

A Plant Story

CHAPTER 1

"It's happened, it's happened!" shouted Natasha.

"What's happened?" asked Marc, looking up from his bowl of breakfast cereal. The Sugar Pops were almost gone. It was mostly milk now.

"Sonny popped!" said Natasha.

"Who's Sonny?" Marc was trying to decide whether to drink the sugary milk or just leave it.

"Sonny the Sunflower I planted. He's popped!"

"How do you know it's a 'he'?" asked Marc, reasonably. "It's just a flower."

"With a name like 'Sonny,' what else could he be?" asked his sister. "Anyway, it doesn't matter. The important thing is he was just a tiny bud yesterday and this morning he's a great big sunflower. With petals! Come and see!"

"OK," said Marc. He picked up his bowl, poured the milk down the sink, and put the bowl and spoon in the dishwasher. Then he followed his sister out to the backyard.



Sonny had indeed popped. Overnight, it seemed, the sunflower had grown until it was by far the tallest plant in the garden and now all of a sudden it had a beautiful brown and yellow flower on the very top of its long stem.

"How did that happen?" asked Marc.

"What do you mean 'how'? It just happened! Isn't he beautiful?" said Natasha.

"Yeah, but how? I mean, when? I mean, it didn't just happen by magic!"

Natasha was about to reply when a voice came to them from the direction of the house. They looked and saw their mother walking toward them. "Oh, there you are," she said, "I've been looking all over for you. Did you put away your breakfast dishes?" she asked Marc.

"Yes, Mom," said Marc. "But look! Look what happened to Sonny!"

"I know, dear," said his mother. "I saw it this morning. Isn't it pretty? You did a good job planting and watering it," she said to Natasha.

"Marc wants to know how it happened," said Natasha. "How could a tiny little seed and some water turn into this beautiful flower?"

"Oh, it took a bit more than that," said their mother, with a mysterious little smile. "But I tell you what," she went on, "Elvira is coming over today and she might be able to show you a thing or two."

"Your friend Elvira?" said Natasha, "Why didn't you tell us? She's cool! Marc, remember the time she took us to—"

"Ssshh!" said Marc, "She said it was a secret, remember?"

"Oh, that's right," said Natasha. "I forgot." She turned to her mother.
"Well, anyway, Elvira is definitely the coolest. I bet she'll know all about Sonny."

"We'll see," said her mother.

Why do plants make flowers?

CHAPTER 2

Marc and Natasha had been waiting for Elvira all morning. They were staring out the window of Natasha's room, which had a good view of the street, and had just about given up when they finally saw her blue sports car screech around the corner and pull into the driveway of their house. They rushed downstairs to greet her.



Elvira was always a bit shocking. Her hair was flaming red and long enough so she could sit on it. Her eyes were as green as grass and her nose turned up like a ski jump. She wore rings on every finger and too many necklaces to count.

But the most extraordinary thing about Elvira was not her appearance at all. Strange and wonderful things had been known to happen when she was with Marc and Natasha – especially when their parents were not around! The kids could hardly wait to see what would happen this time.

“So what have you two been doing with yourselves?” she asked, getting out of her little car as Marc and Natasha ran up. “Not just sitting around, I hope! Life is too short for that!”

She had on a bright green shirt with pink polka dots and tight yellow pants. On her feet she wore yellow socks and shoes that looked like baby alligators, complete with teeth at one end and tiny tails at the other. She was carrying an enormous cloth bag and her hair was pinned up in a big ball that sat on top of her head and made her look about ten feet tall.

“Sonny popped!” said Natasha.

“Sonny your sunflower? I was wondering when that would happen.”

“You remembered his name!” exclaimed Natasha.

“Of course I did. I wouldn’t forget an important thing like that!” said Elvira.

“Marc did,” Natasha said, looking scornfully at her brother.

"I did not," said Marc. "I knew it all along. I just forgot it for a second when you told me that he popped."

"Come see him," said Natasha. "He's beautiful!" She grabbed Elvira's hand and dragged her around the house to the flower garden in the back.

"That's a big sunflower!" exclaimed Elvira, as soon as she saw Sonny. "You must have very good soil in your garden. And you must have watered him regularly, too," she said, turning to Natasha.

"I did," said Natasha, proudly.

"I still don't understand something," said Marc, "Where did this great big plant come from, anyway? I saw the seed that Natasha planted – it was tiny. I don't see how something this big could possibly grow out of such a small seed, I don't care how much water she put on it!"

"Oh, it's not just the water," said Elvira. "Plants need lots of things to grow. And they don't just grow, either. I bet you didn't know that plants move just like you do! They don't walk around, of course, but they bend and sway and turn. I'll show you, but first let me go say 'Hi' to your mom." And she turned and went into the house, leaving Natasha and Marc to wonder what new adventure was about to start.

CHAPTER 3

In a few minutes Elvira came out the back door and walked over to Marc and Natasha. "Your mother is making lunch for us all," she said, "so we only have a few minutes." She reached into her bag and pulled out a flat plastic object with buttons on one side.

"That looks just like the remote control on our TV," said Marc. "The one Natasha is always hogging!" Natasha glared at him, but said nothing.

"It is, kind of," said Elvira. "But a regular remote only controls the TV. This one is a little different. Watch!"

She pressed a button on the remote control. "Notice anything different?"

"Not really," said Marc.

After a few moments Natasha said, "It's awfully quiet."

"See that zinnia over there?" said Elvira, pointing to a pretty orange flower two rows away. "Look closely at it." The two children went over and peered at the zinnia.



"There's a bee flying around it," said Natasha. She bent over to look more closely. "Oh, no, it's not! It's just hanging there!" she exclaimed. And sure enough, the bee was hanging motionless in mid-air an inch or two above the flower. Even its wings had stopped moving.

"Look out in the street," said Elvira. "Do you see anything different?"

Marc and Natasha raced to the back fence and looked over it. "Nothing is moving," Marc reported. "The cars are all stopped."

"That man walking by is frozen!" said Natasha, pointing. "He's got one foot in the air and one on the ground. He looks just like a statue!"

"That's because I pressed 'Stop' on the remote control," said Elvira. "This is a magic remote. It works on the real world instead of the television. It stops time!"

"How come we're moving around, then?" Marc wanted to know.

"Oh, it doesn't work on us," replied Elvira, "just everything else in the world. Watch what else I can do!" She pressed another button and the cars and the people in the street started to move backwards. "I've hit 'Rewind,'" said Elvira. "Time is running in reverse."

"That is so cool!" said Natasha, "Can you fast forward it, too?" She was thinking how she would love to be able to fast forward right through her homework.

"Sure," said Elvira, "but right now I want to show you something. Come back and watch your sunflower while I speed up the rewind!"

Elvira hit the "Rewind" button several more times and things really started to go crazy. The sun moved across the sky and set in the east. It turned dark and the stars came out. But just a few seconds later the sun rose again and started to move across the sky. When it was halfway across Elvira pressed the "Stop" button and the sun stood still once more.

"Look!" said Elvira, "Look at Sonny!" At the tip of the sunflower plant, where a few minutes before there had been a large flower, now there was only a bud.

"I get it," said Natasha. "We've gone back to yesterday when Sonny was only a bud."

"Right," said Elvira, "Now let's go way back. Back to before Sonny was even born!" She pressed the Rewind button again and again. Day and night flew by so quickly that they seemed just a flicker. The sunflower got smaller and smaller. Elvira waited until it had disappeared into the ground. Then she pressed "Stop."

"Now watch closely," said Elvira. "I'm going to run time forward, not as fast as before, but fast enough. Each day will take less than a minute. Watch what happens to Sonny."

Time started up again. Marc and Natasha watched as a green stem poked timidly out of the soil and little bumps began to form along its sides. As the days went by, the stem got taller and the bumps turned into leaves. By the time the plant was about a foot tall, the children noticed an odd thing.



"Sonny is moving!" said Natasha. "He's not just growing. He's turning, too. It's just like he's alive!"

"He is alive, silly!" said Marc. "Just because he's a plant..."

"Yeah, but I never realized that plants could move like that. Notice that he only seems to do it during the daytime, too. At night he just droops."

"Do you notice anything special about the way Sonny moves?" asked Elvira. Natasha and Marc stared intently at the plant. For a few minutes nobody said anything as the sun sailed again and again across the sky, rising in the east and setting in the west. Night followed day and day followed night, over and over. A bud began to form at the top of the sunflower plant.

After a while Marc spoke up, "It looks as though Sonny is pointing toward the sun!"

"He's pointing the tops of his leaves at the sun," corrected Natasha. "The rest of him isn't moving. I wonder why he does that."

Suddenly the bud opened up and out popped a flower. The sun stopped moving.

"We're back in the present," said Elvira. "No more fast forward for us. This is a magical remote control, but it can't see into the future!"

"That was crazy!" said Marc. "Do plants really do that?"

"Do what?"

"Move to follow the sun like that. It was almost as if Sonny was trying to get a tan at the beach!"

"Not every plant does it, but a lot of them do," said Elvira. "People don't notice that plants move because they do it so slowly."

"But why do they do it?" asked Natasha. "They can't really get a tan, can they?"

"No, they don't tan," said Elvira, "but they do need the sun for other things. I promise to show you that later, but right now I think I hear your mom calling us to come in for lunch."

"OK," said Natasha, "but remember, you promised!"

Why do you think a plant would follow the sun?

CHAPTER 4

Marc and Natasha could hardly sit still during lunch. They had no idea what Elvira was going to show them except that it was sure to be unusual.

"Maybe she'll get Sonny to talk to us and tell us why he moves around that way!" said Marc.

"No way," Natasha said. "Plants can't talk!"

"I didn't think they could move either," said Marc, "until she showed us they could. Who knows what else plants can do?"

"We'll soon find out," said Natasha.

But it wasn't so soon, after all. The minute lunch was over and they had put their dishes in the sink, Marc and Natasha rushed out to see what Sonny was doing. Sure enough, the sunflower's leaves were broadside to the sun, soaking in the rays. Natasha was so proud of the sunflower she wanted to give Sonny a hug, but she was afraid it might hurt him.

They waited for Elvira to come out and show them why Sonny moved. They waited a long time, but Elvira stayed inside, talking to their mother. Finally, just when they were sure she had forgotten all about them, she came rushing out.

"Are you ready?" she called out. "We'd better hurry now. We don't have much time!"

"Why? What's going to happen?" asked Natasha, but Elvira didn't answer. Instead she reached into her enormous bag and pulled out something that looked like a magnifying glass. It had a thick handle with a lot of buttons on it.

"Oh, we have one of those in school," said Marc. "It makes things look bigger."

"This one is a little different," said Elvira. "It doesn't just make things look bigger, it actually makes them bigger. Watch what it does to Sonny!"

She walked over to the sunflower plant and put the magnifying glass close to one of its leaves, and pressed a button. Immediately the leaf started to grow. Before long it was bigger than Marc and Natasha put together!

"If you look closely now you'll see that the underside of this leaf has little holes in it," said Elvira. "They're called 'stomata' and they're going to come in very handy."

"Why?" asked Natasha. The leaf was still growing. The little holes were getting bigger and bigger. The nearest one was already as big as her head.

“Because they will let us get into the leaf,” said Elvira. “Like this!” She grabbed Marc and Natasha by the hand, gave a little jump, and sailed with them through one of the stomata.



“This is just like Alice in Wonderland!” said Natasha, “Only we’re going down a leaf hole instead of a rabbit hole!”

CHAPTER 5

"This is getting spooky!" said Marc. They had been traveling for some time now, holding tightly onto Elvira and getting deeper and deeper into the leaf.

"We're almost there!" said Elvira, "I think it's just around this turn.... Oh, yes, here we are!"

"Where?" asked Natasha.

"We're in the chloroplast!" said Elvira.

"The what?"

"The chloroplast. This is the factory where the leaf makes food."

"Oh," said Natasha. She looked around. They seemed to be floating in the middle of a very big room, so big that they could hardly see the walls. All around them everything was green. Even the light was green. Marc's face looked green in the green light.

"I don't see any food here," said Natasha.

"It's not regular food," said Elvira. "It's plant food and it's still too small for you to see it. I guess I'll have to use my special magnifying glass some more!"

She took it out and pressed the button. All around them the room started getting bigger and bigger. The walls disappeared into the distance. So did the ceiling and the floor. Elvira, Marc, and Natasha were left floating in a big green space. Elvira held the magnifying button down for a long time. Finally she said, "OK, now you can begin to see them."

"See what?" asked Marc.

"The molecules. Wait a minute, let me focus this thing and try to make it clearer." She fiddled with a knob on the magnifying glass and pretty soon Marc and Natasha were able to see what was going on.



"What are those blobby things?" asked Natasha.

"Those are the molecules I was talking about," said Elvira.

The molecules were all different sizes and shapes. The little ones moved very fast, the bigger ones just lumbered around. When two molecules bumped into each other they usually bounced off, but every once in a while they stuck together.

"I've slowed time down a lot with my remote control," said Elvira, "Otherwise you wouldn't be able to see much. The little molecules are moving faster than a rifle bullet!"

"It's confusing," said Marc. "With everything bouncing around like this, it looks like the bumper cars at the fair."

Natasha said, "I don't see why you call it a 'factory.' Aren't factories supposed to make stuff? I don't anything being made by this factory. It's just a big jumble."

"It looks complicated," said Elvira, "but it's basically pretty simple. I can show you what's happening. I have one more trick up my sleeve!" She pressed some buttons on her magnifying glass and most of the molecules disappeared. "I've made all the big molecules invisible for the time being," said Elvira. "Tell me what you see now."

"I see blue molecules and black ones with red spots," said Marc.

"The blue ones are round and the black and red ones are straight," said Natasha.

"The black and red ones look like lady bugs," said Marc.

"The colors of the molecules aren't real," said Elvira. "The magnifying glass colors them that way so that you can see them and tell them apart. Really, molecules are so tiny they don't have colors. But they do have names. The blue ones are water and the black and red ones are carbon dioxide."

"You mean regular 'water,' like the stuff we drink?" asked Natasha.

"Exactly. You gave the plant those blue molecules when you watered it," said Elvira. Natasha looked pleased.

"Where did the carbon dioxide molecules come from?" Marc wanted to know. "What is carbon dioxide, anyway?"

"I know, I know!" said Natasha. She put her hand up and waved it as though she were in school. "Carbon dioxide is a gas. It's the gas you breathe when you breathe out. You breathe in oxygen and you breathe out carbon dioxide!"

"Very good!" said Elvira.

"So Sonny got those black and red molecules when we breathed on him?" asked Marc.

"He might have, but you didn't really have to breathe on him," said Elvira, "There's enough carbon dioxide in the air already."

"I see something weird!" said Natasha. She had been watching the molecules very closely. "Every once in a while a blue molecule disappears and a purple molecule takes its place! What's going on?"

Elvira said, "What you're seeing is a water molecule splitting up. Water is made out of hydrogen and oxygen. Those purple things you see are oxygen atoms. I made the hydrogen atoms invisible so it wouldn't be too confusing."

"So what happens to all the oxygen atoms?" asked Marc. "Where do they end up?"

"They go into the air," said Elvira, "The plant breathes them out."

"So the plant is just like us," said Natasha excitedly, "only backwards. We breathe in oxygen and breathe out carbon dioxide; the plant breathes in carbon dioxide and breathes out oxygen!"

"That's right," replied Elvira. "That's one reason plants are so important. If they weren't around, we would use up all the oxygen and suffocate."

Marc had been studying the molecules, too. "There's something else going on," he said. "The carbon dioxides disappear, too, sometimes, but I don't see anything replacing them."

"That's because I made all the big molecules invisible so you could concentrate on the small ones," said Elvira. "What happens is this: the chloroplast factory takes a bunch of carbon dioxide molecules and sticks them together with some hydrogen atoms that it gets from the water, and it makes a bigger molecule that I bet you had for breakfast. I can show you that molecule, too. This magnifying glass can do practically anything! Let me see now, which button do I push? Oh, here it is!"

New molecules appeared. They were much bigger than the water and carbon dioxide molecules; they were long and skinny and they were colored white. They looked like white snakes. Natasha and Marc stared at them for a long time. There weren't very many of them, but if you looked closely you could sometimes see one appear out of nowhere. It was like looking for shooting stars.

"Those are sugar molecules," said Elvira. "Exactly the same kind of sugar that you eat."

"I ate some of those this morning!" Marc said. "I had Sugar Pops for breakfast."

"Sugar Pops are full of sugar," Elvira agreed, "and it all comes from plants like this one that take water and carbon dioxide molecules and turn them into sugar molecules. Plants make food that way."

Natasha noticed something interesting. "Why are the sugar molecules all moving away?" she asked.

"They're going toward the stem and the roots of the plant," said Elvira. "That's where most of them will be stored until the plant needs them."

"What do you mean, 'needs them'?" asked Marc. "What do plants need sugar molecules for, anyway?"

"They use them for food," said Elvira. "Sonny will use that sugar and get energy from it and it will make him grow. That's how he grew so big from such a little seed, just the way you grew from being a little baby."

Marc didn't like talking about when he was a baby.

It was getting dark in the leaf. Elvira looked at her watch. "I was afraid of that," she said.

"Afraid of what?" asked Natasha, in an anxious voice. "Is something wrong?"

"Nothing to worry about," said Elvira. "But do you notice anything different?"

Marc and Natasha stared around them for a long time. Then Marc said, "I don't see any oxygen atoms. No new ones are being made and the old ones have all gone into the air."

"This factory is still making sugar molecules," said Natasha. "But the oxygen-making part seems to have shut down. Why?"

"Do you remember the question you asked me before lunch?" asked Elvira. "Think about it and you'll figure out what just happened. While you're thinking, though, we have to get out of here. It's getting late. Follow me!"

Write a summary of Chapter 5.

CHAPTER 6

Getting out of the leaf didn't seem to take nearly as long as getting in. Before they knew it, Marc and Natasha were back at the same stoma they had come in by.

"Let's get out of this leaf and then I'll make everything small again," said Elvira. She held down a button on the magnifying glass. "There, now everything is back to normal."

"We must have been in there a long time," said Natasha. "The sun is setting."

"Exactly," said Elvira. "Now do you understand why part of the factory shut down?"

"I bet it needs light to run!" said Marc, excitedly. "It needs the sun to make electricity or something. Like those calculators that run on solar cells."

"You're absolutely right!" said Elvira, beaming at Marc. "The leaves in a plant are like little solar cells. They use the sun's energy to break up the water into oxygen and hydrogen. The sugar-making part of the factory can work at night, but the step that gets it all started needs the sun's energy to run."

“And that’s why Sonny turns his leaves to the sun!” said Natasha. “He’s not getting a tan, he’s getting as much energy as he can while the sun is up!”

“Right again,” said Elvira. “You see? I promised I’d explain why Sonny’s leaves move like that.”

“Kind of a long explanation!” said Marc. “But I’m glad you showed us that chloroplast factory. That was cool! You could have just told us the answer, I suppose, but this was a lot more fun!”

THE END

What does the chloroplast factory in the leaf produce?