



Scientists Find Sperm Bypass Key Physical Law

Description

Sperm cells navigate through thick fluids that would typically impede their movement. New research highlights how they achieve this by using unique properties of living matter.

According to a study led by Kenta Ishimoto from Kyoto University, sperm cells manage to swim not by conventional means but by exploiting certain behaviours of active systems. These tiny cells use their flagella, which are long, flexible tails, to generate movement through fluids that create significant resistance.

This study challenges the conventional understanding described by Newton's third law, which states that for every action, there is an equal and opposite reaction. While this principle applies to everyday objects, sperm cells operate as active systems that inject energy into their movement.

The researchers found that sperm do not glide; instead, they rely on non-reversible strokes with their flagella. This is important because, at that tiny scale, inertia is nearly absent while viscosity is strong. In response, sperm cells use flagella powered by molecular motors to create waves that push them forward.

The study also introduces a concept called odd elasticity, where forces in active materials can respond in non-traditional ways. The findings could broaden scientists' understanding of movement in living systems and may aid in developing small robots or materials mimicking natural motion. Future advancements may lead to practical applications in robotics and biotechnology as researchers continue to explore this field.

Vocabulary List:

1. **navigate** //ˈnævəˌgeɪt// (verb): move through an area or environment
2. **impede** //ɪmˈpiːd// (verb): make movement or progress more difficult
3. **exploiting** //ɪkˈsplɔɪtɪŋ// (verb): using something to gain a useful advantage
4. **flagella** //fləˈdʒɛlə// (noun): long, thin tails that help cells move
5. **viscosity** //vɪˈskəʊsəti// (noun): how thick or sticky a liquid is
6. **inertia** //ɪˈnɜːʃə// (noun): a thing's resistance to changing its movement

Comprehension Questions



Multiple Choice

1. What do sperm cells primarily use to generate movement?
Option: Cilia
Option: Flagella
Option: Pseudopodia
Option: Cytoplasm
2. Who conducted the research study on sperm cell movement?
Option: Harvard University
Option: Kyoto University
Option: MIT
Option: Stanford University
3. What principle does the study challenge regarding movement?
Option: Conservation of energy
Option: Newton's third law
Option: The law of large numbers
Option: Thermodynamics
4. What does odd elasticity refer to in the context of the study?
Option: Traditional forces
Option: Active materials responding non-traditionally
Option: The elasticity of gases
Option: Changes in temperature
5. What could the findings of this research potentially aid in developing?
Option: Large vehicles
Option: Artificial intelligence
Option: Surgical procedures
Option: Small robots
6. What is the main force that sperm cells must overcome while moving?
Option: Gravity
Option: Inertia
Option: Viscosity
Option: Friction



True-False

7. Sperm cells glide through fluids as a primary means of movement.
8. Inertia is a significant factor affecting sperm cell movement.
9. The study highlights the use of molecular motors in sperm flagella.
10. Kenta Ishimoto is a researcher from Tokyo University.
11. The findings may lead to advancements in biotechnology.
12. Sperm cells utilize reversible strokes for movement.

Gap-Fill

13. Sperm cells navigate through thick fluids that would typically impede their movement by using _____.
14. According to the study, sperm cells inject energy into their movement, operating as _____ systems.
15. At tiny scales, inertia is nearly absent while _____ is strong.
16. The researchers found that sperm rely on non-reversible strokes with their _____.
17. The study introduces a concept called _____ elasticity.
18. Future advancements may lead to practical applications in _____ and biotechnology.

Answer

Multiple Choice: 1. Flagella 2. Kyoto University 3. Newton's third law 4. Active materials responding non-traditionally 5. Small robots 6. Viscosity

True-False: 7. False 8. False 9. True 10. False 11. True 12. False

Gap-Fill: 13. unique properties of living matter 14. active 15. viscosity 16. flagella 17. odd 18. robotics



Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)

1. Which geological event involved the sudden release of material from the Earth's crust?
Option: Erosion
Option: Eruption
Option: Sedimentation
Option: Deposition
2. What type of energy is emitted in the form of rays or particles from a source?
Option: Conduction
Option: Convection
Option: Radiation
Option: Insulation
3. What term refers to the magnetic field associated with the Earth?
Option: Atmospheric
Option: Geomagnetic
Option: Thermal
Option: Hydrodynamic
4. What type of notice provides recommendations or warnings to the public?
Option: Mandatory
Option: Obligatory
Option: Advisory
Option: Restricted
5. What term describes information that is restricted and not accessible to the public?
Option: Open
Option: Confidential
Option: Classified
Option: Public
6. What word refers to small parts that have broken away from something larger?
Option: Couplings
Option: Chunks
Option: Fragments
Option: Units
7. What do we call a group of organisms that can reproduce and have similar characteristics?



- Option: Genus
- Option: Kingdom
- Option: Species
- Option: Order

8. Which property measures a fluid's resistance to flow?

- Option: Density
- Option: Viscosity
- Option: Elasticity
- Option: Pressure

9. What term describes the act of making someone feel fear or anxiety?

- Option: Encourage
- Option: Intimidate
- Option: Astound
- Option: Motivate

10. What is the act of directing the course of vehicles or vessels called?

- Option: Exploration
- Option: Coordination
- Option: Navigation
- Option: Estimation

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Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

11. In physics, matter is made up of tiny _____ .

12. _____ are highly saline solutions often found in saltwater lakes.

13. An unexpected occurrence in data can be referred to as an _____ .

14. _____ is the eruption of substances like water, ammonia, or methane from the interior of icy worlds.

15. She felt _____ before the big presentation, shaking with nerves.

16. Astronauts experience _____ when they are in space, making them float.

17. In geology, _____ can influence the flow of fluids through rocks.



18. The mountain range presented a _____ challenge to climbers with its steep slopes.
19. Obstacles can _____ progress and make tasks more difficult.
20. Companies are _____ natural resources for economic gain.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

21. Sailors need to accurately navigate their vessels through treacherous waters.
22. Heavy rain can disrupt travel plans and cause delays.
23. The species was characterised by its unique markings and color patterns.
24. The concept of inertia explains why objects remain at rest unless acted upon by an external force.
25. Some microorganisms use flagella for movement through liquid environments.
26. The television series had a thrilling episode that left viewers on the edge of their seats.
27. The company's brand was differentiated by its innovative marketing strategies.
28. Herbivores primarily feed on plants and are an essential part of the ecosystem.
29. The crowd grew agitated when the concert was delayed for several hours.
30. The weather advisory warned residents of potential thunderstorms and high winds.

Answer

Multiple Choice: 1. Eruption 2. Radiation 3. Geomagnetic 4. Advisory 5. Classified 6. Fragments 7. Species 8. Viscosity 9. Intimidate 10. Navigation

Gap-Fill: 11. particles 12. Brines 13. anomaly 14. Cryovolcanism 15. agitated 16. weightlessness 17. fractures 18. formidable 19. impede 20. exploiting

Matching sentence: 1. navigate 2. disrupt 3. characterised 4. inertia 5. flagella 6. episode 7. differentiated 8. herbivores 9. agitated 10. advisory

CATEGORY

1. Sci/Tech - LEVEL4

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