

# It All Began With a Bean

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## *A Curriculum Guide for Grades 2 & 3*

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This science based curriculum guide gives students an opportunity to learn about the digestive system and the digestive process through hands-on activities and experiments. The following standards set by the National Science Teachers Association for grades K-4 apply:

**Science As Inquiry:** understanding about scientific inquiry; abilities necessary to do scientific inquiry → asking questions, observation, following a simple investigation, using data to formulate an explanation

**Life Science:** characteristics of organisms → different structures serve different functions

**Science in Personal and Social Perspectives:** personal health → nutrition → how the body uses food

## For Teachers, Principals and Parents

You might wonder, “Why would a former teacher write about farts?”

Well, kids wonder. They wonder about most everything. That’s why kids say “Why does...?” and “Why do...?” so much more than adults. They’re curious. They want to take the world apart and see how it works.

Their curiosity is a good thing. We should protect it. It’s why first graders are so excited to go to school; it’s fun for them to learn. And if they like learning, they’ll learn well.

But kids can also learn things that don’t serve them. They can learn to be ashamed. Kids watch us closely. They take their cues from us. If they see that we’re ashamed of something normal, something that everyone does, they will follow our lead. They will learn shame.

And if they hear us say, “We don’t talk about farting here,” they will talk about farting over there.

Away from us. And it won’t be pretty.

Then farting will become taboo...and taboo topics have great power over us. Something will mean much more than it should.

## **It All Began With a Bean?**

So, how could one use “It All Began With a Bean,” a book about the whimsical consequences of a collective fart, in a science class? Well, given that the first half of the book is about the causes of flatulence and that flatulence is a byproduct of digestion, opening the book can open the topic of digestion.

### **Yeah, but farting is a taboo topic.**

Yes, farting is frequently a taboo topic.

But consider how “It All Bean With a Bean” began: One day, when I was teaching digestion to second graders, the smartest boy in the room raised his hand and asked, “What would happen if everyone in the world farted at once?”

What was remarkable about that moment was the reaction of his classmates. None laughed. They all looked at him and then looked at me as if his question were legitimate. I realized that I had a decision to make. I could hush the bright and curious second grader, thus guaranteeing that the topic of flatulence would become taboo and be discussed at recess, or I could use it as just another opportunity to play...and learn. I chose the latter.

The students in the room followed my cue, as students typically do. Had I been anxious, they might have giggled. Had I chastised the lad, they all might have learned to suppress their curiosity and imagination. Instead, I told them a whimsical story about the consequences of a collective fart and inserted some science.

They smiled, for children like stories, and that hypothetical, collective fart became just another learning opportunity.

## **Teaching the Digestive System is the Best!**

To use “It All Began With a Bean” in a classroom, the most logical fit is the digestive system...and teaching the digestive system is the best. Some topics are just fun to teach. Digestion is one. Sure, a teacher can limit herself to an overhead projector, a transparency of the digestive tract, and a droning monologue about a cracker’s journey through a body, but don’t.

The digestive tract is shrouded in skin. So, we can’t peel away the shroud and poke around the system. Therefore, the digestive tract invites us to use facsimiles. And facsimiles are fun. More importantly, they’re powerful teaching tools.

## Start with a definition...and a cracker.

Activity length: 10 minutes

Materials needed:

- A soda cracker
- A hammer
- Vinegar
- A cutting board
- Some newspaper

An easy classroom mistake to make is we use a basic word again and again, without a clear understanding of its meaning. This curriculum is about *digestion*, but what is digestion?

***Digestion is the process of reducing, of making food smaller and smaller and smaller. In the end, digestion produces a bit of food so teeny that it can fed to a single cell.***

But why settle for this explanation when you can have fun with it?

Start with a cracker, a hammer, and some vinegar, but first spread some newspaper under a cutting board. Circle your students around the cutting board so that all can see. Feel free to be dramatic and mysterious.

Ask, throughout your demonstration, “What am I doing?”

First, snap the soda cracker (“What am I doing?”). Let it fall on the cutting board.

Then, give it a few whacks with the hammer (“What am I doing?”).

Lastly, dribble some vinegar on it (“What am I doing?”).

Your students might say, in answer to your repeated question (“What am I doing?”), “You’re busting up the cracker.”

“You’re making it into mush.”

“You’re making a mess!”

“You’re making it smaller.”

These are all good answers and those students should be encouraged, for digestion does bust up food, it makes food into mush, it makes a mess, and it makes it smaller.

Then put the word, “digestion,” on the board. Say it too.

And declare: “What I did to the cracker is digestion. I broke it up. I made it smaller. I made it into mush.”

Now point to the cracker mush on the table and ask, “Who would like to eat this digested cracker?”

An attention-craving lad might assert, “I will! I do!”

But most of your students will say, “Ewwwww!”

Then declare, “What I just did to the cracker with my fingers and the hammer and the vinegar is similar to what your body does to a cracker when you eat one. I just digested the cracker on the outside of my body instead of the inside. I broke it up out here instead of in here. (Point to your mouth and your middle as you say this.) Now, we’ll learn about how the inside of your body does to a cracker what I just did to it on the outside.

## **The digestive tract**

**Activity length: 15 minutes**

**Materials needed:**

- **A measuring tape**
- **A 25’ rope**
- **A length of paper long enough and wide enough to trace the teacher lying flat on his back**
- **A crayon/pencil/magic marker**

Tell your students that the digestive system is also called “the digestive tract.” Remind them that *digestion* means to make food smaller and smaller.

Define tract for them: it’s a chain of things through which food passes. You could compare it to a funhouse at a state fair, where one proceeds along a particular path and various things happen to you along the way. A tract could also be compared to the track of a roller coaster, where you proceed along a particular path and various things happen to you along the way: you go up, you go down, you go left, you go right, you go upside down. Put both “tract” and “track” on the board, so that they can see that they’re similar, but not the same.

Tell your students that the digestive tract starts at the mouth and ends where the poop comes out, which is called the anus. Measure from your mouth to your back porch. It will be between 2 and 3 feet.

Now, lie on your back on the paper and have a reliable student trace you on the paper.

Stand and inform them that the digestive tract isn’t 2 or 3 feet long. Tell them it’s 25 feet long. Show them how long 25 feet is by stretching your rope. Now ask them how a 25-foot tract can fit inside a person between 5 and 6 feet tall.

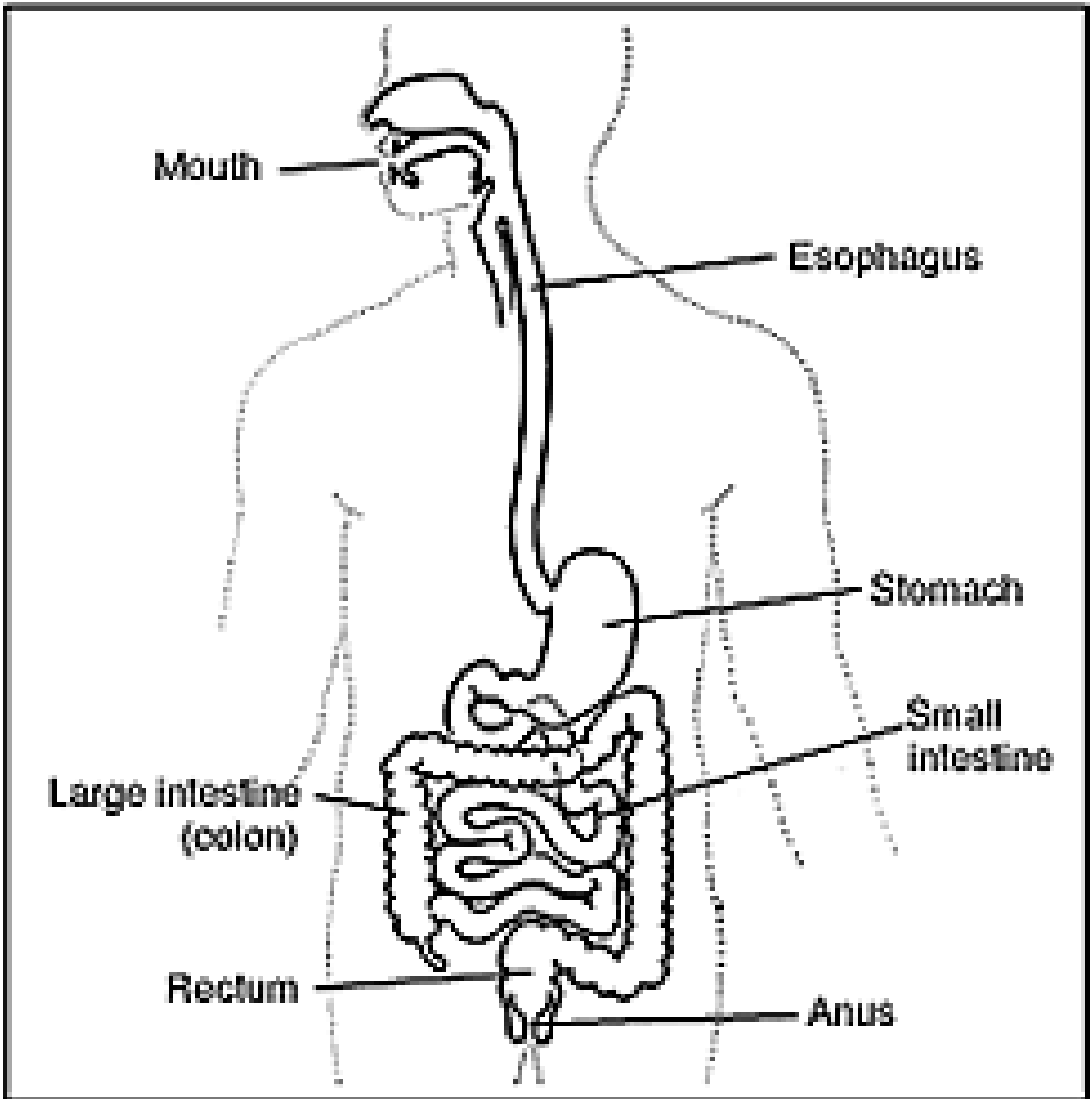
Ask, “Can one of you fit this rope inside my outline, staring at the mouth and ending at my bottom, without making a jumbled, knotted mess of it?”

Of course, to do this, they’ll have wind the rope back and forth.

When they do this, say, “Yep, that’s how it works. Let me show you a picture.”

Show them the cutaway of the digestive tract (Figure 1). Go through the system, part by part.

(Figure 1) Digestive Tract



## **Building the digestive system**

**NOTE:** *An underused modality in the classroom is the kinesthetic. It's often difficult to incorporate touch in a lesson, but when it is included, it accelerates learning.*

**Activity length: 40 minutes**

**Materials needed:**

- **Masking tape**
- **Floor space: the bigger the better**
- **Lots of kids**
- **A piece of paper with a big cracker drawn on it**
- **Scissors**
- **Tube of toothpaste**
- **Water in a spray bottle**
- **Yogurt**
- **Vacuum cleaner**
- **Clothespin**

Tape an outline of a human being on the floor, the bigger the better.

Say, "I need some tough kids. I need kids who are tough as rocks."

They'll be the teeth. Have them squeeze into the head.

Then say, "I need a long kid."

That kid will be the throat. Have this kid lie, connecting the teeth and stomach.

Then, "I need a kid who can hold a lot things. A kid with long arms who can wrap around something bigger than he is."

He'll be your stomach. Have him form a ball in the belly.

Then, "I need some flexible kids, kids who can wind back and forth."

They'll be your small intestine. Have them wind inside the abdomen.

Lastly, "Now, I need a kid who's got the toughest nose in the whole wide world. A kid who can smell any stink and not run away."

This kid will be your large intestine. Fold her in half and have her be the end of your digestive tract: the large intestine.

Now give scissors to the kids who are teeth. Give a toothpaste tube to the throat, the water sprayer to the stomach, the yogurt to the small intestine kids, and the vacuum cleaner and clothespin to the large intestine.

And feed the paper cracker into the mouth. Explain that teeth cut (and smash) food so it can fit in the throat. Have the teeth kids cut the paper cracker and pass it to the throat kid.

Explain that the throat isn't just a tube through which food falls. Tell them that it's lined with muscles that squeeze food through it, much as our muscles squeeze toothpaste out of a toothpaste food (You can prove this by having a kid hang bend at the waist and swallow a cracker. Without straightening, the muscles in his throat can make the cracker go up...against the pull of gravity.).

Have the throat kid simulate squeezing the paper through his length.

Explain that the stomach is also a muscle, but a muscle that adds acid to the food. Tell them that the vinegar that made the cracker dissolve is a mild acid and that the acids in the stomach are stronger than that (They've all tasted those nasty acids: when they vomited.). Have the stomach kid spray the cut-up paper cracker with acid (water). Then have him pass the soggy cut-up cracker to the small intestine.

Explain that the small intestine is full of bacteria and that bacteria make things fall apart. Tell them that they've all seen this happen: when a banana or a pumpkin grows black and collapses. Explain that bacteria ate the fruit and that's why the fruit grew smaller and blacker and collapsed. Now tell them that are good bacteria and bad bacteria. Bad bacteria make our bread moldy. But there are good bacteria in our bodies that help us digest our food. They make our food so small that they can be fed to the tiny bits of our bodies, which are called cells.

Explain that when we're born, we don't have these bacteria in our small intestines, which makes for messes. Ask if they've ever looked into a dirty diaper and noticed that baby poop is often gooey and comes in all sorts of colors. That's because babies don't have a lot of bacteria in their small intestines, so their food isn't as well-digested as ours.

How ask, "So how did the bacteria get inside of us?"

Field some guesses...and note the yogurt.

Say, "Some of the bacteria are in the foods we eat, like yogurt. So, when we eat, the bacteria go in, but don't go out. They cling to the inside walls of the small intestine."

Now say, "If we didn't have the bacteria in us, we'd poop like babies. It would be nasty and messy. But when the bacteria do their work, they make gas. Certain foods cause the bacteria to make more gas than others. After a while, that gas fills our small intestines. The small intestines grow bigger and bigger and hurt a little, like a stomach filled with too much food. So, what do we do?"

If someone guesses, "Fart," say, "That's right."

If they can't guess, then note that the small intestines are closer to the butt than the mouth, "So, what's the quickest way out?"

Now have the small intestine kids tear up the paper cracker as small as they can. Drop the bits in a bowl and explain that the blood in the body goes to the small intestine, picks up the tiny bits and takes them to the cells.

Save a few of the bits and say, "But in all food, there are some parts that we can't use. These parts of the food go into our large intestine. They're soggy and nasty and the large intestine sucks out the water."

Have the large intestine kid use the vacuum to suck out some of the water.

Then say, "Then the large intestine squeezes what's left into a turd and squeezes it out the back door, which is called the anus."

Then hold up the clothespin and say, "This is stinky work, so we'll give this large intestine kid a clothespin for the nose."

Do that.

Then have the digestive system kids return to their seats and build it again, with new kids.

Call for volunteers and test for knowledge by saying things like, “Who wants to be the large intestine, which will suck out the water and squeeze the turd out the anus?”

“Who wants to be the stomach, which will add acid to the food when it comes from the throat and mix it up by using muscles?”

And so on.

You can do this a couple times.

Then test for comprehension again by asking questions using the Figure 1.

### **It All Began With a Bean**

**Activity length: 20 minutes**

**Materials needed:**

- **It All Began With a Bean**

Read, It All Began With a Bean. After reading, note that there are certain foods that produce more gas than others. Remind students that it is the bacteria in our small intestines that produce the gas. So, the bacteria are responsible for the stink: not us!

See how many of the food items they can recall.

Now ask, “Why would the gum-chewers, the runners, and the crowd inhaling lots of air produce farts?”

Ask them to guess how this gas might be different from the gas produced by bacteria in the small intestine.

If they guess that it’s less stinky, tell them that they’re right. Also tell them that some foods produce a lot of farts, but they’re not as stinky. For example, vegetarians fart more than meat-eaters, but their farts aren’t as stinky.

Write the word “sulfur” on the board. Tell your students that sulfur is the gas produced by the bacteria in the small intestines. Ask them if they’ve ever smelled water that smells like eggs? Tell them that that water has sulfur in it.

### **Acid can be cool...and yummy!**

**Activity length: 30 minutes to start the experiment. Two days to see the final results.**

**Materials needed:**

- 4 raw eggs
- 1 hardboiled egg
- A large glass jar with a lid
- Vinegar
- A couple spoons
- A bag of sour candy



Quickly reassemble, using kids as the parts of the digestive system, the digestive system on the floor. Recall what happens in each part of the digestive system.

Ask, "What do the teeth do?"

("They cut and smash.")

What does the throat do?

("It squeezes food from the teeth to the stomach.")

What does the stomach do?"

("It adds acid to the food and mixes it together by using muscles.")

Now say, "Okay, we're going to prove the power of acid. Some acids are so strong that they can melt your face. We won't use an acid that strong because it isn't safe. But even a weak acid can melt through something solid if we give it enough time.

So, that's what we're going to do. We're going to use vinegar again. It's a weak acid, so it won't melt your tongue. Would anyone like to try it?"

Let a couple kids swallow a spoonful. Ask them how it tastes. They might describe it as "icky" or "yucky," but try to narrow it to "sour."

State, "Acids do taste sour, which can be a yummy thing if it's not too sour and has a little flavor added to it."

Pass out the sour candy and say, "Now, you're all going to eat some acid. It's a mild acid, with some yummy flavor added. If it were a stronger acid, it would melt your tongues and lips and teeth, but it's a mild acid, like vinegar."

Then say, "We'll now dissolve the egg shells with the vinegar."

Ask, "If the egg shells are gone, will the insides of the eggs just mix with the acid like this?"

Crack a raw egg and drop into the glass jar, which is filled with water. Let them observe the egg yolk and white joining the water. Then rinse out the jar.

Then do the following experiment. Along the way, keep connecting how an acid working on the eggshell is what acid in your stomach does to food: it dissolves it:

- Place your eggs in the container so that they are not touching.
- Add enough vinegar to cover the eggs. Notice that bubbles form on the eggs. Those bubbles are the eggshell dissolving...in the acid. Cover the container, put it in the refrigerator, and let the eggs sit in the vinegar for 24 hours.
- Use a big spoon to scoop the eggs out of the vinegar. Be careful—since the eggshell has been dissolving, the egg membrane may be the only thing holding the egg together. The membrane is not as durable as the shell.
- Carefully dump out the vinegar. Put the eggs back in the container and cover them with fresh vinegar. Leave the eggs in the refrigerator for another 24 hours.
- Scoop the eggs out again and rinse them carefully. If any of the membranes have broken, letting the egg ooze out, throw those eggs away.

- When you're done, you'll have an egg without a shell. It looks like an egg, but it's translucent—and the membrane flexes when you squeeze it. Very cool!

When you have your 3 see-through eggs, ask the kids why the eggs didn't blend into the vinegar like the raw egg did. Then carefully peel the hardboiled egg and show them that inside a shell, there's a thin skin called a membrane. Tell them that the membrane wasn't yet melted by the acid and that's what's holding the eggs together.

## **Acid and Farts**

**Activity length: 15 minutes**

**Materials needed:**

- **A ziplock bag**
- **A sink or bucket**
- **Newspaper**
- **Baking soda**
- **Vinegar**

Check for comprehension by asking your class what the vinegar is. Then ask them where in the digestive system acid is produced.

Say, "Now acid also produces gas when it dissolves something. So, when your stomach adds acid to food and the acid melts the food, that's also going to produce gas that either goes out the front (burping) or the back (farting). And we'll prove it now."

Working over a bucket or sink which is surrounded by paper, pour some baking soda into the ziplock bag. Then pour some vinegar in there. QUICKLY zip it closed and step back. The bag will swell as the acid dissolves the baking soda and gas is produced. Then it will pop.

## **The sad story of a cracker**

Have your students write about a cracker's journey through the digestive tract from the point of view of a cracker. Remind them that it wouldn't be an easy journey for a cracker. It would be cut and smashed by teeth and squeezed through the throat and mixed with acid in the stomach and so on. Tell them to imagine that they are the cracker and don't just describe what happens to them, but how they'll feel about it.

## **Just for fun**

The following worksheet is for fun...and to further learning. You could copy it and pass it out and talk about it, point by point.

# ***Fart Facts***

- What's a fart? A fart is stinky gas that comes out our back door.
- What is gas? A gas is a thing that floats in the air. We can't see it. But we can sometimes smell it.
- Why does fart gas stink? Well, there are itsy-bitsy critters inside of us. Those critters are called bacteria. Bacteria eat some of the food we swallow. The stinky fart gas comes from those bacteria.
- How often do we fart? Most people fart about 14 times a day.
- Do some people fart more than 14 times a day? People that eat a lot of veggies fart more.
- So, we shouldn't eat veggies, right? No, people that eat a lot of veggies fart a lot, but they don't have stinky farts.
- How much gas would we have if we bottled our farts? About half a liter, which would fill one empty pop can.
- Do fish fart? Oh, yes. Just about everything that eats will fart. This means that principals and presidents fart. Toothy sharks fart. Pretty swans fart. Hey, even whales fart, but don't think too long about that.
- Is there something that eats that doesn't fart? A few things and they all live in the sea. Jellyfish and coral don't fart. They have mouths, but no back door, so food goes in and waste comes out the same opening. Sponges don't fart either. And there's a sea worm that doesn't have a mouth, guts or a back door. It doesn't even eat! There's a special bacteria that lives in it and keeps it alive. It's a very skinny worm, which probably doesn't surprise you.
- What animal farts the most? No, it's not your brother or your father or your mother. It's the termite. Termites fart so much that they warm up the world. So, unless you want to fart more, don't eat wood.
- Can you fight with farts? Some reptiles do. They use farts as a weapon. But don't get the wrong idea here.
- How fast are farts? Most farts take several seconds to reach a nose, but farts will be faster if there's a wind. The next time you fart, try counting until someone smells that fart. But count to yourself, because after the first few times you count out loud, people will learn to run and you'll never know how fast your farts are.
- Do boys fart more than girls? Nope. But girls might blush more than boys.
- Why do beans make us fart so much? There's a sugar in beans that our bodies can't use. So when that sugar reaches our guts, the bacteria there eat it...and then they make fart gas.
- What other foods make us fart? Raisins, eggs, cheese, potato chips, corn, milk and bread also have the sugar that our bodies can't use.

- Can only food make us fart? No, swallowing too much air can make us fart, too. And chewing gum.
- Do some farts stink more than others? Sure. Eggs and meat make very stinky farts, and some animals have farts that stink more than others. For example, turtle farts are terrible, so don't stand behind a turtle!
- Why do some dogs fart so much? Well, a lot of dog food is made of soybeans, and beans make a lot of farts.
- Why do some dog farts smell so bad? Many dogs eat meat, and meat makes stinky farts.
- What's the worst place to fart? Maybe an elevator. Especially if everyone in that elevator ate eggs for breakfast and beans for lunch. And for sure, if that elevator is stuck between the 3<sup>rd</sup> and 4<sup>th</sup> floors, and someone says, "Hey, you guys! Do you want some potato chips and gum?"
- Is it bad to fart? No, it's normal to fart.
- Is it bad to not fart? Well, some doctors think that not farting might give you a tummy ache. A king once worried that it might be bad for people to not fart, so he made it a law that people could fart at the dinner table.
- Where does the fart gas go when you hold it in? It just goes back up your guts...and comes out later.
- What should you do if you must fart at a terrible time? Cough when you do, to cover the sound. Then squint at someone else, so it seems like they did it. Or you can remember that a king once thought it was okay.
- Is there such a thing as a fossil fart? Yes! If a bug is trapped in tree sap and farts as it dies, that fart will be trapped in sap, too. Scientists have found little fossil farts in very old, hard tree sap (which is called amber).
- Can you go a whole day without farting? Maybe. Not eating might help. And don't take deep breaths. And don't chew gum. But as soon as you relax and fall asleep, all that gas is going to be free. So if you have a fart-free day, be kind to your cat and keep it out of your bedroom.
- Could you rocket through space by farting? Well, farting in space could push you. It would work like a little rocket. But it would be a very slow way to reach the moon! I'd use a real rocket instead.

## **Reviews of It All Began With a Bean**

"It All Began With A Bean is a delightfully whimsical picturebook . . . Katie McKy's original story is wonderfully illustrated by Tracy Hill -- the result is a modern classic that will thoroughly engage the imaginations of young readers ages 4 to 8 from beginning to end. " -- **Midwest Book Review**

"While this may not have universal appeal, for a reluctant reader (in particular the boys) this may be just the right choice. Tracy Hill's full page, colorful and cartoon-like illustrations are just perfect for the story." -- **Children's Literature**

"The right audience is sure to get a laugh." – **School Library Journal**

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**A Teacher's Review:** Some may find this topic provocative. After all, nobody writes flatulence into lesson plans but all kids do it (teachers, too!) and find it hilarious so why not talk about. Why not tell a story that teaches and amuses?

I have spent the past nine years in the classroom and seven of those years teaching overseas in three countries. Farting is universal and transcends cultures. "It All Began with a Bean" would have been appreciated in the Czech Republic, France and Germany. The pictures are so animated and colorful that one wouldn't need to translate the text.

The past 6 months have found me at home with my daughter. From the perspective of a parent, I find this book delightful. We read it at least once a week and it truly is a favorite. The alliteration, the tone, the playful use of words and images impress my daughter who is just starting to explore language.

Amanda Howes  
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