Table of Contents

# Meet the Cast!


Can you find all of our plankton friends? Collect them all and win a super cool PACE prize!

# PACE Mission

PACE extends and improves upon NASA's 20+ years of global satellite observations of our living ocean, atmosphere, and land, and initiated an advanced set of data records for basic and applied research. Specific mission goals include extending systematic ocean color, atmospheric aerosol, cloud, and terrestrial data records for Earth system studies, and addressing new and emerging science questions related to socioeconomic applications.

# References

All imagery (if not otherwise stated) is courtesy of NASA SVS and NASA Imagery
https://oceanservice.noaa.gov/facts/phyto.html
https://pace.oceansciences.org/learn_color.htm
https://oceanservice.noaa.gov/facts/redtide.html

**National Aeronautics and Space Administration**

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Greenbelt, MD 20771
www.nasa.gov/goddard

**www.nasa.gov**

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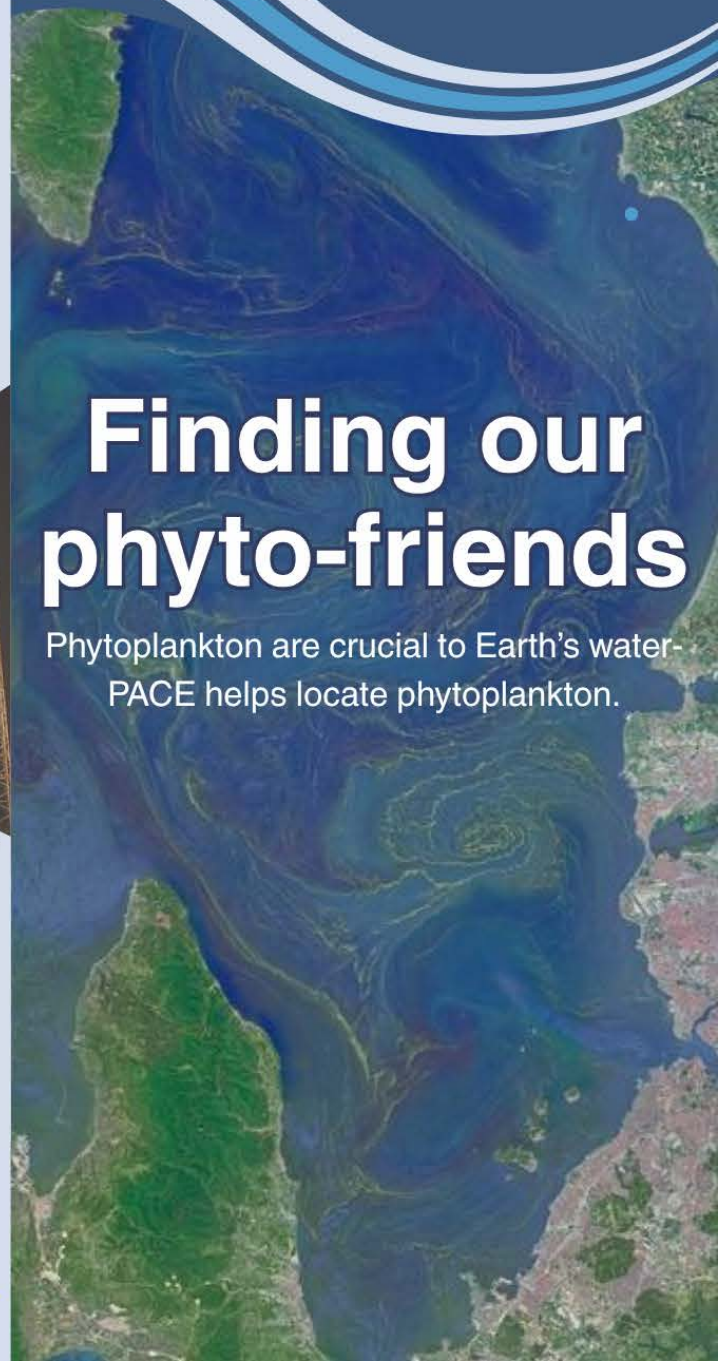


# Finding our phyto-friends

Phytoplankton are crucial to Earth's water- PACE helps locate phytoplankton.

# FAQ's

**Q: What are phytoplankton?**

**A:** Phytoplankton are microscopic marine algae that are invisible to the naked eye. They require sunlight to survive and are the backbone of the marine ecosystem!

**Q: Where can I find phytoplankton?**

**A:** They are found in the uppermost layer of the ocean where sunlight penetrates the water. But they don't just exist in the ocean- any body of water you see has millions of phytoplankton in it!

**Q: What do phytoplankton eat?**

**A:** They actually don't eat- just like plants on land, phytoplankton photosynthesize! They convert energy and carbon dioxide from the sun into the nutrients that fuel them. As a by-product of this process they also create oxygen!

*FUN FACT: millions of years ago phytoplankton oxygenized the world and are likely the reason we are alive today!*

**Q: What do they do for our environment?**

**A:** They provide oxygen and are the base of the marine food web, providing food for a wide variety of sea creatures like shrimp, shellfish, and jellyfish. They also can make our oceans and lakes many beautiful colors!

**Q: How can we study them if they are invisible to the naked eye?**

**A:** NASA missions like PACE (Plankton, Aerosols, Cloud, and ocean Ecosystem) use remote sensing satellites to read them from space! Remote sensing allows for scientists to determine the amount of phytoplankton and type of phytoplankton present, based on the color they create.

**Q: How do phytoplankton color the ocean?**

**A:** Different phytoplankton have different pigments in them. During photosynthesis, different pigments absorb different wavelengths from the sun, leaving the ocean reflecting whatever wavelength colors weren't absorbed. This is why water can be so many different colors. Different combinations and amounts of phytoplankton create different colors!

# Harmful Algae Blooms

An algae bloom is when there is a large group of phytoplankton. They are caused by an increase of nutrients which sometimes can be due to external factors like fertilizer run off. Blooms can be dangerous when they are composed of certain types of phytoplankton, including some dinoflagellates (Dino!). These "harmful algal blooms" can produce toxins that get into our seafood and make us sick, cause large numbers of fish and other wildlife to die, or irritate our skin and respiratory systems. Sometimes they are called "red tides" because they color the ocean red. A common example is the red tide in Florida; beaches are regularly shut down when the red tide comes around because of their detrimental effects! It is important to detect these blooms so we can predict them and study ways to prevent them.

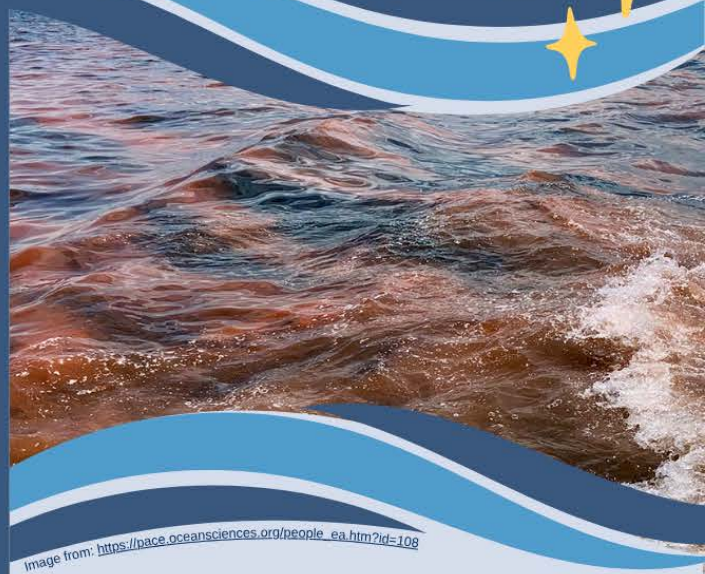


Image from: https://pace.oceansciences.org/people_ea.htm?id=108

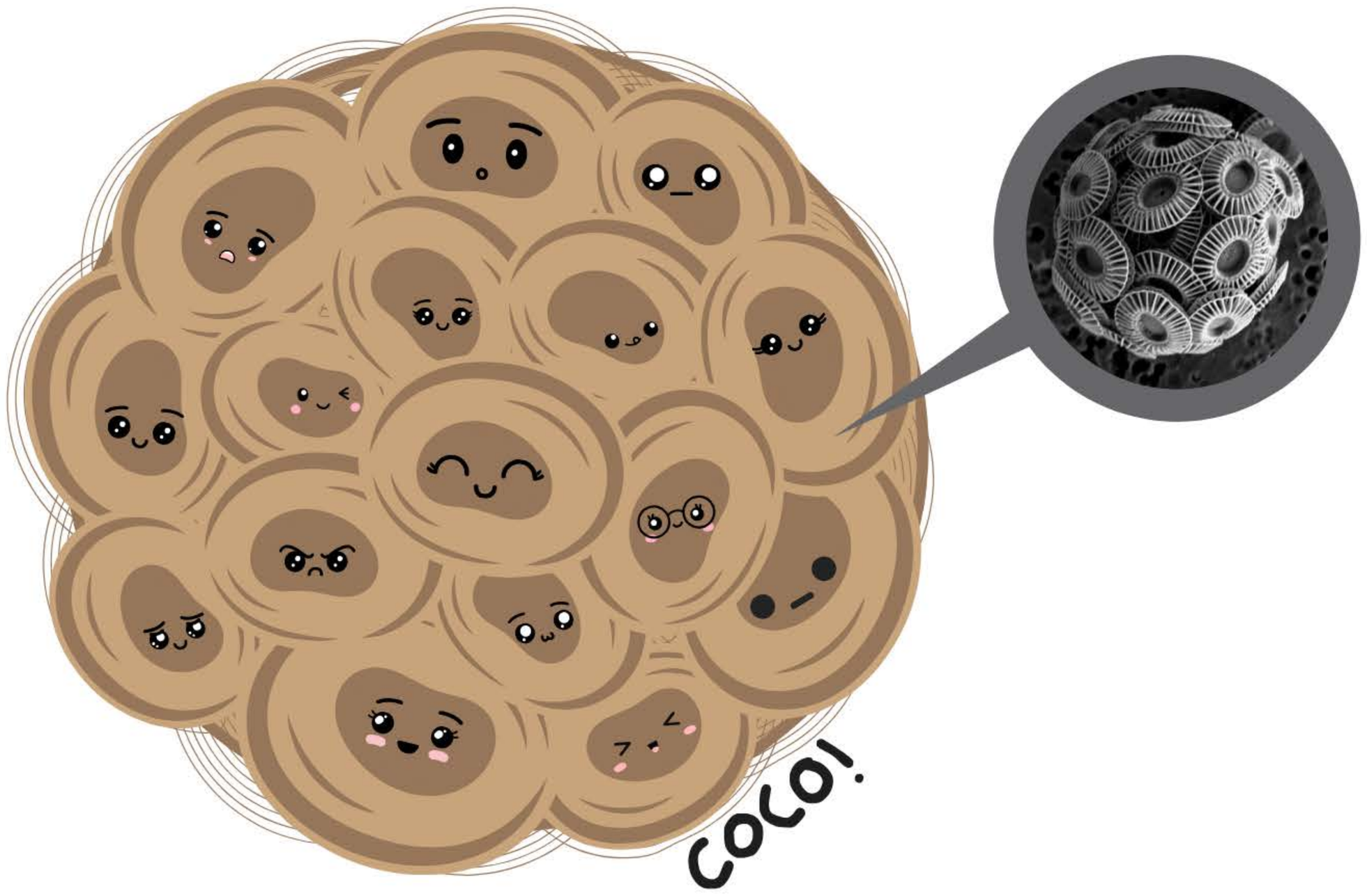
# PACE!

a.k.a. the Plankton, Aerosol, Cloud, ocean Ecosystem mission


The PACE satellite uses remote sensing of ocean color to detect large groups of phytoplankton, called blooms, from space! Thinking about the colors satellites can see as crayons in a crayon box- many satellites have a crayon box of around 12 colors, but PACE has a crayon box of over 100 colors. Being able to see this many colors is important for phytoplankton detection because there are thousands of types, each with unique coloration capabilities.

# Coco!

## a.k.a. Coccolithophore




Even though coccolithophores are very tiny (only a few micrometers big), they produce calcium scales that create large turquoise areas of water that can actually be seen from space! She is important for regulating the amount of carbon in the oceans, and their old scales sink to the bottom of the oceans and become limestone. She also has a secret super power -- their old scales can reflect enough sunlight to change the ocean's temperature!

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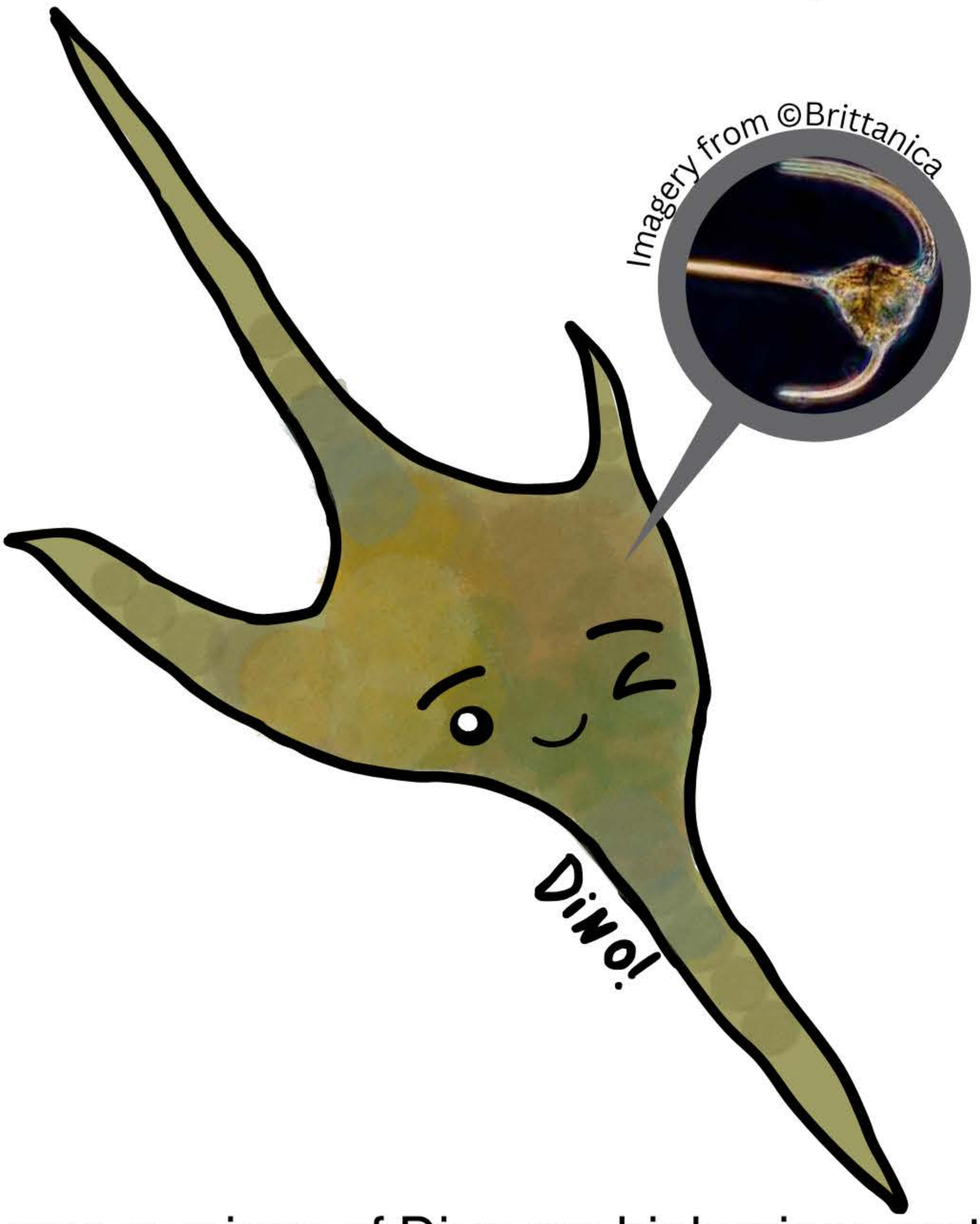
# Dino!

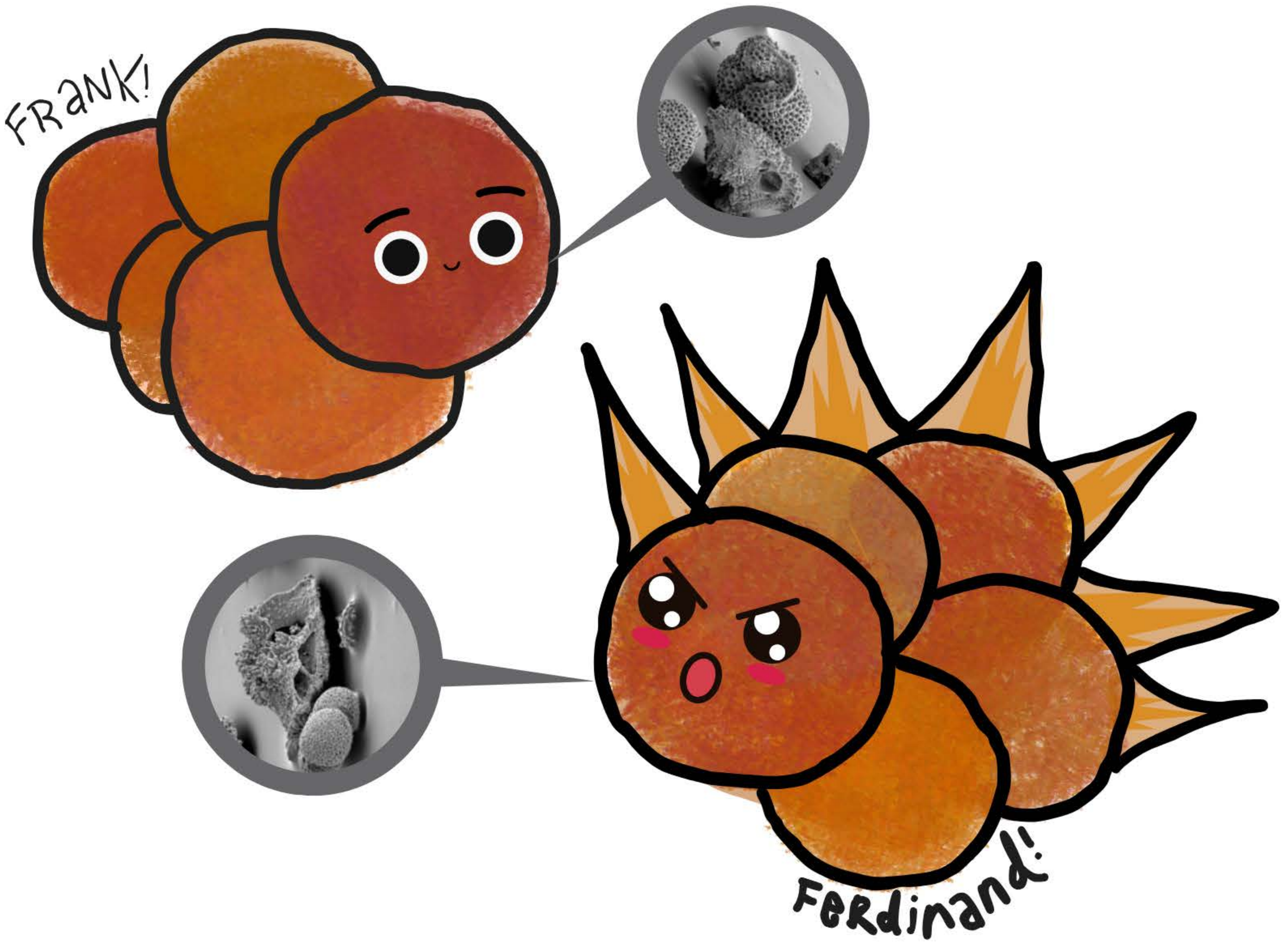
## a.k.a. Dinoflagellates




Some versions of Dino are bioluminescent- they glow bright blue when disturbed! Other versions are more sneaky and create “Red Tides”. Two popular examples of this phenomena are in Florida and the Gulf of Mexico. Red Tides, also known as Harmful Algae Blooms are dangerous to both humans and the marine ecosystem, which is why satellites like PACE that can help detect these blooms are so important!

# Frank & Ferdinand!

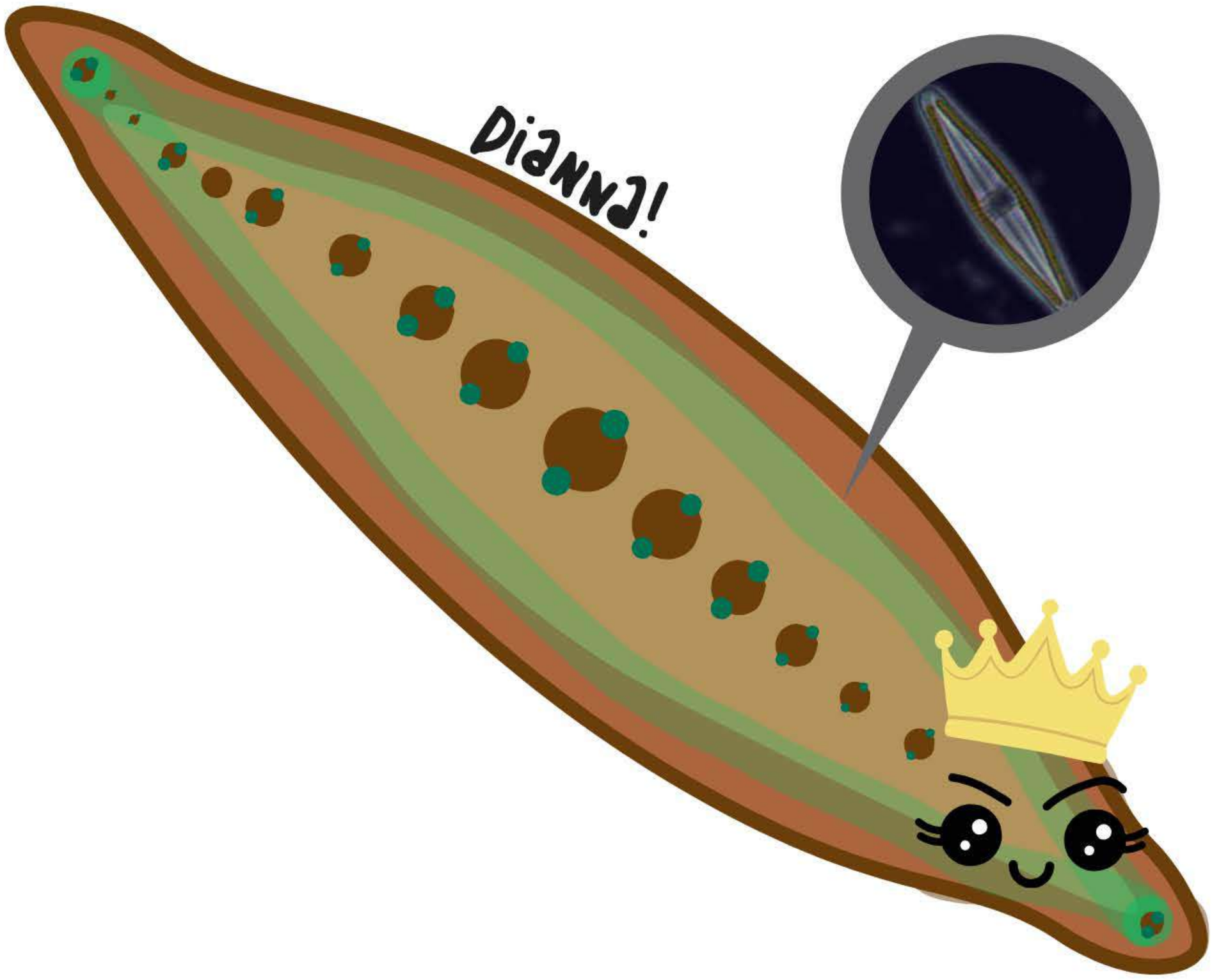
## a.k.a. Foraminifera




Foraminifera, like coccolithophores, also use calcium to build skeletons, but they can be up to 100 times larger than coccolithophores! He is a predator and can extend his long membrane extensions to find and capture his prey. He is also able to use them to move over surfaces. Scientists are studying the ancient foraminifera shells to learn about the Earth's climate long ago.

# Dianna!

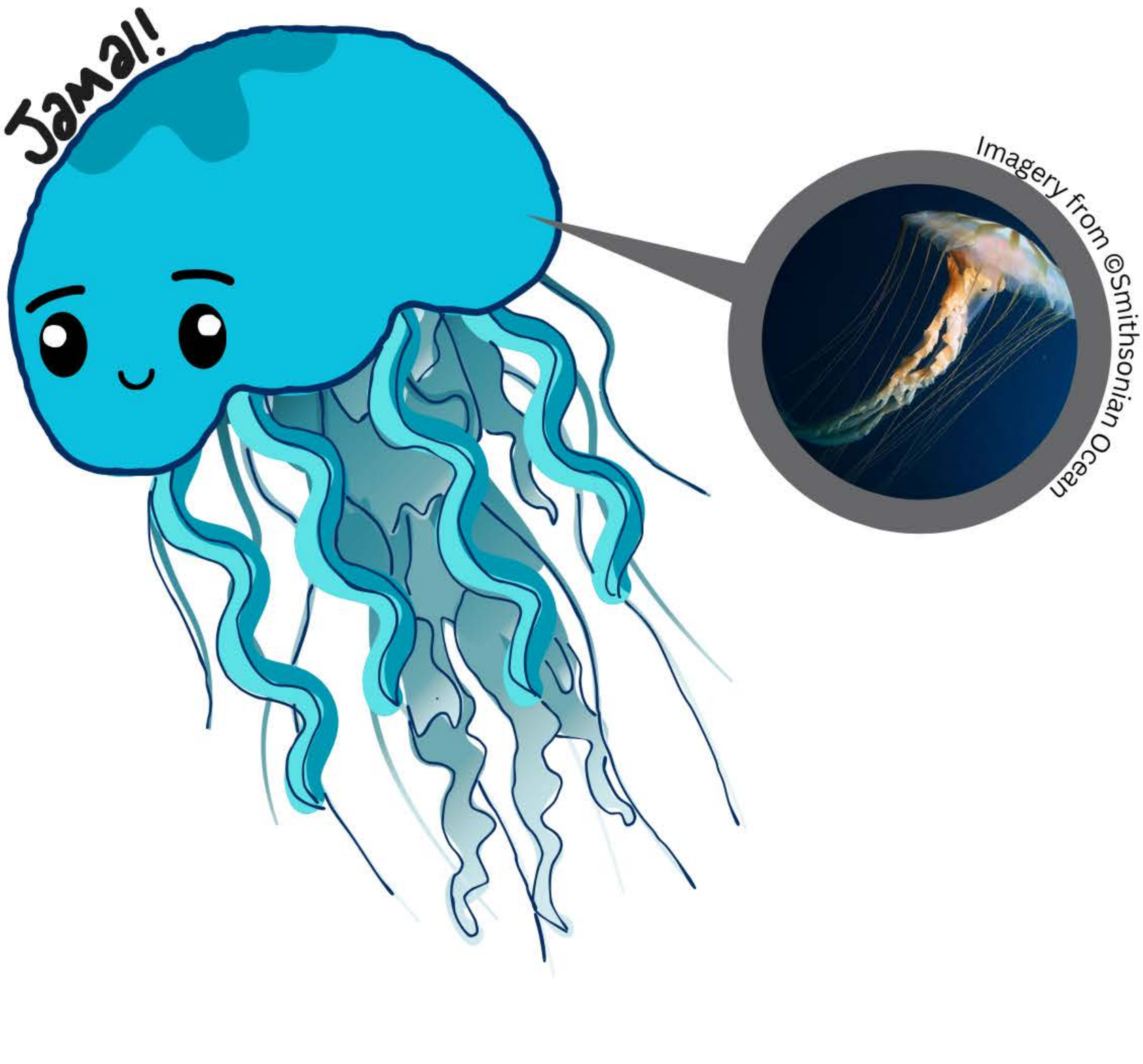
## a.k.a. Diatom




We all know that trees produce oxygen, but did you know that diatoms produce a quarter of the Earth's oxygen? Ancient diatoms turn into rock and oil, and they can be found anywhere from paint to toothpaste! However, she is not always helpful. If you've ever had food poisoning from shellfish, there's a good chance that she is to blame.

# Jamal!

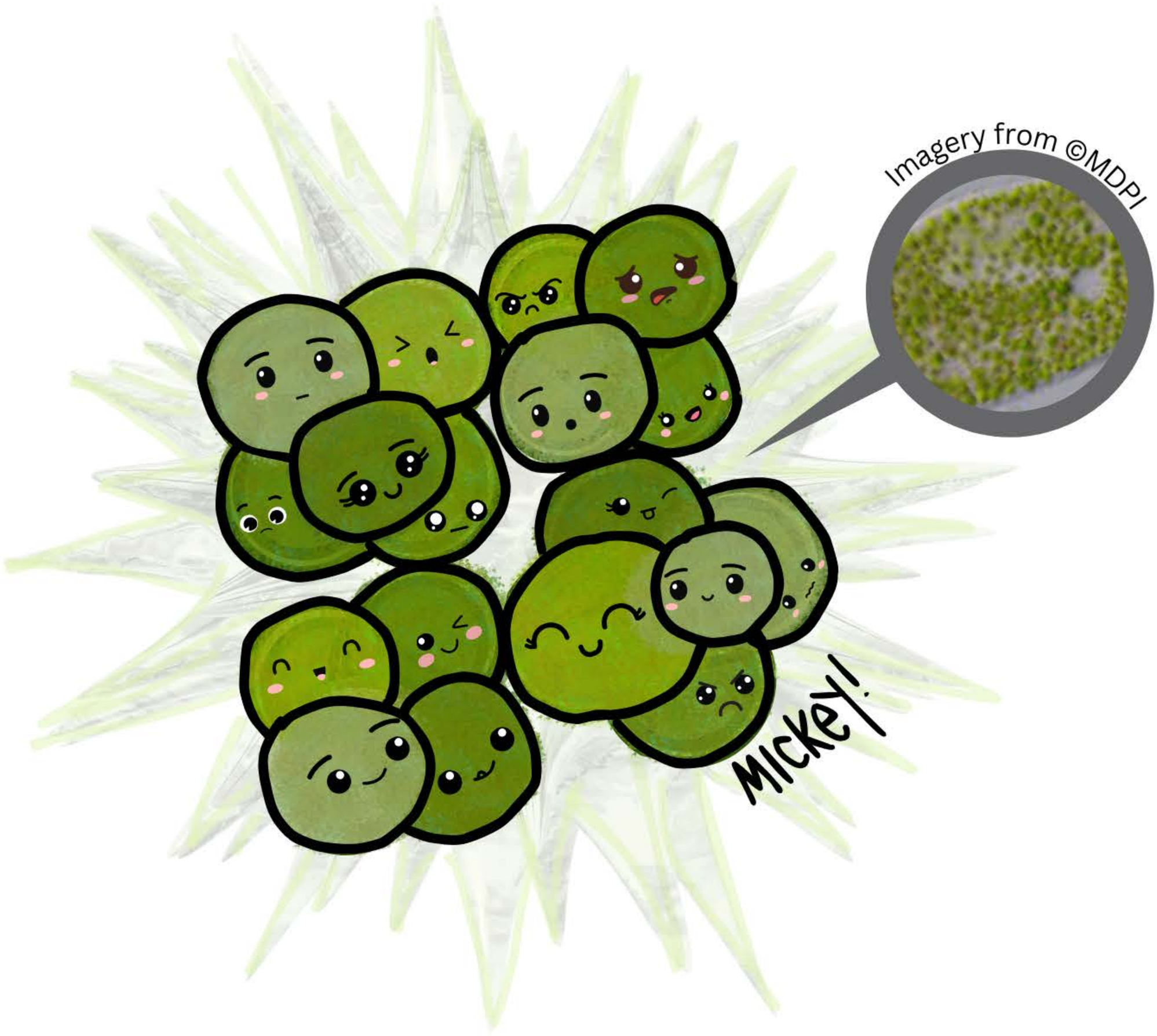
a.k.a. Jellyfish




Probably the most famous type of plankton is the jellyfish! Unlike the others earlier, jellyfish are NOT phytoplankton, and instead are considered zooplankton. Most jellyfish are actually not visible to the naked eye. Jellyfish are super important for research on regeneration and maybe even immortality! Some jellyfish can even light up, called bioluminescence.

# Mickey!

## a.k.a. Micractinium




Meet the friendly freshwater micractinium - tiny green algae with spiky bristles! She will often form a group of friends called a colony, which can have up to 128 different cells. She is found in so many freshwater habitats regardless of temperature, from Antarctica to the pond scum outside your house! They can help to purify the water they are in, making these tiny cells super important for many ecosystems.

# Chrysty!

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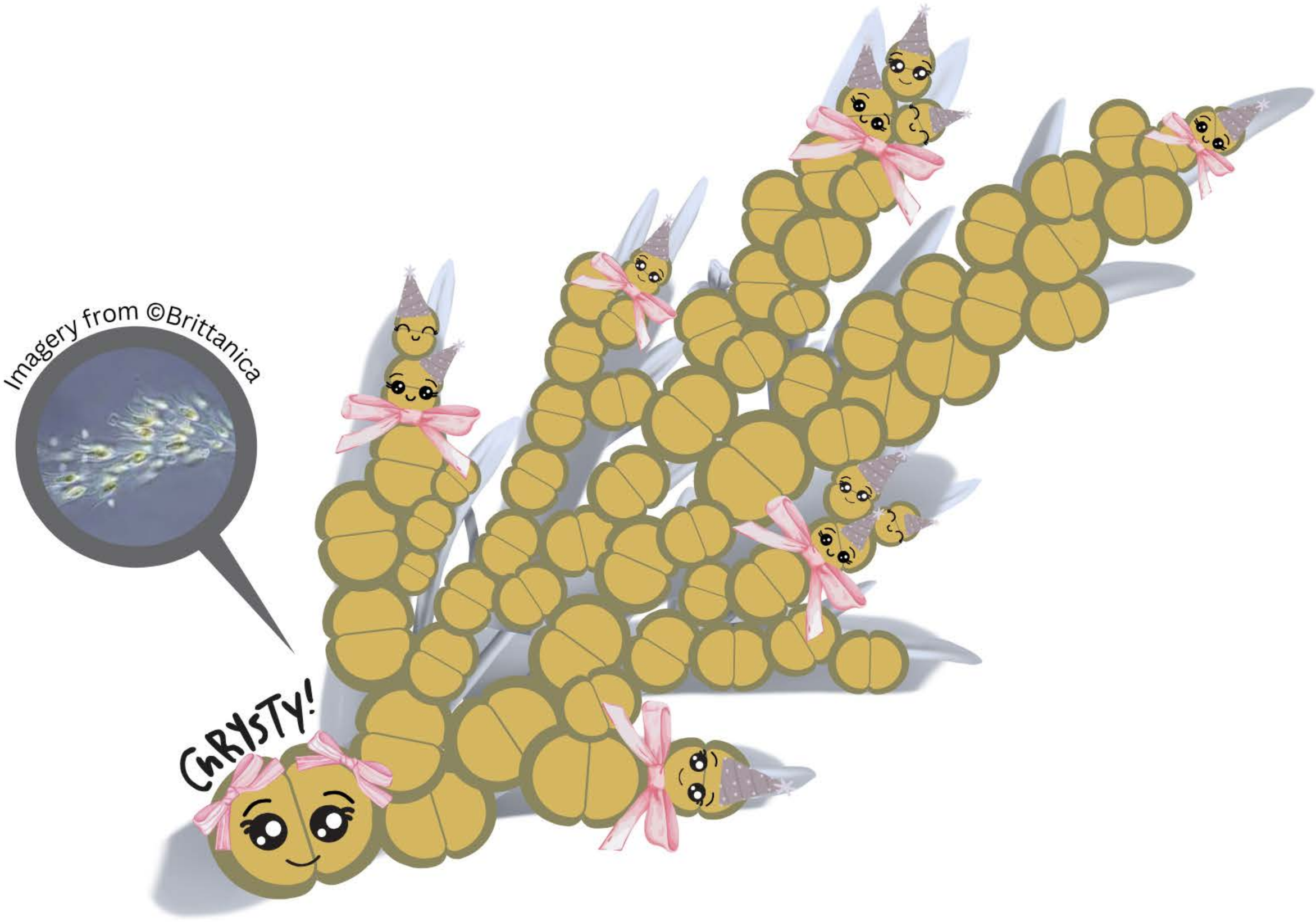
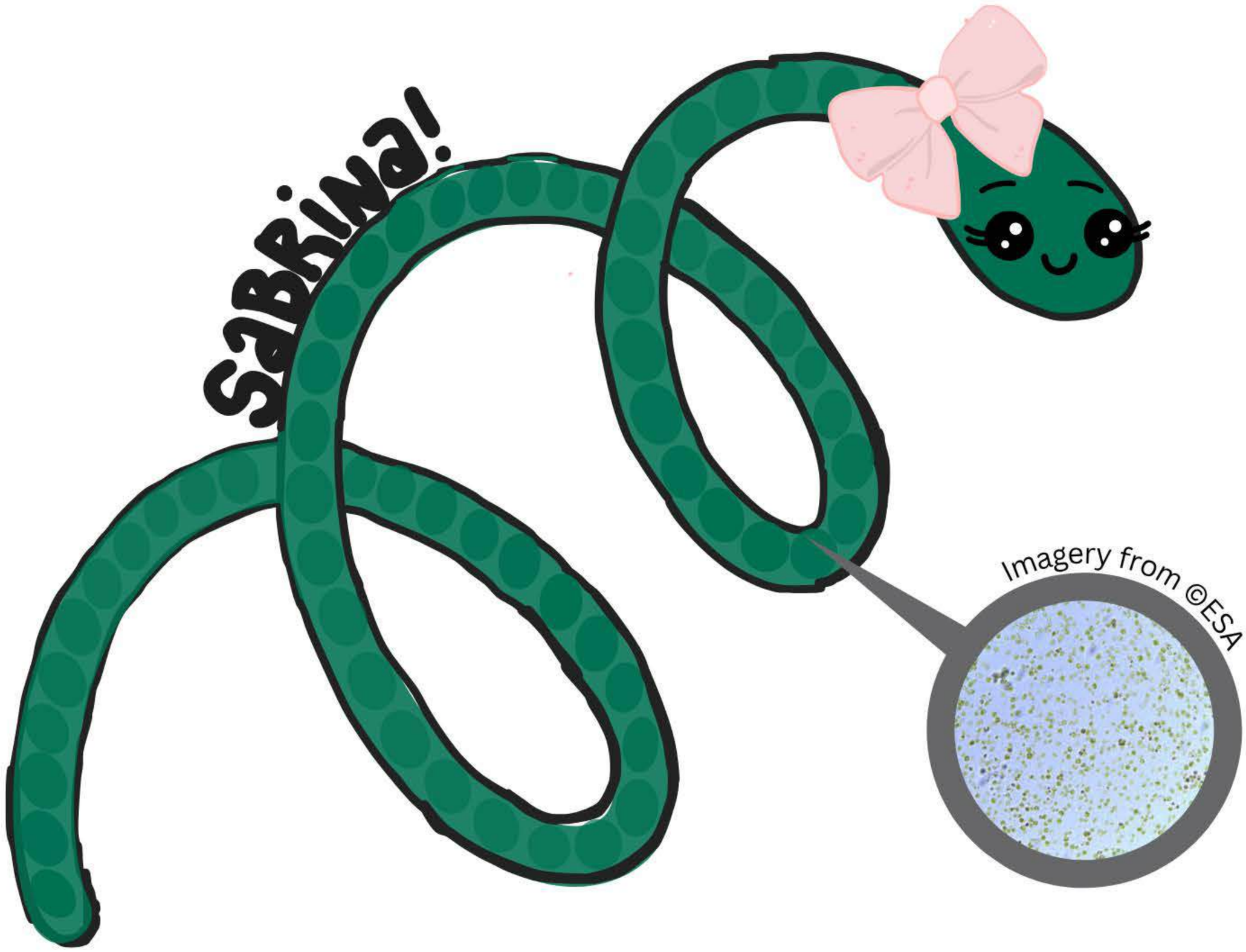



Phytoplankton can be a ton of different colors! Chrysophyceae are known for their beautiful golden-brown color, so they are commonly called “golden algae”. She usually has two "tails", one for power and the other for steering while swimming! You can find her in most US states, as she is a freshwater phytoplankton. One well-known species is known for causing fish kills, as they create toxins that stop their gills from breathing. Recently, over 360 tons of fish died in Poland due to these toxins! So far, scientists don’t think that humans or other wildlife are affected by these toxins.

# **Sabrina!**

## a.k.a. Spirulina




You might know more about Phytoplankton than you think you do! Spirulina is an algae that you can find in tropical lakes throughout Africa and the Americas. She is FULL of protein and is found in smoothies and supplements.

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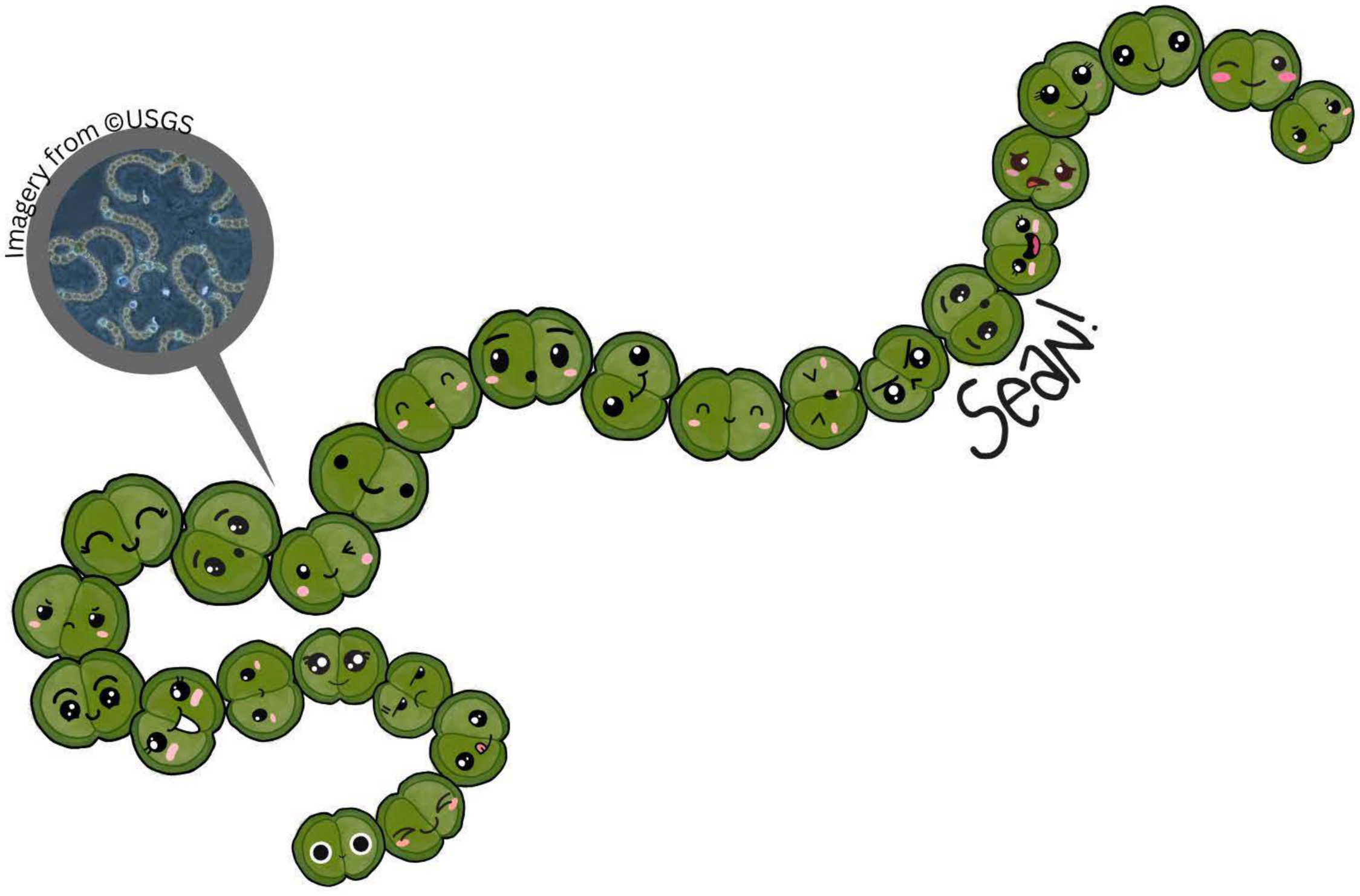


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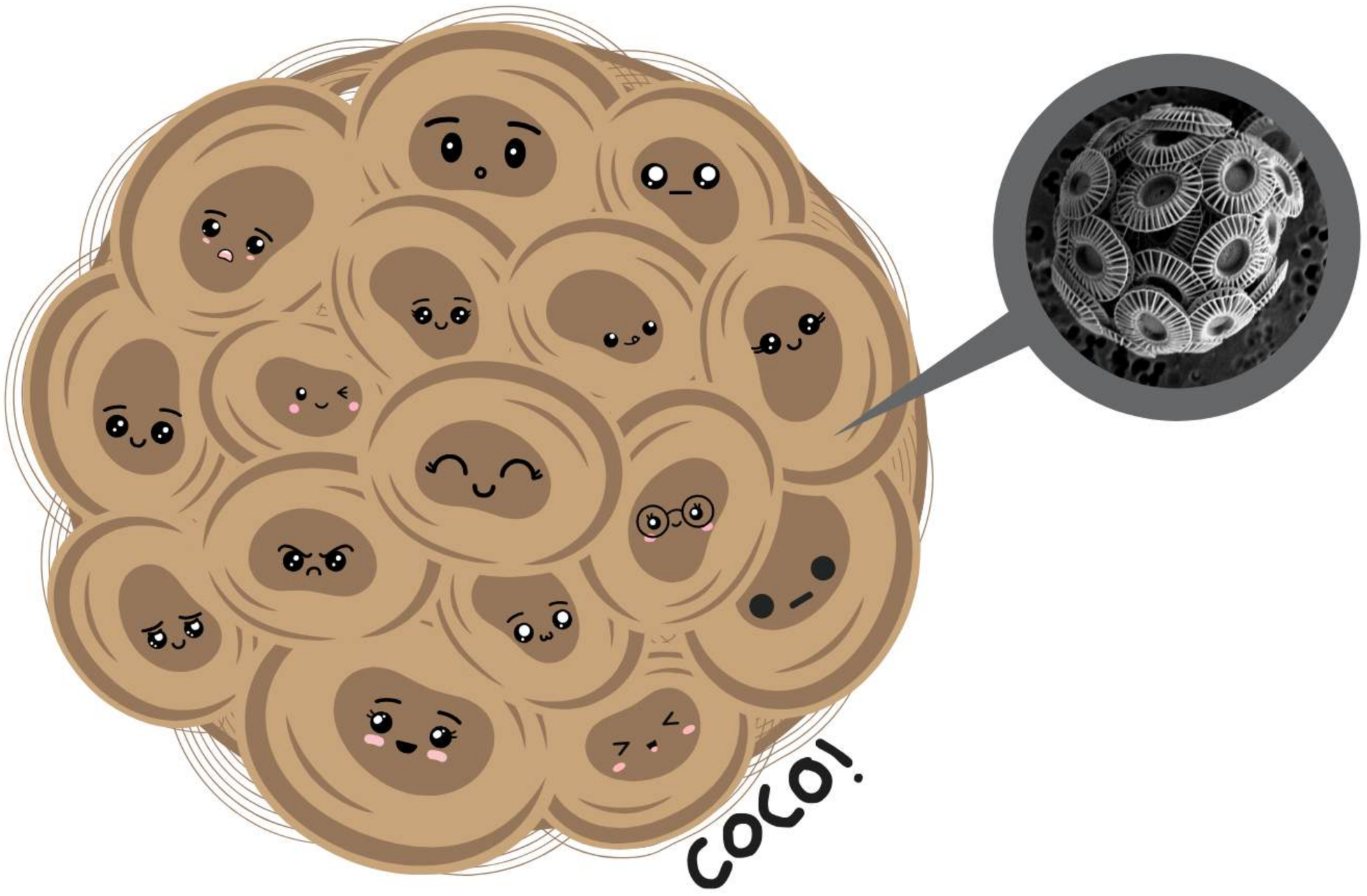


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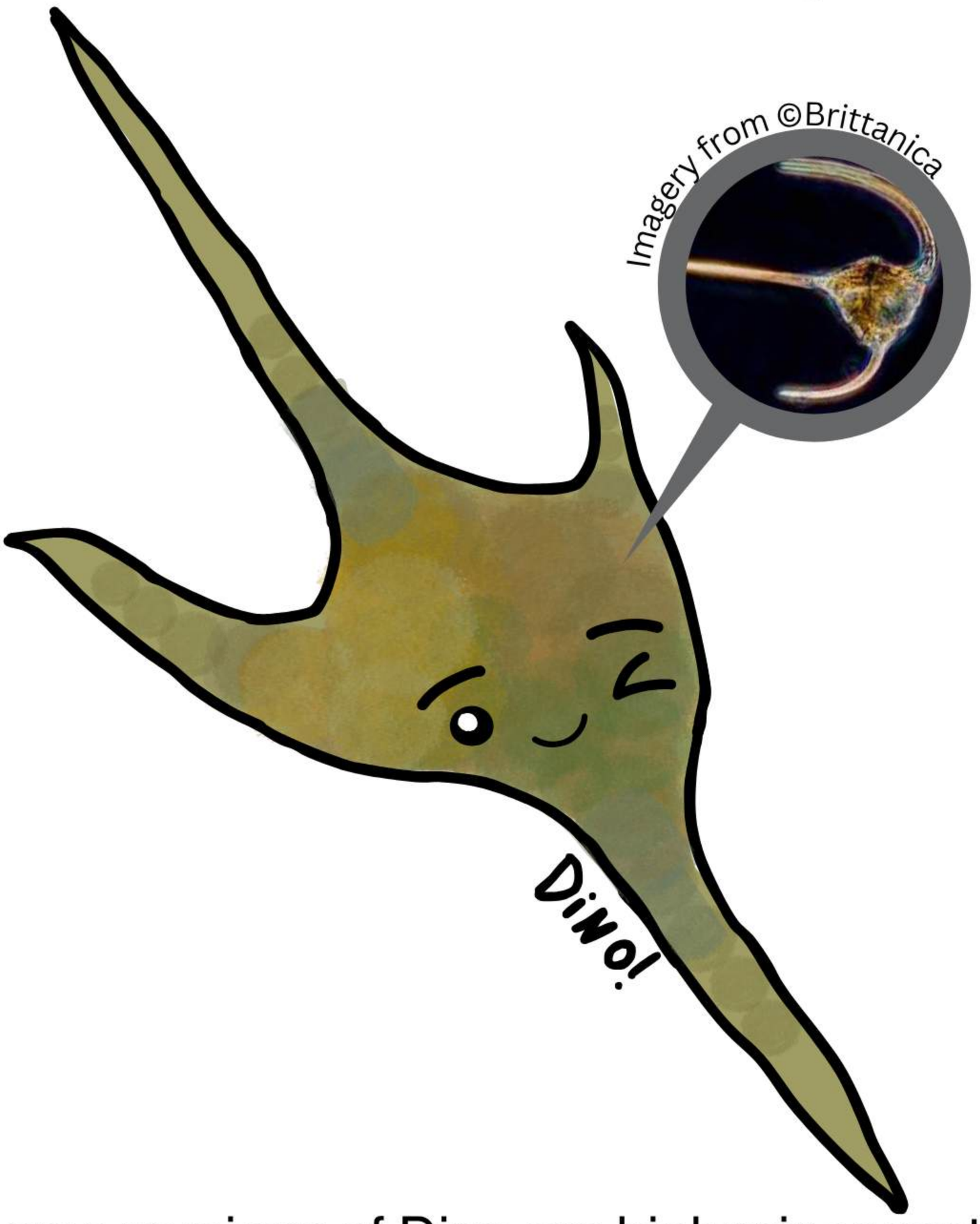


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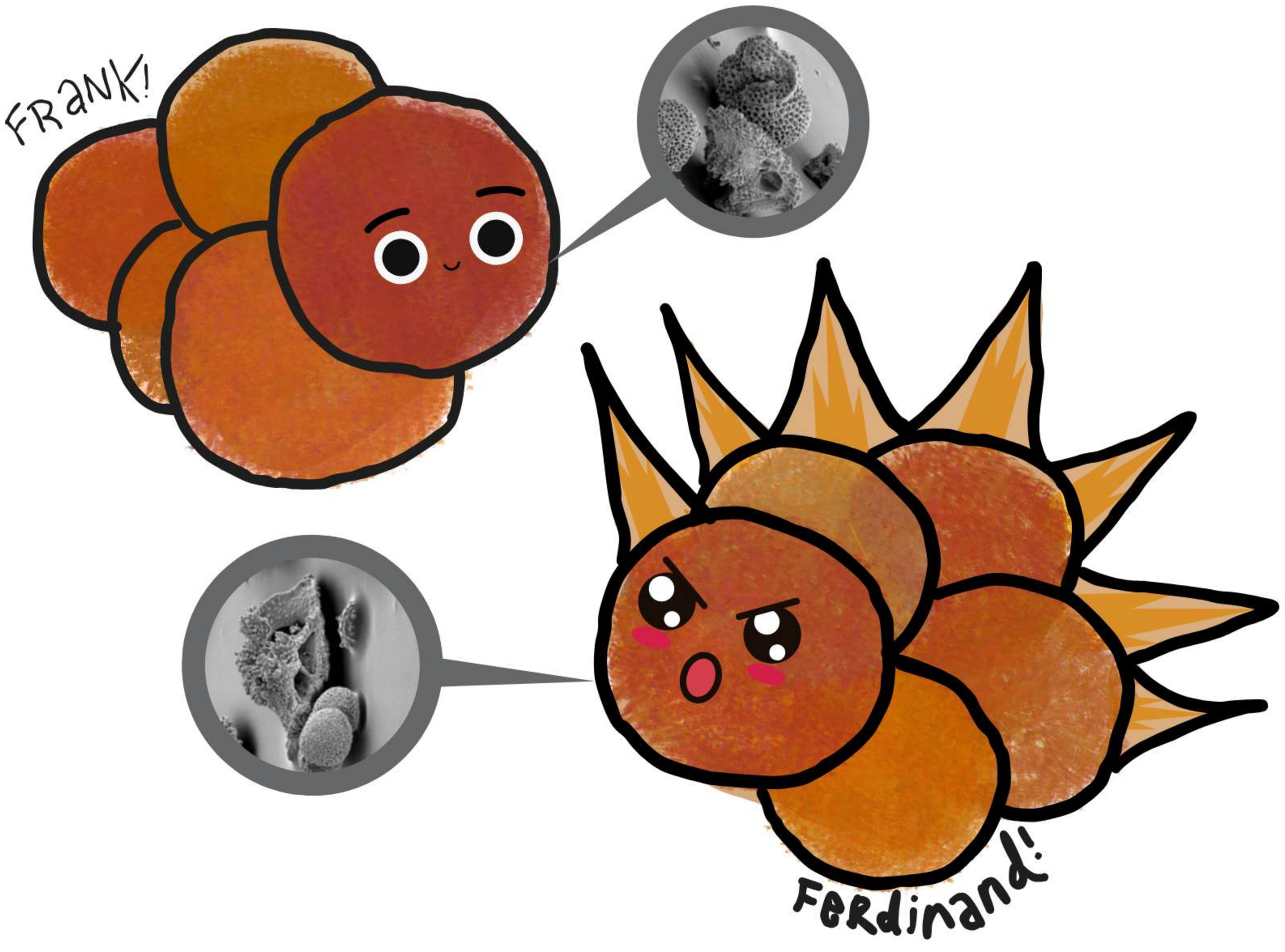


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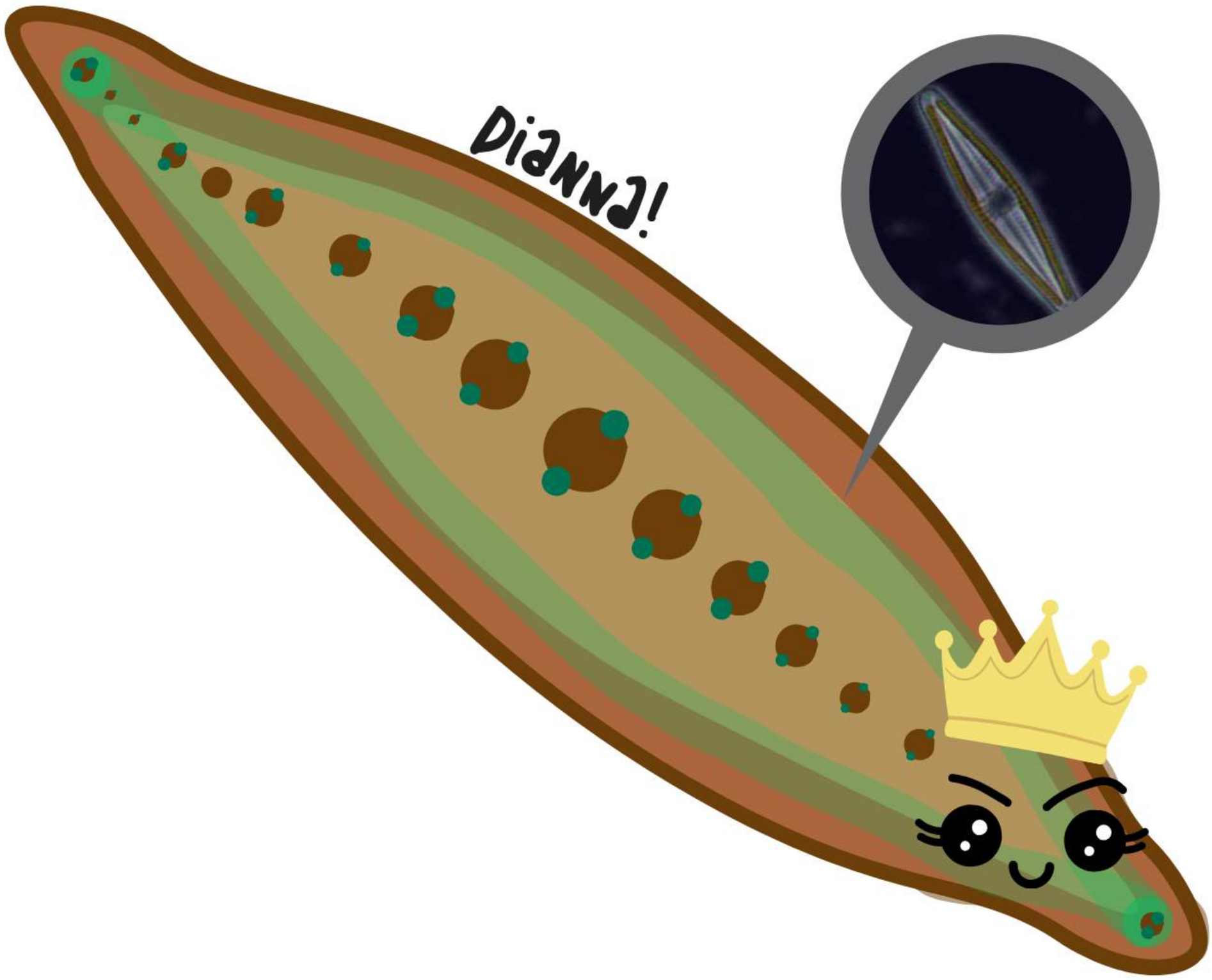


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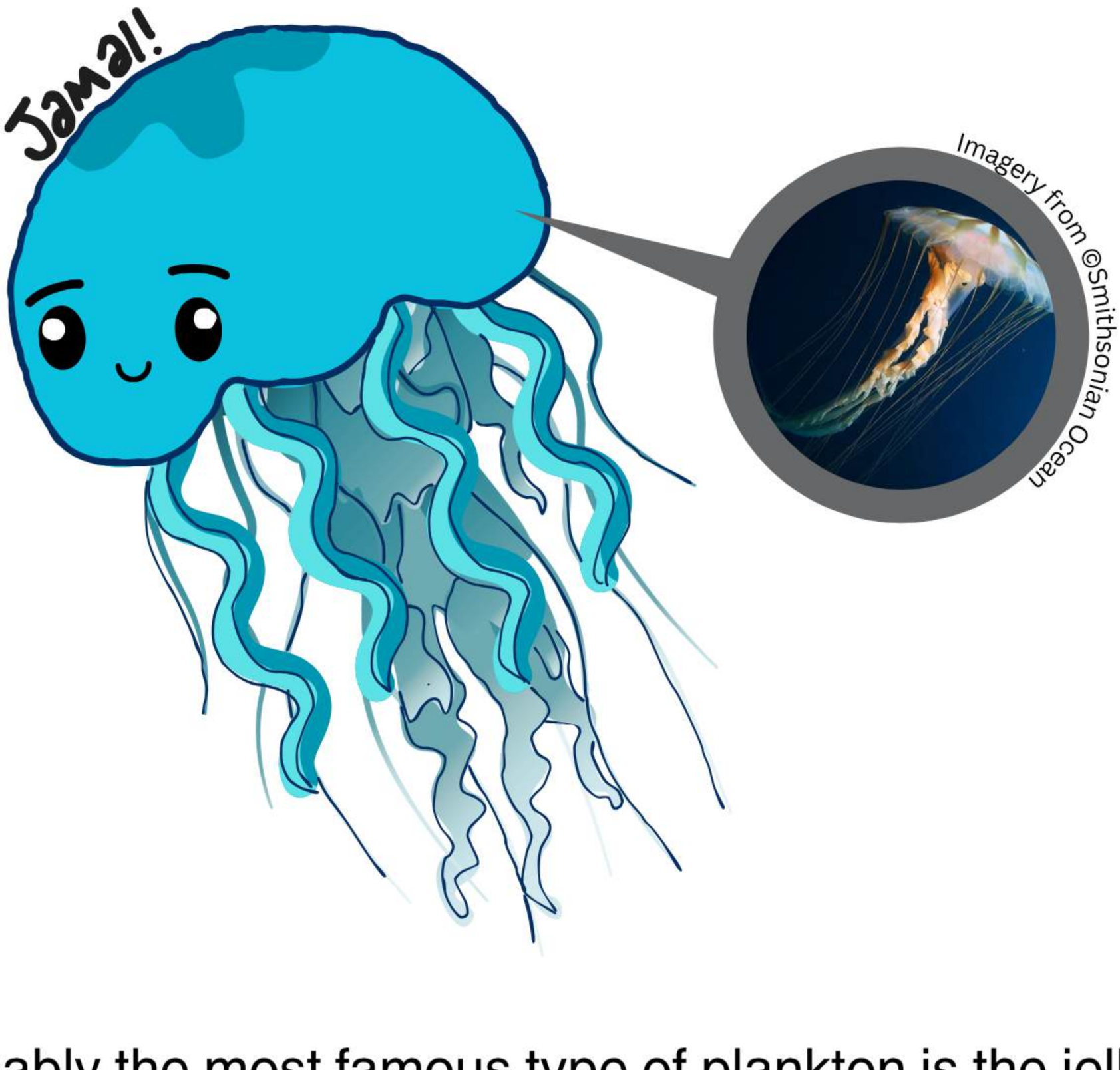


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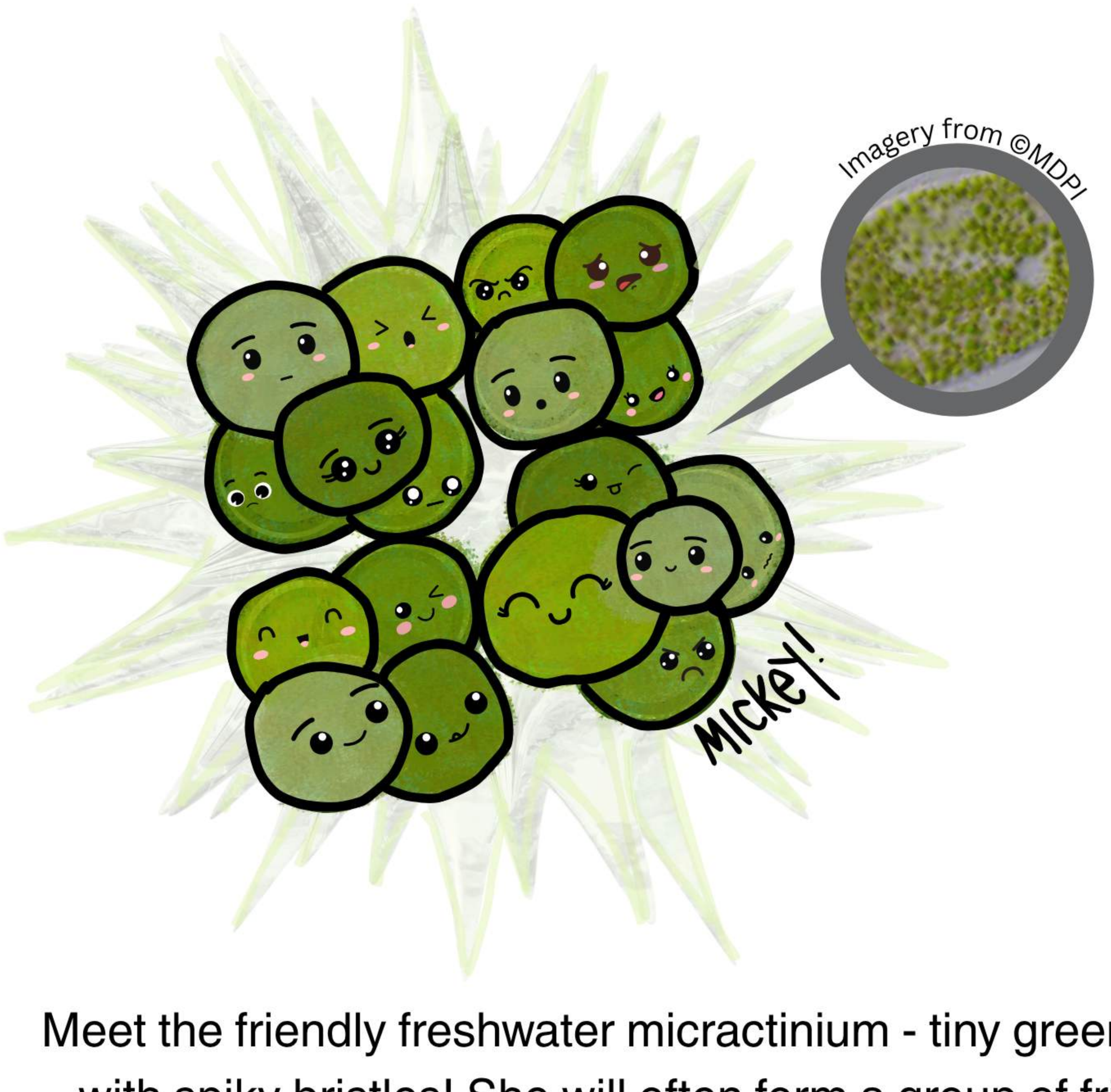


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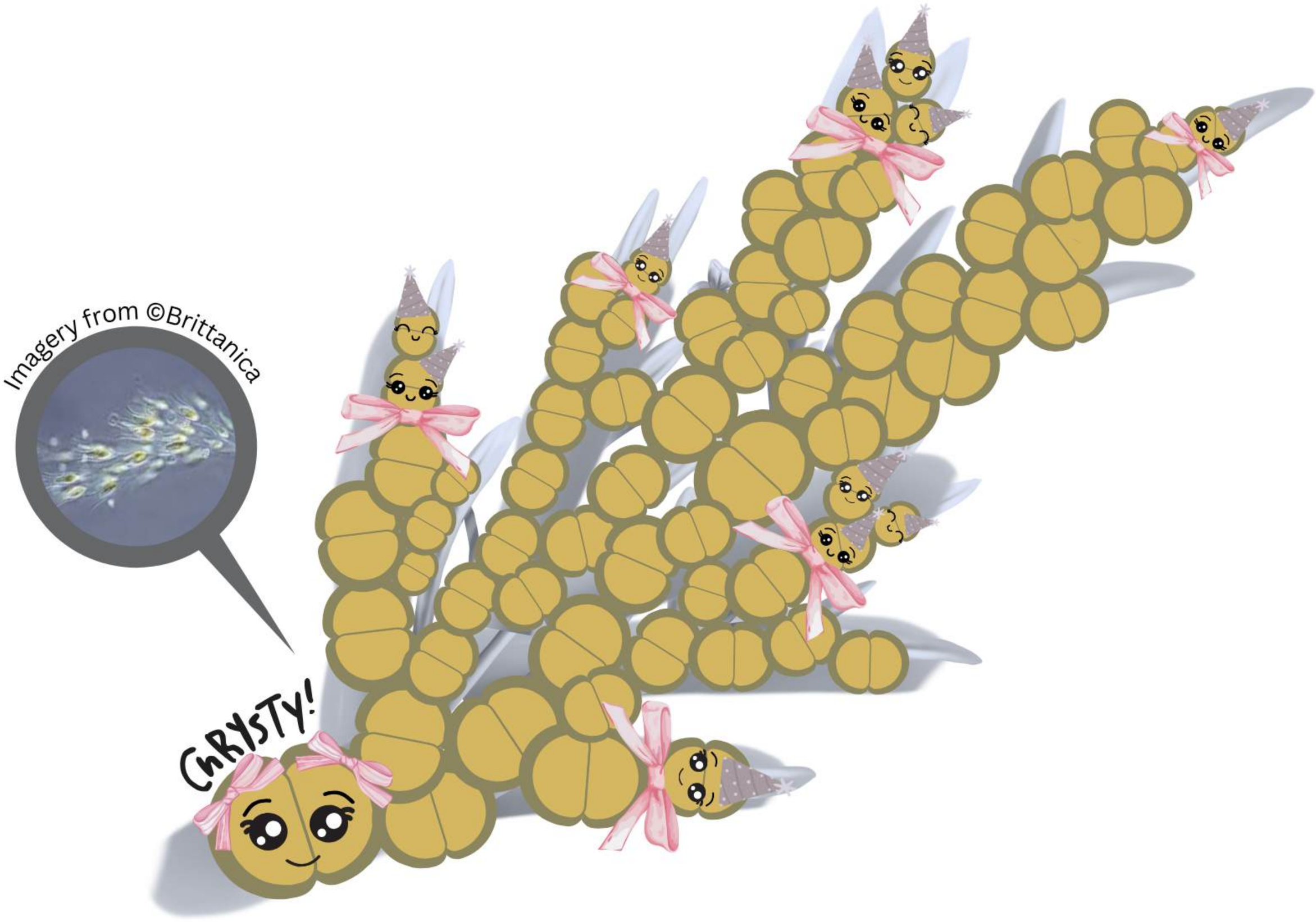


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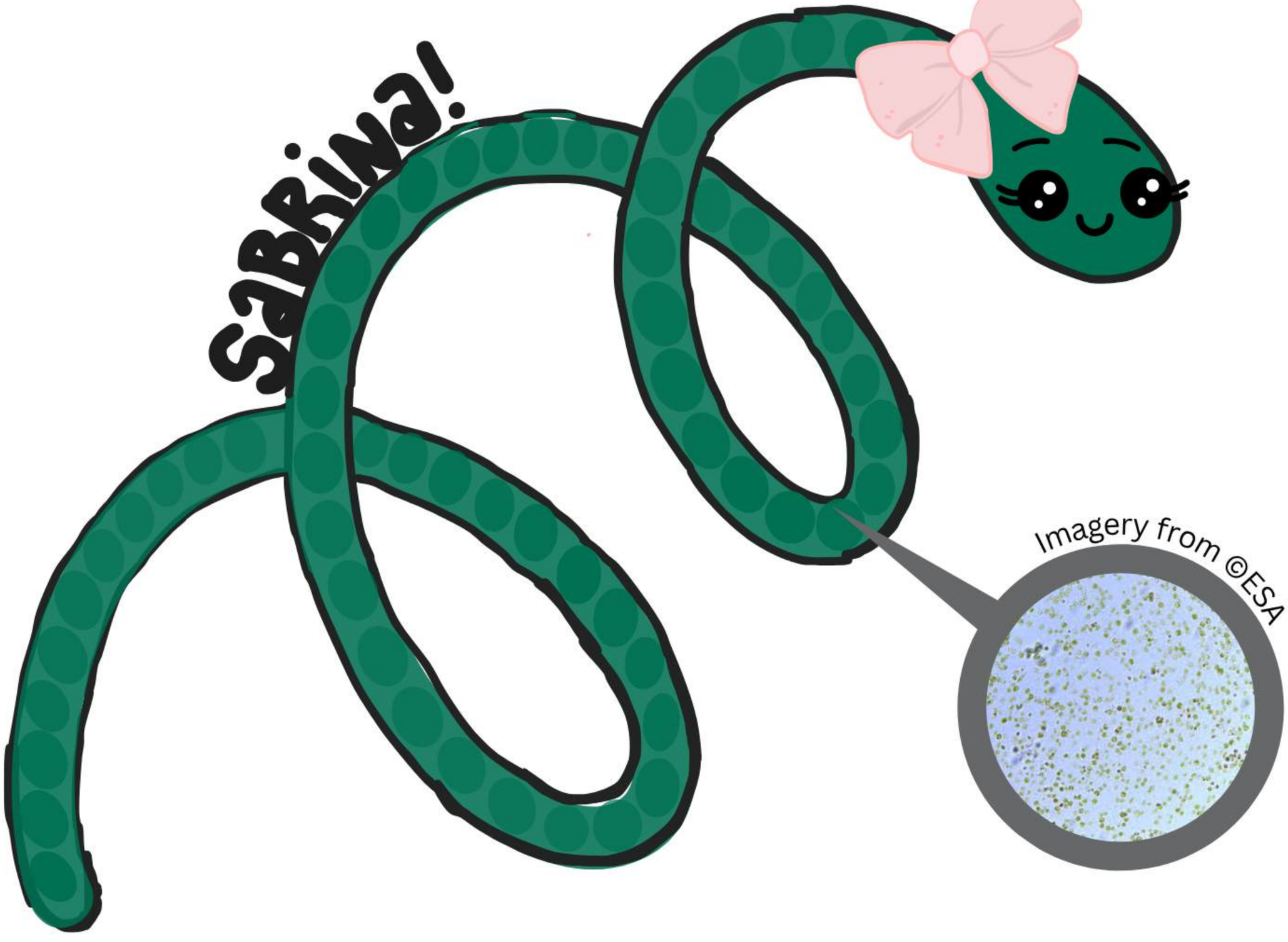


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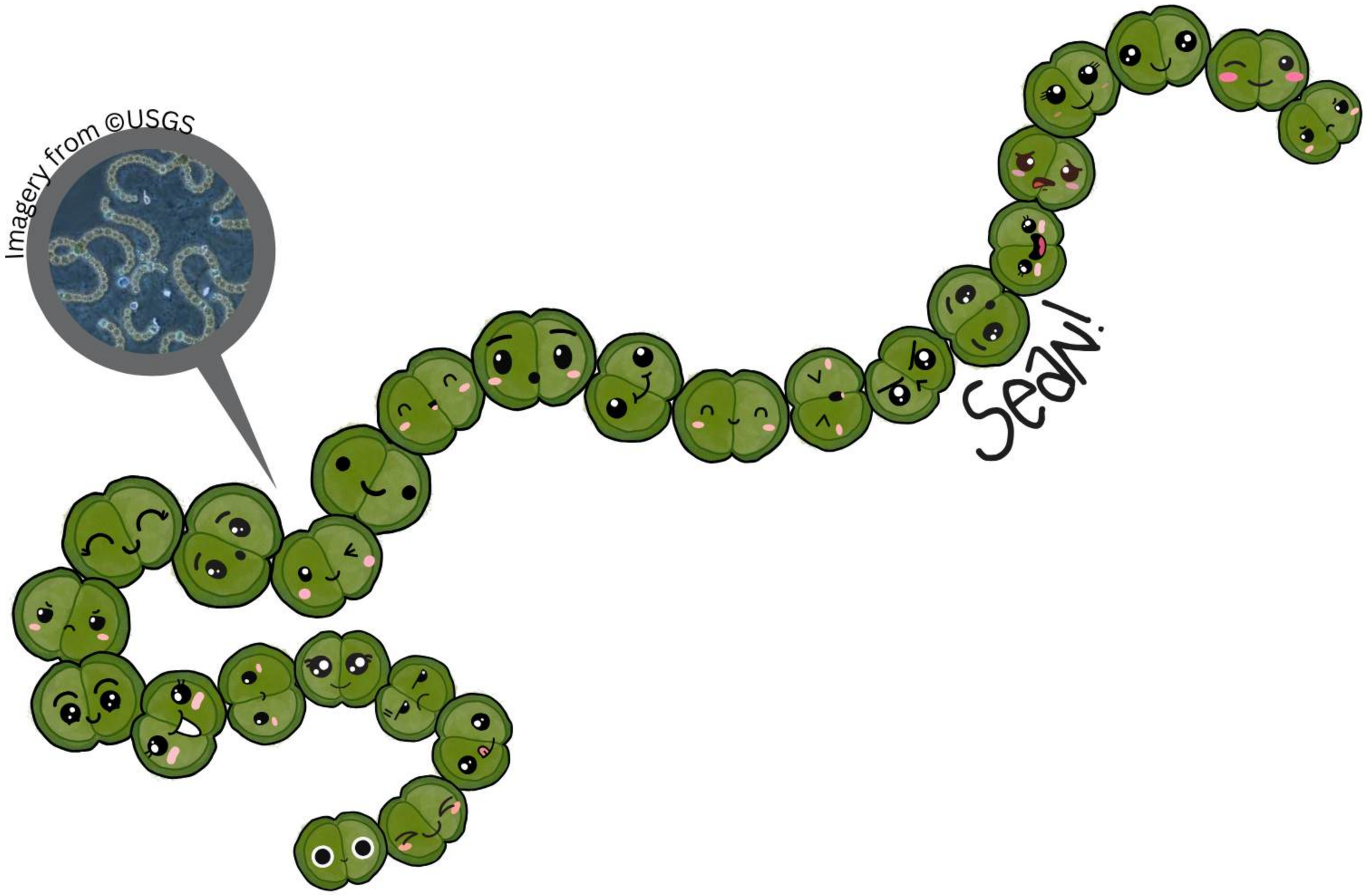


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# Find the Plankton-Friends!

Let's explore the phenomenal plankton that allow for Earth's oceans to thrive. The ocean life that we can see only comprises 2% of its total biomass- that means that 98% of our oceans are invisible to our eyes! Phytoplankton are microscopic algae that support aquatic ecosystems through photosynthesis. Our oceans also need phytoplankton because as the base of many aquatic food webs, they provide food for fish and many other sea creatures! Scientists can see phytoplankton from space using satellites- one satellite in particular named PACE (Plankton, Aerosol, Clouds, and ocean Ecosystem) uses ocean color to locate these little guys.

As you journey through the library, look out for the colorful plankton-friends. Each friend has a fun fact, use them to fill out the worksheet and turn it in for a fabulous phyto-prize- good luck!

**1. The PACE Satellite:** How many colors can she see?

**2. Coco the Coccolithophore:** What is Coco's secret superpower?

**3. Dino the Dinoflagellate:** What is dangerous about Dino?

**4. Frank & Ferdinand the Foraminifera:** How much larger than Coco are Frank & Ferdinand?

**5. Dianna the Diatom:** Where can you find Dianna in everyday life?

**6. Jamal the Jellyfish:** What is it called when Jamal produces light and glows?

**7. Mickey the Micractinium:** How many cells can be in one of Mickey's colony's?

**8. Chrysty the Chrysophyceae:** What is Chrysty's common nickname?

**9. Sabrina the Spirulina:** Where can Sabrina be found everyday?

**10. Sean the Cyanobacteria:** How old is Sean?

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**Over 100**

**2. Coco the Coccolithophore:** What is Coco's secret superpower?

**Their old scales can reflect enough sunlight to change the ocean's temperature**

**3. Dino the Dinoflagellate:** What is dangerous about Dino?

**Harmful algal blooms or Red Tide**

**4. Frank & Ferdinand the Foraminifera:** How much larger than Coco are Frank & Ferdinand?

**100 times larger**

**5. Dianna the Diatom:** Where can you find Dianna in everyday life?

**Paint, toothpaste**

**6. Jamal the Jellyfish:** What is it called when Jamal produces light and glows?

**Bioluminescence**

**7. Mickey the Micractinium:** How many cells can be in one of Mickey's colony's?

**128**

**8. Chrysty the Chrysophyceae:** What is Chrysty's common nickname?

**Golden algae**

**9. Sabrina the Spirulina:** Where can Sabrina be found everyday?

**Smoothies and supplements**

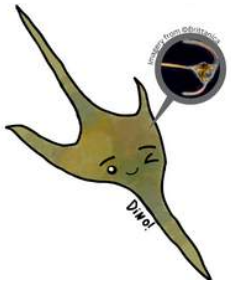
**10. Sean the Cyanobacteria:** How old is Sean?

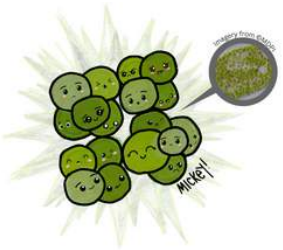
**3.5 million years old**

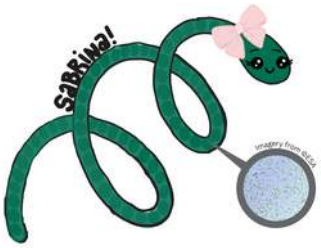
# NASA Ocean Science Scavenger Hunt

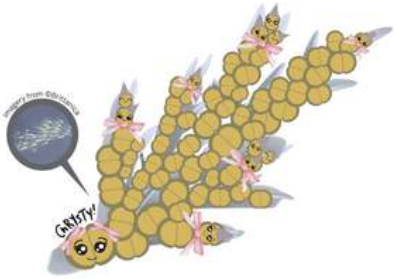
When you find each phyto-friend, draw the matching shape seen on the top corner of the scavenger hunt card.

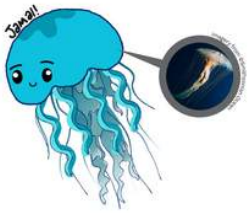




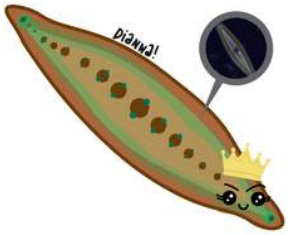



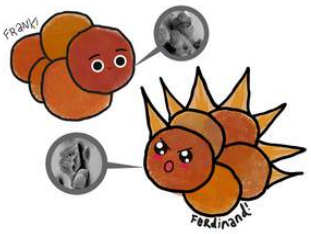







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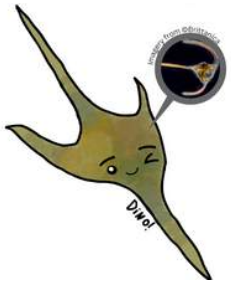
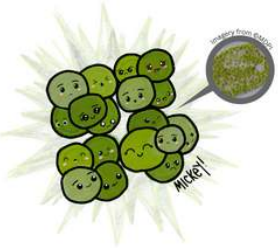
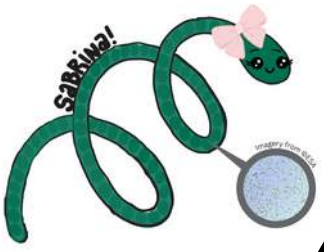
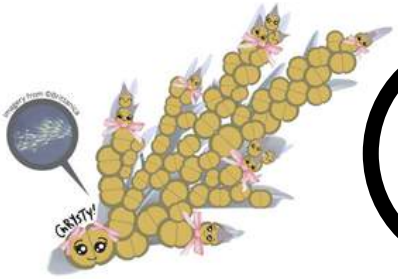
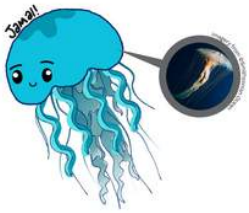
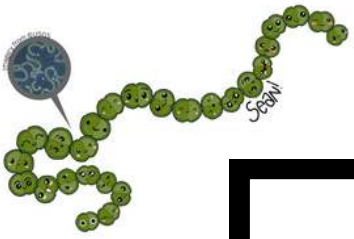


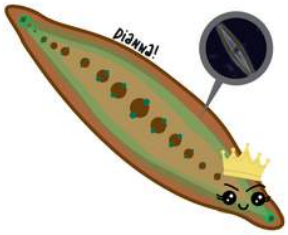



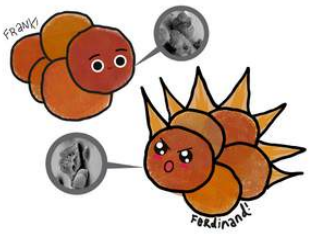



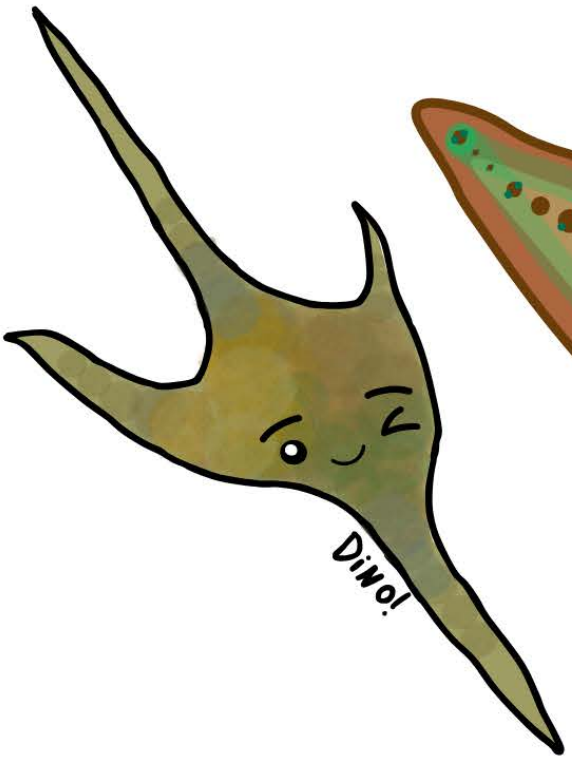



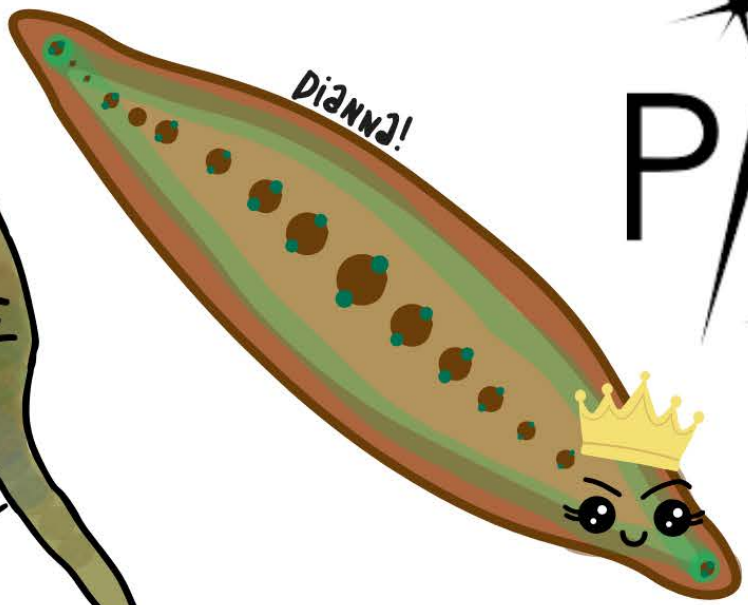



# Pose with your new phyto-friends!

Scan the QR code below and view Dino, Dianna, and the PACE satellite in augmented reality!

Scan the QR code embedded on the website to take pictures with Dino, Dianna, and the PACE satellite!




PACE

THANK YOU for participating in this outreach event. To ensure ease and fluidity, there are a few provided talking points based on things attendees may ask. These answers can be modified if asked by parents or young readers.

*What is this?*

This is a NASA ocean science scavenger hunt to help kids learn about phytoplankton! There are 10 stops around the library with different images of phytoplankton friends and an accompanying worksheet to fill out as you go.

This scavenger hunt will help young readers learn about NASA's ocean science satellite PACE and the different types of phytoplankton it can detect.

*What are phytoplankton?*

Phytoplankton are microscopic aquatic organisms that photosynthesize like plants on land do. They live in the upper sunlit layer of almost all water bodies on Earth. Powered by the sun's energy, they come in many shapes and sizes, and some species are 1/10th the size of a human hair. They serve as the base of the marine food web, and produce oxygen vital to life. Studying this incredibly diverse group is key to understanding the health - and future - of our ocean and life on earth.

Source: https://pace.oceansciences.org/phytopia.htm#!

*What is PACE?*

PACE is the Plankton Aerosol Cloud ocean Ecosystem satellite launched by NASA in 2024. It is able to see different kinds of phytoplankton across the global oceans. PACE is advancing the knowledge of ocean health by measuring phytoplankton and continuing records of key atmospheric variables related to Earth's climate and health as well as water quality. PACE is able to differentiate between different species of phytoplankton and allows for an unprecedented understanding of phytoplankton community composition across the globe. PACE studies aerosols and clouds together, and measurements from PACE will help to clarify the connections between aerosols, clouds, and climate.

https://pace.oceansciences.org/about.htm

*How can PACE see different phytoplankton?*

PACE has an instrument onboard called the Ocean Color Instrument, or OCI. This instrument is hyperspectral, meaning it can see around 100 bands of light across the span of the electromagnetic spectrum, where human eyes can only see the visible light portion of the spectrum. Phytoplankton contain a pigment called chlorophyll, which interacts with sunlight in

different ways. This pigment then reflects light back to the sensor onboard PACE, and the satellite is able to detect these wavelengths and distinguish their differences.

*There is more detailed information in the supplemental packed for librarians here Supplemental Library Document.pdf*

# NASA Ocean Biology and Biogeochemistry Resources for Library Ocean Science Programming

August 2025, First Edition

This guide provides ready to use library program plans that explore NASA's work with ocean color, satellite remote sensing, and phytoplankton detection.

NASA's Ocean Biology and Biogeochemistry (OBB) program is an essential piece of NASA's support in paving the way to supporting and inspiring the next generation. The ocean is our next frontier and OBB is an essential piece of this enterprise, providing critical insights for understanding how the ocean works, from ecosystem function to economic links and resilience to future change, and provides foundational knowledge towards space exploration and inspiration for all generations.

Acknowledgements
This resource was developed by the NASA Headquarters OBB team and Goddard Space Flight Center Ocean Ecology Lab.

Table of Contents

## A Note From the Authors

This programming guide was prepared as an initial incorporation of ocean sciences into libraries for youth programming. This document was created for libraries in the Prince George County area, and after an initial test run the document will be edited to fit other regions as well as contain expanded content with other activities related to marine remote sensing and polar region marine science.

This first edition serves as an introduction to NASA OBB science, phytoplankton, and some remote sensing. Implementation of these activities and programming should provide a basic understanding of phytoplankton and NASA's involvement and these concepts will be expanded upon in further programming.

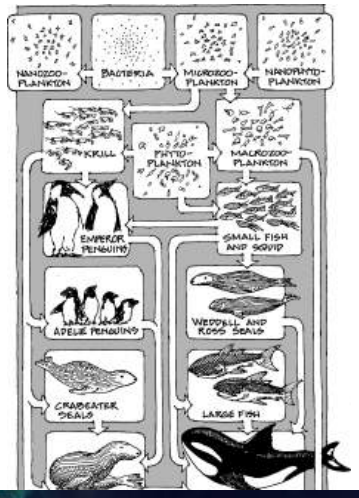
This guide should provide not only a basic understanding for youth library patrons, but for librarians to be able to answer questions children or adults may have in regards to phytoplankton and their importance on our planet. We'd love to hear from you on what works and which elements may need retooling.

# Phytoplankton Lesson

*Background*

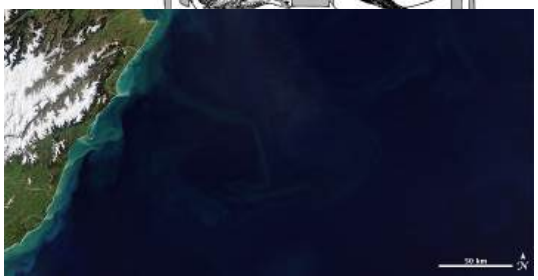
Phytoplankton are microscopic primary producers that live in water. They make their own food through photosynthesis, much like plants on land do. Through this exchange, carbon dioxide is taken up by phytoplankton and oxygen is released as a by-product. Phytoplankton absorb carbon dioxide on a scale comparable to land plants.


Phytoplankton form the base of the aquatic food chain, and zooplankton feed on phytoplankton. Zooplankton are eaten by larger marine organisms like fish. Phytoplankton are crucial to the marine ecosystem because without them, food for all other marine organisms would disappear. Phytoplankton exist not only in ocean water, but in fresh water as well.




Phytoplankton are unicellular, meaning they are made of just one single cell, and they can't move on their own. They drift with the currents.

Phytoplankton are not only essential for the marine ecosystem, but they play crucial roles in global climate and global surface temperatures. Phytoplankton absorb carbon dioxide from the atmosphere during photosynthesis and when they die, they take it with them as they sink to the bottom of the ocean. The carbon they absorb is taken to other layers of the ocean when phytoplankton are eaten by other organisms and waste is secreted and they die. This carbon can sink and stay at the bottom of the ocean for centuries up to millenia. This phenomenon is called the ocean's biological carbon pump. Changes in growth of phytoplankton can change the amount of carbon sequestered, in turn affecting surface temperatures.



Phytoplankton  populations can grow explosively when certain nutrients are present along with sunlight and warm water temperatures. We call this rapid reproduction 'blooms'. Phytoplankton blooms often coincide with spring, much like land plants blooming in spring, due to the warm temperatures and perfect conditions. In these ocean color images to the right, the

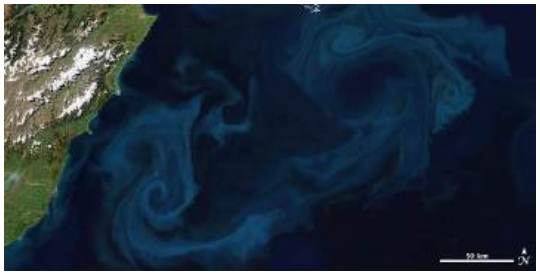


image on top shows the ocean before a massive phytoplankton bloom. There are phytoplankton along the coast line seen in green swirls, and the bottom image shows blue swirls of phytoplankton blooming across the open ocean. These images show the difference from October 11 and October 25, 2009 off the east coast of New Zealand and demonstrate how phytoplankton can explode in numbers over a short period of time (NASA images by Robery Simmon and Jesse Allem based on MODIS-Aqua data).

Phytoplankton are extremely useful to the global and marine ecosystems, but not all species of phytoplankton are good. Phytoplankton can be harmful when they rapidly bloom, and this is known as a harmful algal bloom (HAB). Dinoflagellates are a group that can be harmful under certain circumstances and create unsafe waters for marine organisms and beach goers alike. The water can be unsafe to swim in, and sometimes the toxins produced by these phytoplankton can even create respiratory illnesses in people living in coastal and lake communities. This phenomenon is sometimes called Red Tide, especially in Florida and the Gulf region.

*How do we know so much about microscopic organisms we can't even see with our own eyes?*

Remote sensing is an extremely effective tool to keep track of these guys and the waters they inhabit. NASA uses remote sensing tools like satellites, planes, and drones to better understand the ocean from a distance. Using satellites, we can see phytoplankton all the way from space and can get a better understanding of the scale of the ocean they inhabit. While individual phytoplankton cells cannot be seen from space, they are widely abundant in the water and change the color of the water in both big and little ways. But how can we see these guys all the way from space? Special sensors developed by NASA measure something called spectral reflectance, and the sensors can see different wavelengths of light at such a precise scale that we can identify individual species from over 400 miles away. Spectral reflectance shows us what color phytoplankton are, and they create color based on pigments they absorb and reflect. Different species of phytoplankton have different spectral reflectances, just like when you look in the mirror you see something unique and special!

The PACE (Plankton, Aerosol, Cloud, ocean Ecosystem) satellite is the newest satellite in the NASA observatory fleet measuring ocean color. Previous NASA satellites measuring the color of the ocean were not able to detect as many colors in the ocean as PACE can. If you think of satellites' ability to see color as boxes of crayons, previous satellites were working with approximately 12 crayons in the box, while PACE has a box with over 100 crayons. A crayon box of 12 can provide lots of amazing data, but a box of over 100 provides an unprecedented look into our oceans. The same goes for PACE- because it can see more colors than ever before, it is able to detect more varieties of phytoplankton.

Read more here! https://earthobservatory.nasa.gov/features/Phytoplankton

Scavenger Hunt

Materials Needed:
“Find the Plankton Friends” worksheets (see provided)
Plankton Friends print outs (see provided)
“Finding our phyto-friends” pamphlet (see provided)
Writing utensils
Phytoplankton related prize (see below)

In this activity, young library patrons (roughly ages 5-8) will go on a scavenger hunt around the library to find different phytoplankton friends. Provide hunters with the “Find the Plankton-Friends” worksheet as well as a “Finding our phyto-friends” pamphlet. The pamphlet has images of each phyto-friend they will be hunting for and will be a useful reference as they complete the scavenger hunt.

Give the hunters a writing utensil (blue and green colored pencils recommended, but any work!) and let them know what area of the library the scavenger hunt has been set up in. Librarians should be able to assist with questions based on the previous additional information provided in this document. The scavenger hunt can take place throughout the entirety of the library or in youth sections depending on librarians preference. Library patrons will go through the library finding all the different phytoplankton, and will report back to where they started and return their pencils and completed worksheet for a phytoplankton related prize.

Stops along the scavenger hunt:

1. Station to get worksheet and pencil
2. Phytoplankton stops (phyto-friends do not need to be found in any particular order, but the name on the poster coincided with the question hunters need to answer)
    a. The PACE Satellite
    b. Coco the Coccolithophore
    c. Dino the Dinoflagellate
    d. Frank and Ferdinand the Foraminifera
    e. Dianna the Diatom
    f. Jamal the Jellyfish
    g. Mickey the Micractinium
    h. Chrysty the Chrysophyceae
    i. Sabrina the Spirulina
    j. Sean the Cyanobacteria
3. Once all phytoplankton are found, return to the station at stop one and exchange your worksheet and pencil for a phytoplankton prize!

## How You Can Help

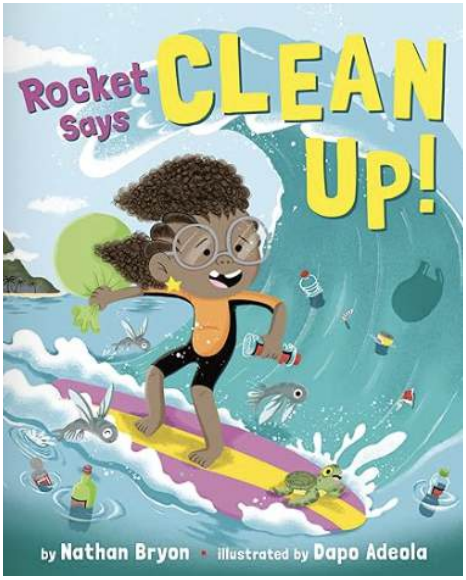
Now that we have made a whole new group of phyto-friends, kids may be inspired to lend a helping hand!

We can encourage young scientists to help their phytofriends by

- Picking up trash next time they are at the beach
- Conserving water. Turn off the faucet when you are brushing your teeth, or take shorter showers.
- Reduce waste. Opt out of a straw next time you are at a restaurant, or use a reusable cloth instead of a paper towel.
- Reduce vehicle pollution. Walk instead of driving if you are able. Take the bus or train if possible.
- Use less energy. Turn off lights when you leave the room.
- Keep learning! Learn more about lakes, our ocean and their importance.

## Additional Reading

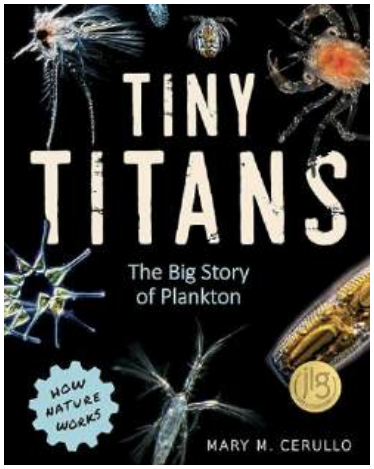
Rocket Says Clean Up! By Nathan Byron and Dapo Adeola




ISBN-10 : 0593118995
ISBN-13 : 978-0593118993

Rocket is off to the islands to visit her grandparents. Her family loves nothing better than to beach comb and surf together...but the beach is clogged with trash! When she finds a turtle tangled in a net, Rocket decides that something must be done! Like a mini Greta Thunberg, our young activist's enthusiasm brings everyone together...to clean up the beach and prevent plastics from spoiling nature. Perfect for fans of *Rocket Says Look Up!* and *Ada Twist, Scientist*, this book is for any youngster concerned about our environment. *Rocket Says Clean Up!* will inspire readers of all ages to dream big and tackle problems head-on.

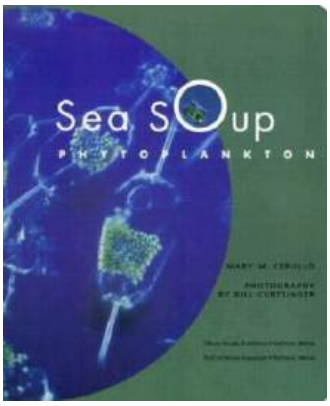
Tiny Titans: The Big Story of Plankton by Mary M. Cerullo




ISBN-10 : 1668944847
ISBN-13 : 978-1668944844

From zooplankton to phytoplankton, these small-scale superheroes are the foundation of the ocean's food chain, keep our climate in check, generate up to fifty percent of the oxygen produced on the planet each year—and much more. Stunning microscopic photos and primary source research provide a seldom seen look at these dynamic drifters. "Science interpreter," Mary Cerullo, dives into the wet world of plankton, and takes a deep look at the good and the bad, the tiny and even tinier. Readers will discover even the smallest actors can make a big difference. Glossary and informative sidebars included. Full-color photographs

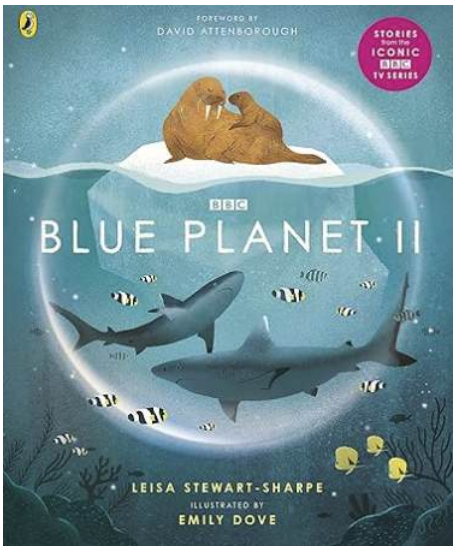
Sea Soup: Phytoplankton by Mary M. Cerullo and Bill Curtsinger




ISBN-10 : 0884482081
ISBN-13 : 978-0884482086

Appraisal In a mere teaspoon of sea water, more than 1 million phytoplankton can live! Some are deadly, some are helpful. But these tiny creatures come in thousands of variations and help make up the most basic life of the oceans. Color photography illustrates the diversity of these microscopic animals.

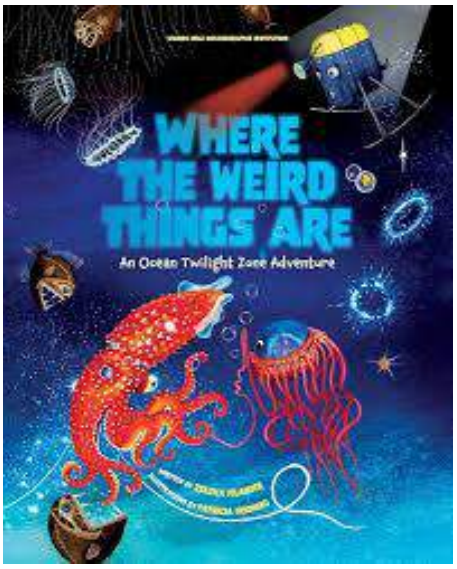
Blue Planet II by Leisa Stewart-Sharpe and Emily Dove




ISBN-10 : 1405946601
ISBN-13 : 978-1405946605

This is our Blue Planet: a beautiful blue marble suspended in a sea of stars. Unlike billions of other worlds in the Milky Way, 71 per cent of our Blue Planet is covered by the ocean. It's home to the greatest diversity of life on Earth but is our least explored habitat; we've better maps of Mars than of the ocean floor. With so much more to discover, take a deep breath . . . and dive into a wondrous world beneath the waves. Explore coral reefs that shimmer in a kaleidoscope of colors. Venture to the bottom of the ocean where creatures beyond your wildest imagination live in the dark. Chase sea otters through kelp forest seas, and glide the open ocean with humpback whales. Discover all there is to love about our Blue Planet , the stories of its inhabitants, and realise how you can help protect this wilderness beneath the waves. In collaboration with BBC Earth, this illustrated non-fiction book will capture the wonder, beauty, and emotion of the iconic BBC Blue Planet II TV series.

Where the Weird Things Are: An Ocean Twilight Zone Adventure by Zoleka Filander

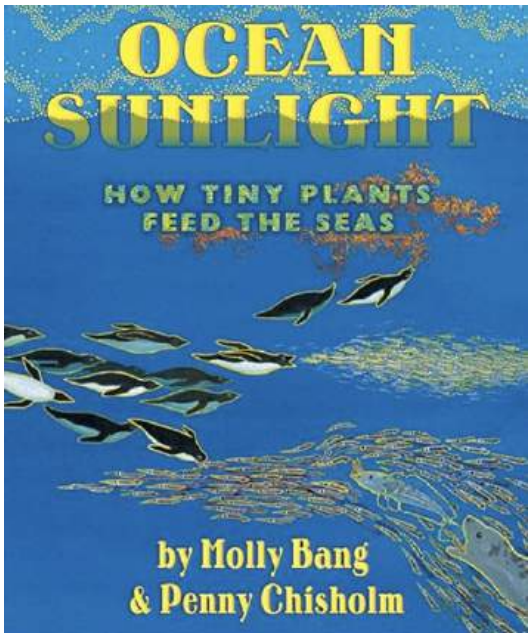



ISBN-10 : 1647225884

ISBN-13: 978-164722588

Meet Meso, an underwater explorer robot, as it’s launched into the mysterious ocean twilight zone. In the cold, dark waters, Meso will discover all sorts of unusual and wonderful creatures, and learn that we’re all weird in our own ways … and that’s a very good thing! *Where the Weird Things Are* is inspired by the Mesobot project, a collaborative effort of the Woods Hole Oceanographic Institution (WHOI), the Monterey Bay Aquarium Research Institute (MBARI), Stanford University, and the University of Texas Rio Grande Valley. Mesobot uses cameras and lights to noninvasively follow ocean animals that inhabit the ocean’s depths, enabling biologists to study their behavior over extended periods for the first time ever!

Ocean Sunlight: How Tiny Plants Feed the Seas by Molly Bang and Penny Chisholm




ISBN-10 : 9780545273220

ISBN-13: 978-0545273220

In this timely book, acclaimed Caldecott artist Molly Bang and award-winning M.I.T. professor Penny Chisholm uses poetic language and dazzling illustrations to introduce the oceanic world. From tiny aquatic plants to the biggest whale or fish, Bang and Chisholm present a moving, living picture of the miraculous balance sustaining each life cycle and food chain deep within our wondrous oceans. On land or in the deep blue sea, we are all connected--and we are all a part of a grand living landscape. Award-winning scientist Penny Chisholm, a leading expert on oceans, packs Ocean Sunlight with clear, simple science, illuminated by Molly Bang's wondrous illustrations. This informative, joyous book will help children understand and celebrate the astonishing role our oceans play in human life.

Still curious? Check out NASA's Curious Universe Podcast Earth Series: The Ocean, Now in Full Color. Available on Spotify or Apple podcasts or at the link below:
(https://www.nasa.gov/podcasts/curious-universe/earth-series-the-ocean/)

## Further Activities

If young library patrons want to explore further, recommend fun science activities in your area.

- The Smithsonian Natural History Museum, Ocean Hall
  - Free, no passes needed
  - Open 10 a.m. to 5:30 p.m. daily (Closed December 15th)
  - 10th St. & Constitution Ave., NW, Washington, DC
- The Smithsonian Air and Space Museum
  - Free, timed-entry passes required
  - Open 10 a.m. to 5:30 p.m. daily (Closed December 15th)
  - 650 Jefferson Dr., SW, Washington, DC
- The Earth Information Center at NASA Headquarters
  - Free, no passes needed
  - Open Monday - Friday 8:30am - 5:30pm

- Mary W. Jackson NASA Headquarters East Lobby 300 E St. SW (East Lobby) Washington, DC 20546

Take photos with your new phyto friends! Scan the QR code at the link below and pose with Dino, Dianna, and the PACE satellite!

- See accompanying flyer

https://oceancolor.gsfc.nasa.gov/community/outreach/pace-ar/dino.html

## Provide Feedback

We want to hear your thoughts! Let us know how this programming worked at your library by filling out the Google Form below or emailing us at bpoutra@ucar.edu or kelsey.bisson@nasa.gov.

https://forms.gle/Cvvq5FUQvCAM7JyD6

References

Lindsey, Rebecca, and Michon Scott. *What Are Phytopankton*, National Aeronautics and Space Administration, 13 July 2010, earthobservatory.nasa.gov/features/Phytoplankton.

National Oceanic and Atmospheric Administration. 2024. *What is a red tide?,* NOAA's National Ocean Service. https://oceanservice.noaa.gov/facts/redtide.html.

National Oceanic and Atmospheric Administration. 2024. *What are phytoplankton?*, NOAA's National Ocean Service. https://oceanservice.noaa.gov/facts/phyto.html.

J. Werdell, PACE Team, *Ocean Color*, NASA PACE - Ocean Color (2025), https://pace.oceansciences.org/learn_color.htm).