible, the mandible chews up and crunch food so that body liquids can be sucked in. The labrum helps hold and manipulate food.





# Eyes

The tiger beetle is known as the fastest running insect in the world. Its speed is recorded as 2.5 meters per second, equivalent to 5.6 miles per hour.

Although they have an extremely sharp vision for insects, the world smears into featureless smudge when running. This is because of their fast speed, and not enough photons comes into their eye to locate the prey. So, when pursuing the live prey, they pursue a course of active running along with pause-and-look behavior. They cannot detect which direction the prey is going without stopping. They have to stop for milliseconds to relocate the prey and pursue again.

To overcome this, tiger beetle holds their antennae directly in front of them in a V-shape to mechanically sense the surroundings, avoid obstacles, and change courses.

In research by Cole Gilbert, a professor of entomology from Cornell University, a runway with a hurdle was set up for tiger beetles to run. It ran the track negotiating the hurdle by the antennae. They would tilt their bodies up when their antennae touched the hurdle. They reacted similarly when the beetle's eyes were painted over to limit their eyesight while running. However, when their antennae were clipped, tiger beetles ran into the hurdle. This research shows that while running, their eyes are rather useless. In fact, their antennae navigate them.

# Legs

Tiger beetles have six jointed legs with a femur, tibia, and tarsus. Beetles bear claws on the end of the last tarsal segment of each leg. These claws are called 'tarsal claws'. It is accountable for clasping onto pitted surfaces. Tarsal claws move through different angles, assisting grip. Just like others, beetles use legs for walking, but they could also be modified and adapted for other uses.

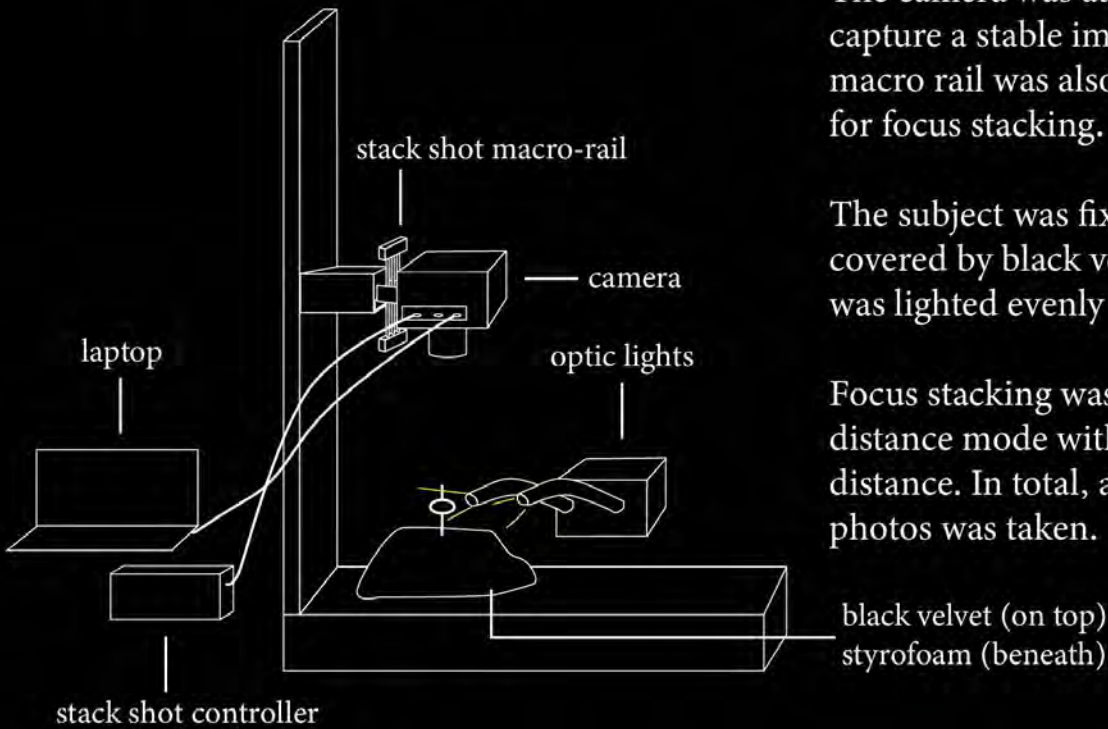
For example, some aquatic beetles' legs are modified for swimming, and their long hair is to aid this purpose.

Other beetles have fossorial legs adapted to digging and underground life. Fossorial legs are widened, and the spine is more effective when digging.

The hairs on the legs and underside of the body are to cover them from the heat emitted from the surface of the sand. Tiger beetle species lives in extremely hot environments, like sand dunes and salt flats. Their thin legs are stilts to lift them from the ground and allow air to flow around their bodies.



# Process



The camera was attached to a stand to capture a stable image. A stack shot macro rail was also attached to the stand for focus stacking.

The subject was fixed in styrofoam, covered by black velvet, with a pin. It was lighted evenly using optic lights.

Focus stacking was done in manual distance mode with 90  $\mu\text{m}$  as the distance. In total, a range of 32 to 72 photos was taken.



Raw photographs stacked into a single image



Final edited photograph of tiger beetle

The captured images were brought into photoshop and then edited in three steps: merging and aligning, removing unnecessary parts, and color editing.

All images were set to the same angle by the auto-aligning feature. Then it was merged into one single photograph by the auto-merge to one stack feature. After doing so, it was merged into a single photograph, and the stamp and patch tool removed unnecessary parts that distract the viewer. Lastly, the photo was corrected through the level, curve, vibrance, and brightness/contrast features to emphasize certain parts of the subject.

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