QUARTERLY ISSUE: MAY–JULY 2025

SCIENCE SPARK

CULTIVATING CURIOSITY

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Science Facts

Science Quiz

Tesla's Electric Dream!

This glowing plasma ball is a mini version of Tesla's lightning experiments. What happens if you touch the glass?

SCIENCE SPARK

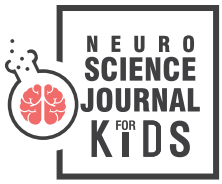
CULTIVATING CURIOSITY

MACMILLAN

First published 2025

Browsing of websites suggested in activities and projects in the book is to be done under adult supervision and Macmillan holds no responsibility for the content or the availability of these resources.

Acknowledgement



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From the MD's desk

MACMILLAN 180
ENGAGING CURIOUS MINDS SINCE 1843

180 years of progress and discovery!

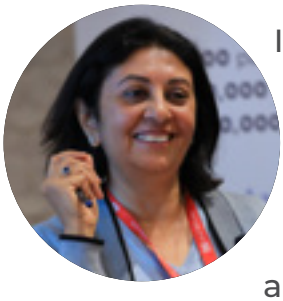
Nearly two centuries of progress and advancement in science and education have helped shape the business we are today. Research and learning continues to be the cornerstone of progress, and we continue to open doors to discovery through trusted brands and innovative products and services. Springer Nature was created in May 2015 through the combination of Nature Publishing Group, Macmillan Education and Springer Science+Business Media.

'Macmillan Budding Scientist' was launched in India in 2018 as a Springer Nature initiative. It is run to cultivate curiosity in young learners, channelise their interest in Science, give a structure to their questioning and offer them a platform to showcase, present and learn. We are committed to taking 'Macmillan Budding Scientist' to thousands of schools and giving them the benefit of our partnership with the Indian Institute of Technology for campus tours and residential experiences. In the process, we will be fostering the next generation of scientists and innovators who will solve India's challenges of inequity and inaccessibility to resources.

The Path to Progress is built on Science.

Mr. Rajesh Pasari
Managing Director
Macmillan Education India

From the Marketing desk



In India, most students view Science as a subject to be mastered to get admission into premier institutes. Faculty at these institutes say that students who enter these premier institutes are the ones who have genuine interest in Science – they ask questions all the time and do not accept things at face value! I believe Science is a mindset—rooted in logical thinking, observation, and critical analysis. It is experimenting, learning from failure, and persistently seeking solutions to make life easier and more enjoyable. As a way of learning, enquiry is the best way to explore problems, seek potential solutions, make observations, pose questions, experiment with ideas, and engage in creative and intuitive thinking.

Science Spark is our collaborative effort with Science Journal for Kids to make scientific research accessible to young learners by presenting it in a language they can understand. *Science Spark* is a compilation of scientific articles of interest from all over the world, written to ignite curiosity and trigger deeper reading and action. It also has other snippets like a quiz, curiosity corner and science skill focus. We would like learners to spend time reading and absorbing it – questioning it and writing back to us.

Science Spark provides scaffolding for our Science programme, 'Macmillan Budding Scientist', which aims to fill the gap between focused acquisition of scientific concepts and their application to real-world challenges. 'Macmillan Budding Scientist' is a transformative experience for students. It only accepts original thinking, questions logic and emphasises science communication. If we can achieve this for even a few students every year, we see it as success for us as a learning company.

The world needs more original thinkers, problem-solvers, and innovators. *Science Spark* and 'Macmillan Budding Scientist' aim to identify some of them!

Ms. Vandana R Juneja

Director Marketing
Macmillan Education India

Contents

HOW DO SOME FUNGI TURN INSECTS INTO ZOMBIES?*

Authors: Charissa de Bekker, William C. Beckerson, and Carolyn Elya
Associate Editors: Elitsa Panayotova and Fiona Firth

ABSTRACT

Did you know some fungi can turn insects into zombies, like in the movies? These fungi control what the insects do! They make them do strange things, like walking a lot, climbing tall plants, and hanging high up. They do this so that they can infect more insects.

There are many types of these fungi, but they all change the insects' behavior in similar ways. But how do they do that? And why do they all seem to change the same behaviors? We looked into many studies about zombie-making fungi. We found out that each fungus has its own tricks to control the insects! We think the fungi change the same behaviors because these are the behaviors that help the fungi infect as many insects as possible.

*Article Source: https://www.sciencejournalforkids.org/wp-content/uploads/2023/11/zombie_article.pdf taken from: https://www.sciencejournalforkids.org

INTRODUCTION

Have you ever seen a zombie movie? They are a bit scary! In some stories, dead things come back to life. In other stories, a virus (or something else) changes people's behavior. They are not themselves anymore.

Something similar happens in real life, although not to people! There are some **fungi** that can change insects' behavior. Like all living things, these fungi want to spread. Fungi spread with tiny cells, called **spores**. They use tricks to control the insects so they can spread these spores better. For example, one fungus infects flies, making them climb and stick to plants. The fungus grows and releases spores from up high to spread in the wind.

There are many types of fungi that infect insects. Sometimes the infection kills the insect quickly. But other fungi have a special relationship with their **host**, the insect. They live together for a while, and the fungus changes the insect's behavior. These fungi wait until their host is in the right place before eventually killing the insect. We call these fungi zombie-making fungi. And guess what? There are even more of them than we thought!

It's amazing that these fungi **evolved** independently. Each one has evolved alongside its host over millions of years!

And each one has its own way of controlling insects. But, all infected insects do similar things. We wanted to know how the fungi do this and why controlling insects is such a popular **strategy** for fungi.

Figure 1:
The wasp is stuck to the leaf as the fungus grows from its body.
Photo: Roel Fleuren

*Article Source: https://www.sciencejournalforkids.org/wp-content/uploads/2023/11/zombie_article.pdf taken from: https://www.sciencejournalforkids.org

METHODS

We looked at what other scientists have learned about zombie-making fungi.
We asked ourselves these questions:

- How do these fungi control the behavior of the insects?
- Why does this happen so often in Nature?

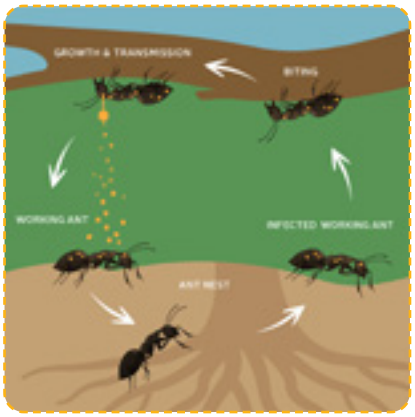


Figure 1:
This is how the fungi turn insects into zombies!

RESULTS

Zombie-making fungi have really cool ways of controlling insects. You can see some examples in Figure 2. All these changed behaviors help the fungi spread.

So how do they manage to change the insects' behavior? Zombie-making fungi have two main ways to do that:

They physically change the insects' bodies. For example, they make the insect spread its wings so that they don't get in the way of the spores. This is quite a common change in behavior. Other changes are unique. For example, one fungus takes over some of the host insect's organs.

They can also release some chemicals that make the insects feel funny. Like drugs, they affect their brain and make them do strange things.

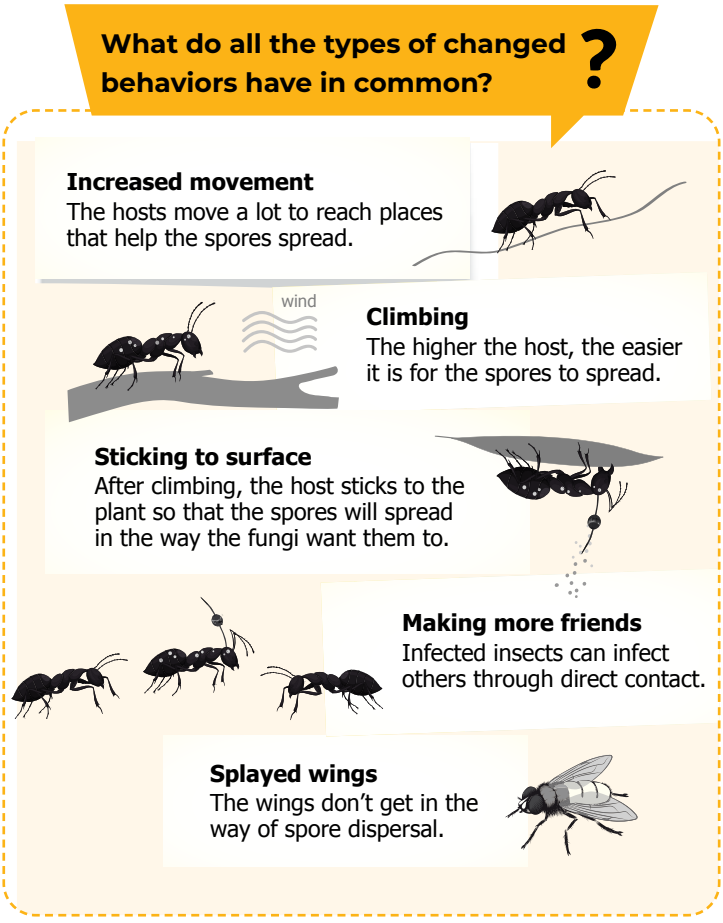


Figure 2:
Some unusual things that the insects will do once they are infected.

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DISCUSSION

Have you ever seen a zombie movie? They are a bit scary! In some stories, dead things come back to life. In other stories, a virus (or something else) changes people's behavior. They are not themselves anymore.

One reason is that these fungi are really good at finding the easiest behaviors to change in insects. Animals, including insects, change their behavior because of their changing surroundings. Zombie-making fungi take advantage of this. It's like they hack the insect's brain.

Another reason behind the similar behaviors is that they do help the fungi spread. For example, high positions make it easier for the spores to spread further using the wind.

Other behaviors help the fungi avoid the insects' protective systems. For example, ants live in colonies. When one ant is sick, the others can tell and get rid of it so that it doesn't infect anyone else.

Zombie ants avoid this by wandering away from the colony. Zombie-making fungi can sometimes use the insects' immune system. When we get sick, our bodies release substances that change our behavior. For example, we often don't want to eat when we're sick. This way our body preserves energy. It's the same with insects. And zombie-making fungi love to use that against them!

CONCLUSION

Zombie-making fungi are truly amazing! They have special ways to infect and control insects. It shows us how incredible Nature is and how everything is connected. Our actions can affect other living things too! That's why it's important for us to make good choices that help the environment. We can reduce waste, save resources, and support efforts to protect animals and plants.

***Article Source:** https://www.sciencejournalforkids.org/wp-content/uploads/2023/11/zombie_article.pdf **taken from:** https://www.sciencejournalforkids.org

GLOSSARY OF KEY TERMS

- **Evolve** - the way groups of living things change and develop over a really long time. Evolution is like a big story of how animals and plants have changed and adapted to survive in different environments.
- **Fungus/fungi** - a special group of living things. It includes things like mushrooms and molds. They usually grow in damp places and get their food by breaking down dead plants and animals.
- **Hack** - to get inside a computer (or brain) in a sneaky way, using different tricks.
- **Host** - like a home for a tiny creature (called a parasite) that lives inside or on another living thing (the host). The parasite relies on the host for food and shelter. Usually this relationship is bad for the host.
- **Spores** - fungal spores are like tiny seeds that fungi make to spread and grow. Just like plants have seeds, fungi have spores. When the conditions are right, the fungi release the spores in the air (or water).
- **Strategy** - a plan or a clever way to reach a goal. For example, when you play a game you think ahead and find the best way to win.

Acknowledgment: This article's adaptation was supported by the Moderna Charitable Foundation

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CHECK YOUR UNDERSTANDING

1. What do zombie-making fungi make their insect hosts do? Give a few examples.

2. Why do zombie-making fungi change their host insects' behavior?

3. Zombie-making fungi need hosts to survive and spread. Can you think of other living beings that need a host to survive?

4. Pretend you're an insect journalist reporting on the invasion of zombie-making fungi. Write a newspaper headline that would grab everyone's attention and write a short article to explain the situation.

5. If you could be transformed into any insect temporarily, which insect would you choose and how would you try to outsmart a zombie-making fungus that's trying to control you and your behavior?

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WHAT DO PARENTING AND BRAIN SIZE HAVE TO DO WITH EACH OTHER?*

Authors: Michael Griesser, Szymon Drobniak, Sereina Graber, and Carel van Schaik
Associate Editors: Mary Bates and Alexandra Appleton

ABSTRACT

Big brains are useful, but they need time and energy to grow. So why do some animals have big brains and others don't? We looked at 1,176 bird species to see how different things affect brain size. We found that parental provision had the largest impact on brain size. This includes egg size and caring for and feeding babies. We think parental care allowed larger brains to evolve. And not just among birds! This could also explain why human brains are so big!

*Article Source: https://www.sciencejournalforkids.org/articles/what-do-parenting-and-brain-size-have-to-do-with-each-other/ taken from: https://www.sciencejournalforkids.org

INTRODUCTION

Having a big brain can be useful. It can help you think and solve problems. It can also help you figure out relationships and emotions. In fact, humans have really big brains.

Lots of other animal species have small brains. It turns out that growing a big brain takes a lot of energy. And they take longer to grow. The energy and time costs may be why there aren't more animals that evolved to have big brains.

If it is so hard to grow a big brain, how do animals do it? Well, the biggest need is energy. Sometimes it is hard for young animals to get enough energy on their own. This is where parents can be helpful. Parents can care for young animals and feed them for a long time. This allows young animals to grow big brains in a safe environment.

Birds are good animals to investigate this relationship. They are very diverse. Birds live in lots of different places. They eat lots of different things. And they have different lifestyles. The size of their brains also varies a lot.

In addition, birds have different levels of maturity when they hatch. Some birds, like chickens, geese, and ostriches, are very mature. They don't need much food or care from their parents. Other birds hatch blind and naked. In other words, they are helpless. Songbirds, parrots, and crows are completely dependent on their parents. Baby birds that are helpless need lots of parental care that can last for weeks or even months.

We wanted to explore how all these characteristics in birds related to brain size.

Birds that are born blind and naked need more parental care than birds that are born more mature.
Photo: Di (via Wikimedia Commons), CC BY-SA 4.0

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METHODS

We found information about 1,176 different bird species. We got the information from handbooks and scientific studies.

We wrote down the brain size of our birds. Then we also looked at:

- Egg size.
- The maturity of baby birds, how much parental care they get, and for how long.
- Where they live and what they eat.
- If they live in groups and how many individuals help raise the babies.

We used a model to see if these factors affect brain size in the birds we looked at.

We also looked to see if these factors were related to bird evolution

RESULTS

- Have larger eggs and fewer of them.
- Are less mature when they hatch.
- Provide care for their babies.
- Feed their babies for longer.
- Do not migrate.
- Feed in trees instead of on the ground.

We found that bird species have larger brains if they:

The first four factors are related to parental care. We found that they have the largest impact on brain size. The last two factors had smaller impacts. We saw that where birds live, what they eat, and how big their groups are did not impact brain size very much. We also saw that the evolution of bird species seems to be related to parental care and brain size.

Out of all the factors, which one results in the largest brain size? What about the smallest brain size?

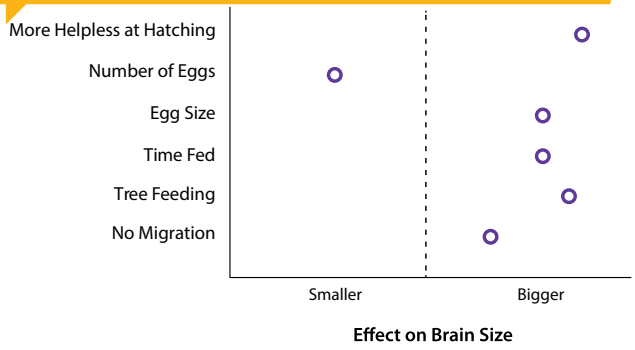

Figure 1: The impact of different factors on brain size. The dashed line at 0 means there was no impact on brain size. Positive means that the brain was larger and negative means the brain was smaller. For example, birds that hatch more helpless have larger brains, and birds that lay more eggs have smaller brains.

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DISCUSSION

Brains can do great things! We found parental care had the largest impact on brain size. Migration and where birds ate had a smaller impact.

Parental care and brain size seem to have evolved with each other. Only species with parental care have larger brains. Fish, amphibians, and reptiles don't have much parental care. They only lay eggs. And they have much smaller brains than birds or mammals.

These ideas may relate to our large human brain. Humans have been evolving for several million years. The number of people taking care of babies has increased. The amount of time people take care of children has also increased. More parental care could be related to our own bigger brains!

CONCLUSION

Just like birds, all kids need to get enough food. Starvation can cause brain damage and make it hard for kids to grow. Children also need to get enough nutrients. They can develop disabilities if they don't. Did you know that babies need iron for brain growth? That's just one example!

Find out how your city is making sure children get enough food. Check out parent groups or community kitchens. You can also look into vegetable gardens and meal support from your school.

CURIOSITY CORNER

Do you have a WHY buzzing in your mind? Do you want to ask about black holes, dinosaurs, dreams in colour, telepathy or anything at all? Ask us!

In the Curiosity Corner, our science expert will answer all your questions and tickle your curiosity.

- ***Mail your question to mbs@macmillaneducation.com***
- ***Subject Line: Curiosity Corner – [Your Name]***

We will feature selected questions (and expert answers) in the next issue of Science Spark.

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GLOSSARY OF KEY TERMS

- **Brain** - the organ in your body that controls thought, memory, emotions, and body functions. Brains need energy to grow and function. Large brains require more energy than small brains.
- **Diversity** - the variety of species and characteristics that we see in a type of animal.
- **Evolution** - the slow process where organisms change over time.
- **Migration** - the movement of birds based on season. Most species move between breeding areas and wintering areas. Some birds migrate thousands of miles. Migration can use up a lot of energy.
- **Model** - the data represented by math. Models allow scientists to look at the impact of lots of different factors at once. They can also look at interactions between the factors.
- **Parental care** - factors that are related to parents caring for and providing energy to their young. This includes how many eggs a bird lays and how big those eggs are. It also includes how many adults provide care and for how long.
- **Species** - a group of similar animals that can breed with each other. For example, there are about 10,000 different bird species in the world.
- **Starvation** - not having enough food in the long term. This causes not having enough energy and, if it's really bad, it can even cause death.

Acknowledgment: This article's adaptation was supported by the Moderna Charitable Foundation

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CHECK YOUR UNDERSTANDING

1. How does parental care help babies grow bigger brains?

2. What other factors did we look at besides parental care? Why?

3. What are some benefits of having a big brain? What are the disadvantages?

4. What are three examples of animals that have lots of parental care? What are three animals that don't have much parental care?

5. With a partner, brainstorm different animal species that have particularly large brains.

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HOW DO BUMBLE BEES PLAY?*

Authors: Hiruni Samadi Galpayage Dona, Cwyn Solvi, Amelia Kowalewska, and others
Associate Editors: Rosy Stanesby (University of Plymouth) and Alexandra Appleton

ABSTRACT

Have you watched cute cat videos or funny dog compilations? Or primates "monkeying around"? Then you know that mammals love to play. Even the dancing cockatiel has gone viral! But have you ever considered whether insects play "for fun"?

We did an experiment to test whether bumble bees take part inobject play. We wanted to see whether they would interact andplay with wooden balls. We found that the bumble bees did playwith a ball-rolling action. Their bethavior fulfilled our expectationsof play in animals. What's more, they also found it rewarding! Weruled out the possibility that the ball rolling was an attempt to lookfor food or to mate. This suggests that bumble bees may be morecapable of feeling than we had thought!

*Article Source: https://www.sciencejournalforkids.org/wp-content/uploads/2024/04/bees-play_article.pdf taken from: https://www.sciencejournalforkids.org

INTRODUCTION

Have you ever heard of a bumble bee (Bombus Terrestre's) rolling a ball? This may not be as crazy as it sounds! Object play is a simple type of play behaviour where animals play with objects. For example, dogs love to fetch a stick or chase a ball. As young mammals grow, playing helps to develop their cognitive and motor skills. This is important for their future as adults. But what about the rest of the animal kingdom? Do insects play?

To answer these questions, we need to understand what counts as play behaviour.

The 5 Rules of Play:

1. No functional outcome.
   Play does not result in the animal obtaining food or other direct benefits.
2. Initiated freely and naturally.
   Play is a spur-of-the-moment (unplanned) choice. The animal wants to do it!
3. Different movements from functional behavior.
   Physical movements of play are different from those of functional needs. For example, looking for food or mating.
4. Repeated, varied, and creative.
   Play must not be confused with a behavioral stereotypy. This is a repetitive movement or habitual action caused by stress, such as pacing.
5. Free from stress.
   Play occurs when animals are in positive states.

We decided to find out whether bumble bees engage in object play. And do they find it enjoyable and rewarding?

Fun fact!: According to the World Wide Fund for Nature (WWF), 1 in 3 mouthfuls of food we eat depends on the work of pollinators such as bumblebees.

Photo: Krzysztof Niewolny on Unsplash.

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METHODS

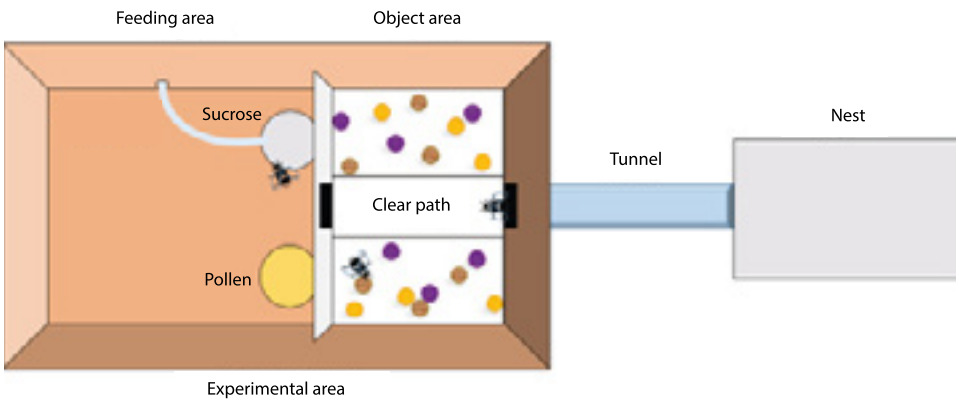
We used a colony of forty-five bumble bees for the experiment. We placed the bees in a box separated into different areas (Fig.1). We video-recorded them when they entered the experimental arena. They could walk freely through the object area to the feeding area. They had the option to stay in the areas with mobile and immobile small wooden balls. We also used different colored balls to see if the bees had a favorite color!

The video recorded:

1. Bees entering the ball area.
2. Bees touching a ball with their antennae or legs.
3. Bees rolling a ball. (To make sure it was intentional, the bee had to be in line with the ball and pull it for at least 0.4 seconds.)

It was very important to limit stress within the experimental area. This was so that the bees could act naturally and carry out their normal behaviours. We made sure that:

- Ethical care guidelines were followed.
- A natural day/night cycle was maintained.
- The nest box imitated their natural environment.
- Pollen and sucrose food was always available.
- The bees were not handled unless absolutely necessary.



A bumble bee nest box was connected via a plastic tunnel to the experimental area. The tunnel led to a clear path in the object area. There were colored balls on the sides of the path: nine mobile balls on the right and nine immobile balls on the left. The feeding area had sucrose and ground pollen. The sucrose and pollen were swapped every day to avoid the bees favoring one particular side.

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RESULTS

Q: Did the bees play with the wooden balls?

A: Yes! Across the 18-day experiment, the bees rolled the balls 910 times.

One bee rolled a ball 117 times.

Q: Did the bees really choose to roll the balls?

A: The bees developed a preference for the mobile ball object area after they had rolled a ball. This suggests the bees returned because they wanted to roll the balls again.

Other interesting results:

- Ball rolls lasted 0.4–31 seconds (Fig. 2).
- The bees rolled the balls 2–601mm.
- Ball rolling was most common in younger bees, particularly aged 3–7 days.
- Bees had no ball color preference.

Which part of their body does the bee use to touch the ball first?

Figure 2:
The nine panels show the sequence of a ball-rolling action over approximately 4 seconds. (The time stamps are in red at the top left). The bee (a) approaches the wooden coloured ball, (b) touches the ball with her forelegs, (c) holds onto the ball using all of her legs, (d–h) rolls the ball past the yellow ball and (i) finishes rolling and leaves the ball.

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DISCUSSION

Our experiment showed that bees engage in object play behavior. This is because their ball rolling met the 5 rules of play.

Ball rolling had no functional outcome.

The bees rolled the balls after eating. They did not extend proboscises onto them. Nor did they stop interacting with the balls after learning they were not edible. The bees rolled the balls in all directions with no particular destination. The male bees made no attempt to mate with the balls.

The bees rolled the balls freely and naturally.

The bees had the option to avoid the balls. Instead, they chose to roll them. They engaged with the balls and developed a preference for the mobile object areas.

Ball rolling movements differed from functional behaviors.

Ball rolling includes object rotation. This is different from flower handling. The bees did not extend their proboscises or genitalia onto balls. They also did not bite, buzz, or sting them. Also, the ball rolling speed did not increase with experience. This is different from functional behaviors which improve over time.

Ball rolling was repetitive, varied, and creative.

Ball roll duration, distance, and tracks varied among and within individuals. So, ball rolling differs from stereotypy.

Bees were free from stress.

The bees did not show any stress indicators, like defensive buzzing or sleepiness.

CONCLUSION

We now know that bumble bees engage in object play, like our pets at home! Knowing this could change the way we view insects. If they can enjoy playing, maybe we need to think more carefully about how we treat them. It is important to keep learning about all creatures throughout the animal kingdom. Do you have a bug house or wildlife park nearby?

Why not go and discover more about the variety of insects that live in your area? See if you notice anything unusual about their behavior!

***Article Source:** https://www.sciencejournalforkids.org/wp-content/uploads/2024/04/bees-play_article.pdf **taken from:** https://www.sciencejournalforkids.org

GLOSSARY OF KEY TERMS

- **Behavioral stereotypy** - behavior that is repeated, unvaried and without function. It can often be caused by stress. For example, pacing or tapping your fingers.
- **Cognitive skills** - skills related to the brain and the ability to process thoughts. These skills are learnt and improved during development.
- **Colony** - a group of one species that live and interact closely with each other.
- **Functional** - a specific behavior that serves a purpose. This means that there is a reason to do it.
- **Genitalia** - the organs of the reproductive system.
- **Mobile** - able to move or be moved freely or easily.
- **Motor skills** - skills related to the body and the use of muscles for movement. These skills are learnt and improved during development.
- **Proboscises** - plural of proboscis. A long mouthpart used for feeding and sucking in invertebrates.

Acknowledgment: This article's adaptation was supported by the Goggio Family Foundation.

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CHECK YOUR UNDERSTANDING

1. Why do animals play?

2. Identify three ways that stress can be limited in an experiment on animal behavior. Why is this important?

3. What evidence did we find that ball rolling is fun for the bees? Why does it count as play?

4. The bumble bee is different from the honey bee. With a partner, look up both species and create a poster that shows their differences.

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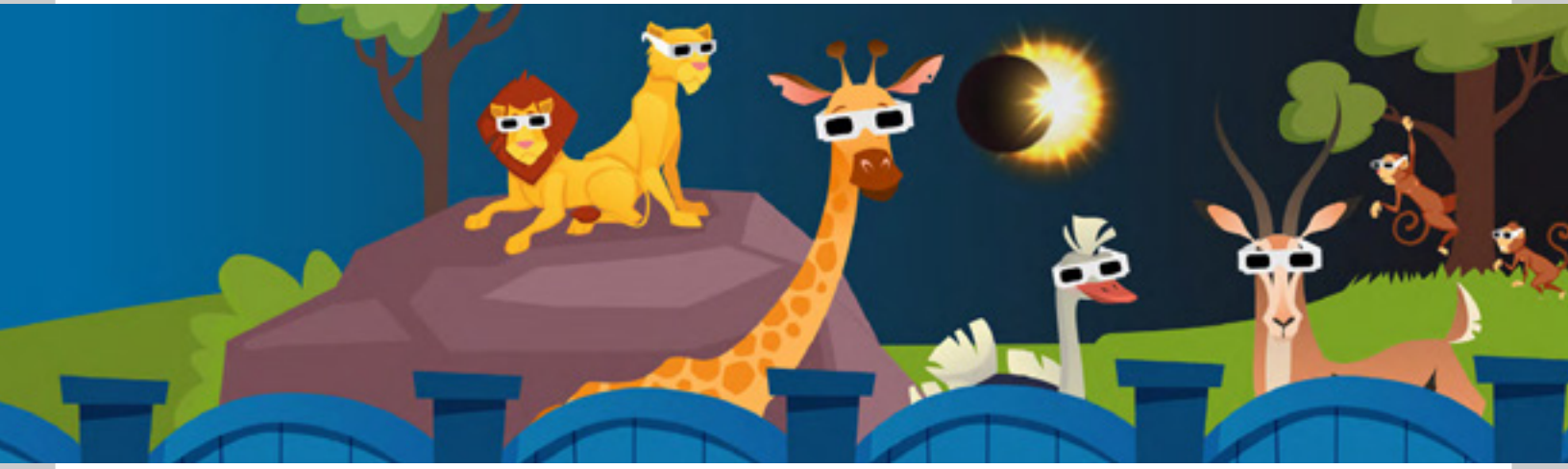
HOW DO ANIMALS BEHAVE DURING A SOLAR ECLIPSE?*

Authors: Adam Hartstone-Rose, Ashley R. Deutsch, and others
Associate Editors: Miranda Wilson and Tanya Dimitrova

ABSTRACT

When was the last time you were at the zoo? You probably saw lots of animals doing lots of different things there. We wanted to know what zoo animals do when a solar eclipse happens. People have observed animals during solar eclipses before. But these were mostly just casual observations.

We designed a study to observe 17 different types of animals at the zoo. First, we observed their normal behaviors. Then we recorded what happened during a solar eclipse. We saw that a lot of animals did something that wasn't normal. Most of them started behaving like it was nighttime – in the middle of the day! Some of them even seemed anxious – like the eclipse stressed them out. This helps us understand how complex animal behavior can be.



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INTRODUCTION

Have you ever seen a total solar eclipse? It's what happens when the moon passes in front of the sun and completely blocks it. It makes everything dark for a little while (Figure 1). Chances are you haven't seen one. They happen in different places every few years. But they only occur in the same place on the Earth about once every 375 years.

Scientists really like solar eclipses. They give them a chance to see what animals do during a novel event. This helps them better understand how complex animal behavior is.

In the past, there have been some observations of animal behavior during solar eclipses. Animals sometimes show evening behaviors. They go to their nests or dens when it gets dark. Other animals seem anxious. They do things like pace or huddle in groups. Sometimes animals don't react at all. Or they do unexpected things like look at the sky. Unfortunately, many of these observations have just been one person noting what happened with one animal. That doesn't give us a scientific understanding of how animals react to eclipses.

That's why we wanted to study animal behavior scientifically during a total solar eclipse. This will help us understand how animals respond to events they have never experienced before.

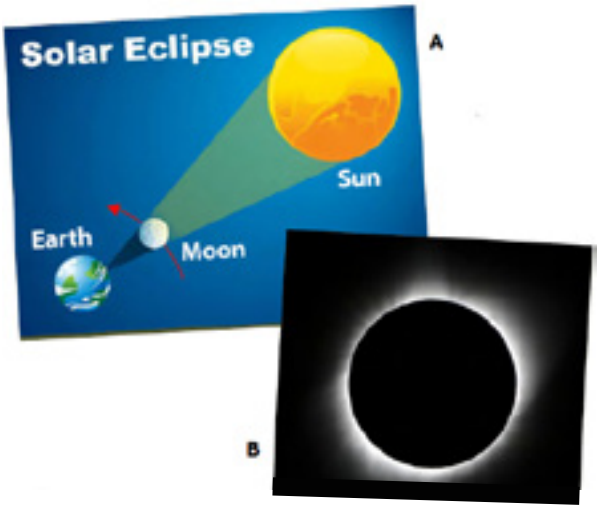

Figure 2:
Solar eclipse A) A total solar eclipse occurs when the moon passes between the Earth and the sun, blocking out all the sun's light. B) Photograph of the total solar eclipse on August 21, 2017, taken in Wyoming, USA. It captures the moment of totality - when the moon completely blocks out the sun. (Images: A. NASA. B. Kimon Berlin.)

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CONCLUSION

We looked at animal behavior at the Riverbanks Zoo and Garden in Columbia, South Carolina. There was a total solar eclipse there on August 21, 2017. We did several things to make sure our study was well designed:

- We trained people to make observations. We made sure they knew the animals and their habitats. We also made sure they watched to see what normal animal behaviors looked like. Each team had researchers, zoo staff, and volunteers making observations.
- Each team observed one type of animal. We looked at 17 different types of mammals, birds, and reptiles.
- We made observations in the two days before the eclipse. That's when we recorded what normal behavior looked like. This was our control data.
- Then we made observations during the eclipse. All our observations were qualitative. They were based on the behaviors teams saw. We put behaviors into four categories: normal, evening, possible anxiety, and novel.
- We also made quantitative observations of siamangs, a type of gibbon, making calls. We recorded them and measured how long the calls were. Then we used statistics to see if they were different during the eclipse.

RESULTS

We found that 13 out of the 17 types of animals acted differently during the eclipse (Figure 2). Most of the animals showed evening behaviors. Some showed possible anxiety. We saw two animals doing novel behaviors.
We also found that siamangs made shorter calls during the eclipse.

What was the most common type of behavior that zoo animals exhibited? The least common ?

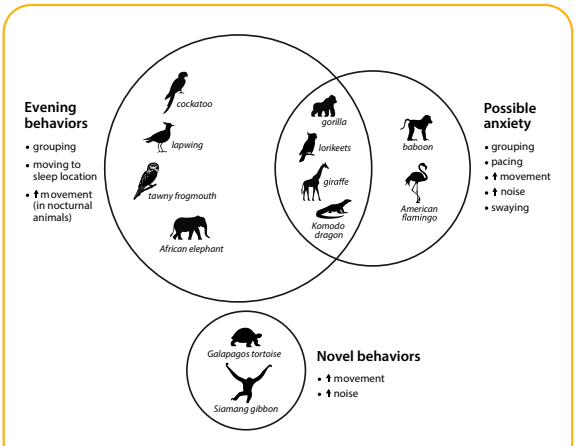

Figure 2:
Unusual behaviors that zoo animals showed during the total solar eclipse.

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DISCUSSION

Our results match other observations. Many of the zoo animals showed unusual behaviors during the eclipse. Most were related to evening routines. Changes in light can cause evening behaviors. This can disrupt the circadian rhythm of animals, especially when light changes in the middle of the day.

Some animals also acted anxious. For example, Komodo dragons are normally very still and slow. During the eclipse, the Komodo dragon ran to where it sleeps at night.

Zoo animals and wild animals can behave differently. We need to consider these differences when we look at our data.

- Learned behavior: Zoo animals learn that when it gets dark, it is time to go to bed. Evening behaviors might be learned behavior. Would wild animals do the same?
- Stress: Animals in zoos can get anxious if there are lots of loud people around. The zoo was crowded during the eclipse. To balance that out, we made our control observations on the busiest weekend of the year.

In the future, we would like to study wild and domestic animal behavior. Is it the same as zoo animals? Wild animals see more novel things in life than zoo animals. Domestic animals like dogs and cats might also respond to the eclipse. Or their behavior might be related to their owners' reactions. We want to know if wild or domestic animals respond differently.

CONCLUSION

Solar eclipses are really cool. If you ever observe one, make sure you never ever look straight into the sun with unprotected eyes. They can get really hurt.

Instead, you could look at animals. You can join a citizen science project. Check out all the different projects online and the links below. You could even collect data during the next solar eclipse for a study like this. Even if you are somewhere where you can only see a partial eclipse. Find out how on **SolarEclipseSafari.org.**

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GLOSSARY OF KEY TERMS

- **Calls** - the sounds that animals make on purpose. Animals use calls to talk to other animals. Calls can help them attract mates, alert others to danger, or communicate a variety of other things.
- **Circadian rhythm** - the physical, mental, and behavioral changes an animal goes through over a 24-hour cycle. Changes in light, stress, activity, temperature, and eating food can all affect circadian rhythms. For example, people generally feel sleepy if they have to get up in the morning before the sun is out.
- **Citizen science** - research that uses regular people (not scientists) to help collect and analyze data or even perform experiments. Recently the term "participatory science" has been used as well. Anyone can contribute to helping answer science questions!
- **Control** - the "normal" situation that you use to compare to what you're testing in an experiment. It helps you see if your test really makes a difference or if something else might be causing the change. For example, in this experiment, the control was observing animals when there was no eclipse. This was compared to observations during the eclipse.
- **Novel** - new, or something that has never been seen before. Total solar eclipses are novel to animals because they don't happen very often in the same place. The researchers observed novel behaviors from the animals during the eclipse.
- **Observation** - noting information using a person's senses or output from instruments.
- **Qualitative** - a type of observation that relies on description using a person's senses. Qualitative observations include things like color, shape, and descriptions of movement. For example: "The flamingos in the flock are pink."
- **Quantitative** - a type of observation where something is measured and/or counted. Numerical data must be gathered. For example: "There are 7 flamingos in the flock."
- **Total solar eclipse** - a condition when the moon moves in front of the sun and completely blocks all sunlight for a short time. Total solar eclipses happen every few years, but it could be hundreds of years before a total solar eclipse happens in the same place on Earth.

Acknowledgment: This article's adaptation was supported by the GM Foundation.

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CHECK YOUR UNDERSTANDING

1. Many animals showed multiple types of behaviors during the eclipse. Look at Figure 2. Which animals showed both evening and anxiety behaviors?

2. Nocturnal animals sleep during the day and are more active at night. What do you think normal behavior looks like during the day for these animals? What did these animals do during the eclipse?

3. Why do you think some animals showed possible anxiety behaviors? (Hint: think about how often they see eclipses)

4. What is a control? Why was it so important that we observed animal behavior on days before the eclipse?

5. What is a control? Why was it so important that we observed animal behavior on days before the eclipse?

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WHAT HAPPENS TO ASTRONAUTS' DNA IN SPACE?*

Authors: Susan Bailey, Christopher Mason, and others
Associate Editors: Miranda Wilson and Alexandra Appleton

ABSTRACT

Space is a really cool place. It is even becoming popular as a tourist destination! But space is also a dangerous place. Floating around sounds fun, right? But weightlessness can have negative impacts on human health. Think muscle and bone loss or vision problems. And exposure to cosmic radiation can actually damage our DNA. So, it is important to better understand how the human body responds to being in space.

We studied DNA from the 2021 SpaceX Inspiration4 mission crew. We looked at it before, during, and after their 3-day trip to space. We were particularly interested in telomeres – the "end-parts" of chromosomes that protect the DNA. Telomere length relates to aging and the risk of other diseases. We found that telomeres got longer while the crew was in space. When the astronauts returned to Earth, telomeres quickly shortened. Exposure to cosmic radiation might have triggered this dynamic response. Keeping people safe from cosmic radiation is essential for any long-duration spaceflight. In the future we can use this information to help keep people healthy as we explore the cosmos.

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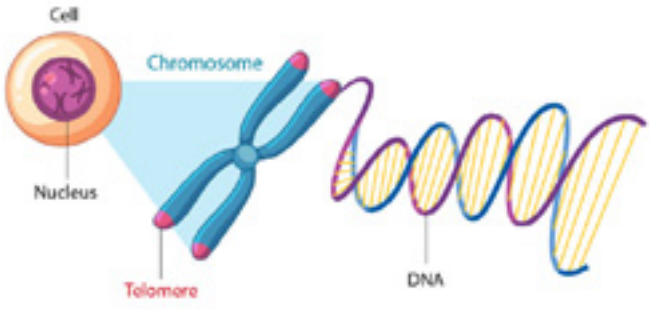
INTRODUCTION

Have you ever wondered what it is like to be an astronaut? They have to deal with an extreme environment very different than any on Earth. There is no gravity. It's really cold. And astronauts are exposed to cosmic radiation. Researchers already know that astronauts lose muscle and bone in space. Their vision changes and their immune systems don't work as well. These become huge problems during longer trips to space.



DNA is coiled into chromosomes within the nucleus of each cell. The ends of the chromosomes are called telomeres. They protect the DNA from fraying or getting tangled.

An astronaut's genome, or DNA, can determine how they respond to space. Changes to their DNA may lead to adverse health effects. But researchers don't have a good understanding of what actually happens to DNA in space. Studying telomeres may help. They are the "end-parts" of chromosomes that protect the ends of the DNA. Like the plastic tips on the ends of shoelaces! They keep the laces from getting tangled or frayed. Researchers know that telomeres get shorter as people get older. This is related to normal cell division. Things like stress and smoking make telomeres shorter, too. Unhealthy environments can also cause telomeres to shorten. For example, places with air pollution or radiation exposure. The length of telomeres is linked to the risk of dementia, heart disease, and cancer. This makes them important to study for human health effects.

In 2015 NASA did a study on the twin astronauts Scott and Mark Kelly. Scott Kelly spent a year on the International Space Station while Mark Kelly stayed on Earth. Researchers studied the twins' telomeres. Scott's telomeres increased in length while in space. His telomeres then quickly shortened when he returned to Earth. In fact, Scott's telomeres were shorter after the 1-year mission than before he went into space. We will have to wait to see what impact this has on his health in the future. The NASA Twins Study gave researchers a lot of new information about astronaut health.

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But there were also limitations. To date, most astronauts have spent less than 20 days in space. Also, Scott and Mark Kelly are middleaged white men. Spaceflight is becoming more common. So more people of different ages, sexes, ethnicities, and starting health will travel to space. There will also be more civilians instead of highly-trained astronauts. Some will be on short-duration trips, but some will be on longer missions. Some may even stay! We wanted to know if telomere length changes occur in a more diverse population. And does telomere length change during a shorter trip into space? This information is important to ensure the future health and safety of humans in space.

METHODS

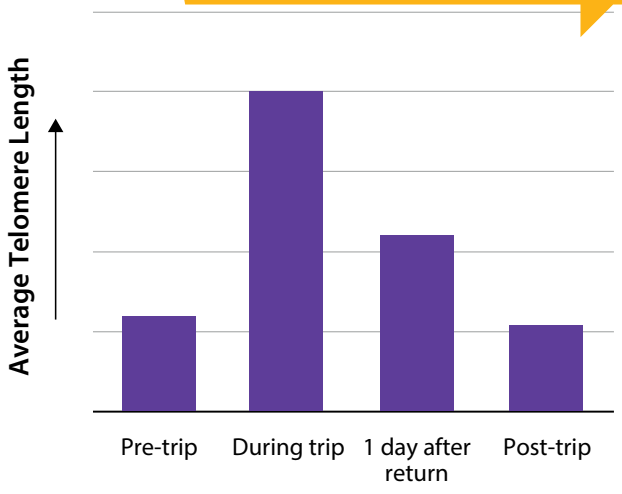
We used the 2021 SpaceX Inspiration4 mission for our study. The mission was only 3 days long. The four crew members were all civilians and first-time flyers. And they were of different ages and sexes. We collected blood from each crew member 92 days, 44 days, and 3 days before their trip. We also collected blood during each of the days they were in space. Lastly, we collected blood again 1 day, 45 days, and 82 days after they returned to Earth.

We extracted DNA from all the blood samples. Then we measured the average telomere length.

RESULTS

We saw that telomeres were longer during spaceflight (Fig. 1). This happened for all four crew members. We also saw that telomeres shortened quickly when they returned to Earth. This happened for three of the four crew members. At 45 and 82 days post-trip, we saw all four crew members' telomeres gradually return to near normal length.

Which of the two time periods are most similar? What does this tell you?



Telomere lengths of the Inspiration4 crew.

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DISCUSSION

The changes in telomere length for the Inspiration4 crew were like those seen in the NASA Twins Study. It is important to know that even short trips into space can change telomere length. And that it can happen in a more diverse group of people. We wanted to learn more about these changes. This will help us understand how they might cause problems for astronauts when they come back to Earth.

We think that telomere length changes because of cosmic radiation exposure. Radiation damages DNA. And it is everywhere in space. Spending more time in space also means more exposure. The International Space Station has shielding in frequently used areas. This helps protect the astronauts from some radiation. But what if humans want to travel to and/or stay on other planets someday? We need a better solution to reduce radiation damage.

CONCLUSION

Space is an extreme and dangerous environment. We don't know a lot about how it can impact people's health longterm, especially their DNA. The more we know, the better we will be able to keep our astronauts healthy.
There are several things you can do to stay healthy down here on Earth:

- Eat healthy food with plenty of fruits and vegetables.
- Get enough sleep.
- Reduce your exposure to toxicants like smoke, pesticides, and pollution.
- Limit your stress. You can try meditation, do relaxing activities, and stay in touch with loved ones.

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GLOSSARY OF KEY TERMS

- **Cell division** - the process by which a cell makes a copy of its DNA and then splits into two cells. Each of the cells is an identical copy of the original cell. Making new cells through cell division is how you grow.
- **Chromosomes** - the organized structure that DNA forms when it is coiled up. Organisms have different numbers of chromosomes. For example, humans have 23 pairs of chromosomes. Dogs have 39 pairs.
- **Civilian** - a person who is not a member of the armed forces or actively engaged in a military conflict. In this case, it also means someone who is not associated with NASA or another government space agency.
- **Cosmic radiation** - high energy particles produced by stars. This includes radiation from the Sun. The energy travels through space. Some examples are x-rays and gamma rays.
- **DNA** - the molecule that contains genetic information. It is found in every cell.
- **Extraction** (of DNA) - a process that removes DNA from cells. This involves several steps. First the cells are broken open. Then the DNA is separated from all the other stuff in the cell. Then the DNA is concentrated.
- **Nucleus** - the structure in a cell that contains the chromosomes. It is surrounded by a membrane.
- **Telomere** - a section of DNA at the end of a chromosome. It protects the chromosome from fraying or getting tangled.
- **Toxicant** - a harmful chemical that is not natural. Toxicants are put into the environment by people. Some examples are pesticides, car exhaust fumes, and industrial waste.

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CHECK YOUR UNDERSTANDING

1. What are telomeres and why are they important to DNA?

2. Why do we care about studying telomeres? Why might they be extra important to study in astronauts?

3. What are three differences between this study and the NASA Twins Study? Were the results similar or different?

4. What do we think caused the change in telomere length while in space? Why do you think this doesn't happen on Earth?

5. What do we think caused the change in telomere length while in space? Why do you think this doesn't happen on Earth?

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HOW DO RAVENS' THINKING SKILLS COMPARE WITH APES'?*

Researchers: Susan Bailey, Christopher Mason, and others
Associate Editors: Miranda Wilson and Alexandra Appleton

ABSTRACT

Ravens behave in ways that suggest they are really smart. Most scientists studying animal intelligence focus on monkeys and apes like macaques and chimpanzees. One group of scientists made a set of puzzles that tested primates' physical and social thinking skills. We wanted to know more about ravens' intelligence, and we wanted to be able to compare ravens and great apes. So, we changed the set of puzzles to make sure they could be solved by a bird using a beak instead of fingers. We found that ravens did just as well as the apes on almost all of the puzzles!

INTRODUCTION

Have you ever wondered what animals think about? We were curious about bird brains and whether they are underrated. Ravens, crows, jays, and magpies are all members of a family of songbirds called corvids. Corvids lead interesting lives! Ravens form long-lasting friendships. Crows use tools. Jays make plans for the future. Magpies collect trinkets and give gifts. These behaviors show us that corvids are pretty smart!

Most scientists studying animal intelligence focus on non-human primates. One famous experiment compared the cognitive performance of chimpanzees, orangutans, and 2.5-year-old children. The researchers invented a set of 38 puzzles to test physical and social cognitive skills. They found that toddlers and chimpanzees have similar physical cognitive skills. But the children did better than both types of great ape on the social skills test! Another experiment showed that children develop cognitive skills at different ages than great apes. Comparisons like this help scientists understand how intelligence evolved and how it develops.

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Surprisingly, no one had made a raven-friendly version of the set of puzzles that were used with the great apes.

We wanted to answer three questions:

- How do ravens' physical cognitive skills compare to their social cognitive skills?
- How do ravens' cognitive skills develop as they grow from hatchlings to subadults?
- How does ravens' intelligence compare to great apes'?

The common raven can be found throughout most of the Northern Hemisphere. It's one of the biggest birds in the corvid family, which includes ravens, crows, and jays. Photo: © Georgine Szipl

METHODS

We chose four pairs of three-week-old raven siblings for the experiment. When the birds were old enough to fly, we took them to our outdoor aviary. Inside the aviary, we set up a small private area where we carried out the experiments. The birds could always choose to come to the experiment sessions and solve puzzles with us (and only one bird stopped participating in the study before the study was complete).

When one of the ravens came into the experiment compartment, one of us (a scientist and friend of the ravens) showed them a puzzle. If the raven solved the puzzle, they received a treat as a reward: for instance, dog treats or pork skins. These special treats (which they really like!) were only available at the experiment station.

Each puzzle tested a single aspect of either physical or social cognitive skills. We kept track of how likely the raven was to get the answer right with a random guess.

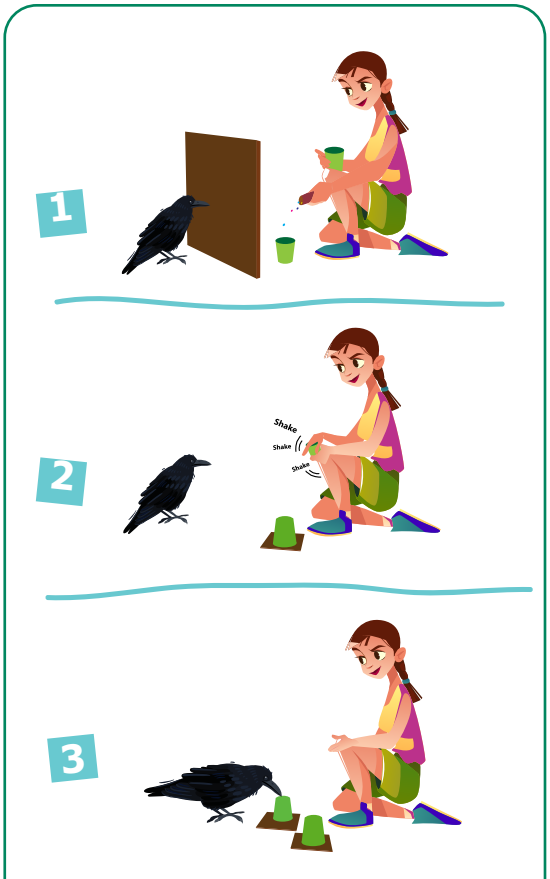

Figure1: Testing a raven's understanding of cause and effect.

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One physical cognitive skill that we tested is called causality (or understanding of cause and effect). (See Figure 1). We showed the ravens two cups. One of them held a treat, but the raven didn't know which one. We gave the bird different clues to solve this puzzle: for instance, sometimes we picked up the cup with a treat and shook it, so the raven could hear the rattle. Other times we picked up the cup without a treat and shook it. If the raven just guessed randomly, she had a 50-50 chance of guessing the right cup. But if she understood causality (that only a cup with a reward inside would make a rattle), she would choose the right cup on the first try.

We tested 9 kinds of physical cognitive skills and 6 kinds of social cognitive skills using similar tests. (See more examples in Table 1.)

Table 1: Some of the tests we used in our experiment.

Type Of Test	What We Tested For	How We Tested For It
Causality	Understanding cause and effect	Shaking a cup: if it rattles, there is something in it
Quantities	Being able to tell the difference between big and small numbers, understanding addition	Choosing the biggest pile of treats
Space	Keeping track of where things are	Knowing that a treat still exists when it is covered up by a cup and is moved somewhere else
Communication	Learning from a person's signaling	Finding a treat when the scientist points at where it is hidden
Theory of Mind	Figuring out what another person or animal is feeling, hoping, or seeing	Seeing the scientist repeatedly stretch out their arm, and guessing that the scientist is trying to reach something

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RESULTS

We found that ravens did equally well on the tests of physical and social cognitive skills. The ravens were best at quantitative skills, such as determining which cup held the most treats. The ravens' scores were lowest on tests of spatial reasoning.

The ravens' scores did not noticeably change as they grew from 4 months old to 16 months old. Most of the ravens' scores were very similar to chimpanzees and orangutans. Spatial reasoning was the only category in which the ravens scored lower than apes.

DISCUSSION

We expected our ravens to perform very well in the social cognitive tasks. But we were surprised to see that for the most part, the physical and social scores were about the same. This suggests to us that ravens have generalized intelligence rather than specialized intelligence.

Since the ravens' scores didn't change between the first test at 4 months old and the last test at 16 months old, it seems that their most important cognitive skills develop before the age of 4 months.

We were also surprised to find that ravens did poorly in the spatial reasoning section. Ravens are capable of acrobatic flying. They hide their food in caches and find their caches again. Those tasks take high spatial thinking skills. But it's important to remember that the same test can measure different things when you give it to a different species. Ravens' low scores on the spatial section of our test may say more about us humans designing the tests than about the ravens' abilities. Ravens' lives are competitive. Other ravens and other animals often try to steal from their caches.

Maybe the ravens thought we were trying to take the treat for ourselves!

Our experiment shows that the cognitive performance of ravens is very similar to great apes'. Since they have very different brains, this doesn't necessarily mean that their cognitive processes are similar, though: for instance, using different body parts (beaks or hands) uses different parts of the brain. Instead, it shows that ravens have a similar ability and motivation to solve the kind of puzzles that we showed them.

We think that future studies should come up with sets of puzzles for testing animal cognition that relate much more to the natural challenges of that species. We also think that it is important how the individuals grow up and if they trust and like to work with the human experimenters.

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CONCLUSION

Do you ever play brain games? Can you think of any puzzles you could use to test your friend's or an animal's physical or social cognitive skills? Maybe you could even try one out on your younger sibling or a friend's pet – just remember to let them choose to participate in your experiment.

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MY EUREKA **Moment!**

Have you ever had a moment when everything just clicked? Maybe you finally understood a tricky science concept, solved a tough math problem, or discovered something new during an experiment. That's your **Eureka Moment** — a flash of insight when you feel like an inventor!

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- ***Share Your Eureka Moment:*** *Email at mbs@macmillaneducation.com*
- ***Subject Line:*** *My Eureka Moment – [Your Name]*

We will feature some inspiring moments in the next issue of Science Spark.

***Article Source:** https://www.sciencejournalforkids.org/wp-content/uploads/2025/01/telomere_article.pdf **taken from:** https://www.sciencejournalforkids.org

3. SCIENCE Facts

Discovery of Two New Milky Way Satellite Galaxies:

Astronomers have identified two previously unknown satellite galaxies of the Milky Way, named Sextans II and Virgo III.

First Mouse Model with Functional Human Immune System:

Researchers have developed a mouse model that possesses a complete and functional human immune system, paving the way for more accurate studies in immunology and Virgo III.

Lunar Cave Discovery:

Scientists have discovered a cave on the Moon, approximately 250 miles from the Apollo 11 landing site, which could serve as a shelter for future explorers.

China's Asteroid Deflection Mission:

China has announced plans to visit and impact an asteroid in 2029, similar to NASA's DART mission, to study changes in its orbit as a planetary defense strategy.

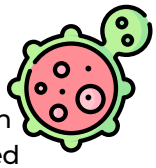
Dark Oxygen Production on Abyssal Seafloor:

A study indicates that polymetallic nodules on the abyssal seafloor can produce oxygen without light, which has implications for deep-sea mining and our understanding of deep-sea ecosystems.

Automated Dental Procedure by Robot:

A fully automated robot dentist has successfully performed the world's first human dental procedure, marking a significant advancement in medical robotics

Fusobacterium's Role in Cancer Prognosis:



The presence of Fusobacterium, a common oral bacterium, has been linked to improved prognoses in head and neck cancers, suggesting potential therapeutic avenues.

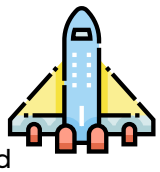
Electric Cars and Pedestrian Safety:

A study finds that electric cars pose twice as large collision risk to pedestrians in cities compared to internal combustion engine cars, likely due to being quieter.

AI Predicts Accelerated Global Warming:

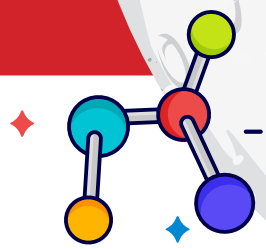
AI-based transfer learning predicts that global warming will reach 3°C faster than previously expected, highlighting the urgency for climate action.

Launch of China's Guowang Mega constellation:



The China Aerospace Science and Technology Corporation (CASC) has launched the first batch of the Guowang (Xingwang) megaconstellation, a planned network of 13,000 satellites aimed at enhancing global communications.

***Article Source:** https://en.wikipedia.org/wiki/2024_in_science **taken from:** https://en.wikipedia.org



4. SCIENCE Quiz

1. **Which fundamental force is responsible for radioactive decay?**

   a) Strong nuclear force
   b) Weak nuclear force
   c) Electromagnetic force
   d) Gravitational force

2. **What does "AI" stand for in technology?**

   a) Automated Information
   b) Artificial Intelligence
   c) Advanced Innovation
   d) Algorithmic Input

3. **Which computer programming language is commonly used for web development?**

   a) Python
   b) Java
   c) C++
   d) HTML

4. **Which cryptographic method is commonly used to secure internet communications?**

   a) RSA Encryption
   b) MD5 Hashing
   c) AES Compression
   d) DNS Routing

5. **What is the main advantage of quantum computing over classical computing?**

   a) Uses less electricity
   b) Can store infinite data
   c) Performs calculations in parallel using superposition
   d) Doesn't require programming

6. **What type of bridge is the Golden Gate Bridge?**

   a) Beam bridge
   b) Suspension bridge
   c) Arch bridge
   d) Truss bridge

7. **What is the main function of a flywheel in an engine?**

   a) Increase speed
   b) Store rotational energy
   c) Reduce friction
   d) Convert heat into motion

8. **What is the Heisenberg Uncertainty Principle?**

   a) The energy of a system is always uncertain

   b) It is impossible to simultaneously determine both the position and momentum of a particle with absolute precision

   c) Electrons always have uncertain charge values

   d) Gravity affects quantum particles differently than classical ones

9. **Which of the following particles is NOT a fundamental particle in the Standard Model?**

   a) Electron b) Proton c) Neutrino d) Gluon

10. **What happens to time as an object approaches the speed of light, according to Einstein's theory of relativity?**

    a) Time speeds up b) Time slows down

    c) Time remains constant d) Time reverses

11. **What type of bond is formed when electrons are shared unequally between atoms?**

    a) Nonpolar covalent bond b) Polar covalent bond

    c) Ionic bond d) Hydrogen bond

12. **Which law states that the total entropy of an isolated system can never decrease over time?**

    a) Newton's Second Law b) First Law of Thermodynamics

    c) Second Law of Thermodynamics d) Boyle's Law

13. **Which of the following is an example of convergent evolution?**

    a) The development of wings in bats and birds

    b) The split between chimpanzees and humans from a common ancestor

    c) The gradual increase in brain size in mammals

    d) The development of fur in Arctic mammals

14. **What is believed to be the primary component of dark matter?**

    a) Neutrinos b) Weakly Interacting Massive Particles (WIMPs)

    c) Antimatter d) Cosmic dust

15. **Which geological era is known as the "Age of Reptiles"?**

    a) Paleozoic b) Mesozoic

    c) Cenozoic d) Precambrian

*Answers are on the last page

Macmillan Budding Scientist

Powered By SPRINGER NATURE

in association with Indian Institute(s) of Technology

WHAT IS IT?

Macmillan Budding Scientist (MBS) is a unique science programme designed for school students by Macmillan Education India (powered by Springer Nature). The programme encourages young learners in middle years, to address real-life challenges through project-based learning. Participation in MBS fosters curiosity, original thinking and problem-solving skills in students. It inspires them to embark on a journey of discovery.

Running for six years, MBS is organised in association with the prestigious Indian Institute(s) of Technology (IIT Delhi, IIT Madras, IIT Bombay and IIT Guwahati). It is a platform for young learners to showcase their talent, interact with the science fraternity and develop confidence, research skills and a sense of enquiry.

The Macmillan team shares a candid moment with the team from Navrachana Higher Secondary School, Vadodara. The Macmillan Budding Scientist programme ignites curiosity and empowers students to explore, experiment, and excel — providing a platform to showcase innovative ideas with the support of dedicated mentors.

Scan Me

Who Can Participate?

All Enquirers!

MBS is open to all learners in grades 6 to 8 in schools across India and in the Middle East. Each school can nominate up to three teams, with each team consisting of three students (from classes 6-8) and one mentor teacher.

Explore the IIT campuses and attend curated lab tours.

Present to academia and industry experts; get questioned by the best minds in STEM.

An immersive and rewarding experience.

Macmillan Budding Scientist

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SPEAKS

PROF. SHILPI SHARMA

Associate Dean, Academics (Outreach & New Initiatives), and Professor, Department of Biochemical Engineering and Biotechnology, IIT Delhi

The word "Science" refers to the state of knowing through questioning, answering, and solving problems. It starts off with basic questions like 'Why is it happening?' Is it possible to modify it? 'The Macmillan Budding Scientist (MBS)' programme aims to cultivate these urges in learners, guiding them to seek beyond their books and think about how science relates to the real world. By fostering curiosity and critical thinking, MBS empowers young students to engage with scientific concepts in a meaningful way.

IIT Delhi's Academic Outreach & New Initiatives office has been supporting MBS for the past two years now, and we are proud as it complements our goal of bringing science to more schools and inspiring students to develop a scientific temperament. Science, in our opinion, is for everyone, especially for students who want to address real-life problems, pose thought-provoking queries, and come up with creative answers. This active and practical style of learning is what scientific research is based on.

A crucial aspect of this collaboration is the involvement of IIT Delhi's research scholars, who not only contribute to MBS by evaluating the entries but also gain valuable insights from their experiences. Interacting with young curious students helps our scholars to experience science in a new light - one that is unfiltered by conventional academic boundaries. This interaction feeds their own inquisitiveness, which strengthens the essence of scientific curiosity. While interacting with the bright young minds, our researchers are refreshed on the principles of inquiry-based learning that helps formulate their own investigations.

I take great pride in the association with the 'Macmillan Budding Scientist Programme' and hope to sustain this partnership. By joining hands, we can create a world where every child is able to reason, investigate, and create, like a real scientist.

At IIT Delhi, we remain dedicated to helping young learners while also inducing a spirit of scientific inquiry. We salute 'Macmillan Budding Scientist' for nurturing the coming generation of problem-solver, researchers and innovators. Over the years, the programme has grown in scale and stature and now receives participation from over 1200 schools spread across India and the Middle East. Let us make deeper attempts to motivate, educate and research because the future of science starts here!

SPEAKS

PROF. SUBODH SHARMA

Associate Professor and Pankaj Gupta Chair Professor in Privacy and Decentralisation, Department of Computer Science and Engineering, IIT Delhi

It has been my privilege to be associated with an initiative like 'Macmillan Budding Scientist (MBS)'. Since its inception in 2019, the MBS initiative has completed six successful iterations and grown significantly, with many prestigious IITs joining hands to support this noble endeavour over the years.

Fostering a scientific temper among students and democratising science to make it more accessible are two objectives that are extremely close to my heart. MBS provides a unique platform for students, encouraging them to view science as an application-driven discipline while nurturing their boundless creativity. Through MBS, students not only apply their scientific knowledge to address real-world challenges—problems they encounter in their daily lives—but also gain the invaluable experience of life at an IIT. IIT Delhi, in particular, has been a beacon of inspiration, championing the cause of pursuing science and fueling curiosity.

The contributions of mentor teachers deserve special recognition. These dedicated educators invest themselves wholeheartedly to ensure their students excel, shaping young, inquisitive minds and inspiring them to explore science beyond the confines of textbooks.

Equally commendable are the principals and school leaders of the participating institutions. Creating an environment that encourages students to ask questions and think critically is no small feat. Their leadership fosters a culture of inquiry that is vital for nurturing the innovators of tomorrow.

I hope these projects inspire students to push the boundaries of their educational experiences, exploring learning opportunities that extend beyond the classroom while remaining rooted within their school systems. More importantly, I envision this booklet as a pioneering effort to honor the often-unsung champions of our society—school teachers—who consistently go above and beyond to empower every student entrusted to their care.

HOW DOES IT WORK?

Very simply!

01

Registering for the programme

The mentor teacher registers the team through an online form. A mentor teacher can register only 1 team.

02

Identifying and analysing a problem

Teams identify a real-world problem they wish to work upon and carry out research, apply scientific principles and consider possible solutions.

03

Creating a prototype

Team develops a working prototype using empirical data.

04

Submitting a video

For the preliminary round they present their project in a 3-minute video.

05

Screening for the preliminary round

Evaluators from various IITs assess submissions to shortlist the top teams from each zone

06

Zonal rounds

Shortlisted teams compete in zonal finals at respective IIT campuses, for the Grand Finale.

07

Grand finale

The top 10 teams compete in the final round, enjoying an immersive experience at the IITs.

WHERE DOES IT HAPPEN?

The zonal rounds take place on the IIT campuses in different regions, offering students:

- A first-hand experience of IIT life
- Engaging lab tours to see Science in practice
- A glimpse into hostel life
- Interactions with IIT students and faculty

The Grand Finale marks the culmination of this six-month journey, where the top 10 teams compete for the ultimate recognition.

WHY PARTICIPATE?

This Programme is more than just a competition—it's a transformational experience for young scientists!

- Develop essential 21st-century skills – collaboration, communication, critical thinking
- Showcase innovative ideas at a premier IIT campus
- Experience life at an IIT – including lab tours and student interactions
- Ignite curiosity and build a scientific temperament

'Macmillan Budding Scientist' is not just about winning—it's about learning, exploring, and Igniting Curiosity!

MS. RITU SHARMA

PGT, Chemistry, The Jain International School, Nagpur

I have had the privilege of being associated with the 'Macmillan Budding Scientist' Programme for the past four years. During this time, my team has been selected for the regional level every single year. Our journey with the 'Macmillan Budding Scientist' has been incredibly rewarding. For the last two consecutive years, our team at The Jain International School participated in the competition, advancing to the zonal level at IIT Mumbai and even reaching the National level at IIT Delhi.

We sincerely thank the Macmillan team for organising this competition every year, which has provided a platform for students to showcase their innovative scientific models. The event is always conducted in a well-structured and seamless manner, ensuring that every team feels supported and valued throughout the process. It has been a learning experience for us, and we look forward to continuing our participation in the years to come.

MASTER AKSHIT JAGAM

Student, Class 8, The Jain International School, Nagpur

The event not only encouraged us to think critically and apply our scientific knowledge but also gave us an opportunity to engage with like-minded peers and experts. The well-structured format allowed us to present our projects in a professional setting, helping us build confidence and gain valuable feedback.

MS. SUDHA NADDI

TGT, Science, Navrachana Higher Secondary School, Sama, Vadodara

I am incredibly grateful to 'Macmillan Budding Scientist' for providing a platform to present our scientific idea. The experience was inspiring, fostering innovation and collaboration. Your unwavering support and encouragement helped us showcase our research with confidence. Thank you for empowering young minds and promoting scientific curiosity.

MS. AANSHI SHETH

Student, Class 8, Navrachana Higher Secondary School, Sama, Vadodara

The chance to visit IIT Delhi was a once-in-a-lifetime opportunity. Maybe it was the thrill of the competition, but the opportunity to interact with IIT professors and students from all over the nation was an amazing ride. I am truly grateful to Macmillan for organising this wonderful event and even our school for giving us a chance to present our idea in front of respected dignitaries.

POONAM ANAND

TGT, Science, Summer Fields School, Gurugram

As a science teacher, I always strive to ignite a passion for discovery in my students. But this year, I had the incredible opportunity to experience that thrill of discovery firsthand, as a participant in the 'Macmillan Budding Scientist Programme'.

Winning the second position in the Grand Finale was truly an honor. But more than the recognition, the experience was invaluable. Thank you Macmillan for providing us a platform to enhance and explore our talent

Winning accolades at the 'Macmillan Budding Scientist Programme' is a well-deserved recognition of our student's hard work, talent, and potential. This achievement not only brings honor to our school but also serves as an inspiration to other students to pursue their interests in STEM fields.

YUVRAJ SHARMA

Student, Class 8, Summer Fields School, Gurugram

The programme brought together aspiring scientists from diverse backgrounds, all eager to share their research and ideas. The atmosphere was electric, with a palpable sense of curiosity and collaboration.

One of the highlights for me was the opportunity to present my own project alongside other talented individuals. The constructive feedback and encouragement from both peers and mentors were invaluable. It was a privilege to be part of a community that fosters creativity and innovation.

Thank you, Macmillan, for creating such an enriching platform for young scientists. I am excited to see how this initiative continues to inspire future generations!

SOBHA ALIN

Science, Abu Dhabi Indian School, Abu Dhabi

Mentoring students for the 'Macmillan Budding Scientist 2024-25' was an incredibly rewarding experience. The event at IIT Delhi provided a platform for young innovators to showcase their brilliant scientific ideas and passion for discovery. I truly appreciate Macmillan Education for nurturing scientific curiosity and inspiring the next generation of thinkers through this exceptional initiative.

RISHIKESH JAYAGOPAL

Student, Class 7, Abu Dhabi Indian School, Abu Dhabi

The event which was held in IIT Delhi was wonderful. It was a great experience. We got to know about many ideas and could look at great projects. We also got to meet people from different parts of India and also esteemed IIT professors, etc.

THINK LIKE A **SCIENTIST:**

LIVING ON MARS!

Imagine this: In the future, humans are planning to live on Mars! Scientists have sent robots to explore, but now they want to build homes for people to stay there. You are leading a team of scientists who are on a mission to build the first human settlement in Mars.

But Mars is very different from Earth. Here are some big challenges:

1. **No Air to Breathe** – Mars doesn't have the oxygen we need. How can we make sure people have air?
2. **Extreme Weather** – It's super cold on Mars, and there are dust storms. How can we build safe homes?
3. **No Food or Water** – There are no plants, rivers, or grocery stores! How can people grow food and get water?
4. **I have the Power** – Mars doesn't have gas or oil. What energy sources could keep lights on and machines running?
5. **Long Distance from Earth** – It takes months to travel to Mars, and there's no internet like on Earth. How can people stay connected and get supplies?

Your Mission: Put on your scientist hat! Think of smart solutions for these challenges. How would YOU help humans live on Mars? You can use ideas from nature, current technology, or even your imagination. Write or draw your ideas, explain how they work, and help design the first happy community on Mars!

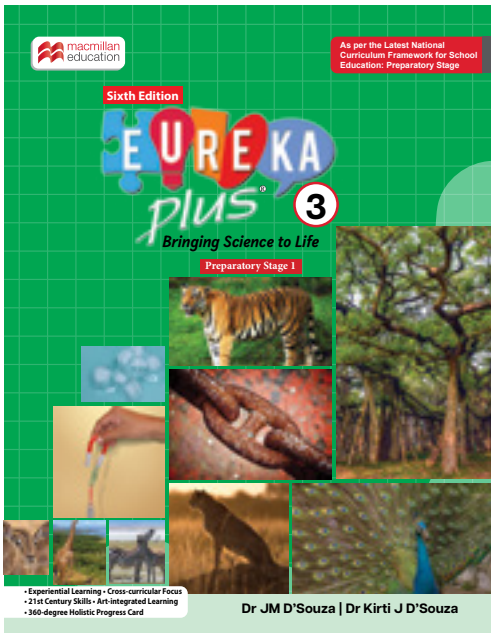
Submit Your Solution: Send your ideas, drawings, or explanations to **mbs@macmillaneducation.com**

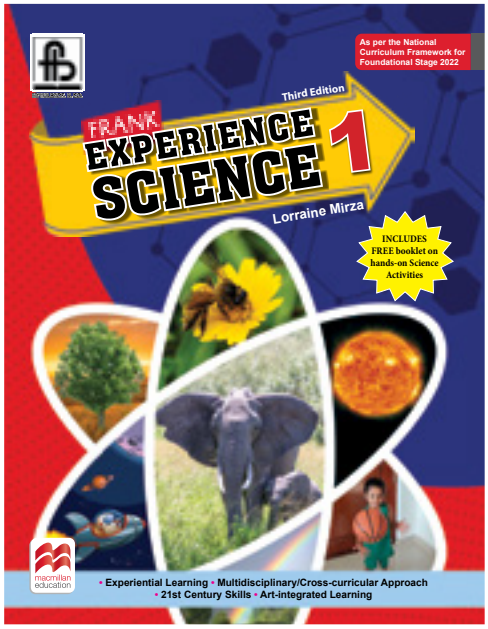
Subject Line: "Think like a scientist – [Your Name]" (Replace [Your Name] with your own name)

The best scientists think creatively and solve problems — just like you!

We'll feature some of the best ideas in the next issue of Science Spark

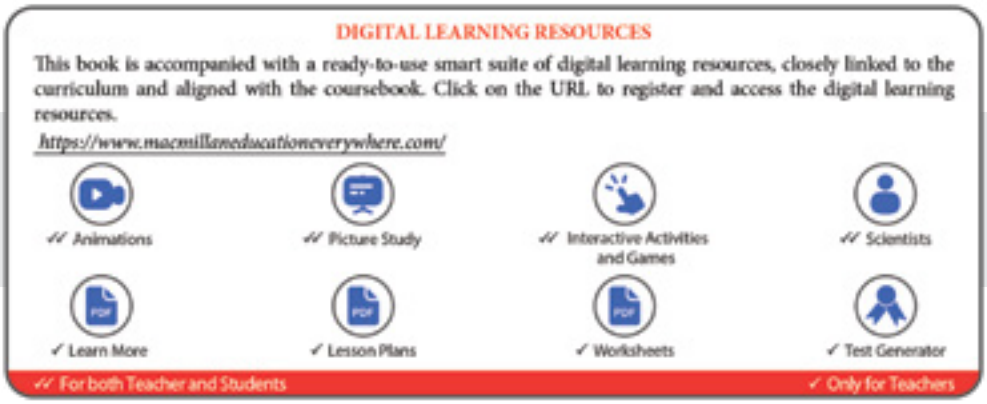
MACMILLAN'S
SCIENCE BESTSELLERS





Eureka Plus and Experience Science for classes 1 to 8, are both aligned to NCF for School Education 2023 and aim to develop scientific temper amongst learners.

1. Learning Outcomes based on Bloom's Taxonomy
2. Art-integrated Activities: To promote creativity
3. Cross-curricular Projects
4. 360 degree Holistic Progress Card
5. Focus on Sustainable Development Goals



SCIENCE Quiz

ANSWERS

1. b) Weak nuclear force
2. b) Artificial Intelligence
3. c) HTML
4. a) RSA Encryption
5. c) Performs calculations in parallel using superposition
6. b) Suspension bridge
7. b) Store rotational energy
8. b) It is impossible to simultaneously determine both the position and momentum of a particle with absolute precision
9. b) Proton
10. b) Time slows down
11. b) Polar covalent bond
12. c) Second Law of Thermodynamics
13. a) The development of wings in bats and birds
14. b) Weakly Interacting Massive Particles (WIMPs)
15. b) Mesozoic

Macmillan Budding Scientist

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About Macmillan Education India

Since 1892, Macmillan Education India has been pioneering quality publishing for teachers and institutions. The passion to transform lives is at the centre of our ideology. Macmillan textbooks, developed by leading academicians and practicing teachers are research-based, learner-centric and are the first choice of over 15,000 institutes pan India. Our resources lead the teaching-learning through new methodologies, and sound teaching practices that inspire learners to achieve more through engaging digital and print content.

Macmillan Education India (MEI) has an unrivaled reputation in the school market. MEI produces curriculum resources in both print and digital form, offers assessments, and provides teacher training. With over 130 years in the education sector, MEI partners with 15,000+ schools and reaches 10 million learners across India.

About Springer Nature

Macmillan Education is part of Springer Nature, a leading global research, educational, and professional publisher. As the world's largest academic book publisher and a pioneer in open research, Springer Nature is home to influential journals and cutting-edge content. With nearly 13,000 staff across 50+ countries, Springer Nature remains committed to advancing knowledge and education worldwide.

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