

FREE!
#2

**UNIVERSITY OF YORK, UNIVERSITY OF LINCOLN
AND TEESSIDE UNIVERSITY PRESENTS**



GREENKID



STORIES! PUZZLES! GAMES! FANART! THIS ISSUE: RDX AND TNT STRIKE!

GLOSSARY

DNA: DEOXYRIBONUCLEIC ACID, THE INSTRUCTIONS FOR LIFE FOR ALMOST ALL LIVING THINGS. NEARLY EVERY CELL IN YOUR BODY HAS YOUR COMPLETE DNA IN IT AND IT CONTAINS ALL THE INFORMATION NEEDED FOR YOUR BODY TO MAKE YOU.

ENTERO: CARTOON CHARACTER THAT DESCRIBES ENTEROBACTER CLOACAE, A SOIL BACTERIUM WITH THE ABILITY TO DETOXYFY TNT.

ENZYME: LITTLE BIOLOGICAL MACHINES PRODUCED BY ALL ORGANISMS TO CARRY OUT REACTIONS. THE ENZYME MAKES CHEMICAL REACTIONS HAPPEN MORE QUICKLY, AND CAN DO THIS OVER AND OVER AGAIN. THERE ARE AT LEAST 75,000 DIFFERENT TYPES OF ENZYMES WORKING INSIDE YOU RIGHT NOW!

GENE: SEQUENCES OF DNA THAT ARE INHERITED FROM THE ORGANISM'S PARENTS. GENES ARE THE INSTRUCTIONS THE ORGANISM NEEDS TO MAKE THINGS LIKE ENZYMES.

GENETICALLY MODIFIED ORGANISM (GMO): AN ORGANISM (PLANT, ANIMAL OR MICROBE) WHOSE DNA HAS BEEN CHANGED USING GENETIC ENGINEERING TECHNIQUES.

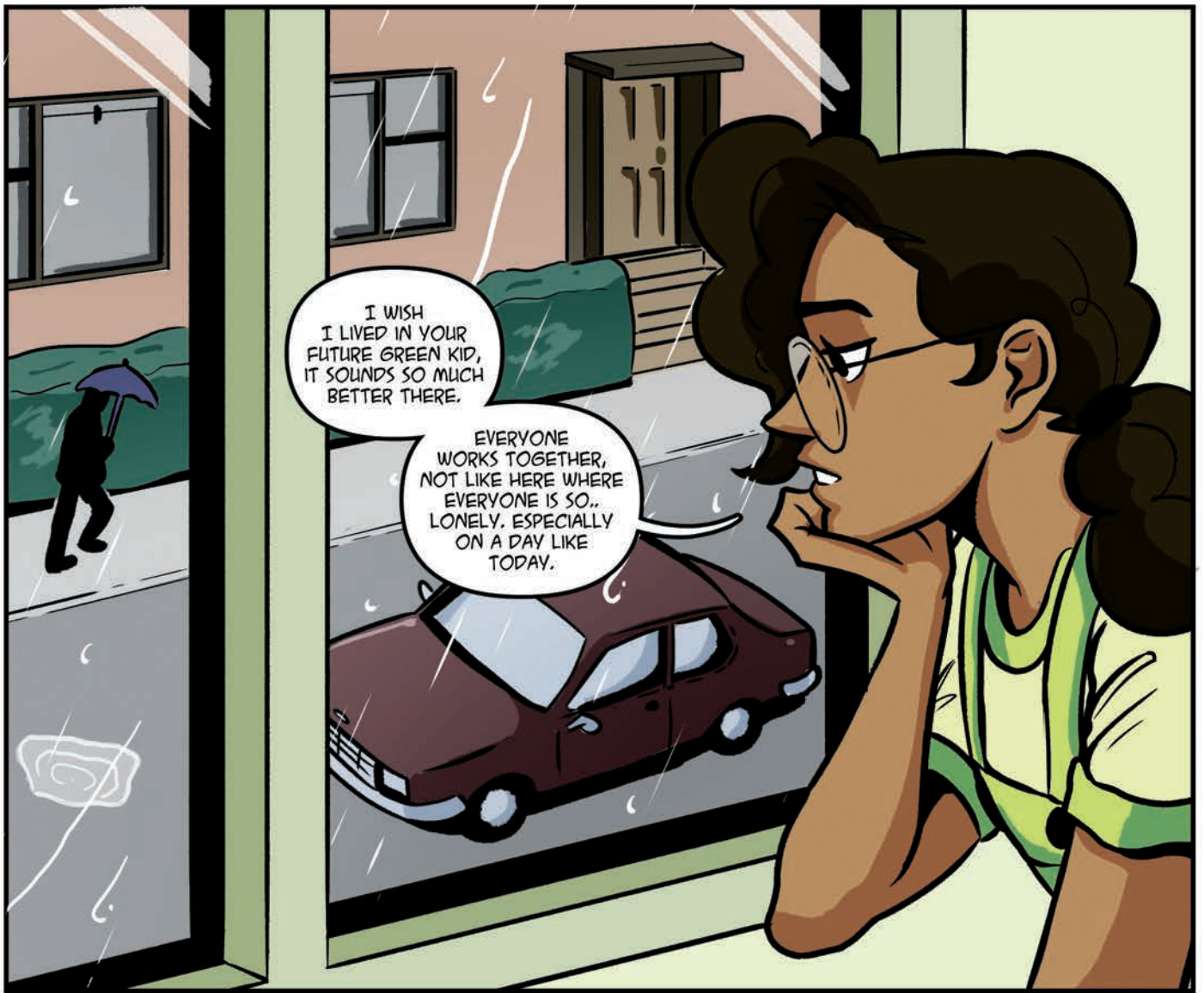
POLLUTANT: A SUBSTANCE THAT CAUSES HARM TO THE ENVIRONMENT AND OR THE ORGANISMS SUCH AS PEOPLE, ANIMALS AND PLANTS LIVING THERE.

PHYTOREMEDIATION: THE USE OF PLANTS TO CLEAN UP POLLUTION FROM OUR ENVIRONMENT.

RDY: ROYAL DEMOLITION EXPLOSIVE A TOXIC EXPLOSIVE USED ALONGSIDE TNT (SEE TNT)

RHODO: CARTOON CHARACTER THAT DESCRIBES RHODOCOCCUS RHODOCHROUS, A SOIL BACTERIUM WITH THE ABILITY TO BREAK DOWN RDY.

TNT: TRINITROTOLUENE, A TOXIC EXPLOSIVE USED BY THE MILITARY IN MUNITIONS (BOMBS, MORTARS, BULLETS).



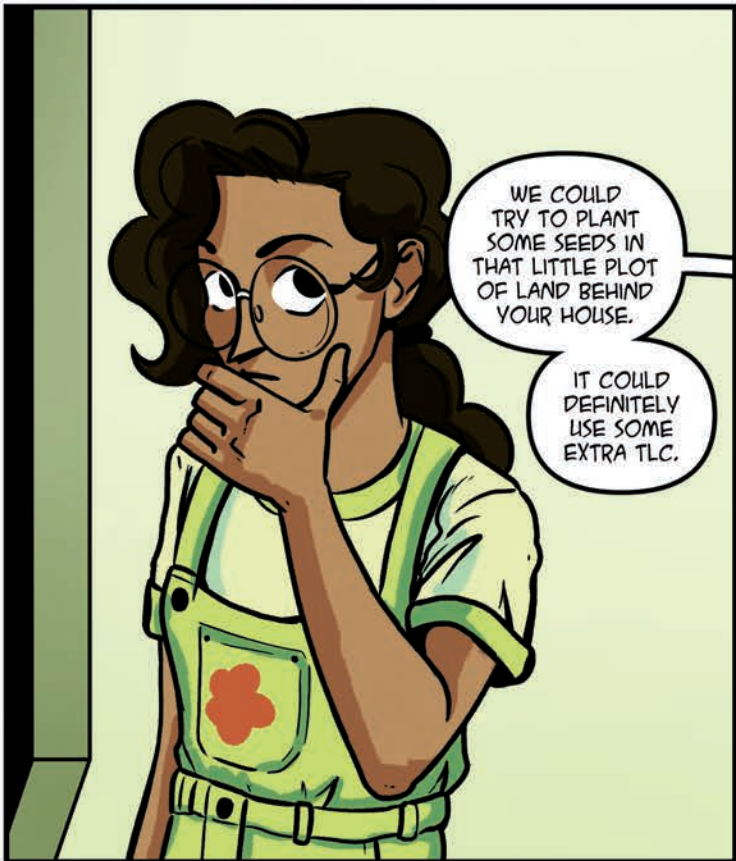
I WISH I LIVED IN YOUR FUTURE GREEN KID, IT SOUNDS SO MUCH BETTER THERE.

EVERYONE WORKS TOGETHER, NOT LIKE HERE WHERE EVERYONE IS SO.. LONELY. ESPECIALLY ON A DAY LIKE TODAY.



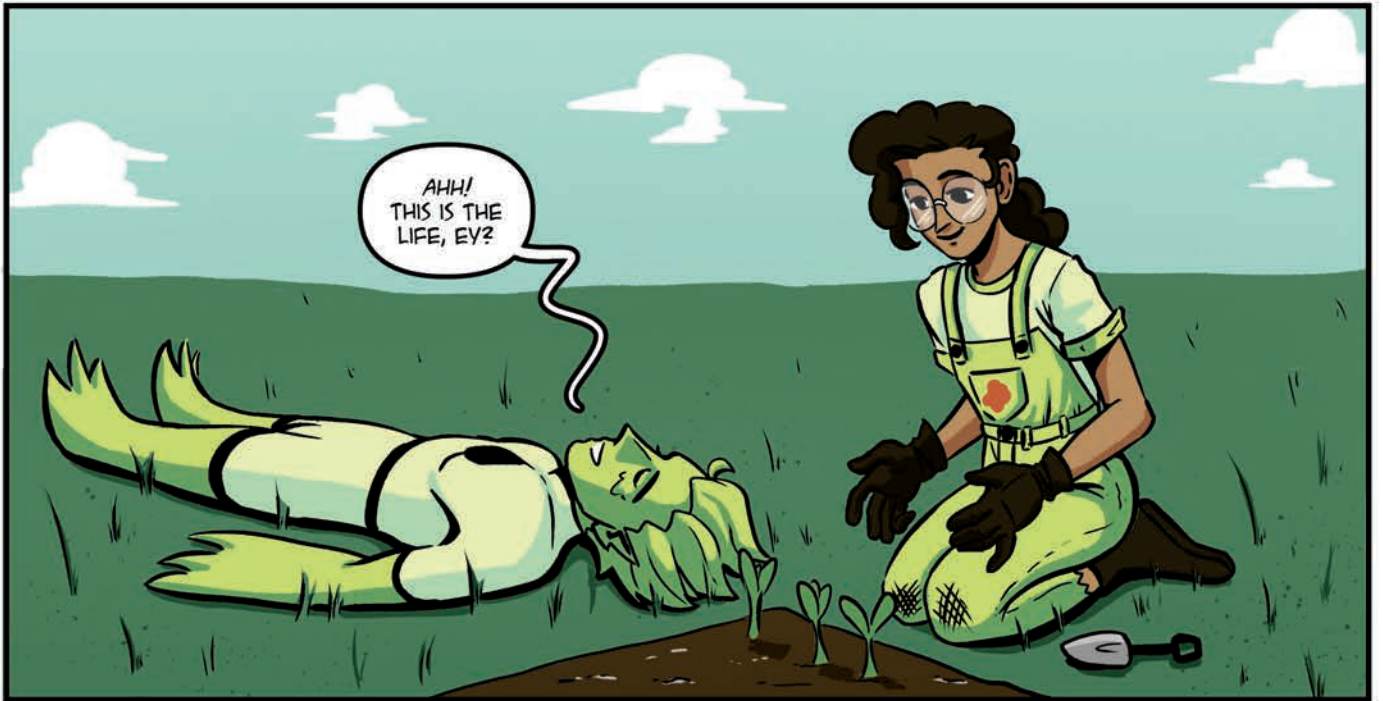
WHERE I'M FROM, PEOPLE NORMALLY GET TOGETHER AND DO SOME GARDENING AFTER IT'S RAINED.

IT'S THE PERFECT TIME FOR SEEDS TO GROW!



WE COULD TRY TO PLANT SOME SEEDS IN THAT LITTLE PLOT OF LAND BEHIND YOUR HOUSE.

IT COULD DEFINITELY USE SOME EXTRA TLC.



AHH!
THIS IS THE
LIFE, EY?

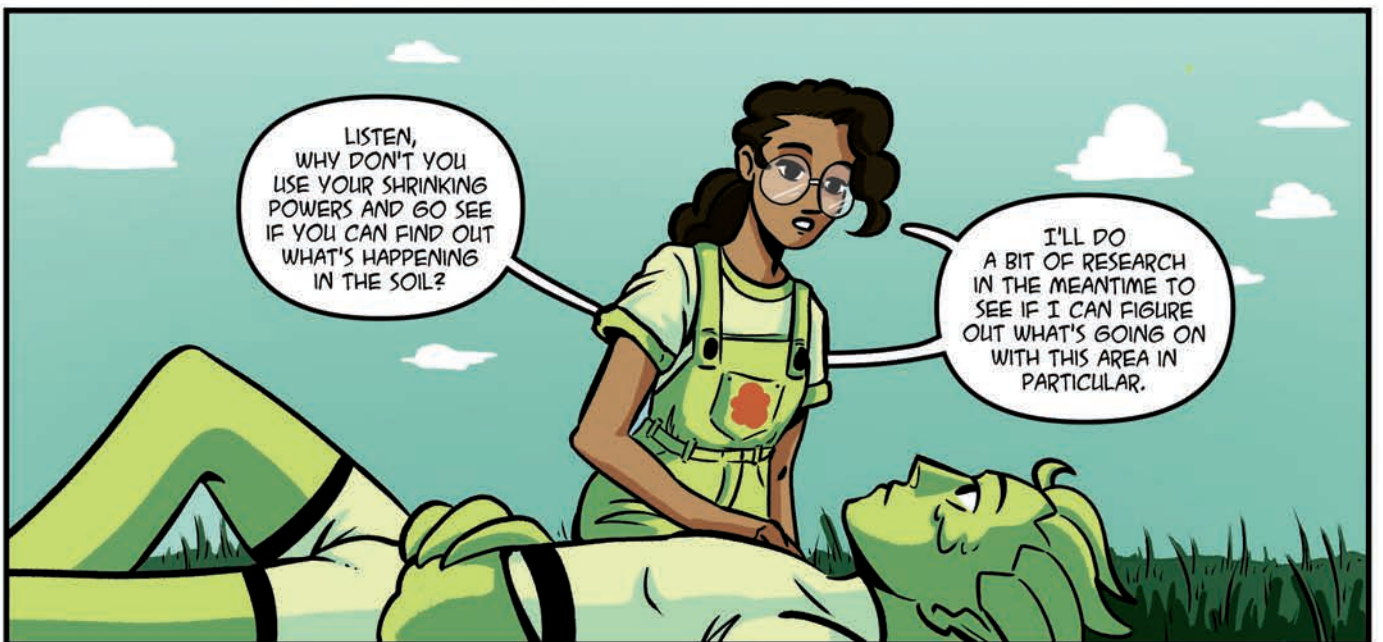


...THERE'S
SOMETHING UP
WITH THE PLANT LIFE
HERE, IT DOESN'T SEEM
LIKE ANY OF THE SEEDS
YOU'RE PLANTING ARE
GOING TO TAKE
HOLD...



DO
YOU THINK
SOMETHING
COULD BE UP
WITH THE
SOIL?

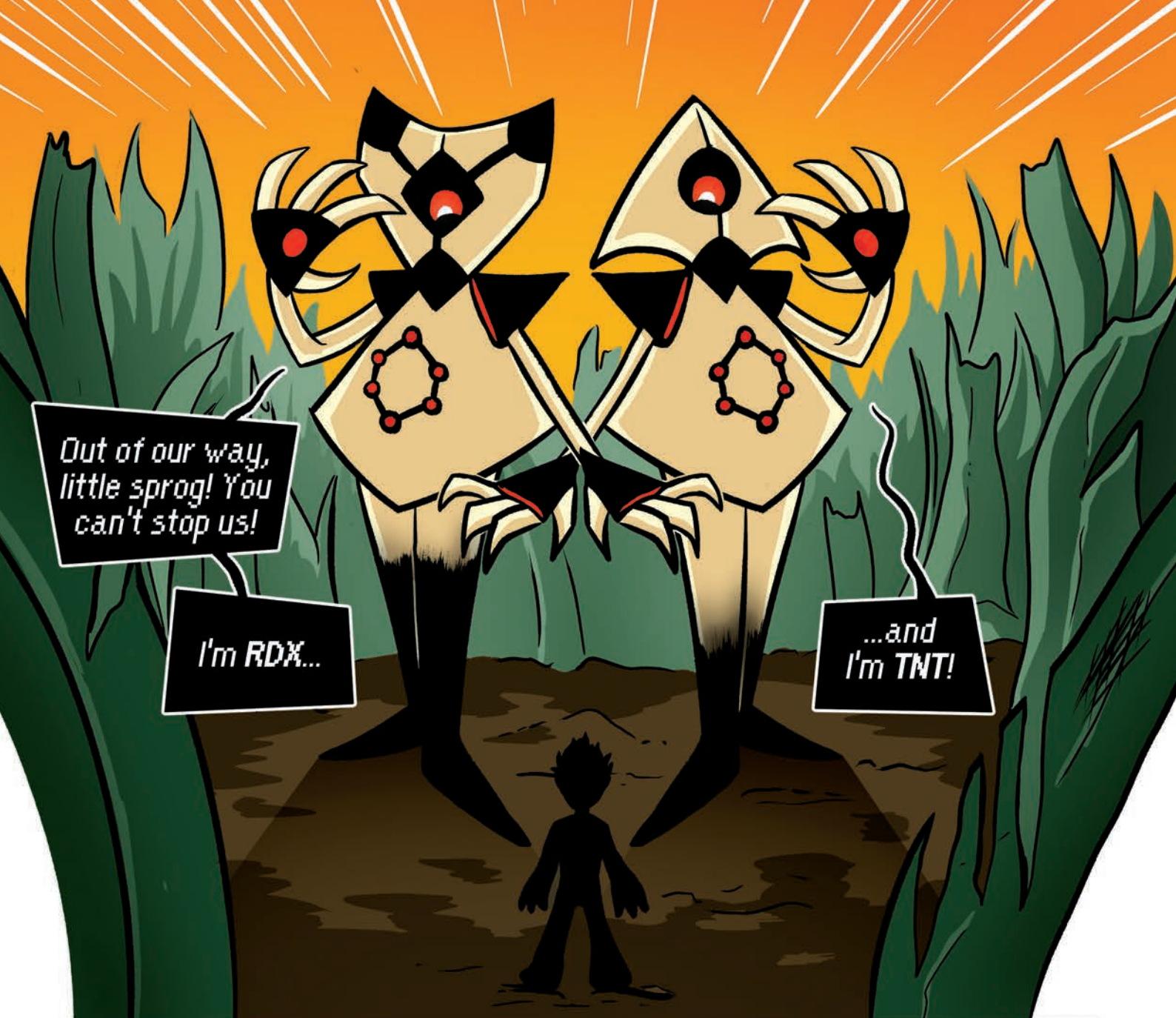
WELL,
WHATEVER IT IS,
IT'S BRINGING
ME DOWN...



LISTEN,
WHY DON'T YOU
USE YOUR SHRINKING
POWERS AND GO SEE
IF YOU CAN FIND OUT
WHAT'S HAPPENING
IN THE SOIL?

I'LL DO
A BIT OF RESEARCH
IN THE MEANTIME TO
SEE IF I CAN FIGURE
OUT WHAT'S GOING ON
WITH THIS AREA IN
PARTICULAR.





Out of our way,
little sprog! You
can't stop us!

I'm RDX...

...and
I'm TNT!



YOU GUYS
BETTER GET
THE HECK OUT
OF HERE OR
ELSE!

CAN'T
YOU SEE YOU'RE
POISONING THE
ROOTS OF THESE
PLANTS?

HOW ARE
THEY MEANT
TO GROW
HERE?



P-Poisoning
the roots?!



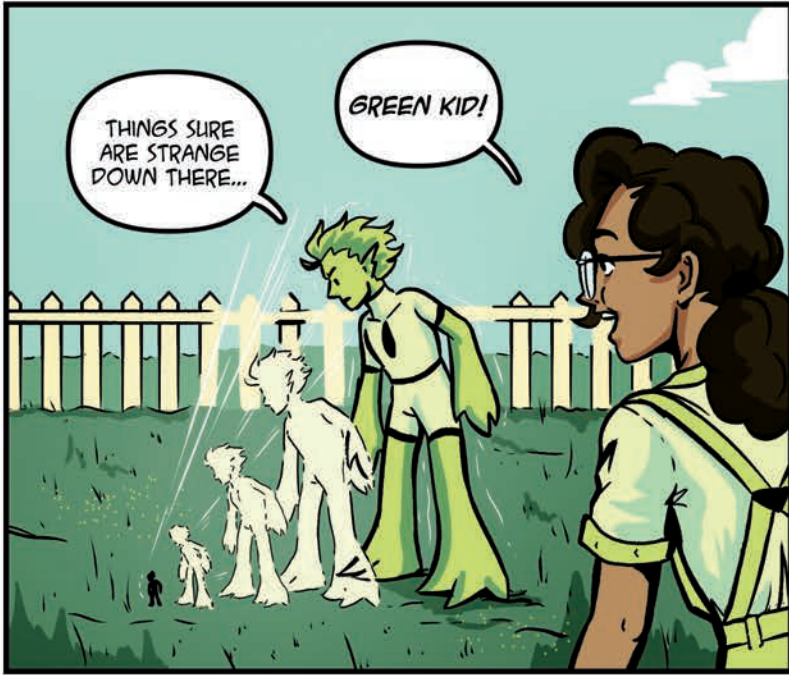
That
sounds...



...like fun!

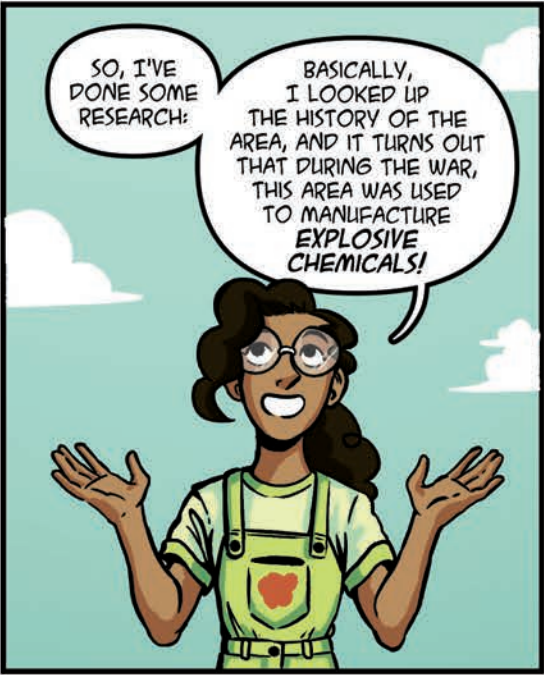
HA HA HA!





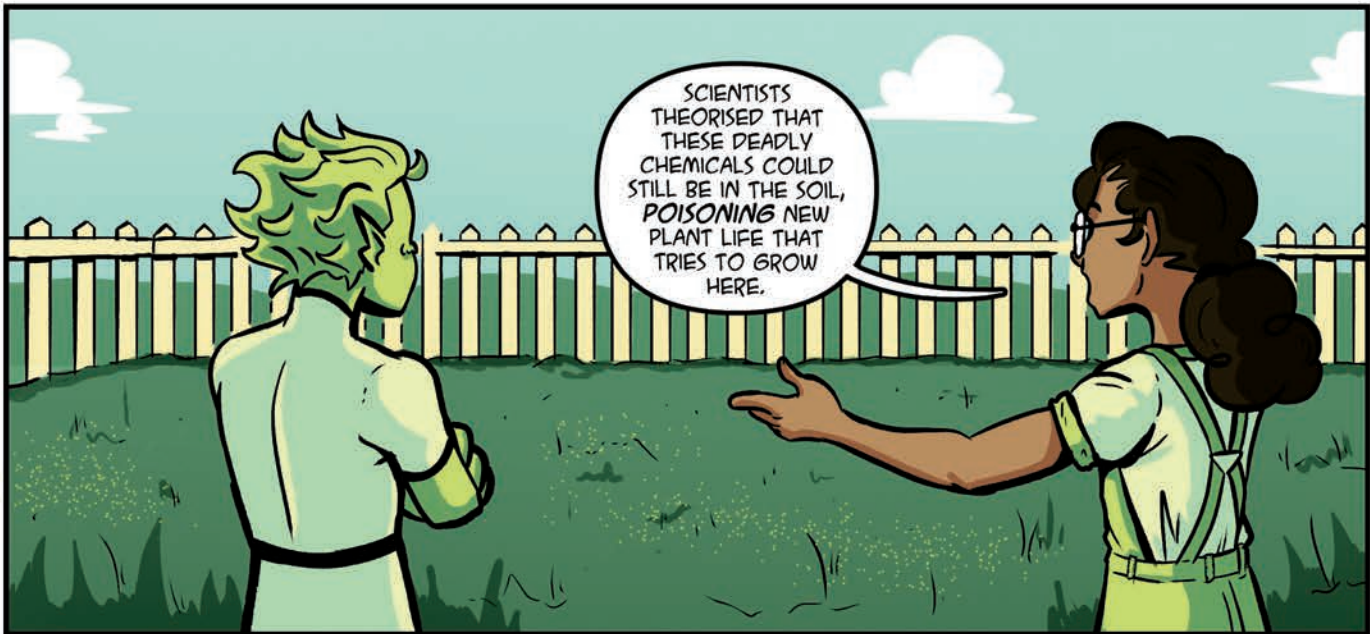
THINGS SURE ARE STRANGE DOWN THERE...

GREEN KID!

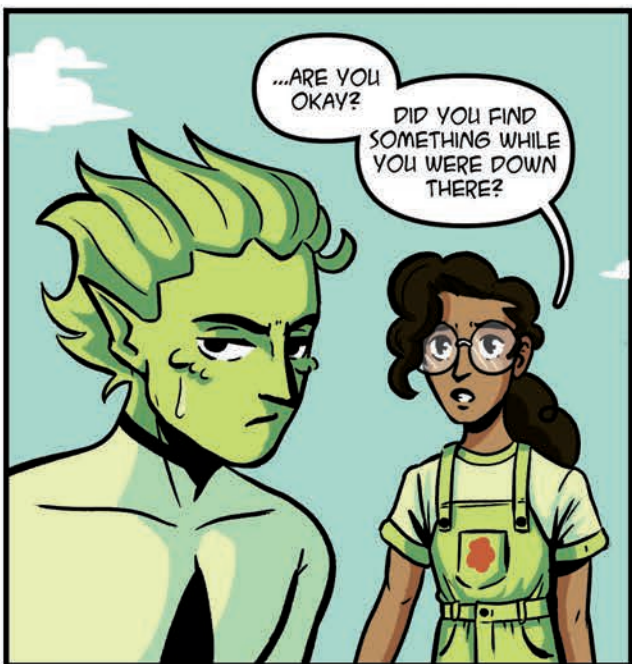


SO, I'VE DONE SOME RESEARCH:

BASICALLY, I LOOKED UP THE HISTORY OF THE AREA, AND IT TURNS OUT THAT DURING THE WAR, THIS AREA WAS USED TO MANUFACTURE EXPLOSIVE CHEMICALS!

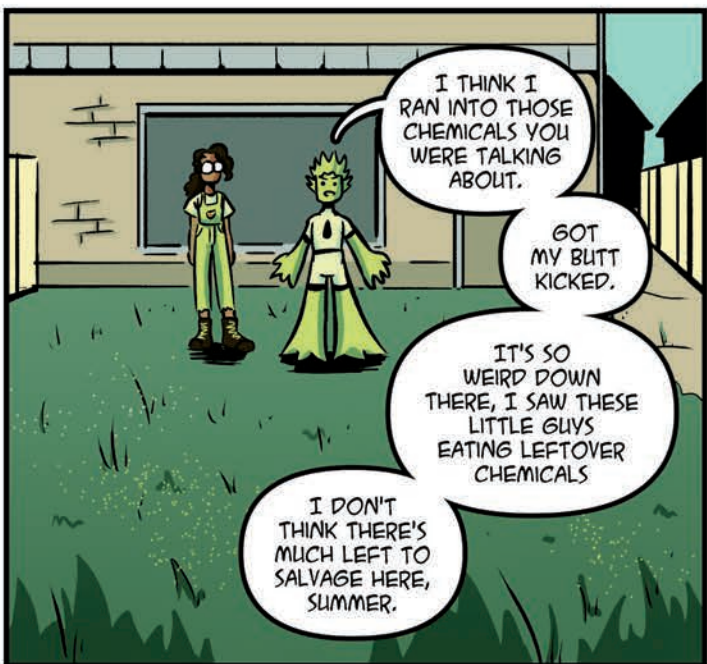


SCIENTISTS THEORISED THAT THESE DEADLY CHEMICALS COULD STILL BE IN THE SOIL, POISONING NEW PLANT LIFE THAT TRIES TO GROW HERE.



...ARE YOU OKAY?

DID YOU FIND SOMETHING WHILE YOU WERE DOWN THERE?



I THINK I RAN INTO THOSE CHEMICALS YOU WERE TALKING ABOUT.

GOT MY BUTT KICKED.

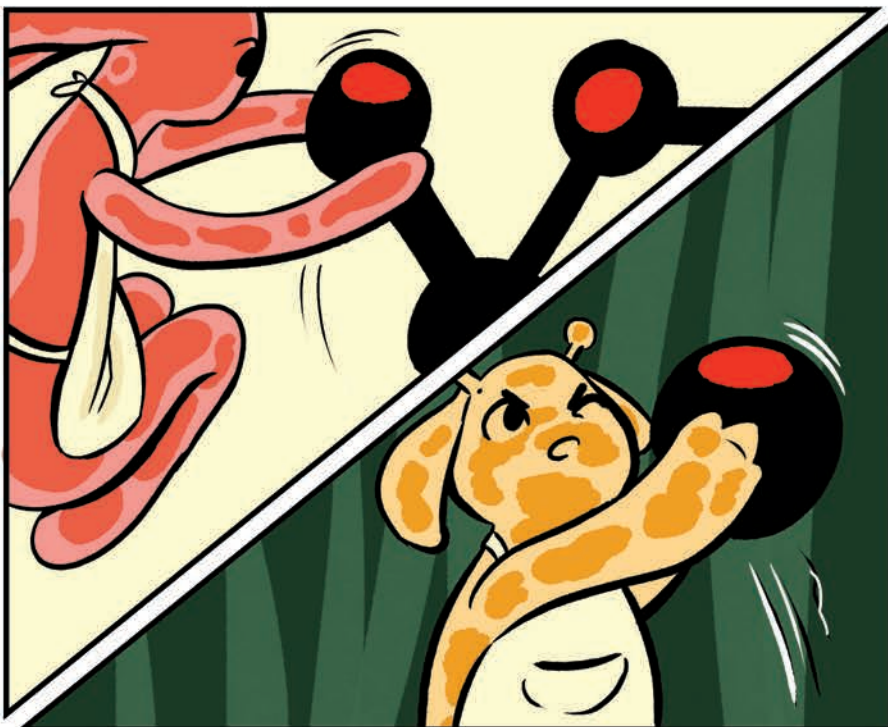
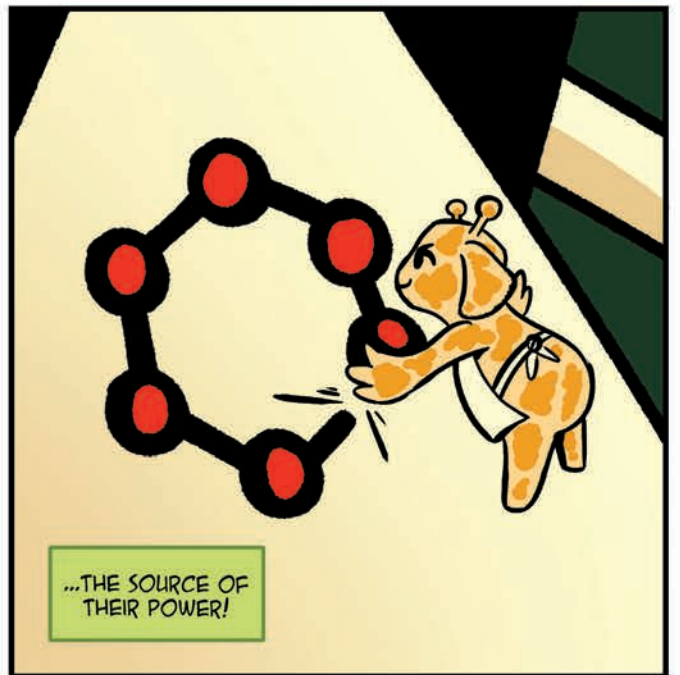
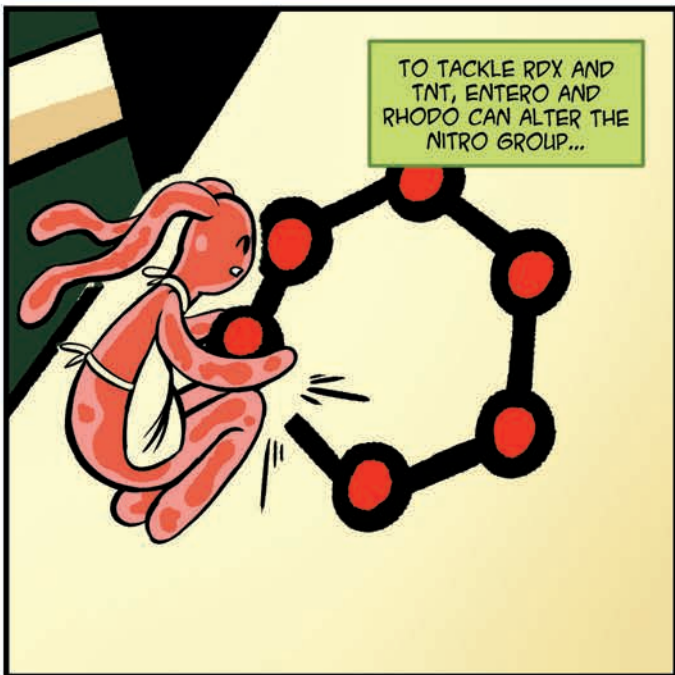
IT'S SO WEIRD DOWN THERE, I SAW THESE LITTLE GUYS EATING LEFTOVER CHEMICALS

I DON'T THINK THERE'S MUCH LEFT TO SALVAGE HERE, SUMMER.



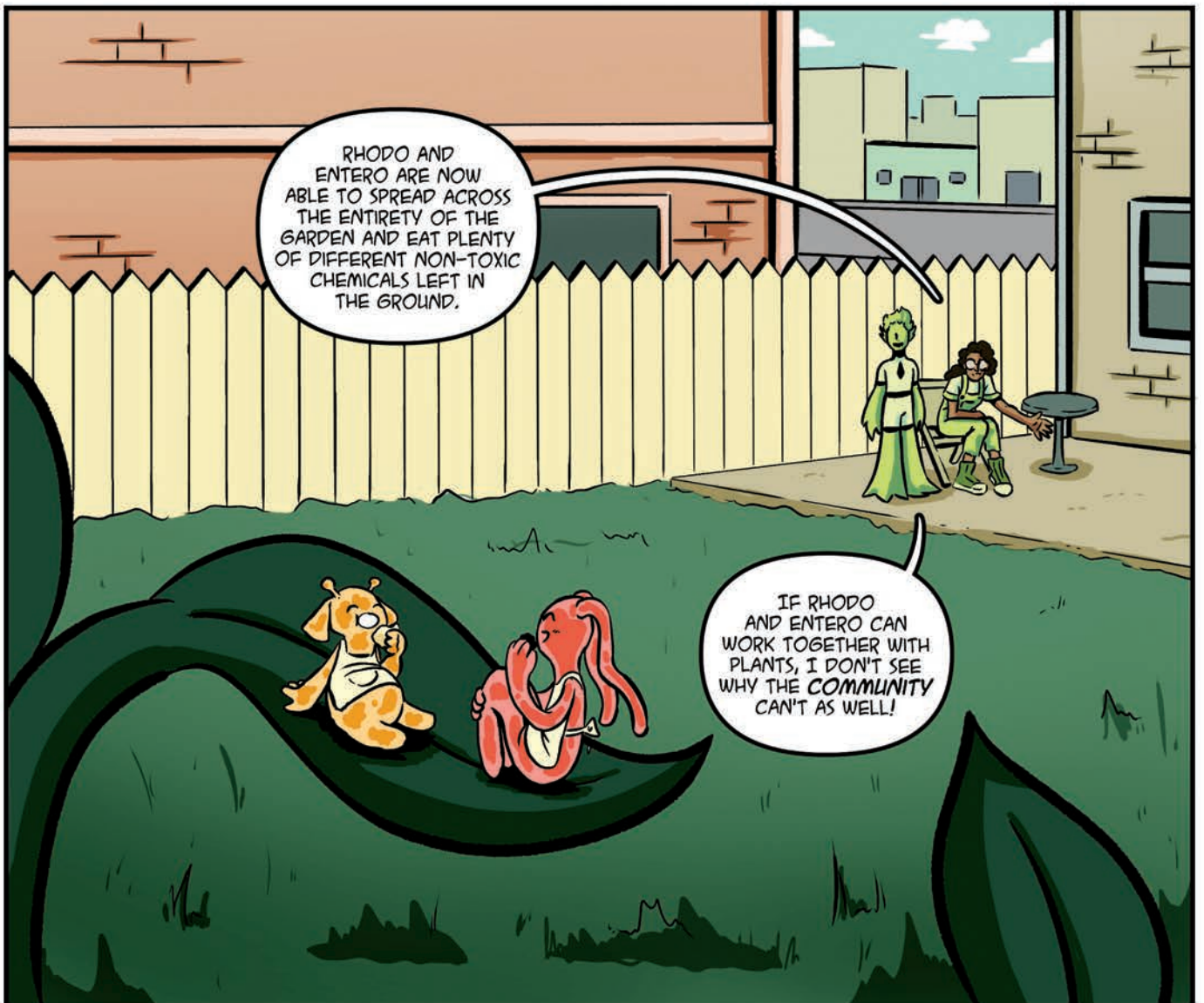
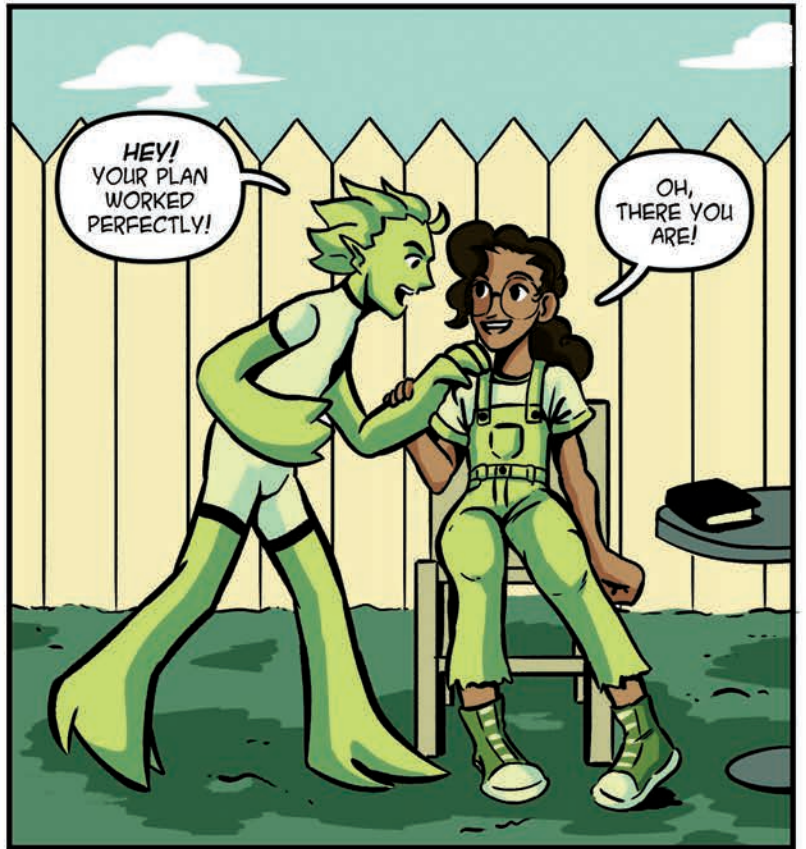


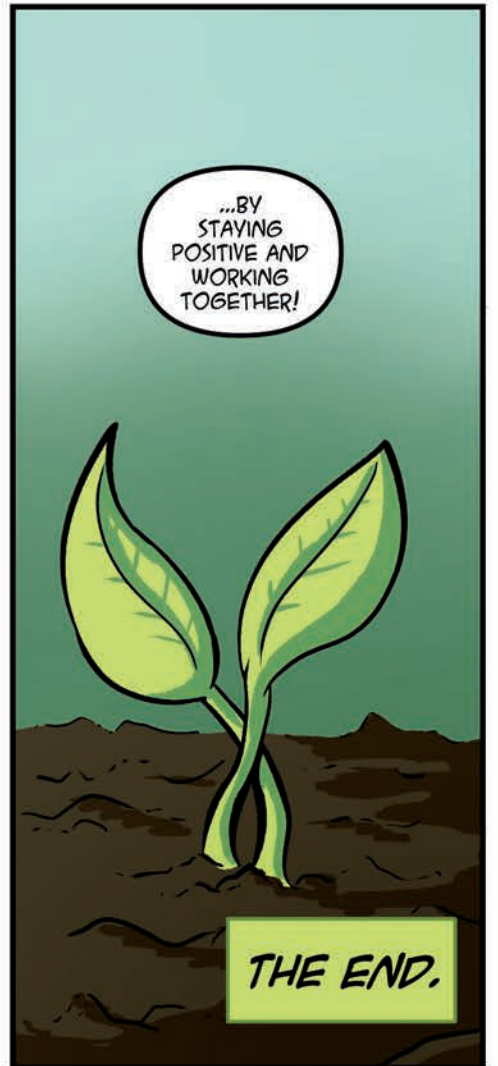












Phytomining

With Sprout and Cyrus

Did you know there are areas of the planet where the soil contains lots of metal? We're on our way to New Caledonia, an island near Australia where the ultramafic soils contain so much nickel that normal plants can't grow.

Then how do the plants survive?

Well plants do need metals like copper, iron and nickel but only small amounts, which they take from the soil. The trees on New Caledonia have evolved to not get sick from all the nickel. In fact their sap is green-y blue!

WOW!

Pycnantra Acuminata

They're grown around this factory so that they can be easily harvested, smelted and turned into nickel.

Cobalt Silver Zinc Nickel Gold

Manganese Selenium

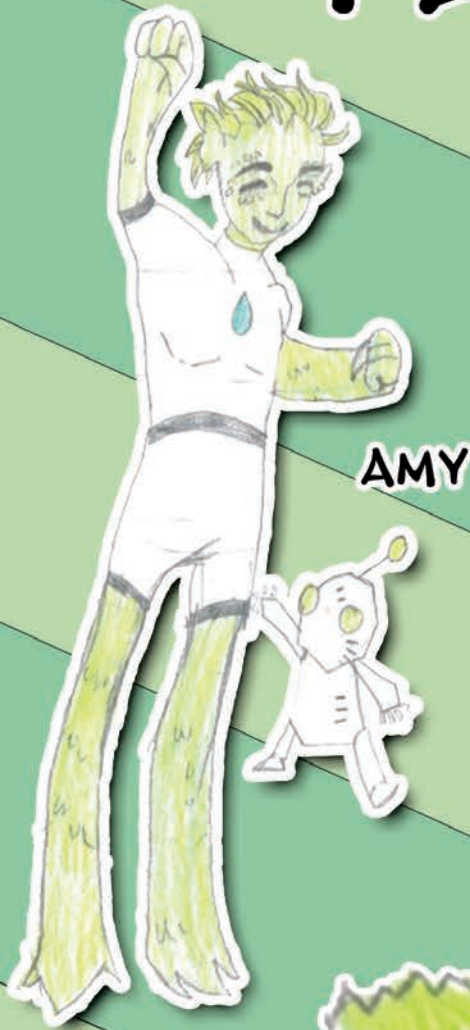
Phytomining allows us to harvest lots of different metal salts from plants. These salts can be turned into pure metal.

Scientists want to use these plants to harvest metal for use in industry. If the toxic metals are removed from the soil, it can then be turned into luscious farmland!

Phytomining won't replace traditional mining but can help reduce mining's carbon footprint, clean contaminated soil and increase biodiversity.

FAN ART!

WOW!
THIS FANART
IS EVEN MORE
SUPER THAN
GREENKID!



AMY



SANDRA



TILLY

DYLAN



CAN'T SEE YOUR FANART? DON'T
WORRY! KEEP AN EYE FOR IT IN ISSUE 3!
COMING SOON.



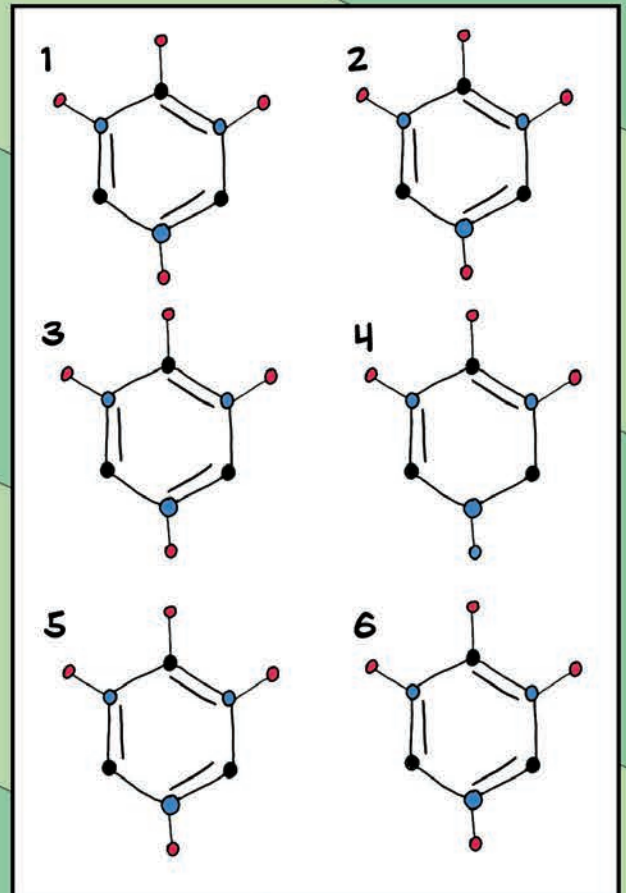
FUN AND GAMES

TIME FOR SOME FUN AND GAMES WITH YOUR FAVOURITE CHARACTERS!

WORD SEARCH

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

SPOT THE ODD MOLECULE OUT



DNA
 ENTERO
 ENZYME
 GENE
 GMO
 POLLUTANT
 PHYTOREMEDIATION
 RDX
 RHODO
 TNT

COLOUR ME IN!

Science
WITH DR SCIENCE

HELLO!
I'M DR SCIENCE!

SOME BACTERIA ARE ABLE TO BREAK DOWN AND OTHERS CAN DETOXY TNT. THEY'VE LEARNT TO DO THIS BECAUSE BACTERIA EVOLVE QUICKLY, IT'S LOTS OF UNUSED FOOD AND IT GIVES THEM AN ADVANTAGE TO LIVE SOMEWHERE THAT OTHER BACTERIA FIND HARD. THE INFORMATION OF HOW TO MAKE THE ENZYMES TO DO THIS IS STORED IN THEIR DNA.

BUT UNLIKE BACTERIA, PLANTS CAN'T NATURALLY USE EXPLOSIVES AS FOOD. BY TRANSFERRING THE BIT OF BACTERIAL DNA INTO PLANTS, THEY CAN NOW GROW IN TOXIC SOIL WHERE OTHER PLANTS CANNOT AND CAN GET RID OF THE RDX AND TNT.

Bacteria DNA → Grass DNA

THE PLANTS ARE ABLE TO REMOVE A NITRO GROUP FROM TNT AND NOW THIS CAN BE BROKEN DOWN EASILY. THEY CAN ALSO CHANGE NITRO GROUPS TO AMINES ON TNT. WHICH THE PLANT CAN THEN DETOXY BY ADDING A SUGAR THIS NEW COMPOUND ISN'T TOXIC ANY MORE.

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WITH SPECIAL THANKS
TO ACOMB PRIMARY
AND
ALL SAINTS RC
SCHOOL YORK FOR
BETA TESTING.



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