The Magic School Bus
Inside a Beehive
The author and illustrator wish to thank Professor Mark L. Winston, Department of Biological Sciences, Simon Fraser University, British Columbia, Canada, for his assistance in preparing this book.

For their helpful advice and consultation, thanks also to Ray Pupedis, Division of Entomology, Yale Peabody Museum of Natural History, New Haven, Connecticut; Eric H. Erickson, Center Director, Carl Hayden Bee Research Center, Tucson, Arizona; and Mark Richardson, who kindly gave us a tour of his beehive.

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ISBN 0-590-25721-9

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Printed in the U.S.A.

The illustrator used pen and ink, watercolor, color pencil, and gouache for the paintings in this book.
To my
honey, Phil.

J.C.

To
Will Tessler
and Jim Setz, and
all the busy bees who
are building our new hive.

B.D.
“What a perfect spring day!” said Ms. Frizzle, looking out the window. We thought it was perfect, too — perfect for playing softball. But the Friz had something else in mind. “It’s just right for observing honey bees!”

There are more insect species on Earth than all other animals put together!

Yes, but do they all have to be in our classroom?

Honey bees are insects. Here are some other insects.

- Wasp
- Cockroach
- Ant
- Housefly
We had been studying about all different kinds of insects. Now Ms. Frizzle said she had found a beekeeper who would show us his honey bee hives.

Some kinds of bees by Florrie
There are more than 20,000 different kinds of bees.
Here are some of them:

- Honey bee
- Bumble bee
- Carpenter bee
- Orchid bee

Common insects:
- Cricket
- Dragonfly
- Goliath Beetle
- Mosquito
“The beekeeper is visiting his hives today. We’ll meet him there,” said the Friz, and she swept out the door.

Maybe this will be a normal field trip for a change.

I don’t call six legs normal.

It is if you’re an insect.
As we boarded the old school bus, Ms. Frizzle talked and talked about honey bees. “They make a delicious food for us to eat,” she said. “They help many plants survive. And they are wonderful examples of social insects!”

**What are social insects?**

- **by Wanda**
- Social insects live and work together in a community.
- Some social insects:
  - Antsnest in the ground.
  - Paper wasps make a nest out of wood pulp.
  - Bumble bees nest in grass-lined holes in the ground.
  - Termites nest in wood.

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**A word from Dorothy Ann**

Social comes from a word that means “friend” or “partner.”
Ms. Frizzle drove out into the country and parked the bus next to the hives. The beekeeper was late, so Frizzle took out a picnic basket.

"Some light refreshments will pass the time while we wait," she said. Sometimes, our teacher has good ideas!

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Honey bees have barbs or hooks, on the end of their stingers.

When a honey bee stings, her stinger gets stuck in the victim's skin. The stinger is pulled out of the bee's body, and the bee dies.
But just as she opened a jar of honey, her elbow knocked a strange little lever. The honey jar fell, and we heard a weird buzzing sound.

It was the bus. It was vibrating, and getting smaller. So was everything in it — including us!

We’re shaking!

We’re shrinking!

I hate when this happens.

Shrinking...

shrunk

Shrinking...

Shrinking...

Shrinking...

Shrunk

ALLEGIC TO BEE STINGS

by Ralphie

Some people get very sick and can even die from bee stings. They have to carry special medicine.
Before we knew it, the bus looked like a little beehive, and we looked like real bees! We really did!
“All out, class,” buzzed the Friz.

BEETLES THROUGH THE AGES
by Tim
Wild bees have always made their homes in hollow trees or logs. Human-made hives are built of straw, pottery, or wood.

BE A BEE, EVERYONE!
DO WE HAVE A CHOICE?

STOP POKING ME WITH YOUR ANTENNAE!
STOP STEPPING ON MY WING!
THESE THINGS DON'T HAPPEN ON MOST CLASS TRIPS.

MEANWHILE
UH-OH!

COMING FROM THE WEST
One by one, we stepped out the door and looked over at the nearest hive. At the entrance, worker bees were standing guard.

“Guard bees usually keep out bees from other hives,” said the Friz.

According to my research, guard bees will bite and sting strange bees.

Do we qualify as "strange bees"?

No doubt about it!
There is one time when guard bees may let in a strange bee,” said Ms. Frizzle.
"Sometimes a hive may 'adopt' a lost bee — if it is carrying a lot of bee food.
All bee food comes from flowers.

BEES EAT ONLY NECTAR AND POLLEN, AND FOODS THEY MAKE FROM NECTAR AND POLLEN.
WHAT? NO CHIPS?

THE AVERAGE BEE VISITS THOUSANDS OF FLOWERS EVERY DAY.

NOW I KNOW WHY THEY CALL THEM BUSY BEES?
"We'll have to visit flowers and get bee food in order to gain entrance to the hive. Follow that bee!" shouted the Friz. We flew after a bee that was headed toward some bright flowers.

EXACTLY WHAT DOES SHE MEAN BY "GAIN ENTRANCE TO THE HIVE"?

SHE MEANS GO INSIDE IT.

I WAS AFRAID OF THAT...

FLYING IS FUN!

BUZZ OFF!
"Observe our bee, children, and do exactly what she does!" Ms. Frizzle called. The bee stuck her long tubelike tongue deep into a flower and pumped out nectar. We each did the same with a rubber tube. "The bee carries the nectar in a pouch called the honey stomach," Frizzle told us. We carried our nectar in a tiny bottle.

Many plants cannot make seeds unless bees pollinate their flowers.

We need bees!
Pollen grains rubbed off the flower and stuck onto the bee’s “fur.” With her front and middle legs, she combed off the pollen and packed it into pollen baskets—pouches on her back legs. Then she returned to the hive. We packed our pollen and went along.

**AT MY OLD SCHOOL, WE NEVER COLLECTED FLOWER PRODUCTS.**

**IF WE HAVE A LOT, MAYBE THE BEES WON’T STING US.**

**I’M GETTING EXTRA!**

**WE NEED BEES!**
One by one, we landed at the hive. The Friz sprayed us with a bee pheromone—a chemical that bees make. Now we smelled like bees. Then came the scary part.

BEE BRAVE KIDS!

There may be as many as 60,000 bees in one hive, class.

What if they notice we're not real bees?

Spray me again please, Ms. Frizzle!

With pheromones, bees send each other many messages. Here are some of them:

"I'm a hive-mate."
"I'm a stranger."
"I'm a worker."
"I'm the queen bee!"
"Danger! Danger!"
"Defend the hive!"

Bees don't talk in words, but they do communicate.
We held our breath as the guard bees
brushed us with their antennae, smelling us.
If they fell for our trick, we’d get into the hive.
If they didn’t, we’d get into big trouble!

**WE’RE TAKING A BIG CHANCE.**

**I’LL BUZZ TO THAT!**

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**WHO’S WHO IN THE HIVE?**
by Michael

In a honey bee colony, there are three castes, or kinds, of bees:
1. The **QUEEN**: Her job is to lay eggs, eggs, and more eggs.

2. The **WORKERS**: They are all female bees that usually do not lay eggs. Workers do almost all the jobs in the hive.

3. The **DRONES** are all male bees. A male bee’s only job is to mate with a queen.

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**WORK ORDERS**
- Guard entrance
- Clean hive
- Build comb
- Make honey
- Fan wings to cool hive
- Tend queen
- Feed baby bees
- Collect pollen and nectar

**QUEEN**

**WORKER**

**DRONE**
The guards smelled our bee spray and our bee food. They let us pass! Other workers took our nectar and bustled off with it.

"Hooray! We're free to explore the hive!" sang out Ms. Frizzle.
The first thing we saw was our bee. She was doing a strange dance. Other bees crowded around her, touching her and listening to her. Ms. Frizzle said the dance was a "language." With her dance, the bee "told" others which way to go to the flowers she had found.
The dance helped the bees find food faster. They did not have to waste time looking for it. They flew off in the direction of the flowers we had visited.

The other bees go outside and fly in a circular pattern near the hive until they find the flowers.

Bees have many dances.

Each dance "says" something different.
New bees gathered around our bee to get the latest "news." We passed the dancing bee and went deeper into the hive.

**Doesn't the dance language of bees give you a sense of wonder, Arnold?**

**Yes, I wonder which way is out.**

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- **The Waggle Dance**
  - **by Carmen**
  - This dance tells bees that a food source is far away. It also tells which way to fly. The dancing bee makes a figure-eight. She waggles her body on the middle line.

1. If the bee waggles straight up, the other bees fly toward the sun.
2. If the bee waggles to the left, the other bees fly to the left of the sun.
3. If the bee waggles to the right, the other bees fly to the right of the sun.
The inside of the hive was covered with beeswax. The bees had shaped the wax into comb — thousands of little containers called cells. Every cell was a hexagon — a six-sided shape. The comb was so perfect, we couldn’t believe bees had made it. “Make comb, class!” said Ms. Frizzle.
We did our best, but our cells came out pretty lopsided. Luckily, the bees didn’t notice us. They just tore down our cells and built them over again. Other bees were busy with other jobs, such as making honey.

**BEES RAISE BABIES IN THE COMB CELLS.**

**THEY STORE NECTAR AND POLLEN IN THE CELLS.**

**THEY MAKE HONEY IN THE CELLS, TOO.**

**THAT’S SWEET OF THEM.**

**HOW BEES MAKE COMB**

**by Rachel**

A bee uses her back and middle legs to pass wax to her front legs. Then she chews and shapes the wax into cells.

Honey bees make the comb cells tilt up so the honey doesn’t drip out!
We saw the bees changing nectar into honey. First, they added chemicals from glands inside their heads. The chemicals changed the nectar-sugars into honey-sugars. Then they spread droplets out and fanned them with their wings. This dried up most of the water — leaving the honey thick, sticky, and extra-sweet. We fanned, too, and helped make honey.
Ms. Frizzle said it was okay to eat some honey, as long as we left plenty for the bees.

“They need a good supply of honey to help them survive over the winter,” she explained.
We stopped eating honey long enough to notice a bunch of worker bees nearby. They were tending a larger bee with a long thin body. She was the queen bee! As the queen walked from cell to cell, she laid a small white egg in each one.

Hi Mom!

ER...I MEAN YOUR MAJESTY.

The queen lays up to 1,500 eggs per day.

Wow! That's one egg every 58 seconds!

That's eggs-cellent!
The workers touched the queen with their antennae, they licked her with their tongues, and they fed her by mouth-to-mouth exchange.

BE A BEE! TEND THE QUEEN! WE CAN TOUCH HER WITH OUR ANTENNAE. WE CAN GIVE HER SOME HONEY.

- BE A BEE! TEND THE QUEEN!
- WE CAN TOUCH HER WITH OUR ANTENNAE.
- WE CAN GIVE HER SOME HONEY.

- Queen Substances
- Take a Message.

The workers leave the queen and walk through the hive. They touch and lick other bees. The other bees get "queen substance," too.

Let's just skip the mouth-to-mouth part. Good idea.

"Queen substance" tells the bees that the queen is alive and well. Then the workers keep doing their jobs and everything runs smoothly in the hive.
How To Feed Baby Bees
by Amanda Jane

Nurse bees make baby food in glands inside their heads. This is called "brood food." The nurses squeeze out the food right into the larvae’s cells.

In some cells, we saw wormlike creatures. "These are larvae — baby bees that hatched out of the eggs," said Ms. Frizzle. Nurse bees were feeding the babies.

"These wormlike things are baby bees?"
"They don't look like bees at all.
"They will, Keisha, they will. All they need is three things: food, warmth, and time."

Older larvae also eat honey and “bee bread,” a food that is a mix of pollen and honey.
The larvae did nothing but eat fast and grow fast. Every time they got too big for their skins, they molted, or shed their skins. Then they started eating and growing again!

BE A BEC! FEED THE LARVAE!

LARVAE ARE LUCKY.

THEY GET ROOM SERVICE.

THE ROYAL TREATMENT
by Phil
If a hive becomes too crowded, workers get ready to start a new hive. First they build some special upside-down cells for new queen bees.

Queen Larva

Nurse bees feed ordinary female larvae special food called "royal jelly." Then the larvae develop into queens.

IF A FEMALE LARVA GETS ROYAL JELLY, SHE BECOMES A QUEEN.

IF NOT, SHE ENDS UP AS A WORKER.
Why does a larva eat a lot?
So the pupa can change a lot!
by Arnold

Pupae do not eat. So, where do they get the energy to grow the parts of adult bees?

They use the fat and tissue they stored up when they were larvae.

"When it is big enough, the larva stops eating," said the Friz. "It spins a silk cocoon around itself. Now it is called a pupa.
The nurse bees put a wax top on the cell.
Inside, the pupa doesn't eat or grow bigger.
It changes into an adult bee.
This is called metamorphosis.

Things sure are changing in there.
The pupae are getting heads...
And eyes, and antennae...
And wings, and legs...
...everything they need to be a bee!

Another word from Dorothy Ann
Metamorphosis comes from a word that means 'change.'
"When the pupae have finished changing into adult bees, they chew their way out of their cells," continued Ms. Frizzle. We saw new worker bees emerging. They let the air dry them off and started working right away. Meanwhile, we heard excited buzzing. What was happening?

Now the metamorphosis is complete, children.

The bees are all grown up.

I'm so proud of them.
The queen was leaving the hive!
And she was taking almost half
the workers with her!
They flew away in a thick swarm.
What would become of the hive now?

SWMING IS NATURE’S WAY
OF STARTING NEW BEEHIVES.

BUT HOW CAN THE
OLD HIVE SURVIVE
WITHOUT THE QUEEN?

THERE’S NO ONE TO
LAY EGGS NOW.

Don’t be so sure. Remember the
queen cells?
Ms. Frizzle led the way to the queen cells. Two new queens emerged at the same time.

A queen bee can sting many times by Arnold

Unlike worker bees, which can sting only once, the queen bee can pull her stinger out of the victim and sting again.

After they had dried out, they had a terrible fight. One queen stung the other queen to death!

Then she killed the other queen pupae in their cells. Now she was the new queen.

Two queens? I thought... There was only...

One queen in a hive.

You were absolutely right.

The stronger queen survives to pass on her strength to her children.
The worker bees pushed the new queen out of the hive. Ms. Frizzle said she was going on a nuptial flight — a flight to mate with drones.

After the new queen mates, she'll return to the hive and start laying eggs. Her eggs will hatch and replace the workers that left with the old queen.

Then the hive will be as strong as it was before.

Maybe yes, maybe no...

Another word from Dorothy Ann

Nuptial comes from a word that means "wedding."
After the new queen left, we heard heavy footsteps. It was a bear, trying to steal the honey and the bee larvae! The workers flew out and tried to sting the bear, but its thick fur protected its body.

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IF THE BEAR BREAKS OPEN THE HIVE...

AND EATS ALL THE HONEY AND THE LARVAE...

THE BEES MAY NOT SURVIVE!

WE HAVE TO HELP!

STING HIM!

I CAN'T GET THROUGH!

HELP!
We flew out and dived at the bear, but it kept coming at the hive.

“We have to use strategy, class,” called the Friz. “We’ll lure the bear away!”

BE A BEE!
DEFEND THE HIVE!

BUT I DON’T WANT TO HURT A CUTE LITTLE BEAR.

I WOULDN’T SAY CUTE AND LITTLE.

I’D SAY BIG AND HUNGRY!

BEE PREPARED FOR ANYTHING

COMMON HIVE RAIDERS by Tim

Skunks
Bears
Wasps
Bees from other hives

Beware
Never get close to bears. They may look cute, but they are very dangerous.

Bees can defeat most robbers, but bears are hard to beat.
Ms. Frizzle made a beeline for the beehive-bus—and we followed.
The jar of honey that had spilled before was still on the floor.
The bear smelled the honey and came after us.
"Ms. Frizzle!" we yelled. "Do something!"
She stepped on the gas, and the bus lurched forward.

The bear will follow our honey away from the hive, class.

Ms. Frizzle spilled that honey before we changed into bees...

And before we became bear bait.

Those were the good old days.
As we rounded a corner, the honey jar rolled out the bus door. As the jar fell, it returned to its normal size. The bear started eating honey and forgot all about us.
Ms. Frizzle reached for a joystick on the dashboard. To our relief, the bus lifted off. It wasn’t a beehive-bus anymore. It was a bee-bus! Down below, we saw the new queen returning home from her nuptial flight.

**THE HIVE IS SAFE!**

**WE’RE SAFE!**

**WE’LL MEET THE BEEKEEPER ANOTHER DAY, CLASS. RIGHT NOW, WE’RE RETURNING TO THE CLASSROOM.**

**IT’S ABOUT TIME.**
We returned home from our flight, too.
The instant its six feet touched the ground
in the school parking lot, the bee-bus changed.
It was a full-size school bus again.
We were human kids again.

THANK GOODNESS FOR THAT LAST METAMORPHOSIS.

THANK GOODNESS WE CHANGED BACK TO OUR REAL SELVES.

I JUST SAID THAT.
And back in the classroom, we thought-of the perfect project to end the day: baking honey buns, of course!

Q: Why do bees itch?
A: They have hives.

Q: Why did the bee hum at her singing lesson?
A: She didn't know the words.

Q: How does a bee fix her hair?
A: She uses a honey comb.

Q: What grade did the students get on their honey projects?
A: They all got B's!

I kind of miss being a bee.
Yes, I feel lost without my antennae.
I liked the stripes.
The best part was the honey... and we can still get that from beekeepers!

To: Ms. Frizzle and her class
Bob's Better Bees
Honey from Bob's Beehive
Honey from Bob's Beehive
Honey from Bob's Beehive

Magic School Bus Oven
CHECK OUT THE FRIZ!

HOW SHOCKING!
Some Things Can't Happen In Real Life

A school bus cannot shrink to the size of a beehive... or a bee.

Schoolchildren cannot become bees...

Fly to flowers and gather pollen...

Or enter a beehive and eat honey!

They can't?

Aw, shucks...

And I was looking forward to starting school.
This book shows bees making honey in a few minutes. It actually takes them many hours.

Yes, and it takes baby bees many days to grow up into adult bees.

The new queen doesn't start mating until she is about five days old.

Then she spends a few days going on mating flights.

And this book shows insects talking in words.

Anyone knows we can't do that.

We can't?

Aw, shucks...

We'd better be quiet, then.
The Magic School Bus

The Bestselling Science Series Ever!