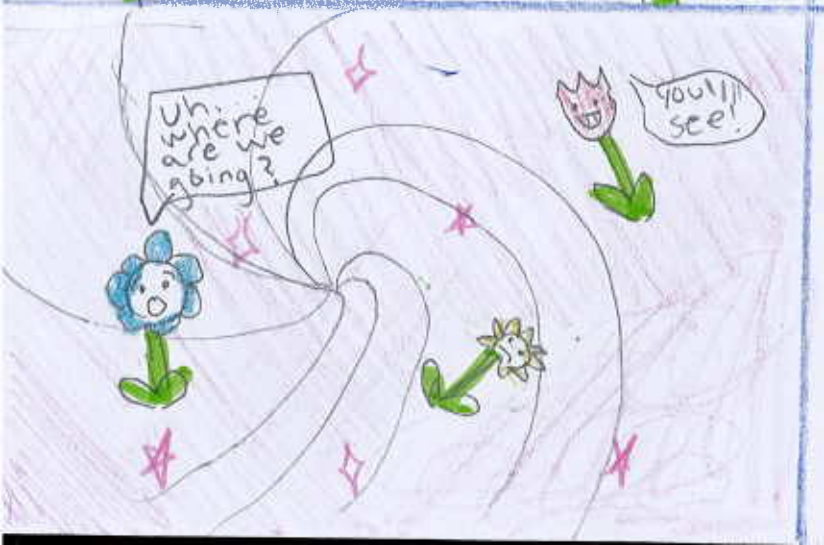
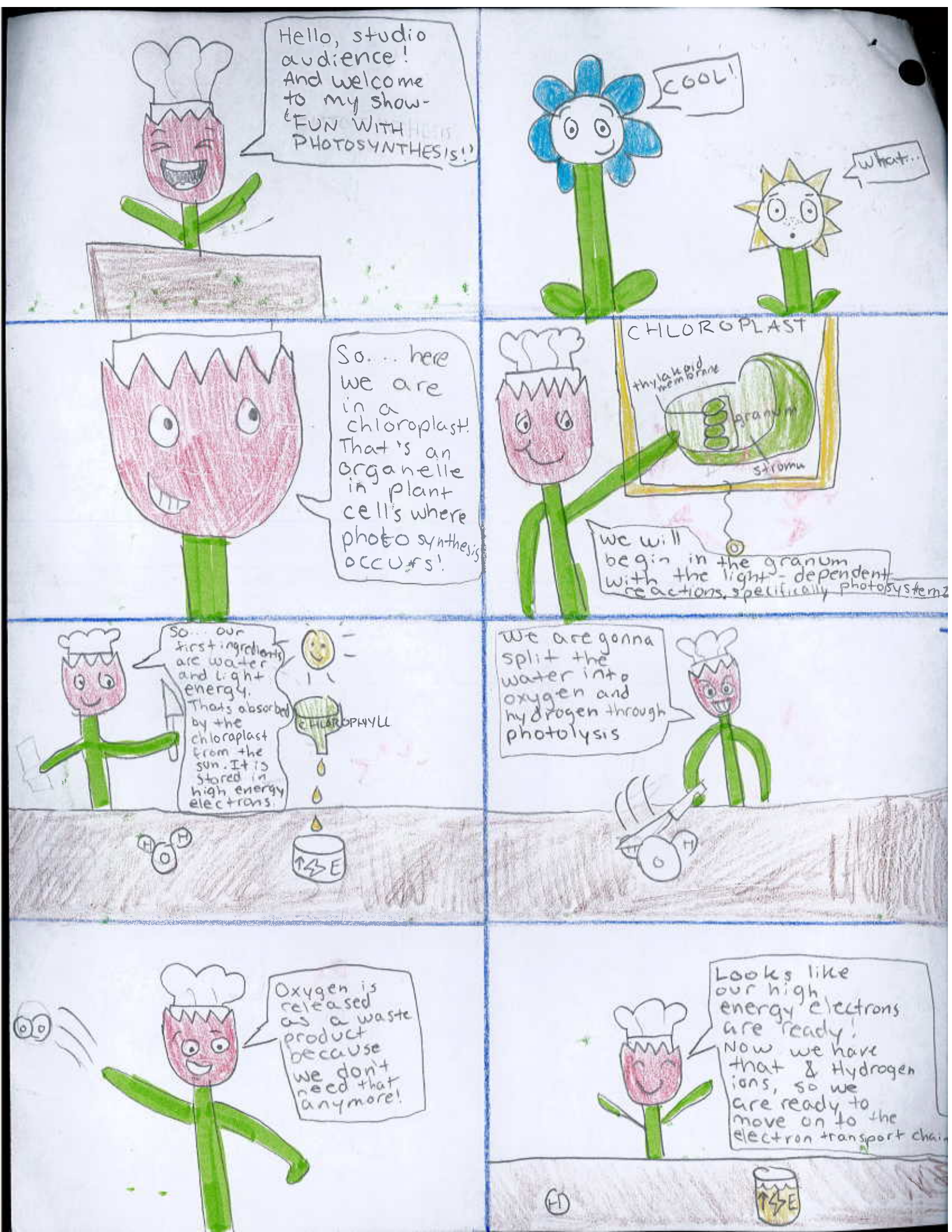
Elizabeth Pecoraro

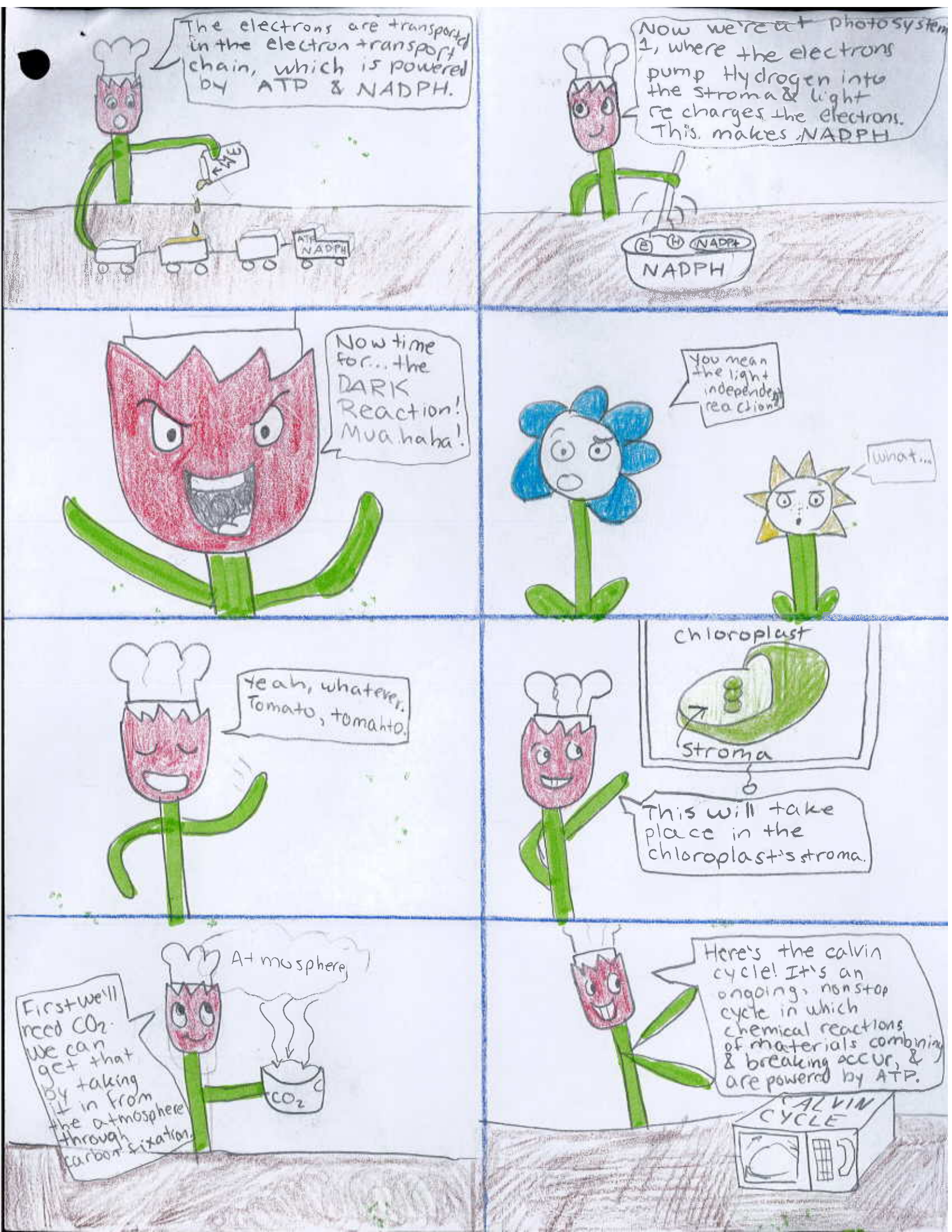
Informative Cooking Show

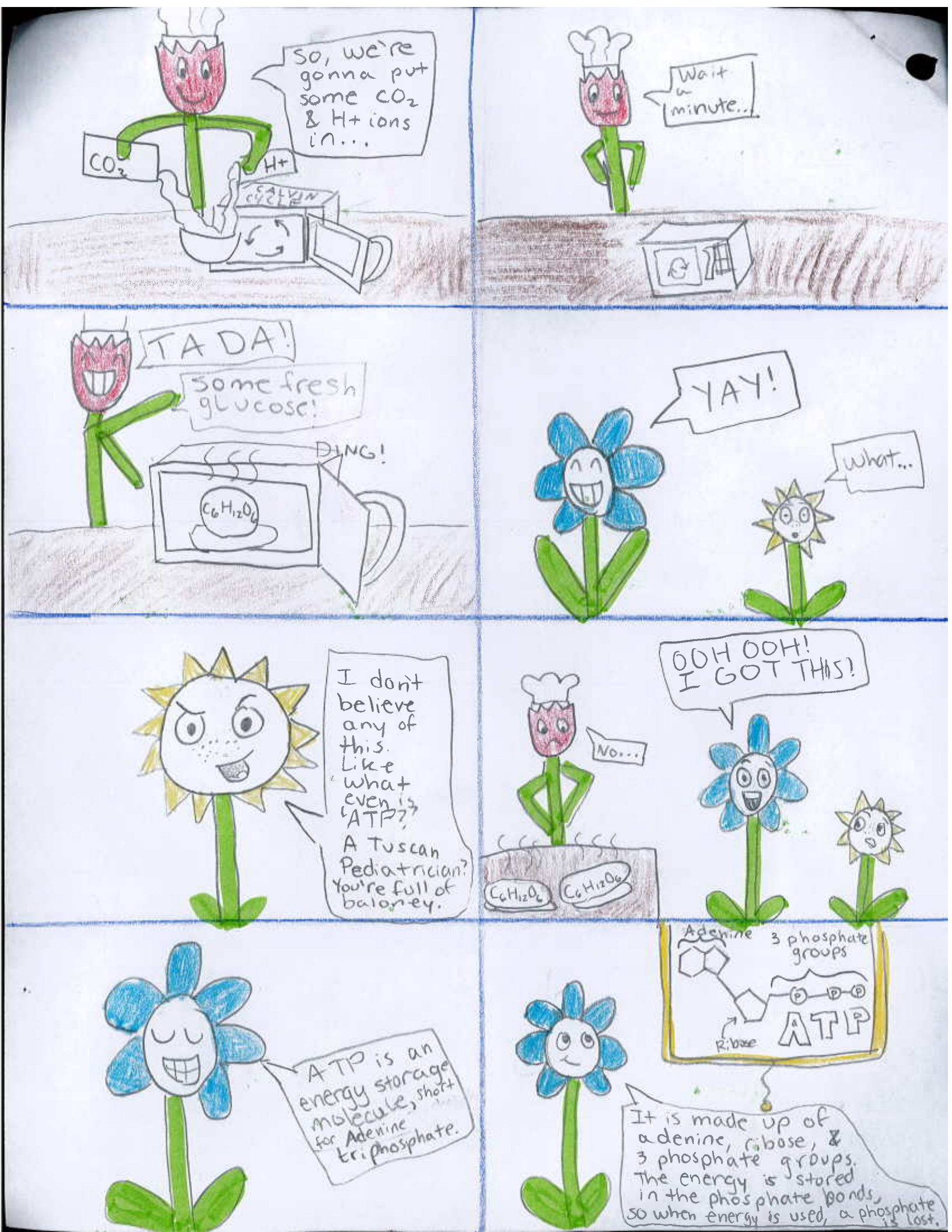
Episode 1 & 2

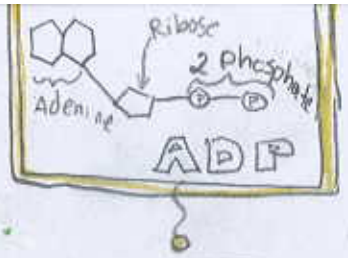


Later...


Hello, studio audience! And welcome to my show- "FUN WITH PHOTOSYNTHESIS!"
COOL!
what...
So... here we are in a chloroplast! That's an organelle in plant cell's where photosynthesis occurs!
CHLOROPLAST
thylakoid membrane
granum
stroma
we will begin in the granum with the light-dependent reactions, specifically photosystem 2
So... our first ingredients are water and light energy. That's absorbed by the chloroplast from the sun. It is stored in high energy electrons.
CHLOROPHYLL
H
O
E
We are gonna split the water into oxygen and hydrogen through photolysis
Oxygen is released as a waste product because we don't need that anymore!
Looks like our high energy electrons are ready! Now we have that & Hydrogen ions, so we are ready to move on to the electron transport chain


The electrons are transported in the electron transport chain, which is powered by ATP & NADPH.
ATP
NADPH
Now we're at photosystem 1, where the electrons pump hydrogen into the stroma & light re charges the electrons. This makes NADPH
NADPH
Now time for... the DARK Reaction! Mua haha!
You mean the light independent reactions?
What...
Yeah, whatever. Tomato, tomahto.
chloroplast
stroma
This will take place in the chloroplast's stroma.
Atmosphere
First we'll need CO_2. We can get that by taking it in from the atmosphere through carbon fixation.
CO_2
Here's the calvin cycle! It's an ongoing, nonstop cycle in which chemical reactions of materials combining & breaking occur, & are powered by ATP.
CALVIN CYCLE


So, we're gonna put some CO_2 & H+ ions in...
CO_2
H+
CALVIN CYCLE
Wait a minute..
TA DA!
some fresh glucose!
DING!
$C_6H_{12}O_6$
YAY!
what...
I don't believe any of this. Like what even is 'ATP'? A Tuscan Pediatrician? You're full of baloney.
NO...
$C_6H_{12}O_6$
$C_6H_{12}O_6$
OOH OOH! I GOT THIS!
Adenine
3 phosphate groups
P P P
ATP
Ribose
ATP is an energy storage molecule, short for Adenine triphosphate.
It is made up of adenine, ribose, & 3 phosphate groups. The energy is stored in the phosphate bonds, so when energy is used, a phosphate is lost.



so, when it loses a phosphate it becomes ADP Adenine Diphosphate. This holds less energy than ATP & is more numerous in the cell.

word.

Okay...

Let's just say you are correct, theoretically, what are you even supposed to do with this glucose stuff anyways?!

Ooh! Informative cooking show number two!

1 Teleportation LATER...

Hi folks! And welcome to our highly requested episode 2! "Respiration Rodeo!"

I'm not sure that it's so "highly requested." We're the only ones he-

-Shut up.

Lets begin, shall we?

First, we have glycolysis, which is in the cytoplasm of the cell! It requires no O_2! It's anearobic!

First we're gonna cut our glucose 6-carbon molecules in $\frac{1}{2}$ to get 2 3 carbon molecules

These 3 carbon molecules are called pyruvate! That's all there is to glycolysis It produces a net of 2 ATP.

O_2 = continue

$\not{O}_2$ = Don't

Now is a desicion point. If we have O_2, we can move onto aerobic cell resp. if not, we can't move on.

Luckily, we have Loads of Oxygen, from being a waste product from photosynthesis! We can move onto the next step, the krebs cycle!

RELOCATION TIME!

Again?

COOL!

Yay!

1 RELOCATION LATER...

Well here we are! The mitochondria! Take a good look! This is the ACTUAL POWERHOUSE of the cell!

COOL!

Fwhat...

Mitochondria

membrane

matrix

The krebs cycle is gonna be in the matrix.

It's a bit like the calvin cycle in the sense that it is quite complex.

Krebs

There are 8 steps of chemical reactions, but to summarize, we put in the pyruvate molecules and...

3 carbon

MATH STUFF

Krebs

TA-DA!

4 NADH

1 $FADH_2$

1 ATP

3 CO_2

Krebs

You get an ATP, 4 NADPH, 1 $FADH_2$, & 3 CO_2!

1 ATP

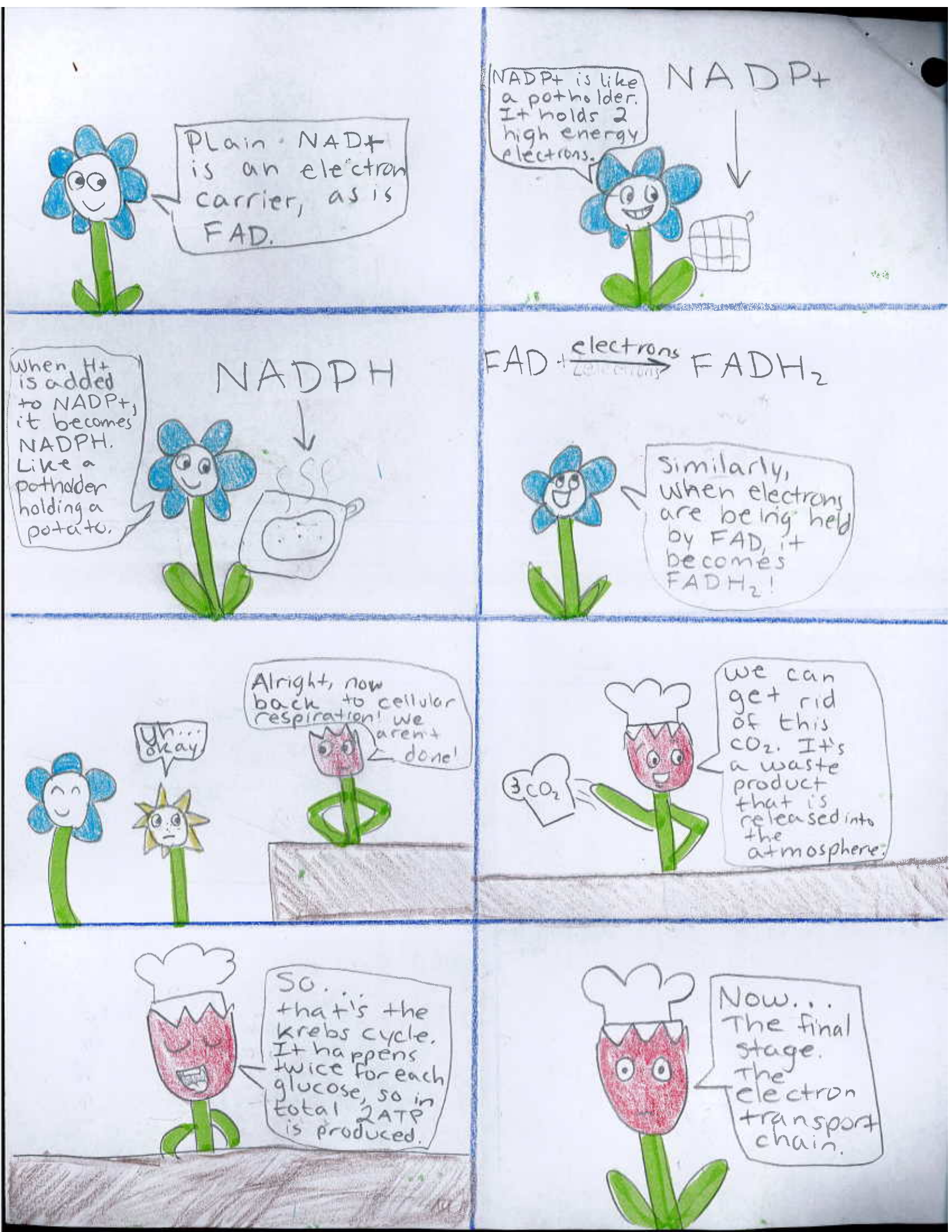
4 NADH

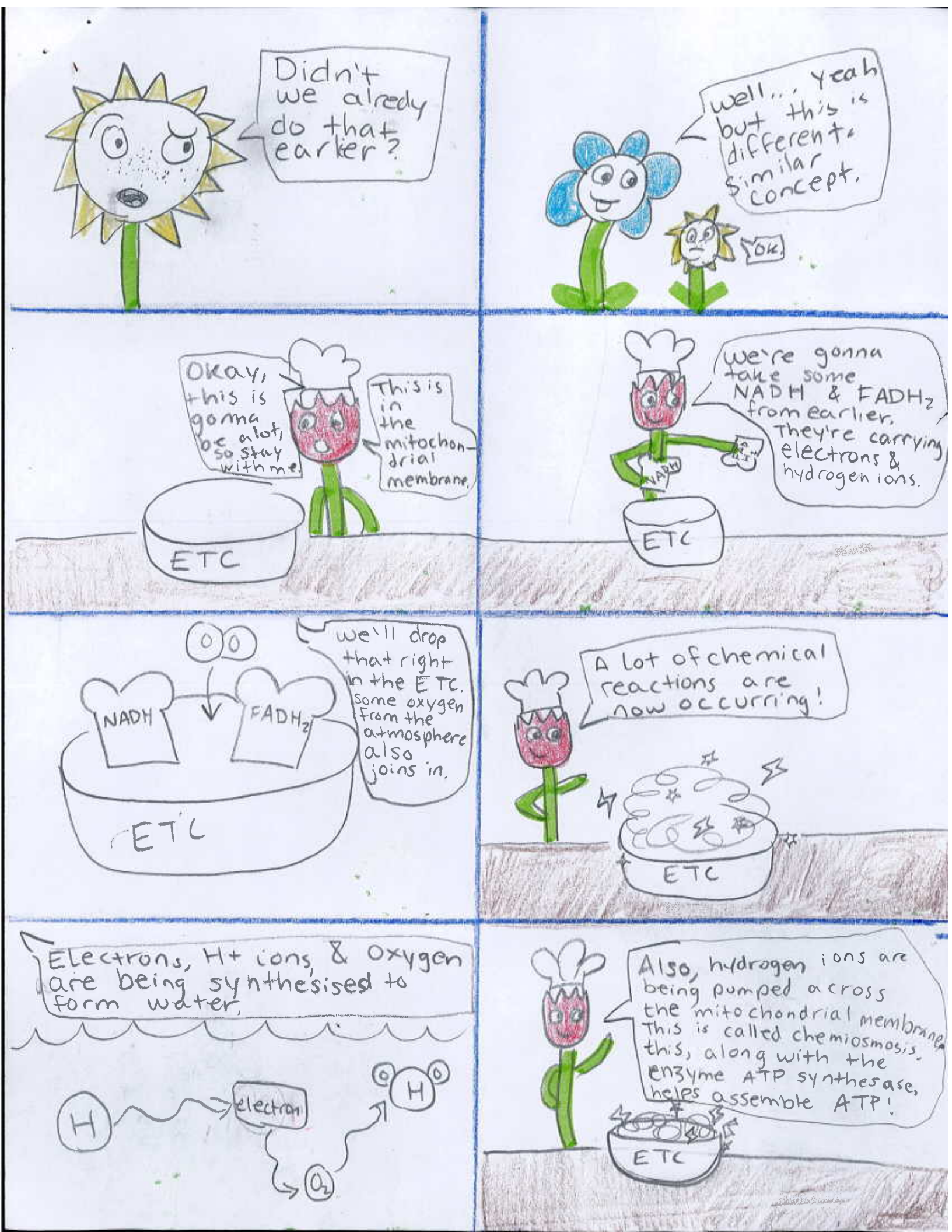
1 $FADH_2$

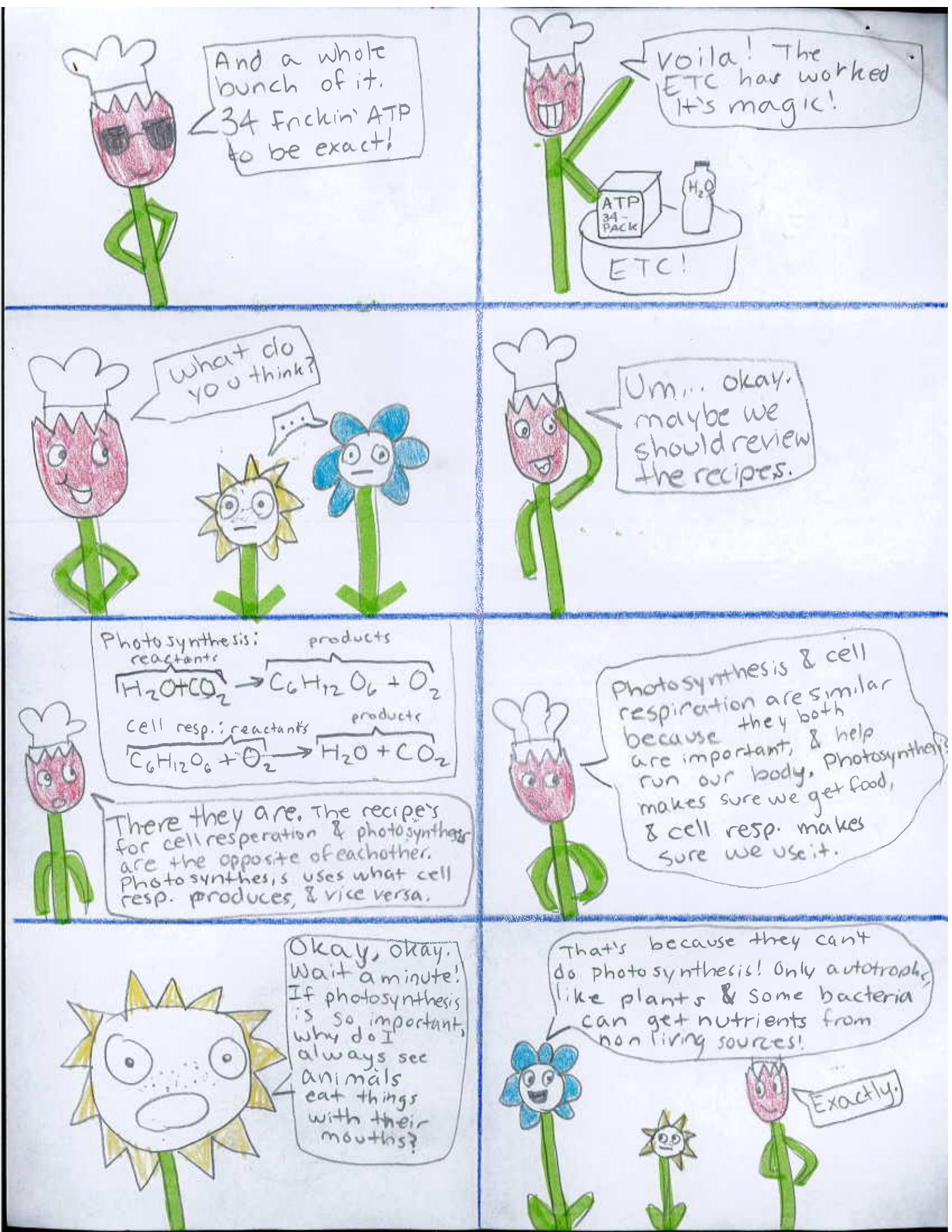
3 CO_2

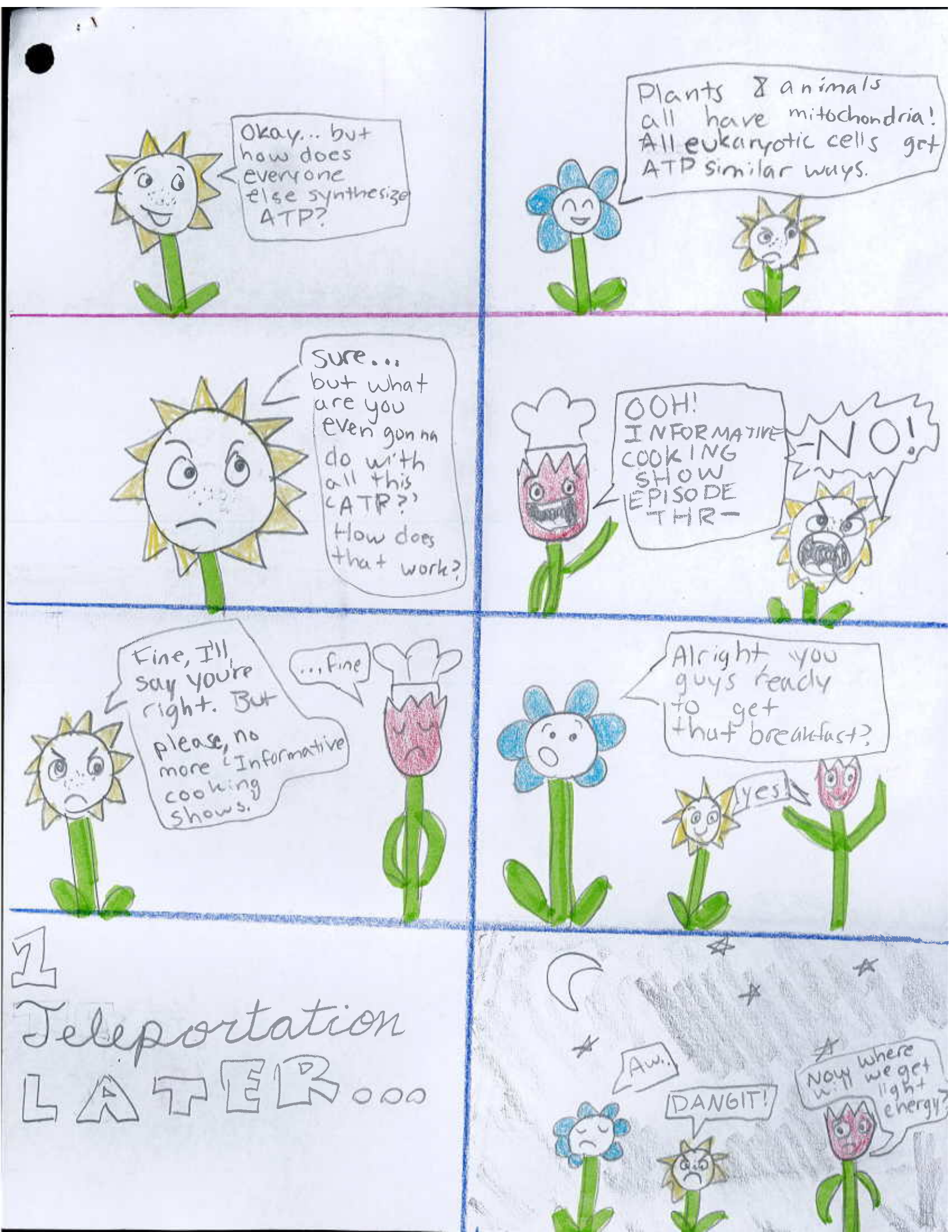
woah, woah, woah. you keep talking about 'NADH.' what even is that?!

I KNOW! I KNOW!


Plain NAD+ is an electron carrier, as is FAD.
NADP+
NADP+ is like a potholder. It holds 2 high energy electrons.
NADPH
When H+ is added to NADP+, it becomes NADPH. Like a pothodder holding a potato.
FAD + electrons → FADH2
Similarly, when electrons are being held by FAD, it becomes FADH2!
Alright, now back to cellular respiration! we aren't done!
Yh... okay
3 CO2
We can get rid of this CO2. It's a waste product that is released into the atmosphere.
So... that's the krebs cycle. It happens twice for each glucose, so in total 2ATP is produced.
Now... The final stage. The electron transport chain.


Didn't we already do that earlier?
well... yeah but this is different, similar concept.
OK
Okay, this is gonna be a lot, so stay with me!
This is in the mitochondrial membrane.
ETC
we're gonna take some NADH & FADH2 from earlier. They're carrying electrons & hydrogen ions.
NADH
FADH2
ETC
NADH
FADH2
ETC
we'll drop that right in the ETC. some oxygen from the atmosphere also joins in.
A lot of chemical reactions are now occurring!
ETC
Electrons, H+ ions, & oxygen are being synthesised to form water.
H
electron
H
O2
Also, hydrogen ions are being pumped across the mitochondrial membrane. This is called chemiosmosis. this, along with the enzyme ATP synthesase, helps assemble ATP!
ETC


And a whole bunch of it. 34 frickin' ATP to be exact!
Voila! The ETC has worked it's magic!
ATP 34-PACK
H_2O
ETC!
What do you think?
...
Um... okay. maybe we should review the recipes.
Photosynthesis:
reactants
products
$H_2O + CO_2 \rightarrow C_6H_{12}O_6 + O_2$
cell resp.: reactants
products
$C_6H_{12}O_6 + O_2 \rightarrow H_2O + CO_2$
There they are. The recipe's for cell resperation & photosynthesis are the opposite of eachother. Photosynthesis uses what cell resp. produces, & vice versa.
Photosynthesis & cell respiration are similar because they both are important, & help run our body. Photosynthesis makes sure we get food, & cell resp. makes sure we use it.
Okay, okay. Wait a minute! If photosynthesis is so important, why do I always see animals eat things with their mouths?
That's because they can't do photosynthesis! Only autotrophs, like plants & some bacteria can get nutrients from non living sources!
Exactly.


Okay... but how does everyone else synthesize ATP?
Plants & animals all have mitochondria! All eukaryotic cells get ATP similar ways.
Sure... but what are you even gonna do with all this 'ATP?' How does that work?
OOH! INFORMATIVE COOKING SHOW EPISODE THR-
-NO!
Fine, I'll say you're right. But please, no more 'Informative cooking shows.
...fine
Alright you guys ready to get that breakfast?
yes!
1 Teleportation LATER...
Aw..
DANGIT!
Now where will we get light energy?

The end!

... or is it?

what will they do with all that freakin' ATP!?

FIND OUT NEXT TIME!