The Little Cell Who Lost Its Way

Ramtin Resai-Kashkooli & Carolyn Leslie

Illustrated by Ramtin Resai-Kashkooli

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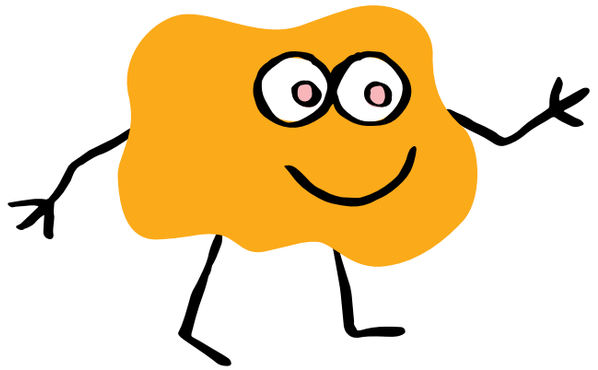

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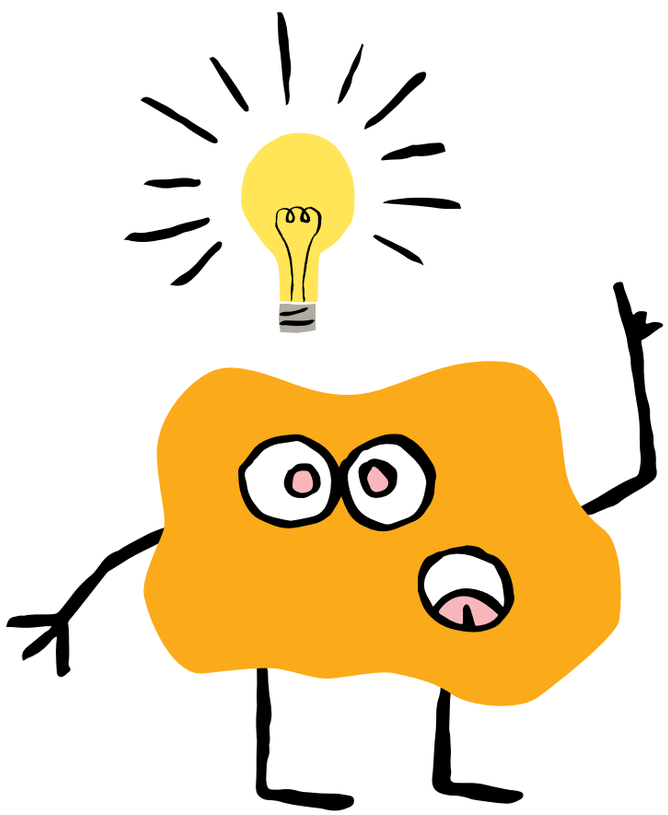
Once upon a time there was a little cell, who believed it could be anything in the world. It had plenty of ideas, but all of its thoughts were twirled.

This little cell dreamt of a life that was larger than just working alone—it wanted a partner. Someone to join with, to make a big impact. What could it become, who could it contact?

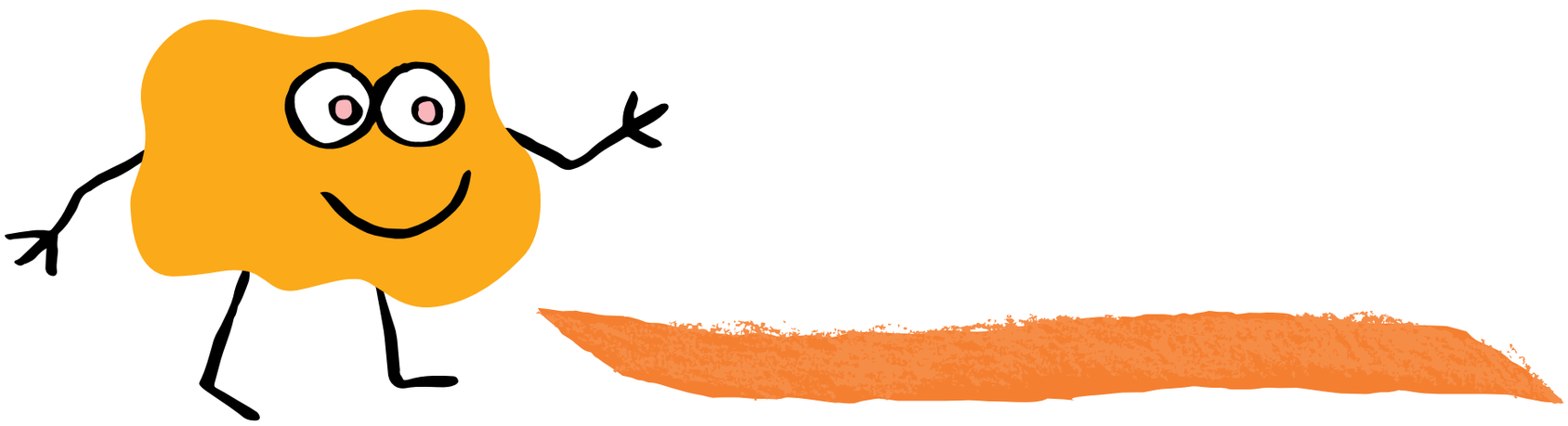
mmmhm, what should I be when I grow up?

I want to be a big strong muscle!

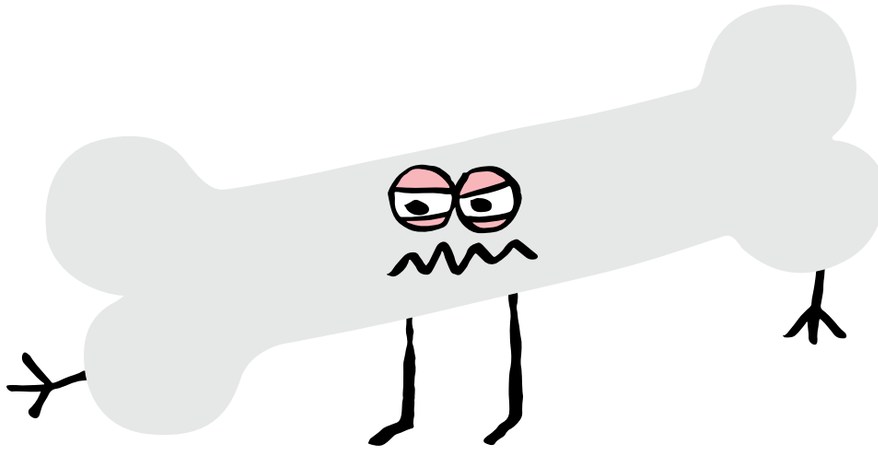


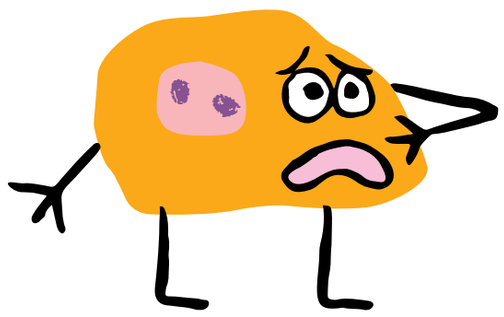
It thought and it thought ... then an idea came to mind.
'I'll be a muscle, the strongest of any kind!
To do this, I'll need friends to join with my plan.'
So off it departed, to find its new clan.

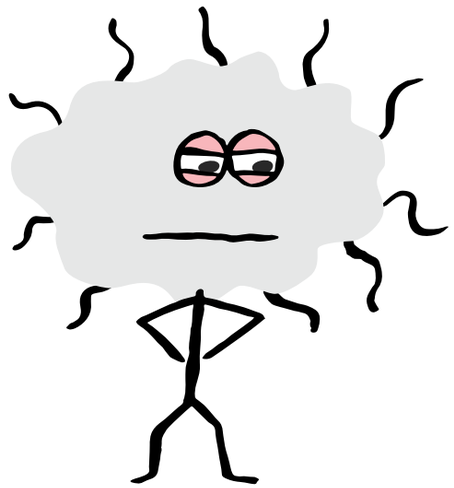
With a skip and a jump, a big smile and a chuckle,
It began its adventure ... to grow into a muscle.
It made its way forward and strolled down a track.
But that path was not easy, for it led to attack.

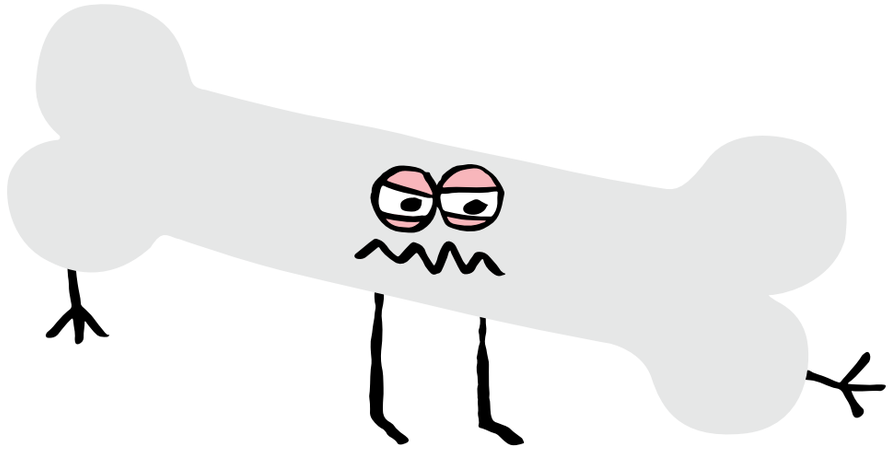


On to the path jumped two tall and strong bones.
‘Oh no...’ thought the cell, who was all alone.
The scary bones yelled ‘You don’t belong here!’
Their voices made the little cell want to disappear.

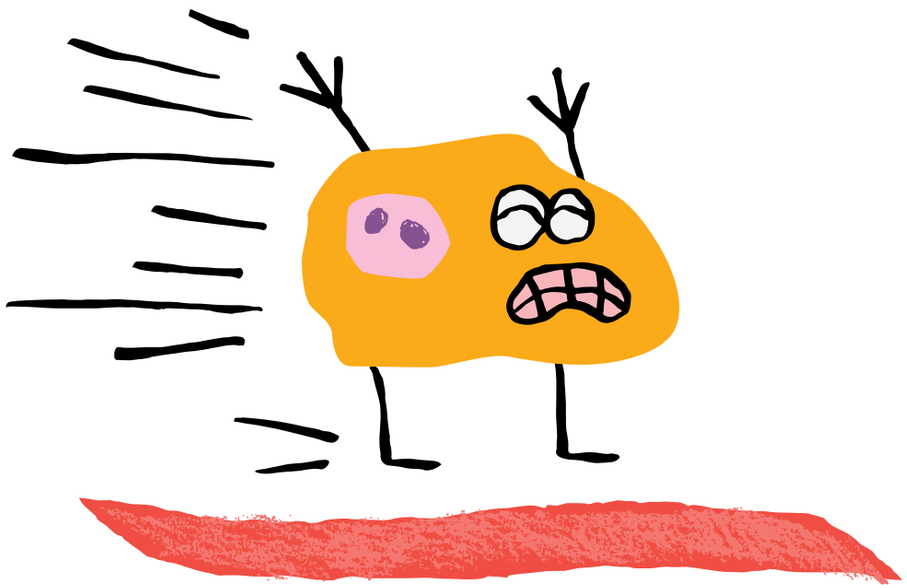


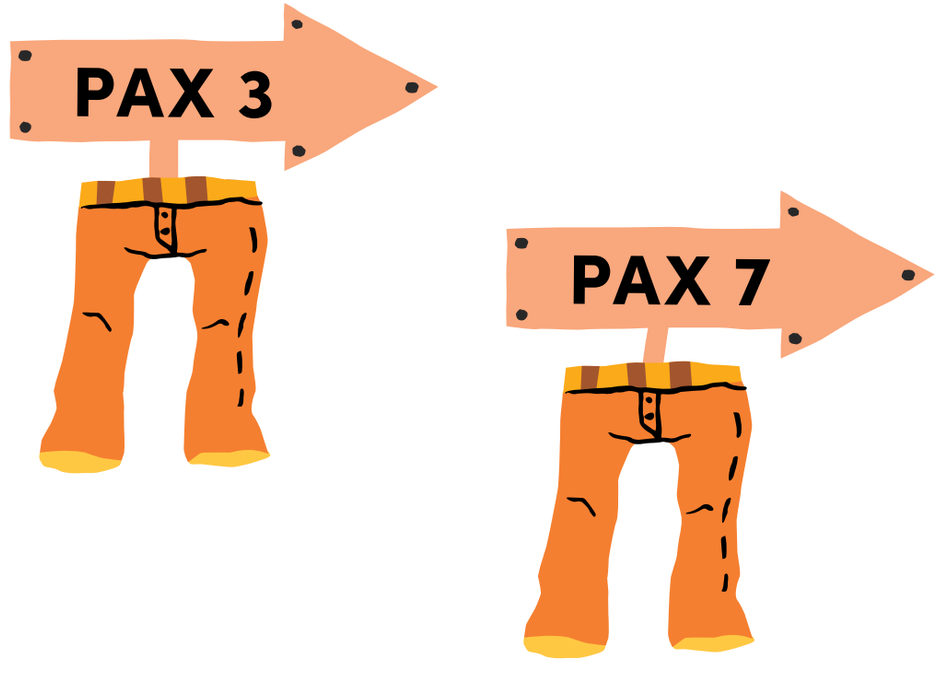


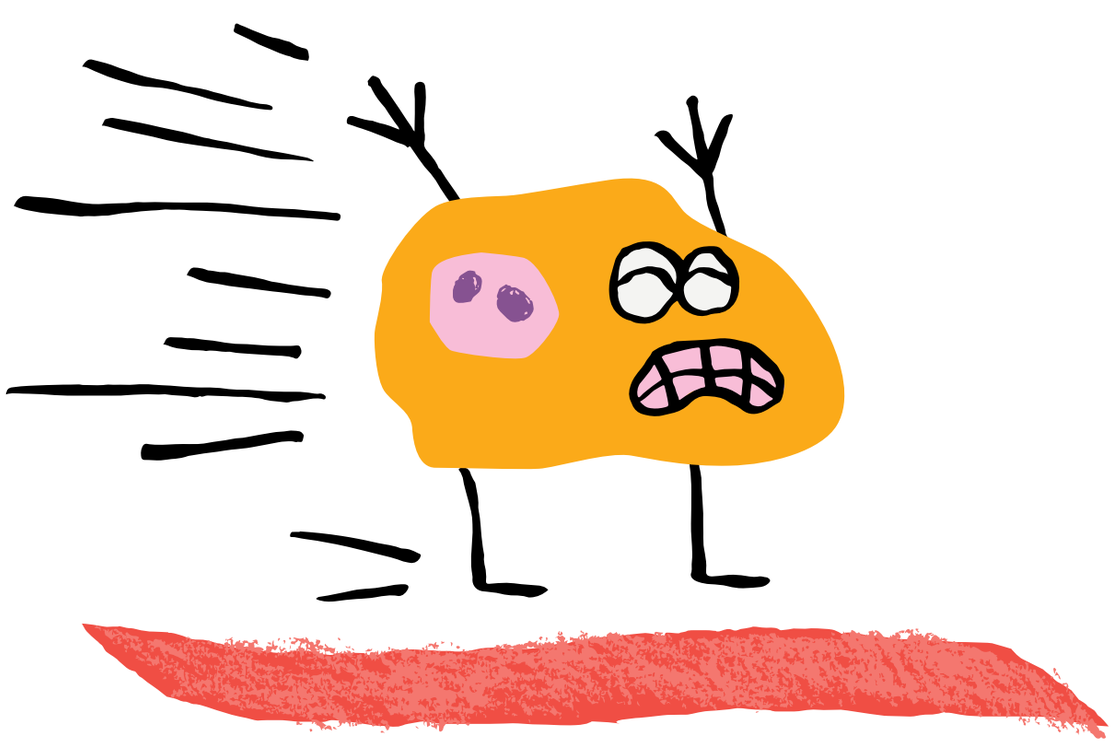




The little cell had gone down the wrong path,
and did not want to stay.
This cell did not want to become a bone today.
So it ran far away without a plan.
It ran and it ran as fast as any cell can.

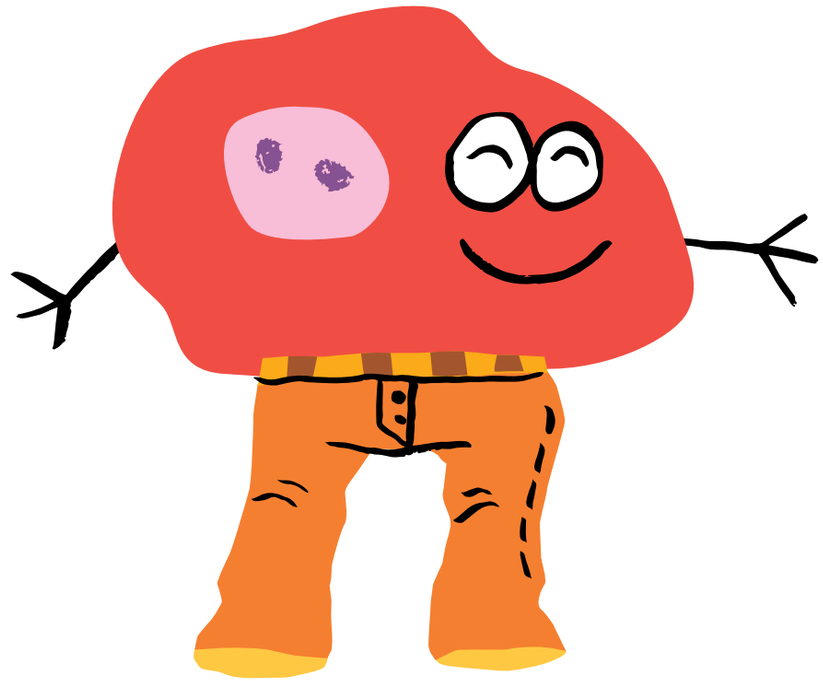




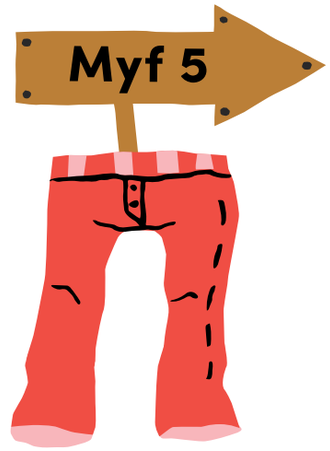


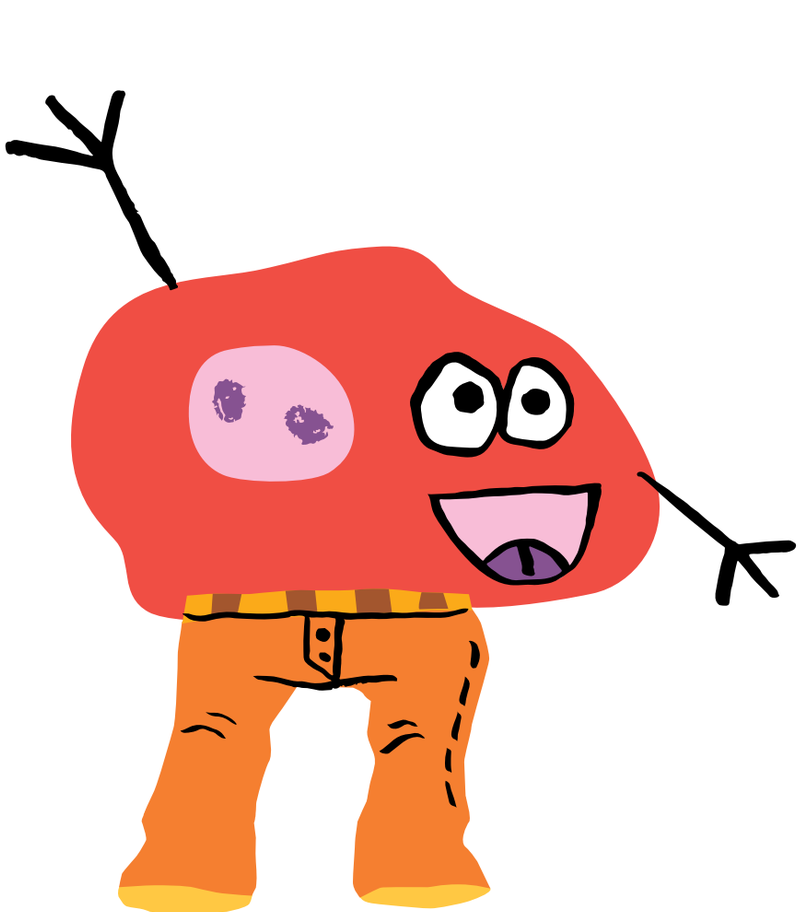
It found a new track, there was no one in sight.
With hands in the air, the cell ran with all its might.
Then it saw two signs, with special pants ahead.
Would wearing these orange pants make it turn red?

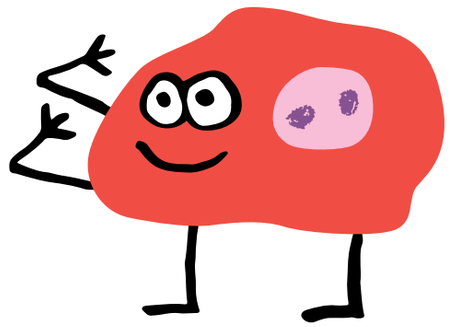
The cell put on the pants.
Something magical happened, quick and fast.
The cell was now red. It was a big myoblast!
It was now on the right track to acheiving its dream.
But there was still something missing, it needed a team.

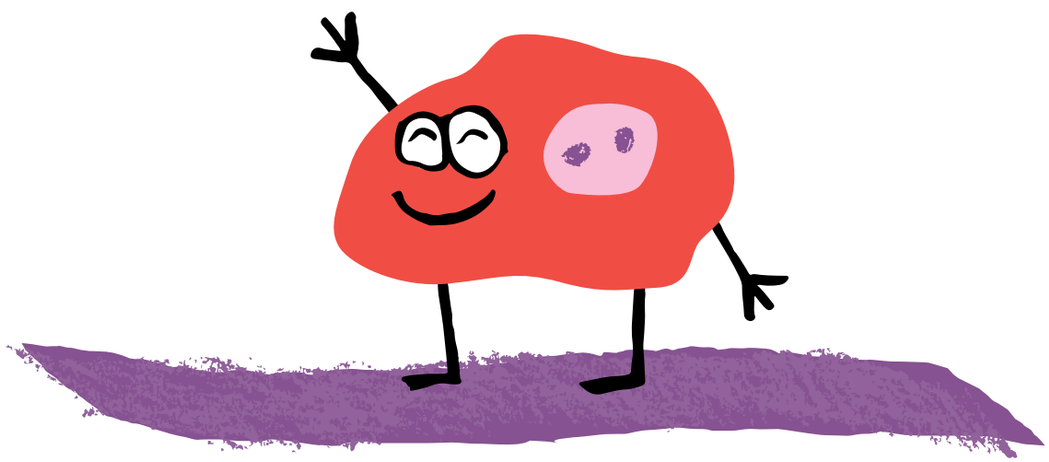


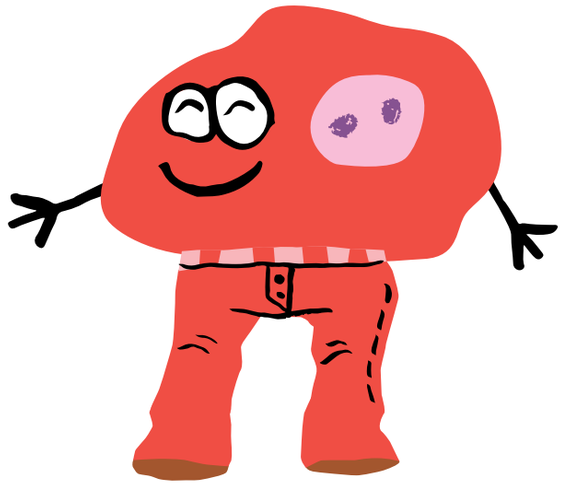
Around the bend, it met red cells that were swell.
These new cells were myoblasts as well.
These cells were just like it, with cool pants to share.
The little cell was so happy to have new friends who cared.



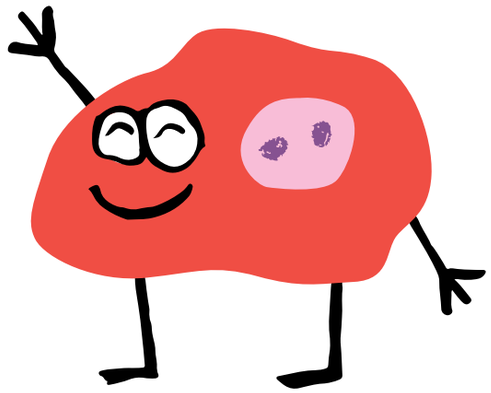


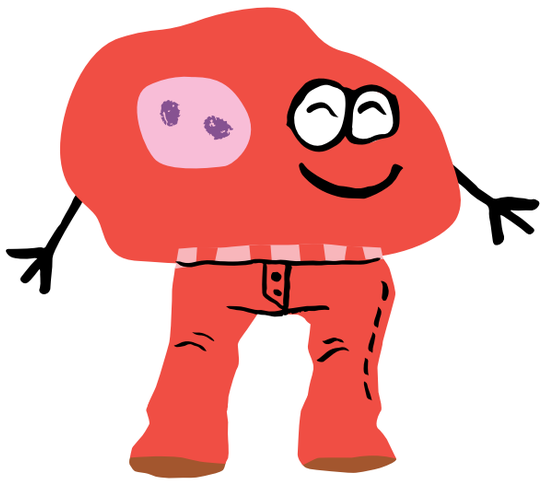


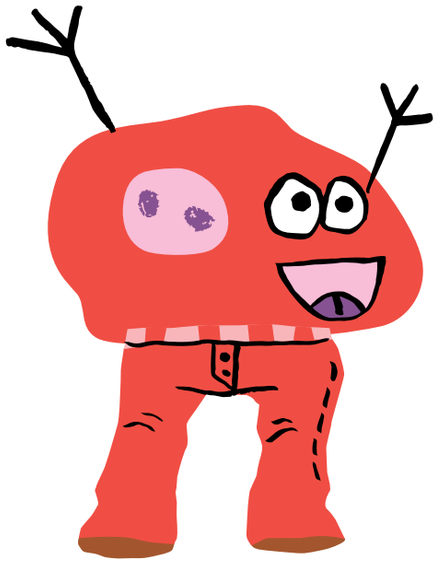


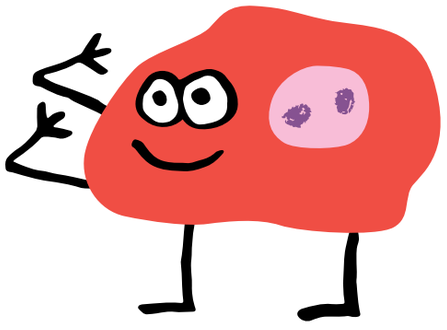


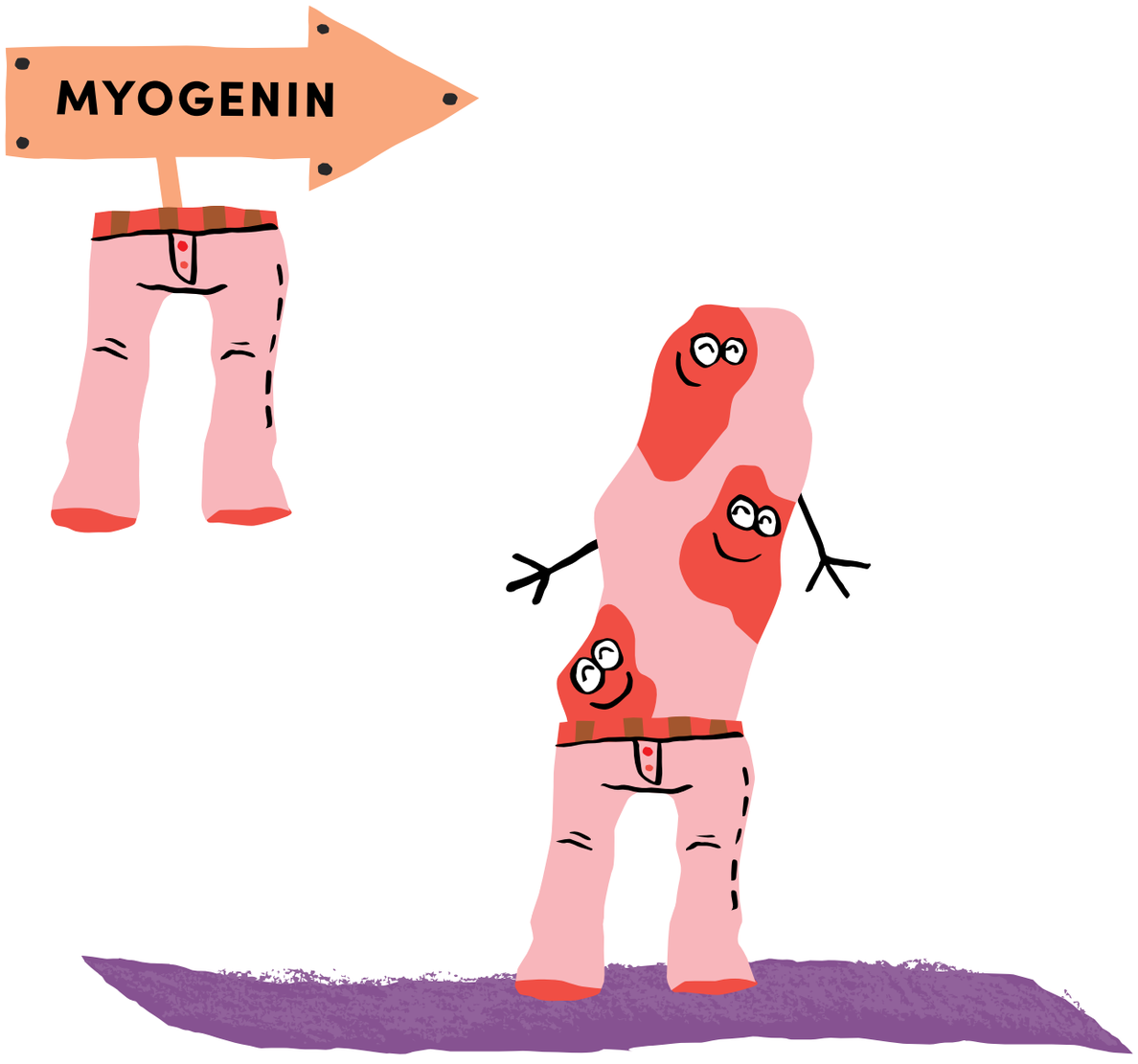
They gave it new pants, that looked like red leather.
And with these pants they would stick together.
These cell-pals connected with chitter and chatter,
and more from the same path gathered together.

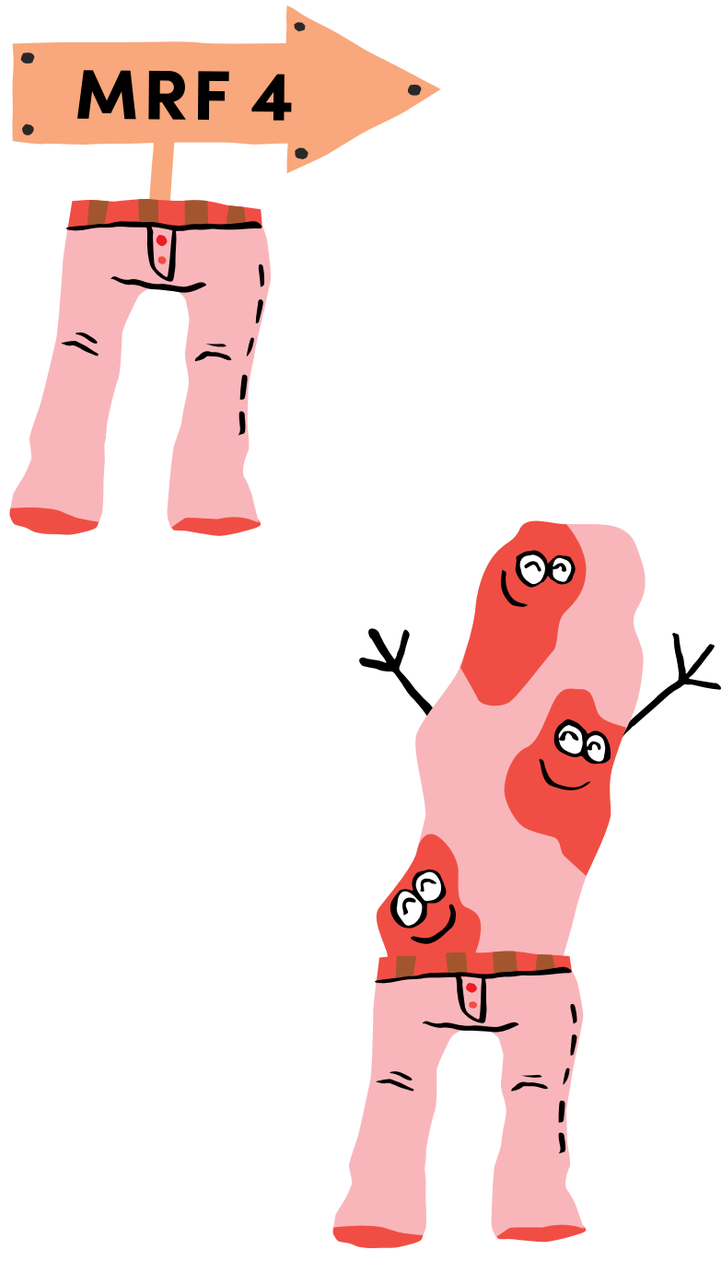






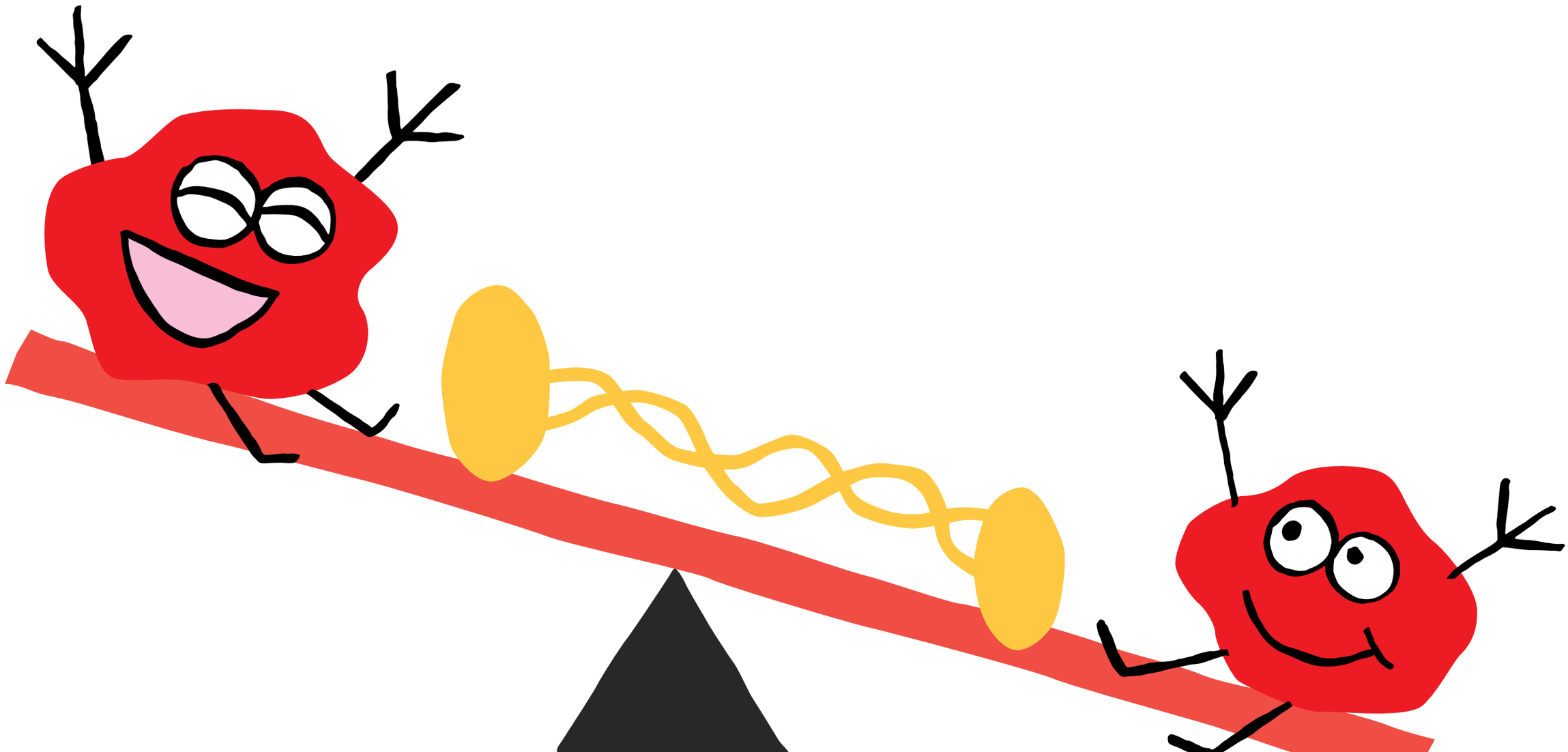


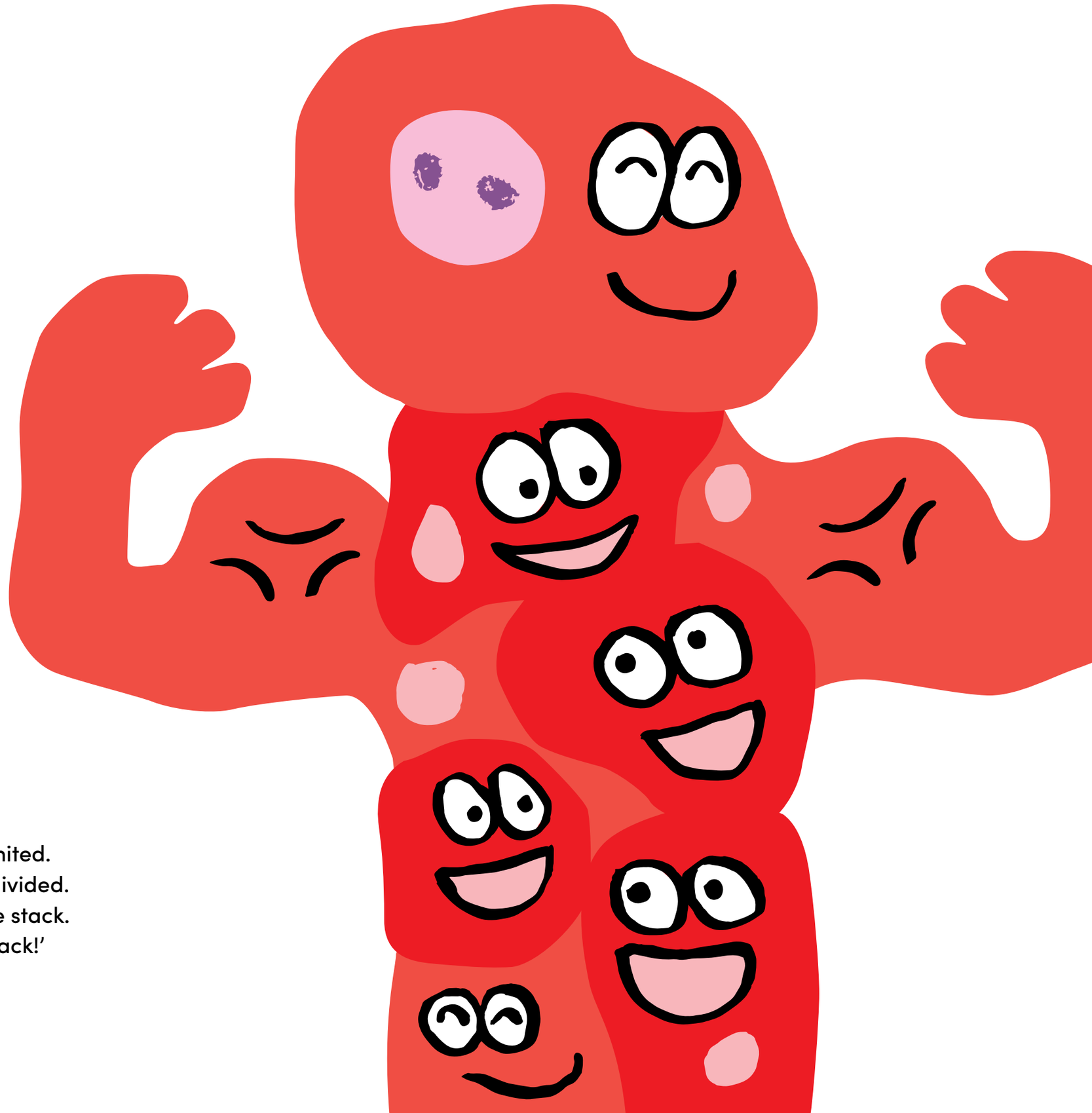




They were playing and jumping and climbing too,
the cells were now forming into one super crew.
They climbed on each other and then, as a group,
they quickly formed into a tall myotube.
Now they were joined and all was fine,
until they reached the very last sign.

They played on the see-saw, it was such fun.
In no time at all they would be one.
They bent and they flexed, stretching higher and higher.
Because they were now formed into one big muscle fibre.





Their work completed, the cells were united.
They were stronger together, no longer divided.
The little cell grinned from its place in the stack.
‘I love being a part of this wonderful pack!’

Teacher's Notes

The 'Little Cell Who Lost Its Way' is a simplified and fun story for children who are beginning to learn about the life sciences. It explores how cells form the building blocks of the body and illustrates the complex process of 'myogenesis', a term to describe muscle formation. There are three types of muscle in the body, but this book is specifically about skeletal muscle formation. Skeletal muscles are the muscles that can move the skeleton and include the muscles of the legs and arms. There are more than 600 skeletal muscles in the body, including the muscles of the face.

The formation of skeletal muscle is an intricate developmental pathway that comprises several stages and the interplay of multiple proteins. For the purpose of this book and its intended young audience, only a few key aspects of this process have been depicted. Nevertheless, the story serves as an introduction to an integral physiological process that transforms a stem cell (undifferentiated) into a unique muscle cell.

In the 'Little Cell Who Lost Its Way' the little cell is described as being lost' because its fate in the body has yet to be determined. This story describes the journey that the little cell undergoes in three stages. The first stage sees the little cell acquire the properties that transform it from an initial undefined state (stem cell) into a myoblast. A myoblast is the first cell type formed from a stem cell that is important in the formation of muscle. This initial transformation is regulated by several proteins, including Pax3 and Pax7. These crucial developmental proteins are depicted as 'special pants' throughout the book, and the little cell is unable to find its 'way' and hence become 'transformed' without acquiring these special pants. It is important to note that the little cell is rejected by the bones because it does not have the proteins or 'special pants' required to transform it into a bone cell .

The second stage in the little cell's transformation is to transform from a myoblast into a myotube. A myotube is formed by the combination of multiple myoblasts to form one larger cell. This process is regulated by different proteins, including MyoD and Myf5. The story of the little cell portrays this stage as the 'cell-pals' that wear similar red leather-like pants to connect and stick together.

The third and final stage is the maturation of a myotube into a fully functional muscle fibre (another word for muscle cell). When lots of fully functional muscle cells all fit together to form a skeletal muscle, the cells can contract and relax to cause movement of the skeleton, and along with this, muscle movement such as kicking a football. The maturation of a myotube is regulated by another set of proteins, including Myogenin and MRF 4. This combined cell structure is depicted in the 'finale' of this story book as the uniting of the cells into a stack formation to form one big muscle fibre.

The story differentiates a myotube from a muscle cell using different colour schemes whereby the myotube is illustrated in pink and red, while the mature muscle fibre is represented as fully red on the final page. The word fibre is based on the characteristic structure of muscle cells whereby they are individually long and appear striped when looking at them under the microscope. They have a highly organised structure and multiple muscle fibres are tightly packed in units that form an entire muscle organ.

Glossary

For each term both suggestions for explaining terms to young children and scientific definitions are included.

cell

Think of the body like a building made of LEGO blocks of different colours, sizes and shapes. Like a LEGO building our bodies are also made of lots of different types of building blocks. The building blocks in our bodies are called ‘cells’ and there are many kinds of cells used to build the body. The different parts of the body are each made of different cells because each part of the body looks different and has a special function.

Scientific explanation

A functional unit of the body that is capable of either dividing and multiplying in number or transforming into a specialized cell type.

bone

Just like the wooden stick that is inside an icy pole, bone is a hard structure found inside our bodies, and forms our skeleton. During Halloween, some kids like to wear a white ‘skeleton’ costume. The skeleton is made up of this hard structure called ‘bone’. A ‘skeleton’ is not scary at all because everybody has one inside them. Bone is important for us because it supports our muscles and entire bodies and help us move around, sit, stand, sleep and play.

Scientific explanation

A rigid connective structure formed from a specialized cell known as an osteoblast and is the main component of the skeleton support structure of the body.

muscle

Do you know why the incredible hulk is so big and strong? That is because his body has a lot of ‘muscle’. Muscle is a softer stretchy part of our bodies that is wrapped around our bones, and is covered and protected by our skin. Our muscles can shrink and stretch, causing the skeleton to move, which in turn enables us to do physical activities like kicking or throwing a ball. When a baby is born, their muscles and bones are small. As the muscles and bones get bigger, the baby gets bigger and stronger as well. Eventually they use their muscles and bones to crawl, walk, run, play and carry things. The muscles of your parents and teachers are bigger than yours, but when you grow up, you will be just as big and strong as they are.

Scientific explanation

Skeletal muscle is a collection of highly organised muscle fibres that are formed through a process called ‘myogenesis’ and are involved in support of the skeleton and movement of the body. (N.B: skeletal muscle are one of 3 types of muscle (skeletal, cardiac and smooth muscle) found in the body.

myogenesis

Did you know that your body has many tiny workshops where your body can produce different kinds of cells? Myogenesis is the production of muscle cells in the body.

myotube

If you build a LEGO building using only the red blocks, this is similar to how myoblasts combine to form their own tower called a ‘myotube’. Myoblasts like to stick to each other so that they can combine their powers in order to get bigger and stronger. They have special ways to find each other and to fit together.

Scientific explanation

A larger multinucleate specialized cell formed from the fusion of multiple myoblasts and is the final (or second) stage in the formation of a muscle fibre.

muscle fibre

A muscle fibre (muscle cell) looks like a long tube with stripes and is formed when ‘myotubes’ are fully joined together to form a long tube that can bend and stretch to get longer or shorter. Many muscle fibres sit together like a pack of straws or liquorice sticks, except that they are tightly held together to form a big ‘muscle’. Muscle is flexible and helps you move, like your leg muscle which you use to walk, or your arm muscle which you use to hold things and perform actives like drawing and writing.

Scientific explanation

A mature myotube, also known as a ‘muscle cell’, that is capable of contraction (via myofibrils) and is the largest cell in the body.

myoblast

Myoblasts are special cells (building blocks), transformed from stem cells , that all look the same and the body likes to put them together, just like picking all the red M&Ms from a packet filled with all the different colours.

Scientific explanation

A single specialized uninucleate cell that is in the early phases (or stages) of morphing into a muscle cell (myogenesis).