The magic of synthetic biology

COLLABORATION 2022

Our stories:

- iRNAldo and Chalino against the great oomycete **(Tec-Chihuahua)**
- The bombolitin (**Thailand_RIS)**
- The Rust-Busters **(UNSW iGEM2022)**
- Binanox **(Leiden)**
- UBX protein (**NYCU_Formosa 2022)**
- Antibody (C**SMU Taiwan)**
- Industries **(REC CHENNAI)**
- CADlock **(Lambert_GA)**
- Nobesity **(KCIS Xiugang Taipei)**
- PCR (CityU **Hong Kong)**
- Fungus (City**U Hong Kong)**
- Pichietecture **(igem Vienna)**
- Do you know? (GYHS)
- Paper based sensor (GYHS)
- How can I dispense the phosphate? **(AACHEN)**
- Endocrine disruptors **(TECCEM)**
- SPIDICIDE **(UAM)**
- Yeast resistant to radiation **(Estonia_TUIT)**
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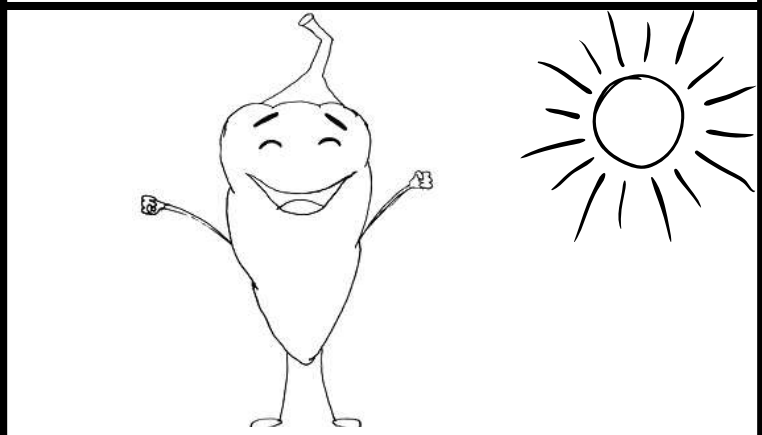
- AcidOceanus **(UM_MACAU)**

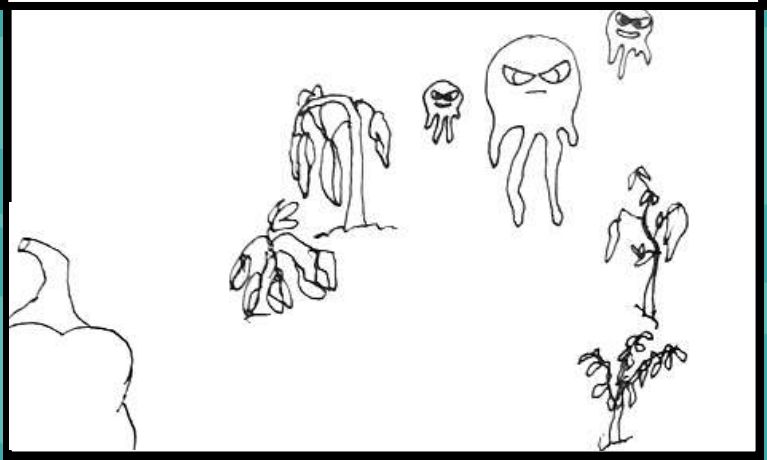
iRNAIdo and Chalino against the great oomycete

Tec-Chihuahua

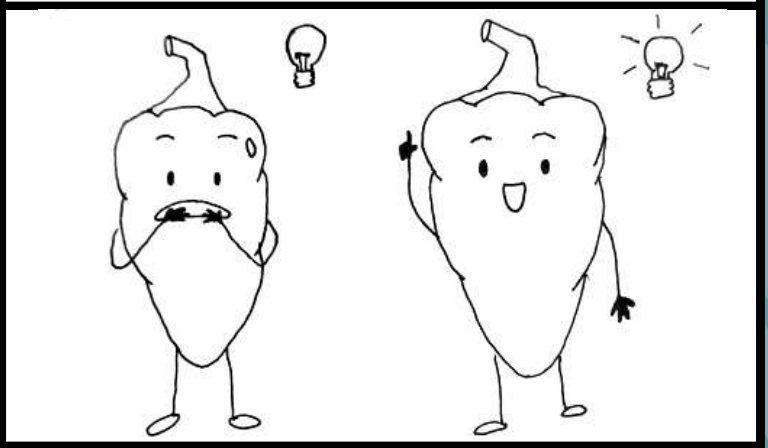
Once upon a time, there was a large/big jalapeño plant called Chalino. They spread their long leaves every morning to bask in the sun.



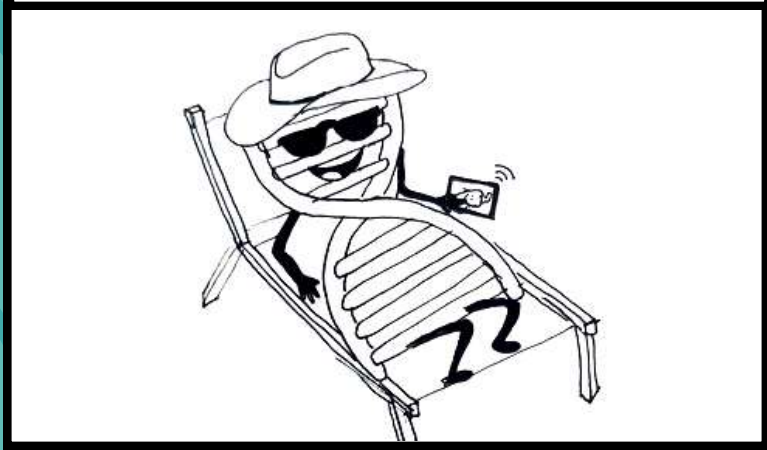
One morning, they were sunbathing and saw a large oomycete slowly approaching them while attacking the other plants.



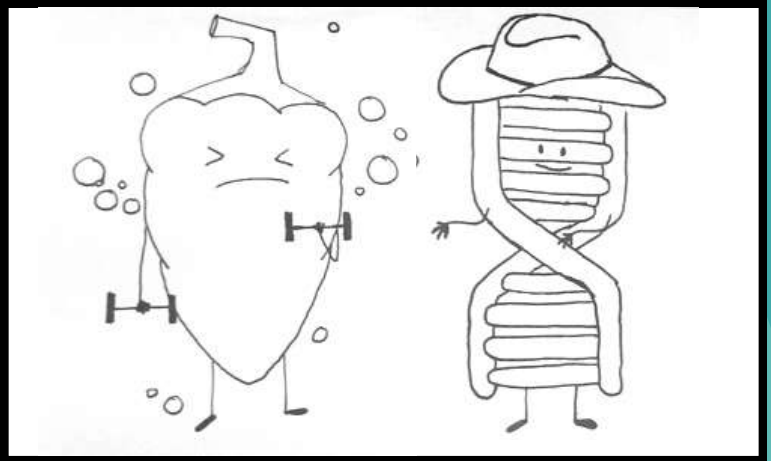
Terrified, but determined to defend themselves and stop the oomycete from harming other plants. Chalino called his old friend IRNaldo for help.



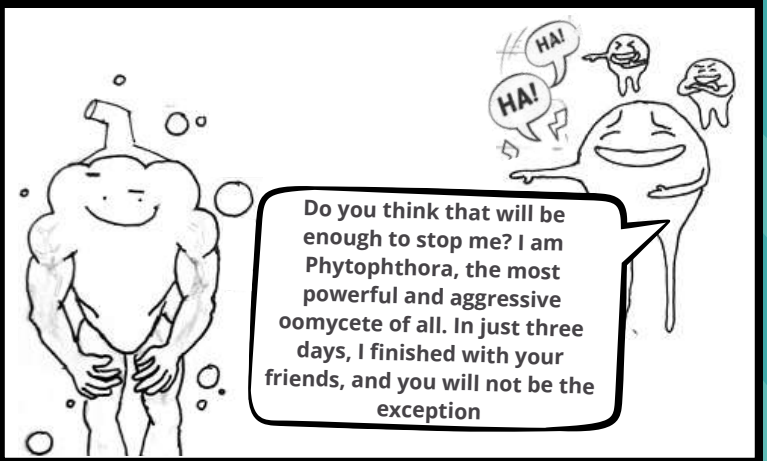
IRNaldo responded to their call and took with him his most powerful weapons: the peptides DsrB1 and PcosM.



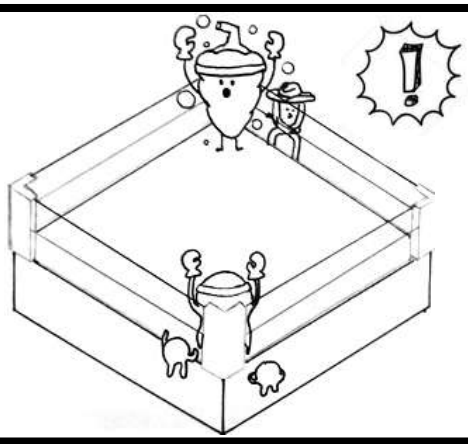
At the same time, Chalino prepared their defense system, and they both waited for the oomycete to arrive.



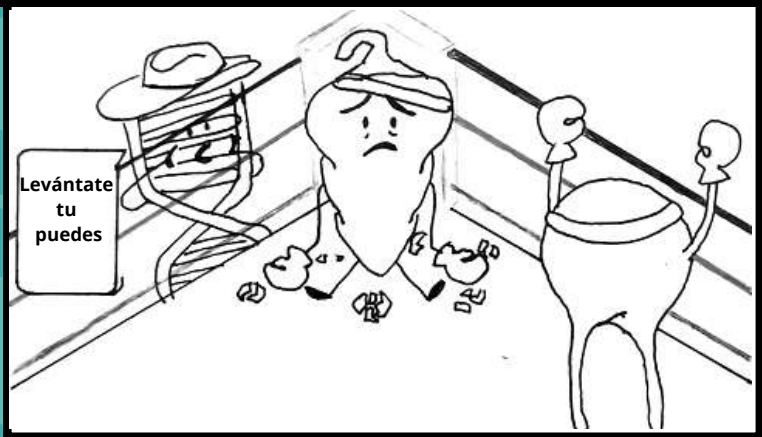
The oomycete came and taunted saying:



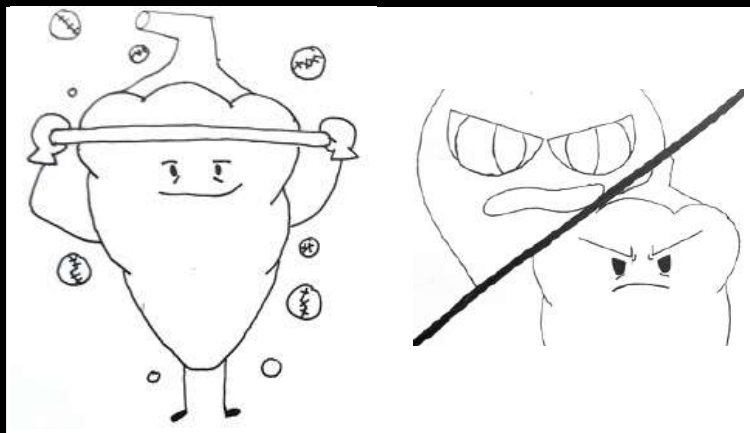
The great battle began



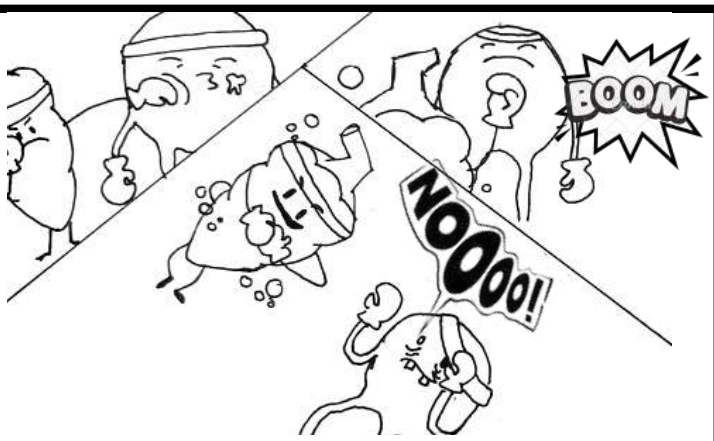
The oomycete began to release its effectors and absorb nutrients from Chalino. Chalino tried to resist with their defense system, but the effectors weakened them, and they fell.



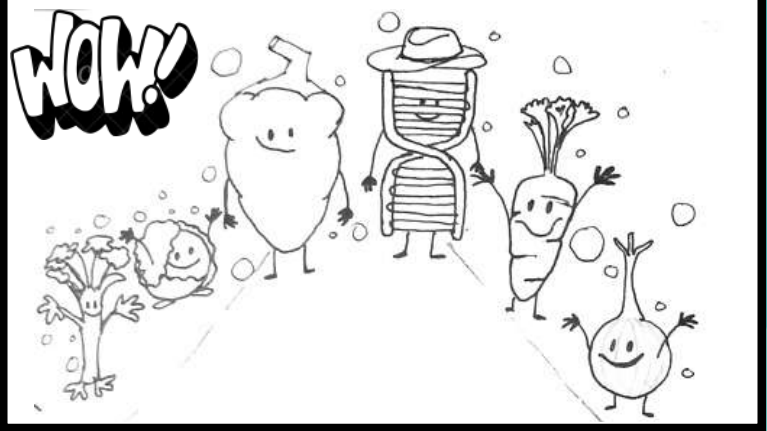
But IRNaldo deactivated the effectors and Chalino rejoined the fight. Simultaneously, IRNaldo released the peptides that weakened the oomycete's armor.



After an arduous fight, Chalino and IRNaldo managed to defeat the great oomycete.

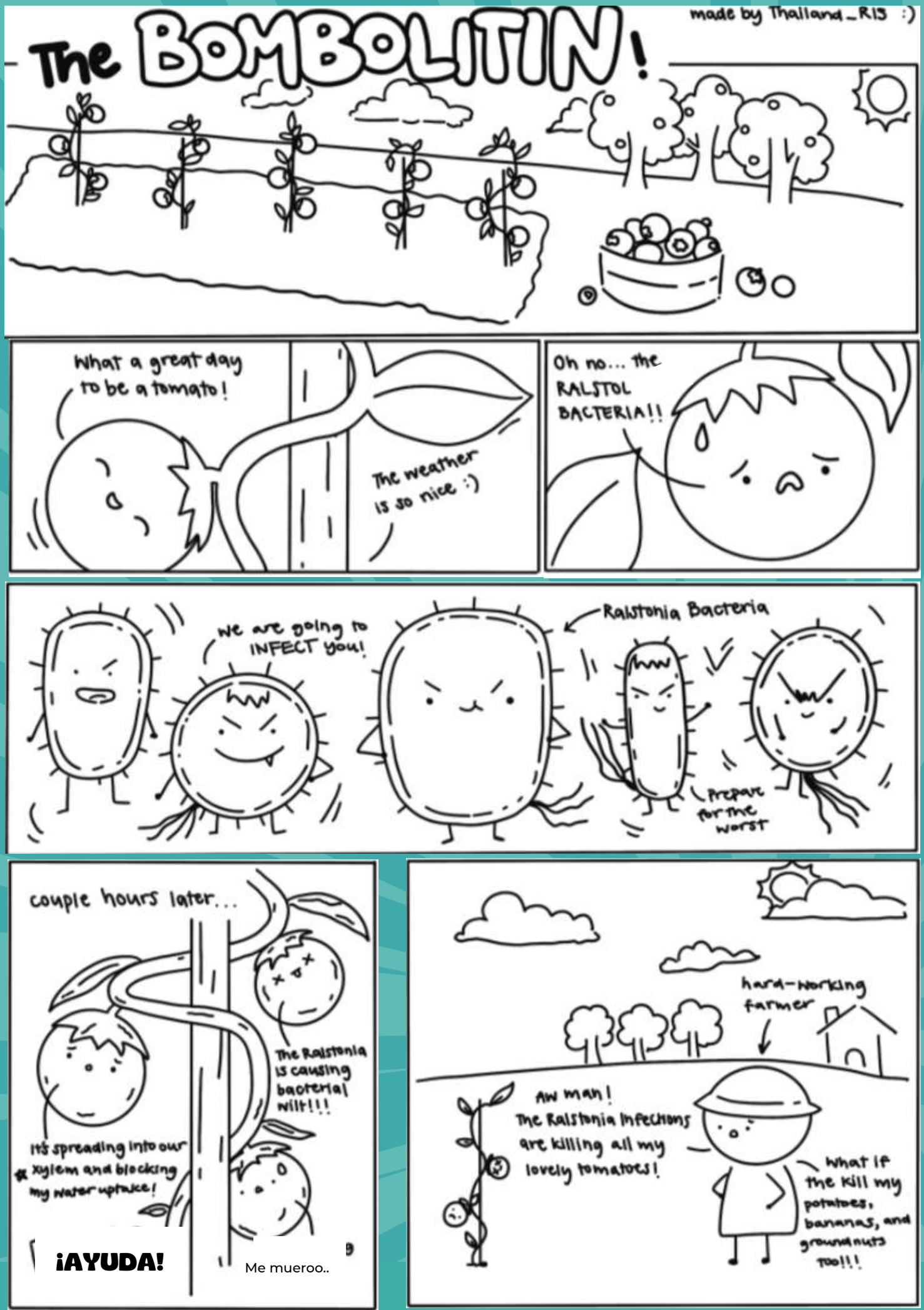


The other plants applauded the great bravery of Chalino and IRNaldo and they all lived peacefully.



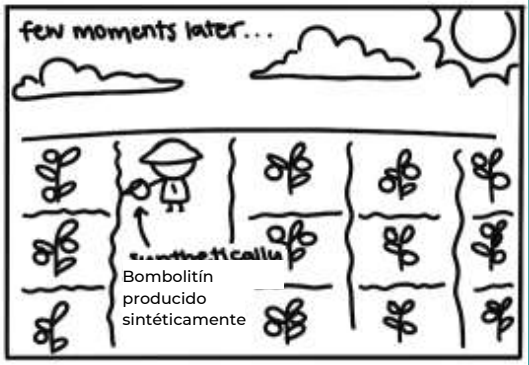
The bombolitin

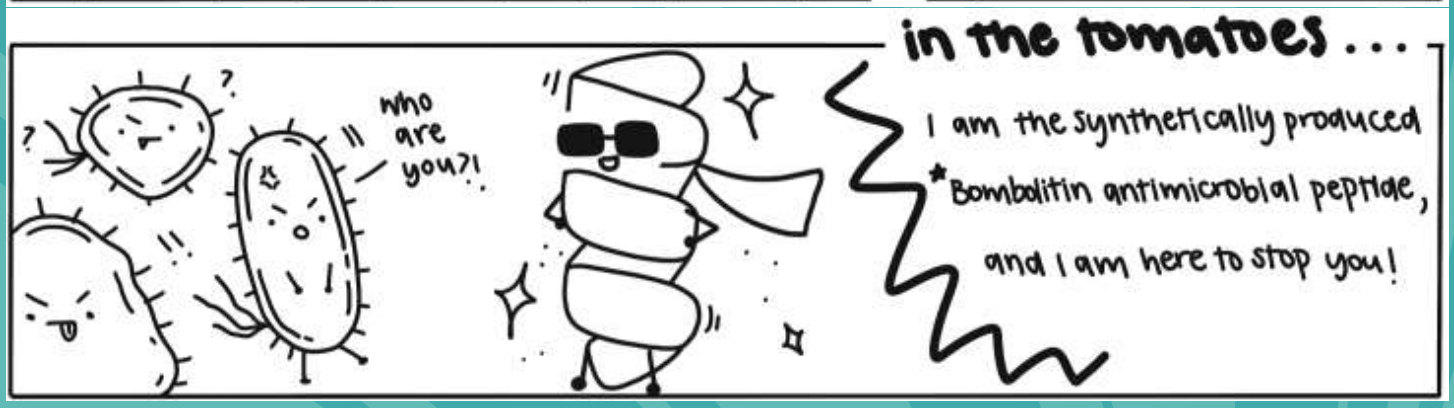
Thailand_RIS

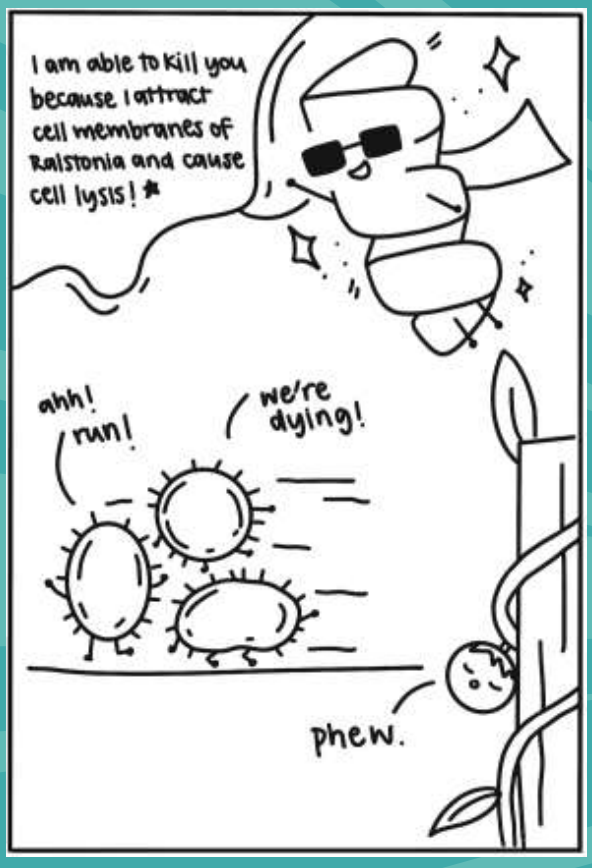

The BOMBOLITIN!
made by Thailand_RIS :)
What a great day to be a tomato!
The weather is so nice :)
Oh no... the RALSTOL BACTERIA!!
We are going to INFECT you!
Ralstonia Bacteria
Prepare for the worst
couple hours later...
The Ralstonia is causing bacterial wilt!!!
It's spreading into our xylem and blocking my water uptake!
¡AYUDA!
Me mueroo..
hard-working farmer
Aw man! The Ralstonia infections are killing all my lovely tomatoes!
What if the kill my potatoes, bananas, and groundnuts too!!!


Pesticides will stop the Ralstonia infections
no!!!
However, there are bad effects on the soil if we use pesticides!
The food is also unsafe to eat
unsafe food


We have to find another way
hmm... let me think
I GOT IT!!!


few moments later...
Bombolitín producido sintéticamente


in the tomatoes...
who are you?!
I am the synthetically produced *Bombolitin antimicrobial peptide, and I am here to stop you!


I am able to kill you because I attract cell membranes of Ralstonia and cause cell lysis! *
ahh! run!
we're dying!
phew.


I can be an alternative to pesticides as a solution to Ralstonia infections!
Everyone can be SAFER!


Thankyou Bombolitin!!!

The Rust-Busters

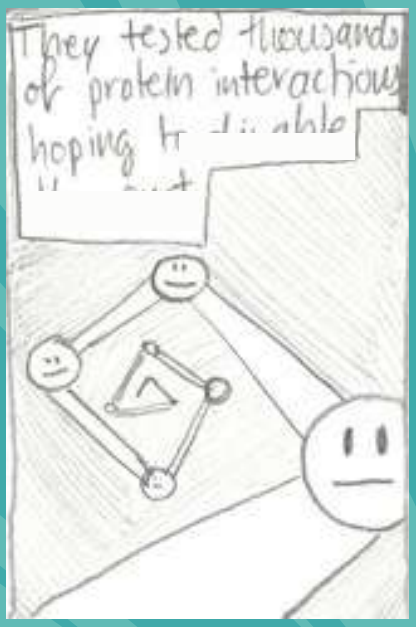
UNSW iGEM2022


I was only a child when the cereal rust attacked...


It ravaged my community & family, sparing me for some ungodly reason


As swiftly as the rust left, the scientists came


At their lab, they tested my apparent resistance to the
UNSW


They tested thousands of protein interactions hoping to


Today, they found it
MATCH FOUND!


With this breakthrough all we needed was a delivery mechanism


She... was that mechanism.

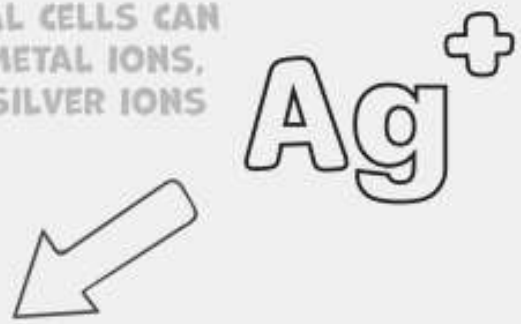
Escrito e ilustrado por Taimooor Mansook

BINANOX

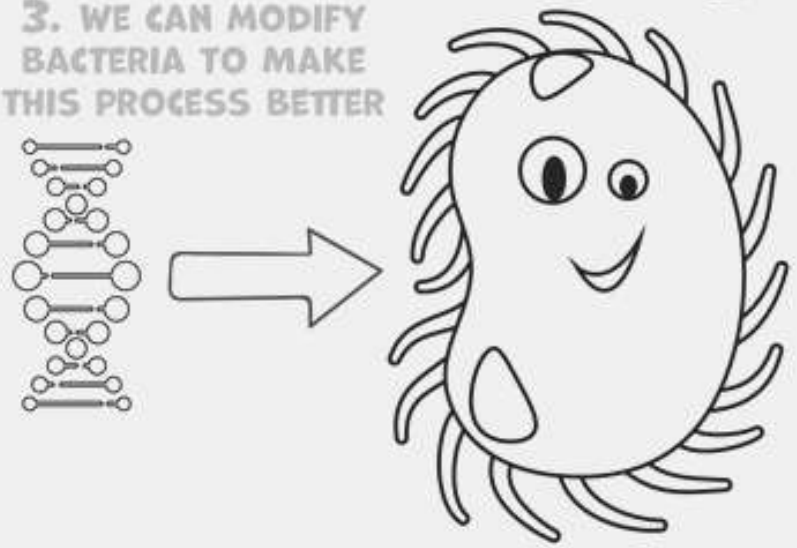
Leiden

iGEM Leiden 2022
BiNANOX

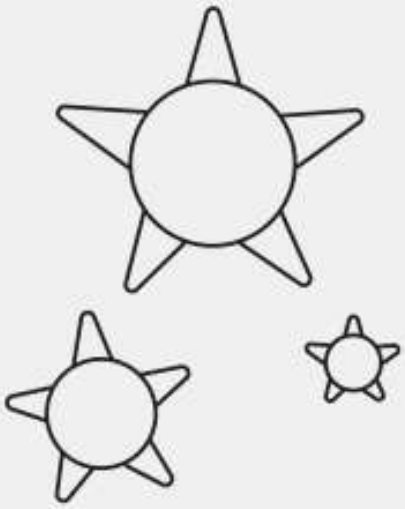
1. Bacterial cells can take up metal ions, such as silver ions



3. We can modify bacteria to make this process better



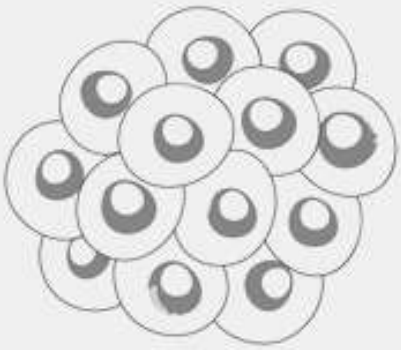
2. These ions can be converted to nanoparticles (NPs). Here we have silver nanoparticles

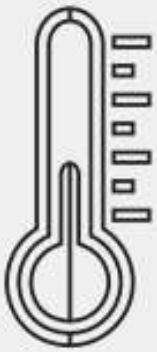


4. WE CAN ALSO USE BACTERIAL SYSTEMS TO MAKE NPs WITH TWO DIFFERENT METALS

-FOR EXAMPLE HERE WE HAVE A SILVER CORE WITH GOLDEN SPIKES

5. THESE NPs CAN BE USED TO KILL CANCER CELLS. THE NPs ARE SIMPLY DELIVERED TO THE TUMOUR



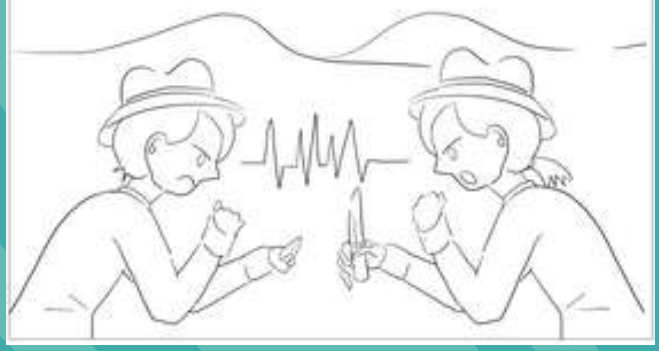


6. THESE PARTICLES ARE THEN HEATED UP, WHICH DESTROYS THE CANCER CELLS!

UBX protein

NYCU_Formosa 2022

Once upon a time, there are two cowboys from different rivals fighting with each other since an irreconcilable conflict.



The man, Rex, eventually won the fight. However, the other man, Jay, was covered all over with cuts and bruises.

The nurse saw Jay was hurt so badly, she came to get him a wound bandage.

Soon, Jay stopped bleeding and felt recovered.

However, after three days, Jay felt his hand hurt. Suddenly, he found that the wound started bleeding again.

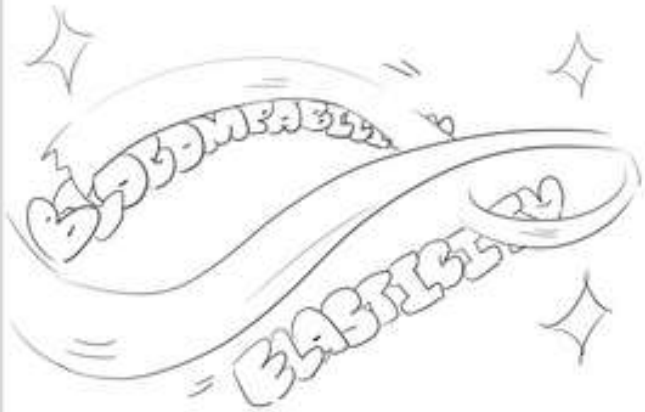
He removed the bandage and found that the wound just got inflamed!!

It turned out that the bandage was so airtight and inelastic that the wound was infected with bacteria and was purulent!

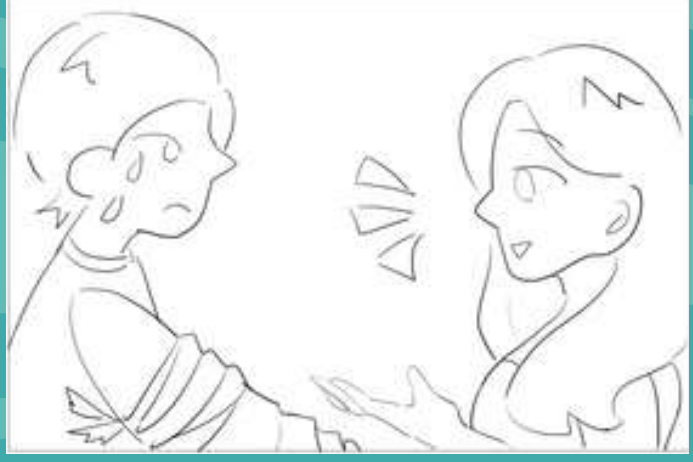
Just then, a girl from the future named Vivian appeared with a magic protein called "UltraBithoraX".

She used the UBX protein and antimicrobial peptides to make a antibacterial bandage.

The bandage made up of UBX protein is elastic and biocompability. It would not caused the infection again!



Vivian quickly dressed his wound and told him the magic power of UBX protein.

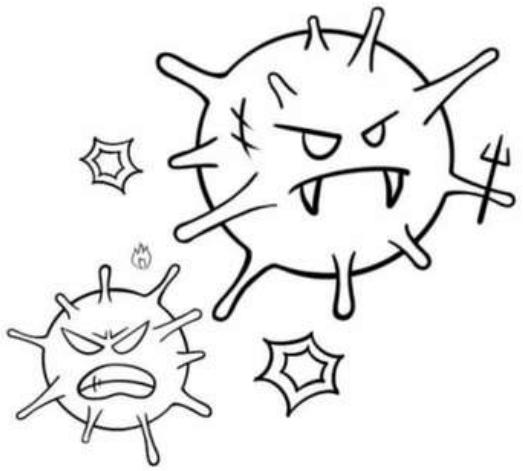


Soon after, the cut on Jay's arm was completely healed !!! Thank you, UBX protein, thank you, Vivian!

Antibody

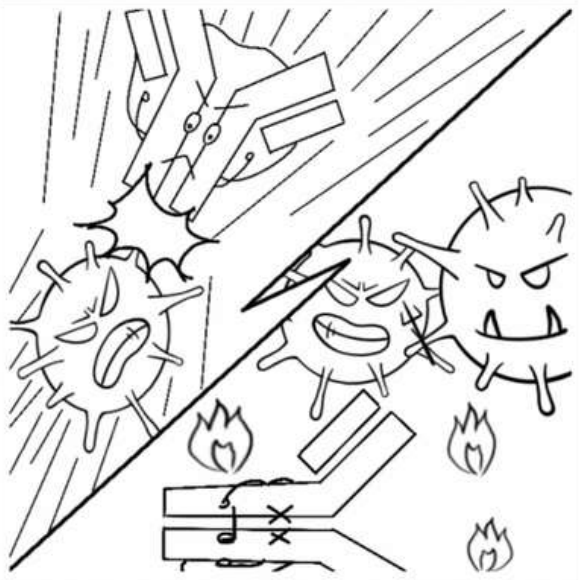
CSMU Taiwan

Once upon a time, a group of viruses attacked the Earth. They brought a horrible pandemic to human society and made the public panic.

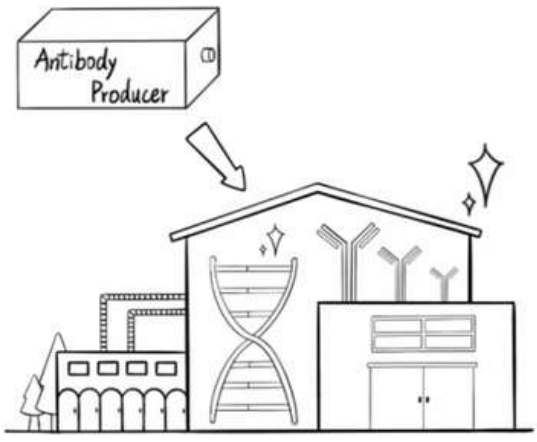


In order to beat them and save lives, scientists produced a legion of monoclonal antibodies to fight against these evil gangsters.

The viruses and antibodies had a fierce fight. However, the antibodies were beaten down, and failed to stop the viruses from infecting human beings.

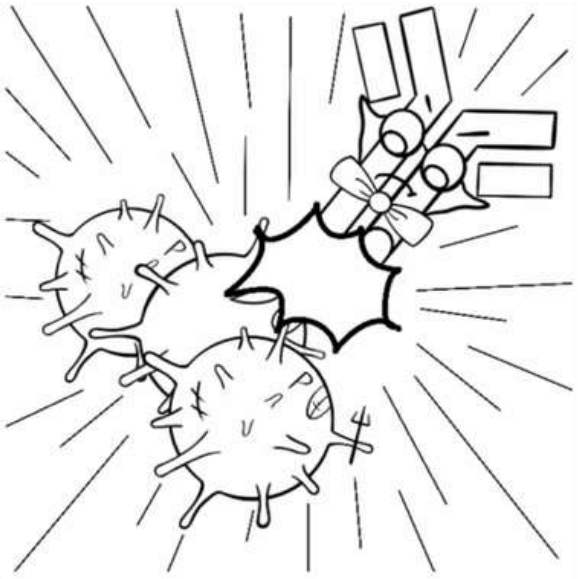


After the antibodies were defeated, scientists found a special component named AID, which could help optimize the antibody producers.

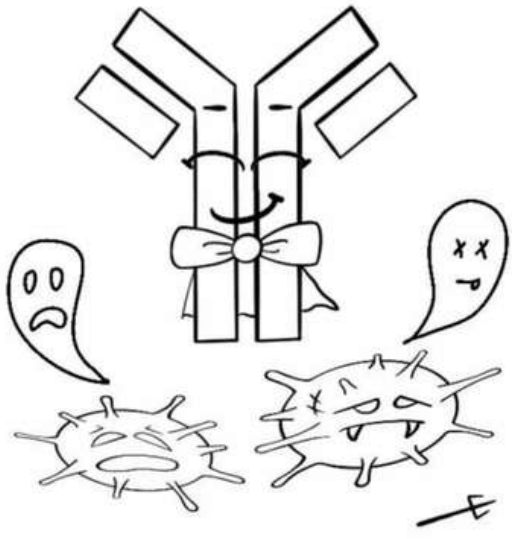


The optimized antibody producer improved the combat effectiveness of the antibodies, and made them brand-new antibodies.

Becoming stronger, the new antibodies legion challenged the viruses again, and got them into trouble.



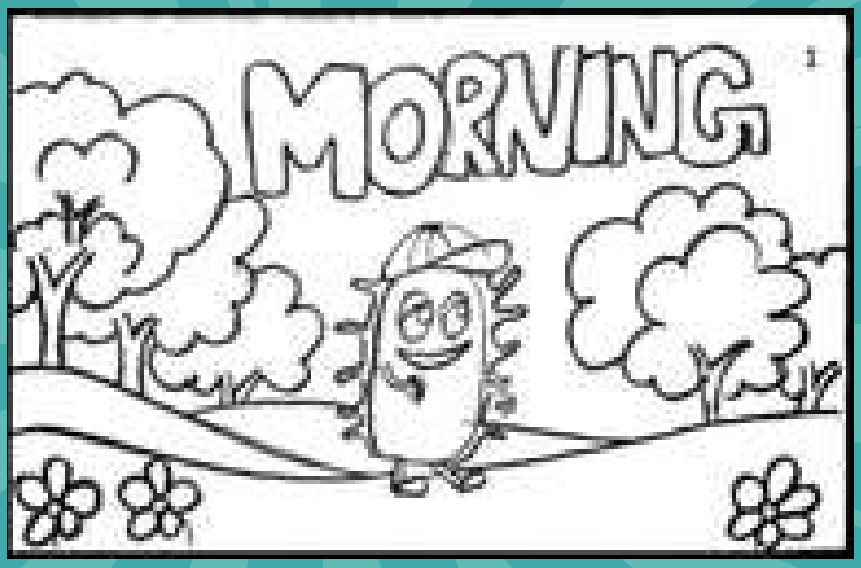
Finally, the new antibodies won the battle, killed all the viruses and saved everyone from suffering from the distressing epidemic.

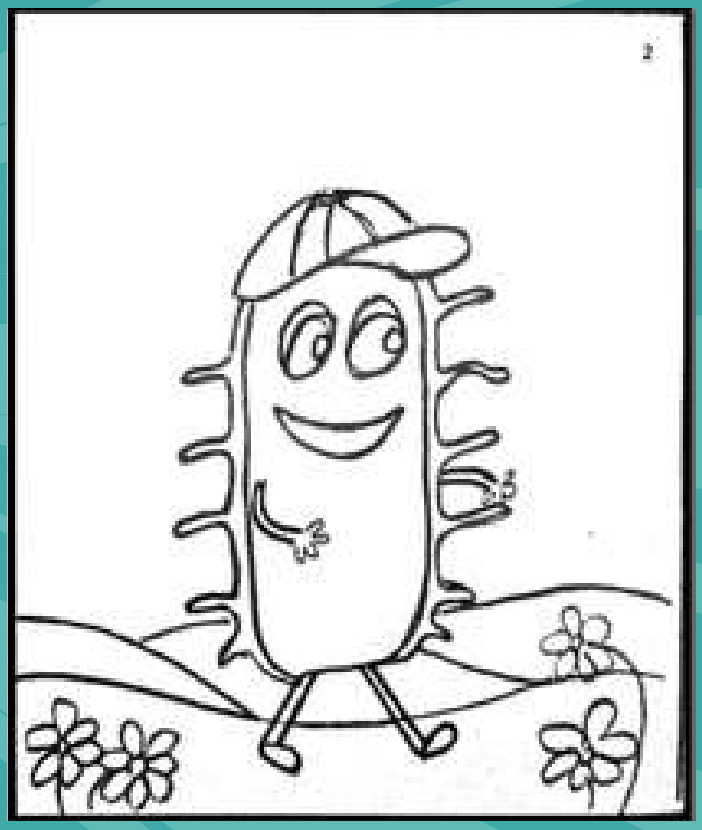


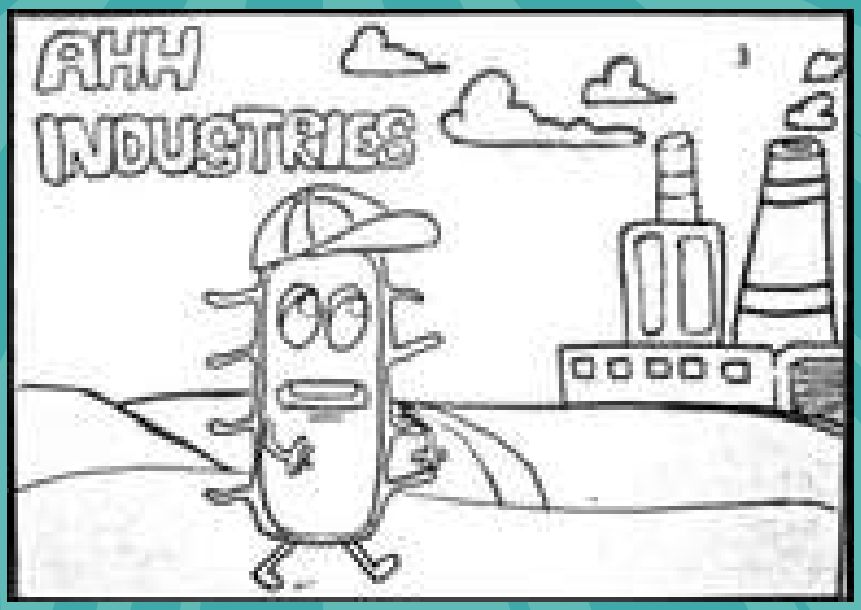
Thanks to the new antibody producer and new antibodies, the Earth and human beings living on it could live happily ever after.

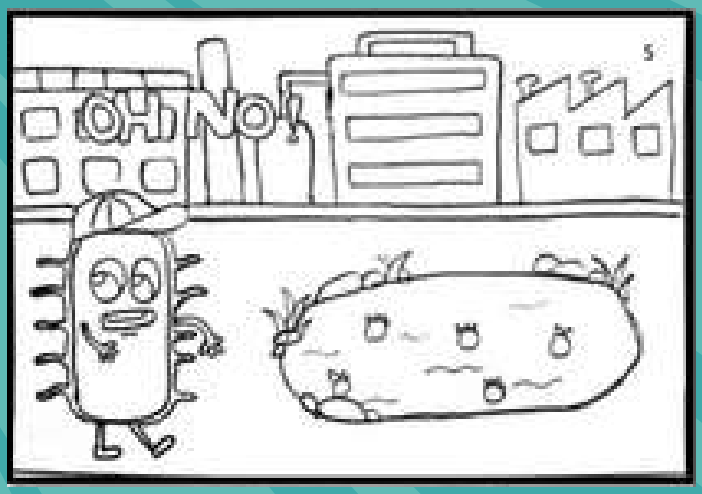
Industries

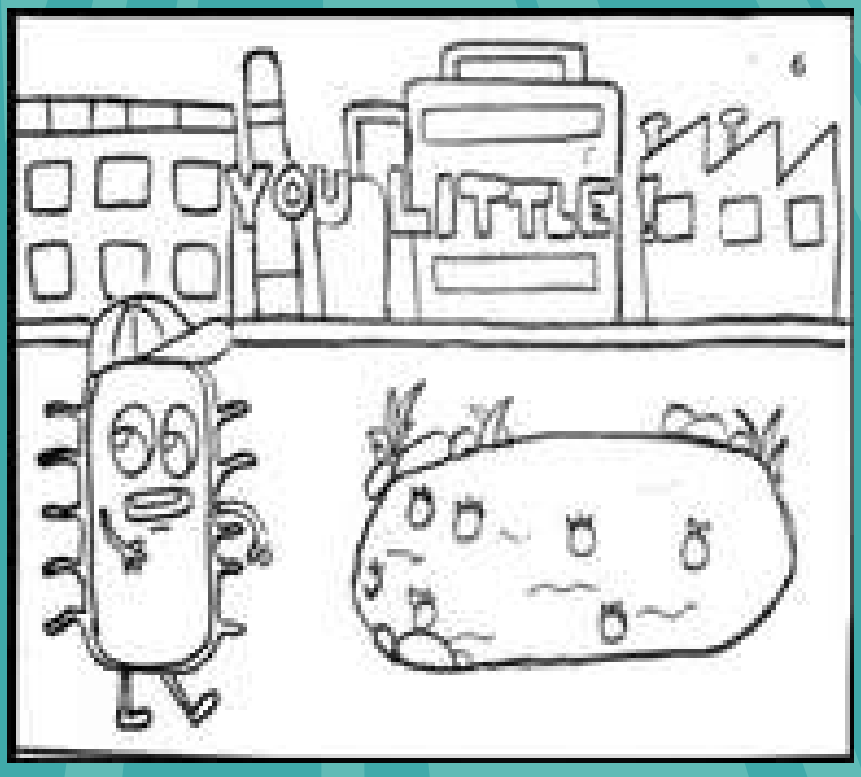
REC CHENNAI

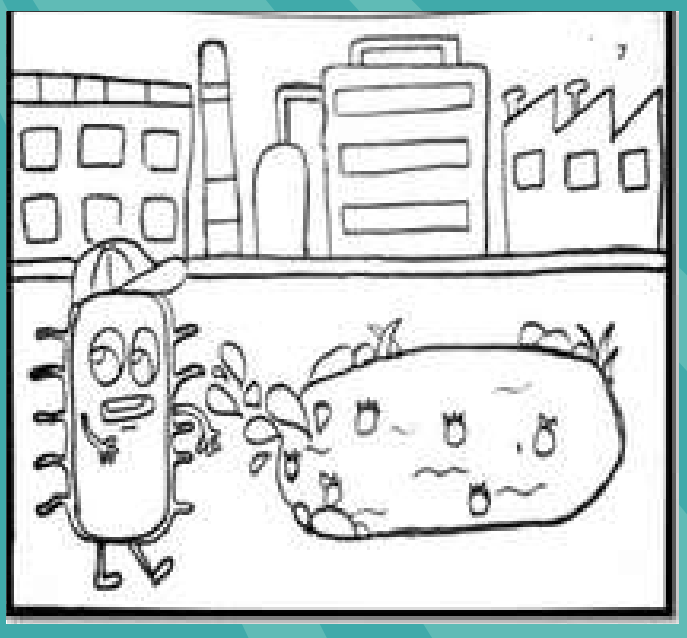

1
MORNING


2


3
AHH
INDUSTRIES


5
OH NO!


6
YOU LITTLE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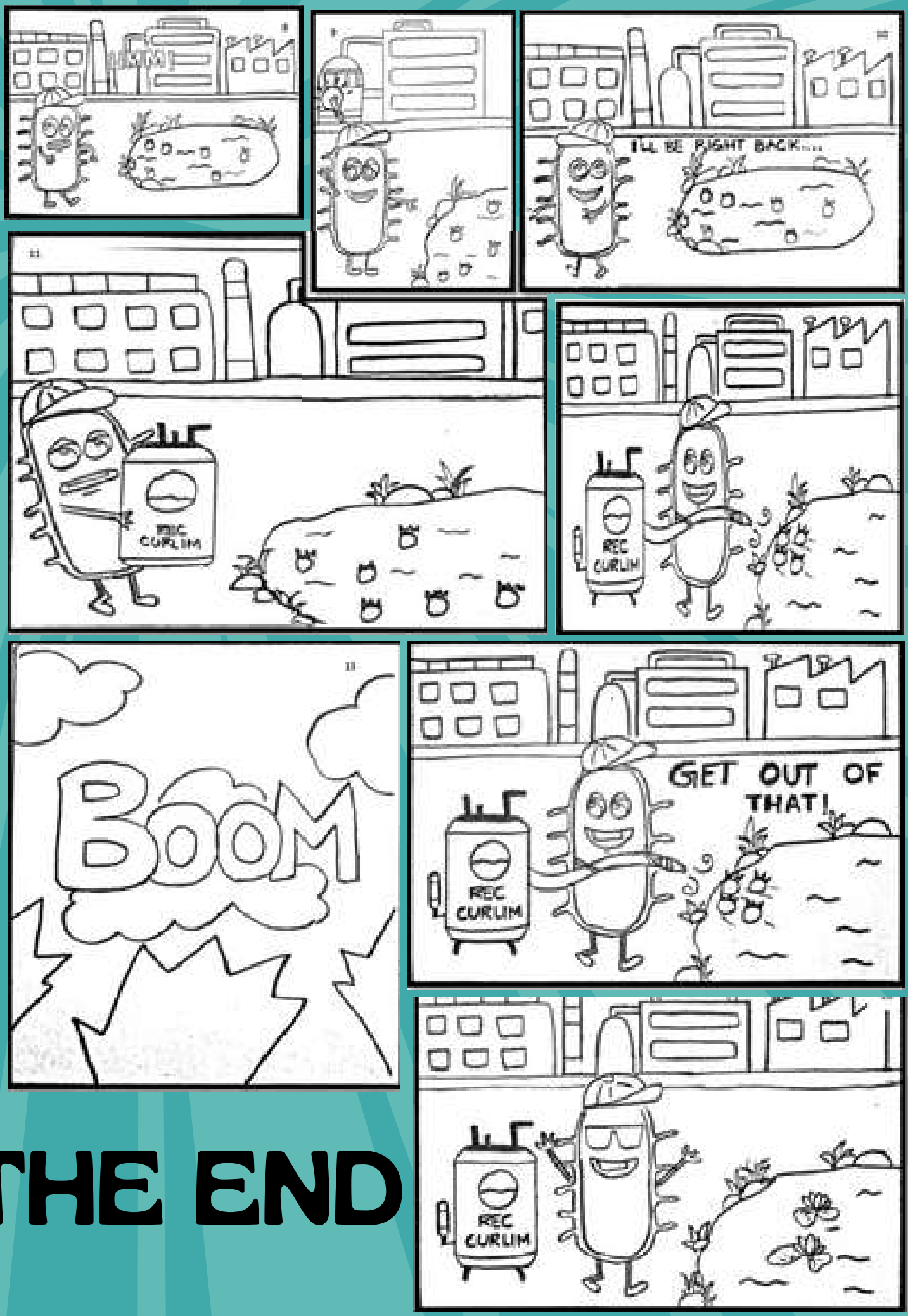

I'LL BE RIGHT BACK...
REC CURLIM
BOOM
GET OUT OF THAT!
REC CURLIM
REC CURLIM

THE END

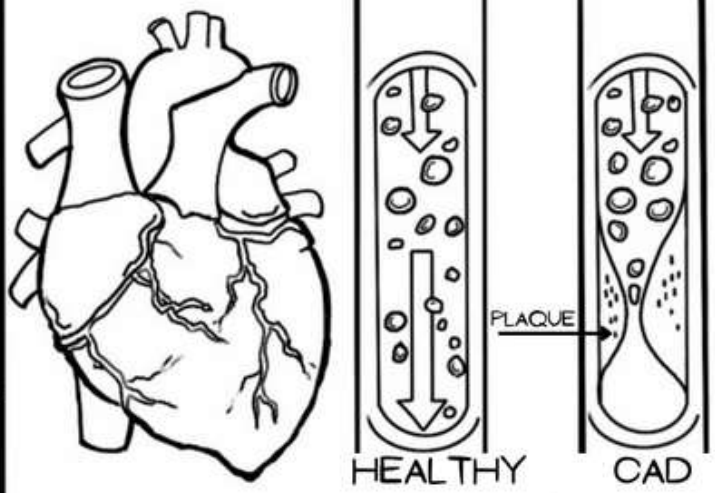
CADlock

Lambert_GA

ON EARTH, III MILLION DEATHS OCCUR EVERY YEAR DUE TO...

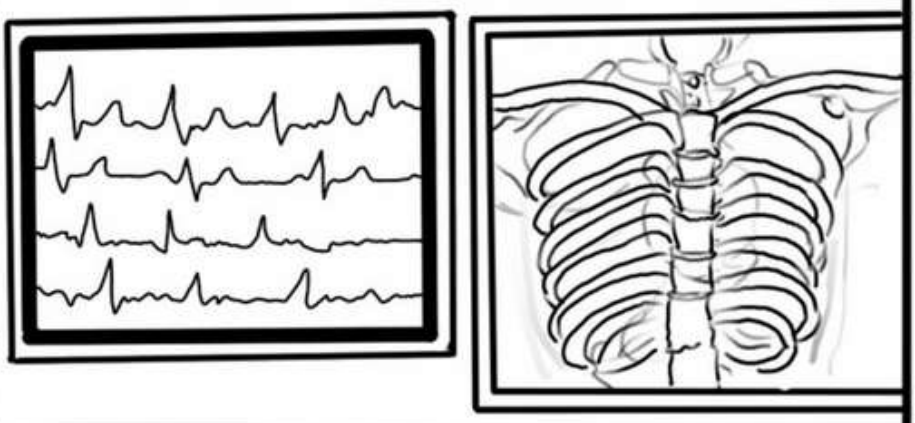
CORONARY ARTERY DISEASE (CAD)

IT IS A HEART CONDITION WHERE THE CORONARY ARTERIES (MAJOR BLOOD VESSELS) STRUGGLE TO SEND BLOOD TO THE HEART. THIS IS CAUSED BY PLAQUE BUILDUP IN THE ARTERIES.



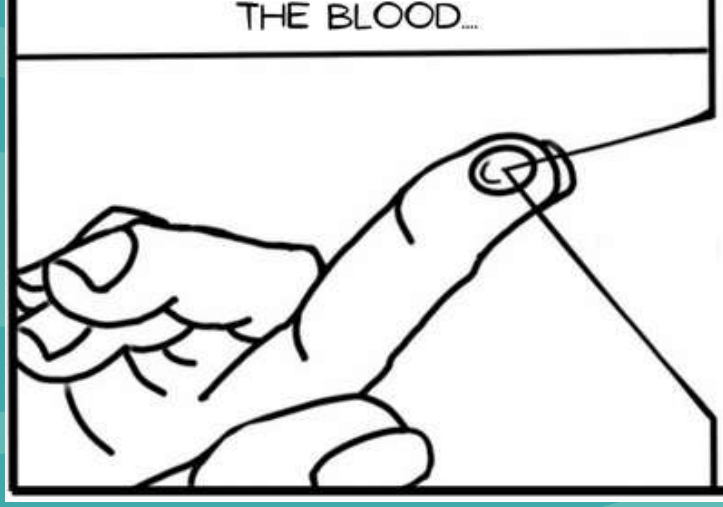
NOT ONLY DOES THIS CONDITION CAUSE DISCOMFORT, BUT CAD CAN ALSO WEAKEN THE HEART MUSCLE AND LEAD TO ITS FAILURE...

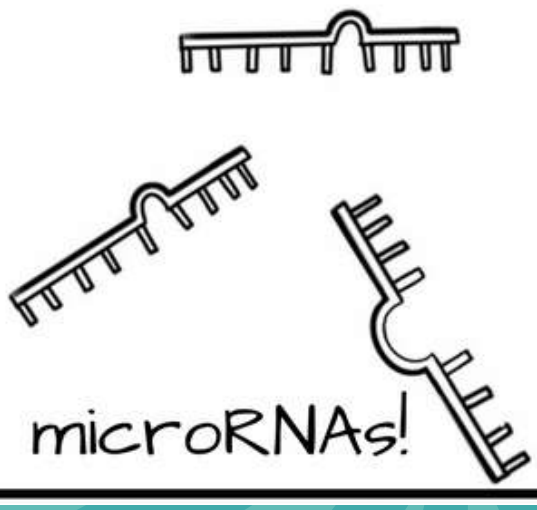
CURRENT METHODS USED TO DIAGNOSE THIS DISEASE INCLUDES CHEST X RAYS



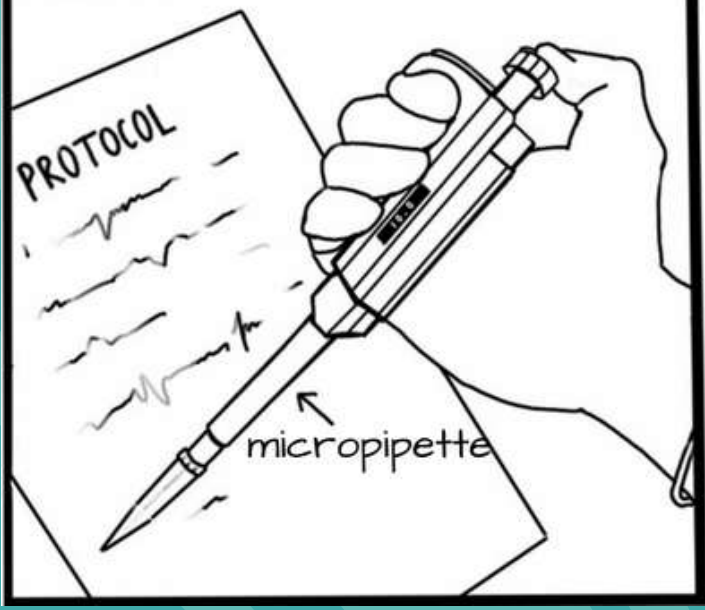
BUT WHAT IF THERE WAS ANOTHER WAY ?

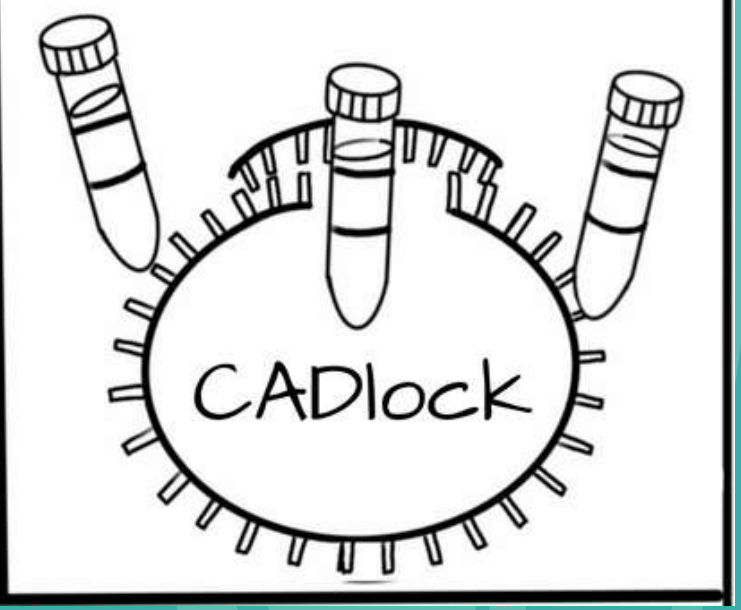
A POTENTIAL ANSWER IS FOUND IN THE BLOOD....





Lambert iGEM IS USING RESEARCH ON THE ROLE OF microRNAs IN CAD AND SYNTHETIC BIOLOGY TO DETECT microRNA LEVELS IN BLOOD SERUM!





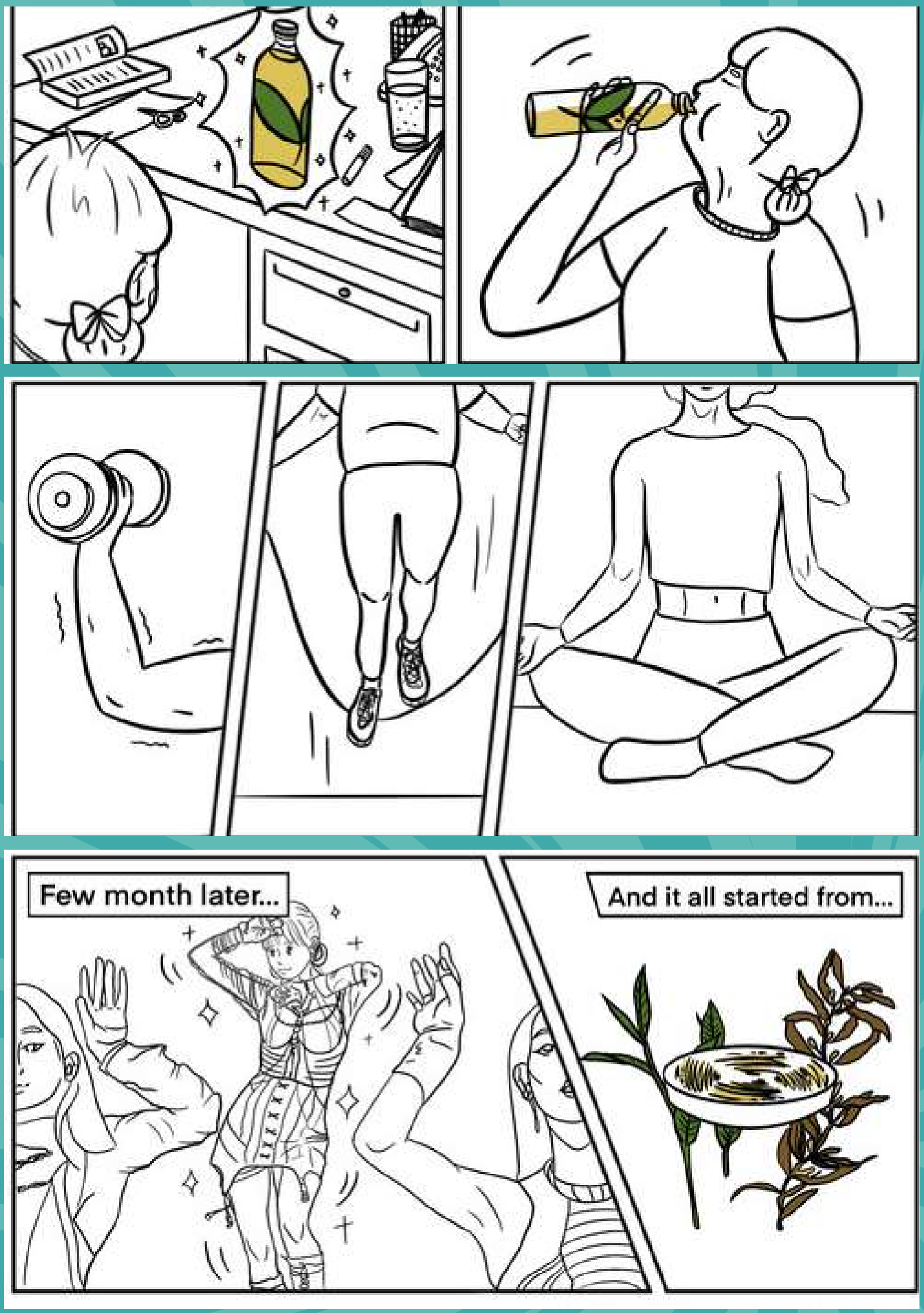
TESTING COULD THEN BE DONE IN HOSPITALS AND AID DOCTORS IN THE DIAGNOSIS OF CORONARY ARTERY DISEASE..

FOR A HEALTHIER AND HAPPIER WORLD!

NOBESITY

KCIS XIUGANG
TAIPEI


NOBESITY
HA HA HA
FAT
HA HA
OVERWEIGHT
HA
HA HA HA


Few month later...
And it all started from...

PCR

CityU
Hong Kong

If you want to join iGEM, you need to know many skills!

Wow!

What kind of skills?

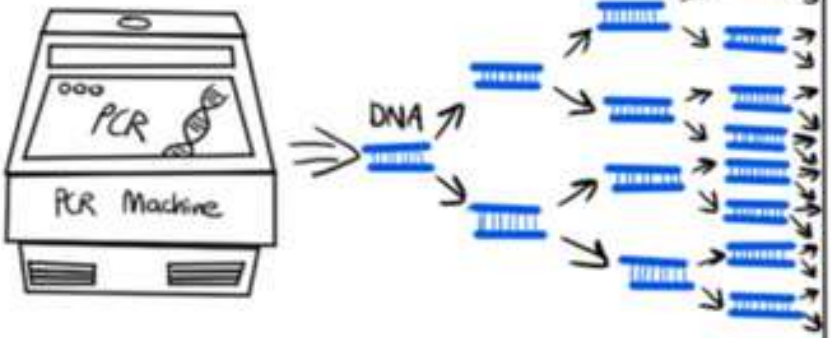
Seum's Lab

BAAM!

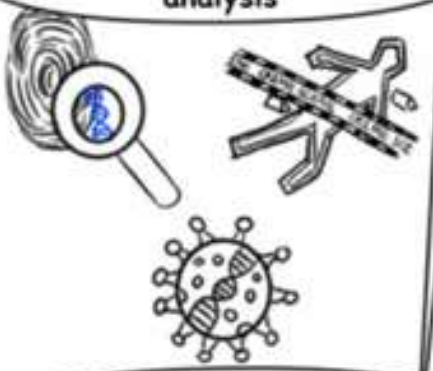
First, you need to know what is Polymerase Chain Reaction (PCR).

Oh, I have never heard of that! What is it?

PCR is like photocopying machine for DNA. A segment of DNA is amplified to produce millions of copies.



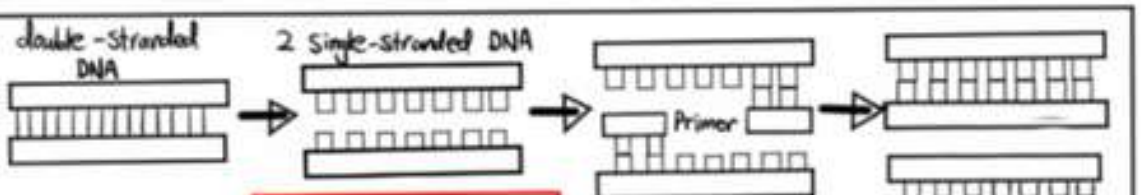
PCR machine is able to conduct DNA fingerprinting and forensic analysis



and even detect a myriad of DNA viruses.

How does the PCR machine work?

There are 3 main steps.



1. Denaturation

A double-stranded DNA molecule eparates into 2 single strands under high temperature.

2. Annealing

DNA primers, a small piece of DNA, bind to the targeted single-stranded DNA molecules under low temperature.

3. Extension

DNA polymerases (Taq) attach to the primers and synthesise new DNA strands.

WOW, I want to try!

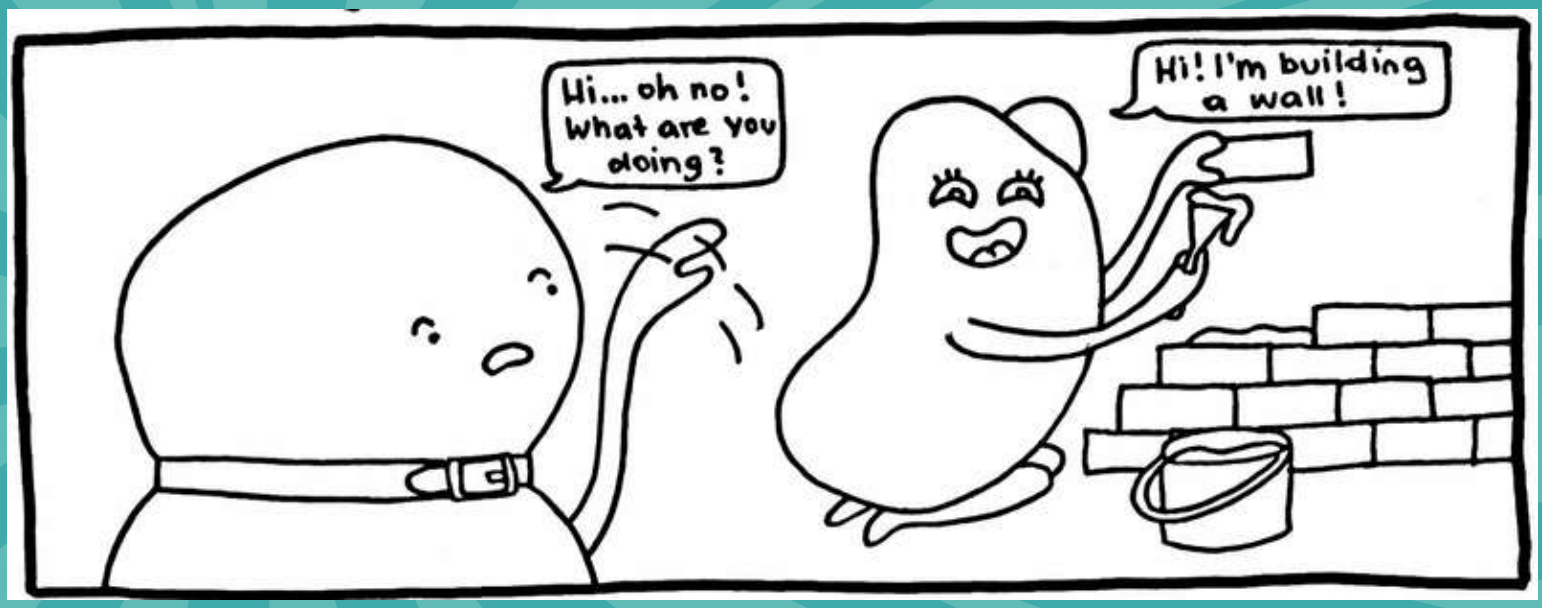
Fungus

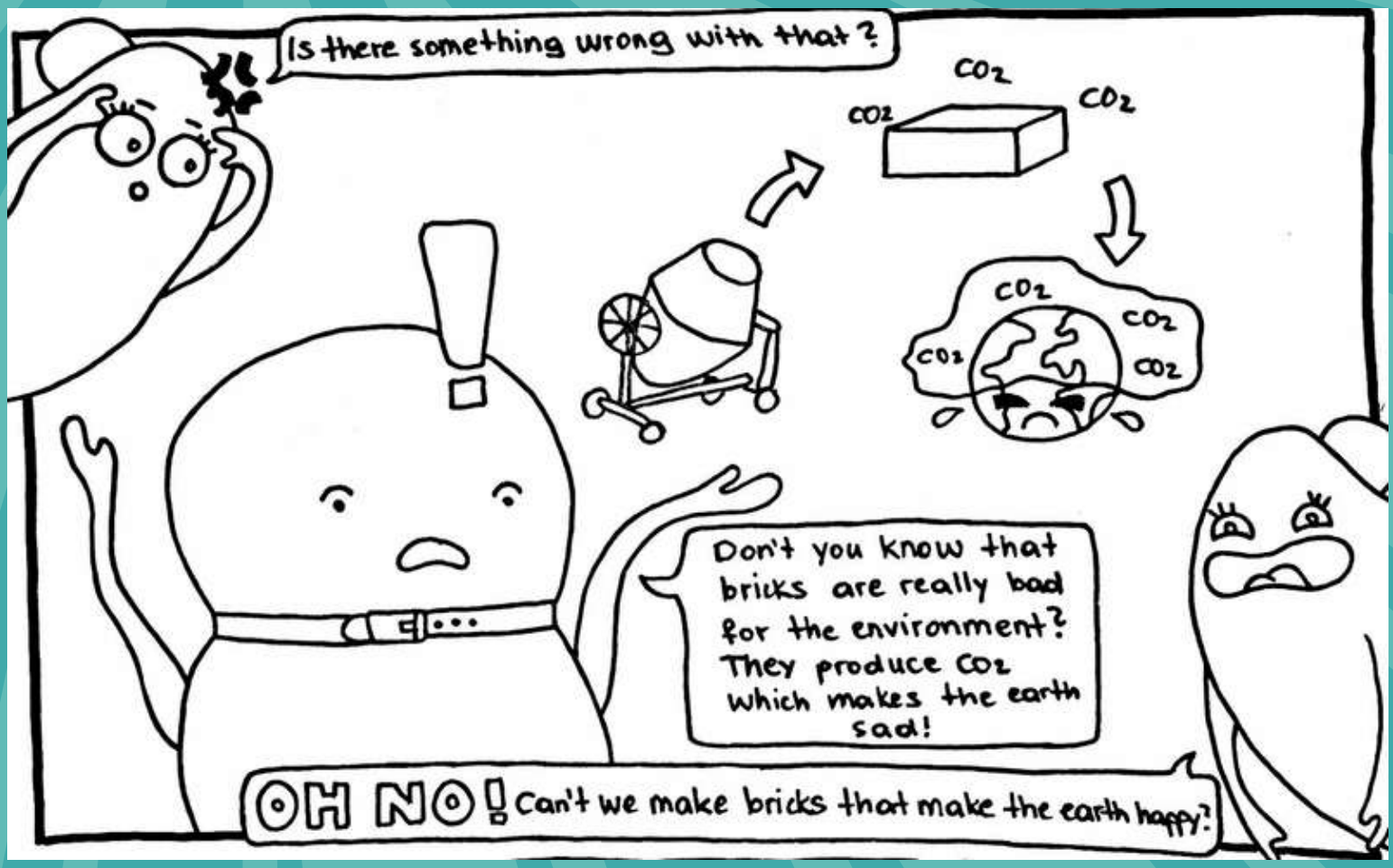
CityU
Hong Kong

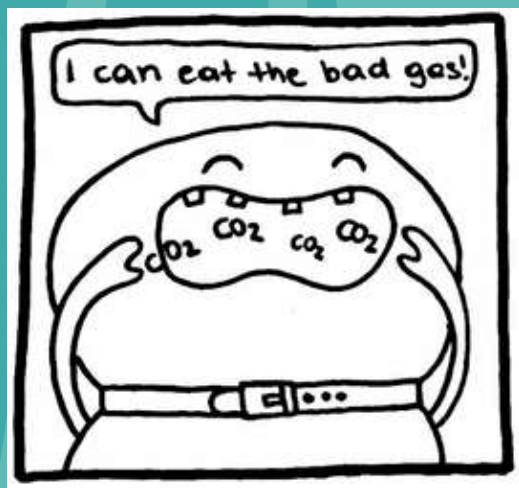

Dad Dad Dad!!!
Is this what you are looking for?
Yes! Well done!
What is this?
That is a fungus!
Fungus?
What are fungi?
* An organism that has evolved for almost 1.5 billion years.
* Estimated to be 3 million different species.
* This includes mushrooms, mold, yeast.
* They are all around us; food, soil, water.
Fungi have been commonly used in our lives.
They have been used for pest control
used in food industry (e.g. beverages, cheese, milk)
used to produce antibiotics
AND used in synthetic biology!
Which is what I am researching right now.

Pichitecture

igem vienna

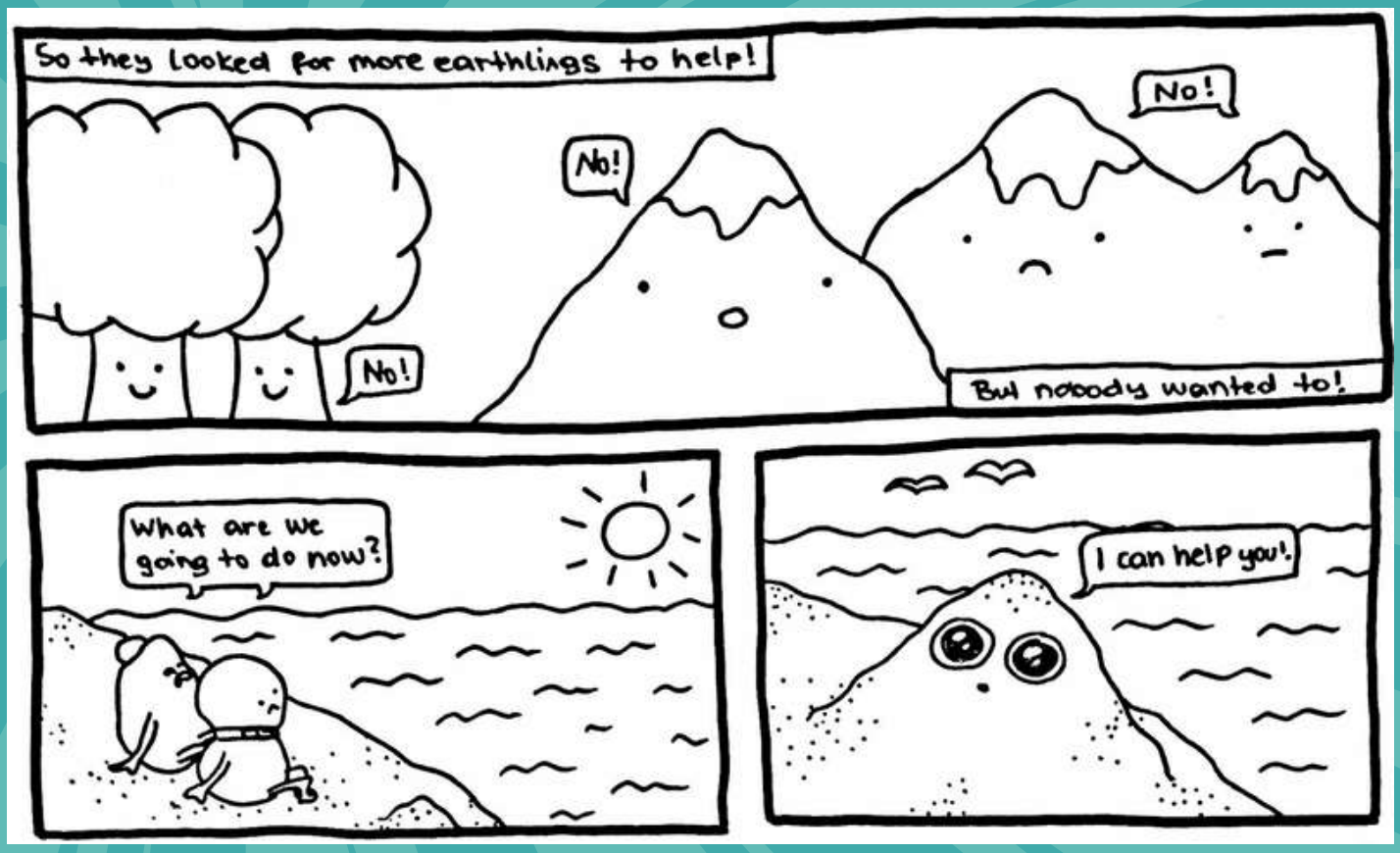

Hi... oh no! What are you doing?
Hi! I'm building a wall!

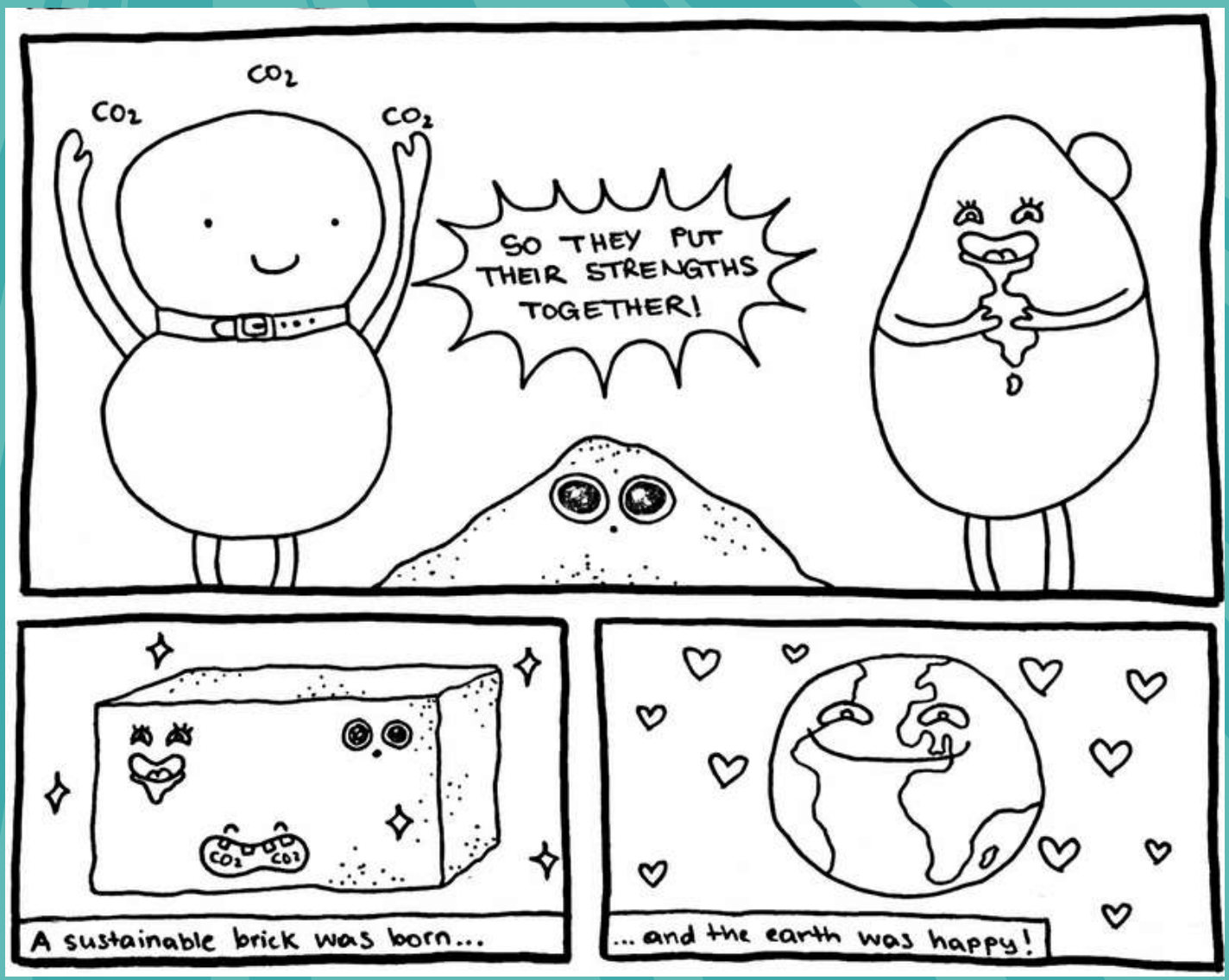

Is there something wrong with that?
CO2
CO2
CO2
CO2
CO2
CO2
CO2
Don't you know that bricks are really bad for the environment? They produce CO2 which makes the earth sad!
OH NO! Can't we make bricks that make the earth happy?


I can eat the bad gas!
CO2
CO2
CO2
CO2


I can spit sticky stuff to hold it together!


Together, they decided to make better bricks!


So they looked for more earthlings to help!
No!
No!
No!
But nooody wanted to!
What are we going to do now?
I can help you!


CO_2
CO_2
CO_2
SO THEY PUT THEIR STRENGTHS TOGETHER!
A sustainable brick was born...
... and the earth was happy!

Did you know?

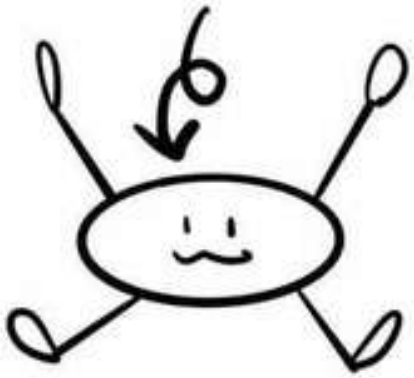
GYHS


Do you know...?
GFP
green
florescent
protein
bacteria
phage
nano
magnetic
bean complex
RBP
They only catch a specific type of bacteria
RBP
(e.g. gp13)
E.coil 0157
GFP : Showing green Light under blue Light!
GFP

Paper-based sensor

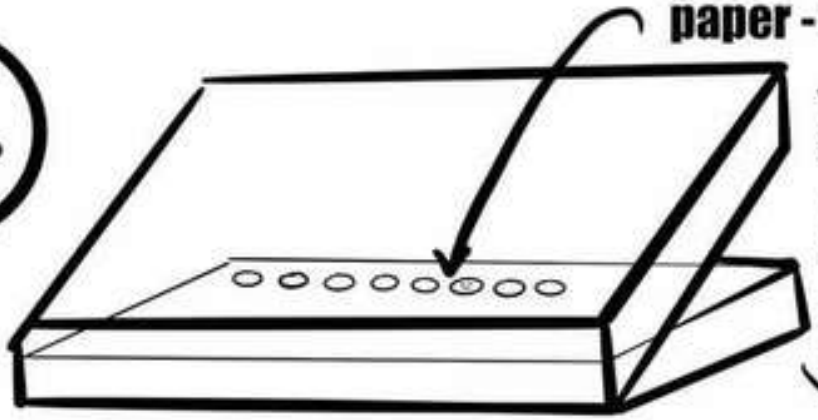
GYHS

paper-based sensor



① chromogenic sub-strate ADDED

② paper-based sensor



Place in 37°C incubator

DRY UP!

Sample

③

30min...

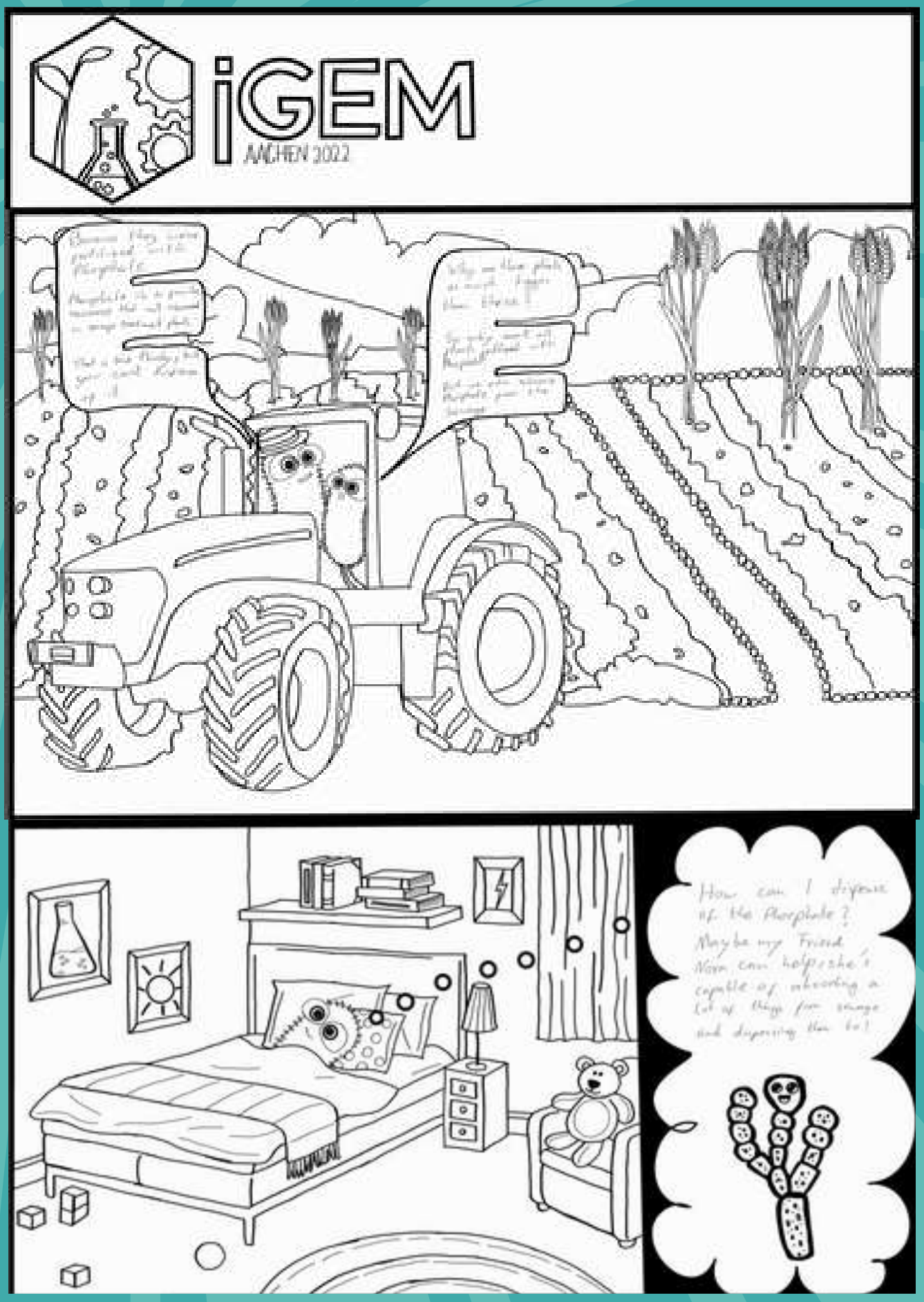
④

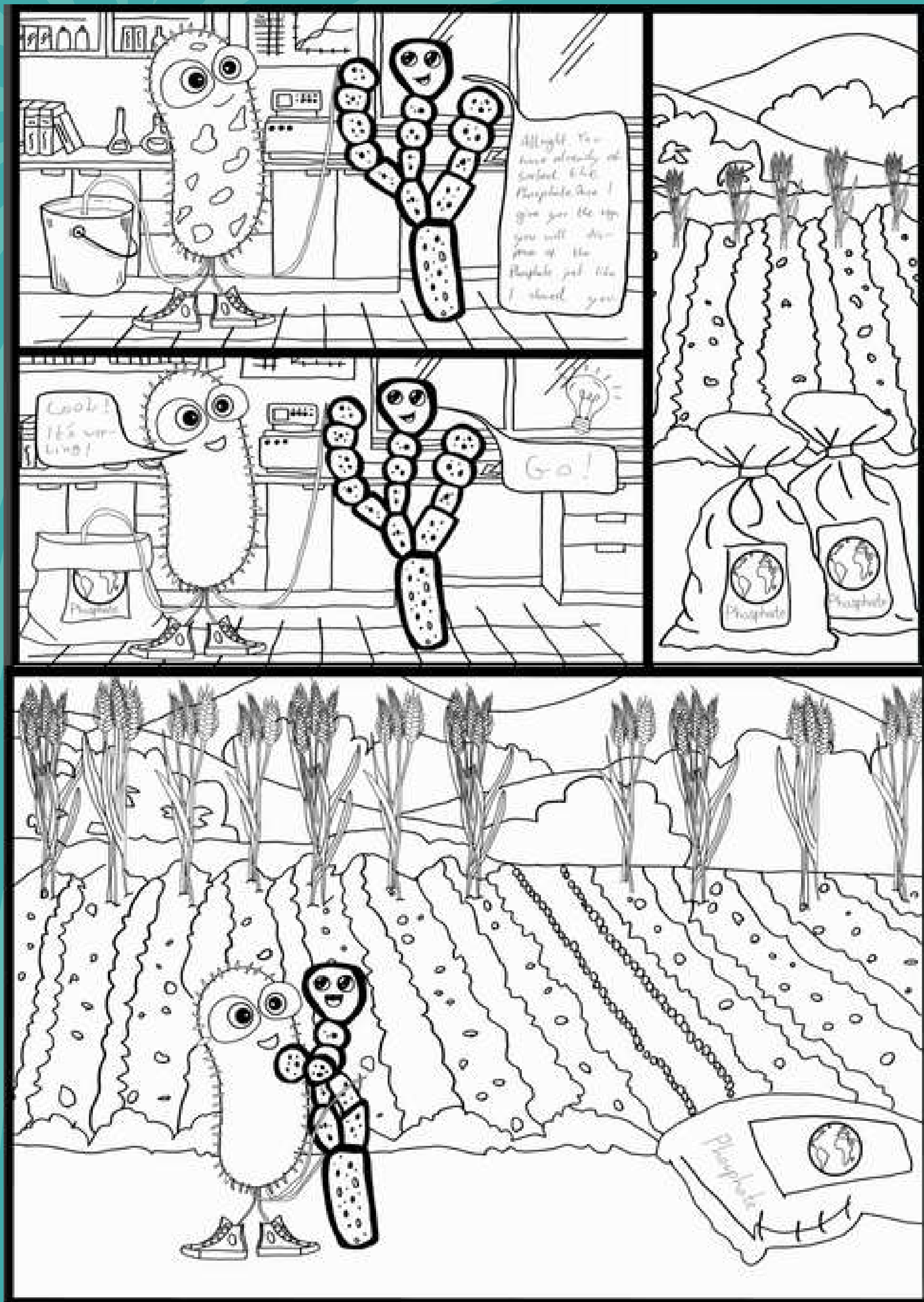
positive color change

negative color X change

How can I dispense the phosphate?

iGEM AACHEN


iGEM
AACHEN 2022
How can I dispose of the Phosphate? Maybe my Friend Noon can help, she's capable of absorbing a lot of things for storage and disposing them later!


Cool!
It's wor-
king!
Go!
Phosphate
Phosphate
Phosphate
Phosphate

Endocrine disruptors

TECCEM

One day Lettie (a beautiful and little lettuce) was enjoying her new life in the fertile ground. She had always enjoyed the fresh water in her leaves.

One day she noticed that the water she received was full of toxic compounds. She knew this because her leaves started to get dark and fragile.

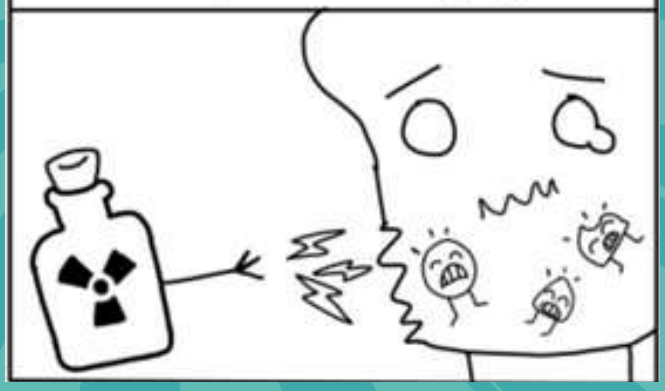
Lettie started looking for help on web sites. Fortunately, she found a one full of Mexican scientists that created a system to detect and eliminate the contaminants, this page was called "iGEM TEC CEM".

Lettie contacted them to ask for help. These scientists were happy to help, so they prepared their armor to attack.

Lettie was surprised about the incredible armors the scientists had developed. One of them was a potent protein called "Hery" that could reveal the identity of the toxics.

And the other armor allowed the elimination of these toxics with the action of the powerful Lacassie, who is a remarkable enzyme with super elimination powers.

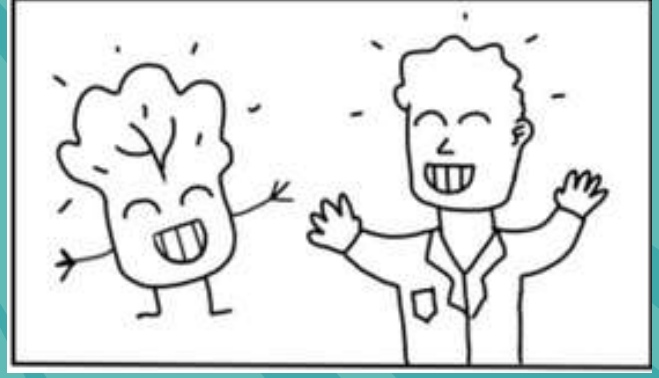
First, Hery determined that these toxics are called endocrine disruptors, and that their malignancy actions consist of affecting the hormones of the plants and thus affecting the growth of them



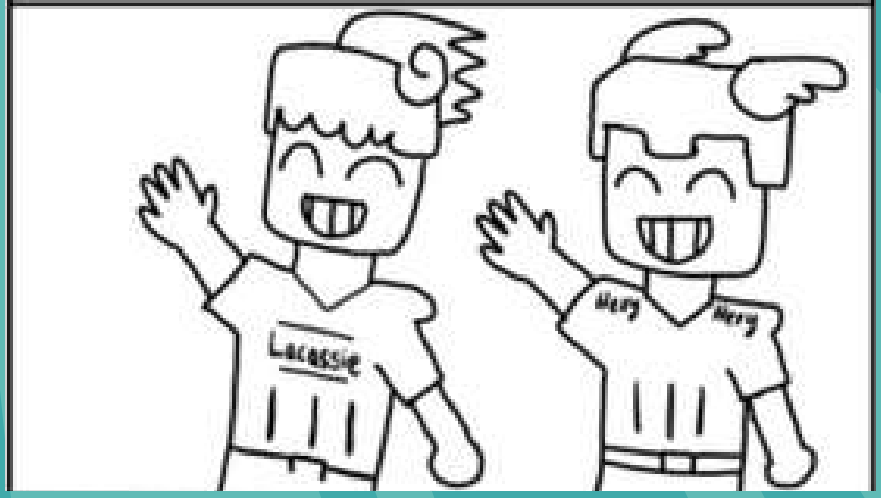
Lettie felt sad when she heard that, but Lacassie calmed her down and told her that she will handle it.

Then, Lacassie did her job and endocrine disruptors abandoned the field.

Lettie and her friends were very grateful and gave the scientist a great hug!



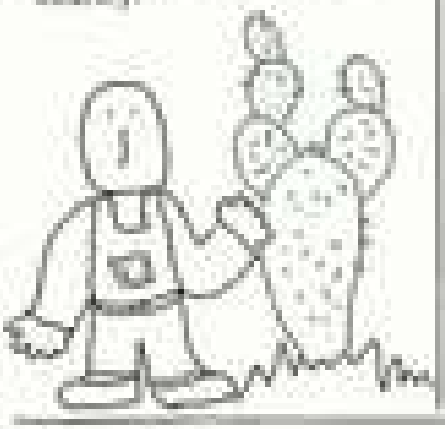
Scientists, Lacassie and Hery said bye and promised to come back if another enemy ever arrived again.



SPIDICIDE

UAM

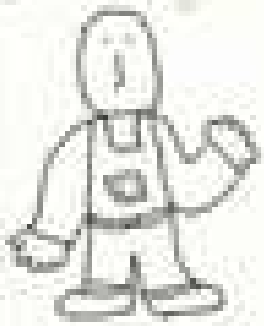
Nopal is one of the main sources of income in our country!



But we had a problem. "El picudo barrenador"

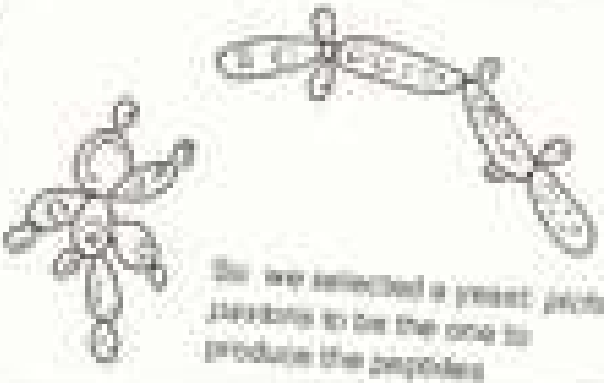
It's an insect from the family "curculionid" who has become a plague and is harming the nopal fields

So we came up with and idea:



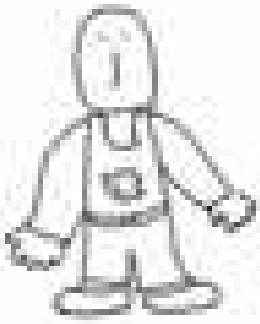
The first part of this idea was that its natural predators, (the spiders) produce a poison that could be used against the picudo.

And the second one, was that using synthetic biology we could modify an organism to produce the two peptides that make the poison deadly to the picudo.



So we selected a yeast: *Pichia pastoris* to be the one to produce the peptides

And after working diligently on the lab ...



That is how SPIDICIDE came to be !!!

A Biopesticide that is specific and non-harmful for the environment.

Yeast resistant to radiation

Estonia_TUIT


What are we doing?
Um... We are making yeast resistant to radiation!
Oh, usually yeast helps us to make bread, but it can also make other things. That's why we want to take yeast to space.
But cosmic radiation is dangerous for yeast. For that we are making it radiation-resistant, so our space yeast can explore planets with us!
to be continued

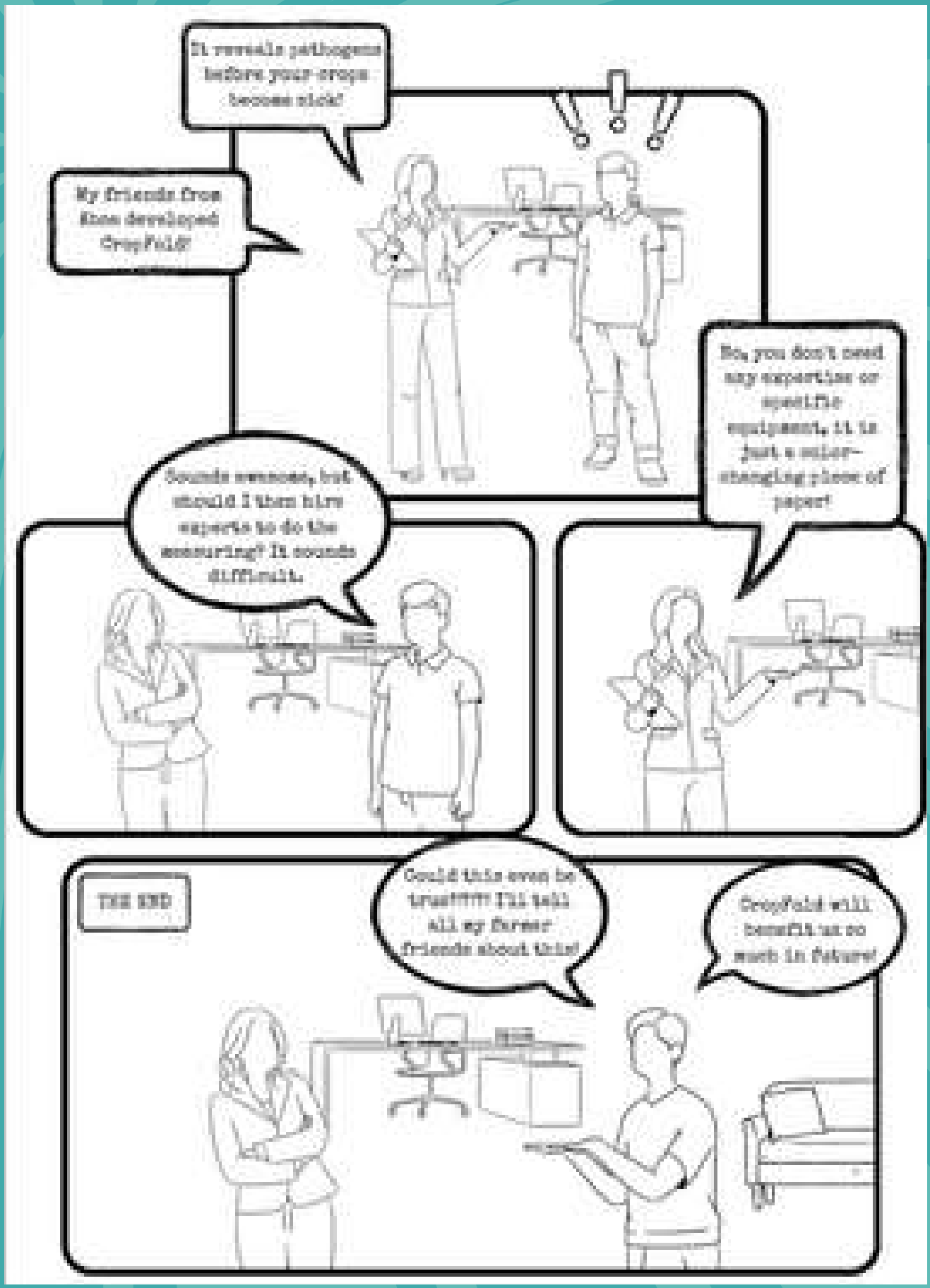
SELENOMELANIN

NCKU-Tainan

Problems in the farm-CropFold

Aboa

Problems in the farm - CropFold


It reveals pathogens before your crops become sick!
My friends from Kew developed CropFold!
Sounds awesome, but should I then hire experts to do the measuring? It sounds difficult.
No, you don't need any expertise or specific equipment, it is just a color-changing piece of paper!
THE END
Could this even be true!?!?! I'll tell all my former friends about this!
CropFold will benefit us so much in future!

Heparosanito

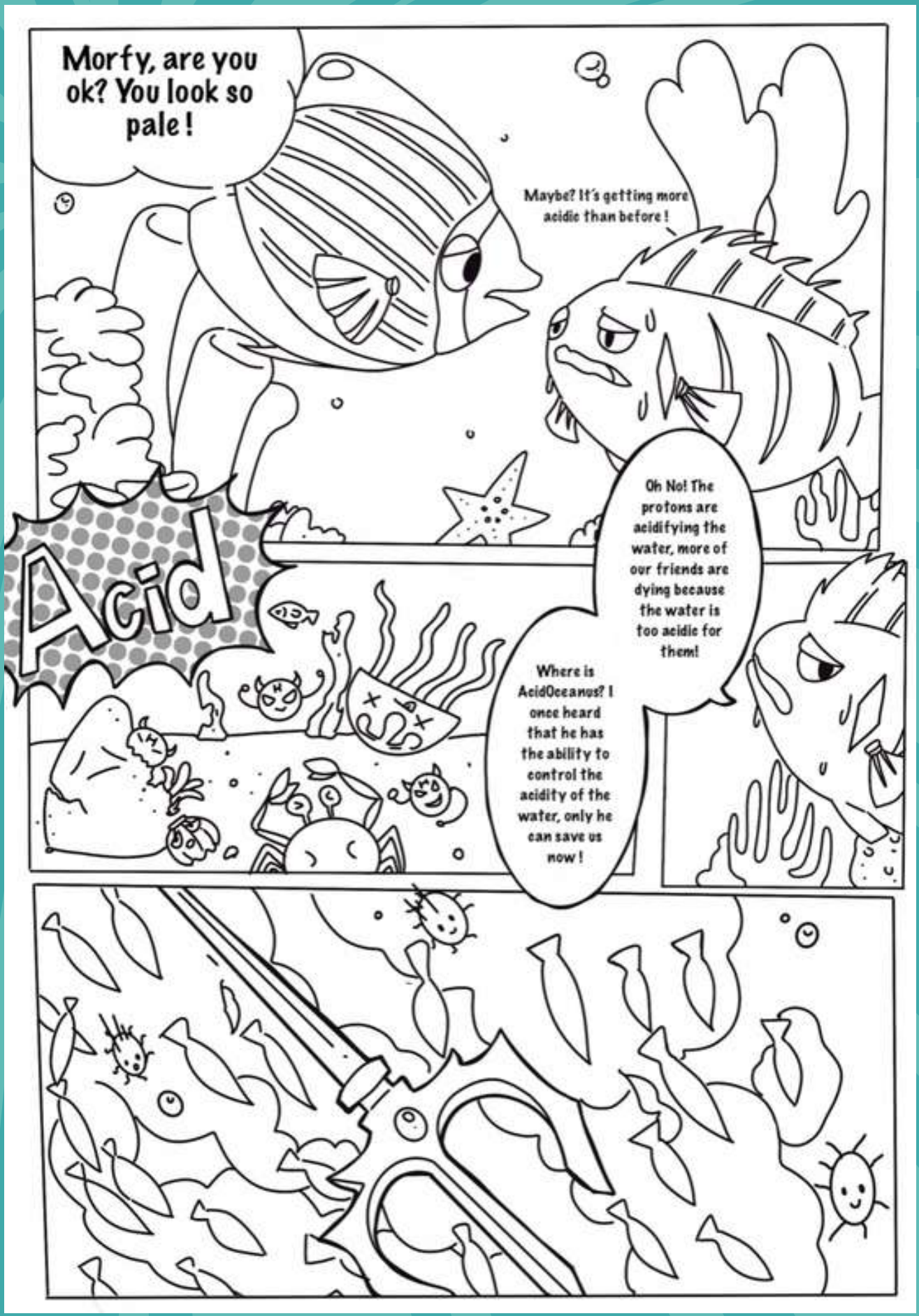
Biotech EC

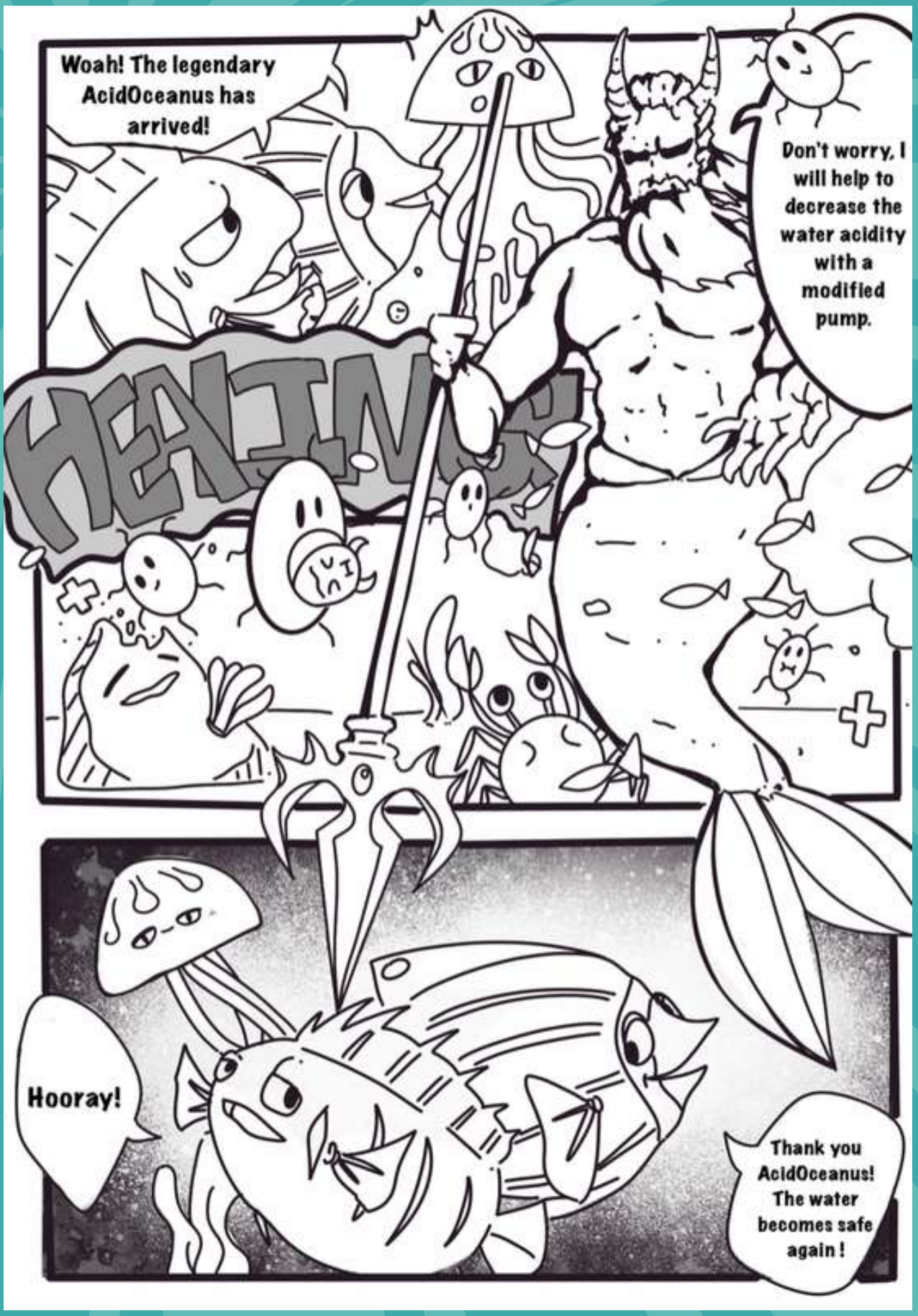
HEPAROSANITO


With my little hands, I can make a little friend who helps people with diabetes like your grandfather.
Hi Paquito, I'm Heparosanito and I can create heparosan, which is the necessary compound for your grandfather to take his medicine in a better way.
Yes, how great! My grandpa needs you!
POW!
I'd better take the pill
Thank you Dr. E.Coli and Heparosanito for improving our quality of life!
iGEM Biotech EC
Team Design League 2022

AcidOceanus

UM_MACAU


Morfy, are you ok? You look so pale!
Maybe? It's getting more acidic than before!
Acid
Oh No! The protons are acidifying the water, more of our friends are dying because the water is too acidic for them!
Where is AcidOceanus? I once heard that he has the ability to control the acidity of the water, only he can save us now!


Woah! The legendary AcidOceanus has arrived!
Don't worry, I will help to decrease the water acidity with a modified pump.
HEALING
Hooray!
Thank you AcidOceanus! The water becomes safe again!