tpo_13_passage_2

Survival and successful reproduction usually require the activities of animals to be coordinated with predictable events around them. Consequently, the timing and rhythms of biological functions must closely match periodic events like the solar day, the tides, the lunar cycle, and the seasons. The relations between animal activity and these periods, particularly for the daily rhythms, have been of such interest and importance that a huge amount of work has been done on them and the special research field of chronobiology has emerged. Normally, the constantly changing levels of an animal's activity-sleeping, feeding, moving, reproducing, metabolizing, and producing enzymes and hormones, for example-are well coordinated with environmental rhythms, but the key question is whether the animal's schedule is driven by external cues, such as sunrise or sunset, or is instead dependent somehow on internal timers that themselves generate the observed biological rhythms. Almost universally, biologists accept the idea that all eukaryotes (a category that includes most organisms except bacteria and certain algae) have internal clocks. By isolating organisms completely from external periodic cues, biologists learned that organisms have internal clocks. For instance, apparently normal daily periods of biological activity were maintained for about a week by the fungus Neurospora when it was intentionally isolated from all geophysical timing cues while orbiting in a space shuttle. The continuation of biological rhythms in an organism without external cues attests to its having an internal clock. When crayfish are kept continuously in the dark, even for four to five months, their compound eyes continue to adjust on a daily schedule for daytime and nighttime vision. Horseshoe crabs kept in the dark continuously for a year were found to maintain a persistent rhythm of brain activity that similarly adapts their eyes on a daily schedule for bright or for weak light. Like almost all daily cycles of animals deprived of environmental cues, those measured for the horseshoe crabs in these conditions were not exactly 24 hours. Such a rhythm whose period is approximately-but not exactly-a day is called circadian. For different individual horseshoe crabs, the circadian period ranged from 22.2 to 25.5 hours. A particular animal typically maintains its own characteristic cycle duration with great precision for many days. Indeed, stability of the biological clock's period is one of its major features, even when the organism's environment is subjected to considerable changes in factors, such as temperature, that would be expected to affect biological activity strongly.
Further evidence for persistent internal rhythms appears when the usual external cycles are shifted-either experimentally or by rapid east-west travel over great distances. Typically, the animal's daily internally generated cycle of activity continues without change. As a result, its activities are shifted relative to the external cycle of the new environment. The disorienting effects of this mismatch between external time cues and internal schedules may persist, like our jet lag, for several days or weeks until certain cues such as the daylight/darkness cycle reset the organism's clock to synchronize with the daily rhythm of the new environment. Animals need natural periodic signals like sunrise to maintain a cycle whose period is precisely 24 hours. Such an external cue not only coordinates an animal's daily rhythms with particular features of the local solar day but also-because it normally does so day after day-seems to keep the internal clock's period close to that of Earth's rotation. Yet despite this synchronization of the period of the internal cycle, the animal's timer itself continues to have its own genetically built-in period close to, but different from, 24 hours. Without the external cue, the difference accumulates and so the

internally regulated activities of the biological day drift continuously, like the tides, in relation to the solar day. This drift has been studied extensively in many animals and in biological activities ranging from the hatching of fruit fly eggs to wheel running by squirrels. Light has a predominating influence in setting the clock. Even a fifteen-minute burst of light in otherwise sustained darkness can reset an animal's circadian rhythm. Normally, internal rhythms are kept in step by regular environmental cycles. For instance, if a homing pigeon is to navigate with its Sun compass, its clock must be properly set by cues provided by the daylight/darkness cycle.

question 1

In paragraph 1, the experiment on the fungus Neurospora is mentioned to illustrate

A the existence of weekly periods of activity as well as daily ones

B the finding of evidence that organisms have internal clocks

C the effect of space on the internal clocks of organisms

D the isolation of one part of an organism's cycle for study

question 2

According to paragraph 1, all the following are generally assumed to be true EXCEPT:

A It is important for animals' daily activities to be coordinated with recurring events in their environment.

B Eukaryotes have internal clocks.

C The relationship between biological function and environmental cycles is a topic of intense research.

D Animals' daily rhythms are more dependent on external cues than on internal clocks.

question 3

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.

A Stability, a feature of the biological clock's period, depends on changeable factors such as temperature.

B A major feature of the biological clock is that its period does not change despite significant changes in the environment.

C A factor such as temperature is an important feature in the establishment of the biological clock's period.

D Biological activity is not strongly affected by changes in temperature.

question 4

According to paragraph 2, which of the following is true about the circadian periods of animals deprived of environmental cues?

A They have the same length as the daily activity cycles of animals that are not deprived of such cues.

B They can vary significantly from day to day.

C They are not the same for all members of a single species.

D They become longer over time.

question 5

According to paragraph 2, what will an animal experience when its internal rhythms no longer correspond with the daily cycle of the environment?

A Disorientation

B Change in period of the internal rhythms

C Reversal of day and night activities increased

D Sensitivity to environmental factors

question 6

In paragraph 2, the author provides evidence for the role of biological clocks by

A listing the daily activities of an animal's cycle: sleeping, feeding, moving, reproducing, metabolizing, and producing enzymes and hormones

B describing the process of establishing the period of a biological clock

C presenting cases in which an animal's daily schedule remained stable despite lack of environmental cues

D contrasting animals whose daily schedules fluctuate with those of animals whose schedules are constant

question 7

In paragraph 2, why does the author mention that the period for different horseshoe crabs ranges from 22.2 to 25.5 hours?

A To illustrate that an animal's internal clock seldom has a 24-hour cycle

B To argue that different horseshoe crabs will shift from daytime to nighttime vision at different times

C To illustrate the approximate range of the circadian rhythm of all animals

D To support the idea that external cues are the only factors affecting an animal's periodic behavior

question 8

The word "it" in the passage refers to

A an external cue such as sunrise

B the daily rhythm of an animal

C the local solar day

D a cycle whose period is precisely 24 hours

question 9

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

Survival and successful reproduction usually require the activities of animals to be coordinated with predictable events around them. Consequently, the timing and rhythms of biological functions must closely match periodic events like the solar day, the tides, the lunar cycle, and the seasons. The relations between animal activity and these periods, particularly for the daily rhythms, have been of such interest and importance that a huge amount of work has been done on them and the special research field of chronobiology has emerged. Normally, the constantly changing levels of an animal's activity-sleeping, feeding, moving, reproducing, metabolizing, and producing enzymes and hormones, for example-are well coordinated with environmental rhythms, but the key question is whether the animal's schedule is driven by external cues, such as sunrise or sunset, or is instead dependent somehow on internal timers that themselves generate the observed biological rhythms. Almost universally, biologists accept the idea that all eukaryotes (a category that includes most organisms except bacteria and certain algae) have internal clocks. By isolating organisms completely from external periodic cues, biologists learned that organisms have internal clocks. For instance, apparently normal daily periods of biological activity were maintained for about a week by the fungus Neurospora when it was intentionally isolated from all geophysical timing cues while orbiting in a space shuttle. The continuation of biological rhythms in an organism without external cues attests to its having an internal clock. When crayfish are kept continuously in the dark, even for four to five months, their compound eyes continue to adjust on a daily schedule for daytime and nighttime vision. Horseshoe crabs kept in the dark continuously for a year were found to maintain a persistent rhythm of brain activity that similarly adapts their eyes on a daily schedule for bright or for weak light. Like almost all daily cycles of animals deprived of environmental cues, those measured for the horseshoe crabs in these conditions were not exactly 24 hours. Such a rhythm whose period is approximately-but not exactly-a day is called circadian. For different individual horseshoe crabs, the circadian period ranged from 22.2 to 25.5 hours. A particular animal typically maintains its own characteristic cycle duration with great precision for many days. Indeed, stability of the biological clock's period is one of its major features, even when the organism's environment is subjected to considerable changes in factors, such as temperature, that would be expected to affect biological activity strongly. Further evidence for persistent internal rhythms appears when the usual external cycles are shifted-either experimentally or by rapid east-west travel over great distances. Typically, the animal's daily internally generated cycle of activity continues without change. As a result, its activities are shifted relative to the external cycle of the new environment. The disorienting effects of this mismatch between external time cues and internal schedules may persist, like our jet lag, for several days or weeks until certain cues such as the daylight/darkness cycle reset the organism's clock to synchronize with the daily rhythm of the new environment. Animals need natural periodic signals like sunrise to maintain a cycle whose period is precisely 24 hours. [] Such an external cue not only coordinates an animal's daily rhythms with particular features of the local solar day but also-because it normally does so day after day-seems to keep the internal clock's period close to that of Earth's rotation. [] Yet despite this synchronization of the period of the internal cycle, the animal's timer itself continues to have its own genetically built-in period close to, but different from, 24 hours. [] Without the external cue, the difference accumulates and so the internally regulated activities of the biological day drift continuously, like the tides, in relation to the solar day. [] This drift has been studied extensively in many animals and in biological activities ranging from the hatching of fruit fly eggs to wheel running by squirrels. Light has a predominating influence in setting the clock. Even a fifteen-minute burst of light in otherwise sustained darkness can reset an animal's circadian rhythm. Normally, internal rhythms are kept in step by regular environmental cycles. For instance, if a homing pigeon is to navigate with its Sun compass, its clock must be properly set by cues provided by the daylight/darkness cycle.

question 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 sentences 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 question is worth 2 points.

A. Most animals survive and reproduce successfully without coordinating their activities to external environmental rhythms.

B. The circadian period of an animal's internal clock is genetically determined and basically unchangeable.

C. Environmental cues such as a change in temperature are enough to reset an animal's clock.

D. Animals have internal clocks that influence their activities even when environmental cues are absent.

E. Animals are less affected by large differences between their internal rhythms and the local solar day than are humans.

F. Because an animal's internal clock does not operate on a 24-hour cycle, environmental stimuli are needed to keep the biological day aligned with the solar day.