



Quantum Search Reveals No Distinction Between Past and Future

Description

We cannot remember tomorrow. Scientists do not know why this is true.

At the University of Surrey, physicists Thomas Guff, Chintalpati Umashankar Shastry, and Andrea Rocco studied time. They wanted to understand how time works in the universe.

They found that time can go forwards and backwards in quantum mechanics. But they learned important things that might help explain why we remember the past.

In physics, time usually seems equal for the past and the future. For example, we never see an egg uncrack. But many physics laws do not care about the direction of time.

Other scientists have looked at how the universe expands from low to high energy. They also wonder about particle behavior. So far, no clear answer exists for why time feels one way.

Guff, Shastry, and Rocco used special math to study particles in a hot container. Their work showed that there is no strong preference for going forwards or backwards in time.

This research was published in *Scientific Reports*.

Vocabulary List:

1. **Quantum** /'kwɒn.təm/ (adjective): Relating to the smallest possible discrete unit of any physical property.
2. **Mechanics** /mə'kæniks/ (noun): The branch of physics that deals with the motion and behavior of objects.
3. **Preference** /'prɛf.ə.rəns/ (noun): A greater liking for one alternative over another or others.
4. **Expand** /ɪk'spænd/ (verb): To increase in size number or importance.
5. **Container** /kən'teɪ.nər/ (noun): An object that can hold or transport something.
6. **Research** /'riː.sɜːrtʃ/ (noun): The systematic investigation into and study of materials and sources to establish facts and reach new conclusions.

Comprehension Questions

Multiple Choice



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1. Who studied time at the University of Surrey?
Option: Thomas Guff
Option: Chintalpati Umashankar Shastry
Option: Andrea Rocco
Option: All of the above

 2. In what publication was the research on time published?
Option: Nature
Option: Scientific American
Option: Scientific Reports
Option: Journal of Physics

 3. What did physicists find about time in quantum mechanics?
Option: Time only moves forward
Option: Time can go both forwards and backwards
Option: Time is relative
Option: Time stands still

 4. What did Guff, Shastry, and Rocco use to study particles in a hot container?
Option: Special math
Option: Special equipment
Option: Chemical reactions
Option: Physical observations

 5. What did other scientists wonder about in relation to the universe?
Option: Time capsules
Option: Particle behavior
Option: Space travel
Option: Weather patterns

 6. What do many physics laws not care about?
Option: Gravity
Option: The direction of time
Option: Particle size
Option: Temperature changes

True-False



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7. Scientists fully understand why we remember the past.
 8. Time feels the same whether moving forwards or backwards according to physics laws.
 9. There is a clear answer for why time feels one way.
 10. Particles in a hot container show a strong preference for moving forwards in time.
 11. The study by Guff, Shastry, and Rocco was conducted at the University of Surrey.
 12. The research on time was conducted at CERN.

Gap-Fill

13. Physicists Thomas Guff, Chintalpati Umashankar Shastry, and Andrea Rocco studied time at the University of _____.
14. No clear answer exists for why time feels one _____.
15. Guff, Shastry, and Rocco used special math to study particles in a hot _____.
16. In physics, time seems equal for the past and the _____.
17. The study by Guff, Shastry, and Rocco was published in _____ Reports.
18. Other scientists have looked at how the universe expands from low to high _____.

Answer

Multiple Choice: 1. All of the above 2. Scientific Reports 3. Time can go both forwards and backwards 4. Special math 5. Particle behavior 6. The direction of time

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

Gap-Fill: 13. Surrey 14. way 15. container 16. future 17. Scientific 18. energy

Vocabulary quizzes



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

1. What are known to be the most resilient animals on Earth?
Option: Tardigrades
Option: Radiation
Option: DNA
Option: Hormones
2. What drives animals to perform certain behaviors without prior experience?
Option: Behavior
Option: Automatic
Option: Instinct
Option: Responsive
3. What can lead to harmful effects when one is in contact with chemicals or radiation?
Option: Exposure
Option: Preference
Option: Leak
Option: Tumor
4. Which field of physics deals with the behavior of subatomic particles?
Option: Mechanics
Option: Quantum
Option: Chemicals
Option: Research
5. What state is characterized by illness or poor health?
Option: Response
Option: Recovery
Option: Oxygen
Option: Sick
6. Which term describes items designed to be thrown away after use?
Option: Hormones
Option: Disposable
Option: Microwaving
Option: DNA
7. What system regulates oxygen levels in tissues to maintain homeostasis?
Option: Tumor
Option: HypoxyStat
Option: Chemicals



Option: Messenger

8. What activity involves the systematic investigation to discover new knowledge?

Option: Tissues

Option: Research

Option: Expand

Option: Messenger

9. What do certain mechanisms in the body do to ensure the safety of cells?

Option: Protect

Option: Expand

Option: Container

Option: Chemicals

10. What term describes the ability to react quickly and positively to something?

Option: Sick

Option: Responsive

Option: Recovery

Option: Radiation

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

11. The process of breathing is mostly controlled by the _____ nervous system.

12. A _____ is an abnormal growth of cells that serves no purpose.

13. Humans need _____ to survive as it is vital for cellular respiration.

14. The study of how _____ react with each other is important in chemistry.

15. Hormones act as _____ molecules in the body to signal various responses.

16. Cells _____ in size as they absorb nutrients and grow.

17. The cell membrane acts as a _____ holding the cell together and keeping its contents within.

18. A _____ in the blood-brain barrier can have serious consequences.

19. Animals may show a _____ for certain food types over others.



20. Excessive sun exposure can be _____ to the skin.

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

21. Genetic information is stored in molecules within the cell.
22. The way an individual acts or conducts oneself is termed .
23. Activities controlled by the brain without awareness are considered .
24. The group of scientists conducting a study are called .
25. When an individual is unwell or diseased they are said to be .
26. The period of returning to a normal state of health after an illness is known as .
27. The process of cooking or heating food rapidly using a microwave oven is called .
28. Being reactive or quick to respond describes a individual.
29. Substances with a specific chemical composition are termed .
30. Having a greater liking for one thing over another is known as a .

Answer

Multiple Choice: 1. Tardigrades 2. Instinct 3. Exposure 4. Quantum 5. Sick 6. Disposable 7. HypoxyStat 8. Research 9. Protect 10. Responsive

Gap-Fill: 11. Automatic 12. Tumor 13. Oxygen 14. Chemicals 15. Messenger 16. Expand 17. Container 18. Leak 19. Preference 20. Harmful

Matching sentence: 1. DNA 2. Behavior 3. Unconscious 4. Researchers 5. Sick 6. Recovery 7. Microwaving 8. Responsive 9. Chemicals 10. Preference

CATEGORY

1. Health - LEVEL1

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