THE CHOCOLATE SCHOOL

Text: Joana Sabata
Illustrations: Armand

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Texts: Joan Rioné
Illustration and layout: Armand armand-art.com
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PROLOGUE

The book you are holding is one of the outcomes of the project "The science of chocolate", an initiative that started out as a pilot programme at the Pau Delclòs School in Tarragona. The aim of this project was to make chocolate, a food loved by young and old alike, the pretext for discussing and explaining various aspects of science to boys and girls at primary school. We decided that the researchers from the Universitat Rovira i Virgili and the Catalan Institute for Chemical Research would be responsible for each workshop. In this way we would show that it is normal for women to be involved in research and we would encourage scientific vocations, particularly in young girls.

The outcome of this initiative has been most gratifying for everybody involved: the boys and girls, who learned by doing experiments; the teachers, who have seen that the concepts learned from the workshops are related to what they teach in their classes; and the researchers, who have realised that scientific communication makes people aware of science and encourages them to take an interest in it. It also shows that research is done in a wide variety of fields ranging from history to engineering and including chemistry, economics, medicine and nutrition... among others.

For all these reasons we have decided to share this experience with the general public. We began by setting up workshop programmes in public libraries and went on to create this illustrated story so that the content of the workshops could be presented in a long-lasting format and be made available to everybody.
The Chocolate School is, then, the culmination of an initiative to communicate science. It shows that science can be of interest to everybody, it can be understood and it can be explained in a wide variety of ways.

Scientific Communication Unit of the Universitat Rovira i Virgili (URV)
Communication Unit of the Institute of Chemical Research of Catalonia (ICIQ)

GOING TO SCHOOL

Tina comes out of her house carrying her satchel, turns left, walks past Mary's cake shop, goes down the 12 steps on Carabassons Street and carefully crosses the road. She reaches a square where some old men are playing a game with a ball, skirts a patio with jasmine climbing up one wall and where a cat miaows good morning to her, climbs over a fence, speeds up a bit and is overtaken by a chef on a bike. Tina breaks into a run, steps around a puddle, goes up two steps, says hello to the caretaker and goes into the tastiest place in the world: the Chocolate School.

The bell rings. "Please wash your hands everybody," the loudspeakers announce.
The first class of the day is about to start.

LESSON 1. THE ORIGINS OF CHOCOLATE

The first person to visit us is Laura, an expert – one of the most expert experts – in the history of cocoa (which what we consider to be the origin of cocoa nowadays). She tells us that it is the fruit of a tree in Central America. Way back in history, America was a far-off place. Now, she points out, it isn't. That's not to say that it has got nearer – ha ha! – she jokes, but in the past you could only get there by sea and now you can **fly**.

The fact is that 1, 2, 3, 4, 5, 6, 7, 8, 9 and up to 3,000 years ago cocoa was grown by the Mayas but not everybody was allowed to eat it. It was very exclusive, a special food – yum, yum – a delicacy that was only for the very rich and warriors because it was full of energy and cured stomach ache. "Mmmm, where were we?" says the expert absent-mindedly.

Now things have changed and cocoa is quite common. People eat it whenever they like.

"Always?" asks Tina.

"In moderation!" corrects her teacher. "Even the most exquisite and delicate foods must be eaten in moderation!"

LESSON 2. THE BUSINESS OF CHOCOLATE

Dolors is an entrepreneur – a very dynamic entrepreneur – who is always looking for new ways to buy and sell chocolate. We are quite used to finding it in the shops, but… How does it get there?

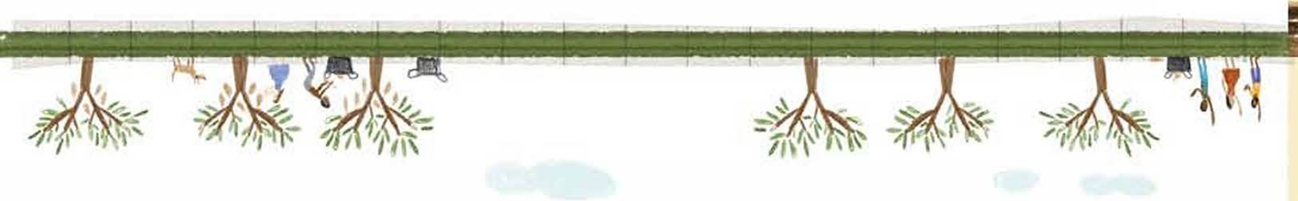
"Now that is an interesting question, a very interesting question!" says Dolors. Let's find out what happens to chocolate before it is put on the shelves.

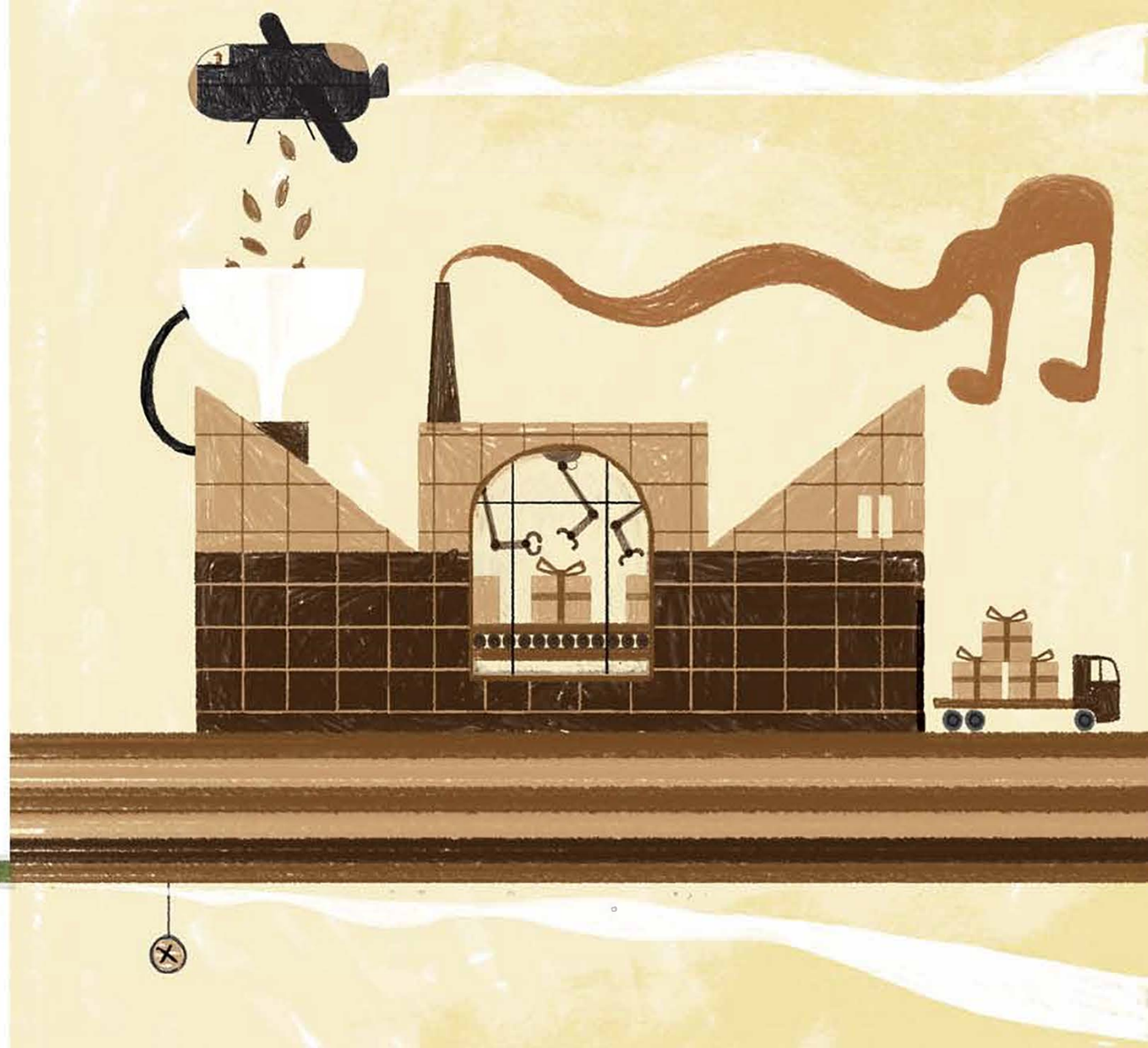
"Before doing anything else, the companies that make chocolate have to go and find the cocoa. But if they don't want to cause stomach aches, they have to acquire it from plantations that are environmentally friendly and treat their workers with respect. To sell their chocolate more cheaply, some companies cheat and buy cocoa from places where the workers are treated badly and children are forced to work instead of going to school. As soon as we have the cocoa, the factories can start the production process."

"What's that?" asks Max curiously.

"It is really rather interesting!" says Dolors. "It's when the chocolate is made, packaged and labelled. Eh! But don't go thinking that it's easy. It's not! It's a delicate job that has to be done carefully and cleanly. (Some people say that if you sing while you're making chocolate it has a special taste.)"

"And, finally, the only thing left to do is deliver all the boxes to the shops and... start eating!"





LESSON 3. DECODING THE DNA OF COCOA

Katherine comes to speak to us. A respected – a highly-respected – expert in biochemistry and biotechnology applied to chocolate, Katherine is interested in anything that has to do with science and she is very passionate about the world of chocolate.

"Let's start at the beginning. Who knows what a cell is?" she asks. The children look at one another, not knowing what to say. "Well, it's the smallest part of all living things. A tomato, a flea and elephant or cocoa. Everything is made up of cells and, of course, so are we. Organisms such as bacteria only have one cell. But plants and animals have a lot because – how shall I put this? – we are much more complicated. Even though cells are really very small, they have several parts and in the centre it has its DNA, which is like a microscopic library which tells us what we are like."

"Right, let's put our lab coats and goggles on and we'll do an experiment: we are going to extract DNA from cocoa and then put it in a test tube," says the teacher. "Mind you don't break any glass!"

All the pupils take great care with the laboratory equipment until, suddenly, a flask drops to the floor with a resounding crash and smashes into a thousand pieces. Everybody turns to stare at Tina and she looks as if she cannot believe it was her.

LESSON 4. CHOCOLATE AS A FOOD

Next up is Rosa Maria, a specialist – a very important specialist – who knows what we have to eat if we want to feel healthy.

"Is chocolate a medicine?" asks Josefina (who is one of Tina's friends – one of her closest friends).

"Well, yes and no! It all depends. Let's take one thing at a time," says Rosa Maria. "First of all we have to differentiate between cocoa and chocolate."

"Cocoa grows on trees like apples and figs. It starts as a beautiful flower, which produces a large fruit with a shell. Inside this shell, you find the cocoa seeds, a real treasure. They are the raw material, and they are what this school is most interested in because when they have been dried, they can be toasted, peeled and made into a paste or a powder.

"Chocolate is made by mixing these by-products with sugar, milk or anything else you feel like. But remember! All cocoa is similar but chocolate can be of lots of different types.

"I should point out that cocoa is healthy but that the sugar it is combined with to make chocolate is not, so you have to be aware of the amount of sugar it contains. All chefs know that measures are important and, when we look at chocolate, colours are a clue: the darker it is, the more cocoa it contains. The lighter it is, the more milk and sugar it contains."

And now, get your taste buds ready because – drum roll – we're going to do some tasting!

"Riiing, riiing!" The bell goes.
It's break time.

BREAK TIME

The children flood out of the classrooms and the corridor fills with the sound of running and laughter. Tina's one of the first.

In the playground, everyone is doing their own thing: the children, the birds, the ladybirds and the teachers.

LESSON 5. THE CHEMISTRY OF CHOCOLATE

Ester is one of the most scientific of scientists who knows lots of really interesting things.

"Chemistry is all around us!" she points out. "In toys, cars, paintings, fireworks, medicines, the wheels of skates and... it's also in chocolate! If I say the word molecule, do you know what I mean?" she asks.

"It is the smallest part of a substance, so small that you can't see it!" yells out Gustau, who is dressed all in blue today.

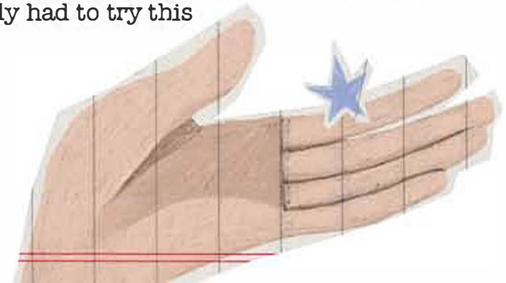
"That's right," says Ester, and everyone turns round to congratulate him. "Well, now we are going to talk about the main molecules in this amazing food (the names seem strange but they do really cool things)."

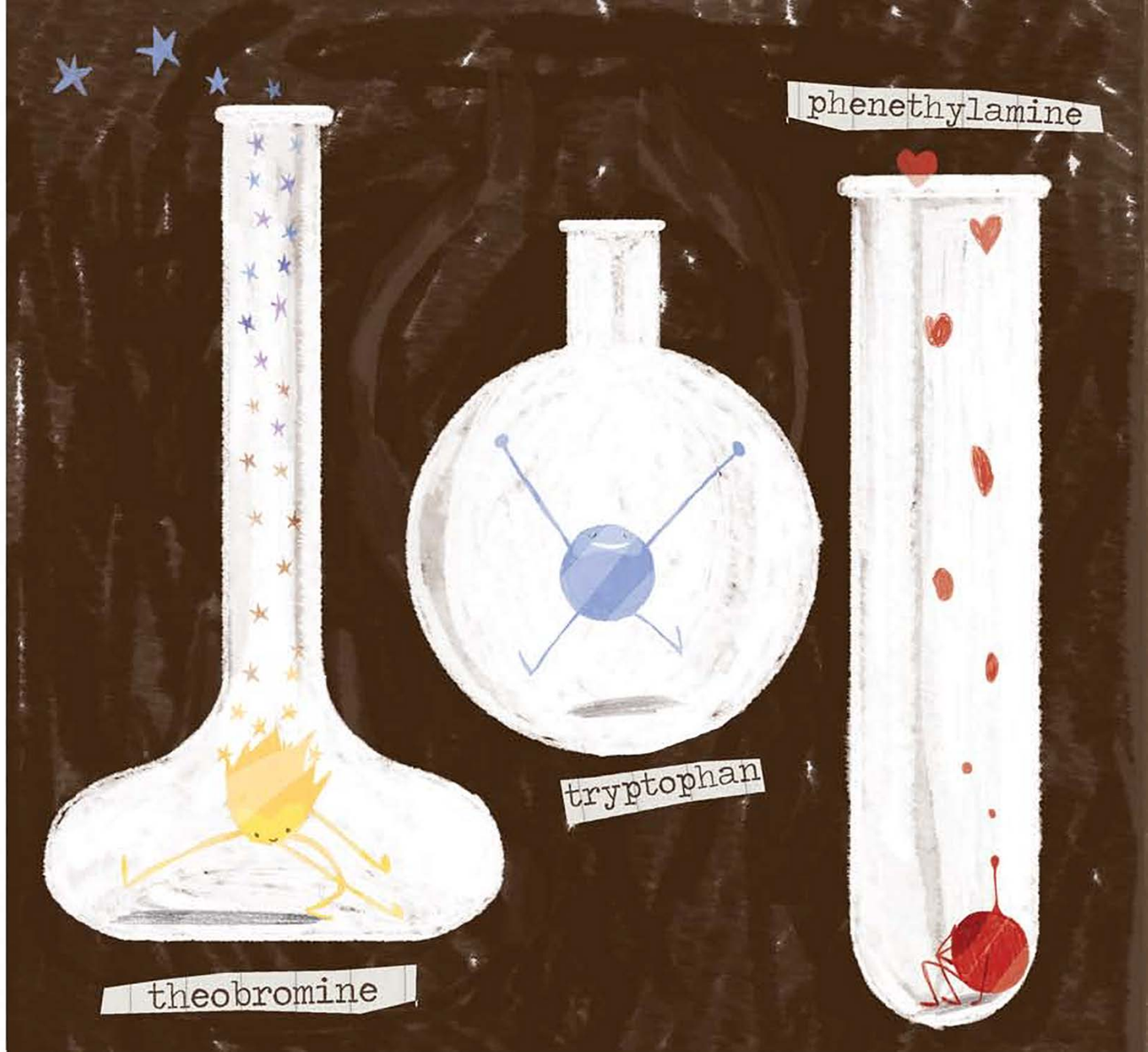
"Theobromine is a stimulant that makes people dance, but don't even think about giving it to animals because it would do them a lot of harm. As the Catalan saying goes, 'No chocolate or dessert for pets!'

"Tryptophan makes people happy. If you feel like crying, eat some chocolate and you won't feel so sad. At least, if you do cry, your tears will be sweeter!

"And finally phenethylamine, the molecule of love. The fact is that if you've got chocolate all over your mouth, it's much easier to kiss someone else!"

Tina and Toni look at each other and then draw closer together until their noses are touching. "Muah!" (well, they really had to try this kissing game, didn't they?).





LESSON 6. CHOCOLATE CRYSTALS

For this lesson, Marta comes in. She's a teacher – a really rather good teacher – who knows a little bit about everything and a great deal about science. She tells us that our lives are full of crystals and that chocolate is no exception, even if we eat it quickly. But, be careful, when we talk about crystals, we don't mean the fancy pieces of glass you find in sophisticated confectionary shops.

"Matter exists in three states: solid, liquid or gas. And in solids, molecules can be ordered or disordered. Well, when we speak of crystals, we are referring to how the molecules are ordered: whether they are all pointing upwards, some are pointing upwards and others downwards, or whether they are all the wrong way round.

"Mmmm, by the way, do you know what a molecule is?" asks Marta.

"It is the smallest part of a substance, so small that you can't see it!" (the whole class shouts out the answer together and the teacher looks very impressed).

"When chocolate goes from liquid to solid the molecules pack tightly together and form crystals. And the taste of the chocolate will depend on what these crystals are like. Remember that science is an excellent cook.

LESSON 7. THE FOOD OF THE FUTURE

Now it's Silvia's turn to teach us something. She is a chemical engineer – a very good chemical engineer.

"But what has chemical engineering got to do with chocolate?" asks Sol, who sounds somewhat disconcerted.

"A great deal!" replies Silvia "The work room in a cake shop is like a laboratory where gases, solids and liquids undergo delicious reactions." Sol opened her eyes wide in astonishment.

"I should tell you that, in the future, our food is going to change and chemistry will enable us to make more attractive meals. For example, mint and strawberry balls, cream airs, chocolate explosions – Baarroom! Bim, bam, boom! – (one of the pots spits out some chocolate and everyone licks their lips).

Very soon there are going to be so many of us on this planet that we won't be able to eat steak every day. There'll be no room for all those cows to graze. So we've got two choices: set up farms on the moon – Mooo! Baaa! Cock-a-doodle-doo! – (which may sound fun but at the moment just can't be done) or add new proteins to our daily menu."

"And what do you suggest?" asks Bernat with a rather hungry look on his face.

"Fruit chocolate with insects!" says Silvia.
"Why are you all looking like that?
It's really tasty! Do you want some?"
she said with her mouth full.

LESSON 8. CHOCOLATE AND ADVERTISING

Iolanda is a very clever lady – one of the cleverest – who knows how to invent stories and she has come to tell us all about the secrets of advertisements. We live our lives surrounded by publicity: in the street, in the newspapers, on the television and on internet. Sometimes, even aeroplanes fly past trailing banners. For us as consumers it is important to know why we choose one thing or another.

"OK. Do you like chocolate?" asks Iolanda.

"Yes, of course we do! A lot! We love it! Long live the Chocolate School!" shout the children.

"Well, just think: chocolate is so delicious that it is not really necessary to advertise it, but even so publicity agents have created images and stories so that we become aware of the individual brands and feel even more like eating it. Making good chocolate is not enough; everybody has to know that it exists.

"But you have to be careful! Chocolate advertisements do not speak only of the product; they also create an imaginary world full of happiness. Have you noticed that people in chocolate adverts are always smiling? Ha ha ha!" the teacher laughs and the pupils do the same. Happiness is contagious!

"Just as magicians surprise us with their tricks or storytellers enchant us with their words, advertisements aim to impact our senses. Even though chocolate is a food, it must first appeal to our sense of sight and our sense of hearing."

"Cling-clang, cling-clang!" The children are captivated by the sound of chiming bells.

LESSON 9. 3D PRINTING

Now it's Gisela's turn. She is a researcher – one of the very best researchers – with a great deal of experience in scientific research projects. "We have to be inquisitive and search for new approaches, because life and science are constantly changing!" she says.

"Things are changing so quickly that very soon baking a cake will be as simple as making a photocopy. Listen carefully because it's really quite straightforward.
Chocolate is a solid that melts when it is heated and solidifies when it cools without losing any of its properties (that is to say, it's still delicious). To make sweets and chocolate you can use moulds. But you can also use 3D printers."

"3D printers?" exclaim the whole class in astonishment.

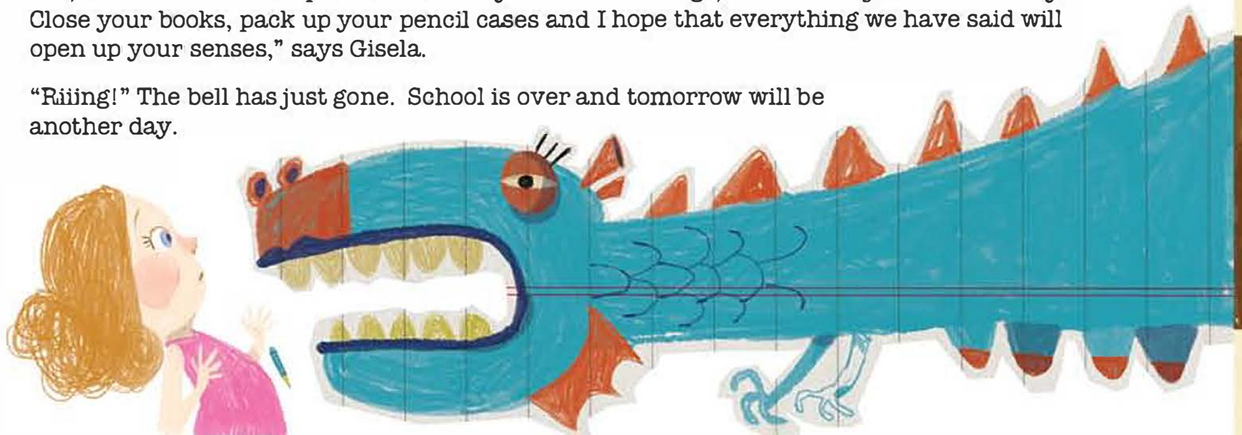
"Do you like drawing?" asks Gisela. "Well, a 3D printer uses chocolate instead of ink and it draws a figure. But before it can do this, you have to design some computer software for three-dimensional drawing."

"Wow! I'll be able to eat everything I draw!" cries Berta while she sketches a dragon with tusks and a gaping mouth.

"Mind that doesn't eat you. It looks real enough!" smiles Bernat.

"So, now that we have spoken of so many wonderful things, there is very little left to say. Close your books, pack up your pencil cases and I hope that everything we have said will open up your senses," says Gisela.

"Riiing!" The bell has just gone. School is over and tomorrow will be another day.



TIME TO GO HOME

Tina and all her friends leave school laden down with new flavours and head for home, playing on the way. One little boy hops his way up the street; another walks in the other direction singing (La, la, la) and, finally, when everyone has gone, the Chocolate School closes its doors and is enveloped in silence.

But a window has been left half open and the subtle scent of hot chocolate gradually leaks out through it. A man with an owl-like face, a woman who is rushed off her feet and a tramp walk past. The bewitching smell enters their nostrils and, when they stop to enjoy it, they are reminded of a thousand memories and, unexpectedly, they all break into a smile.

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The bell rings. 'Please wash your hands everybody,' the loudspeakers announce. The first class of the day is about to start."

Behind the taste, the form, the smell and the history of chocolate there is a great deal of science.
This book is based on the workshops given by the URV and ICIQ in which cocoa is the protagonist.

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