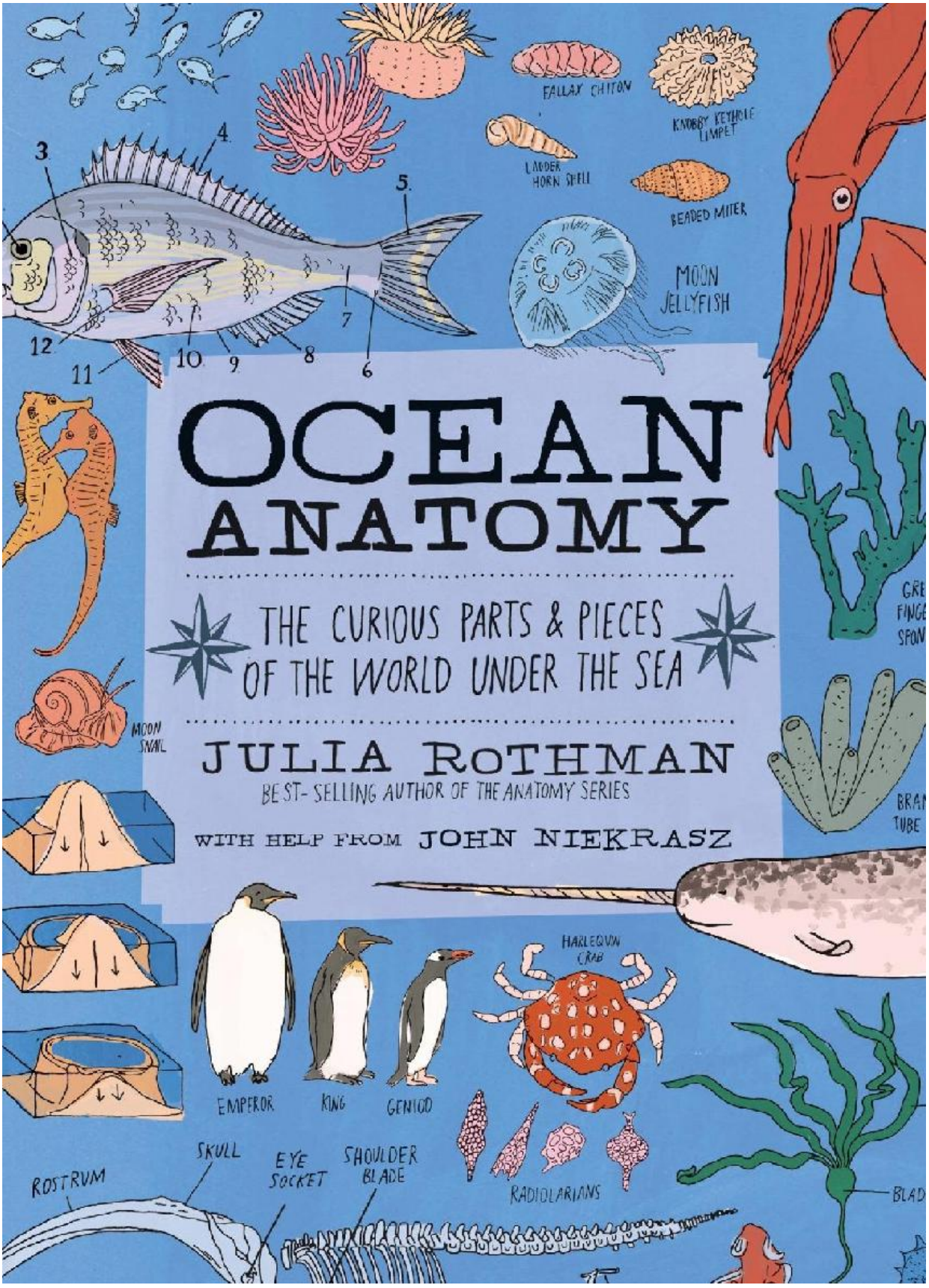

OCEAN ANATOMY

THE CURIOUS PARTS & PIECES OF THE WORLD UNDER THE SEA

JULIA ROTHMAN
BEST-SELLING AUTHOR OF THE ANATOMY SERIES

WITH HELP FROM JOHN NIEKRASZ

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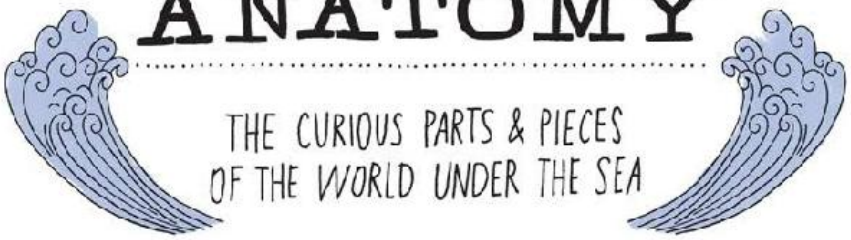

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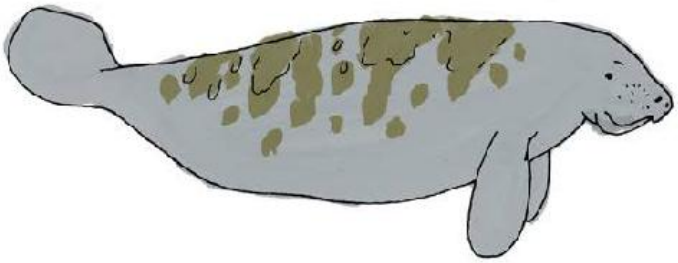
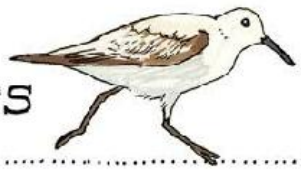
For my City Island friends,
especially Civi, Laur, and Niner
(who once adopted a manatee)





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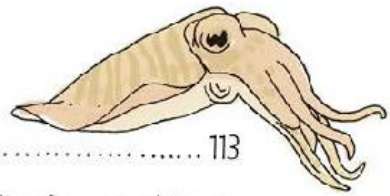
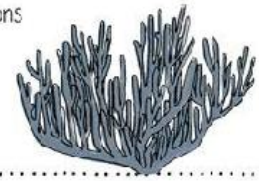
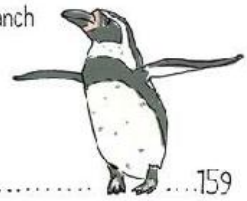
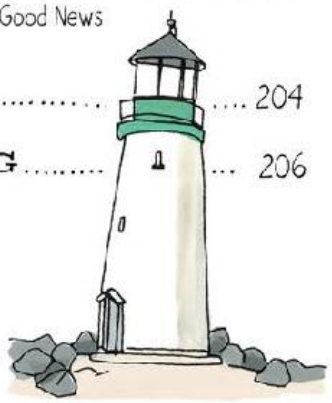








INTRODUCTION

t the end of the street where I grew up on City Island, there was a beach. As a kid, I would walk the shore when the tide was out, looking for hermit crabs, starfish, and whatever else washed up. When the tide was high, we would swim in the bay.

For bigger surf, we headed to Jones Beach on Long Island.

With each huge wave, my sister and I had three choices: jump over, duck under it, or try to ride it to shore. I can still feel the burning sensation of saltwater going up my nose.

My family has always treasured being near the water.

My parents still live in that house. Every summer evening they go down to the beach to join the "sunset club," where they chat with neighbors while the waves lap and the sun goes down.

Working on my books — Farm

On Instagram, posts showed kids

Anatomy, Nature Anatomy, and

learning from them, carrying them

Food Anatomy — has led me to

on nature walks, and copying

explore the world in a deeper way.

drawings from them.

But each book takes over a year

to create, and I couldn't imagine

I also received handwritten letters

doing another one. But then

from kids. Some drew me pictures,

readers changed my mind. I received

like vegetables growing or flowers

emails from people from around

in a rainbow of colors. They told

the world telling me how much they

me which book they liked best or

loved the books.

what they loved about nature or

drawing by Chloe

Julia Rothman

about their favorite food or animal.

I cherish these letters. Twelve-year-old Lydia from Maine wrote, “Since I was younger, I dreamed of becoming a marine biologist. I think growing up on the coast influenced this. I love your books and I would really enjoy one called Ocean Anatomy. I was wondering if you ever decided to make another book if you would consider the topic.”

I thought of my memories of my childhood beach. I thought about the first time I went snorkeling and never heard of — nudibranch, giant saw brightly colored fish. I also spider crabs, leafy sea dragons. And thought about climate change and spent nights worrying what what how it was affecting our beautiful

would happen to our beautiful oceans

oceans and the images I saw of

as the Great Pacific Garbage Patch

starving polar bears. But most of

grows and turtles confuse plastic

all, I thought of Lydia becoming a

bags for jellyfish and eat them.

marine biologist, and all the children who had written to me, and I decided I hope this book opens your eyes to

to do another book.

all the incredible sea life we don’t

even realize is there. I hope this book So here I am.

reminds you how much we need to

conserve all these fascinating plants I enlisted the help of the wonderful and creatures. I hope more children

John Niekrasz who worked with me

are inspired to get involved and

on Nature Anatomy to collaborate

learn how to protect and save our

with me again. He has done extensive

marvelous oceans.

research on all the plants and animals in the ocean and on the shores. We tried to include as much as we could.

Along the way, I learned about so

many jaw-dropping animals I had

Dear Julia Rothman,

I have written to express my love of
book, *Nature Anatomy: The Curious Parts and*
the Natural World. First of all, I love your
and how detailed and beautiful they look.
perfectly capture how wondrous nature
They are colorful and compliment each oth
Your book has inspired me. When I firs
it, it was in my school library, and son
else was holding it. They said, "Do yo
it?" and I accepted. I immediately love
in
alv
in
exp

P.
s

Dear, Julia Rothman

I love your book Food A

I love how you explain
how chocolate
how to eat with
and how to use
my favorite Cha
street food and
I also love the p

from Cole

your
Pieces of
paintings
They
can be.
er well.
t saw
neone
ur want

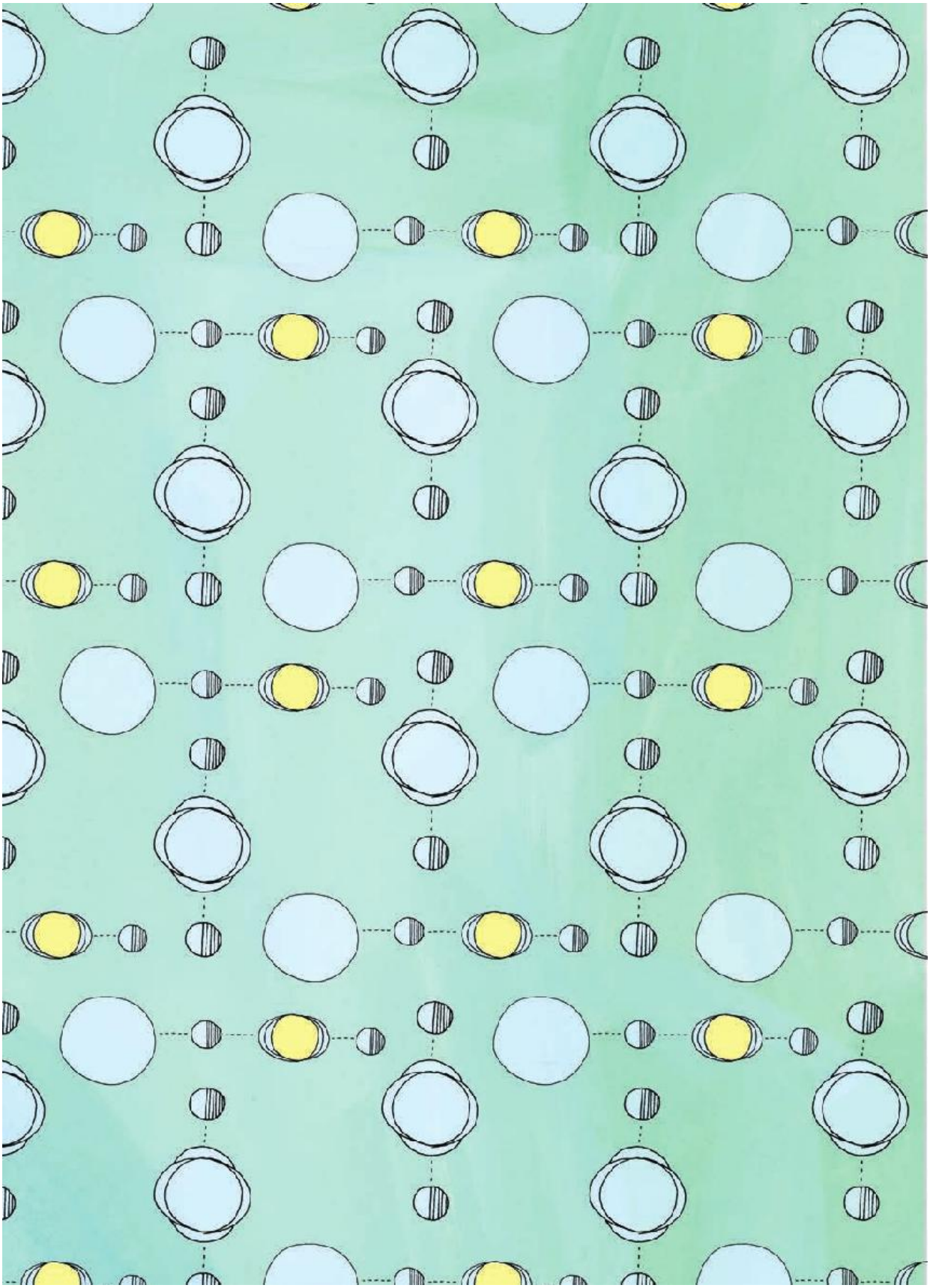
drawing by Chloe

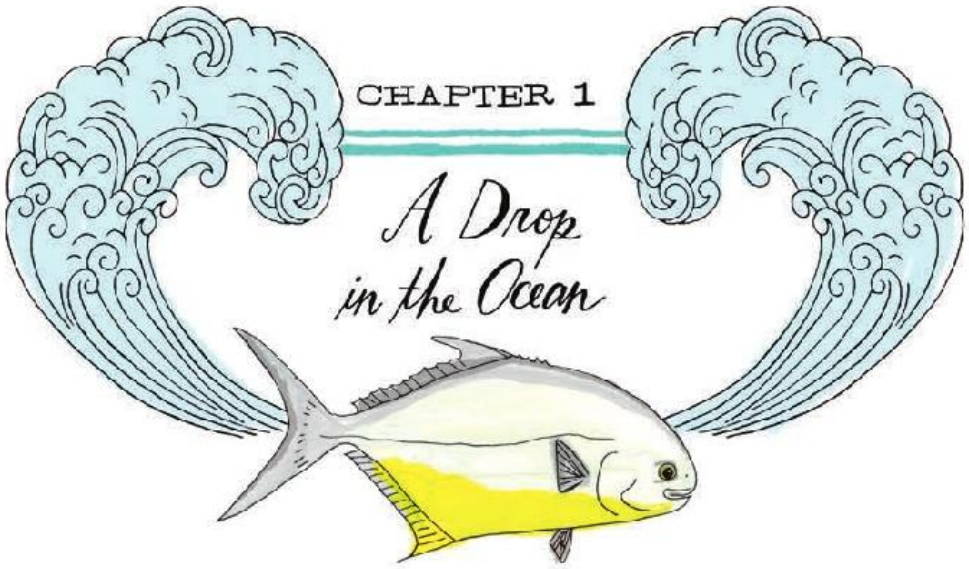
natomy!
about
and

from Molly

from Lydia

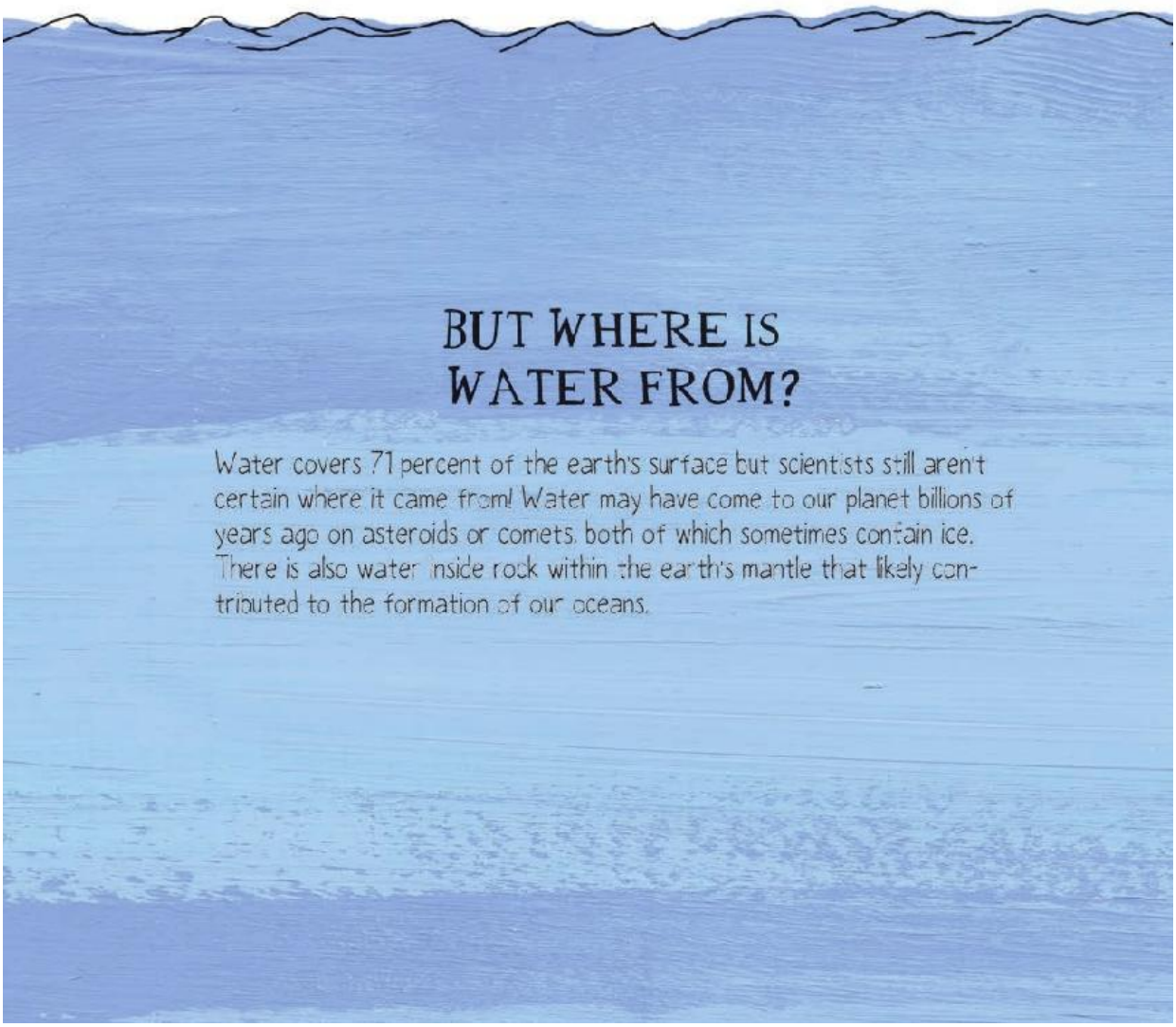
would really enjoy a book called "Ocean Anatomy". I was wondering if you ever decided to make another book if you would consider this topic.




CHAPTER 1
A Drop
in the Ocean

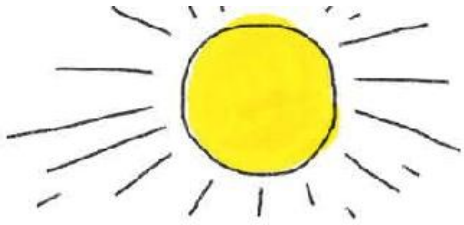
THE EARTH IS OCEAN - UNIQUE

Oceans are Earth's defining feature. This is the only known planet in the universe with stable bodies of liquid water. Water is essential for life and all life began in the ocean about three and a half billion years ago.

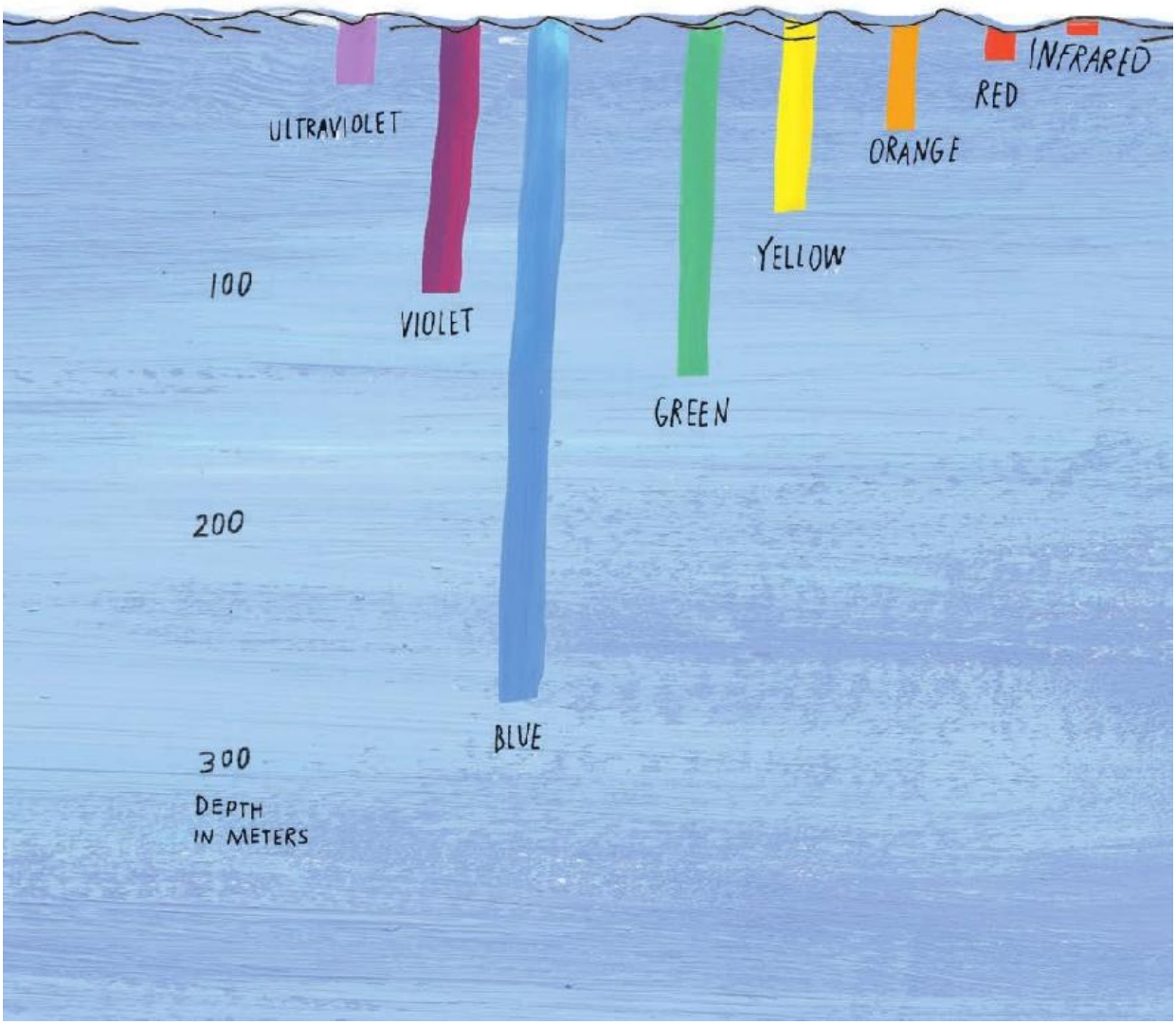


BUT WHERE IS WATER FROM?

Water covers 71 percent of the earth's surface but scientists still aren't certain where it came from! Water may have come to our planet billions of years ago on asteroids or comets, both of which sometimes contain ice. There is also water inside rock within the earth's mantle that likely contributed to the formation of our oceans.



AND WHY DOES THE OCEAN APPEAR BLUE?



The surface of the ocean reflects the color of the sky. On cloudy days, the ocean appears gray. When sunlight shines on the ocean, water molecules absorb light in the red part of the spectrum first. Red, orange, and yellow wavelength colors disappear. They act as a filter, leaving behind colors in the blue part of the spectrum.

WORLD OCEAN

All five of the earth's oceans are connected and exchange water like a single, enormous World Ocean.

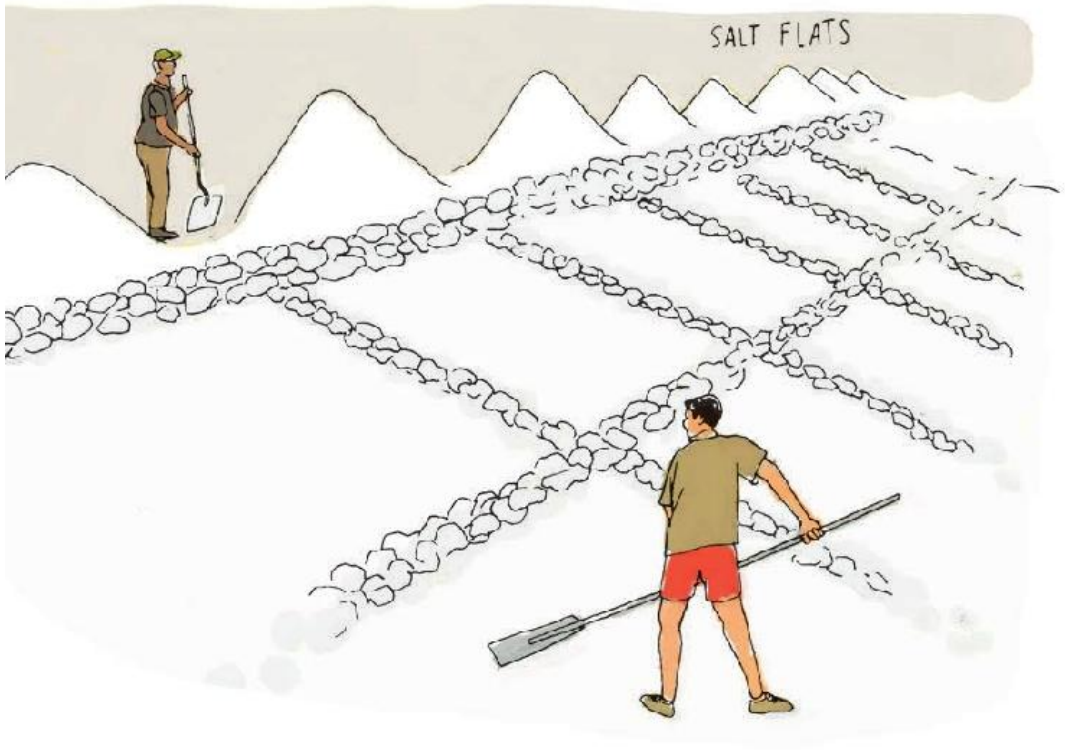

ARCTIC OCEAN
• Covers 2.6 percent of the earth's surface
• Smallest and shallowest ocean
• Average depth 4,000 feet
PACIFIC OCEAN
INDIAN OCEAN
• Covers 14 percent of the earth's surface
• Average depth nearly 13,000 feet
• Encompasses the Persian Gulf and Red Sea
• Covers 4 percent of the earth's surface
• Known as the Antarctic Ocean until 2000
• Average depth about 14,000 feet
• Has seasonal ice cover

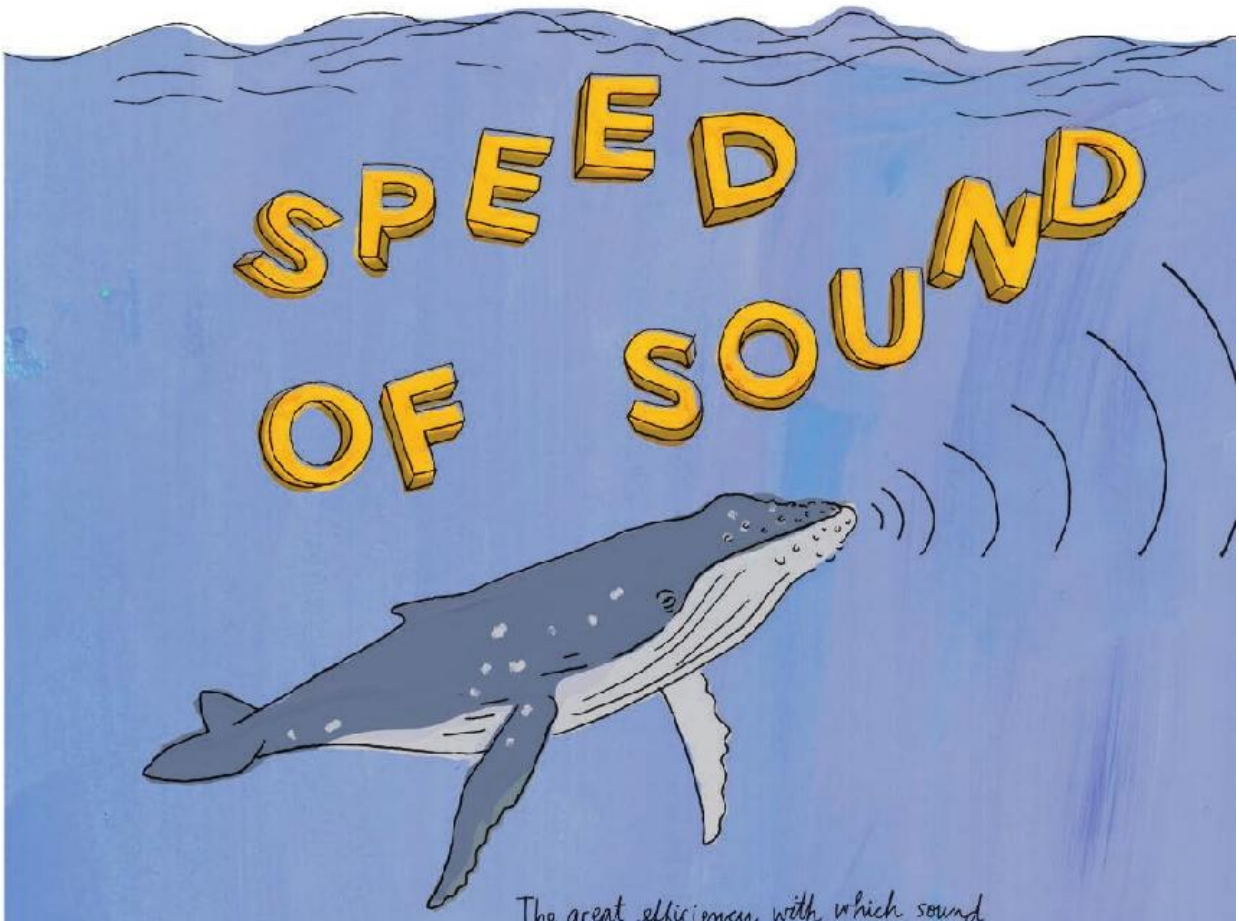
WHY IS THE OCEAN SALTY?

The saltiness, or salinity, of the ocean comes from the land. Over eons, rainfall erodes rocky land and dissolves minerals. Rivers carry these minerals to the oceans where they accumulate. Sodium and chloride are the most common "salty" ions in our oceans.

The salinity of the world's oceans averages thirty-five parts salt per thousand, or 3.5 percent salt.

Ninety-seven percent of all water on Earth is saltwater. For thousands of years, humans have harvested salt by evaporating ocean water.





The great efficiency with which sound travels through saltwater helps explain how some whale species can communicate over thousands of miles.

Sound moves through water about four times faster than it does through air. Water is more dense than air and sound passes through the tightly packed molecules quickly. Ocean water near 70°F (21°C) transmits sound at about a mile per second, much faster than the fastest jet plane can fly.

290 MILLION YEARS AGO

Most of the continents of the earth were crowded into a supercontinent called Pangea. A superglobal ocean called Panthalassa surrounded Pangea and to the east lay the enormous Paleo-Tethys sea.

200 MILLION YEARS AGO

With the gradual movement of the earth's tectonic plates, Pangea began to break apart.

180 MILLION YEARS AGO

The first of our modern oceans, the central Atlantic Ocean and the southwestern Indian Ocean, appeared.

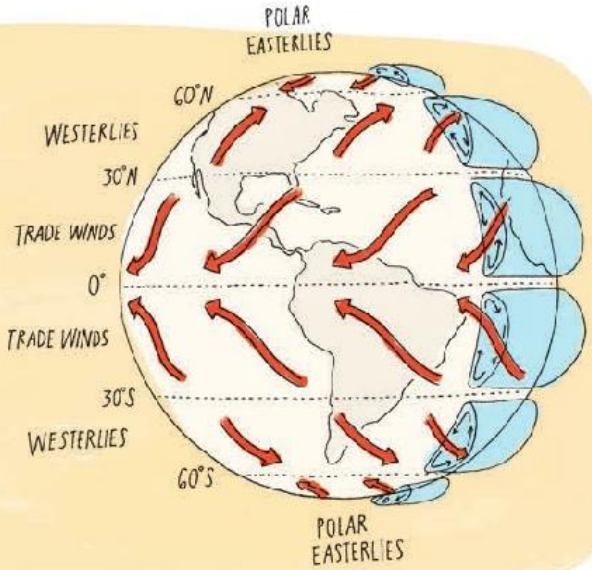
140 MILLION YEARS AGO

The southern Atlantic Ocean emerged as South America pulled away from Africa. The central Indian Ocean appeared as India separated from Antarctica.

80 MILLION YEARS AGO

North America broke off from Europe, forming the northern Atlantic. Eventually, the earth's continents and oceans emerged in their current forms.

Trade Winds



Near the equator, winds from the east blow steadily all the way around the earth. Early sailors from Europe and Africa used these winds and the resulting currents to reach America, allowing them to establish colonies and trading routes. They named these reliable gusts the Trade Winds.

Features of the Ocean Floor