**Insect Wings**

# Paragraph 1

The power of flight is a major chapter in the success story of insects. Because insects with developed wings appear relatively suddenly in the fossil record and there are no good fossils that show intermediate stages, there is a great deal of speculation as to how wings might have evolved.

# Paragraph 2

Insects are different from other flying creatures like birds and bats, which evolved wings from already existing legs, and one of the main questions is what the first protowings (early forms of wings) were used for. One view is that outgrowths from the notum (upper portion) of the thorax (middle region of the body between the head and the abdomen) would have enabled insects to have a more stable and longer glide path (movement through the air without using wings). This paranotal theory envisages early insects climbing plants and launching themselves into the air as a more efficient, and perhaps safer, means of getting around or avoiding predators. These protowings might have had other functions, and experimental evidence suggests that when small, they would have had a significant role in the regulation of body temperature. Other ideas have involved small insects being carried around in air currents or larger insects jumping from the ground and taking to the air.

1. According to paragraph 2. one benefit of the outgrowths from an insect’s thorax might have been to

1. allow the insect to sense the presence of predators
2. prevent the insect from being carried away by air currents
3. allow the insect to glide through the air for a longer distance
4. aid the insect in climbing up plants

# Paragraph 3

There is a major problem with ideas that involve paranotal protowings and gliding, which is that, at some time, these fixed structures needed to have become hinged (connected in a way that allows on structure to swing relative to the other) and to have developed muscle systems to make them flap up and down. It is much easier to imagine structures that were already hinged and muscled in fulfilling some prior function and then eventually taking on a role in flight. The endite-exite theory suggests that protowings developed from the fusion of inner and outer appendages (endites and exites) of short leg segments, which were already hinged and might have been under some sort of muscular control.

2. The word “fulfilling” in the passage is closest in meaning to

1. performing
2. developing
3. replacing
4. combining with

# Paragraph 4

An additional convincing argument in support of the theory that wings developed from leg appendages, and that further disputes the paranotal theory, comes from the occurrence and distribution of sensory receptors on the wings of today’s insects. Chemical-sensing organs are not found on the surface of the thorax but are typical of legs. Furthermore, specialized receptors called campaniform sensilla that are found on wings and react to stresses and strains are only ever found on appendages, not body segments.

3. Which of the following is NOT mentioned in paragraph 3 or 4 as being a problem with the paranotal theory of insect-wing evolution? A. Wings require hinged structures.

1. Insects of today have sensory receptors on their wings.
2. Wings developed at the thorax could not have supported an insect’s weight while gliding.
3. Wing flapping requires a system of muscle control.

4. In paragraph 4, why does the author mention that campaniform sensilla are “only ever found on appendages, not body segments”?

1. To identify a chemical-sensing organ that is not found on the thorax of an insect
2. To provide more evidence for the theory that wings evolved from legs
3. To argue that wings may have evolved as organs for the sense of smell
4. To explain how insects use wings to avoid stresses and strains

# Paragraph 5

Another theory is that wings may have been derived from flap-like gills (organs allowing breathing under water) in immature aquatic insects that might have been retained in the adults for reasons other than movement, such as regulation of body temperature, concealment, and signaling. Aquatic insects, such as the ancient mayflies, use their tracheal gills not just for breathing but also for movement. What then might be the link between movement through water and flying? A novel insight has been provided by the sailing or surface-skimming behavior seen in some stoneflies. Using their wings either as static sails to catch gusts of wind or by gentle flapping, these insects are able to propel themselves across the water’s surface to reach stones and vegetation. Perhaps the early protowings were gill flaps or gill covers that were used by such insects to move through water, but could also have been of use to the adult in surface skimming. Gradual development of larger muscles would have allowed stronger and stronger flapping and led ultimately to true flight.

5. Why does the author discuss the behavior of “some stoneflies”?

1. To suggest how the gills of aquatic insects might have evolved into wings capable of flight
2. To show that some insects are able to use their wings for purposes other than flight
3. To give an example of an insect that has developed muscles for flapping its wings
4. To contrast the use of gills in stoneflies with the use of gills in ancient mayflies

6. According to paragraph 5, what could have been the final development that enabled aquatic insects to fly?

1. Larger muscles
2. Hinged gill flaps
3. Larger gill covers
4. Sail-shaped wings

# Paragraph 6

Flight certainly allowed insects to disperse, to colonize new habitats, and to escape from their enemies. Which of these might have been of primary significance in the evolution of wings is a matter of debate, but predator avoidance is an excellent candidate as it is clear that life in the Paleozoic (540 to 230 million years ago) was dangerous due to the numbers of predators. Preeminent among predator-avoidance mechanisms must have been increasingly sophisticated early-warning systems composed of delicate vibration- or wind-sensing hairs. These systems elicit an escape response of running or jumping. It has been suggested that this escape response, the development of protowings, and a gradual rewiring of nerves in the thorax and abdomen might have been the route by which insects achieved powered flight so quickly.

7. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

1. Debate over the purpose of wing evolution in insects has ended with the conclusion that wings evolved as a means to avoid predators.
2. Whether wing evolution in insects was significant for insect safety in the Paleozoic is a matter of debate.
3. Predator avoidance was difficult for insects during the Paleozoic because wings did not evolve until about 230 million years ago.
4. Wings might have evolved mainly as a means to avoid the many predators that endangered insects during the Paleozoic.

8. What can be inferred from paragraph 6 about how an early insect learned that a predator was near? A. Wind would carry the predator’s smell to sensory receptors on the insect.

1. A predator’s approach would cause a response in specialized hairs on the insect.
2. An insect’s protowing would vibrate when a predator was close.
3. Nerve impulses would pass between the thorax and abdomen when a predator was near.

9. Look at the four squares [▇] that indicate where the following sentence could be added to the passage. Where would the sentence best fit?

**The research showed that protowings less than 1.3 centimeters long would have helped insects absorb heat from sunlight.**

# Paragraph 2

Insects are different from other flying creatures like birds and bats, which evolved wings from already existing legs, and one of the main questions is what the first protowings (early forms of wings) were used for. ¢ One view is that outgrowths from the notum (upper portion) of the thorax (middle region of the body between the head and the abdomen) would have enabled insects to have a more stable and longer glide path (movement through the air without using wings). ¢ This paranotal theory envisages early insects climbing plants and launching themselves into the air as a more efficient, and perhaps safer, means of getting around or avoiding predators. ¢ These protowings might have had other functions, and experimental evidence suggests that when small, they would have had a significant role in the regulation of body temperature. ¢ Other ideas have involved small insects being carried around in air currents or larger insects jumping from the ground and taking to the air.

10. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This questions is worth 2 points.

**The paranotal theory of wing evolution in insects does not account for the kind of structures needed to allow flapping of wings.**

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**Answer Choices**

1. A significant cause of wing evolution was the need to develop structures capable of regulating body temperature.
2. The theory that wings evolved from appendages is supported by the fact that legs had hinged structures as well as sensory receptors like those on the wings of today’s insects.
3. According to one theory, wings evolved from gills and allowed aquatic insects to skim along the surface of the water and eventually life above the surface.
4. As aquatic insects such as ancient mayflies developed wings, their tracheal gills developed into organs for breathing both under water and in the air.
5. As the number of predators declined after the Paleozoic period insect habitats became overcrowded giving an advantage to those who could fly in search of new habitats.
6. Wings may have evolved from the need to escape predators, causing insects to develop structures that allowed them to fly.

词汇伴侣第⼀段/第⼆段

|  |  |  |
| --- | --- | --- |
| intermediate | a. 中间的 | paranotal theory\* 侧背板翅原说 |
| speculation | n. 思考；推断 | envisage v. 正视；⾯对 |

第三段

|  |  |  |
| --- | --- | --- |
| fusion n. 熔化；融合 | segment n. 部分 | |
| appendage n. 附属物 |  |  |

第四段

|  |  |
| --- | --- |
| dispute v. 辩论；阻⽌ | sensilla\* 感器 |
| campaniform\* a. 钟形的 | strain n. 绷紧 |

第五段

|  |  |
| --- | --- |
| derive from 得到；获得 | stonefly\* n. ⽯蝇 |
| concealment n. 隐藏 | static a. 静态的 |
| tracheal a. ⽓管的 | flapping n. 拍动 |

第六段

|  |  |
| --- | --- |
| disperse v. 散开 | delicate a. 微妙的；易碎的 |
| preeminent a. 卓越的 | vibration n. 震动 |
| mechanism n. 机械装置 | elicit v. 引出 |
| sophisticated a. ⽼练的 | abdomen n. 腹部 |

# 词汇测试

## Paragraph 1

The power of flight is a major chapter in the success s\_\_\_\_\_\_\_\_\_\_ of insects. Because insects with d\_\_\_\_\_\_\_\_\_\_ wings appear relatively s\_\_\_\_\_\_\_\_\_\_ in the fossil record and there are no good fossils that show i\_\_\_\_\_\_\_\_\_\_ stages, there is a great deal of s\_\_\_\_\_\_\_\_\_\_ as to how wings might have e\_\_\_\_\_\_\_\_\_\_.

## Paragraph 2

Insects are different from other flying c\_\_\_\_\_\_\_\_\_\_ like birds and bats, which evolved wings from already e\_\_\_\_\_\_\_\_\_\_ legs, and one of the main questions is what the first protowings (early forms of wings) were used for. One view is that outgrowths from the notum (upper portion) of the thorax (middle region of the body between the head and the abdomen) would have e\_\_\_\_\_\_\_\_\_\_ insects to have a more s\_\_\_\_\_\_\_\_\_\_ and longer glide path (movement through the air without using wings). This paranotal theory envisages early insects climbing plants and launching themselves into the air as a more efficient, and perhaps safer, m\_\_\_\_\_\_\_\_\_\_ of getting around or avoiding p\_\_\_\_\_\_\_\_\_\_.