

# How do Geckos walk upside down?

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Westmount Charter Mid-High Grade 6



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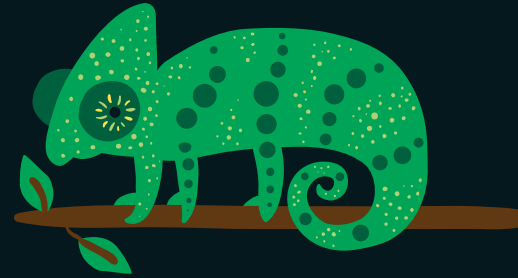
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# Question



01

# Problem & Method



# Problem and Method

Problem/Question: How do geckos walk upside down?

Side Questions:

Do other animals that walk upside down use the same technique as geckos?

What are some inventions that we can use to help us do the same?

Method: We looked at books and websites, watched videos, and observed live geckos to find out the way they walked on walls.

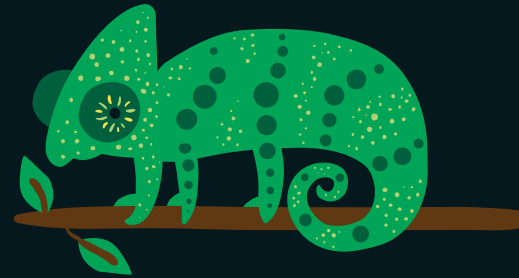
A stylized botanical illustration featuring various green and yellow leaves and ferns. The central focus is the word "Research" written in a bold, rounded, yellow font. The background is a dark, muted green with faint, larger-scale leaf patterns.

Research

02 - 1

# Geckos

What are geckos? What do they eat?



# What are they?

Geckos are a type of lizard that lives everywhere besides Antarctica.

They are nocturnal and have good night vision.

These carnivorous lizards can range from 1.5 centimeters to 60 centimeters and can be green, yellow, orange, blue, and brown.





# GECKO ANATOMY

## EYES

- Good night vision.
- Lick their eyes to clean them.

## TONGUE

- Tongue is sticky to grab prey.

## TAIL

- Escape from predators by letting their tail break away.
- Regrow the tail in thirty days

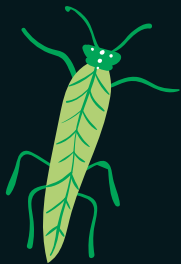
## FOOT

- Foot has special hairs on it called setae



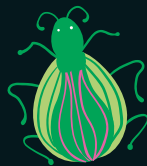
# GECKOS DIET

Crickets



Moths

Beetles



Earthworms

Geckos will eat crickets, waxworms, earthworms, moths, mealworms, fruit flies, beetles, and grasshoppers.



# FACTS ABOUT GECKOS

## STRONG FRONT FEET

The front feet of the largest gecko can carry 2 kilograms

## SPECIAL SOUNDS


Geckos make sounds that sound like the word 'gecko' which is how they got their name.

## DRY FEET UNDERWATER

They can stick to surfaces underwater and keep their feet dry underwater

## LEGLESS GECKOS

Some species of geckos have no feet, relying on their bodies to move in a snake-like manner





02 - 2

# Other Animals That Can Walk Upside Down

How do other animals walk upside down? Do they use the same technique as geckos?

# How do other animals walk upside down?

- Insects: They have hairs that increase the surface area. They also make a glue-like substance made of sugars and oils. They have little claws that they twist to release their foot.
- Tree Frogs: Scientists think they stick using a thin film of water, like a damp piece of paper.



# Do geckos use these techniques?

- Scientists ruled out other possibilities of hooks and suction cups for geckos to stick onto walls.
- Two possibilities are either sticking via a film of water, or Van Der Waals forces.
- There was a big difference which would help determine which it was. Water was polar, but Van Der Waals forces were not.
- In order to test this, they used silicone dioxide, which was polar, and gallium arsenide, which was not.
- The gecko equally stuck on both surfaces, eliminating the thin film of water and confirming Van Der Waals forces in work.

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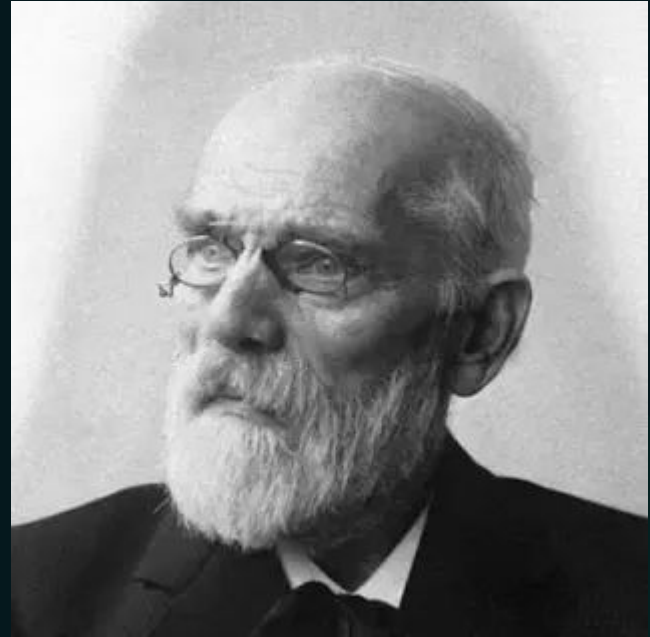


# Van Der Waals Forces

What are they? How do they work?

# Who Is He?

Johannes Diderik van der Waals, a Dutch physicist and Nobel Prize winner born in 1837, discovered the Van Der Waals (pronounced vhan-dur-walls) forces.



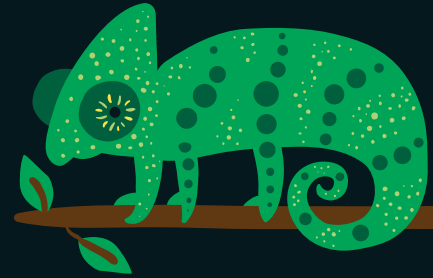


# What are Van Der Waals forces?

- The Van Der Waals forces is an attractive force between the molecules. They work on any surface or material.
- There are different types of Van Der Waals forces.
- This is the weak force that makes geckos stick to the ceiling.
- The gecko uses tiny hairs called setae on its foot, which generate these forces.

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# Setae and Lipids



What are they? How do they work?

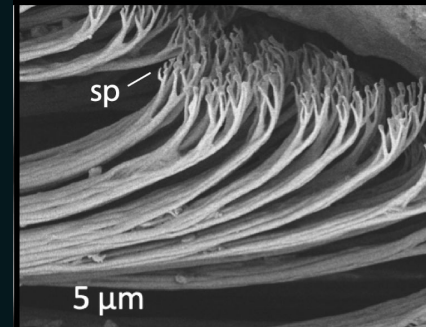
# What are Setae?

- Setae (pronounced seh-tee) are millions of tiny hairs on a gecko's foot that are extremely delicate.
- Setae, by using Van Der Waals forces, are the things that make geckos stick to things.
- Geckos can change the angle of the setae to break the connection, and take their next step.
- On the setae there are lipid molecules.



# What are Lipids?

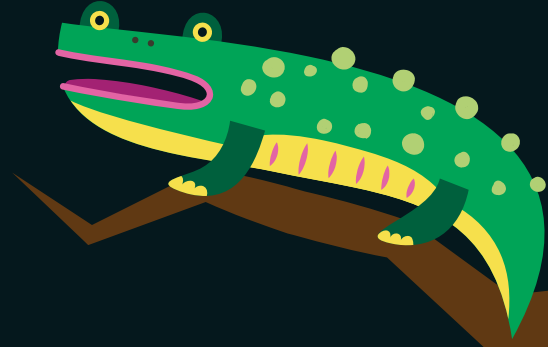
- There is an ultra thin film of lipid molecules on the setae.
- It repels water so geckos can stick to wet surfaces.
- Lipids push water out from under the feet.
- The film is only one nanometre thick.





# Analysis

03





# Inventions

What are some inventions that humans can use to walk on walls?



# WHY CAN'T WE USE VAN DER WAALS?

- We are simply too big for the setae to support us.
  - Geckos are the largest species that can use Van Der Waals forces.
  - Our bodies will be too far away from the wall, whereas a gecko sticks closely to the wall.
  - There are inventions that could maybe help us do the same.
- 
- 



# INVENTIONS



## Magnetic Boots

- Not yet used in spacecrafts as astronauts use straps to hold themselves in place
- If used, can navigate around the spacecraft easily without bumping into equipment
- Boots attach to the iron floors and ceilings of a spacecrafts

## Nano Tape

- Used by the military, health care, and sports
- Using carbon nanotubes (Nanotechnology)
- Used to hang light weight items such as pictures and decorative items, though on smooth surfaces
- Leaves no marks and no residue on the surface and can stick in extreme temperatures



# INVENTIONS – CAN WE DO MORE?

## Grappling Hook

We can make it so that the hook will stick to a smooth surface as well.



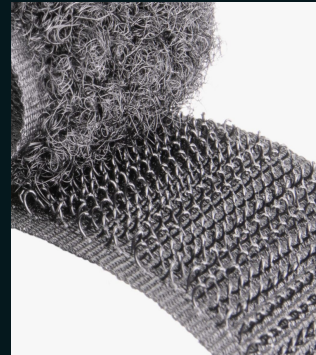
## Suction Cups

Extremely strong suction cups would allow us to stick to walls.



## Velcro Strips


We can put our items anywhere if we don't have enough space on the floor.





# Conclusion

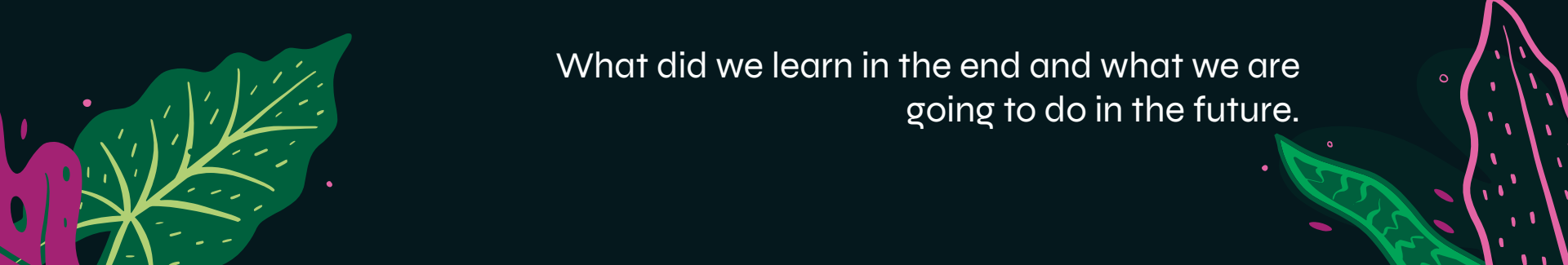


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04 - 1

# Conclusion

What did we learn in the end and what we are going to do in the future.

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# Conclusion

In conclusion, we answered our overall question, by learning that geckos can walk upside down using Van Der Waals forces.

They are triggered by tiny hairs on their feet called setae.

We also found out that not all animals need to have little hairs to walk upside down, though they can't use the Van Der Waals forces without setae.

Humans cannot use Van Der Waals forces but we have inventions that can help us walk on walls.



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**Citations and  
Acknowledgments**

# Acknowledgements

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