"Good afternoon, boys," said the teacher. He looked at them, standing there in their Halloween costumes, clutching their masks. "How kind of you to think of including your poor old teacher in your fun Halloween games."

"But we didn't know . . . ," protested Zit. The other two looked too surprised to speak. "We wouldn't have, not if we'd known this was a *teacher's* house."

"Don't you worry!" said Dr. Reeper with a forced chuckle. "I like to see young people enjoying themselves." He waved a hand around to clear a bit of the lingering smelly smoke. "I'm afraid you interrupted me just as I was in the middle of something. That's why it's a little foggy around here."

"Ugh! Were you cooking?" said Whippet unhappily. "It stinks here."

"No, not cooking—well, not food, anyway," said Dr. Reeper. "I was doing an experiment. I should get back to it. And I shouldn't keep you here—I'm sure you have other people in the neighborhood to delight with your amusing tricks."

"What about . . . ?" said Ringo, trailing off deliberately.

"Oh yes!" said Dr. Reeper. "Why don't you boys come and wait on the doorstep while I go get something. I'll only be a moment."

The boys followed him as far as the open front door, where they hovered while Dr. Reeper went in.

"What's going on?" Whippet hissed to Ringo as they waited.

"Listen up, gang," said Ringo importantly. "Gather round. Greeper wants us to do something for him. And he's gonna pay us."

"Yeah, but what does he want us to do?" asked Tank.

"Relax, chill," replied Ringo. "It's nothing. He just wants us to deliver a letter—to the house with the weirdo in the space suit."

"And he'll pay us for that?" squeaked Zit. "Why?"

"I dunno," admitted Ringo. "And I don't really care. It's money, isn't it? That's what matters." They waited for a little longer. The minutes

ticked by, and there was still no sign of Greeper. Ringo peeked through the front door. “Let’s go in,” he said.

“We can’t do that!” exclaimed the others.

“Yeah, we can,” said Ringo, his eyes sparkling with mischief. “Just think—at school we can tell everyone we’ve been inside Greeper’s house! Let’s see if we can take something of his. Come on!” He tiptoed into the house, stopped, and beckoned furiously for the others to follow. One by one they sidled through the front door.

Inside, they saw a hallway with several doors leading off it. Everything in the hallway was covered with dust, as though no one had touched it for a hundred years.

“This way,” ordered Ringo, snickering with glee. He set off down the hallway, stopping in front of one of the doors. “I wonder what the old doc keeps in here.” He pushed it open. “Well, well, what’s all this?” he said, a sly smile spreading across his face as he peered in. “Seems like there’s more to the doc than meets the eye.” The other boys crowded around him to see what lay in the room beyond, their eyes widening as they took in the strange scene before them.

"Wow!" said Zit. "What's in there?"

But before anyone could answer, Dr. Reeper had reappeared in the hallway behind them.

"I asked you," he said in the scariest voice imaginable, "to wait outside."

"Sorry sir, sorry sir," said the boys quickly, whipping around to face him.

"Did I invite you into my house? I don't think so. Perhaps you could explain why you have behaved so very badly? Or I will be forced to give you extra detention at school for disobedience."

"Sir, sir," said Ringo very fast, "we were waiting outside, but we were so interested to know . . . the experiment you talked about earlier . . . we wanted to come in and see."

"You were?" said Dr. Reeper suspiciously.

"Oh yes, sir!" chorused the boys enthusiastically.

"I wasn't aware that any of you were interested in science," said Dr. Reeper, sounding a little happier.

"Oh, sir, we love science!" Ringo assured him feverently. "Tank here wants to be a scientist. When he grows up." Tank looked rather startled

but then tried to compose his face into what he hoped was an intelligent expression.

"Really?" said Dr. Reeper, perking up considerably. "This is wonderful news! You must all come into my laboratory—I've been longing to show someone what I've been working on, and you seem like the perfect boys. Come in, please. I can tell you all about it."

"What've you gotten us into now?" muttered Whippet to Ringo as they followed Dr. Reeper into the room.

"Shut up," Ringo replied out of the corner of his mouth. "It was this or detention. So look sharp, all right? I'll get us out as soon as I can."

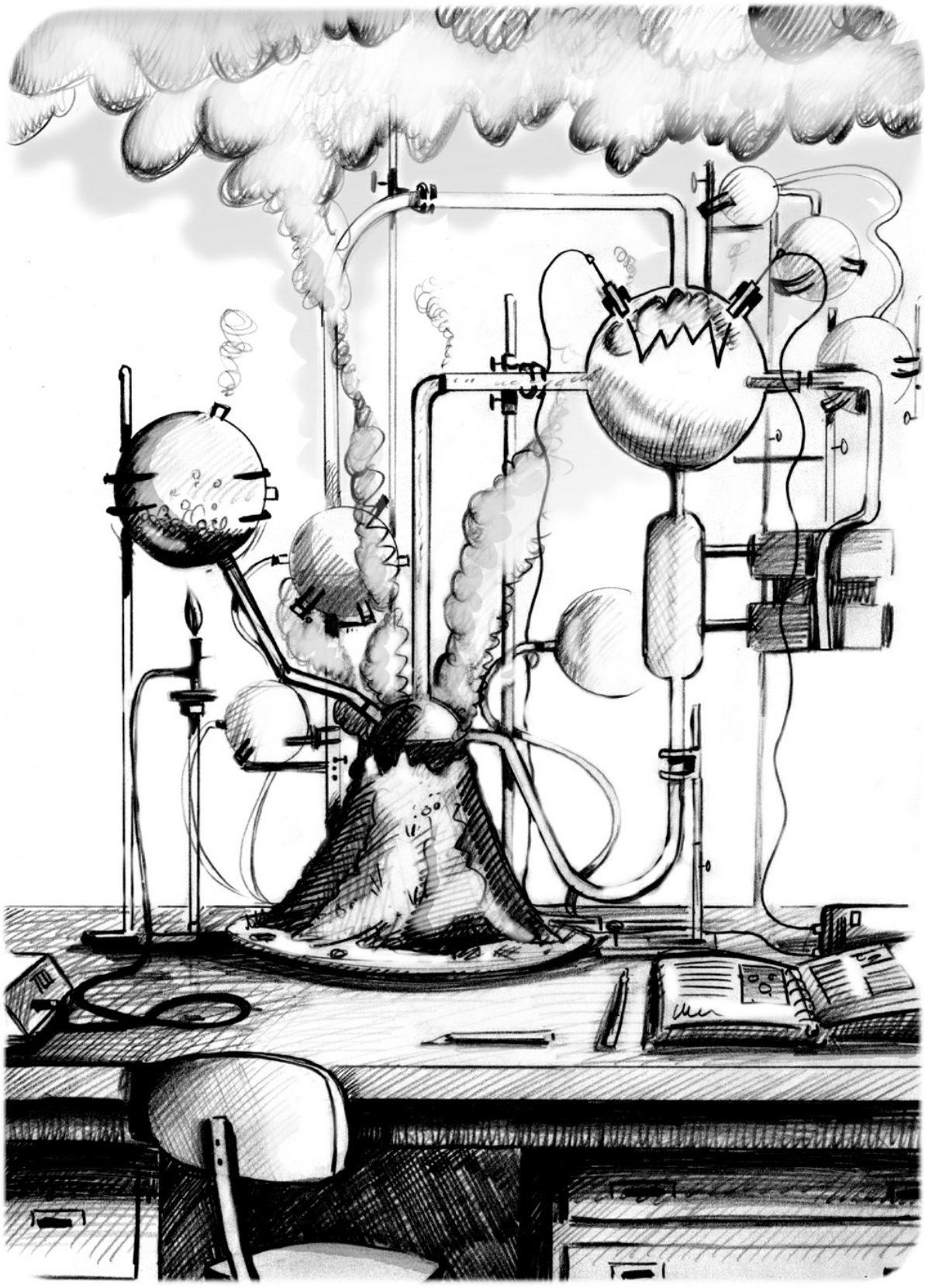
Dr. Reeper's laboratory was clearly divided into two parts. On one side, a strange-looking chemistry experiment was in progress. Lots of glass balls were linked to others via glass tubes. One of the balls was connected to what looked like a miniature volcano. Most of the volcano fumes funneled upward into the glass ball, but from time to time little wisps of them leaked out. Gases poured from one glass ball to the next, eventually ending up in one large ball in the center. There was a cloud inside this last ball, and now and then they saw sparks flying around.

"So, who wants to go first with the questions?" asked Dr. Reeper, excited to have an audience.

Ringo sighed. "Sir, what's that?" he said, pointing to the large chemistry experiment.

"Aha!" said Dr. Reeper, grinning and rubbing his hands. "I'm sure you remember the wonderful rotten-egg stink you smelled when you entered the house. Well, do you know what it is?"

"Rotten eggs?" piped up Tank, feeling happy he knew the answer.



"Stupid child," grumbled Dr. Reeper. "You'll have to try harder than that if you want to become a scientist. Think! What could it be? Such an easy answer."

The boys looked at each other and shrugged. "Don't know," they all murmured.

"Dear, oh dear," sighed Dr. Reeper. "Children today, they really do know nothing. It is the smell of the Earth—billions of years ago, when there was no life on it."

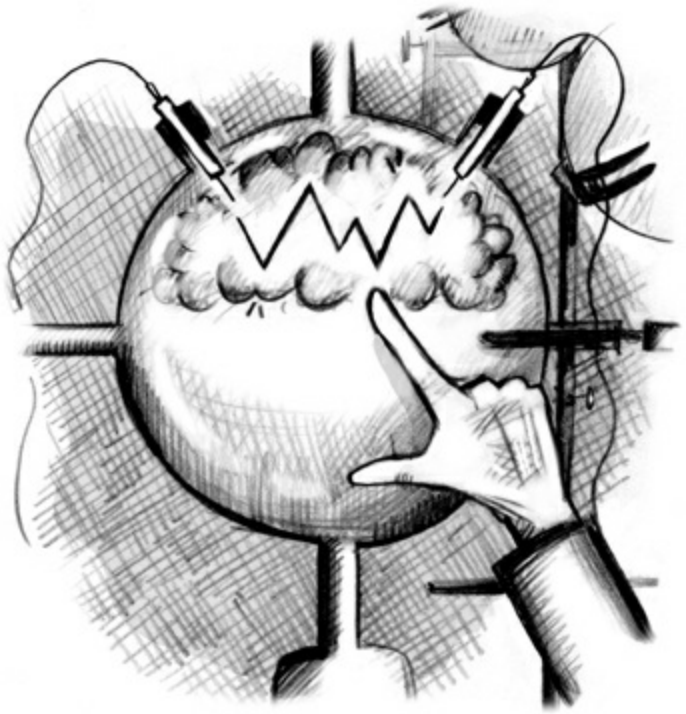
"Well, how were we supposed to know that?" moaned Whippet.

But Dr. Reeper ignored him. "This isn't a real volcano, obviously," he continued, pointing at the small homemade volcano, which had smoke erupting from the crater at its top.

THE EARLY ATMOSPHERE

- The Earth's atmosphere hasn't always been as it is today. Were we to travel back 3.5 billion years (to when the Earth was about 1 billion years old), we would not be able to breathe.
- Today, our atmosphere is made of approximately 78% nitrogen, 21% oxygen, and 0.93% argon. The remaining 0.07% is mostly carbon dioxide (0.04%) and a mixture of neon, helium, methane, krypton, and hydrogen.
- The atmosphere 3.5 billion years ago contained no oxygen. It was mostly made of nitrogen, hydrogen, carbon dioxide, and methane, but the exact composition is not known. What is known, however, is that huge volcanic eruptions occurred around that period, releasing steam, carbon dioxide, ammonia, and hydrogen sulphide in the atmosphere. Hydrogen sulphide smells like rotten eggs and is poisonous when used in large amounts.

"Yeah, like, obviously," murmured Ringo. "I mean, like we hadn't noticed that."



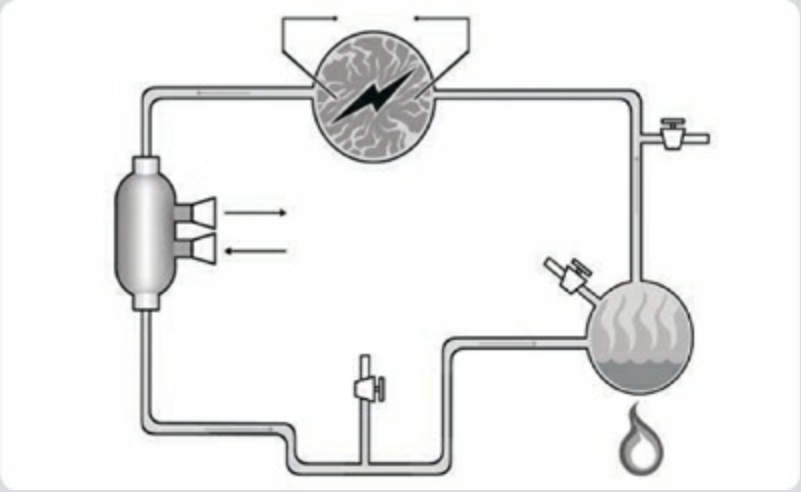
“It’s just a little chemical reaction that emits the same kind of fumes,” Dr. Reeper enthused, seemingly unaware of Ringo’s rudeness. “So, I made it look like a little volcano with mud from the garden. I very much like it.”

The fumes from the volcano puffed upward into a glass ball, where they mixed with water vapor. This came from another glass ball, in which water was being heated over a gas burner. When they mixed together, the fumes and vapor formed a little cloud inside the large ball. Dr. Reeper had built a device inside that cloud that produced electrical sparks.

As the mini-volcano puffed dark smoke upward, a little crackle of lightning shot across the cloud inside the ball. Dr. Reeper tapped the glass gently.

“You see, when lightning strikes clouds of gas, strange reactions occur, and scientists have discovered that these reactions can sometimes lead to the formation of the most basic chemicals that life on Earth needs. These chemicals are called amino acids.”

MILLER & UREY’S EXPERIMENT



- In 1953 two scientists named Stanley Miller and Harold Urey were working on the origin of life on Earth. They believed the ingredients for life could appear out of completely natural phenomena in the Earth's early atmosphere.
- At that time (the 1950s) scientists had an idea about the kinds of chemical compounds the early atmosphere probably contained. They also knew that lightning was frequent. So Miller and Urey conducted an experiment in which they stroked these chemical compounds with electric sparks (to mimic lightning). Astonishingly, they discovered that they had created special organic compounds.
- Organic compounds are molecules that contain carbon and hydrogen. Some of these molecules, like the ones called amino acids, are necessary for life. Miller and Urey's experiment produced amino acids and gave hope to the scientific community that it may be possible to create life in a laboratory.
- Today, however, more than fifty years after Miller and Urey, such a creation has yet to be achieved, and we still do not know how life appeared on Earth. But we have been able to create, under special circumstances that mimic conditions on Earth a long time ago, more and more of the basic chemical building blocks of life.

"But why?" said Whippet. "What do you want them for?"

"Because," said Dr. Reeper, a sinister look crossing his face, "I am trying to create life itself."

"What a load of garbage," said Ringo under his breath.

But Zit sounded more intrigued than his leader did. "Sir," he said thoughtfully, "there's lots of life around us. Why would you need to make some more?"

"There is on *this* planet," replied Dr. Reeper, giving him an approving look. "But what about on another planet? What about another planet where life has not yet emerged? What would happen if we went there and took life with us?"

"Sounds a bit stupid to me," said Ringo. "If we go to a new planet, there won't be anything there, so there'll be nothing to do."

"Oh, unimaginative boy!" cried Dr. Reeper. "We would be masters of the planet! It would be all ours."

"But hang on a minute," said Whippet, somewhat suspiciously. "Where is this planet? And how are we gonna get there?"

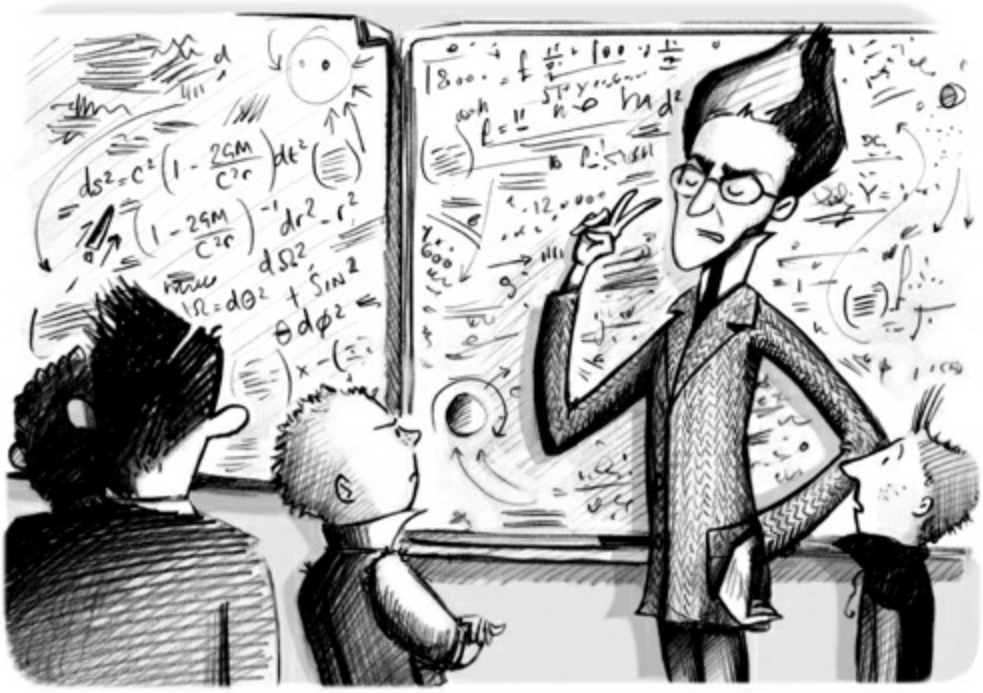
"All good questions," said Dr. Reeper. "Come and have a look over here."

He walked over to the other side of the room, which was covered with a huge picture of space and stars. In one corner there was a red circle around a couple of little white dots with lots of arrows pointing at it. Near the red circle was another circle drawn in green—except that the green circle seemed to be empty. Next to the map were white boards covered with diagrams and crazy-looking scribbles. There seemed to be some kind of link between the scribbles and the star poster.

Dr. Reeper cleared his throat as the boys gathered around him. "This, children, is the future!" he said, waving his hands toward the crazy scribbles. "*Our* future! I expect," he continued, "you have never given a moment's thought to what I do when I'm not teaching you at school."

The group nodded, agreeing that no, they hadn't.

"So let me save you the trouble. I"—Dr. Reeper drew himself up to his full height so he towered over the boys—"am an expert on planets. I have worked all my life on planets, trying to find new ones."



“Did you find any?” asked Whippet.

“I found many,” replied Dr. Reeper proudly.

“But don’t we know them all, like Mars or Saturn or Jupiter?” asked Whippet again.

The other boys nudged each other. “Oooh,” whispered Tank. “Who’d have thought it? Whippet’s trying to be teacher’s pet.”

“No, I’m not,” huffed Whippet. “It’s just interesting, that’s all.”

“Aha!” said Dr. Reeper. “You are right! We know all the planets that are around the star closest to the Earth, the star that we call the Sun. But I am looking for other ones! I am looking for planets that are around other stars, planets that are very far away. You see,” he continued, enjoying having his class—or a few of them, anyway—actually listen to what he said for a change, “a planet is not an easy thing to find. I have spent years collecting data from telescopes, and I have looked at hundreds of planets in space. Unfortunately, most of the planets we have found so far are too close to their sun, making them too hot to support life and be habitable.”

“That’s not gonna help then, is it?” said Whippet, sounding disappointed.

Dr. Reeper pointed at his star map. “But wait,” he said, “I haven’t told you everything yet. Out there in space are extraordinary, fantastic things,

things that until now we have only been able to dream about. But the time is coming when all that will change, when man will go out across the cosmos and inhabit the whole Universe. Just imagine, boys, if we were the first to discover a whole new planet."

EXOPLANETS

- An exoplanet is a planet that revolves around a star other than the Sun.
- So far, more than 240 exoplanets have been detected in space, and new ones are discovered every month. This may not sound like a lot in comparison to the hundreds of billions of stars that are known to exist within the Milky Way alone, but this small number is mostly due to the difficulty of detecting them. A star is easy to detect because it is huge and emits light, whereas a planet is much smaller and only reflects the light of its star.
- Most of the techniques used to detect exoplanets are indirect, meaning that the exoplanet is not seen directly but the effects of its existence are. For instance, a big exoplanet will attract its star via gravity and will make the star move a bit. This star movement can be detected from Earth. One hundred sixty-nine exoplanets have been found this way, and these are really big, much bigger than Jupiter, the largest of the giant planets of our Solar System.
- The *Corot* satellite launched in December 2006 is able to detect tiny changes in the amount of light shining from a star. Such changes can occur when an exoplanet (even a small one) passes in front of a star. The quality of the detectors *Corot* is equipped with should allow for the discovery of exoplanets much smaller than before, down to about twice the size of the Earth. We have not yet seen any Earth-size exoplanets.

Only four exoplanets have been detected by direct imaging (i.e., by taking pictures) so far. These also are huge.

"That's like that TV show," said Zit cheerfully, "where everyone gets on a spaceship and goes to a new planet, where they get eaten by green aliens."

"No, it's not like that at all!" snapped Dr. Reeper. "You must learn to distinguish between science fiction and science fact. This planet here that I have found"—his finger traced the red circle drawn in the corner of the map around the white dots—"could be the new Planet Earth."

"But it looks like this new planet is pretty far away," said Whippet doubtfully.

"Yes, it is," agreed the teacher. "It is very, very, very far. So far away that if I had a phone conversation with someone there, I would need to wait several years between the time I ask a question and the time they reply, just because of the time it would take my question to travel there and their reply to travel back again."

"Did you talk with them on the phone?" the four kids said in unison.

"No, no, no!" said Dr. Reeper in an annoyed voice. "I said *if* I had. Don't you understand anything?"

"But *is* there anyone out there?" Zit persisted, hopping from foot to foot in excitement.

"That's hard to tell," said Dr. Reeper. "So I need to get out there and have a look."

"How are you going do that?" asked Ringo, who was feeling interested now in spite of himself.

Dr. Reeper gazed into the distance over their heads. "I have been trying all my life to get into outer space," he said. "Once, I nearly made it. But someone stopped me, and I have never been able to forgive him. It was the greatest disappointment of my life. Ever since then, I've been looking for a way. And now I've got another chance. That's where you boys come in." Dr. Reeper reached for the letter in his pocket. "Here is the letter that we spoke about in the driveway. Take it to George's friend. His name is Eric. Drop it in his mailbox and make sure no one sees you," said the teacher as he handed the letter over to Ringo.

"What's in it?" asked Ringo.

"Some information," replied Dr. Reeper. "Information is power, boys. Always remember that." Facing his star map and pointing with his burned hands toward the red circle drawn around the bright dots, he

said, "And the information contained in this letter is the space location of this amazing new planet Earth number two."

Whippet opened his mouth to speak, but Dr. Reeper interrupted him.

"Drop off the letter *tonight*," he said, cutting short any questions. "And now it's time for you to go," he added, hurrying them back out into the hallway.

"What about the cash?" asked Ringo sharply. "When do we get our money?"

"Come and see me on Monday at school," said Dr. Reeper. "If you've delivered the letter, I will pay you handsomely. Now go."

At lunchtime on Monday, George was sitting quietly in the school cafeteria, minding his own business. He got out his lunchbox and looked inside it, wishing he could have bags of chips or chocolate bars or orange soda like the other kids. Instead, he had a spinach sandwich, a hard-boiled egg, yet more broccoli muffins, and some apple juice pressed by his mother. He took a large bite of his sandwich and sighed. He wished his parents would understand that he wanted to save the planet as much as they did, but he wanted to do it in his own way. It was all very well for his parents to lead their alternative lifestyles because they only hung around with their friends, who were just like them. They didn't have to go to school every day with people like Ringo and his gang laughing at them because they wore funny clothes and ate different food and didn't know what happened yesterday on the television. He tried to explain this to his dad, but all he heard back was, "We all have to do our part, George, if we're going to save the Earth."

George knew this was true; he just thought it was unfair and rather pointless that his *part* meant him being a laughingstock at school and not having a computer at home. He had tried to explain to his parents how useful a computer could be.

"But, Dad," he had pointed out, "there's stuff you could do on a computer too, stuff that would help you with your work. I mean, you could get lots of information from the Internet and organize your marches with e-mail. I could set it all up for you and show you how." George had gazed hopefully at his dad. He thought he saw a spark of interest in his dad's eyes, but it flickered and died.

"I don't want to talk about it anymore," his dad had said. "We're not getting a computer and that's final."

That, thought George as he tried to swallow his lump of spinach sandwich, was why he had liked Eric so much. Eric had listened to George's questions and given him honest replies—ones that made sense to George. George wondered if he dared stop by and see Eric later that afternoon. There was so much he wanted to ask him, and also he really wanted Eric to check his talk for the competition.

Just before lunch he had finally summoned up the courage to sign up on the board for the science competition, the one with a computer as the first prize. Under "Topic" he had written, *My Amazing Rock from Outer Space*. It looked great as a title, although George still wasn't sure

his talk was any good. He'd taken his lucky rock from outer space out of his pocket while he stood in front of the bulletin board, but to his horror had found it was crumbling into dust! It was his lucky charm—the little piece of the Solar System he had picked up near Saturn. The principal had been delighted to see George writing his name on the board.

He had bounced up as George filled out the form. "There you go, George! That's the spirit! We'll show them, won't we?" He beamed at George. "We can't just let Manor Park walk away with every trophy in the area, can we now?" Manor Park was a private school that hogged all the prizes and won all the sports matches with boring regularity.

"Yes, sir," said George, trying to stuff his outer-space rock back into his pocket. But the sharp-eyed principal spotted it.

"Oh dear, a handful of dirt," he said, grabbing a nearby trash can. "Toss it in here, George. We can't have you going off to lunch with a pocket full of dust." When George just stood there, rooted to the spot, the principal rattled the can impatiently under his nose. "I was just the same as a boy," he said, a claim George doubted. As far as he was

concerned, the principal had never been a boy; he'd been born wearing a suit and making enthusiastic comments about the Under-12 Football League. "Pockets full of nonsense. Drop it in and off you go."

Reluctantly George dropped the gray, crumbly remains of his most treasured possession into the can. He promised himself he would come back later and try and save it.

As George munched his way through his sandwich, he thought about Eric and outer space and the competition the next day. While he was thinking, a hand crept over his shoulder and snatched a mufin out of his lunchbox.

"Yum! This looks good!" said Ringo's voice behind him. "Georgie's famous muffins!" Ringo took a large bite, then made a spluttering sound as he spat it out.

George didn't need to look around to know that the whole dining room would be staring in his direction and snickering.

"Ugh, that's gross," said Ringo, making fake gagging sounds behind him. "Let's see if the rest is just as horrible." His hand made another dive for George's lunch, but George had had enough. As Ringo's big paw rooted inside the handmade wooden box in which he kept his sandwiches, George slammed the lid down on his fingers.

"*Ow!*" squealed Ringo. "Ow! Ow! Ow!" George opened the box again, allowing Ringo to pull out his hand.

"What's all this noise?" said the teacher on lunchroom duty, walking over. "Can't you boys manage to do anything without causing trouble?"

"Sir, Doctor Reeper, sir!" screeched Ringo, who was cradling his damaged hand. "I was just asking George what he had for lunch when he attacked me, sir! You better give him double detention, sir, for the rest of term! He's broken my hand, sir!" Ringo smirked at Dr. Reeper, who gave him a cool glance.

"Very well, Richard," he said. "Go and see the school nurse and come to my room when she's looked at your hand. I'll deal with George." He

ordered him away with a point of his finger, and Ringo slouched away, grinning to himself.

The rest of the dining room had fallen silent while they waited for Dr. Reeper to announce George's punishment. But Dr. Reeper surprised them. Instead of giving George an earful, he just sat down next to him on the long bench. "Go on!" He waved a red hand at the rest of the room. "Get on with your lunches. The bell will ring soon enough, you know." After a couple of seconds, the usual hubbub started up again as everyone lost interest in George and went back to his or her conversations.

"So, George . . . ," said Dr. Reeper chummily.

"Yes, Doctor Reeper?" asked George nervously.

"How *are* you?" Dr. Reeper sounded as though he really wanted to know.

"Oh, um, fine," said George, somewhat taken aback.

"How are things at home?"

"They're . . . well . . . okay," said George cautiously, hoping Greeper wasn't going to ask him about Cosmos.

"And how about your neighbor?" said Dr. Reeper, trying and failing to sound casual. "Have you seen him lately? Is he around at the moment? Or perhaps he has gone away . . ."

George tried to figure out what answer Dr. Reeper wanted so he could give him the opposite one.

"Perhaps people on the street are wondering where he's gone," went on Dr. Reeper, sounding spookier and spookier. "Maybe it seems that he has just disappeared! Vanished from view! No idea where he might be! Is that it?" He peered hopefully at George, who was now convinced that there was something very wrong with Dr. Reeper. "Almost as though"—Dr. Reeper sketched a shape in the air with his hands—"he just flew off into outer space and never came back. Hmm? What about that, George? Is that what's happened, would you say?" The teacher was gazing at George, obviously wanting to hear that Eric had somehow melted away into thin air.

"Actually," said George, "I saw him this morning." He hadn't, but it seemed very important to tell Dr. Reeper he had.

"Drat," muttered Dr. Reeper angrily, suddenly getting to his feet. "Miserable boys." He walked off without even bothering to say goodbye.

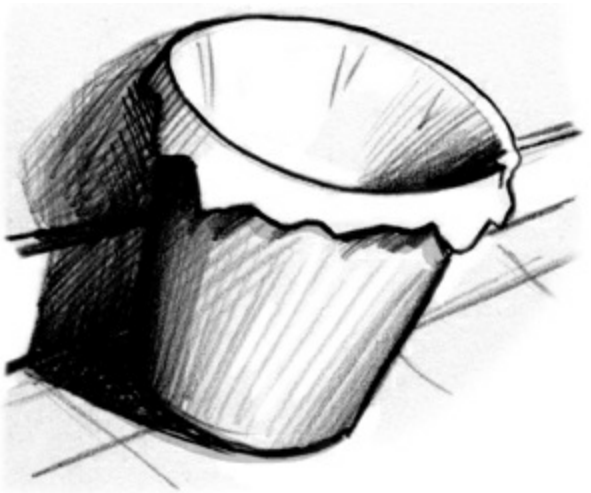
George closed up his lunchbox and decided to head back to the bulletin board so that he could look for his rock in the trash can. As he hurried down the corridor, he passed Dr. Reeper's office. He heard raised voices and stopped to listen through the door for a second.

"I told you to deliver the note!" rasped the familiar voice of Dr. G. Reeper.

"We did?" whined a boy's voice, which sounded all too like Ringo's.

"You couldn't have," insisted Dr. Reeper. "You just couldn't have."

George would have stayed to listen longer, but then the bell rang and he desperately wanted to find his special outer-space rock before class began. However, when he got back to the can, it had been emptied. There was only a clean plastic liner inside it. Saturn's mini-moon had gone.



It was pouring when George walked home that afternoon. Cold splats of water hurtled down from the dark gray sky as he trudged along. Cars dived through the big puddles at the edge of the road, sending tidal waves of dirty water swooshing over the pavement. By the time George reached his own street, he was shivering with cold. He got as far as Eric's door and hovered anxiously on the doorstep. He was longing to ring the bell and ask the scientist to help him with his talk for the next day. And he also wanted to find out why Dr. Reeper might think he had disappeared. But he was worried Eric would still be angry with him and send him away. To ring or not to ring? What to do? The skies were getting darker and darker, and suddenly he heard a huge clap of thunder. The rain got even heavier, and George made up his mind. It was important to ask Eric about his talk and tell him about Dr. Reeper. He decided to be brave and ring the bell.

Bing-bong! He waited for a few seconds and nothing happened. Just as he was wondering whether to ring again, the door flew open and Eric's head popped out.

"George!" he said in delight. "It's you! Come in!" He reached out a long arm and whisked George inside, shutting the front door with a brisk slam. To his great surprise, George found himself standing in Eric's hallway, his wet coat dripping onto the bare floorboards.

"I'm so s-sorry," he stammered.

"What for?" said Eric, looking a little startled. "What have you done?"

"About Annie . . . and the comet . . . and Cosmos," George reminded him.

"Oh, that!" said Eric. "I'd forgotten all about it! But now that you mention it, don't worry. Annie told me that it was her idea, not yours, and that she made you go into outer space. I take it that's true?" He looked at George over his heavy glasses, his bright eyes twinkling.

"Um, yes, actually, it is," said George with relief.

"So really," continued Eric, "I should be saying sorry to *you*, for jumping to the wrong conclusion. Instead of considering all the evidence, I just applied some common sense—otherwise known as prejudice—and came up with a totally wrong answer."

George didn't really understand all of this, so he just nodded. From the library he could hear the sound of voices.

"Are you having a party?" he asked.

"Well, yes, a kind of party," said Eric. "It's a party of scientists, so we like to call it a conference. Why don't you come in and listen? You might be interested. We're talking about Mars. Annie's had to miss it, I'm afraid, as she's still at her granny's. You can tell her about it if you stay."

"Oh yes, please!" said George, forgetting in his excitement to ask about his talk or tell Eric about Dr. Reeper. As he took off his wet coat and followed Eric into the library, he could hear a woman's voice.

". . . this is the reason why my colleagues and I strongly advocate a thorough search of our closest neighbor. Who knows, in the end, what we may find by digging underneath the red surface . . ."

Eric and George tiptoed into the library. It looked quite different from the last time George had seen it. All the books were neatly arranged on shelves, pictures of the Universe hung on the wall in frames, and in the corner lay a pile of carefully folded space suits. In the middle of the room, on rows of chairs, sat a group of scientists who were all different

shapes and sizes and looked like they had come from all over the world. Eric showed George to a seat, a finger pressed to his lips to show that George should keep very quiet.

Standing at the front of the room was the speaker, a tall, beautiful woman with a braid of thick red hair so long it reached right down past her waist. Her green eyes glittered as she smiled at the scientists gathered for the conference. Just above her head, Cosmos's window portal was showing a red planet. The red-haired speaker continued her talk.

“Isn’t it highly probable that evidence of life, had life existed on Mars in long-ago times, is not there for us to find on the surface? We should never forget that every now and then, sandstorms radically alter the planet’s surface, burying deeper and deeper beneath layers of inorganic dust the entire past of our red neighbor.”

As she spoke, they all saw through Cosmos’s window an enormous sandstorm that took over the whole surface of the red planet.

Eric bent his head toward George and whispered, “What she means is that even if there was once life on Mars, we wouldn’t see it on the surface today. In fact, I can tell you, this scientist strongly believes there was life on Mars at some stage. She sometimes even declares that there still *is* life there. That would be one of the most amazing discoveries of all time. But we can’t say much more than that at this stage. We need to get onto this beautiful red planet ourselves to find out.”

George was about to ask why Mars was red, but realized that the speaker was finishing her talk.

“Do you have any questions before we have a short break?” she asked her audience. “After that we will discuss our last and most important issue.”

George felt very sad that he had only heard the end of the talk, so he raised his hand to ask something.

Meanwhile all the scientists were murmuring, “Ooh, snacks!” None of them wanted to ask a question.

“So let’s have our well-deserved break then,” said Eric, who hadn’t spotted George’s raised hand.

The scientists rushed over to the tea cart in the corner of the room, anxious to nab all the jelly doughnuts before the others could grab them.

But the red-haired speaker had noticed George’s thin arm waving in the air. “Well, well,” she said, looking at George. “Colleagues, we do have a question after all, and it’s from our new fellow down here.”

The other scientists turned and looked at George. When they saw how small he was, they all smiled and brought their coffee and pastries back to their seats.

“What would you like to know?” asked the speaker.

“Um . . . please . . . if you don’t mind,” said George, suddenly feeling very shy. He wondered if his question was a really stupid one and whether everyone would laugh at him. He took a deep breath. “Why is Mars red?” he asked.

"Good question!" said one of the other scientists, blowing on his tea. George breathed a sigh of relief. Professor Crzkzak, the red-haired speaker, whose name no one ever managed to pronounce, nodded and started to give George an answer.

“If you walk through the hills and mountains here on Earth, you can sometimes see red patches of ground that are not covered with any plants. This is true, for instance, in the Grand Canyon in the United States. But there are many other places where this is also the case. The ground is this red color because there is iron there that has rusted. When iron becomes oxidized, which is another way of saying that it has rusted, it becomes red. It is because of the presence of oxidized iron, I mean rusted iron, that the surface of Mars is red.”

“Do you mean that Mars is made of iron?” asked George.

“Well, not quite. Since we sent some robots to Mars, we know that it is just a thin layer of rusted iron powder that gives Mars its red color. It seems that underneath the layer of red dust, the surface of Mars may be quite similar to the surface of the Earth—without the water, that is.”

“So, there is no water on Mars?”

“There is, but the water we know of is not liquid. On Mars it’s far too hot during the day—any water turns into vapor and is lost. So, the only places where water can remain are those where the temperature always remains cold, day and night, so that water can freeze and remain frozen. This happens at the poles. At the north pole of Mars we have found large

quantities of frozen water: ice. It is the same on Earth, where large ice reservoirs can be found at the poles, in the Arctic and the Antarctic. Does that answer your question?"

MARS

Mars is the fourth closest planet to the Sun.

Average distance to the Sun: 141.6 million miles (227.9 million km)
Diameter at equator: 4,228.4 miles (6,805 km)
Surface area: 0.284 × Earth's surface area
Volume: 0.151 × Earth's volume
Mass: 0.107 × Earth's mass
Gravity at the equator: 37.6% of Earth's gravity at Earth's equator

Mars is a rocky planet with an iron core. In between its core and its red crust, there is a thick rocky layer. Mars also has a very thin atmosphere mostly made of carbon dioxide (95.3%), which we cannot breathe. The average temperature on Mars is very cold: around -76°F (-60°C).

The largest volcanoes in the Solar System are on the surface of Mars.

- The largest one of all is called Olympus Mons. From one side to the other, it spreads over a disc-shaped area 403 miles (648 km) wide and is 15 miles (24 km) high. On Earth the largest volcano is on Hawaii. It is called Mauna Loa and reaches 2.54 miles (4.1 km) in height from sea level—though if one measures it from where its base starts at the bottom of the ocean, it rises 10.5 miles (17 km) high.

Since Mars has an atmosphere, one can talk about Martian weather. It very much resembles what the weather would be like on a very cold desert-covered Earth. Sandstorms are common, and huge cyclonic storms of water-ice clouds measuring more than ten times the size of the United Kingdom have been observed.

- Mars is believed to have once been at the right temperature for liquid water to flow on its surface and carve the channels we can now see there. Today, the only confirmed water presence there is in the ice caps at the poles, where ice-water is mixed with solid carbon dioxide.
- In December 2006, however, scientists looking at pictures of newly formed gullies on the Martian surface suggested a striking possibility: liquid water may still be present on Mars, buried deep down under its surface.

Mars has two small moons: Phobos and Deimos.

"Yes, thank you!" said George. He was just busy thinking up another question when Eric stood up at the front of the room, next to the speaker.

"Thank you, Professor Crzkzak," he said, "for your very interesting paper on Mars."

Professor Crzkzak bowed and went to take her seat.

"Dear friends and colleagues," continued Eric. "Before we move on to the last and most important issue we have to discuss, let me thank you all for making the effort to get here. Some of you have come from far across the globe, but I know the talks we have heard today have made the journey worthwhile. I'm sure I don't need to remind you how important it is that the existence of Cosmos stays a closely guarded secret."

The group nodded its agreement.

“Now,” continued Eric, “the question we all came to answer is a question of fundamental interest for everyone who is involved in science. We all know far too well how it can be used for evil purposes, and that is why we have all taken the Oath of the Scientist, so that science is used only for the good of humanity. But we are now facing a dilemma. As you heard in the news and saw at the evironmental march on Saturday, more and more people are concerned about the state of the Earth. So, the question we now have to answer is: Should we concentrate on finding ways to improve life on Earth and face its problems, or should we try to find another planet for humanity to inhabit?”

All the scientists in the room were silent and looked very serious. George watched them as they wrote an answer on a little piece of paper. Eric then collected the papers in a hat. In total, including Eric and the red-haired speaker, eight scientists had voted. Eric then started to open up the papers one by one.

“The Earth.”

“The Earth.”

“Another planet.”

“Another planet.”

“Another planet.”

“The Earth.”

“The Earth.”

“Another planet.”

“Well, well,” said Eric. “It seems we have a split vote.”

The red-haired Professor Crzkzak put up her hand. “May I make a suggestion?” she asked. Everyone else nodded. She got to her feet. “George,” she said, addressing the boy directly, “we may lack a bit of perspective on this matter, because we are all specialists in our fields. So you could maybe tell us what you think about it.”

All the scientists were looking at him now. George felt very shy and stayed silent for a few seconds.

“Say what you really think,” whispered Professor Crzkzak.

Twisting his fingers in his lap, George thought about his parents and the green campaigners. He then thought about the excitement of traveling in space and trying to find another home out there. And then he heard himself say to the scientists, “Why can’t you do both?”

"George, you are absolutely right," Eric said as they waved good-bye to all the scientists, who were leaving now that the conference had come to an end. George and Eric went back into the library, which was covered in cake crumbs, half-drunk cups of coffee, old pens, and conference papers folded into airplane shapes. "We need to work on saving this planet *and* looking for a new one. We don't have to do one or the other."

"Do you think you will?" asked George. "You and your friends? Do both, I mean?"

"Oh, I think so, yes," said Eric. "Maybe we could invite your parents to our next conference? Do you know, George, I heard your father's talk at the climate-change protest march the other day. Maybe he has some good ideas we could use?"

"Oh no, don't do that!" said George, panicking. He wasn't at all sure that his father would approve of Eric and his friendly scientists. "I don't think he'd like that."

"He might surprise you," said Eric. "We all need to work together to save the planet if we're to get anything done." He started to clear up some of the mess the scientists had made. They seemed to have left behind an extraordinary number of things: jackets, hats, sweaters—even a shoe.

"It was very nice of you to drop by to apologize," said Eric, gathering together a great armful of abandoned clothing.

"Well, actually," admitted George, "that's not quite why I came around." Eric dumped the clothes in a corner of the room and turned back to look at him. "I signed up for a science competition," the boy continued nervously. "It's sort of like your conference, except it's kids giving the talks. And there's a big computer as first prize. I've tried to

write something to say, but I'm really worried I've made lots of mistakes and everyone will laugh at me."

"Yes, Annie told me about your competition," said Eric, looking serious. "And I've got something that might help you. Funnily enough, I had an idea after your comet ride. I decided to start writing a book about the Universe for you and Annie—I've made some notes. They might help you with your science presentation." He picked up a plate of cookies. "Have one of these. Brain food."

George helped himself to what was left of the cookies.

"How about this for an idea?" said Eric thoughtfully. "If you could just give me a hand to get my library straightened up a bit—Annie's left me strict instructions that I'm not to make the house messy while she's away—then we can talk about your science presentation and I'll go through the notes I made for you. Does that sound like a fair deal?"

"Oh yes!" said George, delighted by Eric's promise. "What would you like me to do?"

"Oh, perhaps a little sweeping or something like that," said Eric vaguely. He leaned casually on a wobbly pile of chairs as he spoke, accidentally pushing them over with a loud crash.

George burst out laughing.

"You can see why I need help," said Eric apologetically, but his eyes were twinkling with laughter. "I'll pick up these chairs, and maybe you could brush a bit of this mud off the floor? Would you mind?"

The carpet was covered in footprints left by the scientists, none of whom ever remembered to wipe their feet on the doormat.

"Not at all," said George, stuffing the last cookie into his mouth and running off to the kitchen, where he found a dustpan and brush. He came back into the library and started to swish away at some of the worst bits of dirt. As he worked, a piece of paper stuck to his brush. He picked it off the bristles and was about to throw it away when he realized it was a letter, addressed to *Eric*. There was something strangely familiar about the handwriting.

"Look at this!" He passed the note to Eric. "Someone must have dropped it." Eric took the piece of paper and unfolded it while George kept on sweeping. Suddenly he heard a great shout.

"Eureka!" cried Eric. George looked up. Eric was just standing there, piece of paper in hand, a joyous look on his face.

"What's going on?" George asked him.

"I've just been given the most amazing piece of information!" cried Eric. "If this is correct . . ." He peered at the piece of paper again, holding

it up very close to his thick glasses. He muttered a long string of numbers to himself.

"What is it?" asked George.

"Hang on." Eric seemed to be calculating something in his head. He ticked off a series of points on his fingers, scrunched up his face, and scratched his head. "Yes!" he said. "Yes!" He stuffed the paper into his pocket, then picked George up off his feet and whirled him around. "George, I've got the answer! I think I know!" Suddenly dropping him again, Eric went over to Cosmos and started typing.

"What do you know?" said George, who was a little dizzy.

"Great shooting stars! This is fantastic!" Eric was frantically tapping on the computer's keyboard. A huge flash of light shot out of Cosmos's screen into the middle of the room, and George saw that the great computer was once more making a doorway.

"Where are you going?" George asked. Eric was struggling into a space suit, but he was in such a hurry that he put both feet into one pant leg and fell over. George hauled him up again and helped him on with the suit.

"So *exciting*!" said Eric as he buckled it up.

"What is?" said George, who was now feeling rather alarmed.

"The letter, George. The letter. This might be it! This might be what we've all been looking for."

"Who was the letter from?" asked George, who had a bad feeling in his stomach, although he didn't know why.

"I'm not sure," admitted Eric. "It doesn't really say."

"Then you shouldn't trust it!" said George.

"Don't be silly, George," said Eric. "I expect it was written by someone at the conference who wanted me to check out the information using Cosmos. I expect they wanted to know it was correct before they announced it to the whole scientific community."

"Then why didn't they just ask you directly? Why write a letter?" persisted George.

"Because, because, because," said Eric, sounding a little annoyed. "They probably had a good reason, which I'll find out when I get back from my trip."

George saw that Cosmos's screen was now covered in long strings of

numbers. “What are those?” he asked.

“Those are the coordinates of my new journey,” said Eric.

“Are you going now?” asked George sadly. “What about my science presentation?”

Eric stopped in his tracks. “Oh, George, I am sorry!” he exclaimed. “But I really have to go. It’s too important to wait. Your talk will be fine without me! You’ll see . . .”

“But—”

“No *but*s, George,” said Eric, putting on his glass space helmet and speaking in his funny space voice once more. “Thank you so much for finding that letter! It has given me a vital clue. Now I must go. G-o-o-o-d-b-y-e-e-e-e!”

Eric leaped through the portal doorway and was gone into outer space before George had time to say another word. The portal slammed shut behind him, and George was left alone in the library.

After the door to outer space closed, there was a moment of deathly silence in the library. It was broken by the sound of a tune playing very faintly in the background. George looked around to see who might be humming, but then he realized it was Cosmos, singing a little song to himself as he crunched the long strings of numbers that were flashing across his screen.

"*Ba-ba-ba-ba,*" tooted Cosmos.

"Cosmos," said George, who wasn't feeling very happy about Eric's sudden departure. He certainly didn't feel like whistling a merry tune.

"*Tum-ti-tum-tum,*" said Cosmos in reply.

"Cosmos," repeated George, "where has Eric gone?"

"*Tra-la-la-la*," Cosmos went on cheerfully, rolling reams of endless numbers across his screen.

"Cosmos!" said George once more, this time with more urgency. "Stop singing! *Where has Eric gone?*"

The computer stopped mid-hum. "He has gone to find a new planet," he said, sounding rather surprised. "I'm sorry you don't like my music," he continued. "I was just singing while I worked. *Pom-pom-pom-pom*," he started again.

"Cosmos!" yelled George. *"Where is he?"*

"Well, that's hard to say," replied Cosmos.

"How come you don't know?" said George, surprised. "I thought you knew everything."

"Unfortunately not. I don't know what I have not been shown."

"Do you mean Eric is lost?"

"No, not lost. His travels uncover new places for me. I follow him and I map the Universe."

"All right," said George, relieved to know Eric wasn't lost. "Fine. I suppose it must be something very special that he's gone to see, for him to rush off like that—"

"No, no," interrupted Cosmos. "Just another undiscovered part of the Universe. All in a day's work."

George felt a bit confused. If that was the case, why had Eric just shot off into outer space in such a great hurry? He'd thought that Eric was his friend and that, unlike other adults, he would explain what he was up to and why. But he hadn't. He had just gone.

For a split second George wondered about grabbing a space suit, asking Cosmos to open the portal, and joining Eric. But then he remembered how furious Eric had been after he and Annie had gone into outer space without his permission. He realized sadly that he would just have to go home now. Maybe Eric wasn't really his friend at all but just another grown-up who didn't think it mattered whether George understood stuff or not. He picked up his wet coat and school bag and made for the door; Cosmos was still humming his little melody in the background.

George opened Eric's front door to leave. He was just about to step out into the street when he had a sudden flash of memory. There had been *two* reasons he had come to see Eric today, and he'd only managed to tell him about one of them: the science competition. In all the excitement he'd completely forgotten to warn Eric about Dr. Reeper and his strange questions.

The letter, George now remembered. It's Greeper! George had overheard him asking the bullies to deliver a note! *That must be the letter Eric received! And Reeper asked if Eric had disappeared!* George turned and rushed straight back into the house, leaving the door wide open behind him.

In the library, Cosmos was still at work. On the desk in front of him, George spotted the letter that Eric had read with such joy. He read the whole thing, his hands shaking as he realized who had written it.

Dear Eric,

I understand that your longstanding quest to find new planets to inhabit isn't yet over.

I wanted to draw your attention to a very particular planet I happen to have found. It is roughly the size of the Earth and lies at about the same distance from its star as the Earth is from the Sun. As far as I know, there has never been such a strong candidate planet for humans to settle on. I am pretty sure it has an atmosphere like ours. An atmosphere we could breathe.

I'm not in a position to verify this information, but I very much look forward to hearing what you think of it. Please see below for the coordinates of that planet, or rather, a way to reach it.

Scientifically yours,

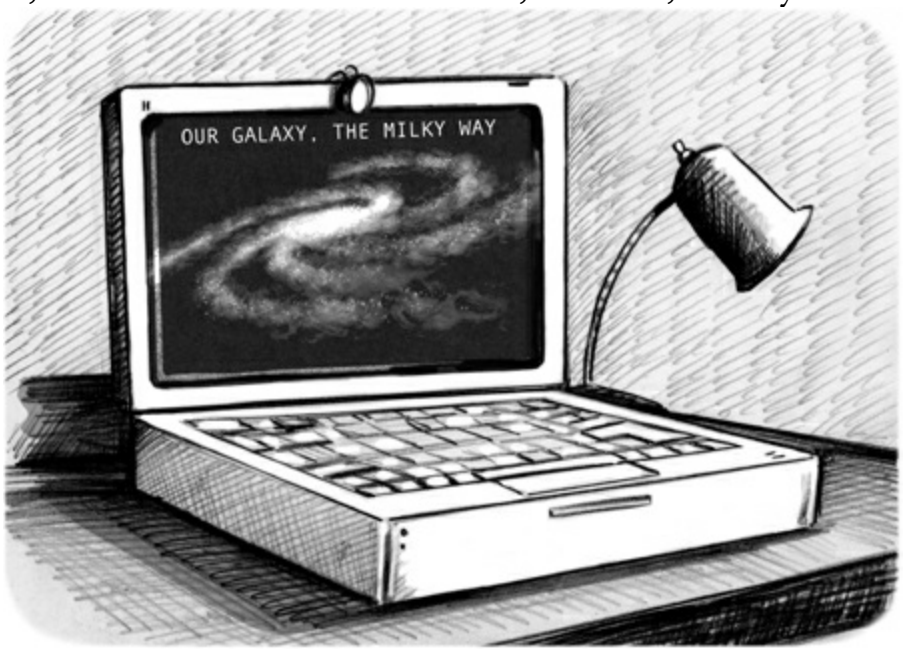
G.R.

George knew perfectly well who "G.R." was. The handwriting was all too familiar to him—he recognized it from his school reports, which usually said things like, *George will amount to nothing unless he learns to pay attention in class and stop daydreaming.* It was without doubt written by Dr. Reeper.

And Greeper knows Cosmos exists! It must be a trap! George thought. "Cosmos!" he said out loud, interrupting the computer, who was now humming "Twinkle, Twinkle, Little Star." "You have to take me to Eric right now! Can you find him?"

"I can try," replied Cosmos. A succession of images appeared on his screen. The first one looked like a starfish, with long arms twisted into some sort of spiral. Above it was written, OUR GALAXY, THE MILKY WAY.

"Our galaxy, the Milky Way, is made of approximately two hundred billion stars," Cosmos started. "Our star, the Sun, is only one of them—"



Chapter Twenty-three

"No!" howled George. "Not another lecture! I haven't got time—this is an emergency, Cosmos."

The picture of the Milky Way zoomed inside the spiral very quickly, as if Cosmos was offended by George's lack of interest. George could see that the spiral was indeed made of countless stars. The image whizzed past these until it reached a place where there didn't seem to be anything anymore. The picture stopped moving. The screen looked as if it had been cut in two. The bottom half of the screen was full of stars, the other half completely empty except for a thin line that was moving up toward the top edge of the screen. The empty part of the screen seemed to correspond to an unknown part of the Universe—an unknown part that the thin line seemed to be unraveling as it moved.

Pointing at the upper end of the line was a moving arrow with a little tag attached to it. The writing was so small, George could hardly read it.

"What does it say?" he asked Cosmos.

Cosmos didn't reply, but the tag grew bigger, and George saw the word ERIC written on it.

"*There he is!* Open the portal for me! Near that arrow," commanded George, pressing the ENTER key on Cosmos's keyboard.

"George is a member of the Order. Authorization granted. Space suit needed," Cosmos said in the mechanical voice he used to process orders.

George rummaged through the pile of space suits but he couldn't see the one he'd worn before. Eric's old space suits were all huge, so he reluctantly ended up wearing Annie's old pink one. It was a bit tight and he felt very silly, but as the only person he was going to see in outer space was Eric, he figured it didn't matter. Once George was snugly buckled into the sequined suit, Cosmos drew the doorway into outer space.

George reached forward and opened the door. Holding onto the portal frame with his hands, he leaned out to have a look around, his feet still anchored inside Eric's library. This part of outer space seemed very similar to the one he had seen before, but this time he didn't see any planets around him. It didn't look much like the image on Cosmos's screen—it wasn't cut in two at all. There were stars shining everywhere. Eric, however, was nowhere to be seen.

"*Eric!*" George shouted. "*Eric! Can you hear me?*"

There was no reply.

Maybe he was in the wrong place.

George looked back into the library, toward Cosmos's screen; the ERIC arrow was still there. Next to it he saw a new one that had GEORGE written on it. He realized that what he saw out of the doorway wasn't yet on Cosmos's screen. Cosmos had to process the information and only after he had done so, would it appear on the screen.

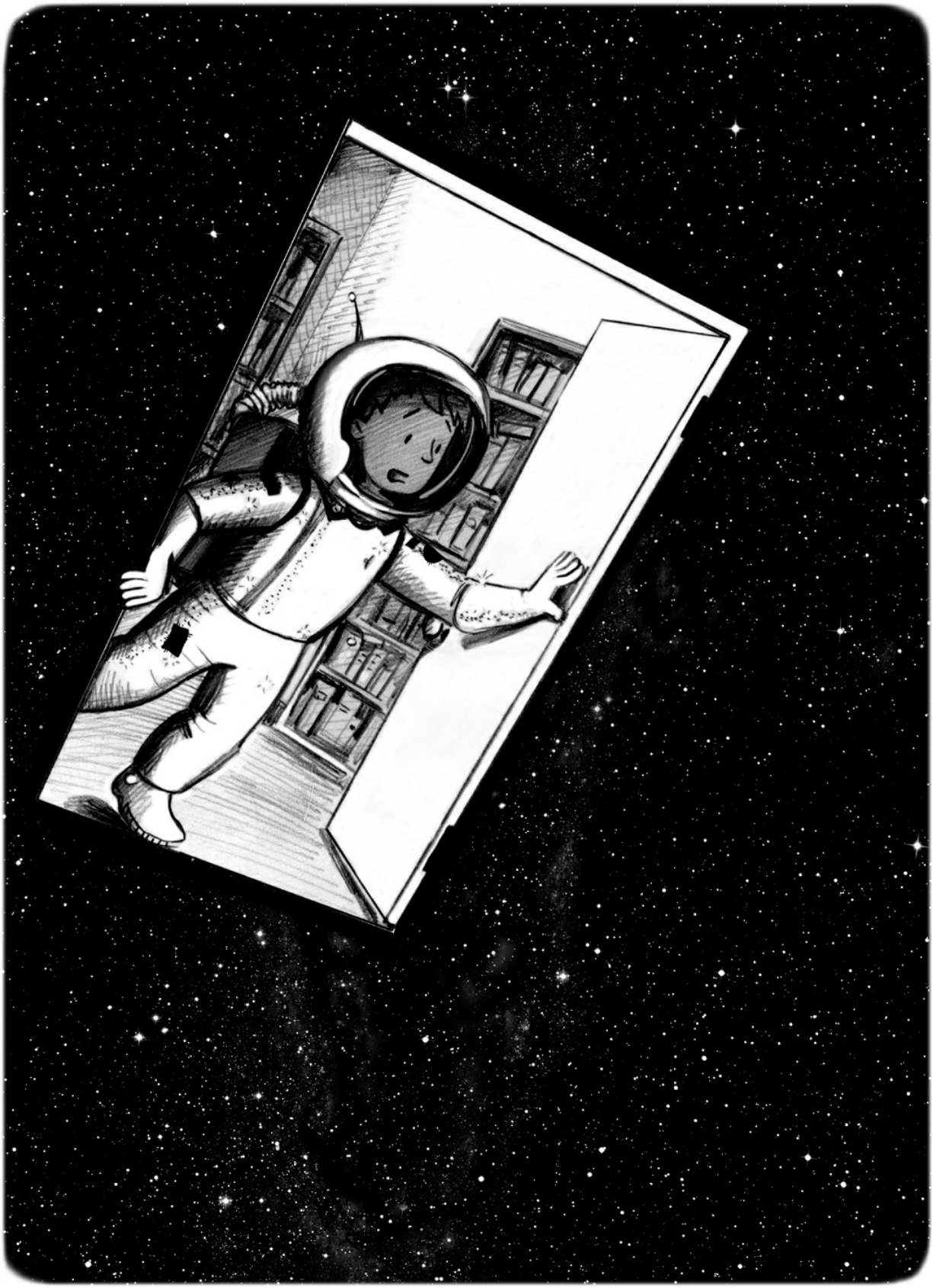
George leaned through the door into outer space once more, making sure not to fall. "*Eric! Are you there? Can you hear me?*" he yelled.

"Who's calling me?" replied a faint voice through the transmitter fitted inside George's space helmet.

"*Eric! Where are you? Do you see the door?*"

"Oh, hello! George! Yes, I can see you. Stop shouting now, you're hurting my ears. I'm coming straight toward you from your left."

George looked to his left and there it was, a little asteroid, gently traveling through space. Sitting on it was Eric, holding in each hand a rope attached to spikes he had planted in the rock. He looked very relaxed.



“What are you doing?” he asked.

“Come back!” cried George, trying to sound urgent without shouting. “It’s Greeper who sent you the letter! It’s my fault! I spoke to him about Cosmos!”

“George,” replied Eric firmly, “right now I’m working, so we’ll have to talk about this later. You definitely shouldn’t have mentioned Cosmos to anyone. Close the portal, George, and go home!”

"You don't understand!" said George. "Greeper is horrible! I know him, he's my teacher! It must be a trap! Come back now! Please! This morning he asked me if you had disappeared!"

"That's enough! And stop being silly! Look around—there's nothing dangerous at all," said Eric impatiently. "Now go home and forget about Cosmos. I'm not sure I should have shown you my computer after all."

George looked over at Eric's rock. In a few seconds it was going to be close enough for him to jump onto it. He took a few steps back into the library, paused for a second, and then ran toward the doorway, leaping through it as far toward the rock as he could.

"Holy planet!" he heard Eric say. "*George! Grab my hand!*"

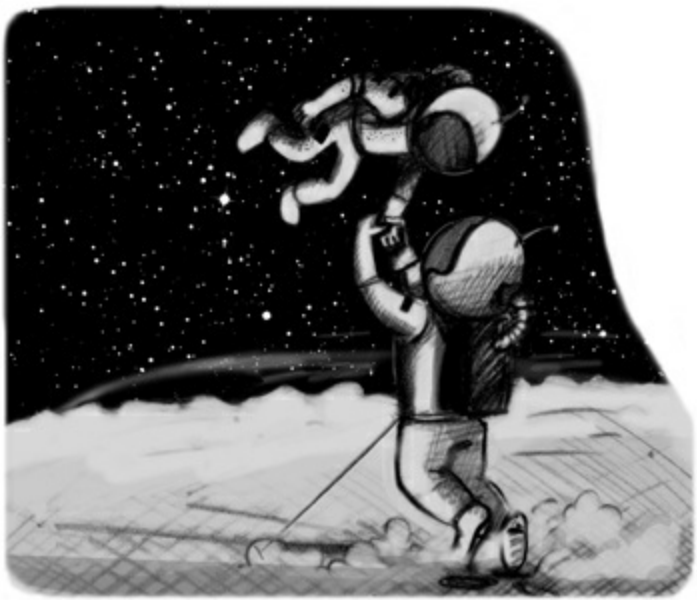
Chapter Twenty-four

As George flew through space, he just managed to hold on to Eric's hand. Eric hauled him onto the rock, sitting him down beside him. Behind them, the doorway back into Eric's library vanished.

"*George, are you crazy?!* If I hadn't caught your hand, you could have been lost in space forever!" said Eric, sounding furious all over again.

"But—," said George.

"*Silence!* I'm sending you back! *Now!*"



"*No!*" shouted George. "*Listen to me! This is really important.*"

"What is?" said Eric, suddenly aware that there was something very wrong in George's voice.

"What is it, George?"

"*You have to come back with me!*" babbled George. "I'm really, really sorry, and it's all my fault, but I told my teacher from school about Cosmos—I told Doctor Reeper and then he sent you the letter about the

planet!" Before Eric could say anything, George rushed on, "And this morning he asked me if you'd disappeared! He did! It's true! It's a trick, Eric! He's out to get you!"

"Greeper . . . Reeper! . . . I see!" said Eric. "So the letter is from Graham! He found me again."

"Graham?" asked George, astonished.

"Yes, Graham Reeper," Eric replied calmly. "We used to call him Grim."

"You *know* him?" George gasped with shock underneath his space helmet.

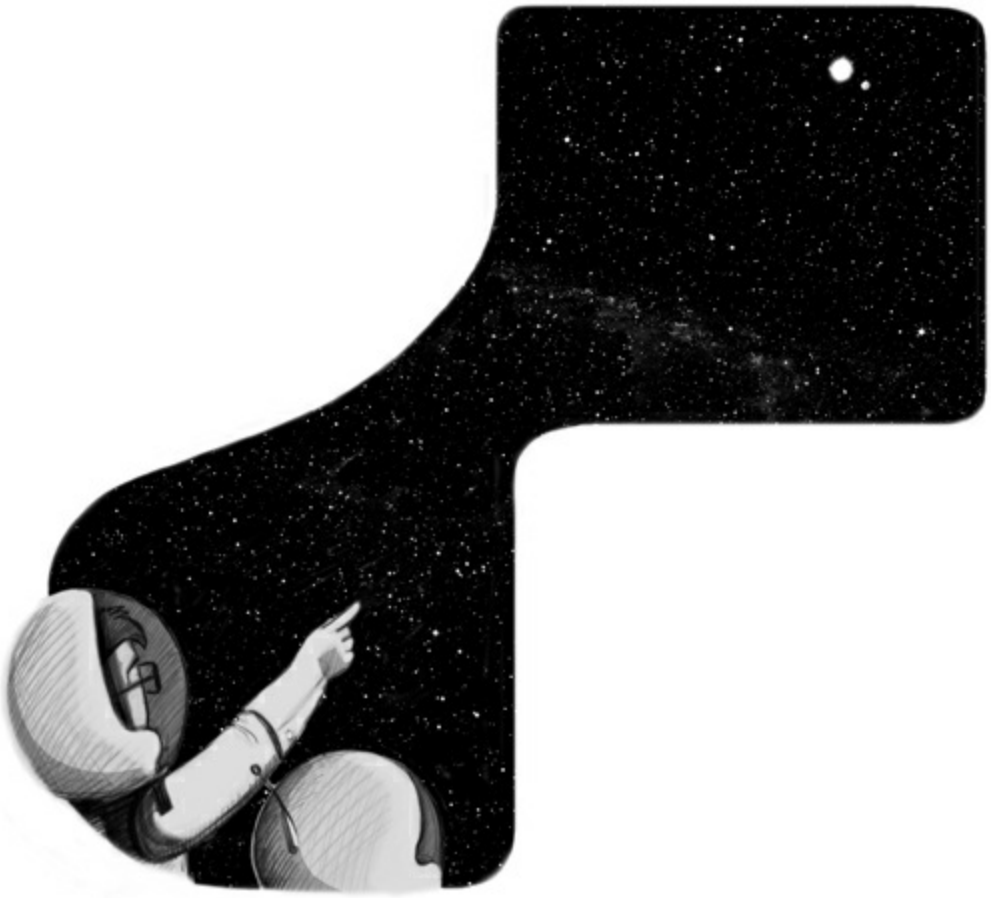
"Yes, I do. A long, long time ago we used to work together. But we had an argument that led to an awful accident. Reeper got very badly burned, and after that he went off on his own. We stopped him being a member of the order in the end because we were so worried about what he might do. But do you know what he sent me in that letter?"

"Yeah," said George, remembering how Eric left without saying good-bye. "Just another planet."

"*Just* another planet? George, you must be joking! The planet Graham told me about is one where humans could live! I've been looking for such a place for ages, and there it is!" Pointing toward two little dots in front of him—one big and bright, the other smaller and less bright—Eric added, "*It's right there!* The big bright dot there is a star, and the smaller dot is the planet we're heading for. It doesn't actually shine on its own—it just reflects the light of its star, like the Moon reflects the light of the Sun at night."

"But Greeper is horrible!" objected George, who really couldn't understand why Eric and Cosmos always had to be in lecturing mode in times of danger. "He would never have given you the coordinates of that planet just like that! There *must* be a trick."

"Oh, come on, George," said Eric. "You know that I can get Cosmos to open up the portal to take us home again any time I want. We're quite safe. It's true that your teacher and I had our differences in the past, but I expect he's decided to put it behind him and join in the efforts we're making to explore and understand the Universe. And I have installed new antennae on our helmets. We can now communicate with Cosmos even if they get damaged."



"Why didn't you ask Cosmos to just send you there directly? Let's do just that—let's get back to your library."

"Aha!" said Eric. "We can't do that. Cosmos doesn't know what lies ahead of us, and that's my job—to go where computers cannot. After I've been somewhere new, then we can use Cosmos to go there again, like you just did to find me here. But the first trip I always need to do myself."

"Are you sure it's safe?" asked George.

"Positive," said Eric confidently.

George and Eric fell silent for a few moments, and George started to feel a bit better. He managed to stop thinking about Greeper and look around him to see where he was. In all his eagerness to warn Eric, he had quite forgotten he was on a rock in outer space!

To be fair to Eric, everything around them seemed calm. They could see clearly in all directions, and the star with its planet was growing bigger and bigger as their rock approached it.

But then something started to go wrong with the path of the rock. Just as George's comet had changed direction when it flew past the giant planets and the Earth, their rock seemed to be switching course. But this time there didn't seem to be any planets around them. The rock was now heading in a completely different direction, away from the distant planet Eric so much wanted to see.

"What's going on?" George asked Eric.

"I'm not sure!" replied Eric. "Look around and let me know if you see any place in the sky where there is no star! And Cosmos, open the portal, just in case."

Cosmos didn't seem to have heard Eric's request since no portal appeared nearby.

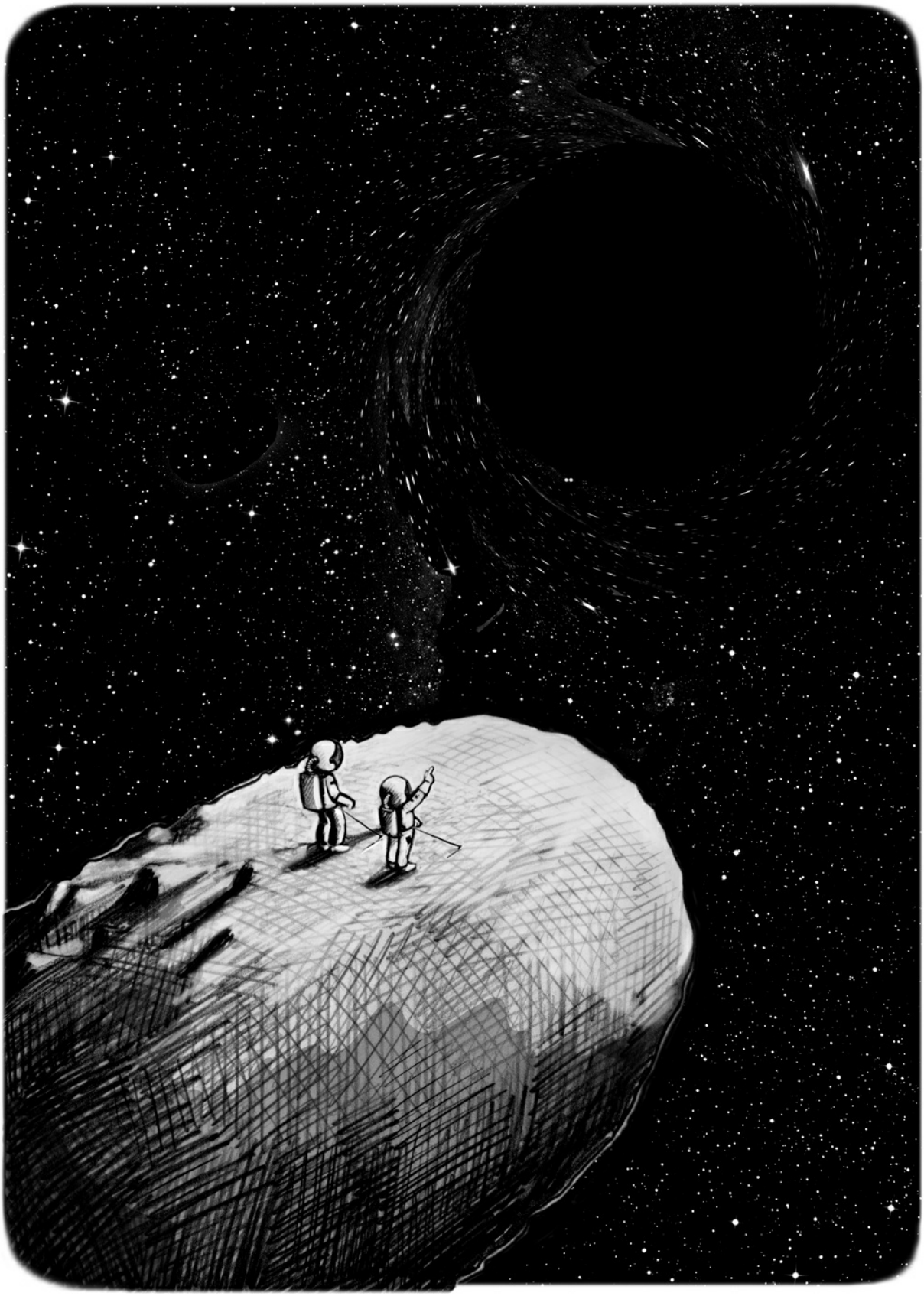
George and Eric looked in the direction the rock was heading. Everywhere, all around them, were stars—except for an area on their right, where there was a small patch of sky containing no stars, which was becoming larger and larger all the time.

"Over there!" George said to Eric, pointing toward the growing dark patch. The stars around it were moving in a very strange way, as if space itself were being distorted by it.

"*Oh, no!*" shouted Eric. "*Cosmos, open the portal now! Now!*"

But no portal appeared.

"*What is it?*" asked George, who was becoming scared.



The dark area now covered more than half the space they were looking at, and all the stars they could see outside it were moving erratically, even though they were far behind it.

"*Cosmos!*" shouted Eric once more.

"Trying . . . ," Cosmos replied in a very faint voice, but nothing happened.

George's mind was starting to spin! In front of them, the dark area was becoming enormous. All the space around George and Eric was warped, and some dark patches started to appear to their left and right. George could no longer tell up from down or right from left. All he knew for sure was that the dark patch was getting bigger and bigger, from all sides, as if it wanted to eat them up.

"*Cosmos! Hurrrrryyyy!*" Eric yelled.

A very faint doorway started to appear in front of them. Eric grabbed George by the belt of his space suit and threw him toward it. As he flew through, George saw Eric trying to reach it too. He was shouting something, but his voice was distorted and it was hard to make sense of it.

Just before landing on Eric's library floor, just before the portal door shut and the view of outer space disappeared, George saw the dark patch engulf Eric entirely. It was only then that he understood what Eric had been saying.

"*Find my new book!*" Eric had shouted. "*Find my book on black holes!*"

George fell back through the door and landed on the floor with a heavy *thump*. This time the journey back from outer space to Eric's library had seemed to suck all the breath out of him, and he had to lie on the floor for a few seconds, panting, before he could get up. When he staggered to his feet, he hoped he would see Eric hurtling through the doorway behind him. But instead, all he saw was the outline of the door, which had become faint and wavy. It seemed to be fading into nothing. He yelled out, "*Eric!*" but got no reply. A millisecond later, the door vanished entirely.

"*Cosmos!*" shouted George, undoing his glass space helmet. "Quick! Cosmos, we have to get—"

But as he turned around to face the mighty computer, he had his second great shock. Where Cosmos should have been, there was just a spaghetti tangle of colored wires and an empty space. Looking wildly around the room, George saw that the library door was ajar. He ran through it and into the hallway, to find the front door wide open and the cold night air blowing in. With no time to take off his space suit, he dashed into the street, where he could make out the shapes of four boys running along the road. One of them was carrying a bulky backpack with a few wires sticking out of the top of it. George hurried after them as fast as he could in his heavy suit. As he stumbled along, familiar voices drifted back to him on the wind.

"Be careful with that!" George heard Ringo shout.

"Beep! Beep!" came a noise from the backpack. "Unlawful action! Unauthorized command!"

"When's it going to shut up?" shouted Tank, who was carrying the backpack. "How come it can speak when it isn't even plugged in?"

"Help! Help!" came the mechanical voice from the backpack. "I am being kidnapped! I am the world's most amazing computer! You cannot do this to me! Alarm! Alarm!"

"It'll run out of batteries soon," said Whippet.

"Unhand me, you villains!" said the voice inside the backpack. "This bouncing around is bad for my circuits."

"I'm not carrying it any farther!" said Tank, coming to a sudden halt. George immediately stopped in his tracks.

"Someone else can take over," he heard Tank say.

"All right," said Ringo in a menacing voice. "Give it to me. Listen up, little computer. *You* will *shut up* for the rest of the journey or I will take you to pieces bit by bit until you are just a big pile of microchips."

"Eek!" said the computer.

"Do you understand?" said Ringo in fierce tones.

"Of course I understand," said the computer snootily. "I am Cosmos, the world's most amazing computer. I am programmed to understand concepts so complex that your brain would explode if you were even to —"

"*I said*," snarled Ringo, opening the top of the backpack and speaking down into it, "*shut up!* Which part of those two words don't you get, you moron?"

"I am a peaceful computer," replied Cosmos in a small voice. "I am not used to threats or violence."

"Then be quiet," replied Ringo, "and we won't threaten you."

"Where are you taking me?" whispered Cosmos.

"To your new home," said Ringo, shouldering the backpack. "C'mon, gang, let's get there." The boys set off at a run once more.

George staggered after them as fast as he could, but he was unable to keep up. After a few more minutes, he lost them in the foggy, dark night. There was no point in running any farther—he couldn't tell which way they had gone. But even so, he felt sure he knew who had asked Ringo and his friends to break in and steal Cosmos. And knowing that was the first step to finding the super computer again.

As Ringo and the boys ran off into the night, George turned and walked back to Eric's house, where the front door was still wide open. He went in and headed straight for Eric's library. Eric had told him to look for the book—but which book? The library was full of books—they stretched from floor to ceiling on the shelves. George picked out a large, heavy volume and looked at the cover. *Euclidean Quantum*

Gravity, it said on the front. He flicked through the pages. He tried to read a little:

> *. . . because the retarded time coordinate goes to infinity on the event horizon, the surfaces of constant phase of the solution will pile up near the event horizon.*

It was hopeless. He had no idea what any of it meant. He tried another book, this one called *Unified String Theories*. He read a line from it: *The equation for a conformal . . .*

His brain hurt as he tried to make out what it meant. In the end he decided it meant he hadn't yet found the right book. He carried on looking around the library. *Find the book*, Eric had said. *Find my new book*. George stood in the middle of the library and thought very hard. With no Cosmos, no Eric, and no Annie, it seemed terribly empty in that house. The only link George had to them now was a pink space suit, some tangled wires and these huge piles of science books.

Suddenly, he missed them all so terribly that he felt a sort of pain in his heart: he realized that if he didn't do something, he might never see any of them again. Cosmos had been stolen, Eric was fighting with a black hole, and Annie would certainly never want to speak to him again if she thought George had anything to do with her dad getting lost forever in outer space. He had to think of something.

He concentrated very hard. He thought of Eric and tried to imagine him with his new book in his hand—to picture the front cover so that he could remember what the book had been called. Where would he have put it? Suddenly George knew.

He ran into the kitchen and looked next to the teapot. Sure enough, there, covered in tea stains and rings where hot mugs had been rested on top of it, was a brand-new book called *Black Holes*, which, George now realized, was actually written by Eric himself! There was a sticker on it that read, in what must be Annie's handwriting: *Freddy the pig's favorite book!* with a little cartoon drawing of Freddy next to the words. That's it! thought George. This must be the new book Eric was so happy to find when Freddy stormed through the house! This *must* be the one.

There was just one more thing he needed from Eric's house—it was another book, a large one with lots and lots of pages. He grabbed it from beside the telephone, stripped off Annie's pink space suit, and, shoving the two books into his school bag, rushed back to his own house, closing Eric's front door carefully behind him as he went.

• • •

That evening George scarfed down his supper very quickly and then shot upstairs to his room, claiming he had lots of homework to do. First of all he got the very big book out of his bag. On the front it said, TELEPHONE DIRECTORY. As his parents didn't have a phone, George had thought it was unlikely they would have the phone book, which was why he had

borrowed Eric's. He searched through the alphabetical lists under *R*. Using his finger to go down the long column of names, he came to REEPER, DR. G., 42 FOREST WAY. George knew Forest Way—it was the road that led out of town, to the woods where his parents took him in autumn to gather mushrooms and blackberries. He figured he couldn't go there tonight—it was too late and his parents would never let him out at this time. And anyway, he still had work to do with the *Black Holes* book. First thing in the morning, though, he'd go to Dr. Reeper's house on his way to school. By then he hoped he would have a plan.

He put down the phone book and got Eric's *Black Holes* book out of his bag, desperately hoping it would hold the information he needed to rescue Eric. Every time he thought about Eric—which was about once every three minutes—he felt awful. He imagined him alone and frightened in outer space, not knowing how to get back, with a black hole trying to drag him into its dark belly.

George opened the book and read the first sentence of page one. *We are all in the gutter, but some of us are looking at the stars*, he read. It was a quote from the famous Irish writer Oscar Wilde. George felt it was written specially for him: he was indeed in the gutter, and he knew for sure that some people were looking at the stars. So he kept on reading, but that first sentence was the only one he understood. Next he read: *In 1916 Karl Schwarzschild found the first ever analytic black hole solution to Einstein's equation . . .*

Aarrgghh! he groaned to himself. The book was in a foreign language again! Why had Eric told him to look for this book? He didn't understand it at all. And Eric had written it! Yet every time Eric had told him about science, he had made it sound so simple, so easy to understand. George felt his eyes tearing up. He'd failed them: Cosmos, Annie, and Eric. He lay down on his bed with the book in his hand as hot tears ran down his cheeks. There was a knock at the door, and his mom came in.

"Georgie," she said, "you look very pale, honey. Are you feeling ill?"

"No, Mom," he said sadly. "I'm just finding my homework really difficult."

"Well, I'm not surprised!" His mom had picked up the *Black Holes* book, which had fallen out of George's hand and onto the floor. She

looked through it. “It’s a very difficult textbook for professional researchers! Honestly, I’m going to write to the school and tell them this is ridiculous.” As she spoke, a few pages fluttered out from the back of the book.

“Oh dear,” said George’s mom, collecting them up, “I’m dropping your notes.”

“They’re not—” *Mine*, George was about to say when he stopped himself. At the top of one of the pages, George read, *My Difficult Book Made Simple for Annie and George*.

“Thanks, Mom,” he said quickly, grabbing the pages from her. “I think you’ve just found the part I need. I’ll be fine now.”

“Are you sure?” said his mom, looking very surprised.

“Yes, Mom.” George nodded furiously. “Mom, you’re a star. Thank you.”

“A star?” said his mom, smiling. “That’s a nice thing to say, George.”

“No, really,” said George earnestly, thinking of Eric telling him that they were all the children of stars. “You are.”

“And don’t you work too hard, my little star,” George’s mom told him, kissing him on the forehead. George was smiling now so she went off downstairs to put another batch of lentil cakes in the oven, feeling a lot happier about him.

As soon as his mom left the room, George jumped off his bed and gathered together all the bits of paper that had fallen out of the back of the *Black Holes* book. They were covered in spidery handwriting and little doodles, and numbered pages 1 to 7. He started to read.

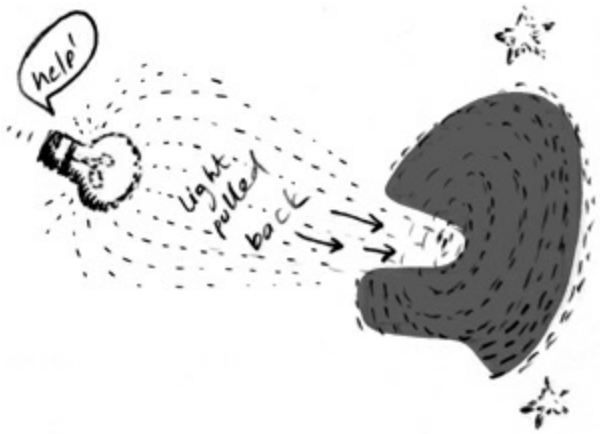
Chapter Twenty-six

My Difficult Book Made Simple for Annie and George (version 3), it began.

WHAT YOU NEED TO KNOW ABOUT BLACK HOLES

SECTION 1

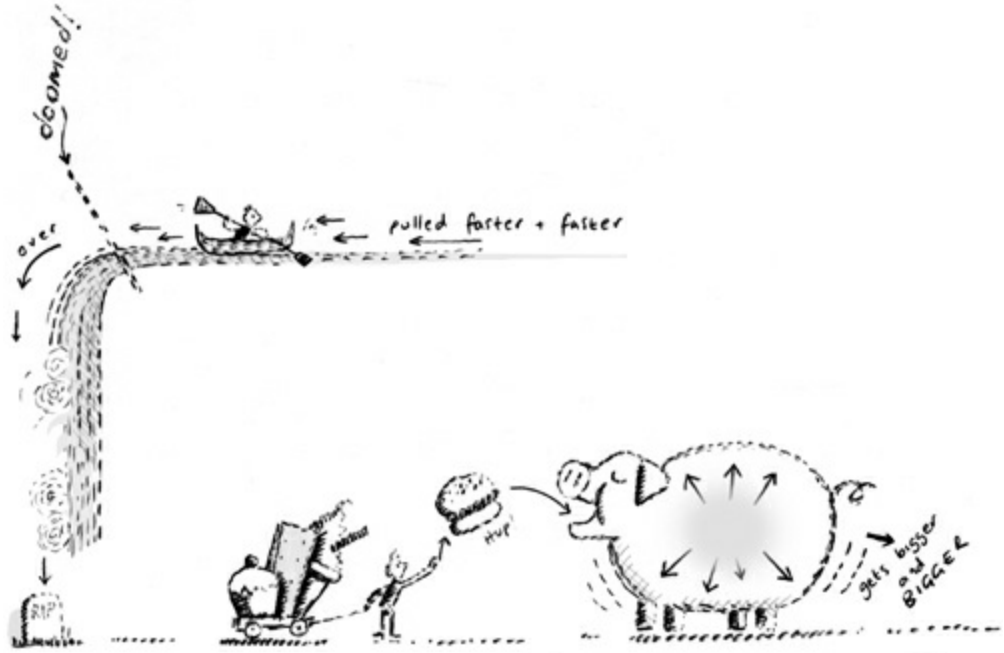
What Is a Black Hole?



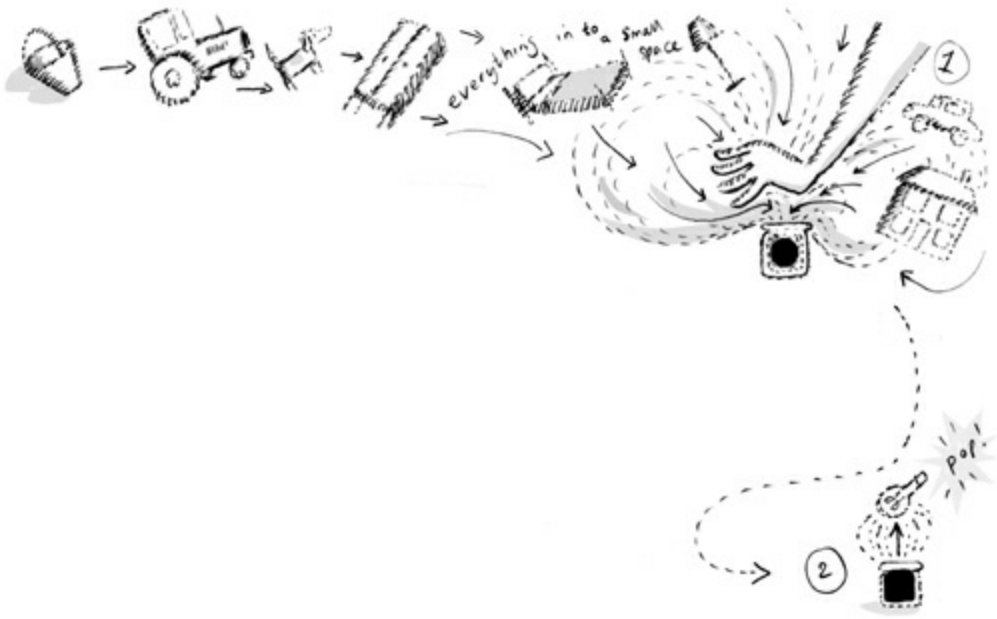
A black hole is a region where gravity is so strong that any light that tries to escape gets dragged back. Because nothing can travel faster than light, everything else will get dragged back too. So you can fall into a black hole and never get out again. A black hole has always been thought of as the ultimate prison from which there's no escape. Falling into a black hole is like falling over Niagara Falls: there's no way of getting back the same way you came.

The edge of a black hole is called the "horizon." It is like the edge of a waterfall. If you are above the edge, you can get away if you paddle fast enough, but once you pass the edge, you are doomed.

As more things fall into a black hole, it gets bigger and the horizon moves farther out. It is like feeding a pig. The more you feed it, the larger it gets.



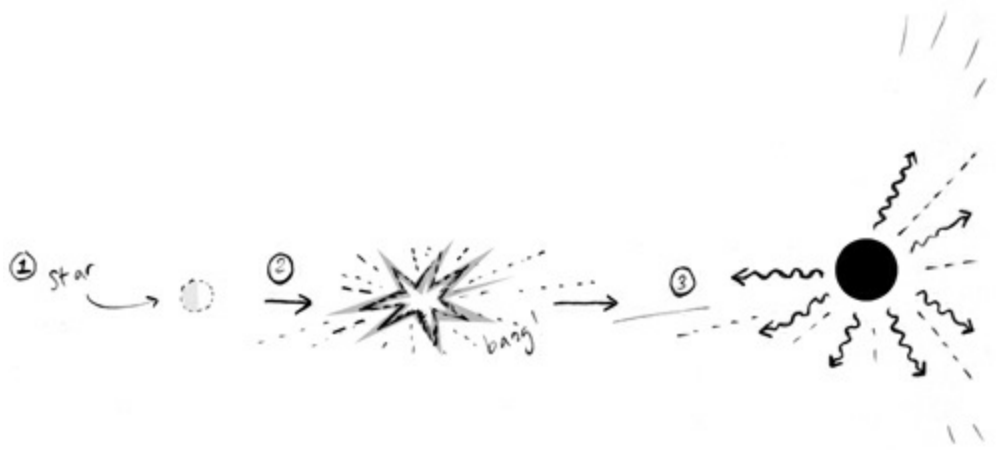
SECTION 2



How Is a Black Hole Made?

To make a black hole you need to squash a very large amount of matter into a very small space. Then the pull of gravity will be so strong that light will be dragged back, unable to escape.

One way black holes are formed is when stars that have burned up their fuel explode like giant hydrogen bombs called supernovas. The explosion will drive off the outer layers of the star in a great expanding shell of gas, and it will push the central regions inward. If the star is more than a few times the size of our Sun, a black hole will form.



Much larger black holes are formed inside clusters and in the center of galaxies. These regions will contain black holes and neutron stars as well as ordinary stars. Collisions between black holes and the other objects will produce a growing black hole that swallows anything that comes too near it. Our own galaxy, the Milky Way, has at its center a black hole several million times the mass of our Sun.

NEUTRON STAR

When stars much more massive than the Sun run out of fuel, they usually expel all their outer layers in a giant explosion called a supernova. Such an explosion is so powerful and bright it can outshine the light of billions and billions of stars put together.

But sometimes not everything is expelled in such an explosion. Sometimes the core of the star can remain

behind as a ball. After a supernova explosion, this remnant is very hot: around 180,000 degrees Fahrenheit (100,000 degrees Celsius), but there is no more nuclear reaction to keep it hot.

- Some remnants are so massive that under the influence of gravity they collapse in on themselves until they are only a few dozen miles across. For this to happen, these remnants need to have a mass that is between around 1.4 and 2.1 times the mass of the Sun.

- The pressure is so intense inside these balls that they become liquid inside, surrounded by a solid crust about 1 mile (1.6 km) thick. The liquid is made of particles that normally remain inside the core of the atoms—the neutrons—so these balls are called neutron stars.

- There are also other particles inside neutron stars, but they really consist mostly of neutrons. To create such a liquid on Earth is beyond our present technology.

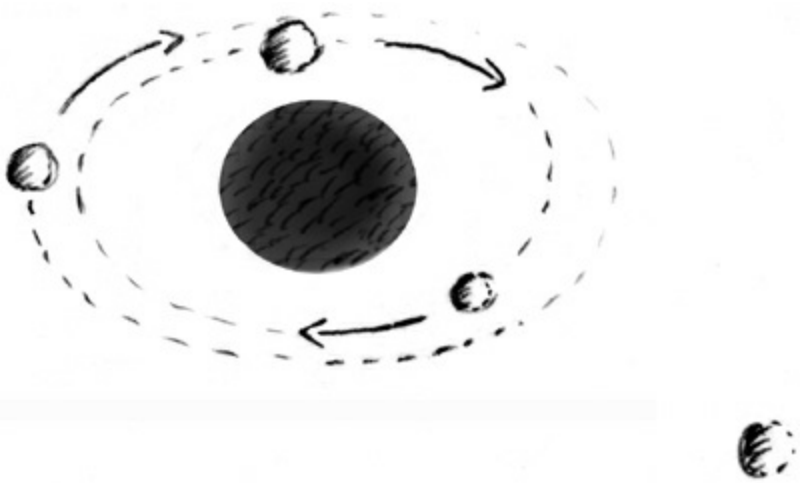
Stars like the Sun do not explode in supernovae but become red giants whose remnants are not massive enough to shrink under their own gravity. These remnants are called white dwarfs. White dwarfs cool down over a period of billions of years, until they are not hot anymore.

Many neutron stars have been observed by modern telescopes. Since the cores of stars are made of the heaviest elements forged inside stars (like iron), although white dwarfs can be quite small (about the size of the Earth) they are extremely heavy (about the mass of the Sun).

Star remnants that are less heavy than 1.4 times the mass of the Sun become white dwarfs. Neutron stars are born from supernovae remnants that have between 1.4 and 2.1 times the mass of the Sun. Remnants more massive than 2.1 times the size of the Sun never stop collapsing on themselves and become black holes.

SECTION 3
How Can You See a Black Hole?

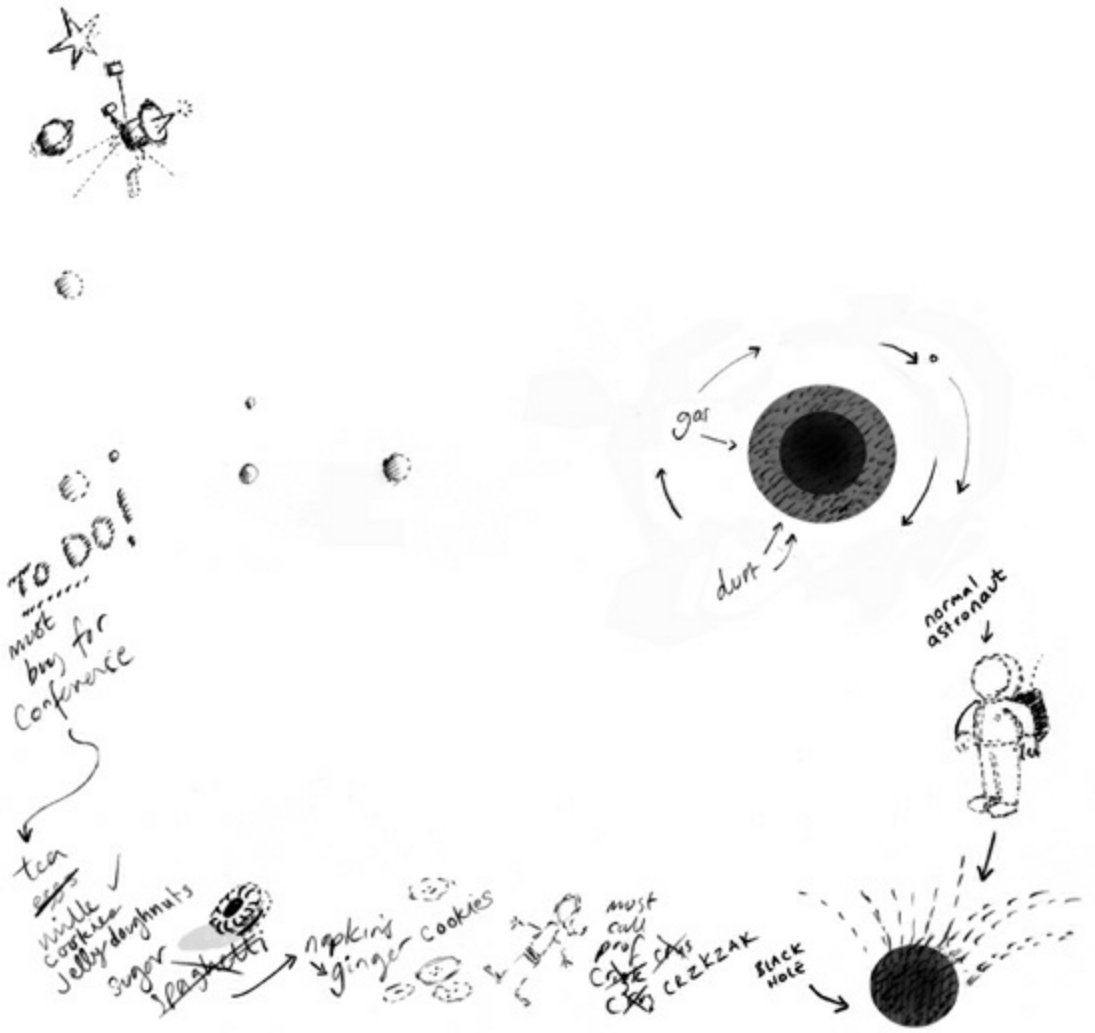
The answer is, you can't, because no light can get out of a black hole. It is like looking for a black cat in a black cellar. But you can detect a black hole by the way its gravity pulls on other things. We see stars that are orbiting something we can't see but that we know can only be a black hole.



We also see discs of gas and dust rotating around a central object that we can't see, but that we know can only be a black hole.

SECTION 4
Falling into a Black Hole

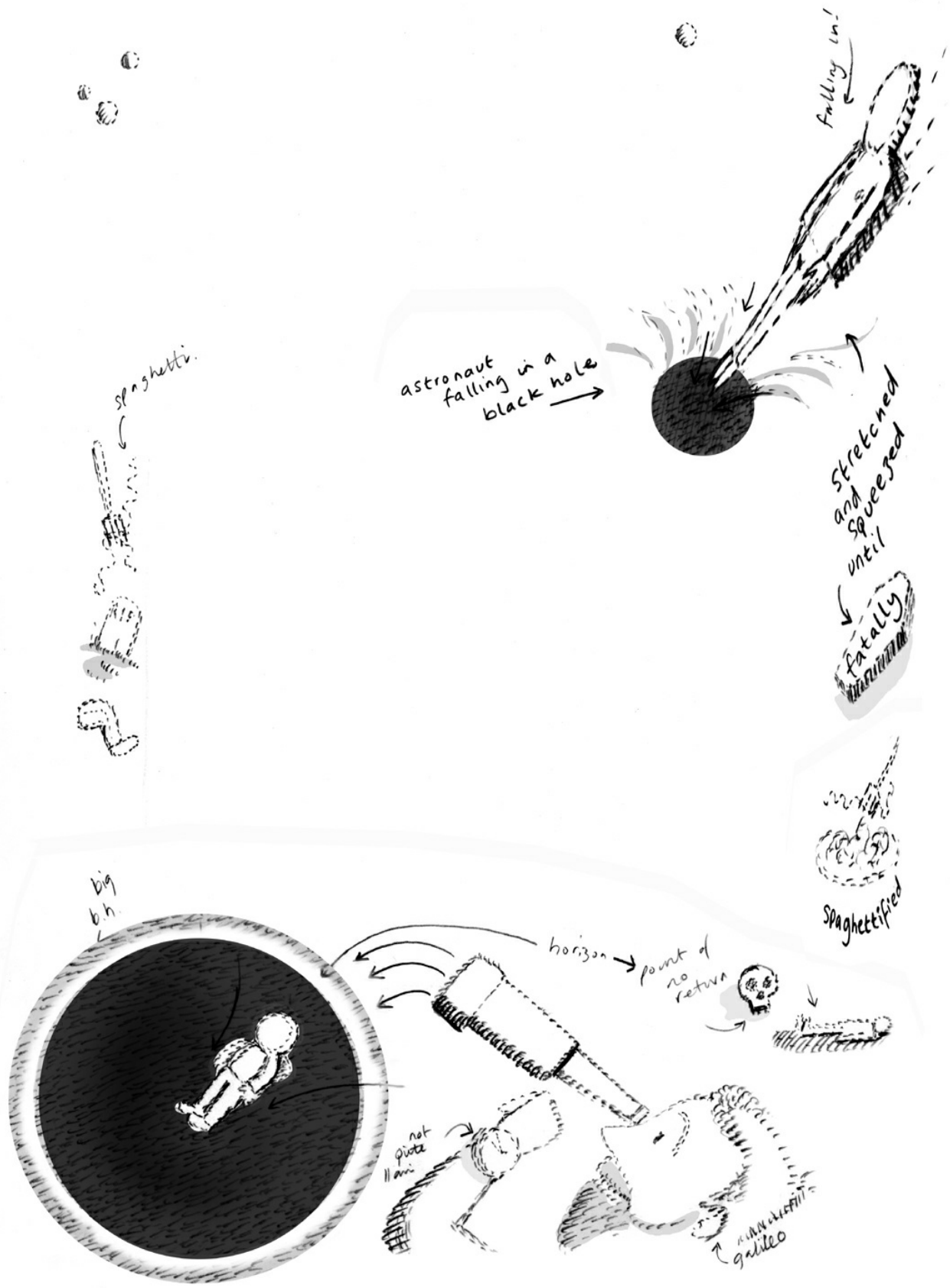
You can fall into a black hole just as you can fall into the Sun. If you fall in feetfirst, your feet will be nearer to the black hole than your head and will be pulled harder by the gravity of the black hole. So you will be stretched out lengthwise and squashed in sideways.



This stretching and squeezing is weaker the bigger the black hole is. If you fall into a black hole made by a star only a few times the size of our Sun, you will be torn apart and made into spaghetti before you even reach the black hole.

But if you fall into a much bigger black hole, you will pass the horizon —the edge of the black hole and the point of no return—without noticing anything particular. However, someone watching you fall in from a distance will never see you cross the horizon because gravity warps time and space near a black hole. To them you will appear to slow down as you approach the horizon and get dimmer and dimmer.

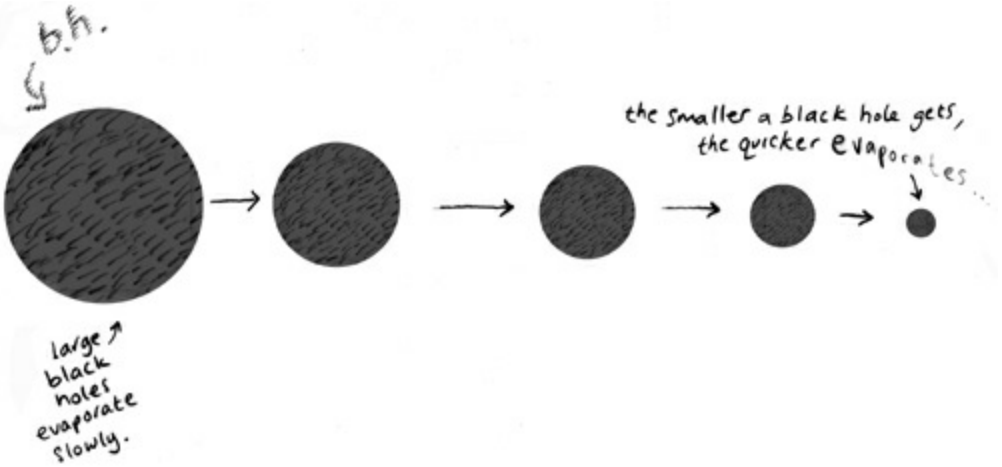
You get dimmer because the light you send out takes longer and longer to get away from the black hole. If you cross the horizon at 11:00 according to your wristwatch, someone looking at you would see the watch slow down and never quite reach 11:00.


falling in!
astronaut falling in a black hole
stretched and squeezed until
fatally
spaghetti.
spaghettified
big b.h.
horizon
point of no return
not quite
Galileo

SECTION 5
Getting Out of a Black Hole

People used to think nothing could ever get out of a black hole. After all, that's why they were called black holes. Anything that fell into a black hole was thought to be lost and gone forever; black holes would last until the end of time. They were eternal prisons from which there was no hope of escape.

But then it was discovered that this picture wasn't quite right. Tiny fluctuations in space and time meant that black holes couldn't be the perfect traps they were once thought; instead they would slowly leak particles in the form of Hawking Radiation. The rate of leakage is slower the bigger the black hole is.



The Hawking Radiation would cause black holes to gradually evaporate. The rate of evaporation will be very slow at first, but it will speed up as the black hole gets smaller. Eventually, after billions and billions of years, the black hole will disappear. So black holes aren't eternal prisons after all. But what about their prisoners—the things that made the black hole or that fell in later? They will be recycled into energy and particles. But if you examine what comes out of the black hole very carefully, you can reconstruct what was inside. So the memory of what falls into a black hole is not lost forever, just for a very long time.

YOU CAN GET OUT OF A BLACK HOLE!

The next day was the day of the big science competition at school. George left home early. He said good-bye to his pig, kissed his mother, put Eric's book on black holes into his school bag, and scooted out of the door, breakfast in hand. His dad offered to take him to school on the back of his bicycle-made-for-two, but George just yelled, "No thanks, Dad," and was gone, leaving his parents feeling like a small tornado had just swept through the house.

George ran up the road, and when he got to the main intersection, he looked back to see if either of his parents was waving at him from the front door. When he saw they weren't, he turned left at the corner instead of right, the direction he would have taken to go to school. He knew he didn't have much time, so he hurried along as fast as he could. As he ran, thoughts streamed through his head.

He thought about Eric, who, by now, would be swallowed up by the great dark menace of the black hole, the strongest force in the Universe. He thought about Cosmos and whether George would find him in the place where he was headed. He thought about Annie, whom he would see later at the competition. Would she believe him when he told her that her dad had been tricked by an evil former colleague into taking a journey across outer space that had plunged him into great danger?

Now George understood why Annie told such extraordinary stories —after the wonders of the Universe, real life did seem pretty dull. He couldn't imagine a life without Annie or Cosmos or Eric now. Or at least he could, but he didn't want to. He had to save Eric, he *had* to!

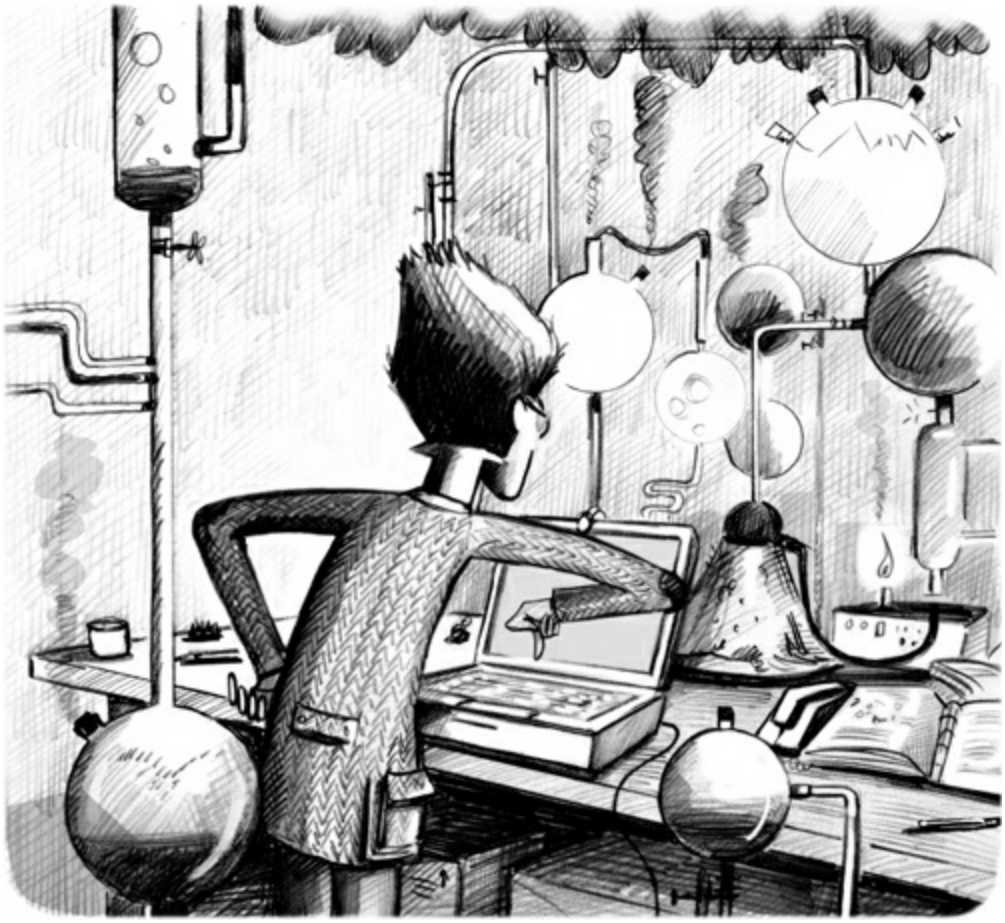
George didn't know and couldn't imagine why Dr. Reeper wanted to throw Eric into a black hole and steal his amazing computer. But he could guess that whatever Dr. Reeper was up to, it wasn't for the good of mankind, science, Eric, or anyone else. Whatever Dr. Reeper's aim was, George felt sure it was a horrible one.

The other thing that went through George's head as he ran on toward Dr. Reeper's house was the science competition later that day. If he won the competition by giving a great talk about the Solar System, even his dad wouldn't be able to say no to George having the computer in the house. The problem was that the awesome plan George had cooked up to save Eric from being eaten up by a black hole meant he wouldn't actually *be* at the competition. So he had no hope of winning. It wasn't easy for George to give up the idea of entering, but he knew he had no choice if he wanted to get Eric back. There was no other way to do it.

George reached 42 Forest Way and took a few moments to get his breath back. As he panted quietly, he looked at the house in front of him. The driveway led through some dilapidated gates to a huge, old building with weird-looking turrets sticking out of the roof.

George crept up the driveway to the house and stared in through a large window. Through the grimy glass, he saw a room full of furniture covered in yellowing sheets, and cobwebs hanging from the ceiling. Picking his way through a bed of nettles, he tiptoed to the next set of windows. One of the windows was slightly open at the bottom. Looking in, George saw a familiar sight.

In the middle of a crazed mess of pipes, cables, and narrow glass tubes holding brightly colored bubbling liquids, was Dr. Reeper, with his back to him, standing in front of a computer screen that was glowing with green light. Even from behind, George could tell that Dr. Reeper was not at all happy. He watched as his teacher struck the computer keyboard wildly, using all his fingers at once, as though playing a very difficult piano solo. The window was open just enough for George to hear what he was saying.



"*See!*" Dr. Reeper yelled at the computer screen. "I can keep doing this all day! Eventually I'll find the secret key, you just see if I don't! And when I do, you'll have to let me into the Universe! You'll have to!"

"Negative," replied Cosmos. "You have entered an incorrect command. I cannot process your request."

Dr. Reeper tried some different keys.

"Error," said Cosmos. "Error type two-nine-three."

"Grrrrrrr!" cried Dr. Reeper. "I will crack you, Cosmos. I will!" At that moment his phone rang. He snatched it up. "Yes?" he barked into the receiver. "Ahhh," he went on in a more polite voice. "Hello—you got my message?" He coughed in a very fake way. "I'm not feeling so good today . . . No, just a bad cold . . . I think I'll have to take the day off . . . Such a shame about the competition . . ." He coughed a few more times. "Sorry! Have to run—I'm feeling really foggy. *Byyyeee!*" He slammed the phone down and turned back to Cosmos. "See, little computer!" he said, rubbing his hands. "Now I have all *day*!"

“I do not operate for anyone who is not a member of the order,” replied Cosmos, sounding very brave.

“Ha-ha-ha-ha!” Dr. Reeper laughed crazily. “So the old order still exists, does it? Those silly busybodies who think they can save the planet and humanity! The fools,” he went on. “They should save themselves while there is still time. That’s what *I* intend to do. Forget humanity! Humans don’t deserve to be saved.” He spat on the floor. “Look what they’ve done so far to this beautiful planet. I’m going to start again somewhere else, with a new life form. Those silly little boys think I’ll be taking them with me. But I won’t! Ha-ha-ha-ha! I’ll leave them here to die, like the rest of the human race. I’ll be the only one left in the Universe, me and my new life form, which will obey my every word. All I need is to get out there, into outer space. You, Cosmos, are going to help me.”

“Negative,” replied Cosmos. “I refuse to operate for a nonmember of the order.”

“I was a member once,” claimed Dr. Reeper.

“Your membership was canceled,” replied Cosmos firmly. “After you _”

“Yes, yes, yes,” said Dr. Reeper quickly. “Let’s not talk about that. Don’t bring up bad memories now, Cosmos. Surely it’s time to forgive and forget?” He spoke in a horrible, syrupy voice.

“Negative,” said Cosmos, causing Dr. Reeper to rise up in a fury in front of the computer and bring his hands crashing down once more on the keyboard.

“Ouch,” said Cosmos, a few bright sparks flying out from the keyboard.

George couldn’t bear to watch any longer. As much as he wanted to break in and stop Dr. Reeper from hurting poor Cosmos any more, he knew it was vital to get him out of the house and away from the great computer as quickly as possible. To do that, George needed to get to school.

He ran back until he reached the school gates. Big buses sat in the road outside, hordes of children wearing different-colored school uniforms climbing out of them. These were the other kids from nearby schools arriving to take part in the science competition. George weaved through the crowds, saying, “ ’Scuse me, sorry, ’scuse me, sorry.” He was searching for someone.

“George!” He heard his name and looked around but couldn’t see who was shouting at him. Then he spotted her—a tiny figure in a dark blue uniform, jumping up and down and waving at him. He scrambled over to her as quickly as he could.

"Annie!" he said when he reached her. "I'm so glad to see you! Come on, we haven't got a minute to spare."

"What's up?" said Annie, wrinkling her nose. "Is something wrong with your talk?"

"Is that your boyfriend?" A much older boy in the same school uniform as Annie interrupted them.

"Oh, go away," Annie snapped at the bigger boy. "And say stupid things to someone else." George held his breath in fear, waiting to see what the bigger boy would do. But he just turned away meekly and got lost in the crowd.

"Where've you been?" George asked Annie.

"I told you," replied Annie. "At Granny's house. Mom dropped me back at the school, so I haven't even been home yet. What's wrong, George? What is it?"

"Annie," said George very seriously, "I've got something awful to tell you." But he didn't get the chance. A teacher blew a whistle very loudly, forcing everyone to be quiet.

"Okay everybody!" the teacher announced. "I want you all to line up in your school groups, ready to go into the great hall, where the science competition will begin. *You*"—he pointed at George in his dark green uniform among a crowd of kids in blue—"are with the wrong school!

Kindly go and find your own group before you confuse people anymore!"

"Meet me just outside the hall!" George hissed to Annie. "It's really important, Annie! I need your help!" With that he left her and joined his own school group. He started walking toward the hall, looking now for someone—or rather several someones—else. When he saw them—Ringo and his group of friends hovering in the hallway—George knew what he had to do. He grabbed the nearest teacher and started speaking in a very loud voice.

"Sir!" he yelled. "*Sir!*"

"What is it, George?" said the teacher, backing off a little at the unexpected volume.

"Sir!" shouted George again, making sure everyone around had stopped what they were doing and was listening to him. "I need to change the topic of my talk!"

"I'm not sure that's possible," said the teacher. "And do you mind not shouting?"

"But I have to!" bellowed George. "I've got a new title!"

"What's the title?" said the teacher, who was now worried that the boy had gone a little crazy.

"It's *Cosmos, the World's Most Amazing Computer, and How He Works*."

"I see," said the teacher, thinking George was definitely insane. "I'll ask the judging panel what they think."

"*Oh good, thank you, sir!*" George yelled even louder than before. "Did you catch the whole title? It's *Cosmos, the World's Most Amazing Computer, and How He Works*."

"Thank you, George," said the teacher quietly. "I'll do my best for you."

As he walked off, sighing deeply to himself, George noticed that Ringo had taken out his cell phone and was making a call. All he could do now was wait.

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George stood by the entrance to the hall, watching the long lines of schoolchildren file in past him. He didn't have to wait long before, out of breath and trembling with excitement, Dr. Reeper rushed up to him.

"George!" he exclaimed, smoothing his hair down with one scaly hand. "Did you manage? To change the topic of your talk, that is?"

"I think so," George told him.

"I'll check for you," said Dr. Reeper. "Don't worry, you go ahead and give the talk on Cosmos and how he works, and I'll make sure it's okay with the judging panel. Good idea for a talk, George. Brilliant!"

Just then the principal came by. "Reeper?" he said curiously. "I heard you were ill today."

"I'm feeling *much* better," stated Dr. Reeper firmly. "And very much looking forward to the competition."

"That's the spirit!" said the principal. "I'm so glad you're here, Reeper! One of the judges has had to drop out, so you're just the man to take his place."

"Oh no no no no no no no no no," said Dr. Reeper hurriedly. "I'm sure you can find someone much better."

"Nonsense!" said the principal. "You're just the ticket! Come along, Reeper, you can sit with me."

Grimacing, Reeper had no choice but to follow the principal and take a seat next to him at the front of the hall.

George waited by the door until at last he saw Annie again, coming toward him in a great gaggle of kids in blue uniforms. As she walked past him, he grabbed her sleeve and pulled her out of the great river of children flowing into the hall.

"We've got to go!" he whispered in her ear. "*Now!*"

"Where?" asked Annie. "Where have we got to go?"

"Your dad's fallen into a black hole!" said George. "Follow me—we have to rescue him . . ."

Annie hurried along the hallway after George.

"But, George," she said, "where are we going?"

"Shush," he said over his shoulder. "This way." He was taking Annie toward the side door, which led out onto the road. It was strictly forbidden for pupils to go out of that door by themselves during school hours. If George and Annie were caught leaving school without permission, they would be in deep trouble. Worse—much worse—they would forfeit their only chance to reach Cosmos, which would mean that Eric would be lost inside a black hole forever. It was vital that they leave the school as fast as possible.

They walked along stiffly, trying to look completely natural and innocent, as though they had every reason in the world to be going in the opposite direction from everyone else. It seemed to be working—no one paid any attention to them. They were just approaching the side door when George saw a teacher walking toward them. He crossed his fingers, hoping they wouldn't be spotted, but it didn't work.

"George," said the teacher. "And where might you be going?"

"Oh, sir!" said George. "We, um, we are just, um . . ." He faltered and ran out of steam.

"I left something for the science presentation in my coat pocket, sir," Annie's clear voice cut in. "So my teacher asked this boy to show me the way back to the coatrooms."

"Carry on, then," said the teacher, letting them pass. But he stood watching them until they disappeared into the coatrooms. When they peered back down the hallway, he was still standing there, guarding the school exit. The last children were straggling into the science presentation, which was due to start any minute now.

"Rats," said George, retreating back into the coatroom. "We won't get out through that door." They looked around. In the wall above the rows of coat pegs was a long, thin, rectangular window.

"Do you think you can squeeze through?" George asked Annie.

"It's the only way out, isn't it?" she said, looking up at the window.

George nodded grimly.

"Then I'll just have to," said Annie with great determination. "I'm not letting a black hole eat my dad, I'm not, I'm not, I'm not!"

George could tell by the way she scrunched up her face that she was trying not to cry. He wondered if he'd done the right thing in telling her —maybe he should have tried to rescue Eric all by himself? But it was too late for these kinds of thoughts. He had Annie with him now, and they needed to get on with it.

"Come on," he said briskly. "I'll give you a leg up." He hoisted her up so she could undo the catch, push the window open, and slither through the narrow gap; she gave a small squeak as she vanished from view. George pulled himself up onto the ledge and tried to slide through as Annie had done, but he was a lot bigger than her and it wasn't easy. He got halfway through but then couldn't go any farther! He was stuck, one

side of him dangling out of the window over the street outside his school, the other still inside the coatroom.

"George!" Annie reached up and grabbed his foot.

"Don't pull!" he said, gently easing himself through the gap, sucking in his breath as much as he could. With another wriggle, he pulled himself free of the tight frame and landed in a crumpled heap on the pavement. He staggered to his feet and grabbed Annie's hand. "Run!" he panted. "We've got to get out of sight."

They sped around the corner and stopped so that George could catch his breath. "Annie—," he started to say, but she waved at him to be quiet. She'd got out her cell phone and was making a call.

"Mom!" she said urgently into the phone. "It's an emergency . . . No, I'm fine, it's not me . . . Yes, I'm at the school where you dropped me this morning, but I've got to . . . No, Mom, I haven't done anything . . . Mom, listen, *please*! Something's happened to Dad, something awful, and we've got to rescue him . . . He's gone into outer space and got lost, and we have to get him back . . . Can you come and pick us up us? I'm with my friend George and we're just near his school. Quickly, Mom, quickly, hurry up, we haven't got long . . . okay, bye."

"What did your mom say?" asked George.

"She said, *When will your father learn to stop doing silly things and behave like an adult?*"

"What does she mean by that?" said George, perplexed.

"I don't know," said Annie. "Grown-ups have funny ideas."

"Is she coming?"

"Yes. She won't be long—she's coming in her Mini."

Sure enough, just a few minutes later a little red car with white stripes pulled up next to them. A sweet-faced lady with long brown hair wound down the window and stuck out her head.

"Well, whatever next!" she said cheerfully. "Your father and his adventures! I don't know. And what are you two doing out of school?"

"George, this is my mom. Mom this is George," said Annie, ignoring her mother's question and wrenching open the passenger door. She held the front seat forward so that George could climb in. "You can go in the back," she told him. "But be careful, don't break anything." The backseat was covered in recorders, cymbals, triangles, mini-harps, and string drums.

"Sorry, George," said Annie's mom as he clambered in. "I'm a music teacher—that's why I have so many instruments."

"A music teacher?" echoed George in surprise.

"Yes," said Annie's mom. "What did Annie tell you I was? President of the United States?"

"No," said George, catching her eye in the rear-view mirror. "She said you were a dancer in Moscow."

"That's enough talking about me as though I wasn't here," said Annie, putting on her seat belt. "Mom—drive the car! We *need* to rescue Dad, it's really important."

Annie's mom just sat there with the engine off. "Don't panic, Annie," she said mildly. "Your father's been in all sorts of difficult situations before. I'm sure he's going to be fine. After all, Cosmos wouldn't let

anything terrible happen to him. I think you two should go back to school and we won't say any more about it."

"Um, that's the thing," said George, who wasn't quite sure what to call Annie's mom. "Eric hasn't got Cosmos—he's been stolen! Eric's in outer space all by himself. And he's near a black hole."

"By himself?" repeated Annie's mom. She suddenly turned quite pale. "No Cosmos? But then he can't get back! And a black hole . . . ?"

"Mom, I keep telling you it's an emergency!" pleaded Annie. "Now do you believe me?"

"Oh my goodness gracious me! Fasten your seat belt, George!" exclaimed Annie's mom, starting the car. "And tell me where I need to go."

George gave her Dr. Reeper's address, and she put her foot down on the accelerator so hard that the little car shot forward with a great lurch.

As the red Mini zoomed through the heavy traffic toward Greeper's house, George explained as best he could what had happened over the past twenty-four hours. While the little car wove through the traffic across town, cutting in and out—much to the annoyance of people in bigger cars—he told Annie and her mom (who asked him to call her Susan) all about going to see Eric yesterday to ask for his help with his science presentation. He told them about the mysterious note that he hadn't trusted and about Eric leaping through the portal into outer space and having to follow him. And how both of them had got sucked toward

an invisible force and how when the doorway appeared to save them, it was too faint and only George had managed to get through.

He told them about landing in the library and looking around to find that Eric wasn't there, and how Cosmos had been stolen; how George had run after the thieves but had lost them in the dark; how he had gone back to Eric's to look for the book that Eric had told him to find; how he'd tried to read it but couldn't understand it and then had found the notes in the back that explained that it *was* possible to escape from a black hole; how he needed to find Cosmos because although someone *could* escape from a black hole, he would need Cosmos to make it happen; and how he'd realized where Cosmos must be and had gone there that morning and seen Dr. Reeper—

"Reeper? Do you mean Graham Reeper?" Susan interrupted him as she swerved the little car around a corner.

"Yes," replied George. "Greeper. He's my teacher. Do you know him?"

“I did once, a long time ago,” said Susan in a dark voice. “I always told Eric that he shouldn’t trust Graham. But he wouldn’t listen. Eric always thought the best of people. Until . . .” She trailed off.

“Until what?” piped up Annie. “Until what, Mom?”

“Until something terrible happened,” said Susan, her mouth set in a grim line. “Something none of us have ever forgotten.”

“None of who?” said Annie, gasping with excitement at the prospect of a thrilling family story she hadn’t heard before. But she didn’t get to find out, because right then, her mom turned into Greeper’s driveway and parked the car in front of his house.

Chapter Twenty-nine

It wasn't easy to break into Greeper's house. Even though the place was old, scruffy, and unloved, Greeper had locked every single window and door. They went around the house, trying everywhere, but nothing would budge. When they reached the window of the room where George had seen Cosmos only that morning, it looked like the great computer was no longer there.

"But I saw him!" protested George. "In that room!"

Annie and Susan looked at each other. Susan bit her lip to try and hide her disappointment. A fat tear snaked down Annie's cheek.

"If we can't find Cosmos . . . ," she whispered.

"Hang on a minute!" exclaimed Susan. "Shush, you two! Listen!" They all strained their ears as hard as they could.

From somewhere inside the room they heard the faint tinny mechanical sound of someone singing: "*Hey diddle diddle the cat and the fiddle . . . the cow jumped over the moon . . .* although technically that

would not be possible without a space suit because the cow would freeze," the voice added.

"It's Cosmos!" cried George. "He's singing so that we know where to find him! But how are we going to get to him?"

"Wait there!" said Susan mysteriously. She vanished off around the corner, but a few minutes later appeared inside the room where Cosmos was singing. She opened the ground-floor window very wide so that Annie and George could climb through.

"How did you do that?" asked George in wonder.

"I should have thought of it before," said Susan. "Graham had left his spare key under a flowerpot by the front door. It's what he always used to do. So I let myself in."

Meanwhile Annie had followed the sound of brave Cosmos's singing and was rooting around in a big cupboard. She pulled out a cardboard box full of old blankets, threw them out, and, at the bottom, found Cosmos himself. Unfolding his screen, she covered it in kisses. "Cosmos, Cosmos, Cosmos!" she squealed. "We found you! Are you all right? Can you rescue my dad?"

"Please plug me in," gasped Cosmos, who was a bit the worse for wear. At Eric's house, he had been sleek, silver, and shiny—a glossy, well-looked-after computer. Now he was scratched and battered, with marks and smudges all over him. "I am exhausted. My batteries are nearly dead."

George looked at the spot where he had seen Cosmos earlier that day and, sure enough, there was the computer's cable. He attached Cosmos to the cable and heard him take big, thirsty gulps, as though he were drinking down a huge glass of cold water.

"That's better!" sighed Cosmos. "Now, would someone like to tell me what the microchip is going on around here?"

"Eric's fallen into a black hole!" George told him.

"And we need you to get him out," pleaded Annie. "Dear Cosmos, please say you know how."

Cosmos made a whirring noise. "I am checking my disks for information," he said. "I am searching for files on how to rescue someone from a black hole . . . Please wait . . ." He made more whirring noises and then stopped and went silent.

"Well?" said Annie, sounding worried. "Can you?"

"Um, no," said Cosmos reluctantly. "Those search terms have produced zero information."

"You don't know how? But, Cosmos, that means—" Annie couldn't finish the sentence. She threw her arms around her mom and started to cry.

"No one has provided me with information about escaping from black holes," explained Cosmos apologetically. "I only know how to get into a black hole and not how to get out again. I am not sure it is possible. Eric would have told me if he knew. I am accessing my archive on black holes, gravity, and mass, but I fear none of these files holds the data I need." His drives whirred again, but then he fell silent—unusually, for Cosmos, lost for words . . .

"So Eric's lost," said Annie's mom, wiping her eyes. "He told me a long time ago that nothing can come out of a black hole once it has fallen in."

"No!" said George. "That's not right! I mean, Eric's changed his mind about black holes. That's what he says in the notes he wrote for Annie and me."

"What notes?" asked Cosmos.

"The ones I found in the back of his new book."

"What did the notes say?"

Searching in his bag, George tried to remember Eric's exact words.

“Eric wrote that black holes are not eternal,” he said. “They somehow spit out everything that falls in . . . takes a long time . . . radiator something.”

“Radiation,” corrected Cosmos. “Do you have the book? Maybe I can download the information from it and work something out.”

“Yeah! Radiation! That’s it!” George had found Eric’s big book on black holes and handed it over to Annie. “But, Cosmos, we’ve got to be quick—as soon as Greeper sees I’m not at school to give my talk, he’ll come right back here.”

“We’d be a lot quicker if Eric had bothered to update my system properly in the first place.” Cosmos sniffed.

“Perhaps he meant to but forgot?” said George.

“Typical!” said Cosmos.

“Do you mind?” said Annie angrily. “Could we hurry up?”

“Of course,” said Cosmos, sounding serious again. “Once I have the new information, I can start right away. Annie, attach the book to my book port.”

As quickly as she could, Annie pulled out a clear plastic tray from Cosmos’s side and adjusted it until it stood upright. She propped the book on it and pressed a button on the computer. “Ready?” she said.

The humming noise of the computer grew louder and louder and the pages of the book started to glow. “Rebooting my memory files on black

holes!" said Cosmos. "Finished! You were right, George. It *is* all in Eric's new book. I *can* do it. I can rescue Eric from a black hole."

"Then *do it*!" George, Annie, and her mom shouted in unison.

Annie pressed the ENTER key on Cosmos's keyboard and the portal window appeared in the middle of the room. On the other side of it was a very distorted view of somewhere in outer space. In the middle was a black patch.

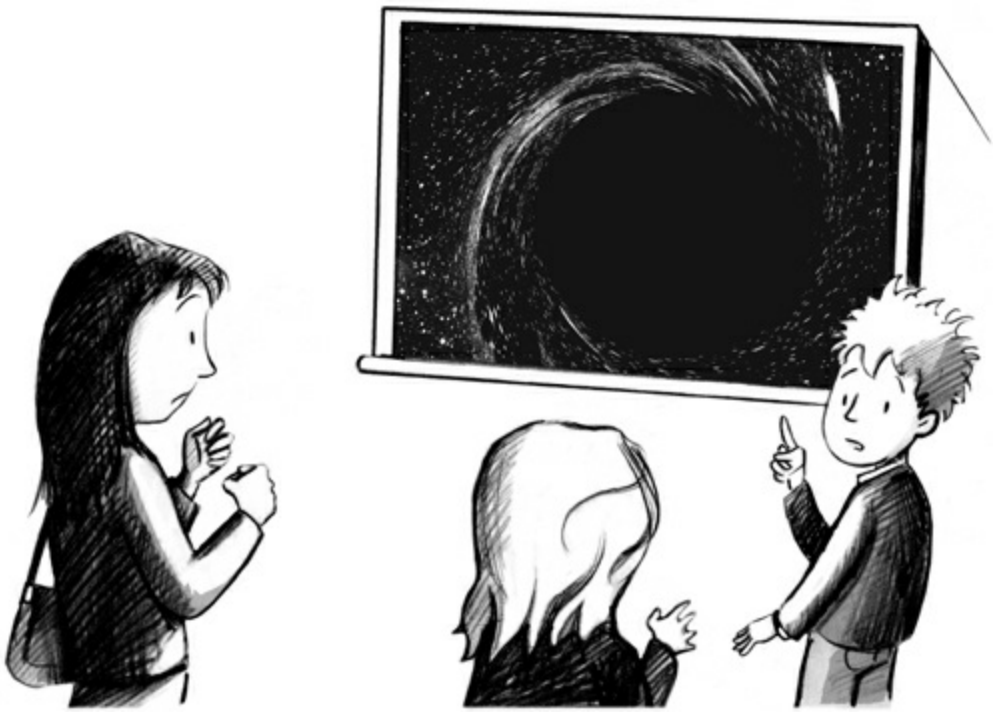
"That's the black hole!" cried George.

"Correct," replied Cosmos. "That's where I left you and Eric."

The view seemed very still, as though nothing was happening.

"Cosmos, why aren't you doing anything?" asked Annie.

"It takes time," replied Cosmos. "I need to pick up all the little things that come out of the black hole. Most of them are so small, you can't even see them. If I miss one, I may not be able to reconstruct Eric. I will have to filter out Eric from every single object that ever fell in the black hole."



"What do you mean *reconstruct*?" asked Annie's mom.

"The black hole expels particles one by one. Each time a particle gets out, the black hole expels more the next time, so it gets quicker and quicker all the time. I'm fast forwarding time by billions of years. Please let me work. I need to pick up everything."

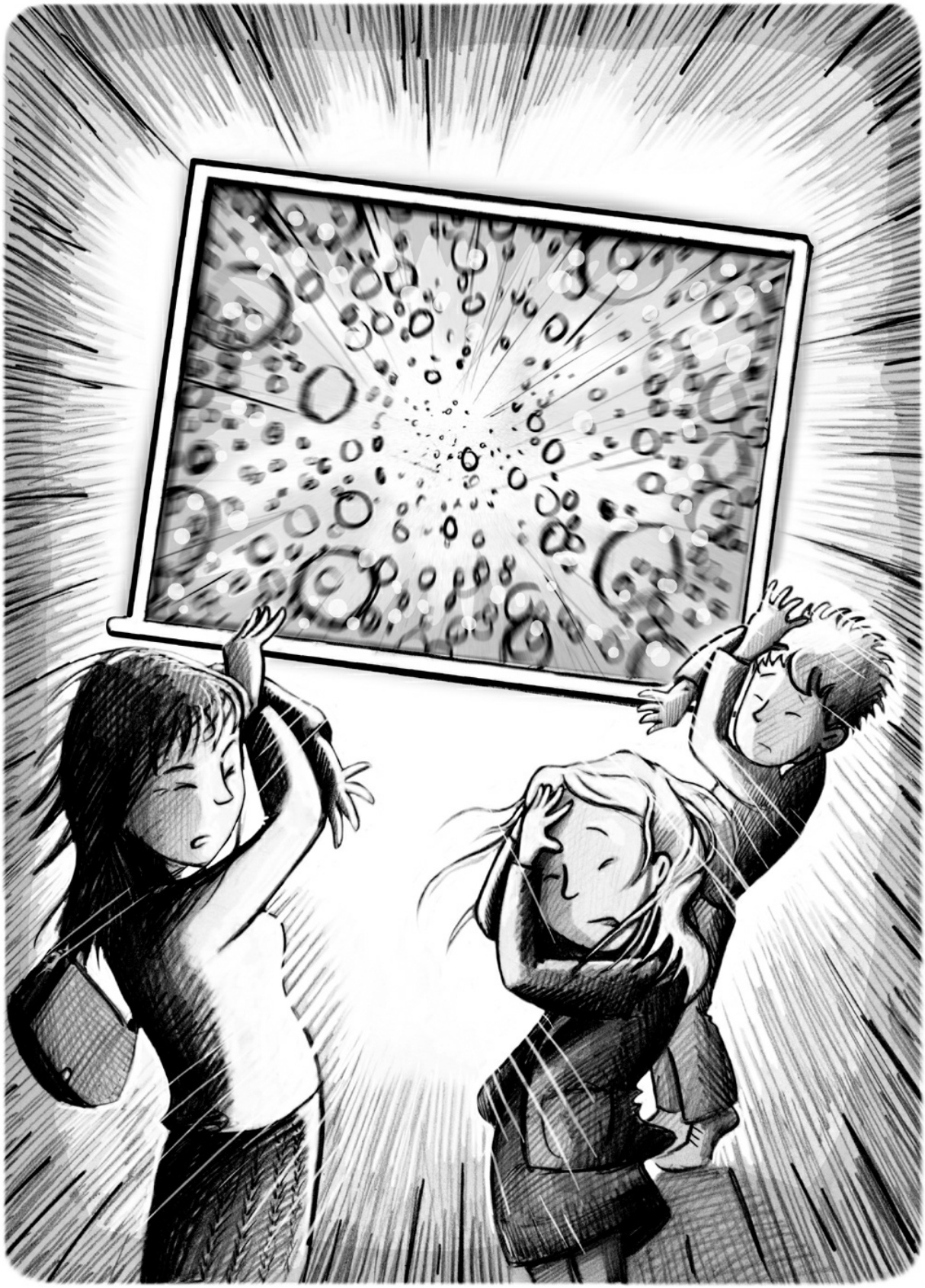
George, Annie, and her mom fell silent and stared through the window, each willing Cosmos to get it right. After a few minutes the black hole still looked exactly the same as it had before. But then, as they watched, it started to shrink, and the space around it became less and less distorted. Once the black hole had begun shrinking, it got smaller and smaller faster and faster. Now they could see an enormous number of particles that seemed to be coming from the black hole itself.

Cosmos was making a whirring noise that was getting louder and louder as the black hole shrank. The lights on his screen—so bright just a minute ago—started to flicker and grow dim. The whirring noise suddenly went crunchy and a high-pitched alarm rang out from Cosmos's keyboard.

"What's wrong with Cosmos?" George whispered to Annie and Susan.

Susan looked worried. "It must be all the effort he's making with the calculations. Even for Cosmos, they must be very difficult."

"Do you think he'll be able to do it?" squeaked Annie.



"We just have to hope," said Susan firmly.

Through the window, they saw that the black hole was now the size of a tennis ball. "Don't look!" cried Susan. "Cover your eyes with your hands!" The black hole became very bright and then suddenly exploded, disappearing in the most powerful explosion the Universe could withstand. Even with their eyes closed, George, Annie, and her mom could see its light.

"Hold on, Cosmos!" shouted Annie.

Cosmos gave a horrible groan and shot a green blaze of light from his screen as some white smoke rose from his circuits. "*Eu-re-k—!*" Cosmos started to shout, but his voice was cut off before he reached the end of the word.

The light suddenly vanished, and when George opened his eyes, he saw that the window was no longer there. Instead, the portal doorway had appeared. It burst open and the room in Dr. Reeper's house was flooded with the fading flash of brilliant light from the explosion. Standing in the middle of the doorway was the figure of a man in a space suit. Behind him, the portal doorway opened on a quiet place in space where the black hole was no more.

Chapter Thirty

Eric took off his helmet and shook himself, like a dog after a swim.

"That's better!" he said. He looked around. "But where am I? And what happened?" A pair of eyeglasses with yellow lenses slid off his nose, and he looked at them in bemusement. "These aren't mine!" He glanced at Cosmos, but Cosmos's screen was blank and black smoke drifted from the keyboard.

Annie rushed forward and hugged him. "Dad!" she squealed. "You fell into a black hole! And George had to rescue you—he was so smart, Dad. He found out from the notes you left him that you could escape from the black hole, but first he had to find Cosmos—Cosmos was stolen by a horrible man who—"

"Slow down, Annie, slow down!" said Eric, who seemed rather dazed. "You mean I've been inside a black hole and come back again? But that's incredible! That means I've got it right—that means all the work I've done on black holes is correct. Information that goes into a black hole is *not* lost forever—I know that now! That's amazing. Now, if I can come out of—"

"Eric!" said Susan sharply.

Eric jumped. "Oh, Susan!" he said, looking rather sheepish and embarrassed. He handed over the yellow glasses. "I don't suppose," he said apologetically, "you have a spare pair of my glasses with you? I seem to have come out of the black hole wearing someone else's."

"These two have been running around all over town to try and save you," said Susan, digging into her handbag and pulling out a pair of Eric's usual glasses. "They've cut school, and George is missing the science competition he wanted to enter, all for your sake. I think the least you could do is say thank you, especially to George. He figured it all out by himself, you know—about Graham and the black hole and everything else. And don't lose this pair!"

"Thank you, Annie," said Eric, patting his daughter gently and putting his glasses onto his nose at their familiar crooked angle. "And thank you, George. You've been very brave and very smart."

"That's all right." George stared at his feet. "It wasn't me, really—it was Cosmos."

"No, it wasn't," said Eric. "Cosmos couldn't have got me back without you—otherwise I'd be here already, wouldn't I?"

"S'pose so," said George gruffly. "Is Cosmos all right?" The great computer was still silent and black screened.

Eric untangled himself from Annie and went over to Cosmos. "Poor old thing," he said, unplugging the computer, folding him up, and tucking him under his arm. "I expect he needs a bit of a rest. Now, I'd better get home right away and write up my new discoveries. I must let all the other scientists know immediately that I've made the most astonishing—"

Susan coughed loudly and glared at him.

Eric looked at her, puzzled. "What?" he mouthed.

"George!" she mouthed back.

"Oh, of course!" said Eric out loud, striking his hand against his forehead. He turned to George. "I'm so sorry! What I meant to say was that first of all, I think we should go back to your school and see if you're still in time to enter the science competition. Is that right?" he asked Susan, who nodded and smiled.

"But I'm not sure . . . ," protested George.

"We can go through your presentation in the car," said Eric firmly. He started clanking toward the door in his space suit. "Let's get moving." He looked around to find that no one was following him.

“What now?” he asked, raising his eyebrows.

“Dad!” said Annie in a disgusted tone. “You’re not going to George’s school dressed like that, are you?”

“I don’t think anyone will notice,” said Eric. “But if you insist . . .” He peeled off his space suit to reveal his ordinary everyday clothes below, then ruffled his hair. “And anyway, where are we? I don’t recognize this place.”

“This, Eric,” said Susan, “is Graham Reeper’s house. Graham wrote you that note to send you into outer space, and while you were there, he stole Cosmos, thinking this would mean you could never come back.”

“No!” Eric gasped. “Graham did it deliberately? He stole Cosmos?”

“I told you he’d never forgive you.”

“Oh dear,” said Eric sadly, struggling to pull off his space boot. “That is very unhappy news.”

“Um, Eric,” piped up George, “what did happen with you and Greeper? I mean, why did he want you to be eaten by a black hole? And why won’t he ever forgive you?”

“Oh, George,” said Eric, shaking off the space boot, “it’s a long story. You know that Graham and I used to work together?” He reached into the inside pocket of his jacket for his wallet. From it he took out a crumpled old photo and handed it to George. In the picture George saw two young men; standing in between them was an older man with a long white beard. Both the young men were wearing black gowns with white fur–lined hoods, and all three were laughing at the camera. The man on the right had thick dark hair and heavy-framed glasses that, even then, were sitting at a slightly strange angle.

“But that’s you!” said George, pointing at the photo. He examined the face of the other young man. It was strangely familiar. “And that looks like Greeper! But he looks really nice and friendly, not scary and weird like he is now.”

“Graham,” said Eric quietly, “was my best friend. We studied physics together at the university, the one here in this town. The man you see in the middle was our tutor—a brilliant cosmologist. He invented the concept of Cosmos, and Graham and I worked together on the early prototypes. We wanted a machine that would help us to explore outer space so that we could extend our knowledge of the Universe.

“At the beginning, Graham and I got along very well together,” Eric continued, gazing into the distance. “But after a while he became strange and cold. I started to realize he wanted Cosmos all for himself. He didn’t want to go on a quest for knowledge to benefit humanity—he wanted to use Cosmos to make himself rich and powerful by exploiting the wonders of space for his own good. You have to understand,” he added, “that in those days, Cosmos was very different. Back then he was a gigantic computer—so big he took up a whole basement. And yet he wasn’t even half as powerful as he is now. Anyway, one evening when Graham thought he was alone, I caught him. He was trying to use Cosmos for his own terrible plans. I was there and I tried to stop him and . . . it was . . . dreadful. Everything had to change after that.” Eric fell silent.

"What—after the terrible thing happened?" asked Annie.

Susan nodded. "Yes, honey," she said. "Don't ask your father any more questions about it. That's enough for now."

Chapter Thirty-one

Back at George's school, the pupils in the hall were getting restless and bored. Kids were shifting around in their seats, whispering and giggling as a series of nervous, solemn-faced competitors from the different schools battled to gain their attention. However, no one was more agitated or jumpy than Dr. Reeper, who was sitting in the front row with the principal and the other judges.

"Sit still, Reeper! Good heavens, man!" hissed the principal out of the side of his mouth. He was feeling very irritated with Dr. Reeper for behaving so badly in front of the teachers and principals from the other schools. So far he hadn't bothered to listen to any of the presentations and hadn't asked a single question. All he had done was anxiously check the order in his program and crane his neck around to look at the hallway behind him.

"I'll just go and make sure George is up to speed with his speech," Reeper whispered back to the principal.

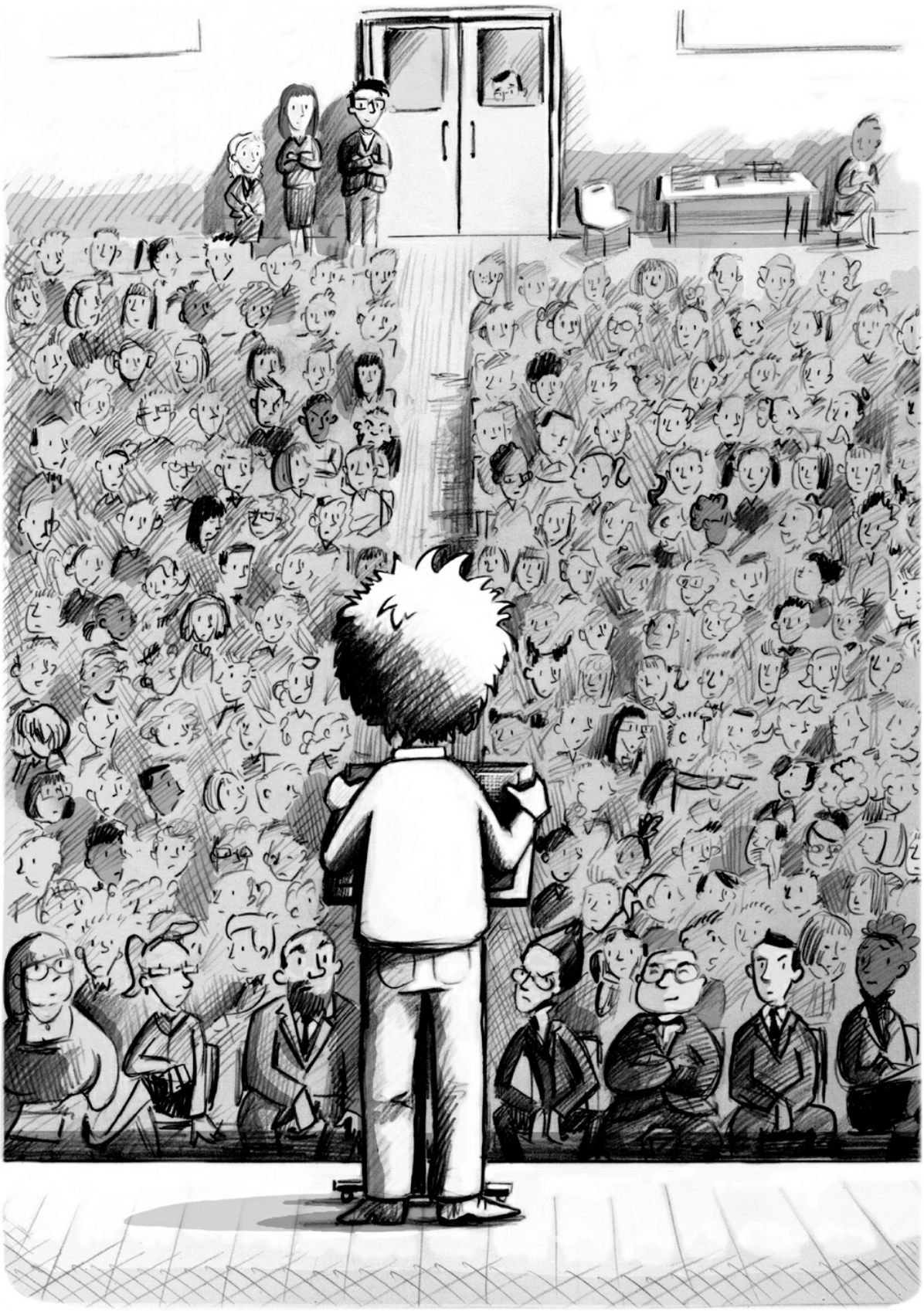
"You will not!" spluttered the principal. "George will do perfectly well without you. Try and show some interest, would you? You're letting the school down."

The boy on stage finished his speech on dinosaur remains. "So that," he concluded brightly to his tired audience, "is how we know that dinosaurs first walked the Earth two hundred and thirty million years ago." The teachers dutifully clapped as he clambered down from the stage and went back to join his school group.

The principal stood up. "And now," he said, reading from his notes, "we have our last contestant, our own George Greenby, from this very school! Can we give a big welcome to George, whose topic today is . . ." The principal paused and read his notes again.

"No, no, that's correct," said Dr. Reeper hurriedly. He stood up. "George's talk will be on the subject of Cosmos, the world's most amazing computer, and how he works. Hurray for George!" he cheered, but no one joined in. Then a long silence followed as everyone waited for George to appear. When he didn't, the noise level in the room rose as the kids, sensing the prospect of a swift end to the school day, rumbled with excitement.

The principal looked at his watch. "I'll give him two minutes," he said to the other judges. "If he hasn't shown up by then, he'll be disqualified, and we'll get on with the prizes." Just like the pupils, the principal was thinking how nice it would be to get home early for once, so he could put up his feet with no pesky kids getting in the way.



The clock ticked but still there was no sign of George. With just seconds to go, the principal turned to the judges and was about to announce the competition closed, when a flurry of activity at the back of the hall caught his attention. A group of people seemed to have come in —two adults, one with a laptop computer under his arm; a blond girl; and a boy.

The boy ran straight up to the front of the hall and said, "Sir, am I still in time?"

"Yes, George," said the principal, relieved that he had shown up after all. "Get yourself onto the stage. Good luck! We're relying on you!"

George climbed onto the big school stage and stood right in the very middle.

"Hello, everyone," he said in a thin voice. The crowds in the hall ignored him and carried on pushing and pulling and pinching each other. "Hello," George tried again. For a moment he felt sick with nerves and very foolish, standing there by himself. But then he remembered what Eric had said to him in the car on the way there, and he felt more confident. He pulled himself up straight, threw his arms out to either side, and yelled, *"Good afternoon, Alderbash School!"*

The kids in the audience fell silent in surprise.

"I said," bellowed George again, *"Good afternoon, Alderbash School!"*

"Good afternoon, George!" the room shouted back at him.

"Can you hear me at the back?" asked George in a loud voice. Leaning on the wall at the back of the hall, Eric gave him a thumbs-up.

"My name," continued George, "is George Greenby. And I am here today to give a talk. The title of my talk is *My Secret Key to the Universe*."

"Noooooo!" cried Dr. Reeper, jumping out of his seat. "That's wrong!"

"Hush!" said the principal angrily.

"I'm leaving!" said Dr. Reeper in a furious temper. He tried to storm out of the hall but got halfway down the center aisle when he saw Eric standing at the back. Eric gave him a little wave, smiled, and patted Cosmos, whom he was carrying under his arm. Reeper turned a shade of

light green and slunk back to his seat at the front, where he sat down quietly once more.

"You see," George carried on, "I've been really lucky. I found a secret key that's unlocked the Universe for me. Because of this secret key, I've been able to find out all sorts of things about the Universe around us. So I thought I'd share some of the stuff I learned with you. Because it's all about where we came from—what made us, what made our planet, our Solar System, our Galaxy, our Universe—and it's about our future. Where are we going? And what do we need to do to survive centuries into the future?

"I wanted to tell you about it because science is really important. Without it, we don't understand anything, so how can we get anything right or make any good decisions? Some people think science is boring, some people think it's dangerous—and if we don't get interested in science and learn about it and use it properly, then maybe it *is* those things. But if you try and understand it, it's fascinating, and it matters to us and to the future of our planet."

Everyone was listening to George now. When he stopped talking, there was complete silence.

He started again. "Billions of years ago, there were clouds of gas and dust wandering in outer space. At first these clouds were very spread out and scattered, but over time, gravity helping, they started to shrink and become denser and denser . . ."

EARTH

- Earth is the third closest planet to the Sun.
- Average distance to the Sun: 93 million miles (149.6 million km)

A total of 70.8% of the surface of the Earth is covered with liquid water and the rest is divided into seven continents. These are: Asia (29.5% of the land surface of the Earth), Africa (20.5%), North America (16.5%), South America (12%), Antarctica (9%), Europe (7%), and Australia (5%). This definition of continents is mostly cultural since, for instance, no water expanse divides Asia from Europe. Geographically, there are only four continents that are not separated by water: Eurasia-Africa (57% of the land surface), Americas (28.5%), Antarctica (9%), and Australia (5%). The remaining 0.5% is made up of islands, mostly scattered within Oceania in the central and South Pacific.

- A day on Earth is divided into 24 hours, but in fact it takes Earth 23 hours, 56 minutes, and 4 seconds to rotate around itself. There is a 3-minute-and-56 second mismatch. Over a year this adds up to the one turn the Earth makes by going around its orbit.
- An Earth-year is the time it takes for the Earth to complete one revolution around the Sun. It may vary very slightly over time, but remains about 365.25 days.
- So far, the Earth is the only known planet in the Universe to harbor life.

"*So what?* you might think," continued George. "What's a cloud of dust got to do with anything? Why do we care or need to know what happened billions of years ago in outer space? Does it matter? Well, yes, it does. Because that cloud of dust is the reason we are here today.

"Now we know that stars are formed from giant clouds of gas in outer space. Some of these stars end their lives by becoming black holes that slowly, very slowly, let things escape until they vanish in a huge explosion.

"Other stars explode before they become black holes and send all the matter inside them through space. We know that all the elements we are made of were created inside the bellies of these stars that exploded a long time ago. All the people on Earth, the animals, the plants, the rocks, the air, and the oceans are made of elements forged inside stars. Whatever we might think, we are all the children of stars. It took billions and billions of years for Nature to make us out of these elements."

George paused for a second.

"So, you see, it took an incredibly long time to make us and our planet. And our planet isn't like any other planet in the Solar System. There are bigger ones and more impressive ones but they aren't places you could think of as home. Like Venus, for example, which is really hot. Or Mercury, where one day lasts for fifty-nine of our Earth days. Imagine that, if one day at school lasted fifty-nine days! That would be pretty awful."

George paused for a moment and then continued to speak, the whole hall hanging on his every word as he described some of the wonders of the Solar System. Finally he came to what he thought was probably the most important part, at the end of his presentation.

"Our planet is amazing and it's ours," he summed up. "We belong to it—we're all made of the same stuff as the planet itself. We really do need to look after it. My dad's been saying this for years, but I've just felt embarrassed by him. All I could see was how different he was from other parents. But I don't feel that way now—he's right to say we have to stop messing up the Earth. And he's right that we can all try just a little bit harder. I feel proud of him now for wanting to protect something as unique and beautiful as the Earth. But we all need to do it or it won't work, and our awesome planet will be ruined.

"Of course, we can also work on finding another planet for us to live on, but it isn't going to be easy. We know there isn't one close to us. So if there is another Earth out there—and there might be—it's a long, long way away. It's exciting, trying to discover new planets and new worlds out there in the Universe. But that doesn't mean that home isn't the place you still want to come back to. We've got to make sure that in a hundred years' time, we've still got an Earth to return to.

"So, you might wonder how I know all this. Well, the other thing I wanted to say to you is that you don't need to find an actual secret key, like I did, to unlock the Universe and help the Earth. There's one that

everyone can use, if they learn how. It's called 'physics.' That's what you need to understand the Universe around you. Thank you!"

The hall burst into applause as everyone rose to his or her feet to give George a standing ovation. Wiping a tear from his eye, the principal sprang onto the stage to clap George on the back, and said, "Well done, George! Well done!" He pumped George's arm up and down in a very vigorous handshake. George blushed. He was embarrassed by the clapping and wished it would stop.

Down in the audience, Dr. Reeper also appeared to be crying, but not from pride or happiness, like the principal. He was weeping for quite a different reason. "Cosmos!" he raged under his breath. "So close! I had you in my hands! And now he's stolen you away from me!"

The principal helped George down off the platform and had a very brief consultation with his fellow judges—all except Dr. Reeper, that is, who was hunched in his seat, whispering to himself and casting nasty looks at George. Borrowing the gym teacher's whistle and blowing it sharply several times, the principal brought the hall to order again.

"A-hem!" he said, clearing his throat. "I would like to announce that this year's winner of the interschool science presentation is, by—almost! —a unanimous vote on the part of the judges, *George Greenby*!" The school hall cheered. "George," the principal continued, "has given us a wonderful presentation, and I am delighted to award him the first prize, which is this truly amazing computer, kindly donated by our sponsors." One of the other judges produced a large cardboard box from under the table and handed it to George.

"Thank you, sir, thank you!" said George, who was rather overwhelmed, both by the experience and by the size of the box he had just been given. He staggered down the center aisle toward the exit, clasping his prize in both hands. Everyone smiled as he passed—except for one group of boys sitting at the end of the row, who were deliberately not clapping. They sat there with their arms folded, glaring at George.

"You haven't heard the last of this," hissed Ringo as George passed him.

George ignored him and hurried on until he reached Eric, Annie, and Susan.

"You did it, George! I'm so proud!" said Eric, trying to hug George around the huge cardboard box.

"George! You were great," said Annie shyly. "I never thought you would be so good on stage. And your science was pretty amazing too."

"Did I get it all right?" George asked her, feeling worried as Eric took the large box from him. "I mean, when I said 'billions,' should I have said 'tens of millions'? And when I talked about Jupiter, I thought maybe I should have said—"

"No!" said Annie. "You got everything right, didn't he, Dad?"

Eric nodded and beamed at George. "Especially the last part. You got that really, really right. And you won first prize as well. You must be very happy."

"I am," said George, "but there's just one problem. What are my parents going to say when I come home with a computer? They're going to be *so* angry."

"Or they might be *so* proud," said a voice.

George looked around and saw his dad, standing next to Susan. His jaw dropped. "Dad?" he said. "Were you here? Did you hear my speech about science?"

"I did," said his dad. "Your mother wanted me to come and pick you up from school—she was worried about you this morning—and I got here in time to hear your talk. I'm very glad I did, George. Because you're right, we shouldn't be scared of science. We should use it to help us save the planet and not close our minds to it."

"Does that mean I can keep my computer?" squeaked George.

George's dad smiled. "Well, I think you deserve it. Only an hour a week, though, or my homemade generator won't be able to keep up."

There was a sudden commotion behind them, and their little group was rudely pushed to one side by Dr. Reeper, who was charging through the crowd in a great hurry. Following him were Ringo and the other members of his gang. They all looked mad.

George watched them go and turned to Eric. "Aren't you going to do something about Greeper? Like punish him?"

"Um, no," said Eric sadly. "I think Graham's punished himself quite enough already. Best leave him alone. I doubt our paths will cross again."

"But . . . but . . . ," said George. "Eric, I wanted to ask you—how did Greeper know where to find you? I mean, you could have gone

anywhere in the world, but he was waiting for you here, and he was right. How did he know?"

"Ah well. The house next door to you," said Eric. "It belonged to my old tutor, the man in the photo with the beard."

"But he disappeared!" said George.

"He only sort of disappeared," replied Eric. "I got a letter from him some time ago, saying he was going away on a very long journey, and he didn't know if or when he'd be back. He told me he wanted me to have his house, in case I ever needed somewhere to work on Cosmos. He couldn't have imagined that Graham would lie in wait for me here, for all these years."

"Where did the old man go?" asked George.

"He went . . . ," Eric started.

"Home," said Susan very firmly. "Can I give you a lift?" she asked George's dad.

"Oh no!" he said. "I've got my bike. I'm sure we can balance the computer on the handlebars to get it home."

"Dad!" huffed George. "Please! We might drop it."

"I don't mind running George home," said Susan. "It might be cramped, but it's amazing what you can fit inside a Mini."

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Back at George's house that night, Eric, Susan, and Annie all stayed for a delicious supper of home-grown vegetables eaten by candlelight at the

kitchen table. Eric and George's dad got into a long and very enjoyable argument about whether it was more important to look for a new planet or to try and save this one, while Susan helped George to set up his shiny new computer.

Annie went out into the garden and fed Freddy, who was looking rather lonely in his sty. When she came back from chatting to the pig, she spent the evening dancing around George's mom, showing her all her ballet steps and telling her lots of tall stories, which George's mom pretended to believe.

After they went home, leaving with lots of promises of eco-warriors talking to scientists at their conferences and trips to *The Nutcracker* together, George went upstairs to his room. He was very tired. He got into his pajamas but he didn't close the curtains—he wanted to look out of the window as he lay under his comforter.

It was a clear evening, and the night sky was studded with brilliant, twinkling stars. As he watched, a shooting star fell across the dark background, its long, shiny tail blazing with light for a few seconds before it melted into nothing.

Perhaps the shooting star is a piece of the comet's tail, thought George as he fell asleep. As a comet passes the Sun, it warms up and the ice on it starts to melt . . .