



PART 2

Read the text below and answer questions 14–26.

ANIMAL NAVIGATION: THE MYSTERY OF MIGRATION

A

Across taxa as diverse as seabirds, insects and marine reptiles, migration remains one of the most striking examples of reliable long-distance movement without external guidance. Individuals frequently arrive at feeding grounds, breeding sites or overwintering habitats with an accuracy that appears disproportionate to their neural resources and prior experience. Contemporary consensus therefore posits that migration is rarely dictated by a singular capability; rather, it emerges from multi-modal integration of environmental cues, coupled with mechanisms for error correction when winds, currents or detours distort an intended trajectory.

B

At the most accessible level, animals exploit spatial structure in the landscape. Migrants may learn coarse corridors through coasts, ridgelines, river valleys and other large-scale features, and in some species route knowledge is socially transmitted, with inexperienced individuals following older conspecifics during early journeys. Yet reliance on landmarks is inherently conditional: topographic information can be absent over open ocean, obscured by cloud, or degraded in unfamiliar terrain. For this reason, landmark guidance is best treated as one component within a broader orientation toolkit rather than a self-sufficient map.

C

Celestial orientation provides a second class of information whose utility is greatest where landmarks are unreliable. Diurnal travellers may derive a bearing from the sun, but only if they compensate for its predictable shift across the sky; experimental manipulations with homing species have repeatedly demonstrated that directional performance deteriorates when this **temporal adjustment**, governed by an **internal clock**, is disrupted. Nocturnal migrants, by contrast, can extract a stable directional framework from the apparent rotation of the night sky, using the geometry of star patterns rather than individual constellations as fixed signposts.

D

Developmental calibration constrains the effectiveness of star-based guidance. Juveniles may express migratory restlessness without displaying coherent headings until they have experienced a naturally rotating sky, implying that early exposure is required to render an inherited tendency operational. This suggests that what looks like an “innate compass”



may be better understood as a predisposition that must be tuned by experience before it can support consistent orientation under field conditions.

E

A third modality, magnetoreception, is frequently described as the most enigmatic because it offers a global reference independent of visibility. Evidence implicates magnetic sensitivity across birds, turtles, insects and even microorganisms. Because field parameters vary geographically, magnetic information has been proposed not only as a compass but also as a component of a crude position sense: migrants could, in theory, learn regional magnetic signatures associated with latitude-like bands, although the resolution and reliability of any such magnetic map remain contested.

F

Two candidate mechanisms dominate current debate, and crucially they are not mutually exclusive. One proposal invokes magnetite—ferromagnetic mineral particles found in certain tissues—which could function analogously to a microscopic compass needle by aligning with an external field. A second proposal focuses on cryptochromes, light-sensitive proteins in the retina whose reaction dynamics may be modulated by magnetic fields, potentially generating a direction-dependent perceptual effect. A persistent challenge is to explain how weak geomagnetic signals are transduced into robust behavioural outputs, and why performance in some taxa appears to depend on wavelength or ambient light conditions.

G

Even if each cue is individually noisy, navigation becomes resilient when information streams are integrated. A first-time migrant may inherit a broad directional and timing programme, yet through experience it can learn to correct for systematic drift caused by prevailing winds or currents, effectively reweighting cues when one becomes unreliable. Redundancy is therefore functional rather than wasteful: when cloud cover limits celestial information, reliance on magnetic input may increase; when electromagnetic noise disrupts magnetic sensitivity, landmark cues can dominate. Additional signals may extend this flexibility. Infrasound generated by ocean waves or wind over mountain ranges has been proposed as a long-range geographic hint, while olfaction can operate as a chemical map—famously invoked to account for salmon homing to natal waters. Despite decades of work, prioritisation rules remain incompletely understood, and anthropogenic change introduces novel interference, from artificial light to electromagnetic pollution, with potential consequences for survival and reproductive success.

Questions 14–18



Which paragraph contains the following information?

14 a statement that competing magnetoreception mechanisms may not exclude each other.

15 reference to migrants reaching their destinations with remarkable precision despite relatively limited neural resources and experience.

16 a suggestion that regional variations in the magnetic field could help migrants estimate their position, although such a map may be imprecise.

17 mention that experimental manipulation can disrupt time compensation in sun-based orientation.

18 a claim that juvenile performance may be incoherent until exposure calibrates an inherited tendency.

Questions 19–22

Choose **TRUE** if the statement agrees with the information given in the text, choose **FALSE** if the statement contradicts the information, or choose **NOT GIVEN** if there is no information on this.

19 The passage suggests that landmarks alone are enough to guide migrating animals.

20 The passage suggests that a solar compass depends on an internal clock.

21 The passage claims that scientists have already proven animals can build a highly detailed magnetic map of the world.

22 Artificial light poses a greater threat to reproductive success than electromagnetic pollution.

Questions 23–26

Complete the notes below. Choose **ONE WORD ONLY** from the text for each answer.

The debate on magnetoreception

- Magnetoreception is described as a global **23** that can operate independently of visibility.
- Geographical variation in magnetic cues may provide one element of a rough positional **24**, though the dependability of this proposed map is still disputed.
- One proposal involves magnetite acting like a microscopic compass **25**
- Another proposal centres on retinal proteins known as **26**



Answer Key

14. F

15. A

16. E

17. C

18. D

19. FALSE

20. TRUE

21. FALSE

22. NOT GIVEN

23. reference

24. sense

25. needle

26. cryptochromes