

January 23, 2014

Brod Bagert

Muse Project Batch # 9

—14 Life Science Texts—

Dear Muse,

Once again, thanks for the inspiration. The science curriculum phase of the Muse Project is almost finished.

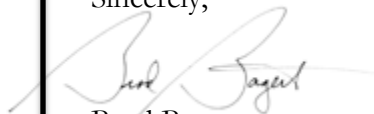
As you probably remember, content for the Muse Project started out with a single genre—poetry. As things went along, the project evolved to include monologues, dialogues, and short plays. These additional genres were especially useful when dealing with the more sophisticated levels of scientific content for the upper grades.

That said, grab your hats. Batch 9 consists of 14 Life Science texts, about half of which are fairly long pieces that deal with some pretty sophisticated science.

If any of you who are teaching 3rd, 4th, or 5th graders are feeling adventurous, I would be extremely interested to know how your students might react to this advanced material, specifically the last five pieces labeled appropriate for “*MIDDLE*.”

Thanks again. This is a life-long dream, and your being here has made it possible. If I were a rich guy every one of you would be in my will.

Sincerely,



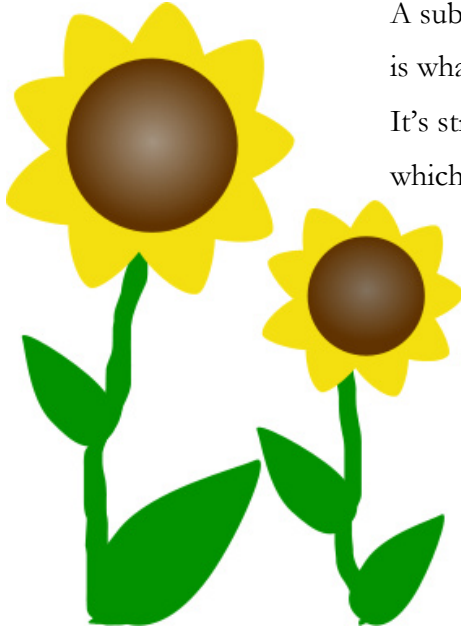
Brod Bagert

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Stand Up!

by Brod Bagert



For little plants to grow up tall
their cells have got to have a wall.

A substance we call cellulose
is what those walls are made of most.
It's strong enough to hold the weight
which helps a plant to grow up straight.

How can corn stalks grow so tall?
Corn-stalk cells have got a wall.

Why don't giant oaks trees fall?
Oak-tree cells have got a wall.

Blades of grass, so very small?
Even grass-cells have a wall.

I guess those plants must think it's fun
to grow and grow toward the sun,
and if they want to grow up tall
their cells have got to have a wall.
Without cell walls to do the job
a plant would be a mushy blob.

PRIMARY, INTERMEDIATE –SC. 2. 146

The Excretory Cheer

by Brod Bagert

Stinky breath! Stinky sweat!

Stinky yellow pee!

Stinky stuff inside of you.

Stinky stuff in me.

Everybody ready?

Everybody shout—

THE EXCRETORY SYSTEM!

IT'S HOW WE GET IT OUT!



Stinky breath! Stinky sweat!

Stinky yellow pee!

Stinky stuff inside of you.

Stinky stuff in me.

PRIMARY, INTERMEDIATE –SC. 2. 147

The Kidney Brothers
or
Glory of the Golden Stream
by Brod Bagert

Cast:

Peter Kidney
Paul Kidney

Peter & Paul:

Hello, and welcome to the Human Excretory System.
We're the Kidney Brothers.

Peter:

My name is Peter Kidney,

Paul:

My name is Paul Kidney.

Peter & Paul:

But our friends just call us "THE P-P TWINS!"

Peter: (Turning toward Paul)

Are they laughing at us?

Paul:

I'm... not... sure...
But let's get on with it.
We are part of the excretory system of a human being by the name of Alexander Pic.
Alexander is a normal human who does normal-human things.

Peter:

He consumes and metabolizes nourishment.

Paul:

He rids himself of metabolic waste.

Peter & Paul:

And he thinks about girls.

Peter:

Now we don't help him metabolize nourishment,
and we certainly don't help him with girls,
but we do help with waste, liquid waste, that is.
Solid waste is the responsibility of another systems altogether.

Paul: (Turning toward Peter)
Shall we recite the excretory poem?

Peter: (To Paul)
Why not!

Paul:
OK,
We learned this little poem back in Excretory College,
it's a classic among kidneys.
So... here we go.

Peter & Paul: (Reciting together and ending with a formal bow)

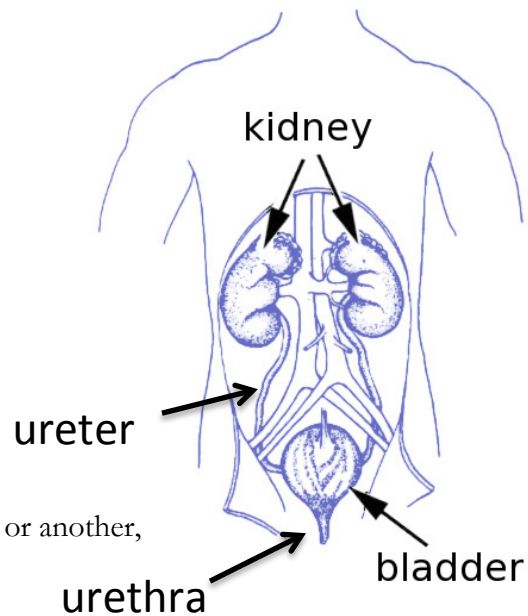
The Pee-not-Poo Poem

by Kanisha Kidney

Human beings make lots of waste,
it's nasty as can be.
The solid waste comes out as poo,
the liquid waste as pee.

And we excrete the liquid waste,
it's what we're made to do,
but solid waste is not our job
cause we don't mess with poo.

Peter:
So you know the drill—
the body of our human consumes stuff,
he breathes, drinks, and eats,
and all that stuff gets metabolizes in one way or another,
and all that metabolizing produces waste,
and somebody has to get rid of that waste...



Paul:
Which is where we come in: ALEXANDER'S EXCRETORY SYSTEM!
Now we kidneys are not Alexander's whole excretory system;
he has other organs and we work with them as a team.
His skin sweats waste,
his lungs exhale carbon dioxide waste,
and his liver converts ammonia into urea
which is then sends to us for disposal.

Peter:
So we really are a team,
but those other organs all have dual functions.
Sure, they all excrete waste,
but they also do other stuff,
but we kidneys... the famous P-P Twins,
our work is about one thing and one thing only— Urine!

Paul:

So here's what we do.

Peter & Paul:

Kidneys filter urea and uric acid from the blood,
ureters carry it to the *urinary bladder*,
bladder stores it up so Alexander's not constantly peeing in his pants,
 then it's out through the *urethra* until—
 The rush of mystic river.
 An excretory dream.
 Glory of the natural world.
 Behold... THE GOLDEN STREAM!

INTERMEDIATE & MIDDLE— SC. 3. 148

Stamen! Pollen! Pistil! Seed!

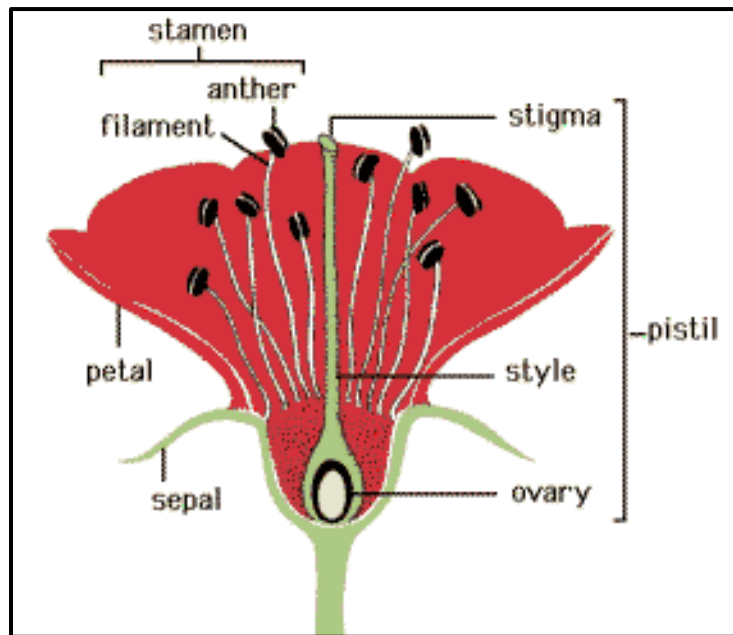
by Brod Bagert

I'm the stamen, long and slim.
In a flower I'm the him.
With filament and antler too,
I make the pollen, yes I do.

I'm the pollen—yellow dust.
For reproduction I'm a must.
Bird or bee or windy day
will come and help me fly away.

Pistil! Pistil! One-two-three!
Stigma, style, and ovary.
I give tiny seeds a start,
because I am the female part.

Stamen! Pollen! Pistil! Seed!
You're exactly what I need.
Prettier than any other.
Perfect flower for my mother.



PRIMARY, INTERMEDIATE, & MIDDLE – SC. 2. 149

Oxidation— The Fire of Life

by Brod Bagert



The gas they call *oxygen*, that is the name
of the gas that produces a fiery flame.
The campfire burning in bright conflagration
is wood in the process of fast *oxidation*.

And green *copper oxide*, a picturesque metal,
appears after years on an old copper kettle—
But where does it come from? What is the causation?
That kettle is burning. It's slow *oxidation*.

And that crusty old bicycle covered in rust—
“Watch out!” you might shout. “It’s about to combust!”
And then you can offer a glib explanation:
“The rust on that bike is from slow *oxidation*.”

Or freshly-cut apples that slowly turn brown—
“Disgusting!” your sister will say with a frown.
Which is when you’ll announce in a wise declaration:
“Those apples are burning. It’s slow *oxidation*.”

And if you eat popcorn or candy or gruel,
oxidation’s what turns all that stuff into fuel.
So shout it out boldly, without reservation:
“My body is burning in slow *oxidation*!”

So when taking a hike to celebrate Earth Day,
or lighting the candles to sing happy birthday,
or slicing a Thanksgiving ham with a knife—
IT’S ALL OXIDATION! THE FIRE OF LIFE!

Note: When writing this poem, I wanted to make sure that the fifth stanza was scientifically correct, so I called a scientist I know in California. I apologized for waking him up and asked him if oxidation was what turns food into fuel for our muscles. The scientists, still half asleep, sounded as though he might doze off in the midsentence. “That’s right,” he said. “The sugars and fats and proteins we eat are complex molecules that need to be broken down into simple, high-energy molecules that muscles can use like ATPs, and oxygen is good at moving electrons around, and that’s the process we call oxidation and reduction that makes those molecular changes.”

The scientist in this story is my son, and when he was a little boy he was just like you, and all that scientist-stuff in his head sounds complicated, but now for him it’s the normal stuff that pops out when he’s half asleep, and it’s no more complicated than the normal stuff that pops out of the head of a basketball fan in the middle of a playoff game. So here’s the message: If your brain can learn basketball, it can learn science. Really!”

Nature!

by Brod Bagert

Nature! Nature! Yes-siree!
So much stuff for us to see!



Spider web, hanging high.
Spider wants to catch a fly.

Salamander. Puffy toad.
Bullfrogs hopping down the road.

Grumpy turtle. Lizard sweet.
Crocodile! Don't bite my feet!

Catfish, tuna, northern pike.
Water is what fishes like.

Chicken skinny, robin fat,
pigeon poop on top your hat.

Monkey in a monkey tree,
monkey looks a lot like me.

Nature! Nature! Yes-siree!
So much stuff for us to see!
Nature-nature-nature-nature!
Nature! Nature! NATURE!

I bet some of you noticed that this poem contains examples of the six basic classes or groups of animals:

Arthropods:	spiders and flies
Amphibians:	salamanders, toads, and frogs
Reptiles:	turtles, lizards, and crocodiles
Fish:	catfish, tuna, northern pike
Birds:	chicken, robin, pigeon
Mammals:	monkeys, human beings.

PRIMARY – SC. 1. 151.

Successful Ecosystem

by Brod Bagert

Failure can be such a pain,
I'm going to have to use my brain.
I'm going to have to do my best
to pass this ecosystem test.



Biotic is...? My brain goes BING—
Biotic is a living thing.

And *abiotic*? Ain't no jive—
A thing that never was alive.

Population? I do exclaim—
A bunch of creatures all the same.

Community? Light as a feather—
Different species living together.

Habitat? My brain replies—
A place a creature lives and dies.

Failure can be such a pain,
but I have got an awesome brain.
I'll ace this test! Oh yes-siree!
Success! The perfect *niche* for me.

PRIMARY, INTERMEDIATE, & MIDDLE – SC. 2. 152

The Place for Me

by Brod Bagert

Ocean! Ocean!
Cold and deep,
way down where the fishes sleep.

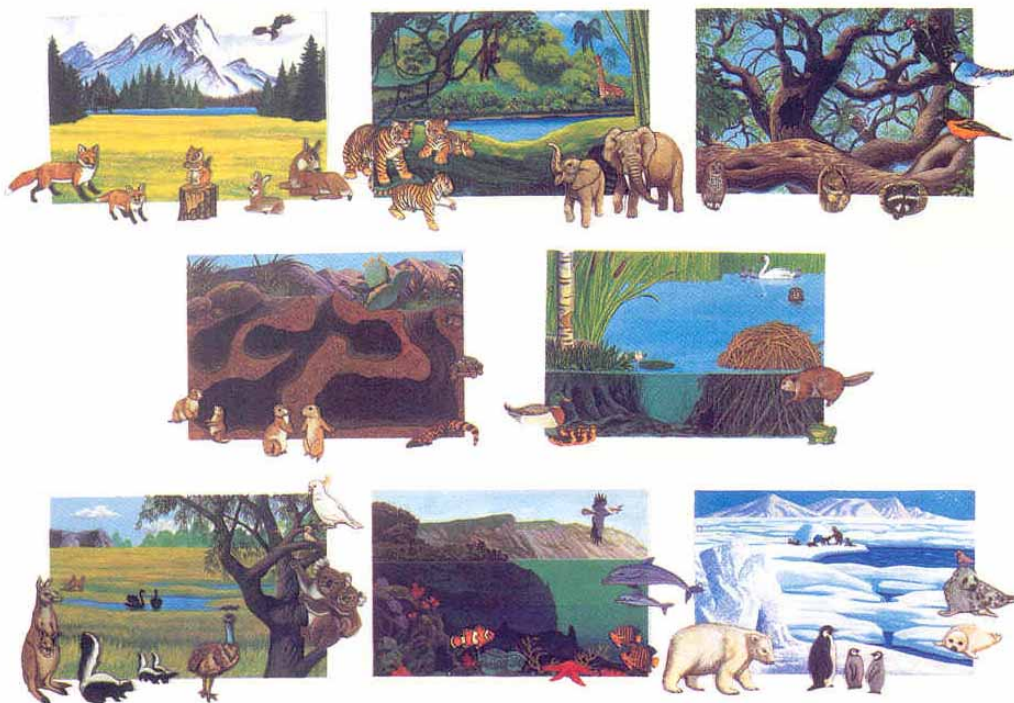
Desert! Desert!
Shifty sand.
Hard to walk and hard to stand.

Mountain! Mountain!
Oh so high,
almost reaching to the sky.

Spooky forest,
spider laces,
forests are such creepy places.

In the swamp
the darkness grows.
Gator, please don't bite my toes!

Back to school?
Yes, I see.
School's the habitat for me!



PRIMARY & INTERMEDIATE, – SC. 2. 153

On the Field with the Pros

(A Crocodile Tale)

by Brod Bagert

Today was of the most important days of my life.

It started when my Aunt Janelle called me “trifling.”

She said:

“Girl, you all full of questions.

You may well be the most trifling child I have ever known.”

So I said:

“Aunt Janelle, I can ask all the questions I want.”

And she said:

“Well Tamara, then you keep on asking those questions,

just don’t expect to get any answers from me,

cause you done passed me up a long time ago.

You go find out for yourself.”

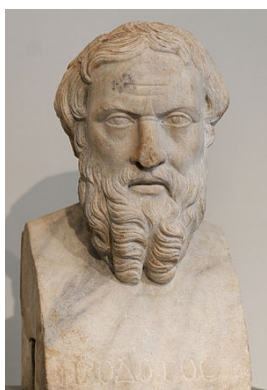
She always does that, plays like she’s not smart,
but Aunt Janelle is the smartest person in the family,
cause she reads nonstop, and knows a lot of stuff,
which is why I’m always saving up questions to ask her,
and I usually get a lot of answers,
but not today.



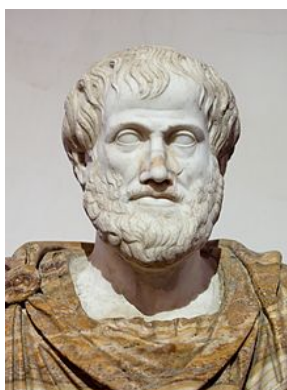
So I opened my laptop,
double-clicked Google™,
typed—“crocodile teeth bird clean,” and pressed enter.
I had asked her about a story I heard when I was little,
how there’s this bird that lives around crocodiles,
and they have this symbiotic thing going
where the crocodile opens his mouth real wide
and the bird hops in and cleans the crocodile’s teeth,
pecking out little bits of food caught between the teeth,
and how the crocs never eat the birds,
and it’s a very cool story,
but lately I started asking myself, is it true?
I mean it still would be a cool story even if it’s wasn’t true,
but I needed to know, which is why I asked Aunt Janelle,
and why I ended up reading about it on the internet,
and why I’m pretty sure the whole thing is not true.
First of all, crocodiles don’t need teeth cleaning.
They’re constantly shedding their teeth
and replacing them with new ones,
so their teeth don’t decay,
and besides, crocodile teeth are far apart;
no way food gets stuck.

And nobody has ever gotten a picture of it,
 let alone a video.
 and with over a billion smart phones in the world
 you'd think somebody would have gotten a picture.
 Well actually there's one picture,
 it's the only one,
 you see it everywhere on the internet,
 and it's a fake.

So the story is probably not true.
 Birds and crocodiles are not mutuals.
 So why is that such a big deal for me?



Herodotus
 Father of History
 (484-425 BCE)



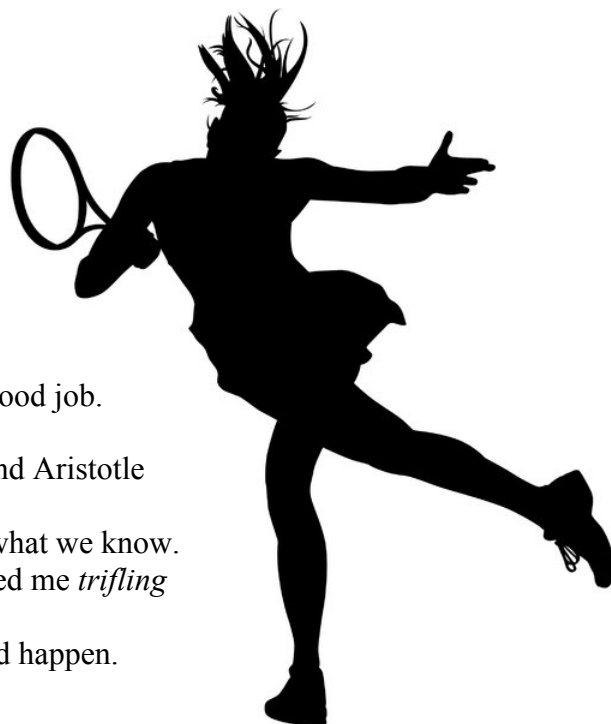
Aristotle
 Greek Philosopher
 (384-322 BCE)

Well, this bird-crocodile thing is not just a story,
 it's a story that's been around a long time:
 It starts with this guy Herodotus who lived twenty-five hundred years ago,
 and they even call him the Father of History,
 and he describes it in detail.
 Then Aristotle, who is like the most famous philosopher of all time,
 he, too, writes about it in detail.
 And sometimes they teach it in schools,
 they even have children's books about it.
 And then one day along comes me,
 my Aunt Janelle calls me trifling and won't answer a question,
 so I start reading a bunch of stuff from a bunch of different sources,
 and come to the conclusion that it's probably not true.

I.... ME....

looking things up and thinking it through,
with this brain in my head,
and it's like I'm on the field with the pros,
AND I HAVE THE POWER

Sorry, I do get a little carried away.
But it's pretty cool,
questioning and searching,
and now that I know how good it feels,
I want more.... to learn more,
and it's not just about good grades and getting a good job.
It's about wanting to be in the game,
to be on the field with the greats like Herodotus and Aristotle
and all the other great teachers,
to be one of the people who adds a little more to what we know.
And it all happened because my Aunt Janelle called me *trifling*
and stopped answering my questions,
and I can't help but wonder if she knew this would happen.
Hmmm....
She is definitely the smartest person in the family.



MIDDLE –SC. 3. 154

The Geek, the Goth Quarterback and the Oldest Story Ever Told

by Brod Bagert

Characters:

Bruce: Goth quarterback.

Ernesto: His best friend.

Bruce:

Dude, you're a geek.

Ernesto:

Why am I a geek?

Bruce:

Because you're reading.

Ernesto:

That's ridiculous. Reading doesn't make me a geek.

Bruce: (Reading Ernesto's page from over his shoulder.)

But, Dude! It's what you're reading—
fossils... radioactive decay... Paleocomic era.

Ernesto:

Paleozoic.

Bruce:

What?

Ernesto:

You said "Paleocomic."
The word is "Paleozoic—Pa-le-o-zo-ic."

Bruce:

Dude.
Do you see what I mean?
Totally geek.



Ernesto:

Not geek. Cool.

Bruce:

Well, Dude, you're just going to have to prove that to me.

Ernesto:

Ok. It starts with these two things—
the geological column and the fossil record.
The geological column is all these layers of rock,
one on top the other,
billions of years old.
and the fossil record is stuff from animals,
most of them extinct for millions of years,
but they're right there in the rock.

And they can tell us a story,
the oldest story ever,
about some of the changes the earth went through
and some of the living things that changed along with it.

Bruce:

Geek.

Ernesto:

You have some nerve calling me names.
In the history of middle-school football
you're the first goth quarterback.
You do the pregame warm-up in a trench coat.
And stop calling me "Dude."
It's a ridiculous habit.

Bruce:

I wear my coat because I get cold,
and anyway, rocks can't talk,
how they gonna tell a story.

Ernesto:

That's what's so cool.
It's not a story in words;
it's fossils in rock and radioactive decay....
Here, look at this picture.

Mud and sand and stuff
settle in layers and morph into rocks,
like smushed rock pancakes,
and these pancakes on the bottom are the oldest,
the Paleozoic Era, made out of stuff
that settled at the bottom of the ocean 550 million years ago.
And this is where we see the first animal fossils, all invertebrates.
Then higher up you get fish, then amphibians, then reptiles,
and it's almost like you watching the sea animals crawling up on the land
except it takes a long time, like 300 million years.

Bruce:

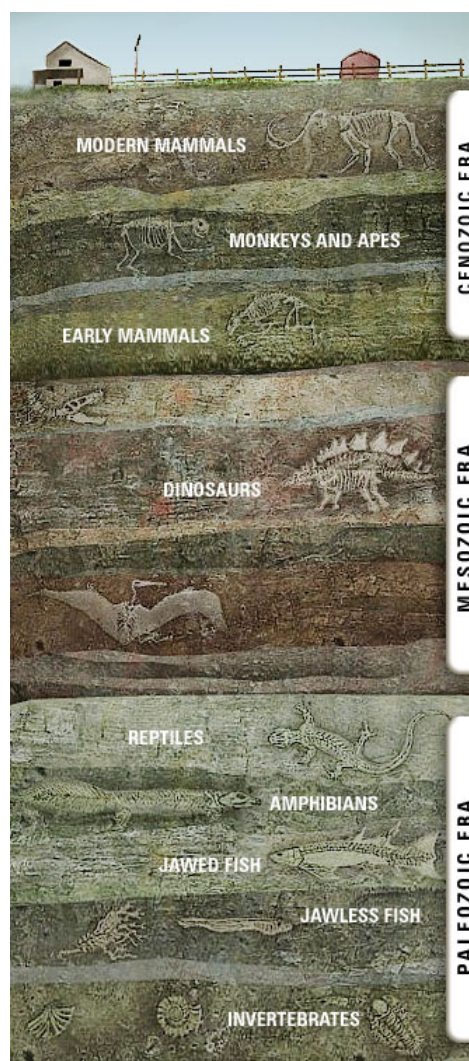
Dude, where are the dinosaurs?

Ernesto:

That's next, the Mesozoic Era, which starts about 250 million years ago,
and for almost 200 million years dinosaurs rule the earth, until BAM!—
65 million years ago, the K-2 meteor crashes into earth:
Humongous explosion! Giant earth quakes! Roaring tsunamis!
Volcanoes popping like Champaign bottles on New Year's Eve!
The cloud of death fills earth's atmosphere and cloud blots out the sun!
No... more... dinosaurs.
It's the Cenozoic Era,
and HERE... COME... the MAMMALS!

Bruce:

But Dude, how do we know all that?



Ernesto:

We've been working on this story for a long time,
 couple hundred years at least,
 putting it together one tiny piece at a time,
 and we'll still be working on it a hundred years from now.
 Each generation; little by little.
 Observing, experimenting, analyzing,
 and then publishing what they learned
 so they can pass it on to the next generation.
 Which is why I'm reading this stuff.
 I'm thinking I might want to be part of it.
 Like, dude, I might get to be one of the guys
 who adds a little bit of understanding to a story
 that people will be tell long after I'm dead and gone.

Bruce:

Dude, you called me "dude."

Ernesto:

No I didn't.

Bruce:

Did too. You said, "Like, dude, I might get to be one of the guys..."

Ernesto:

OK. I said "dude."
 And I admit I'm turning into a geek,
 but I like it,
 and I think I'm going to be a scientist,
 so when you're quarterback for the Green Bay Packers,
 freezing cause they won't let you wear your trench coat for pregame warm-ups,
 I'll be reading the story of the earth,
 in geological time,
 and maybe even getting famous.... DUDE!

Bruce:

I'm down with that.

Ernesto:

Thank you.

Bruce:

Geek.

Ernesto:

You bet.

Bruce & Ernesto:

Cool.

MIDDLE – SC. 3. 155

An Apology for Cell Membrane Rudeness

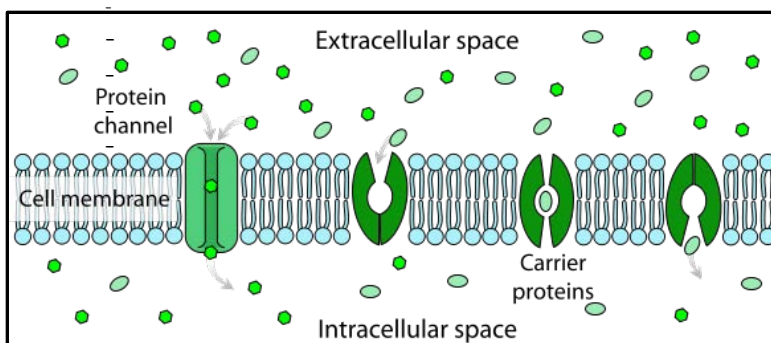
It is widely known that cell membranes lack basics social skills. In fact, as you are about to see for yourself, they are intolerably snobbish and unforgivably rude. But we ask you to be patient. It's not their fault. The Cell Membrane you're about to meet has never before spoken to a human being. You are the first.

The Cell Membrane's Monologue

by Brod Bagert

Permit me to introduce myself,
my name is Cell Membrane,
and although you humans may not be aware of it,
you will find one of my kind in every living cell on this little-ole planet.
Those prokaryote bacteria cells?
They have cell membranes.
Those eukaryote cells,
the ones that come with cell walls?
They have cell membranes, too,
just inside that wall.
And eukaryote animal cells,
the ones that have no walls at-all,
like the ones in side of you.?
That's right, cell membranes one and all.
Without me you human beings would be nothing more
than has-beens of the unremembered history of a dead planet,
so listen closely while I tell you more about my wonderful self.

I am composed of a double layer of lipid molecules.
Doesn't that sound just delicious—
"double layer... of lipid molecules."
And I am "selectively... permeable..."
which means I let some things in, and keep some things out.
Or put more simply for you mere mortals,
I'm like a screen porch on a summer evening:
I let that cool breeze in,
I keep those pesky mosquitoes out,
and now and then I might open a door to throw out some nasty-ole trash.



Now as you-all know,
 or at least should know,
 this whole business of letting-things-in and letting-things-out is what we call *transport*,
 and since I am loathe to work unnecessarily,
 my favorite kind of transport is passive transport,
 which means I don't have to spend any of my precious energy making it happen,
 it just more-or-less happens on its own by what we call *osmosis*.
 And again, for you mere mortals,
 osmosis is somewhat similar to when your baby brother wets his diaper,
 and that baby-pee just sort of seeps through the whole thing.

(Hmmm... I actually think some of you are listening to what I say
 and may even understand it,
 which raises the small possibility that one or two of you may be smarter than I thought,
 so I'll go a little further
 and tell you that along with osmosis there is also a phenomena called *diffusion*.
 Listen closely, now, because I'm only going to say this once.
 Nature... doesn't... like... to be crowded.
 So when something like a group of oxygen molecules find themselves in a crowd,
 they just naturally want to move to a less crowded space,
 they want to *diffuse*,
 which is what they do when they pass from the crowded space outside of my cell,
 to the less crowded inside of my cell.
 And the last thing I'm going to tell you is that osmosis and diffusion are very closely related
 but if you want to know more you'll just have to figure it out for yourself,
 because I have nothing more to say on that subject.

So watch me work:
 Here's some water molecules.
 My cell needs a little water now and then,
 but I don't have to do anything to let it in,
 it's already happening by *osmosis*,
 I already feel those water molecules slipping though my double lipid layer.
 Ahhhh... done.

A little oxygen?
 Now how in the world is my poor cell going to produce energy without oxygen?
 Here it come... hmmm...
 I can feel those oxygen molecules diffusing through my lipids

And what do I see now?
 Well hel-lo, Sugar.
 Hmmm... you're a might too large to slip though my lipids,
 so why don't you just mosey around till you find a protein channel
 and come in that way.

I didn't mention it, but my double lipid layer is studded here and there
 with some rather large protein molecules that act like little windows,
 we call them *protein channels*.

It's still passive transport, but the windows make it easy,
and "facilis" is the Latin word for easy,
so we call this "*facilitated transport*."

(Knock-knock. Are you still there?
Hmmm... I see that you are.
I must admit, I am quite surprised.
They didn't tell me you were smart.
I was expecting a somewhat... shall we say...
less intelligent group of human organisms.
Will wonders never cease.)

Well, that's about it,
except there's also this thing called *active transport*,
which is when I actually have to use energy.
Certain substances, like calcium and potassium and sodium,
they may not want to pass into my cell on their own,
but I always get what I want,
so what do I use?
That's right, it's proteins again, but this time they're not passive proteins.
This time I use transport proteins and they are very active.
They suck those molecules in from the outside of my cell,
pass them through my membrane,
and spit them out on the inside of my cell,
and that requires an expenditure of energy on my part,
I declare, it makes me weary just thinking about it.

And when a really big thing comes along,
a bit of food perhaps,
I become what you science fiction fans might call a shape-shifter.
I just change shape and engulf that food.
We call it *endocytosis*.
And I may as well add that when I want to get something out of my cell
I do it in reverse and we call this *exocytosis*.
It's quite simple,
just remember: "endo" for "in," "exo" for "out,"
and cytos from the Greek word kytos which means... bowl?
Hmmm...

And one more thing—
I am quite sure that every one is green with envy,
feverishly jealous,
every one of you wishing you were me,
covetous of my *double lipid layer*.
Well you need not be jealous.
The living part of you is made up entirely of cells, trillions of them,
and every one of them has a membrane just like me,
a deliciously functional *double layer of lipid molecules*,
with passive transport by diffusion and osmosis,

facilitated transport through protein channels,
active transport through transport proteins,
gobbling up whole things by endocytosis and exocytosis.

It's our world... all of us... our life... you and I.
Doesn't it just make you tingle.

MIDDLE – SC. 3. 156

The Protein Makers or Dancing the Two Step

by Brod Bagert

Cast:

Jennifer Gene
Raul Ribosome
The Nuclear Membrane Chorus
Danny DNA
Rosa RNA

Jennifer Gene:

(Standing in the center of ring of students holding hands. Dramatic voice.)

We are here today to show you how to dance the Two Step,
the intracellular process upon which all human life depends.

My name is Jennifer Gene,
and, yes, I actually am a gene.

(Gesturing to the entire room.)

This room is the interior of a living cell,
I am standing inside the nucleus of that cell,

(Now gesturing to the ring of students around her.)
and this is our nuclear membrane.

Oh yes, I can hear what you're thinking.

You're thinking:

"Nucleus ...A-HA!

Prokaryote cells do not have a nucleus,
so if this cell has a nucleus it must be a eukaryote cell."

(Squinting her eyes and tilting her head suspiciously.)

Well anyway...

This particular eukaryote cell is on the tip of your teacher's big toe.
(Ordinarily at this point I might make a little joke like "pardon the odor,"
but this particular nuclear membrane has no sense of humor whatsoever.)

Nuclear Membrane: (Speaking in chorus.)

Ba humbug.

Jennifer Gene:

Now if you're going to dance you got to feel the beat.

Me first—

(Clapping her hands to the beat.)

Transcription! Translation!

Plans for protein fabrication.

Now you—

Nuclear Membrane:

Transcription! Translation!

Plans for protein fabrication.

Jennifer Gene:

Once again; louder please.

Nuclear Membrane: (A good bit louder.)

Transcription! Translation!

Plans for protein fabrication.

Jennifer Gene: (Like a cheerleader.)

LET THEM HEAR YOU IN THE PRINCIPAL'S OFFICE!

Nuclear Membrane: (Screaming.)

Transcription! Translation!

Plans for protein fabrication.

Jennifer Gene:

Quite good. Now, if everyone is ready...

(In imitation of the famous "Let's get ready to rumble.")

LET'S GET READY TO MAKE PROTEINS!

So I'm the gene,

and right over there, on the other side of the nuclear membrane,
that huge molecule is my coworker, Raul Ribosome.

We work together to make the proteins of your teacher's big toe.

I provide the blueprints for a particular protein,
and Senor Ribosome will use my blueprint to assemble
just the right kind of amino acids,

in just the right sequence,
so that they fold into just the right kind of protein.

I give him the code... he makes the stuff.

Simple, right?

Ah, but there's one little problem, one... small obstacle.

Observe.

(Waving to Raul.)

Hello, Mr. Ribosome

Raul Ribosome: (Friendly smile.)

Hola, Senorita Gene.

¿Cómo estás?

Jennifer Gene:

So there it is.

We do not speak the same language,
so here's how it happens.

Permit me to introduce my assistant,
that famous double helix,
the molecular master of genetic code,
the **D**eoxy-ribo **N**ucleic **A**cid we all know and love—
Daaaanyyyy DNA!

(Danny runs into circle like fighter. Nuclear Membrane applauds.)

And Danny's partner in intracellular communication,
that somewhat less famous but equally as important

single-strand transcript of genetic code,
the **RiboNucleic Acid** of our dreams—

Senorita Roooooosa RNA!

(Rosa saunters, humble and demure. Nuclear Membrane goes crazy.)

Now watch closely as Danny passes the code to Rosa.

(Danny looks loving, approaching her as if to begin a slow dance.

Rosa wads a forbidding finger at him and holds out her hand.

Danny with paper and pencil writes a message and hands it to Rosa.)

And there it is, the first step in the process, TRANSCRIPTION!

We call it that because the code is now transcribed into a language

Senor Ribosome can understand.

Raul Ribosome: (Waving from a distance.)

Gracias, Senorita Gene.

Jennifer Gene: (Waving back.)

De nada, Señor Ribosome.

(Turning back to the audience.)

So now that transcription is complete

it's time for step number two, TRANSLATION!

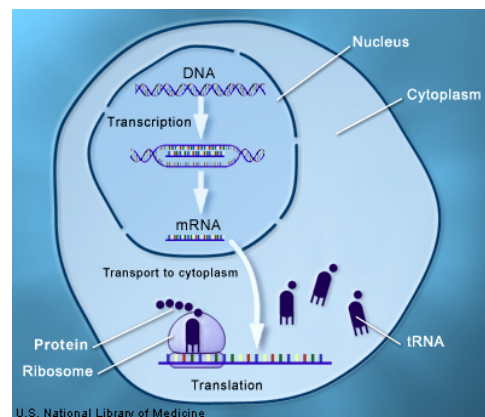
Now this is very thrilling stuff so please...

try to control your excitement.

Ok... here we go...

Senorita Rosa RNA must now deliver her message to Señor Ribosome,

but to do so she must first pass through the nucleic membrane...



Rosa DNA: (Nudging through the ring.)

Coming though.

Jennifer Gene:

...move through the cytoplasm...

Nuclear Membrane: (Spooky.)

Oooooooooooooooooooooo.

Jennifer Gene:

...and present himself to Señor Ribosome.

Raul Ribosome:

Hola, amiga.

Rosa RNA: (Handing him the message.)

Hola, Señor Ribosome.

Jennifer Gene:

Annnnd WALLAH! TRANSLATION COMPETE!

Now let me see, what comes next?

(As if saying it to herself.)

Transcription! Translation!

Plans for protein fabrication.

Ah yes, fabrication.

(Speaking very quickly.)

*Señor Ribosome reads the message,
which is written in a series of codons.
each codon coding for a particular amino acid.*

(Speaking at regular pace.)

I don't actually know what that means
but don't you think I sound smart when I say it.
Watch, I'll do it again.

(Using her super-scientist voice.)

*RNA delivers its information in codons,
each of which codes for the assembly of a particular amino acid.*

(Normal voice.)

And the result is the formation of a series of particular amino acids,
chained together in a particular sequence,
that will fold in a particular pattern,
thus forming a particular protein,
capable of performing a particular function
in your scientist teacher's magnificent big toe.

And why am I so excited about it.
Well, it's just that you humans, little by little,
are beginning to understand how all this works,
and who knows, maybe in the very near future,
you'll be able to genetically produce a different kind of science teacher,
one who might have not two but three big toes,
one on each foot, as usual,
and a third one... an extra-large, hairy one...
growing out... from the bottom... of his chin.

**(All form line across the front as they chant and dance, ending with bow.
Repeat several times.)**

*Transcription! Translation!
Plans for protein fabrication.
DNA to RNA
Ribosomes will save the day.
Making proteins, yes-siree,
Making them for you and me!*

MIDDLE –SC. 3. 157



Final Arguments in the Case of The Nervous System vs. The Endocrine System

by Brod Bagert

CHARACTERS:

TV News Reporter
Judge Barnabas Brain
Henrietta Hypothalamus
Pedro Pituitary
12 Members of the Jury

TV Reporter: (dramatic voice, hushed tone.)
Behind me is the courtroom of Judge Barnabas Brain
where for the last three days this jury has heard testimony
in the case of the Endocrine System vs. The Nervous System.
As the whole world knows by now,
this all began when the nervous system of Anna Maria Benedetto
was forced to seek a court order
to prevent her endocrine system from going on strike,
which if...
One moment.
I see that Judge Brain is about to take the bench.

Judge Brain:

Let me see... (shuffling papers)
We are here today to hear closing arguments
in the case of Nervous System vs. Endocrine System.
Are we ready to proceed.

Ms. Hypothalamus:

Good morning, your honor.
Henrietta Hypothalamus appearing on behalf of plaintiffs
the nervous system of Anna Maria Benedetto.
We are ready to proceed.

Mr. Pituitary:

Pedro Pituitary, your honor,
appearing on behalf of the endocrine system.
Ready to proceed.

Judge Brain:

Members of the jury, are you ready to proceed?
(Jurors nod.)

Judge Brain:

Very well then.

Ms. Hypothalamus, you represent the plaintiffs.
What do you have to say?

Ms. Hypothalamus:

Thank you, your honor.

Ladies and gentlemen of the jury,

I think it's important to begin with a review
of exactly what's at stake in this case.

The endocrine system of Anna Maria Benedetto
has threatened to go on strike;
nothing less than a general and complete work stoppage,
an action which,
as we know from testimony in this very courtroom,
would result in Ms. Benedetto's almost immediate death.
Which, as the whole world now knows,
makes this a CASE OF LIFE AND DEATH!

Mr. Pituitary:

Objection, your honor!

Judge Brain:

Objection sustained.

Ms. Hypothalamus,

we're here to hear legal argument;

Please reserve the drama for your statement to the press.

Now proceed.

Ms. Hypothalamus:

Yes, your honor.

Getting to the heart of the matter (no pun intended),

Anna Maria's brain is like a central computer,

it controls everything her body does

by sending messages over two networks—

the nervous system and the endocrine system.

And we in the nervous system work very hard.

every step she makes, every breath she takes, the very pounding of her heart,

we carry the messages and make it happen.

And we do it fast, your honor.

When Anna Maria puts her finger on something hot

our pain messages have to move at lightening speed

or else she might burn her finger half off before she reacts.

And we know that the endocrine system does its part, too, your honor.

Ask my opponent, Mr. Pituitary.



I work with him everyday.
 As Anna Maria's hypothalamus, I work as a kind of switchboard
 that sends commands to the pituitary
 that in turn regulates most of her endocrine system.

And we, the great nervous system,
 are quite happy with our working conditions.
 But this endocrine system,
 this mob,
 this gaggle of glands squirting hormones everywhere,
 they apparently think they deserve more,
 and they have the audacity to threaten to strike
 unless they be given....

Mr. Pituitary:

Obbbbbbb-JEC-tion!

Consul for the nervous system is deliberately misstating our demands.

Judge Brain:

Objection sustained.

Ms. Hypothalamus, you know very well
 that the endocrine system has NOT made a claim
 for either higher wages or better working conditions.

In an effort to resolve this matter,
 it might be best if the court permits Mr. Pituitary to state clearly
 exactly what it is that it is seeking in this litigation.

Mr. Pituitary:

Thank you, your honor.

Ladies and gentlemen of the jury,
 the endocrine system is not asking for higher wages
 or improved working conditions.

We love our work and doing it is its own reward.

And we have the highest regard for the nervous system
 and the work they do with the "fast response" activity of Ms. Benedetto's body.
 Indeed, while others may call them a tangle of temperamental tingleers,
 you will never hear those words from me or my fellow glands.

We respect the nervous system and view them as equal partners.

And that, ladies and gentlemen, is the crux of the matter.

We respect them, but we ourselves get no respect in return.

And it's not just the nervous system,
 at least they know we exists.

It's everyone,
 the whole population of human beings,
 it's as though we don't exist.

Ask people on the street to tell you about their endocrine systems,
 and see what kind of answers you get.

And yet, we are easily as important as the nervous system.
 We are a system of glands and other tissues
 that produce chemicals and send them into Ms. Benedetto's bloodstream.
 These chemicals are called hormones and we make more than twenty of them.
 Each of these hormones carry messages that are cleverly coded:
 a message to the heart can only be understood by the heart;
 a message to the lungs can only be understood by the lungs.
 And we admit that we work more slowly than the nervous system,
 but our kind of work happens slowly.
 And what is our work?
 You will find us at work in almost every cell,
 in every organ,
 influencing every single function of Ms. Benedetto's body.
 We control her moods,
 we stimulate her growth and physical development,
 we regulate her metabolism,
 and in a few more years,
 we will manage the sexual functions and reproductive processes
 that will permit Ms. Benedetto to bring children into the world.



Yes, all that,
 and hardly anyone even knows we exists.
 (voice cracking with emotion)
 Who ever hears our names or knows what we do.
 Tough little Thaddeus Thyroid producing not one
 but several hormones to manage metabolism.
 Angelica Adrenal always ready with a little dose of adrenaline
 to shift those bodily functions into high gear.
 And for poor Pamela Pancreas it's nonstop—more insulin, less insulin, more insulin—
 day and night, watching out for that all important blood sugar level.
 We work so hard....
 (starting to cry)
 Working all alone in the dark...
 Nobody knows us....
 Nobody cares....
 (Breaking down completely.
 About to collapse.
 Totally over the top.)
 And all we want... all we want is...
 we just need a little...
 (Total emotional breakdown.)

Ms. Hypothalamus: (Comforting, patting, soothing.)

There, there. Don't cry
 I think we're starting to understand.

Mr. Pituitary: (Still crying, trying to get back under control.)

I'm so sorry, I feel like such a fool.
 Sometimes I just can't control myself.
 All these hormones.

Ms. Hypothalamus: (Very decisive.)

Your honor,

I move for an immediate recess to give things a moment to settle down.

Judge Brain:

Motion granted.

We'll take a break for lunch.

And I'd like to see both parties in my chambers.

Now that we know what's really going on,

I have a feeling that we might be able to settle this whole thing.

This court stands at recess until 1pm this afternoon.

(Entire cast begin to stand as if about to leave the stage,
then all freeze as TV Reporter steps forward.)

TV Reporter: (Dramatic voice, hushed tone.)

And there we have it.

An opportunity to bring harmony to the body of Anna Maria Benedetto,

to restore equilibrium,

to reinstate the working relationship between nervous and endocrine systems

and to return her body to an ongoing homeostasis.

Entire Cast forms across stage and recites in unison:

Glands and hormones, hormones and glands,

constantly sending out bio-commands.

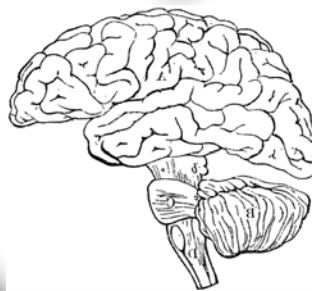
adjusting our state on an hourly basis,

keeping our bodies in homeostasis.

So learn the facts, you can if you try,

or else you'll make your hormones cry.

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Two Wannabe Nerds and Laquita a Science Goddess

by Brod Bagert

Jamal:

Are you serious?
You actually like prokaryote cells.
You actually prefer them to eukaryotes.
That is totally ridiculous.

Philippe:

What's so ridiculous about liking prokaryotes?

Jamal:

Well, for one thing,
eukaryote begins with the letters "eu" pronounced "you"
which is appropriate
because YOU, your entire body, is made of eukaryote cells.
And not just you, but everything you like—
your dog, your canary, your goldfish, the flowers in your mamma's garden,
almost everything you eat, all eukaryote cells.
But PROkaryotes are nothing but a bunch of bacteria.
Dude, you like GERMS!

Philippe:

Oh yeah!
Well over 90% of the cells in the human body
are nonhuman, prokaryote, bacteria cells.
Which means your whole body is nothing more than a biome for bacteria.
Jamal—Habitat for Non-Humanity.

Jamal:

You're just proving my point, Philippe.
The reason our bodies play host to so many prokaryote cells,
is because they're so small.
My eukaryotes are at least ten times bigger,
sometimes a hundred times bigger than your prokaryotes.
They're nothing but a bunch of teeny-tiny single cell germs
living inside intestines and eating feces.
That's right, dude, they eat poo.

Philippe:

How can you be so blind?
They don't eat poo.
They eat the same food you eat and help turn it into poo.

Jamal:

You can try to twist everything I say
but you can't get around the fact that prokaryote cells are totally simple.
Just look at them under a microscope
and see what you won't see.

You won't see any organelles.

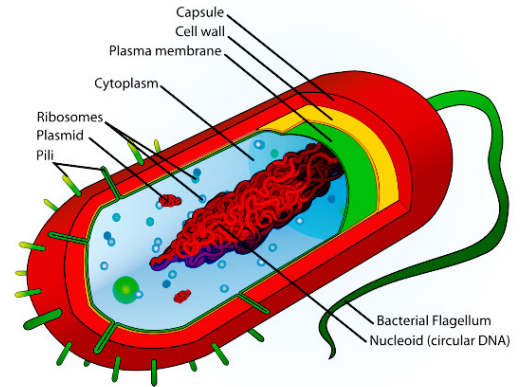
Your prokaryotes are just little blobs with no internal divisions:

- no mitochondria to produce energy through cellular respiration,
- no nucleus to store DNA,
- no golgi apparatus to package needed proteins and lipids for the rest of the cell,
- and no lysosome to haul out the garbage.

Totally simple.

Prokaryotes are like first grade arithmetic.

Eukaryotes are like college calculus.



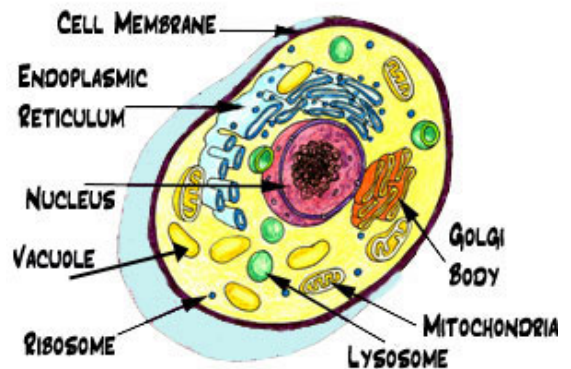
Philippe:

Jamal, you make me laugh.

Your whole argument is based on the idea
that *complex* is better than *simple*.

Where did you get such an idea?

And besides, prokaryotes outnumber eukaryotes,
and they account for at least half the biomass of all living organisms,
they were here a billion years before your eukaryotes newcomers,
and prokaryote simplicity, in my humble opinion,
almost guarantees they'll be around long after the last eukaryote
has been consumed by some conscientious bacterial decomposer.



Laquita:

I couldn't help overhearing your conversation, boys,
and I'd just like to say that I am amazed
at how little some people know.

(Jamal and Philippe cringe at the entrance of Laquita.)

Jamal:

Now you listen, Laquita,
just because you won first place in the National Science Challenge
doesn't mean you can push us around.
Every word we've said is accurate and you know it.

Philippe:

Yeah-you-right, brother Jamal.

Laquita:

It's not that anything you said was wrong, boys,
it's just that everything you said is totally outdated.

Have either of you ever heard of Archaea?
 Yes, those amazing little extremophiles
 that survive in the most extreme environments:
 some love ice,
 you can find them in boiling water at the core of a nuclear reactor;
 they replicate happily in pools of acid;
 they thrive in toxic waste;
 they even live in salt crystals and solid rock,
 which leads some theorists to speculate
 that some of them may be our very first visitors from outer space,
 little alien Archaea.

(All their previous arrogance gone.)

Jamal:

Laquita, please.

Philippe:

Just let us alone.

Laquita:

Oh, I will,
 but first I'd like to add
 that your entire discussion is based on the idea
 that your prokaryotes and eukaryotes
 represent the only two major classifications of evolutionary descent,
 which is what we scientists have thought for many years.
 But since the Archaea have a separate evolutionary history
 and are biochemically distinct,
 it is now widely accepted that life is organized along a three domain system,
 consisting of Archaea, Bacteria, and Eukaryota.
 So there.
 Now quit showing off
 and come help decorate the gym for the dance
 or I'll tell the world that you guys are just a pair of nerd-wannabes.

Jamal:

Laquita, you are a science goddess.

Philippe:

You got that right.

Laquita:

Why... thank you, boys.
 How sweet of you to say so.

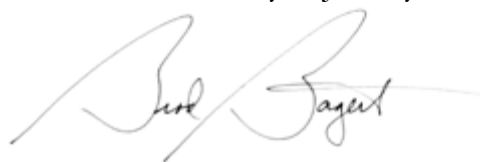
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