

The Butterfly Effect

by Andy Zach

"Whatcha doing, Brice?" my boss Wilma O'Reilly asked, after sneaking up behind me.

I jumped. As usual, I was cruising the internet, bored with my job. Wendy was my boss. How awkward.

We worked at Vegan Inc, an agricultural conglomerate. I was their lead geneticist in charge of enhancing the qualities of the corporation's vegetable products through genetic modification.

Thinking fast, I said, "Uh, researching. I'm reading about the 'Butterfly Effect'. It shows how small changes lead to great changes far away. Like a butterfly's wing causes a cyclone on the other side of the earth." That should work since that was what I was reading.

"How is this related to your current assignment of increasing the yield of our zucchini varieties?"

"I'm trying to relate my past success with cucumbers to zucchinis."

"I'd think you'd just do what you did last time when I promoted you."

"Well, I did and it didn't work for zucchinis. I tried zombie hummingbird DNA, zombie turkey DNA, and twenty other zombie animals as well. But nothing worked. So I'm stretching my mind to the farthest reaches of what might be possible."

"That might work. Try this scenario for a possibility: if you don't make progress in another month, you'll lose your position. You got promoted for great success. You'll get demoted for failure." Then she smiled sunnily and said, "Have a nice day!" as she left me.

Great. I couldn't coast anymore. Why did work have to be so much work? And I *had* worked hard, testing twenty species of zombie animals trying to make chimeras with zucchini. There were a hundred and seventy-three DNA spots on the zucchini DNA where I could insert the animal or bird genetic sequence.

Those were all the known zombie species, except for humans. Vegan Inc. had strict rules about not editing human DNA. My choices were to create a new species of zombie or do something else to increase our zucchini production.

I didn't know what else to do. My one GMO success had been creating a chimera, a cross between a zombie hummingbird and a cucumber. The zombie hummingbird's super high metabolism crossed into the cucumber and they matured to full growth in a week.

Only animals could get zombiism through the zombie bacteria, itself a mutation from genetically modified bacteria E Coli.

What other animals could I try? People had tried inducing zombiism in other mammals and birds with no success. They had to have E Coli gut bacteria, but out of hundreds of species tried, only twenty worked.

Think outside the box, Brice Butterworth. That's the one thing I was good at. Bird species--check. Animal species--check. Reptiles? They hadn't been tried for zombiism. But they had slower metabolisms. Not a good trait when I wanted faster growth. What else? Insects? They certainly had fast metabolisms. None had shown any zombiism. Perhaps I could induce it. This might give me recognition even outside Vegan Inc. I might even win a Nobel Prize!

Let's see: what insects have a fast metabolism? Flies, fleas, gnats, ants, dragonflies, butterflies, bees, beetles. Praying mantises? Why not? What could go wrong?

Uh-oh. Do any of these insects have E Coli? They need to host E Coli to become zombies.

After a couple of hours of research, I discovered insects had gut bacteria, but none of it was E Coli. Maybe I could induce zombism anyway. I didn't really have a choice.

Okay, I needed insect gut bacteria. Could I buy it online? Amazon? Nothing. Google? Zilch. Looks like I'll have to make my own. First, I've got to figure out how.

Another four hours of internet cruising taught me cockroaches, butterfly larvae, and termites were my best bets to zombify. They had symbiotic gut bacteria like human E Coli. That was good. I'd rather have three species than three hundred to try. I think I only had time to try three anyway.

I could order cockroaches, butterfly larvae, and termites online, so I ordered plenty, with next day shipping. After all, it was Vegan Inc.'s dime I was spending.

I studied the habitats I needed for my creepy crawlies and ordered them. I'd use my hummingcumber chimera plants to feed the butterfly larvae. They grew so fast, one plant could feed hundreds of caterpillars. I needed rotting wood for termites. There was plenty in the park near my house. I just needed garbage for the cockroaches. I'll just clean out my refrigerator.

Therefore, I had to leave work and go home to clean out my fridge. That's a new reason to take off early!

I never enjoyed cleaning out of my fridge as much as I did that afternoon, knowing my company paid to me do it. It was a dirty, thankless job, but I was glad to do it in the cause of science.

I put the moldy yogurt and green slices of meat in a plastic pail along with soft apples and mushy oranges. I added limp celery for bulk and took it to work the next day.

Three packages awaited me on my desk the next morning. Cockroaches to go, termites in transit, and leaping Lepidoptera larvae—caterpillars. I love the internet!

I dumped the cockroaches into the garbage pail, the termites on the rotten wood, and the caterpillars on the hummingcumpers. I sealed each environment in a glass case in my lab. I selected one individual of each insect to sequence the DNA of its gut bacteria.

A week later, I had the bacteria DNA all sequenced and I planned to add in the 'zombie sequence' of E Coli Gallopavo, the zombie turkey bacteria. I double-checked all the enclosures to make sure they were insect and caterpillar proof. The termites and cockroaches were busy reproducing. The caterpillars had tripled in size since I dumped them on the cucumber plants. But nothing escaped the sealed glass containers.

I added the zombie bit to each strain of gut bacteria and then bred them on agar in Petri dishes. The bacteria colonies grew and covered the three dishes. Then I contaminated each environment with the new bacteria.

How would I tell if it took and the insects became zombies? I'd have to take samples. Starting the next day, I sampled each species and checked the gut bacteria. Oh for three the first day. I re-infected the environments with my still-growing cultures. I also force-fed some individuals the bacteria. I highlighted them with an orange marker.

The following day I checked these individuals. Termite: no zombie bacteria. Cockroach: nothing. Caterpillar: Yes!

I checked three other caterpillars. Zilch. Apparently, it wasn't contagious. So tediously, I force-fed a hundred caterpillars the zombie bacteria.

I had already planned where I would put the insect DNA into the zucchini. I took my little zombie caterpillar and tried to make a chimera at seven different spots in the zucchini DNA sequence. Seven seeds were planted, each in its own container.

Six of the plants lived and grew. I carefully measured the growth rates. Five were normal and one was fifty percent faster. This might be my next success. As I backup, I created five more caterpillar chimeras matching that modification. They also grew faster.

Impatiently, I waited for the plants to flower. The normal time for a zucchini to flower was forty days. My deadline was just two weeks away. Even looking at fifty percent growth improvement, it'd take over three weeks. Could I get an extension from Wilma?

"Hi Wilma," I said as I called her on my phone.

"Hi, Brice, what's up?"

"I've got the zucchini growing fifty percent faster."

"That's great! I knew you could do it."

"It'll be ripe in three weeks."

"That's fine. I'll drop by for a taste. See ya later. I've got a meeting."

Whew. That was easy. Now I had to make sure nothing went wrong.

I carefully fertilized the seven plants, hand-pollinated the flowers. The butterfly zucchini chimera rewarded me with a bumper crop. What should I call it? A zucchinifly? A butterchini? I decided upon zucchinifly. 'Zombie zucchinifly' rolls off the tongue.

Wilma showed up a day before the deadline.

"Hi, Wilma. I expected you tomorrow, not today."

"I wanted to see your progress. Wow! These zucchini look great! This is from seed in three weeks?"

"That's right."

"Let me try one."

"Uh, okay." I was nervous. I hadn't tried one before myself. "I'll have my first one with you."

I grabbed the biggest zucchini and cut it into slices. We each took a bite.

"Gah!" Wilma spit it out on the floor.

"Yuck," I said, after gagging out mine.

"That's so bitter. It's like chewing steel wool."

"Or aspirin," I agreed.

"See if you can find out why it tastes so bad and get rid of the taste."

"Will do."

A chemical analysis revealed extremely high concentrations of iron, with traces of lead as well. Examining the genetically engineered symbiotic bacteria, I discovered they extracted metals from the soil and concentrated them in the fruit.

I checked the caterpillars too. Some had woven pupae. The concentrations of iron and lead were even higher in them.

"I wonder if these concentrations are too high for the butterflies to live?" I murmured to myself. "It'll be interesting to see if they live."

I planted some zucchinifly seeds in a special hydroponic garden, free of any nutrients except those I added. Maybe I could keep the metals out.

My new plantings grew slowly, even slower than normal zucchini. Meanwhile, the pupae popped into butterflies. Rather than the plain white cabbage butterflies I used, they were white and red. All their wing veins were red.

I tested them. They still had the mutant zombie gene. I'd made a new zombie species! The wing veins had all the iron concentrated in them. I wondered what behavioral changes I'd see.

They just pollinated plants but grew larger and larger. Soon they were dinner plate-sized. Meanwhile, my iron-starved zucchini were just flowering. A week later I had zucchini.

I tasted them. Okay, nothing to write home about. So I got rid of the bitter taste and fast growth.

"Wendy, I've got good news and bad news for you," I told her as she walked into the lab.

"Give me the bad news first. I don't want to get my hopes up."

"The bad news is the non-bitter tasting zucchini I've made don't grow any faster than normal."

"Ugh. What's the good news?"

"They're not bitter."

"That's a bitter pill to swallow. You've spent six months of your time of this project with nothing to show for it."

"It seems without iron or other metals the fast-growing zombie effect isn't there. The symbiotic bacteria are still there, but they're in a dormant state."

"Hmmm. What will happen if you add iron now, to the mature plants?"

"I don't know. I'll try it."

"I'll try to think of some use for this weird zucchini."

"I've named it a 'zucchini-fly' because it's a chimera."

"Woah!" Wendy looked at the huge butterflies ponderously pollinating my cucumber and zucchini plants in the lab. "Are those zombie butterflies?"

"Yup. It's a new species, the first human-made zombie."

"That's something. Congratulations. Write up the paper and submit it for peer review. Keep puttering around with these plants and butterflies and see what you find out."

So now, I have my regular job and I have to write a paper that'll pass peer review. I'll have to dig out my old college papers and copy that format.

I experimented adding different metals to the soil. Iron first. How much would the zucchinifly actually absorb? Did it affect the caterpillars? I was now on my second generation of zombie butterflies.

I also tried lead, cadmium, lithium, arsenic, chromium, and mercury. I put biohazard warning signs on my zucchinifly pots. I also put the zucchinifly caterpillars on these plants.

While I waited for the plants and caterpillars to grow, I wrote my paper on the zucchinifly. I documented the DNA modifications in first the cabbage butterfly gut bacteria, and then in the zucchini itself.

If anything, the zucchini and the caterpillars grew faster with the poisonous metal additives. I tested the fruit, stems, and leaves. All the metals were concentrated in the zucchini fruit.

When the butterflies emerged, they were spectacular, with silvery veins of chromium, cadmium, and lithium. The mercury came out as a rust red, cinnabar, mercuric oxide stripes on the wings.

"Those are lovely!" exclaimed Wendy. "We can definitely market those butterflies as art objects. Also, I have a government customer who's interested in using our GMO vegetation to clean up toxic waste sites. You ready to take your zombie zucchiniflies on the road?"

"You bet!"

I began my tour of the US Superfund sites, where the government funds the clean up of hazardous waste. I felt like Johnny Appleseed planting my zucchinis everywhere across the US. I covered each site's poisonous soil with zucchini plants and zucchinifly caterpillars. After ten or twenty sites, I returned and called in rental zucchini harvest machines and Vegan Inc. trucks.

"Hey, Wendy," I said on my phone as I watched the first harvest.

"Hi, Brice. What's up?"

"What are we going to do with all these zucchini? You know they're poisonous with toxic metals."

"We've got a twofer going! The government is paying us to extract the metals and then we're selling them to high tech companies who need them to manufacture integrated circuits. You've come through again, Brice."

"What about the zucchiniflies? I see you've got hundreds of people leaping around the field capturing them."

"That's another income stream. I've hired a thousand lepidopterists to follow the harvest trucks and catch them. I pay them piece work wages, a hundred dollars per zucchinifly."

"Heck, I'll catch them for that rate!"

"No, I need you at the next twenty superfund sites. I'm paying you a per diem for all your expenses, so that's like a raise."

"Thanks, I guess. How do we make money on butterflies when they cost a hundred bucks each?"

"We sell them as jewelry under the brand 'Iron Butterfly' at nine hundred percent profit. But that's not all."

"What else are you selling?"

"The zucchinis themselves."

"They're poisonous!"

"No, not the iron enhanced ones. We sell them as iron supplements to the health food market. 'All organic, iron enhanced zucchinis.'"

"What about the terrible bitter taste?"

"That's become a marketing feature. Our CEO ate one on Youtube and challenged the CEO of our rival Corn-All to eat one for ten thousand dollars, donated to charity. It's gone viral on social media."

"Fantastic. What charity, by the way?"

"The Lepidopterist Society."