

# ARROW, THE LUCKY PLANARIAN



By Oné R. Pagán

Illustrated by Ethan Kocak

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*To my Vanessa*

*You will always be my little girl*

A message to parents. I am an educator by calling and training. I am also in awe of the natural world and would like to share this admiration with everyone. I wrote this short story with children in mind. Flatworms are fascinating animals, but since they display a few unusual characteristics, including their regeneration and lack of aging, I suggest you read this story with your child. I advise so in case weird questions come up (I am a father times 3, so I am pretty sure that these kinds of questions will come up!). I would be happy to answer any questions that you may have. My contact information is included in the 'About the author' section. Thank you for reading my words. I hope you and your precious child(ren) enjoy this story.

The story. This is the story of a very lovely and lucky flatworm, and about how it met two of its friends.



Some flatworms, like the one in this story, are called *planarians*, you know, because they are really flat.

There are many types of planarians. Some live on land, some live in the



ocean, and others live in freshwater. In this story, we

will talk about the kind of planarians that live in freshwater.

But before we talk more about planarians, let's talk about the time when a certain planarian made two human friends.

Tasmania is a heart-shaped island right below Australia. It is beautiful!



Hobart is a city in Tasmania. It's beautiful too.

According to a little girl from Hobart named Vanessa, the most beautiful part of city is a pond in a park, which happened to be near Vanessa's house.

Most of the time, Vanessa was only allowed to visit the pond when her mother or father could come too. They loved her and worried that she might fall in and turn into a fish, which would be eaten by a bird, which would be eaten by a kangaroo or a koala.

They said the kangaroo and the koala part to make Vanessa laugh.

And Vanessa did laugh, and would always say, "That's silly. Kangaroos and koalas only eat plants!"



But her parents still insisted the pond was dangerous for a little girl to visit alone. Mostly!

So, Vanessa always paid attention to what her parents said, for her safety.

Sometimes Vanessa was allowed to visit the pond by herself for a little while. She had to be careful, of course, because again, her parents didn't want her to fall in. That meant that when she explored, Vanessa kept her feet away from the water and just walked in the mud like a lapwing.

But, unlike a lapwing, her face was brown instead of bright yellow.

As most children do, Vanessa loved nature, and loved to enjoy the world in all its beauty. She also liked collecting little treasures, like beautiful pebbles, flowers, oddly shaped leaves, and even the occasional little bug.

One sunny summer morning, probably in mid-December, when the park was full of older kids playing soccer and younger kids playing Aussie T-ball (and dogs ran around playing "keep the stick from the human"), Vanessa got permission to visit the pond alone.

She skipped across her yard, through the fence, and down the path to the park, singing, "I am Vanessa, the lucky girl. I am the luckiest girl in the world."



And maybe that was true, because almost as soon as she reached the pond, she saw a tiny wiggly thing in the water. It looked like a worm that had been run over by a road roller, because it was flat. This worm had a triangular head and crossed, googly eyes.

Vanessa liked the worm as soon as she laid eyes on it. How could Vanessa not like it? This wormy was c-u-t-e!



Vanessa very carefully kept one foot on dry ground so she wouldn't fall into the pond and scooped the flatworm out of the water.

She looked down at the worm, and the worm looked up at her. Its long shape and triangular head reminded her of an arrow.



And indeed, Vanessa said, "You look like an arrow. I'll name you Arrow."

Vanessa had brought a cheese sandwich with her in case she got hungry. She pinched off a tiny piece of cheese with her thumbnail and put it next to Arrow, who was wiggling around in the water she cupped in her palm.



Somehow Arrow smelled the cheese in the water, and then it sprouted a tiny tube from the middle of its body. It chomped up the cheese with a mouth on the end of its tube.

Vanessa had never seen any animal eat in such a weird way.

So many questions!

What was this worm?

Where did it come from?

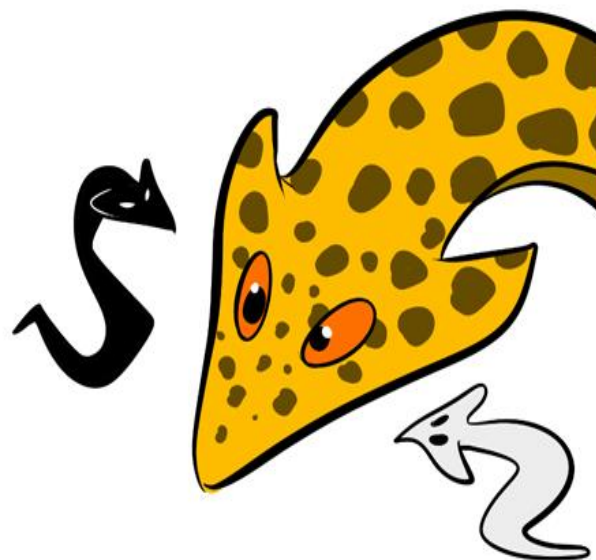
How old was it?

Just like Vanessa, you probably have many questions about planarians.

About planarians. Most

planarians are tiny, about as long as your fingernail. Some are dark colored, some are almost white, and others are even spotted or striped, just

like a leopard or a tiger. Their heads are usually shaped like a triangle, and their eyes are always crossed. Nobody knows why.



There are many classes of planarians, with heads and eyes of different shapes.

Some even have many eyes!



Planarians eat funnily. When they are hungry, they sprout a tube from the middle of their bodies, where our belly buttons would be. Some scientists call this tube its pharynx.



The end of this tube is the planarian's mouth.



Even though most planarians are tiny, all planarians are hunters. They would eat smaller critters, and when very, very hungry, they would also happily eat fellow planarians!



Although they are all hunters, planarians are also very shy. They like hiding under rocks or plants, usually in very dark places. They don't like bright light. It scares them.

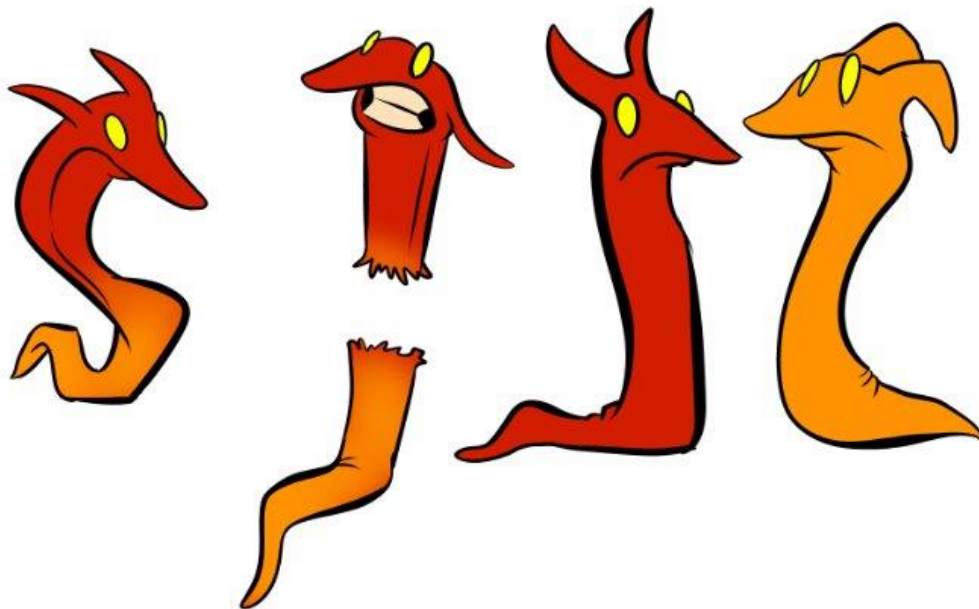


Planarians move in a funny way too. They can inch their way around just like any proper worm, or glide on the bottom of a pond, or at the bottom of a plastic dish. They glide by using tiny hairs on the underside of their bodies.



Many species of planarians have a strange yet very cool ability: they can *regenerate*. This means that if a planarian loses the tip of its

tail, it can grow it back, it is a little bit (but not quite!) as when your hair grows after a haircut.



Strangely, this does not seem to hurt the worm. Each piece continues moving as if nothing had happened. We do not even think that they feel pain at all.

As astonishing as this is, it gets better. The tail tip can regrow a new body!

If someone cuts a planarian in half, the worm will not be harmed, and in time, there will be two worms. If someone cuts a planarian in four, in time you will have four worms. And actually, you can cut some planarians in a hundred pieces or more, and (you guessed it) you will eventually have about one hundred tiny planarians. Not a lot of animals have this ability!

Please don't  
try cutting a  
worm by  
yourself!



Strangely, most planarians do not seem to age, ever.

Nobody knows why they do not get old.



Also, nobody knows exactly how long they live.

Because of the planarians ability to regenerate, and the fact that they do not seem to age, we can imagine a story that could well have happened in real life...

Back to the story. As she observed Arrow, Vanessa kept thinking about the worm. Where did it come from? How old was it?

With a sigh and a smile, Vanessa released Arrow into the water. "You're the luckiest worm I ever met because I'm going to bring you more cheese tomorrow."

But Vanessa didn't know that Arrow was already the luckiest flatworm in the world.

And here's why. She did not know, she could not have known, but it just so happens that Arrow was rather old and had a fascinating life story.

Arrow came from a small piece of a worm that was left when a small fish fed on it. Before that, the whole worm that the fish mostly ate came from a half worm that was left when a small rock carried by the water current split it in half.

Even before that, the whole worm that was split in half came from the head of a worm that was mostly eaten by a freshwater shrimp...



And so, the story of Arrow went on into the past, to a time when a young man, who loved nature as much as

Vanessa did and never lost the curiosity of a child, happened to walk by the same pond in Hobart that Vanessa walked by some two hundred years later.

The young man's name was Charles Robert Darwin, and he was from England.

When Charles was 22 years old, he got on a ship called the *Beagle* and traveled the world, collecting treasures from nature, plants, animals, rocks (oh, he *loved* rocks!), pretty much like Vanessa did. As he traveled, he took notes of EVERYTHING he observed.

After five years, Charles got back home and thought (a lot) about his travels and what he collected then.



Because of all that thinking, Charles came up with one of the best explanations about why there are so many kinds of living things on our planet.



But before going back to England, and way before he began trying to make sense of the world he observed, Charles met Arrow. The original Arrow, that is.

Charles saw the Arrow that hatched from an egg.  
Arrow was born just a couple of months before  
Charles got to Hobart, on February 5, 1836, near the  
end of Tasmania's summer.



Arrow did not know, it could not have known  
(because his brain was really tiny) that he was the  
only living thing on Earth that would meet both  
Vanessa and Charles, separated by all those years.

And it is quite possible  
that in the future,  
perhaps in two  
hundred more years, a  
little boy, a young  
woman, a young man



like Charles, or even another little girl like Vanessa,  
would get to meet Arrow and inspire in them the  
same love for nature and its wonders.

Perhaps they might even bring some cheese for Arrow  
to eat. A very lucky worm indeed.

**THE END**

About the story. This story is an adaptation of the epilogue of my book *The First Brain: The Neuroscience of Planarians* (2014), Oxford University Press.

Acknowledgments. To my Vanessa, who let me name the human protagonist of this story after her, and to my friends, Kate Shaw, author and host of the Strange Animals Podcast (@strangebeasties), and Melissa McCue-McGrath, host of the BewilderBeasts Podcast (@BewilderedPod), for their feedback and invaluable ideas to improve this story. And of course, I'd like to thank the one and Only Ethan Kocak for his art.

About the author. Dr. Oné R. Pagán

is a husband, a father of three,  
and a baldie, who also happens to  
be a pretty good (he hopes)

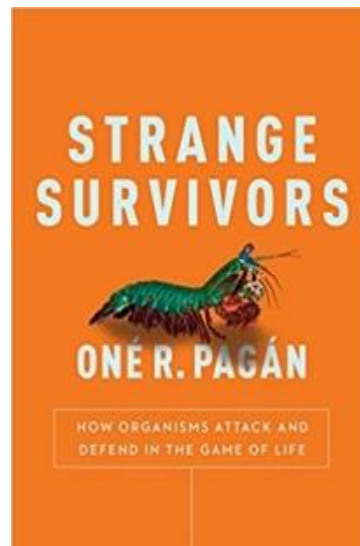
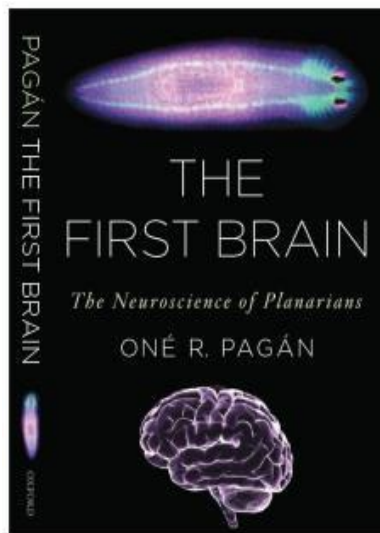


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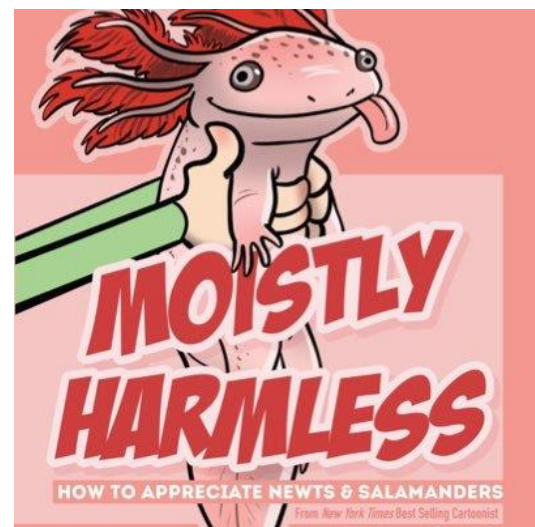
*The First Brain: The Neuroscience of Planarians*, First  
Edition. Oxford University Press (2014). Second  
Edition coming up in 2023.

*Strange Survivors: How Organisms Attack and Defend  
in the Game of Life*. BenBella Books (2018).

*Drunk Flies and Stoned Dolphins: A Trip Through the  
World of Animal Intoxication*. BenBella Books (2021).



About the illustrator. Mr. Ethan Kocak is a talented illustrator and salamander enthusiast who lives in upstate New York. He illustrated the New York Times



Best seller *Does it Fart?* and its sequels, *True or Poo?*, and *Believe It or Snot*, all authored by Nick Caruso and Dani Rabaiotti. His website is [ethankocak.com](http://ethankocak.com), and he can be contacted at Twitter

@Blackmudpuppy. He created the avatar of Dr. Pagán (above).

*A few cool planarian pictures.*



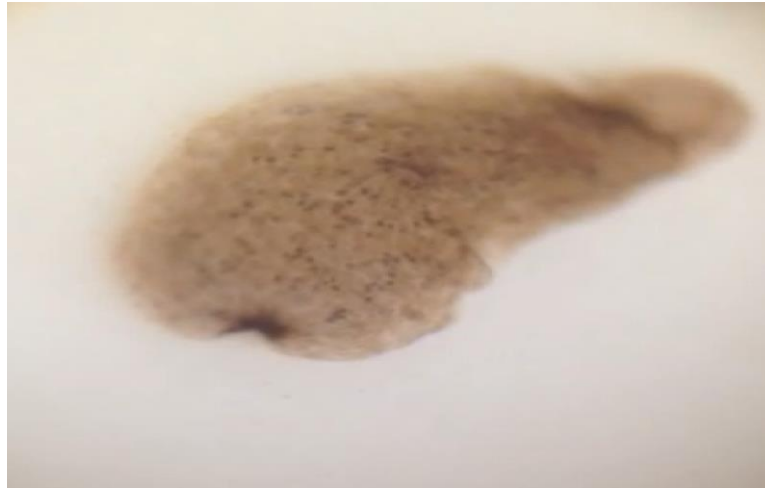
*Figure 1.* A planarian twisting around, showing that it is indeed a flatworm. The line below is about a cm long (Pagán Lab).





*Figure 2.* A few planarian heads. They are absolutely alive and happy. Eventually they will regrow new bodies (Pagán Lab).

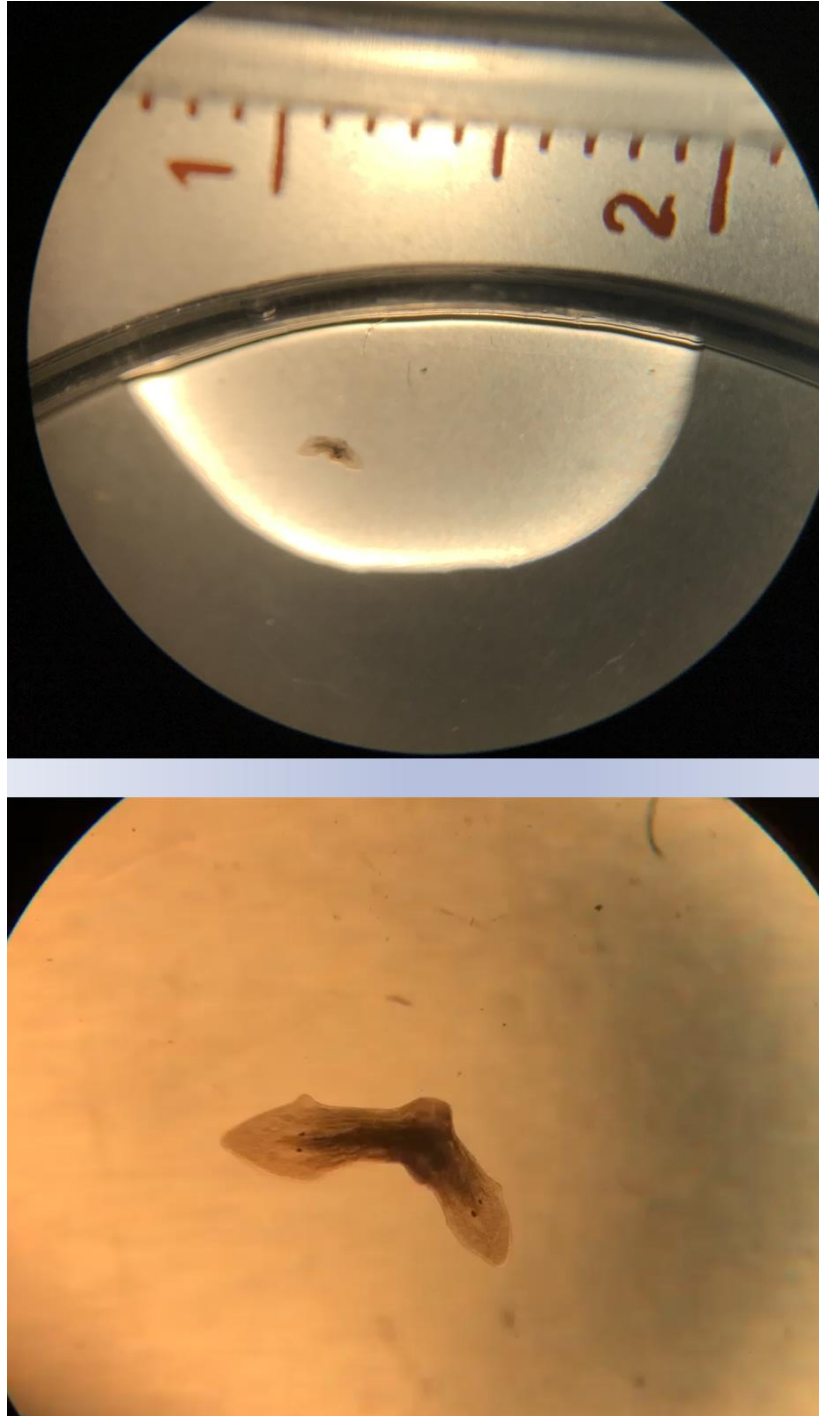




*Figure 3.* A headless planarian. Yes, it is absolutely alive and happy. Eventually it will grow a new head (Pagán Lab).



*Figure 4.* A two-headed planarian (Pagán Lab).



*Figure 5.* Another two-headed planarian. This one is tiny, ~ 1 mm long (about the width of a fingernail- see the top picture; Pagán Lab).



*Figure 6.* A three-eyed planarian. Pagán Lab.

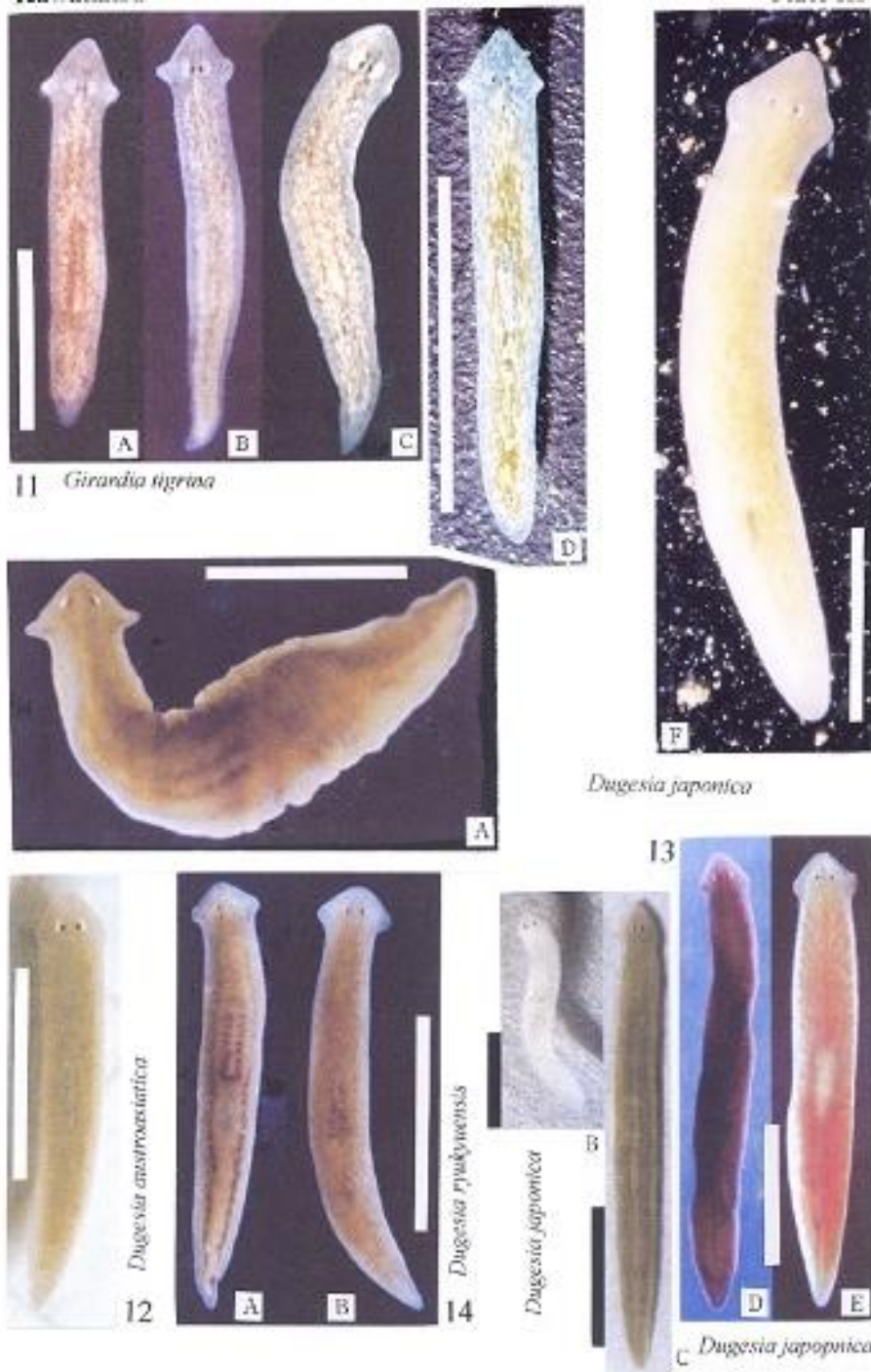


*Figure 7. A planarian silly joke. Pagán Lab.*

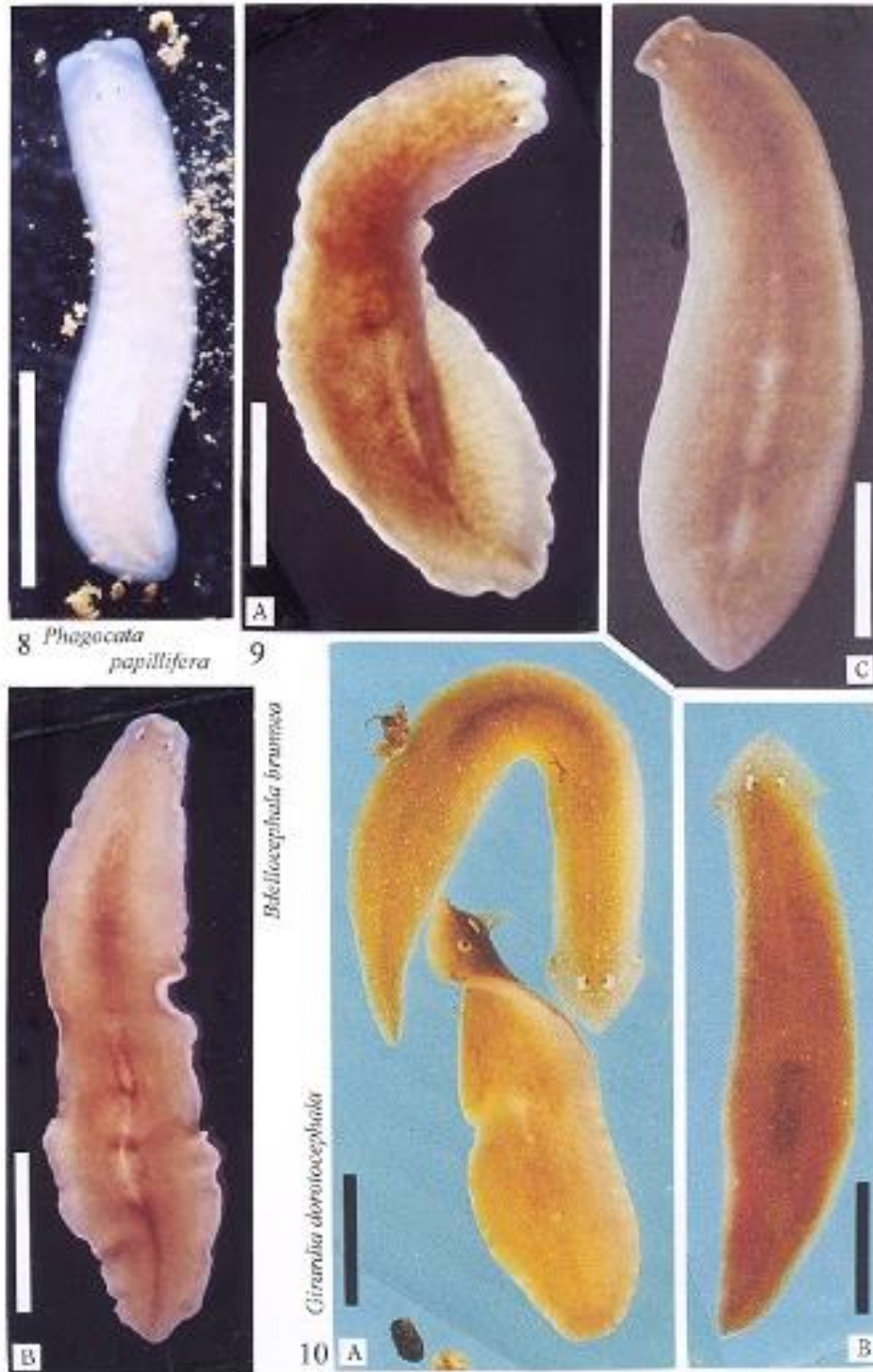


*Figure 8.* Just to give you an idea of the size of a freshwater planarian.

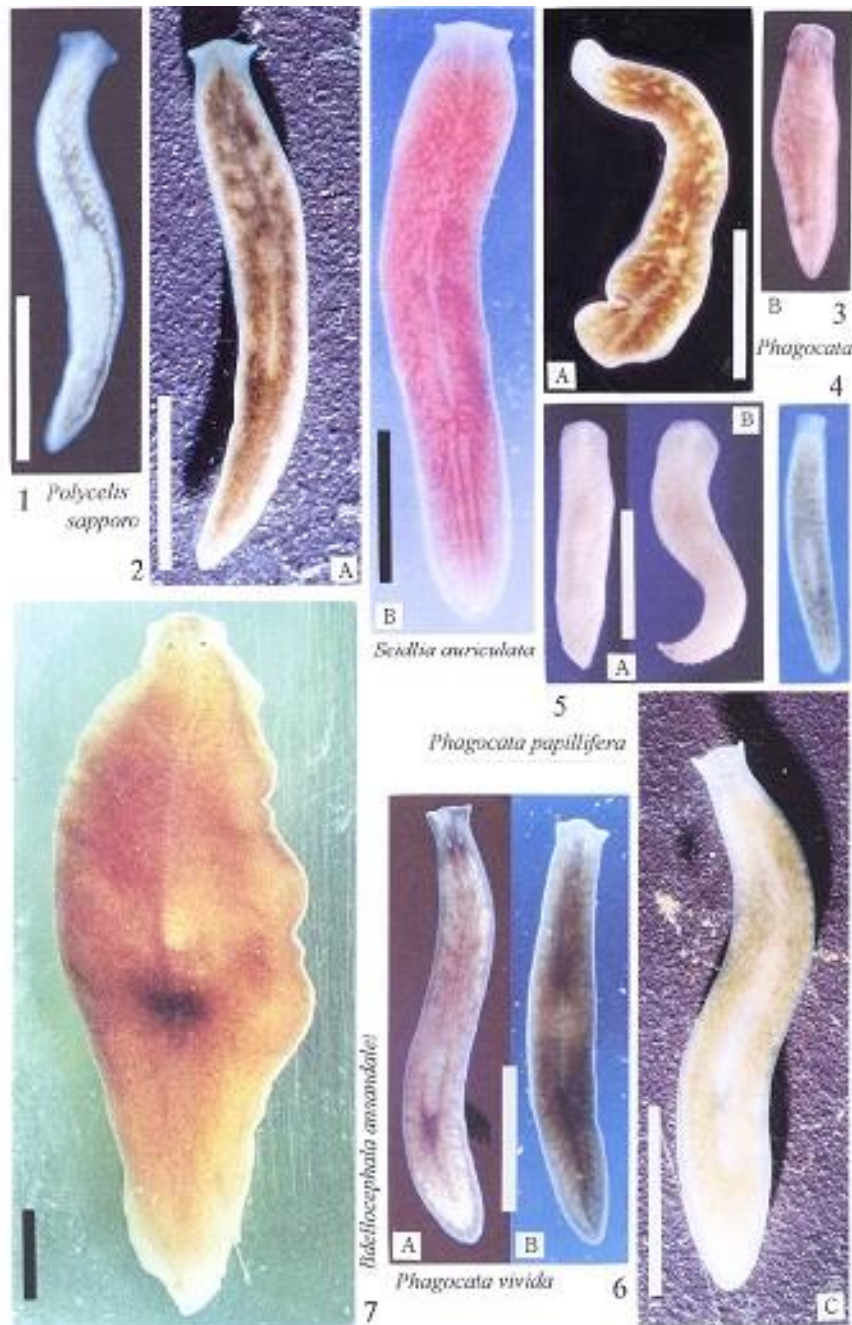




**Figure 9.** Some colorful planarians 1. The bars in each picture represent a length of 1 mm. Courtesy of Dr. Masaharu Kawakatsu.



**Figure 10.** Some colorful planarians 11, with some interesting head shapes. The bars represent a length of 1 mm. Courtesy of Dr. Masaharu Kawakatsu.



**Figure 11.** Some colorful planarians III, with even some more interesting head shapes. The bars represent a length of 1 mm. Courtesy of Dr. Masaharu Kawakatsu.





*Figure 12.* Some more silliness. The square is 1 cm long.  
Pagán Lab.

*Thank you!*