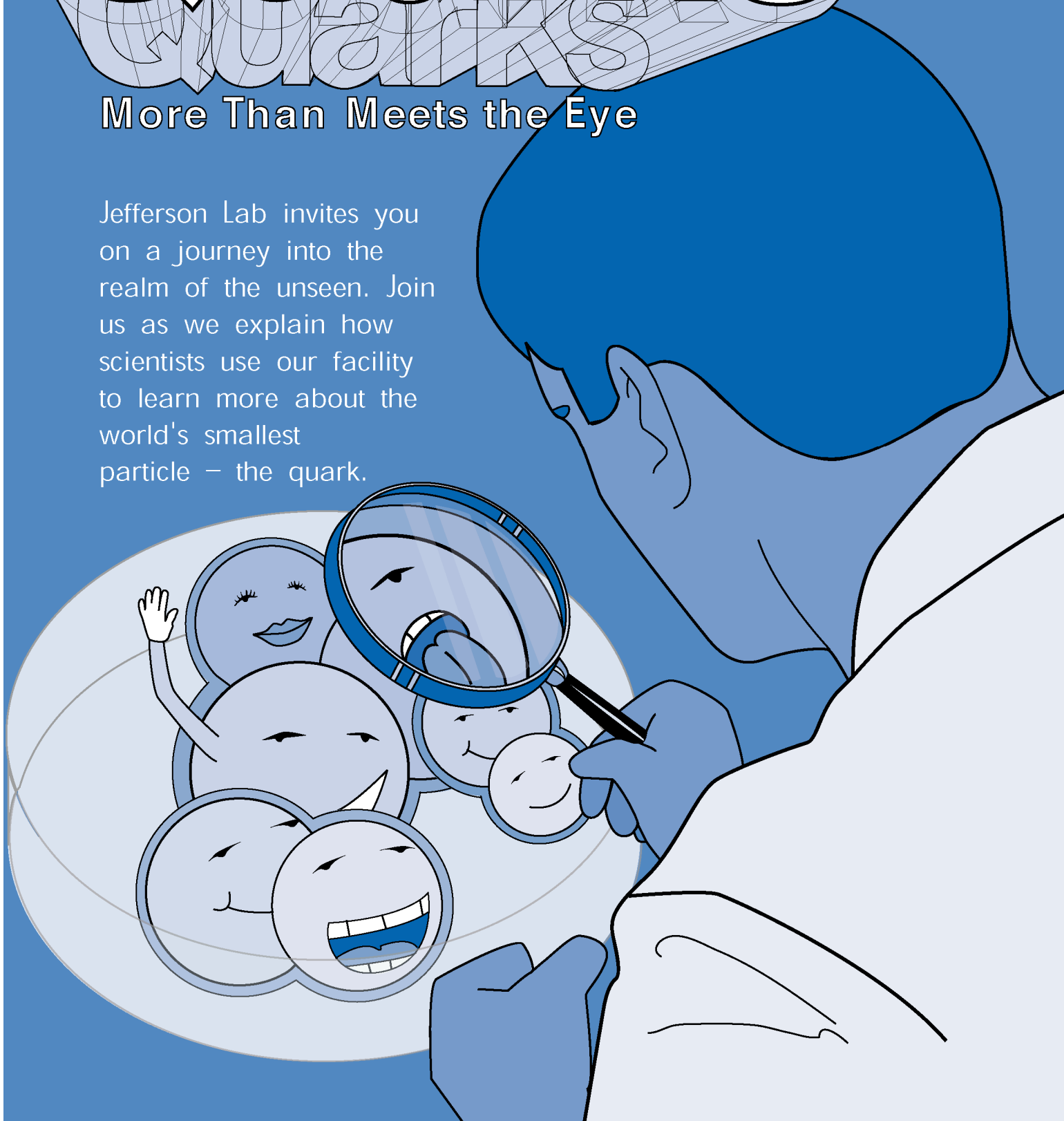


Quarks

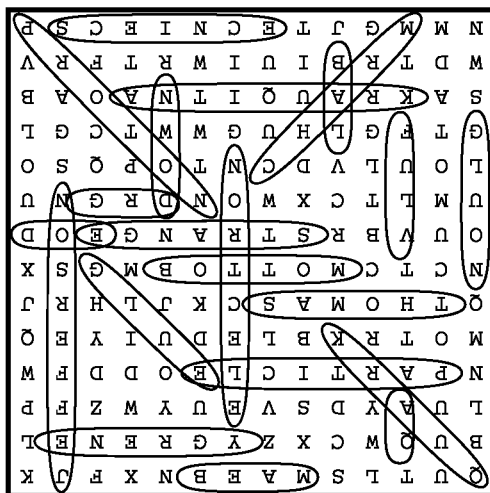
More Than Meets the Eye

Jefferson Lab invites you on a journey into the realm of the unseen. Join us as we explain how scientists use our facility to learn more about the world's smallest particle – the quark.

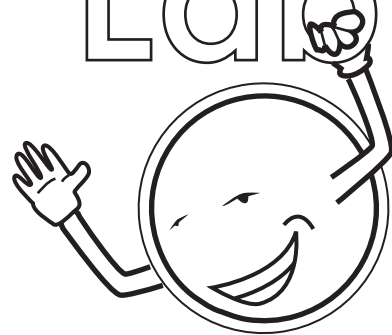


Narrative poem and storyboard by: John Anderson II
 Illustrations and design by: John Thomas

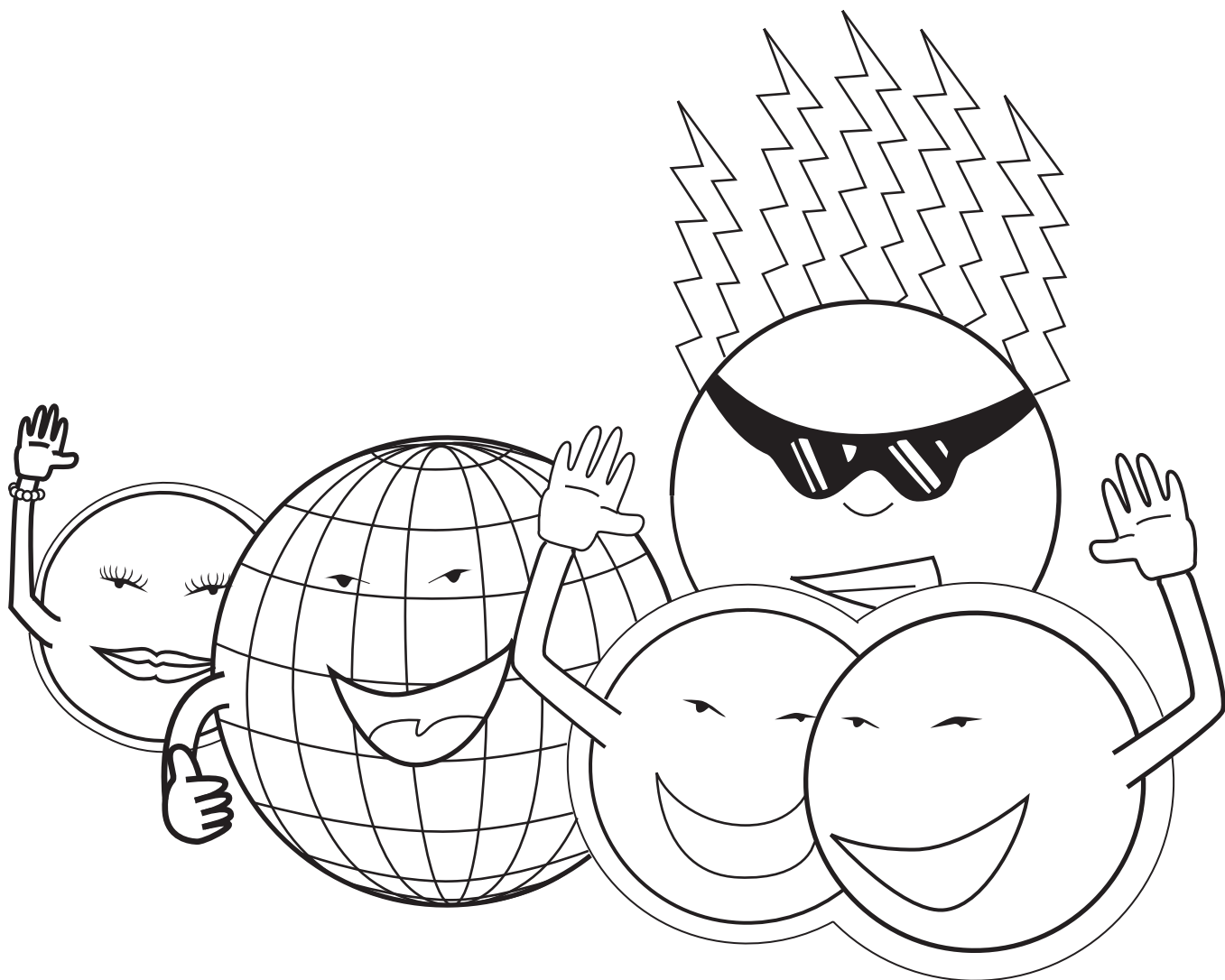
Answers to word find on last page.



Jefferson Lab



This book was created to help people of all ages understand and appreciate the research conducted at Jefferson Lab. We hope this story/coloring book is both informative and entertaining.

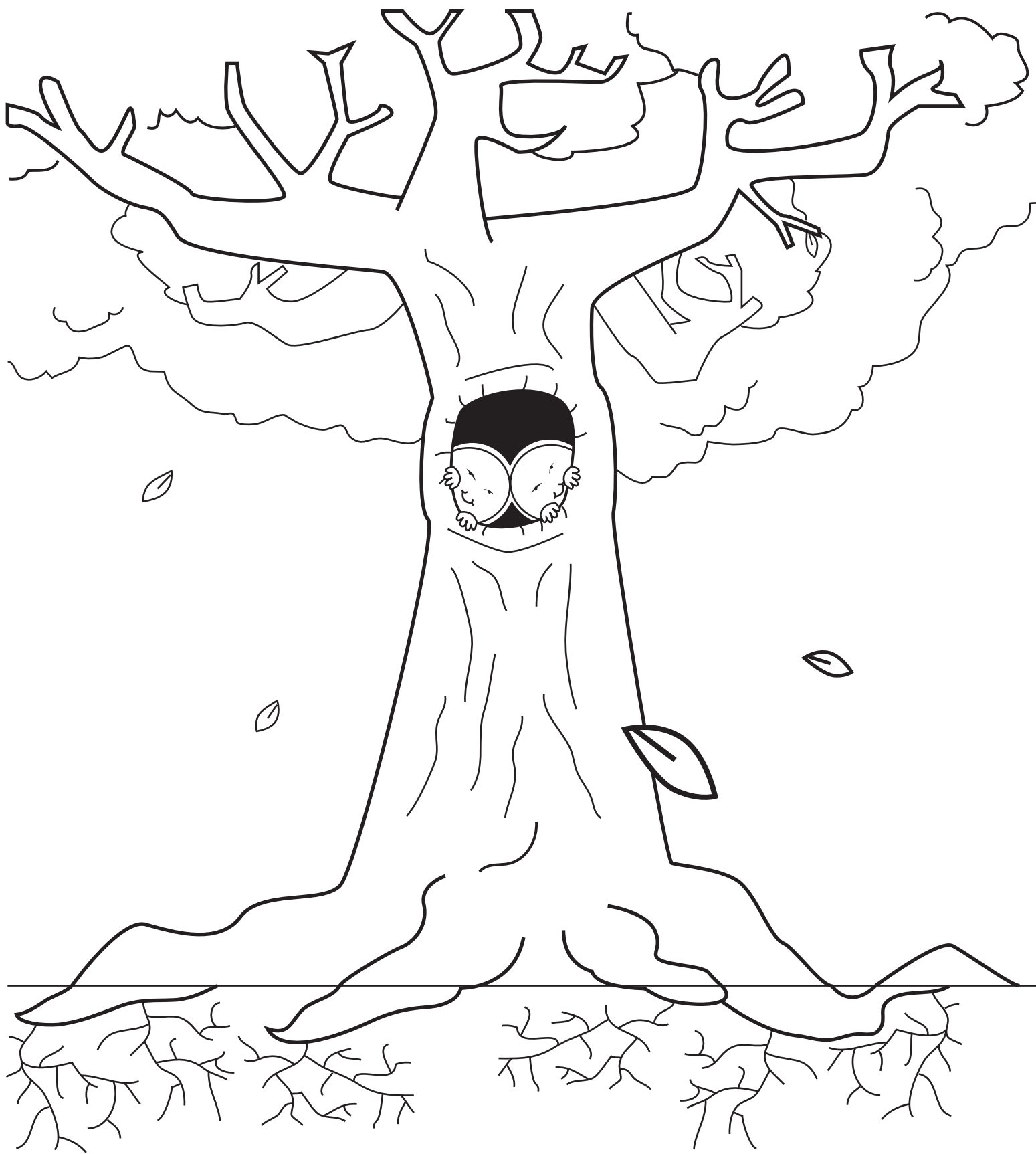




The sun, the moon, the galaxy and every single star,
consist of tiny particles that make up who we are.



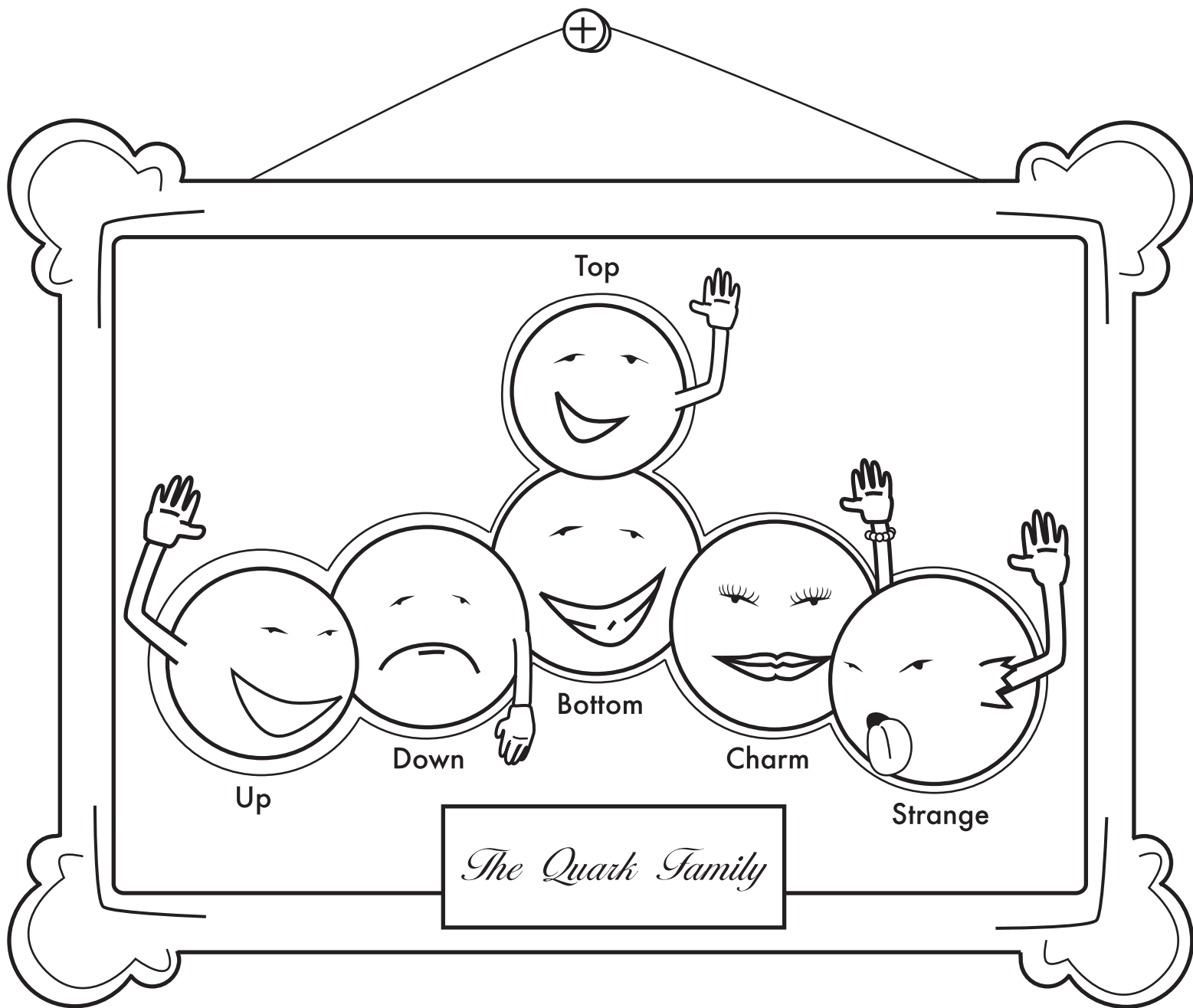
**These particles are everywhere, in everything around.
Inside the drops of rain that fall and underneath the ground.**



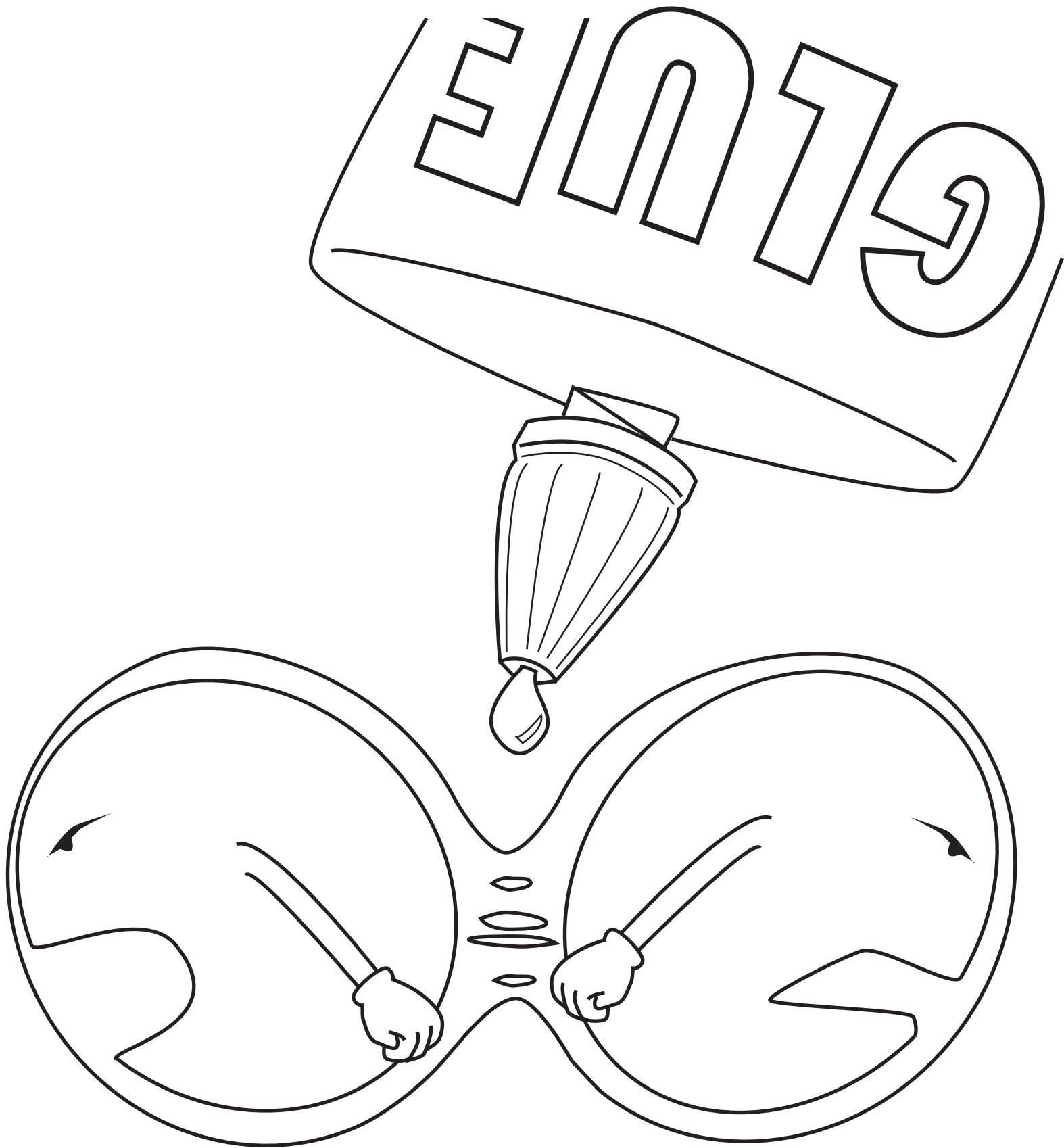
They're deep within the roots and trunk of every single tree,
the neatest things in nature are the ones we cannot see.



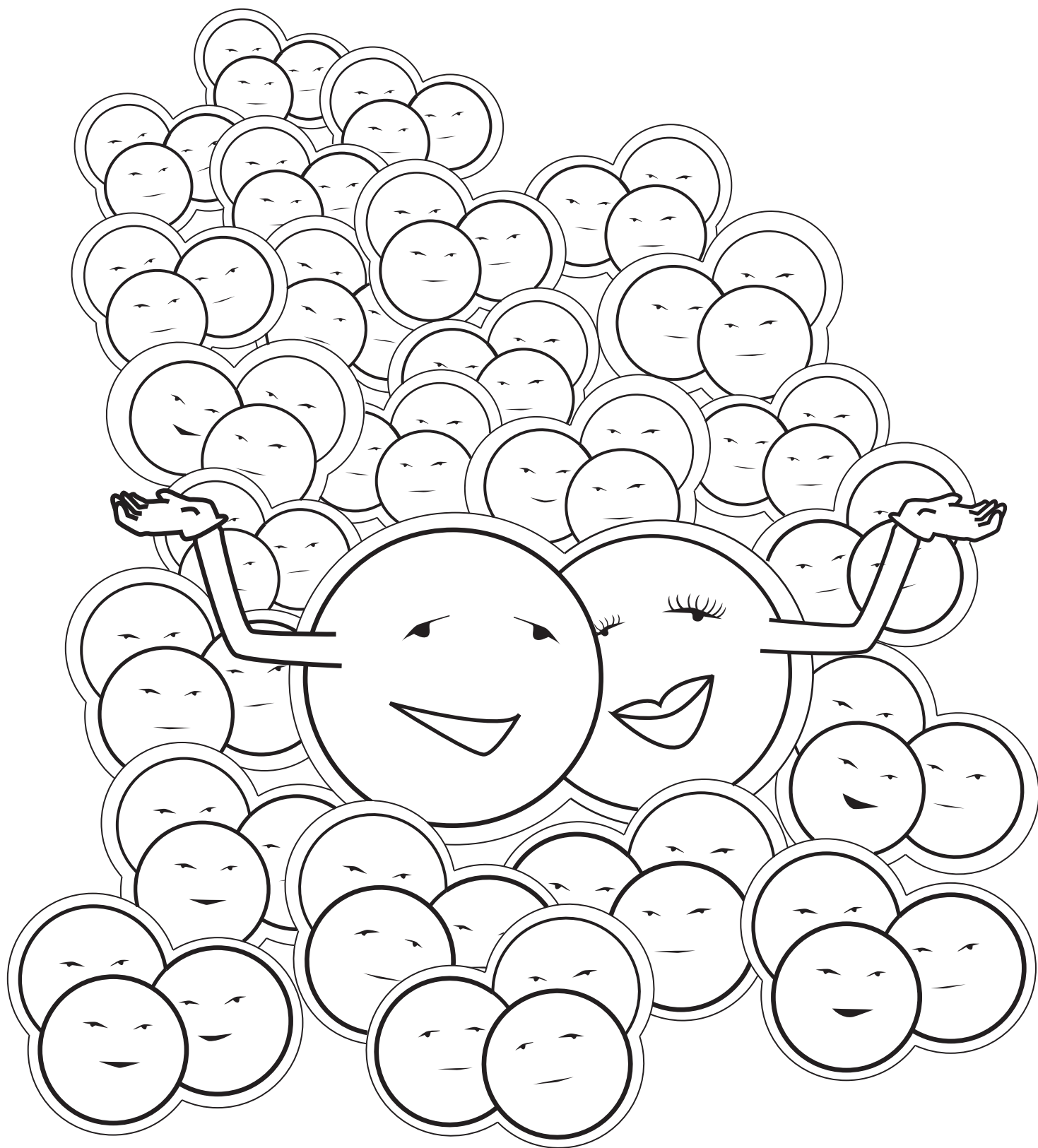
From tiny little tuna fish to larger flying storks,
these itty-bitty particles are known to us as quarks.



Quarks are top or bottom, up or down, or charm or strange;
they're tightly held together by the gluons they exchange.



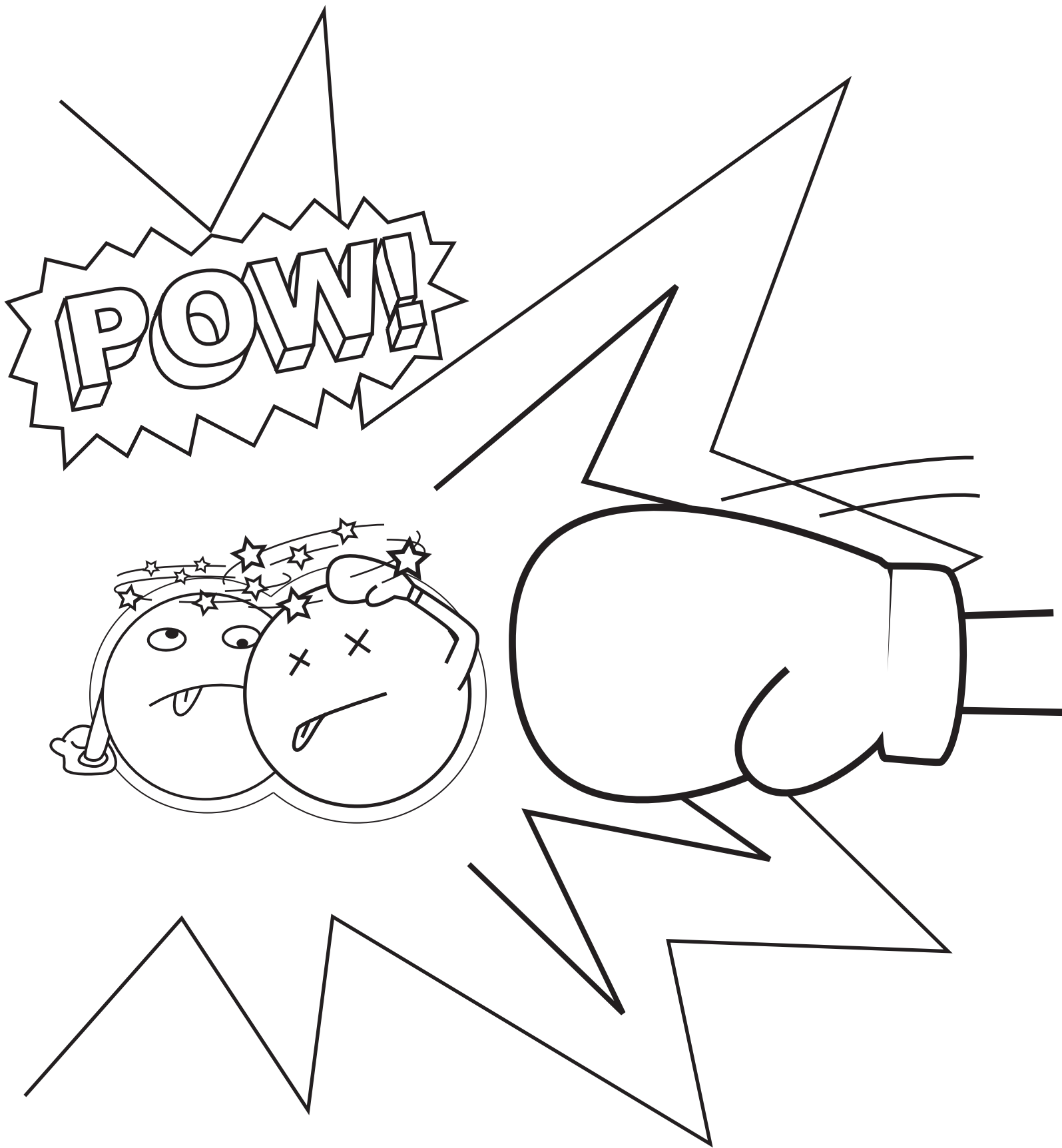
And this exchange of particles, we've come to know as glue,
for quarks cannot exist alone; there can't be less than two.



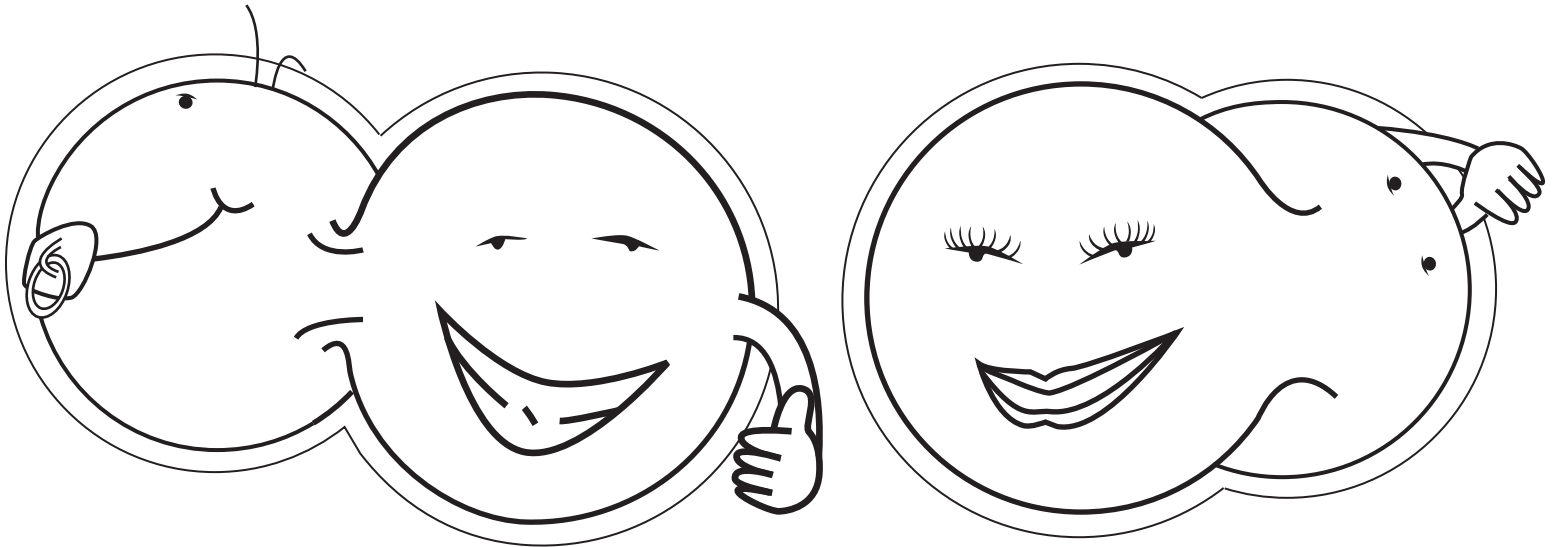
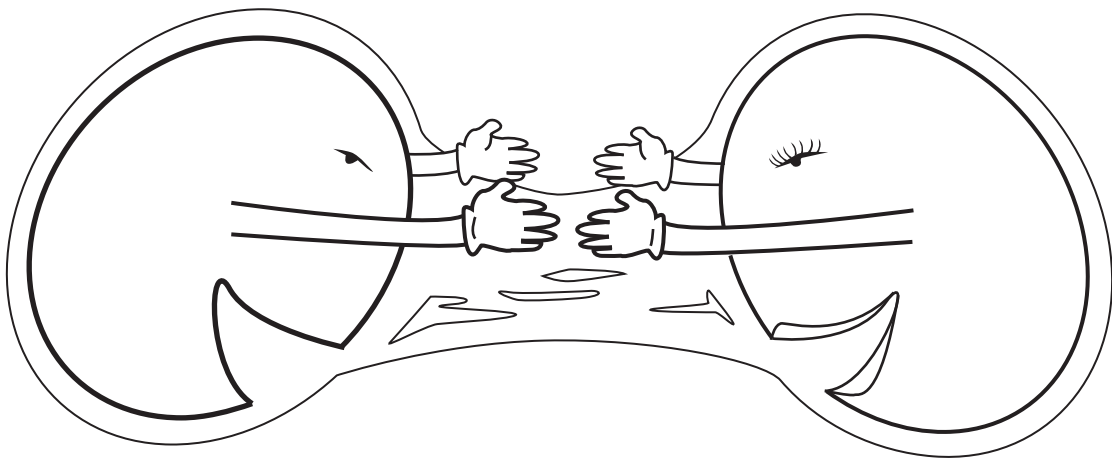
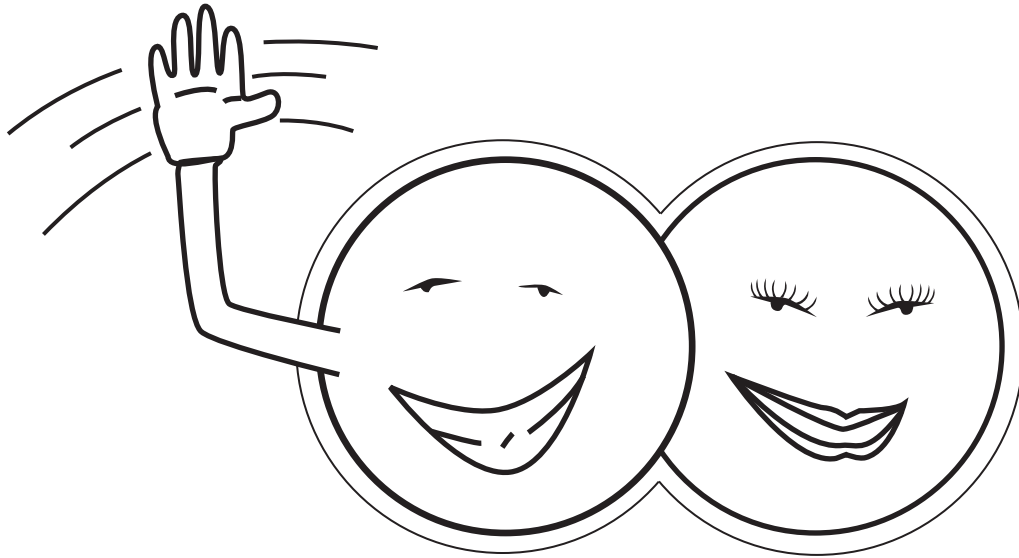
Perhaps by now you've noticed that our quarks are in a pair,
although it's true, there can be two; it's relatively rare.



Most exist in groups of threes, for this is how they thrive,
However, we just might have seen a pentaquark with five.

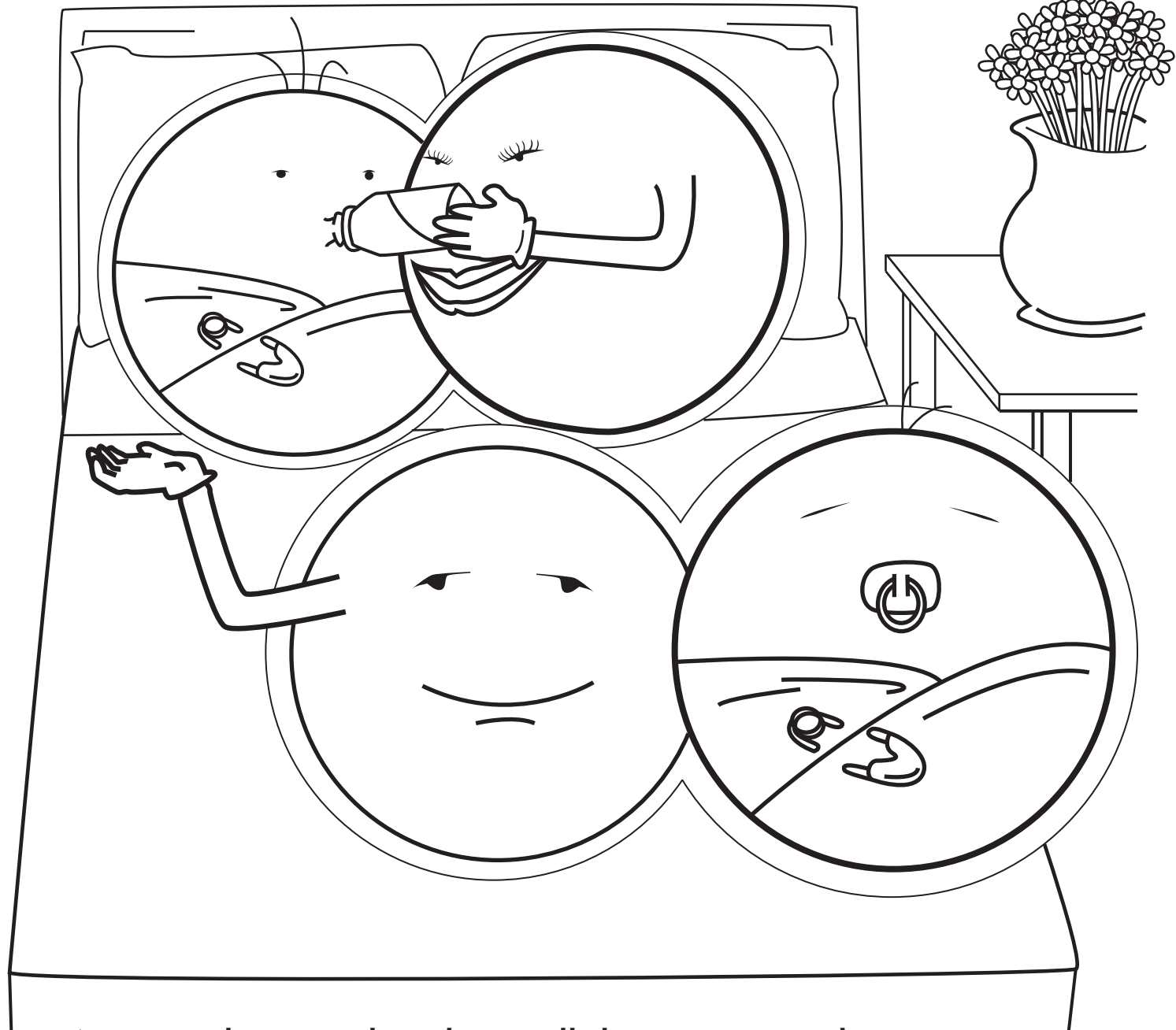


Despite the things we do to them, the quarks will never split.
They still remain together, even after they are hit.

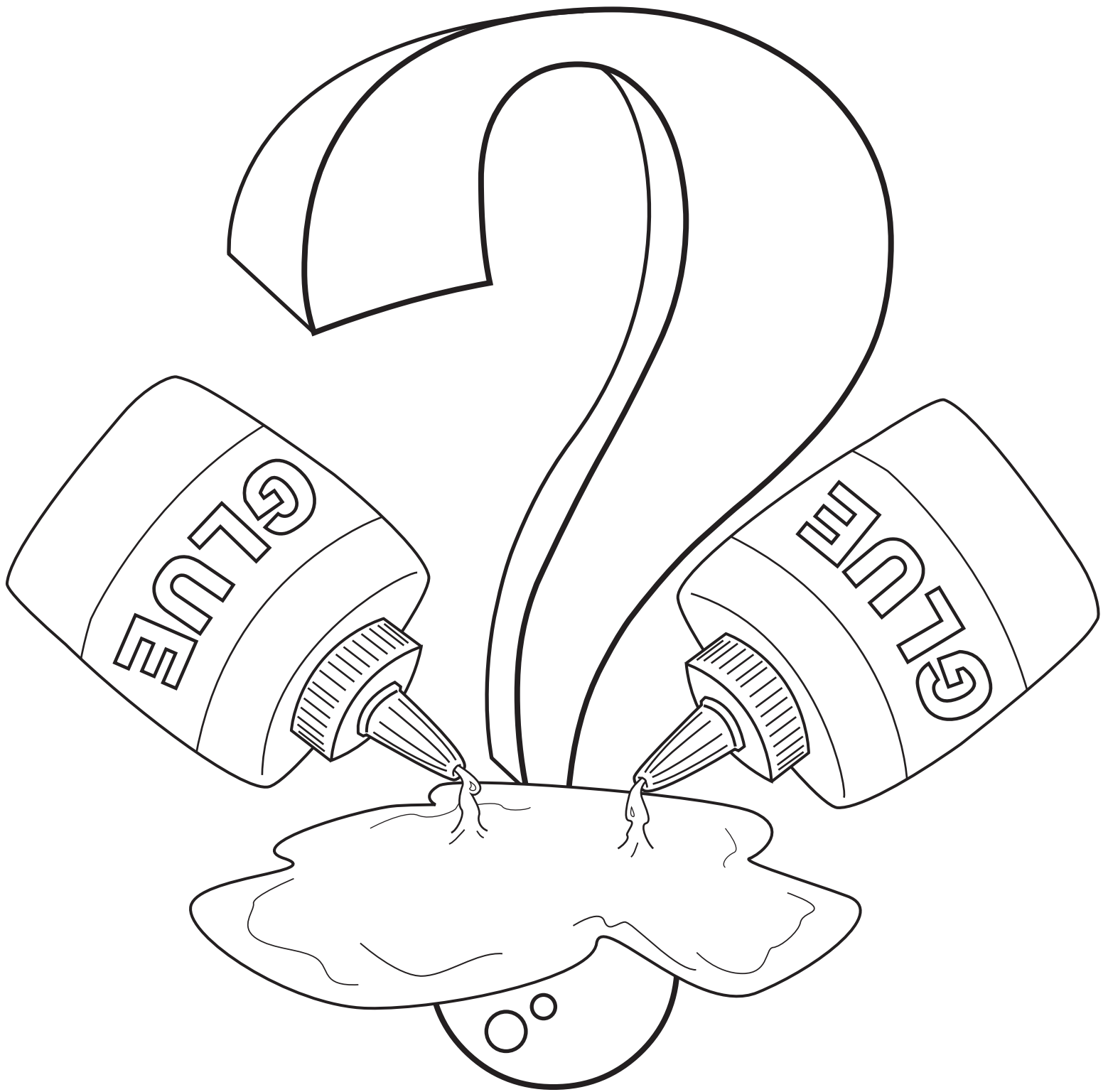


You see, the way these quarks behave is far beyond the norm.
For when we try to separate them, other quarks will form.

*Congratulations!
It's an anti-quark!*



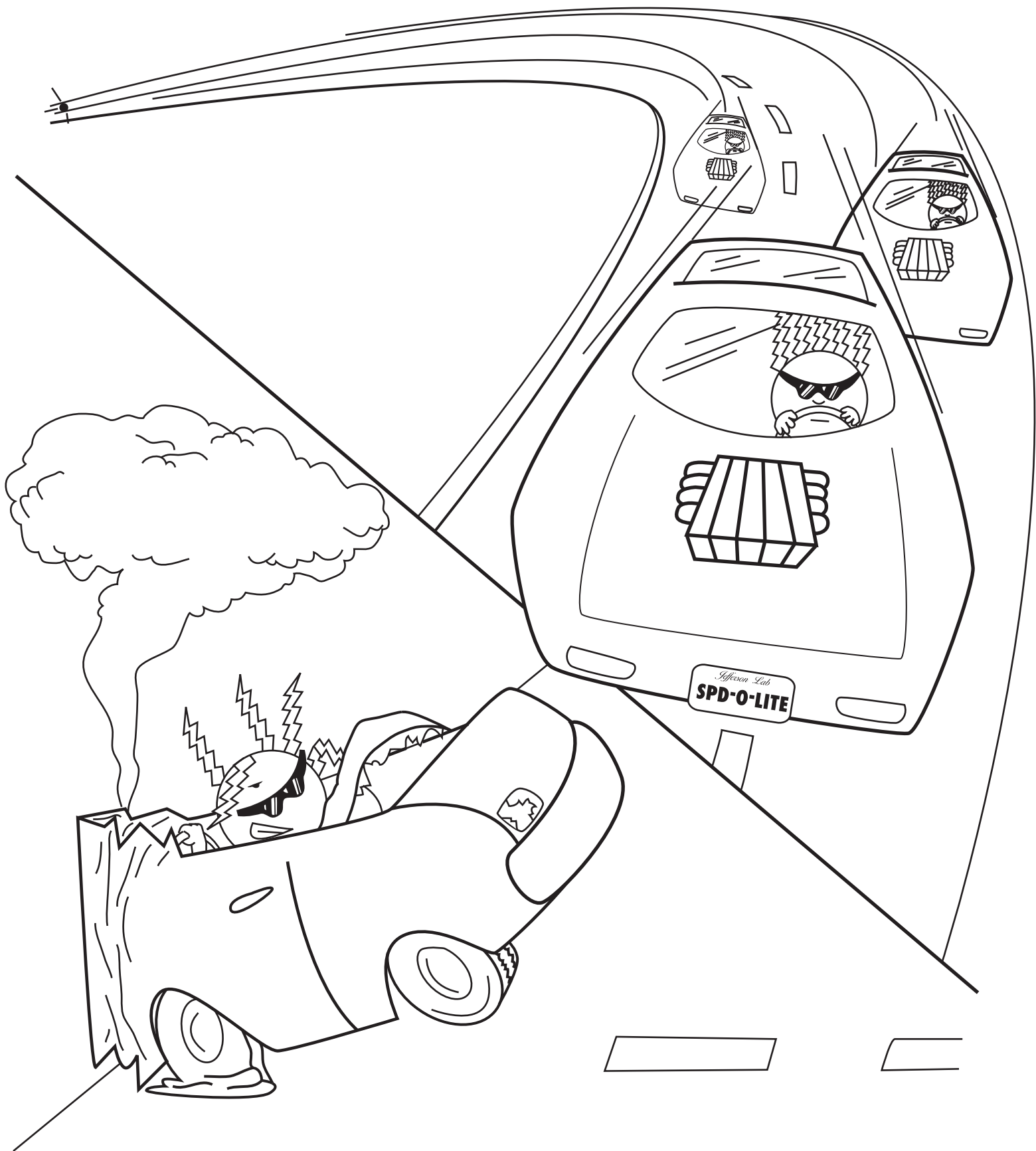
Anti-quarks are what they call the new ones that appear;
we know this always happens, yet the reason isn't clear.



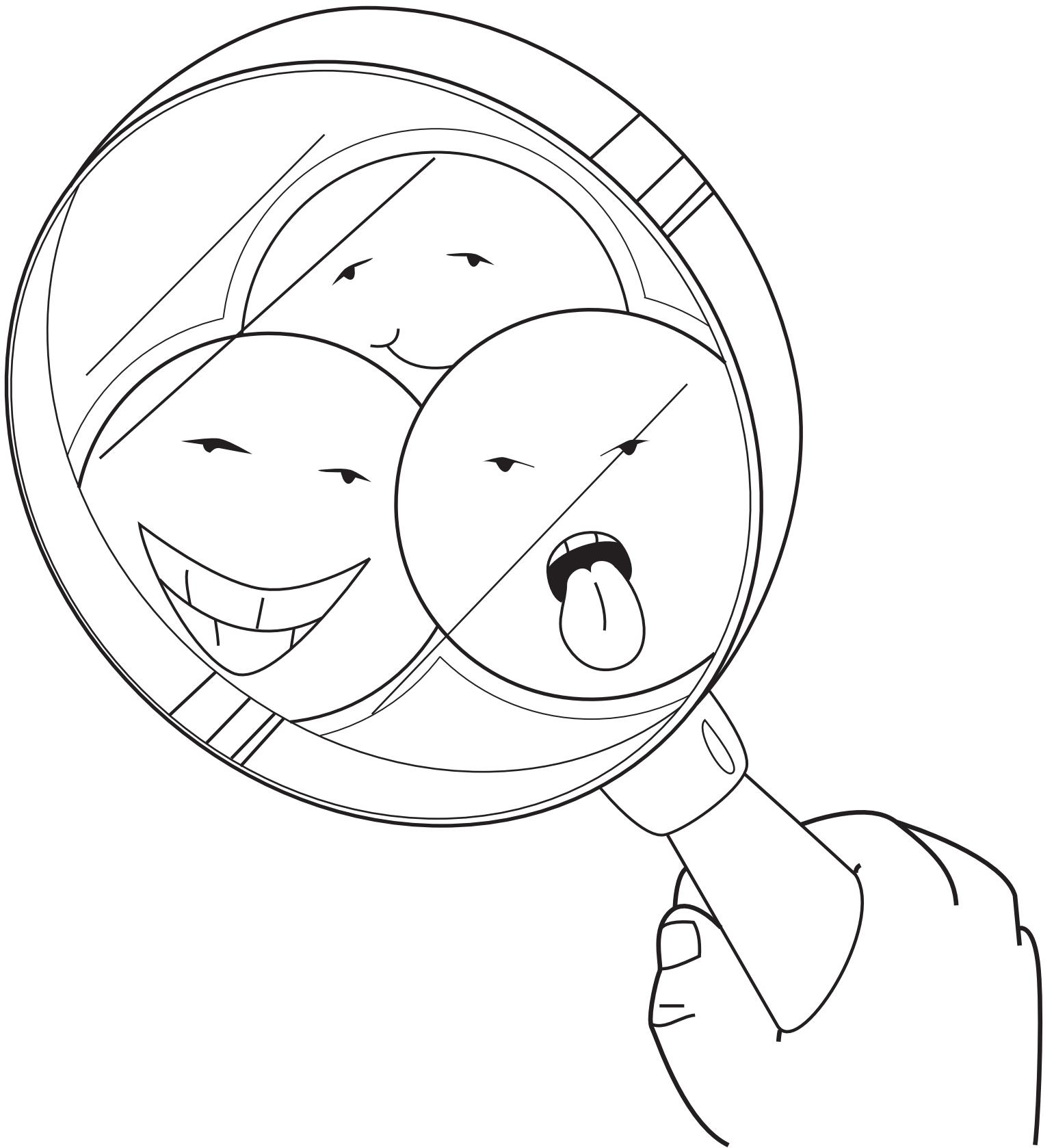
We seek to find the reasons why they act the way they do,
and hope to understand the reason glue attracts to glue.



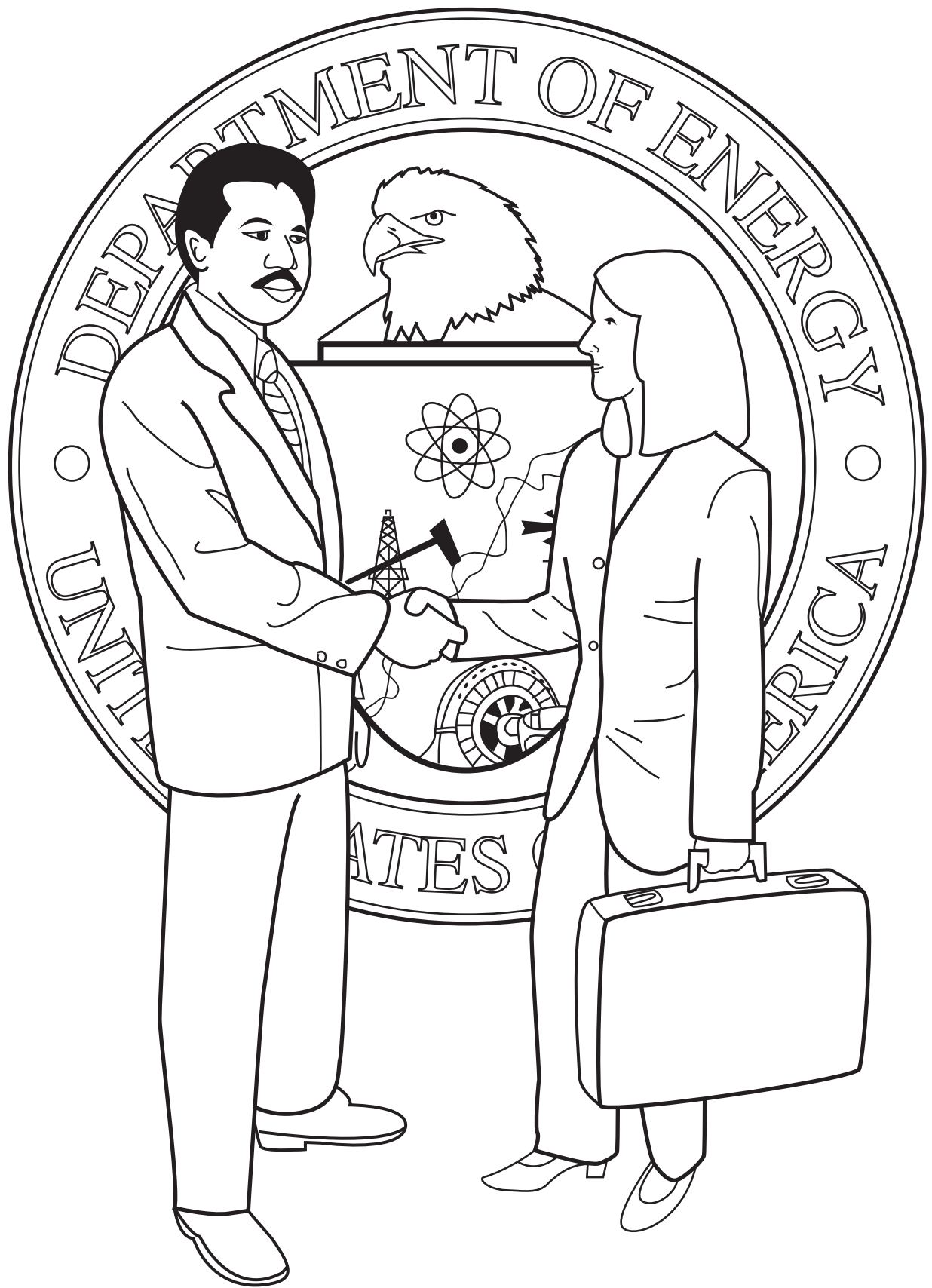
By speeding up electrons, we generate a beam;
a beam with brighter light than many labs could even dream.



We make them race around and round and speed up very fast.
They're almost at the speed of light when atoms get the blast.

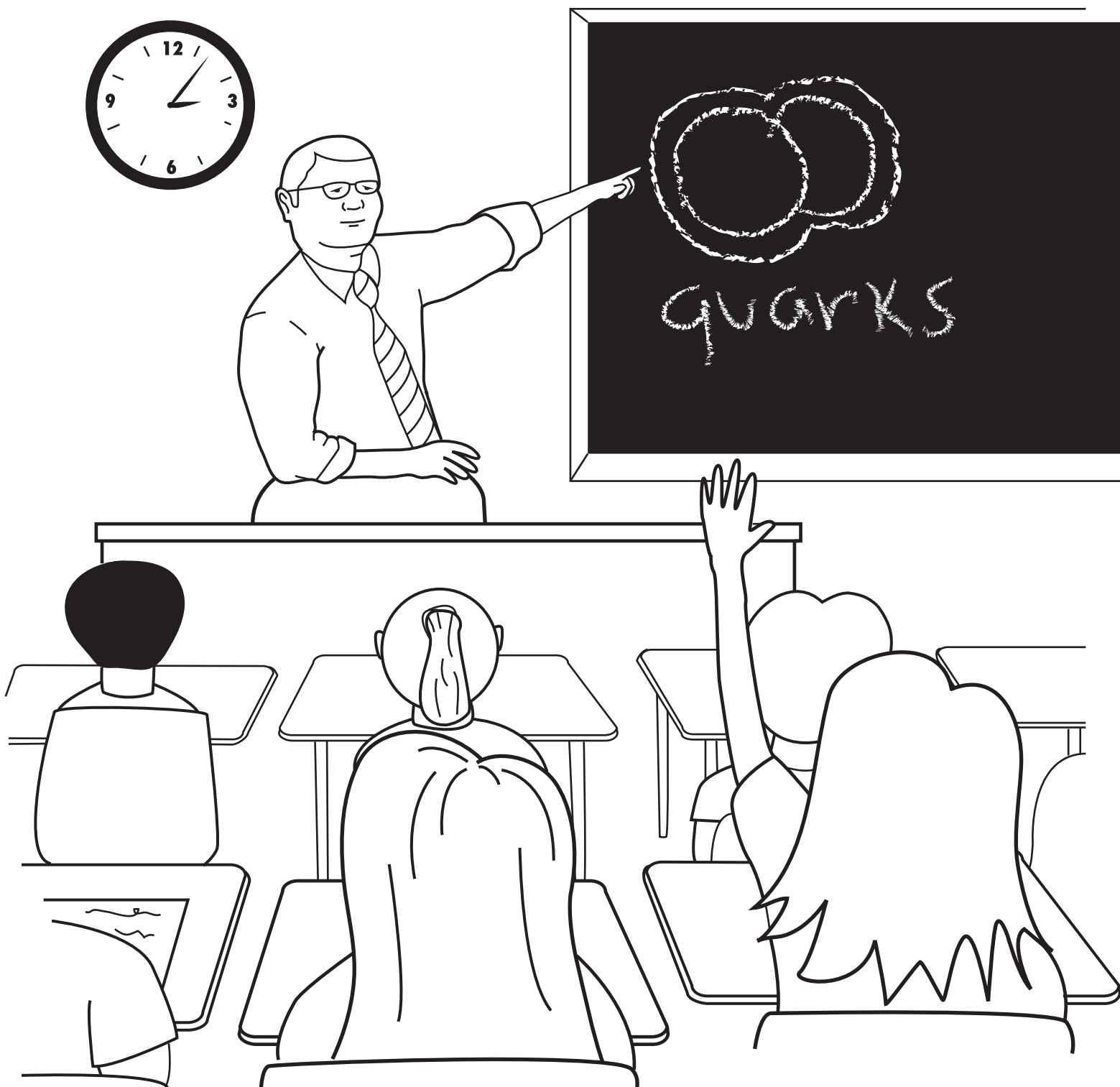


In doing this, we find out what the quarks are going to do, and find out if the theories that we hold of them are true.

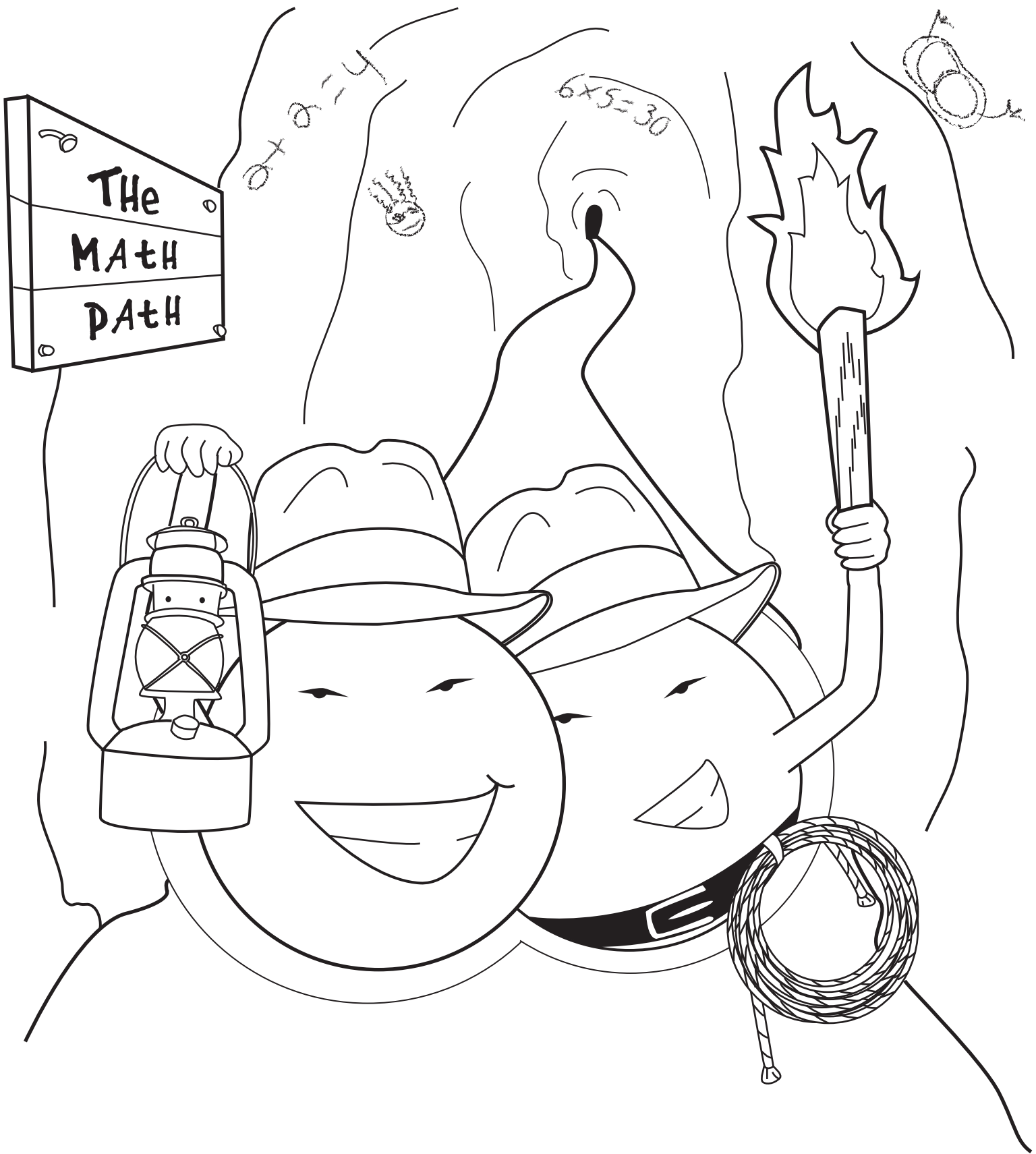


The Energy Department oversees us as a whole, providing what we need to reach our laboratory's goal.

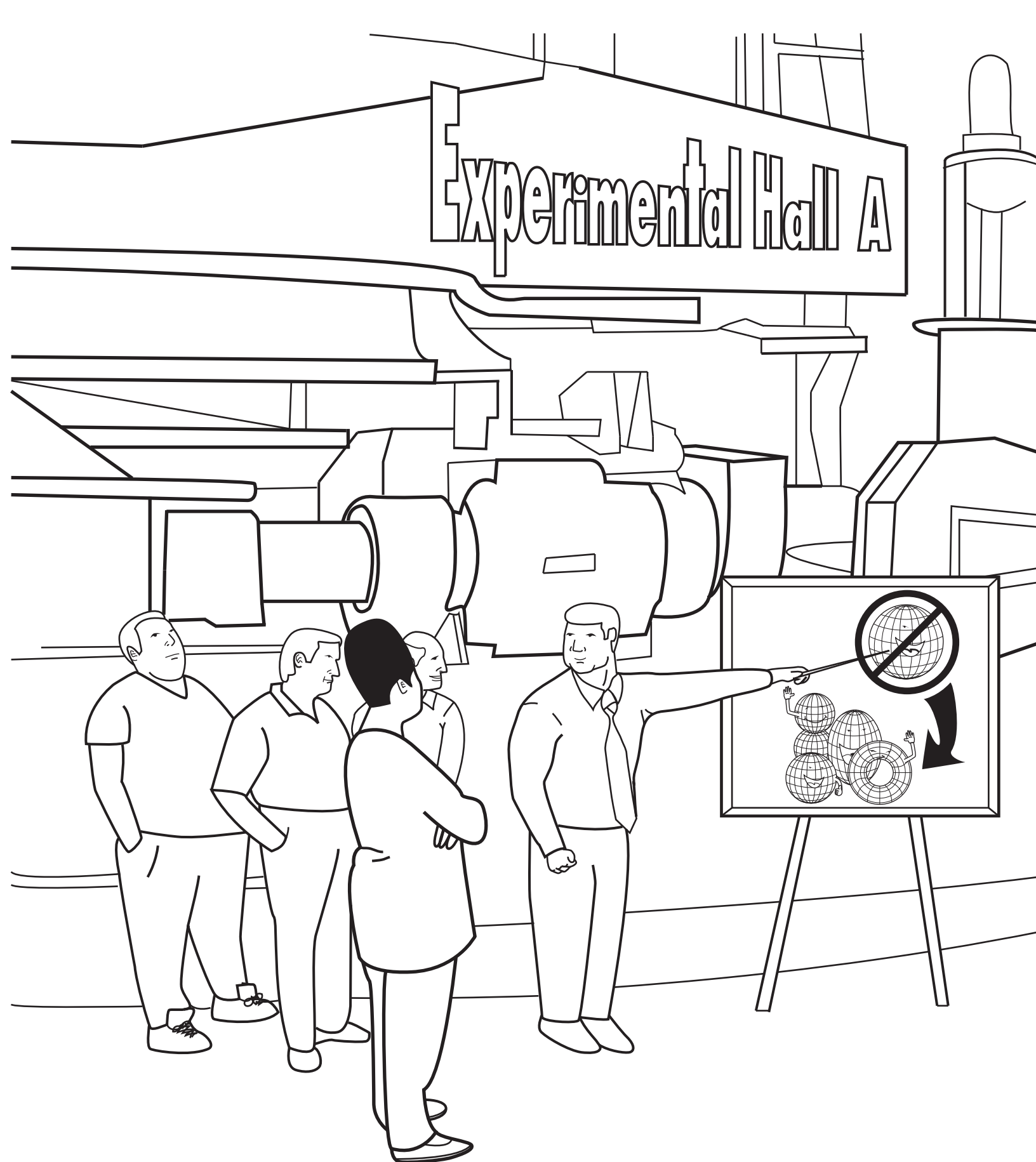
Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll



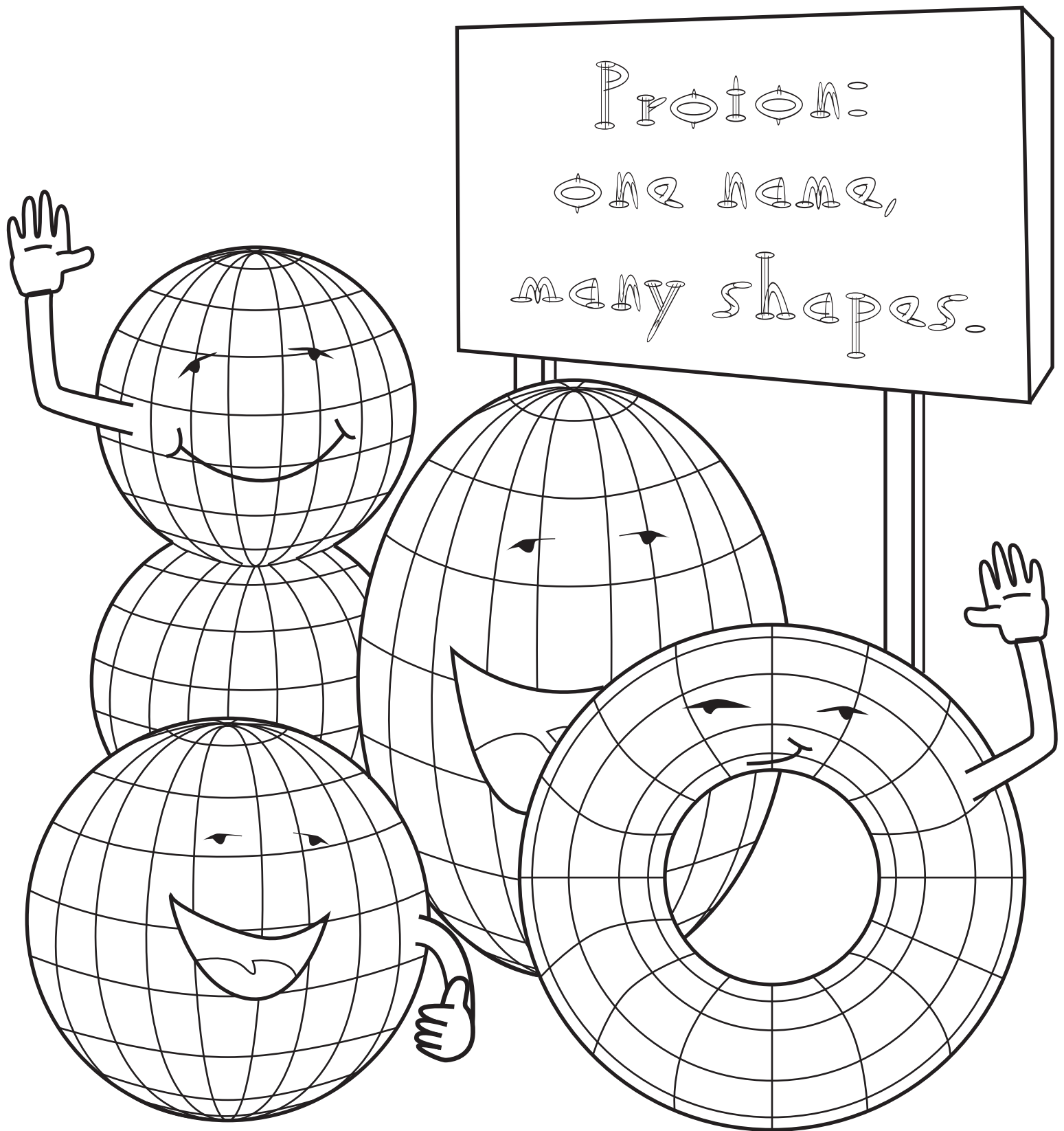
Our goal is to discover all we can and then in turn,
to give to our community, so everyone can learn.



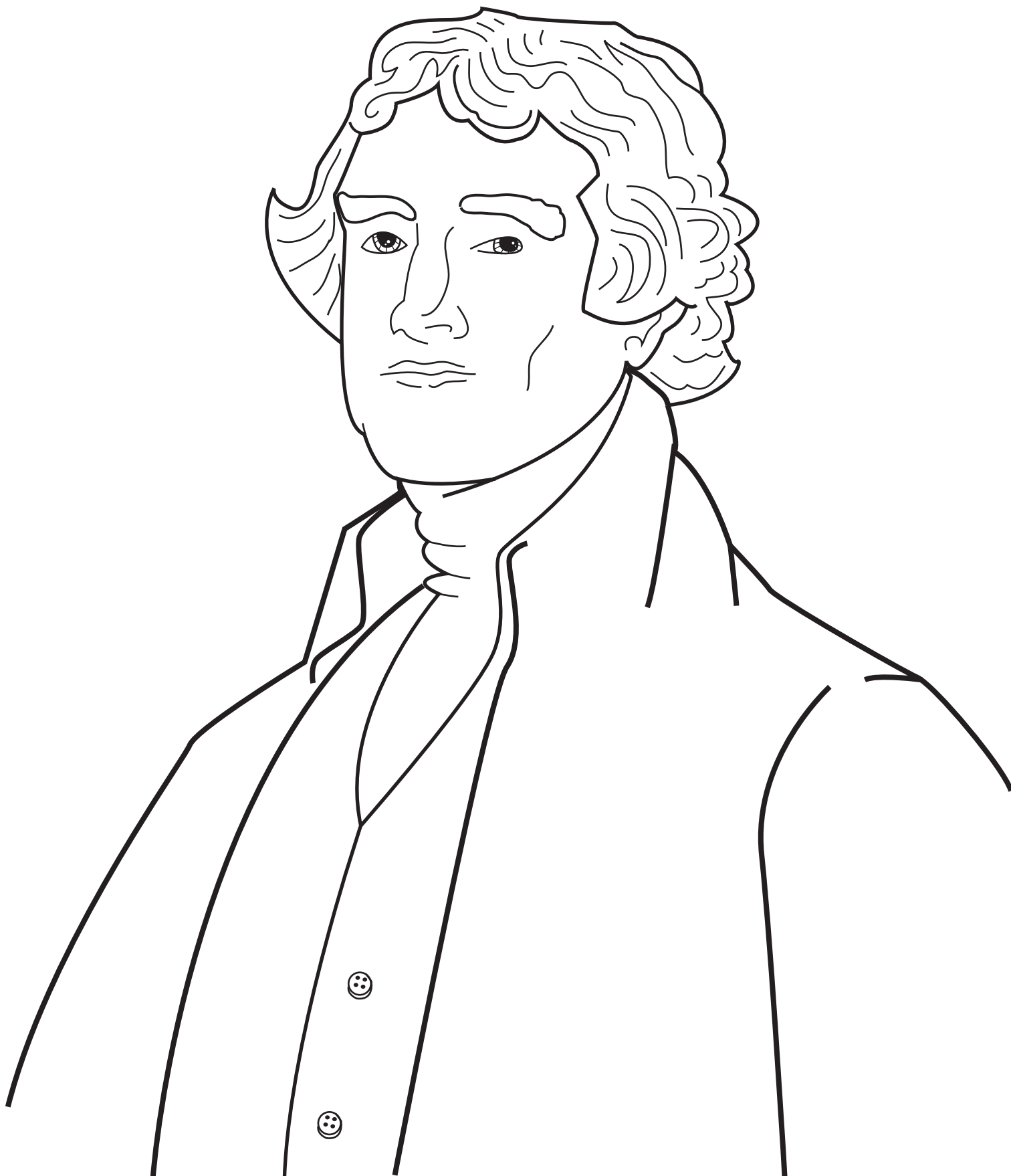
We work with our community and help to light the path,
enhancing education both in sciences and math.



Many school books say that protons all resemble balls,
but we discovered more in our experimental halls.



Although we know that some of them resemble rounded grapes, we proved that they could take the form of many different shapes.



We named our laboratory after Thomas Jefferson.
In summary, it's where particle experiments are run.



We hope that you'll remember things from each and every page,
because tomorrow's scientists, today are kids your age!

Q	U	T	L	S	M	A	E	B	N	X	F	J	K
B	U	Q	W	C	X	Z	Y	G	R	E	N	E	L
L	U	A	Y	D	S	V	E	U	Y	W	Z	F	P
N	P	A	R	T	I	C	L	E	O	D	D	F	W
M	O	T	R	K	B	L	E	D	U	I	Y	E	Q
Q	T	H	O	M	A	S	C	K	J	L	H	R	J
N	C	T	C	M	O	T	T	O	B	M	G	S	X
O	U	V	B	R	S	T	R	A	N	G	E	O	D
U	M	L	T	C	X	W	O	N	D	R	G	N	U
L	O	U	L	V	D	C	N	T	O	P	Q	S	O
G	T	F	G	L	H	U	G	W	W	T	C	G	L
S	A	K	R	A	U	Q	I	T	N	A	O	A	B
W	D	T	R	B	I	U	I	W	R	T	F	R	V
N	M	M	G	J	T	E	C	N	E	I	C	S	P

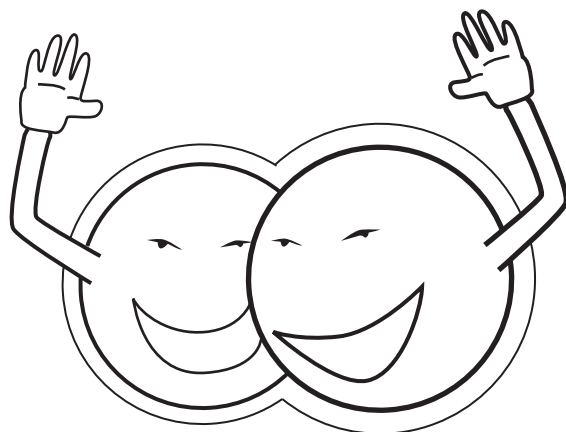
Answers on inside front cover.

Help the quarks find these words:

quark
particle
gluon
atom
up
down
proton

bottom
charm
strange
energy
electron
beam
DOE

lab
antiquark
top
thomas
jefferson
glue
science



QUARKS: More Than Meets the Eye

The sun, the moon, the galaxy and every single star,
consist of tiny particles that make up who we are.
These particles are everywhere, in everything around.
Inside the drops of rain that fall and underneath the ground.

They're deep within the roots and trunk of every single tree,
the neatest things in nature are the ones we cannot see.
From tiny little tuna fish to larger flying storks,
these itty-bitty particles are known to us as quarks.

Quarks are top or bottom, up or down, or charm or strange;
they're tightly held together by the gluons they exchange.
And this exchange of particles, we've come to know as glue,
for quarks cannot exist alone; there can't be less than two.

Perhaps by now you've noticed that our quarks are in a pair,
although it's true, there can be two; it's relatively rare.
Most exist in groups of threes, for this is how they thrive,
However, we just might have seen a pentaquark with five.

Despite the things we do to them, the quarks will never split.
They still remain together, even after they are hit.
You see, the way these quarks behave is far beyond the norm.
For when we try to separate them, other quarks will form.

Anti-quarks are what they call the new ones that appear;
we know this always happens, yet the reason isn't clear.
We seek to find the reasons why they act the way they do,
and hope to understand the reason glue attracts to glue.

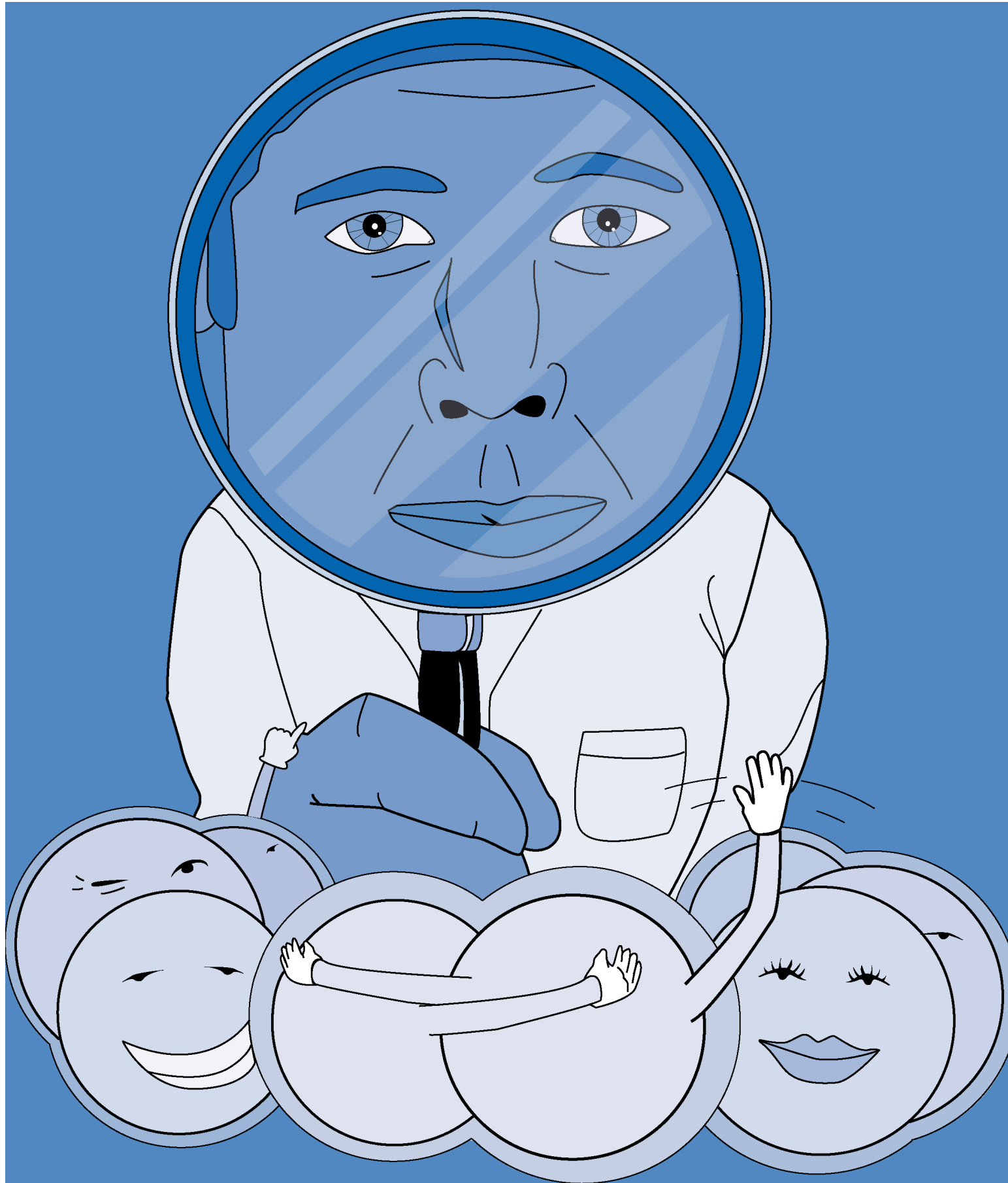
By speeding up electrons, we generate a beam;
a beam with brighter light than many labs could even dream.
We make them race around and round and speed up very fast.
They're almost at the speed of light when atoms get the blast.

In doing this, we find out what the quarks are going to do,
and find out if the theories that we hold of them are true.
The Energy Department oversees us as a whole,
providing what we need to reach our laboratory's goal.

Our goal is to discover all we can and then in turn,
to give to our community, so everyone can learn.
We work with our community and help to light the path,
enhancing education both in sciences and math.

Many school books say that protons all resemble balls,
but we discovered more in our experimental halls.
Although we know that some of them resemble rounded grapes,
we proved that they could take the form of many different shapes.

We named our laboratory after Thomas Jefferson.
In summary, it's where particle experiments are run.
We hope that you'll remember things from each and every page,
because tomorrow's scientists, today are kids your age!



Jefferson Lab is managed by the Southeastern Universities Research Association
for the Office of Science of the U.S. Department of Energy.
Jefferson Lab, 12000 Jefferson Avenue, Newport News, VA 23606 • www.jlab.org
Main: (757) 269-7100, Science Education Office: (757) 269-7164



OFFICE OF SCIENCE