



endosymbiont



Blake Charlton is the author of three forthcoming fantasy novels, which will be published by Tor Books. The first, Spellwright, is scheduled for release in 2009. This story marks Charlton's debut as a fiction writer.

Charlton is currently a student at Stanford Medical School. His decision to pursue a career in medicine—and to write “Endosymbiont”—was inspired by his father’s struggle with cancer. “The theme of Seeds of Change immediately appealed to my belief that fiction can help bring about social change,” Charlton said. “As the national debate about health care reform continues to gather steam, I hope ‘Endosymbiont’ makes people think about what it’s like to struggle with disease, about what exactly defines a human-being neurologically, and about what we—as individuals and as a society—might do to alleviate the burden of disease.”

The author’s proceeds from the sale of this story have been donated to the American Cancer Society: www.cancer.org.



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he rattlesnake swallowed its tail until it shrank into a tiny knot.

Stephanie cocked her bald head to one side and frowned. What she was seeing was impossible. The tail couldn't just disappear into the snake's mouth. The matter had to go *somewhere*.

Originally, the scaly neo-toy had stretched three feet from tongue to rattle tip. Now it had contracted into a

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fanged tortellini that was telling the laws of physics to go fuck themselves.

STEPHANIE HATED HER broad Chinese cheeks, her blotchy Irish freckles, and most especially her bald head. The chemo had ruined her body; now it was ruining her mind, making her see things.

She reached for the snake that was swallowing itself. But the snake took a final gulp of its tail and disappeared with a pop.

Some invisible force froze Stephanie's hand. All sound in the hospital stopped. There were no squeaking wheels, no chattering nurses, not even buzzing florescent lights.

Then came a hiss of static, another pop, and suddenly Stephanie was holding the three-foot rattlesnake.

Confusion swept over her like vertigo. What had just happened? The neo-toy's scales felt warm under her fingers.

"WTF?" she grunted while pressing her left hand to her chest. Her heart was kicking hard and her vision dimmed.

It was the new chemo, had to be the new chemo making her see things.

She frowned at the snake. "I'm losing my mind." She shook the toy to make sure it was real. It coiled around her wrist. Real enough.

Two hours ago she had awakened alone in the hospital room. Memory provided no answer as to how she'd got-

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ten there. Wasn't the first time that had happened. "Fuck-ing chemobrain."

She dropped the rattler and began to absently turn the hospital ID bracelet around her wrist. Meanwhile the neo-toy slinked among the stuffed animals that cluttered her floor.

She'd found them in the toy chest. As usual they'd put her in a room better fit for a four-year-old than a fourteen-year-old. That meant most of the toys had been inanimate, cutesy things: grinning dinosaurs, bespectacled owls, blah, blah, blah.

But there had been a few neo-toys: a turtle, a mouse, a rattlesnake. San Francisco Children's Hospital being public, they were ragged and dated.

But she'd taken an interest in them, not for their playmate value, which she'd outgrown years ago, but for their neuro-bandwidth. Each toy contained a small concinnity processor.

Using the room's desktop, she'd hacked the neo-toys. Most of their nanoneurons had committed themselves to safety reflexes. But enough fibers had remained for a game.

She'd written several seek-and-swallow instincts for the snake and used her keyboard to remotely control the mouse about the floor. Initially the game had been to avoid the serpent, but soon she began venturing her mouse closer, goading her own neuroprogram. Eventually she'd fooled the snake into biting its own tail.

And that's when . . . what? When she'd hallucinated about the snake swallowing itself?

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“God, I can’t even remember what day it is,” she muttered before pressing her palms to her cheeks and her fingers to her hairless eyebrows.

The squeak of sneakers on linoleum made her look up. A tall South Asian woman in blue scrubs and a white coat was standing in the doorway. “Hi, Stephanie,” the woman said with typical pediatrician perkiness. “I’m Jani.”

Only superhuman restraint kept Stephanie from rolling her eyes. “Hi,” she replied in monotone.

Judging by the knee-length coat and the exhausted-but-not-yet-haggard expression, Jani was a new pediatric resident.

Fucking awful.

Most women went into peds to play with toddlers. They usually had no idea how to be around a fourteen-year-old.

“I see you’ve put the neo-toys to good use,” Jani said while stepping among the stuffed animals.

The rattlesnake began investigating the newcomer’s white sneakers. “Sleep,” the resident told the neo-toy to trigger its programmed reset instinct. The toy coiled up and lay motionless.

Like many South Asian doctors, Jani had a gratuitously long last name. Embroidered on her coat in blue was “Rajani Ganapathiraman, M.D.” The woman crouched beside Stephanie.

Just to be a snot, Stephanie nodded at the embroidered name and asked, “How do they page you on the intercom?”

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Jani grinned. “Paging Doctor Ganapathiraman,” she imitated in baritone. “Paging Doctor Ganapathiraman; Doctor Ganapathiraman to the name reduction room please.”

Despite herself, Stephanie sniffed with amusement.

“They use my first name or they text me.” Jani tapped the cell on her belt. “How are you feeling?”

Stephanie looked away. “Fine.” Suddenly she noticed there was something in her gown’s right pocket. A moment ago it had been empty.

Absently she reached into the pocket and pulled out a smooth green object. It was a glass snake biting its own tail.

Weirdness.

Jani didn’t seem to notice the object. “Do you know how long you’ve been here?” the doctor asked.

Stephanie slipped the glass snake back into her pocket. “I guess my parents brought me in last night. I’ve been having trouble when I’m sleeping. Are you an oncologist or a nanomed doc?”

Jani shook her head and sent her black hair swaying.

Stephanie swallowed; she’d had hair like that once. “Well, chemo can make you stupid. It’s called chemobrain. And I’m on the traditional poison and in a trial for a new nanomed immunotherapy. The two together give me bad chemobrain. Sometimes I forget things at night.”

“You’ve learned a lot about your treatment?”

This time Stephanie could not help rolling her eyes. “My mom invented the neuroprocessor and was the one

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who started Conninity Corp. And my dad teaches about infectious nanodisease at the Monterey Institute. They're always blabbing at me about it." She stopped short of saying that she probably knew more about nanomed and neurotech than the pediatrician did.

"I see," Jani said before pausing. Her almond eyes scanned the younger woman's face. "Stephanie, do you remember talking to me before?"

This made Stephanie nervously turn the hospital ID bracelet around her wrist. "No."

"Do you know what day it is? What year?"

"It's like mid-August, 2017?" her voice squeaked. Jesus, had she really lost her mind?

"That's right." She smiled. "Don't be scared. I just wanted to be sure."

"What do you mean don't be scared?" she blurted. "Sure about what? Jesus! How long have I been here? How many times have you seen me before?"

Jani held up her hand. "Slow down; it's okay . . . I'm not an oncologist, but I'm following your case. The cancer responded well to the treatment. And our research suggests that the side effects are temporary."

Stephanie started to protest but then stopped. A terrifying memory flashed through her mind. "Mom said they might take me to a hospital for the dead." She didn't know what that meant but the memory was clear. "She said you'd keep me here to fool me into thinking I'm still alive."

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Jani was holding up both hands now. “Slow down. The survival rates are scary but they’re far better—”

“You’re not listening. She said they’d take me to a hospital for people who’ve *already* died. I have to escape before—”

Stephanie started to stand but Jani put a heavy hand on her shoulder and said “Lullaby.”

The word opened a bloom of orange light across Stephanie’s vision. A static hiss exploded into her ears, and she felt herself falling. There was a firecracker yellow flash and then . . . nothing.

STEPHANIE WOKE BENEATH dark fluorescent lights. Pudgy footprints had been stamped into the ceiling tiles. It was a pediatrician’s trick: ask the kids who’d been walking on the ceiling so the brats would laugh while their stomachs were poked or palpated or whatever.

Stephanie groaned. She was at SF Children’s again, and as usual they’d put her in a five-year-old’s room.

She sat up. Outside her window shone a too-blue Californian sky that made her squint. Farther out, the famous bridge was straining the famous fog as it flowed into the stupid famous bay. Nothing Stephanie hadn’t seen a million times before. She tried to remember if she’d been in this room before, but rummaging through her mushed-up memory only gave her a headache.

She got out of bed and found her body wrapped in a hospital gown and her feet covered by traction socks.

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On her desk, a monitor was flashing STEPHE in primary-colored balloon letters. Below this dollop of pediatric saccharine was a toy chest.

Possibly with neo-toys?

She started for the chest but then stopped. A memory was squirming through her head like a worm.

Not really knowing why, she reached into her pocket and pulled out a small glass snake that was biting its tail.

For some reason, her throat tightened. She had seen this snake yesterday, hadn't she? Or had that been a chemodream? Hot dread filled her stomach.

She ran to her door and found it locked. Next she tried her desktop. It functioned but blocked access to all non-hospital websites. Someone had removed all the phones and intercoms from the room.

There wasn't even a call button for the nurse.

They'd locked her in. But why? Her head felt light and the room began to spin. Nothing made any sense.

Hot tears filled her eyes. She sat heavily on the floor and covered her face.

"Damn it, why aren't you here?" she growled to her absent parents and then struck the floor. "I hate this stupid chemo, these stupid doctors, and my stupid stupid gliofucking-blastoma."

She cried then until her eyes ran out of tears and she felt numb with exhaustion.

She took out the glass snake that was swallowing its own tail and examined it. On its belly, written in flowery

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cursive, was a strange name: *Carsonella ruddii*.

Stephanie frowned at this for a long time before she went to her desktop and accessed the hospital's encyclopedia.

Carsonella ruddii turned out to be a freaky bacteria that lived only inside the belly of a kind of jumping plant louse that ate amino acid-deficient plant sap.

The tears returned to Stephanie's eyes. Only one person would send her such a strange and hopelessly geeky message.

"Mom," she whimpered first in English then in Shanghainese.

But after a moment, she thumbed the moisture from her eyes. Something very, *very* bad must have happened if her mother was reduced to communicating in this way. And the more Stephanie thought of it, the more she recovered hazy memories of both her parents lecturing her on . . . on . . . she couldn't remember exactly what.

Then it's not just the chemobrain, she thought and gave her ID bracelet a twist. There's something . . . wrong. Really fucking wrong.

She read on about the *Carsonella*. Aside from being totally gross, it owned the shortest known genome: only about 180 genes. That was so little genetic material that it lacked the ability to produce certain needed proteins. It depended on its host for the needed molecules and in return manufactured enzymes helpful to the host's digestion.

It was an endosymbiont that had given up so much of its genetic identity that it depended on its host.

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All this had been figured long ago. Since then, several experiments had shown that certain mutations could cause the louse cells to swallow the Carsonella. Over many generations, the louse cells and the bacteria could evolve together so that the Carsonella gave up all of its genetic independence and became an organelle of the host's cells. Scientists saw this as proof that mitochondria and chloroplasts had evolved by a similar process of endocytosis.

Stephanie read on about mitochondria. They were like bacteria in structure; they multiplied independently of their cells; they possessed their own DNA. And all mitochondrial DNA was passed on through the female line.

In fact, the mitochondria of every living human came from one woman, dubbed "Mitochondrial Eve," who had lived in eastern Africa 140,000 years ago.

Here Stephanie paused. All mitochondrial DNA was passed on from mother to child.

"Mom, what the hell are you trying to say?"

She typed:

> What the FUCK??????

into the search engine and mashed the enter key. The screen changed to a warning about using provocative language in a children's hospital.

In frustration Stephanie bent forward and wrapped her arms around her bald head.

"Nothing makes any sense!" She started to stand up but then stopped.

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The glass snake still lay in her lap. Suddenly it became fluid and swallowed itself into a tight knot. Then with a pop, it disappeared.

“Oh my God,” she moaned. “I really am crazy. I’m totally out of my sandwich.”

But then something moved in her pocket. She reached in and pulled out the same green snake, again its normal size, again biting its tail.

A sudden, disorienting wave of memory washed over her and she saw her neo-toy swallowing its tail. She saw Jani holding her down and saying a word that made darkness explode across her vision. She remembered her father’s explanation of uploaded consciousness. “The neurotech Mom invented will change medicine someday,” he’d said. “If somebody’s brain is hurt, we’ll be able to upload their mind into the concinnity processor while we’re fixing the damaged brain tissue.”

Stephanie found that she was breathing hard. Her eyes couldn’t focus.

Back then, she hadn’t understood the difference between mind and brain. Now it was painfully clear.

She squeezed her eyes shut and put the pieces together: the snake disappearing, Jani knocking her out with the word “lullaby” . . . she wasn’t living in the physical world anymore.

Her mind had been uploaded into a concinnity neuroprocessor. That meant her brain was either receiving repairs from an army of nanorobots or was dead.

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But if the nanomed was digging the tumor out, why was she trapped in the pediatric hospital? Why was her mother sending her strange messages?

She turned the glass snake over and traced *Carsonella ruddii* with her pinky. It was odd to think that the snake didn't exist, that her pinky didn't exist. It was merely a sensation generated in the dark wet center of a super neuroprocessor.

"Why Carsonella?" she asked the snake. "What's Mom trying to say?"

Perhaps it had something to do with one entity enveloping another. That would make sense. After all, Stephanie's own mind had been enveloped by a neuroprocessor.

This realization made her jump. That was it. Her mother was trying to warn her, trying to tell her the neuroprocessor was taking away her identity, making her into an organelle like the freaky louse cells had enslaved mitochondria.

Her head began to spin, so she sat down and took a few long breaths. Her mom was trying to tell her to escape. "So how the hell do I do that?" she wondered aloud.

She looked at the toy chest and remembered hacking the snake neo-toy. That had glitched out the neuroprocessor. Perhaps she could hack the neo-toys again. Maybe she could hack into the whole hospital.

She started for the desktop but then a terrifying thought stopped her.

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What if her mind hadn't been uploaded? What if there was no nanotreatment? What if all of this was a hallucination caused by the glio-fucking-blastoma?

TOWARD EVENING, JANI came in and turned to close the door.

Seated on the bed, Stephanie kicked her chair. It shot across the room and struck the back of Jani's knees, making her sit down hard. The hospital fell dead silent. All movement stopped. A slow hissing grew louder and louder until it broke into a loud crack.

Then Jani was sitting on the chair facing Stephanie. A strip of red cloth wound around the resident's mouth. The back of her white coat was now the color and texture of the plastic chair. In fact, her back had fused with the chair.

"So either your drugs are giving me a grade-A acid trip," Stephanie said while rolling the woman over to the desktop, "or my body is dying somewhere, and we're in a neuroprocessor. I'm betting on door number two because working on this computer I hacked not only the neo-toys but every object in this room. So how about it? We in a virtual hospital?"

Jani was glaring at her.

That was enough of an admission for Stephanie. She hobbled over to her bed and sat. "And I'm guessing the new nanomed treatment didn't go so well for my brain. Somebody—most likely my mom—got me uploaded

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into one of California's concinnity processors. Still on track?"

Jani had closed her eyes and lowered her chin.

"You won't be able to logout," Stephanie said and the resident's eyes snapped open. "That program you're sitting on prohibits exiting the hospital environment."

The woman's eyes narrowed.

Stephanie tried to look as stern as possible. "I'll peel you off when I get answers. I remember my father explaining why doctors would want to upload people. He said you'd be able to put a guy's mind into a neuroprocessor while the nanomed pulled a clot out of his brain. Or save an old woman's neural patterns so you could restore them after Alzheimer's screwed them up. Of course none of this is on the hospital's encyclopedia." She nodded to the desktop. "You've cut off access to that, huh?"

Jani stared at her for a while and then nodded.

Stephanie sniffed. "Well, you didn't do as good a job as you thought. The encyclopedia has all sorts of info about the people who think that uploading minds is immoral or ungodly or some crap. The encyclopedia told me they pushed for something called the Anti-Singularity Act. But—surprise, surprise—the article on the AS Act is blocked. And that's where you come in. You're going to tell me what the AS Act is."

Jani pointed to her gag.

"Use the keyboard," Stephanie said with an annoyed sigh. "That's why I pushed you to the computer."

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Tentatively, the woman reached out and typed:

> lullab

But when she hit the Y key, the whole word disappeared.

“I’ve hacked the computer interface,” Stephanie said with a note of pride. “You won’t be able to write that word. Which is convenient for me since *somebody* programmed into my head an instinct that resets my memory whenever I see or hear it. Now—” she gestured to the keyboard, “—the Anti-Singularity Act.”

Jani frowned under her gag and wrote:

> You must know as little about your situation as possible.

“Why? Because something bad will happen if I find out what’s really going on?”

Jani nodded.

“Then something bad has already happened. I already know that I’m out of my head.” She laughed nervously at her unintended pun.

> I can reset you.

the doctor typed and looked at Stephanie earnestly.

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> Most of the memories will be gone.
Trust me, you want it this way.

“Jesus, no, I don’t!” Stephanie nearly shouted while pulling her hands across her bald head. “You’re never going to reset me again! I’d rather *die*. How many times have you reset me anyway?”

Jani looked away.

“That many, huh? Well then, tell me about the Anti-Singularity Act.”

Jani typed:

> Telling you would mean killing you.

“For all I know, I’m already dead,” Stephanie snapped.

Jani closed her eyes.

Stephanie felt as if her chest were filled with lead. “I am dead, aren’t I? Or my body is. That’s why you look that way.”

The doctor didn’t move.

“Jesus! How long ago?”

Slowly Jani opened her eyes and typed:

> ~50 yrs.

“Jesus,” Stephanie whispered. “Why so long? What are you waiting for?”

Jani was looking at her sympathetically.

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> You're an unusual case. You were uploaded before the laws took place. But, Stephanie, you don't want to know any of this.

"Yes, I do," she said, folding her arms. "I'm not letting you logout until you tell me. So get it over with."

Jani shook her head.

"Fine," Stephanie said in exasperation, "I'll guess what the Anti-Singularity Act is and you can tell me where I go wrong."

The doctor looked at her pleadingly but Stephanie blustered on, "When they figured out how to upload people, the technophobes flipped about where someone's soul went when you uploaded them. But they had to deal with the fact the new tech could end Alzheimer's and help kids with glio-fucking-blastoma. So they were screwed—didn't want to oppose tech that could save lives, but didn't want anything that's not in a body being consciousness. How's that sound?"

Jani typed:

> There was more worry about the dangers of conscious supercomputers.

Stephanie thought about this for a moment. "They're afraid some computer god-mind might take over the world?"

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> In a way.

Jani replied on the keyboard.

> Society depends on neuroprocessors now. If they rebelled, everything would come to a screeching halt. But what carried the Anti-Singularity Act was a fear that conscious neuroprocessors would accelerate technology so quickly that normal humans wouldn't be able to keep up. That event, when humanity's creations outstrip their creators, is called the technology singularity. Hence the Anti-Singularity Act, which set down laws to stop the creation of any non-human self-aware consciousnesses. They don't want anything to evolve that might be post-human.

Stephanie licked her lips. "They're afraid uploaded patients might start thinking of themselves as post-human?"

Jani nodded.

> The specialty of virtual medicine, VM, was created to stop that. That's what I do, keep uploaded patients from knowing they're not in their bodies.

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“But why not just save us to disk or something?”

Jani shook her head.

> You can't save consciousness in a neuroprocessor. The connections decay unless they're active.

“What about you?” she pointed at the doctor. “You're in this virtual place.”

Jani shook her head.

> I've a special neurointerface to login to this world. But all my thoughts are still happening in my head.

Stephanie rubbed her mouth. “And mine are happening in some neuroprocessor. So, what do you do to patients who realize they're out of their bodies?”

Jani looked at her with sad eyes.

> Very few ever reach that state. We managed to keep you from it for fifty years. But those that do . . . well, the senior attending physician analyzes them to see if they're human or post-human. If they're still human, every effort is made to get them back into a body. If they're not . . . they're terminated.

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Stephanie felt her legs tremble. “Are you going to tell your virtual shrink to delete me?”

The woman’s eyes were round with sorrow. Slowly she typed:

> I have to, soon as I leave this room.

Stephanie tried to stand, but her parakeet legs folded and she fell onto her butt. Jani scooted over and awkwardly helped her stand enough to sit on the bed.

Stephanie’s hands were shaking, but somewhere in her heart she felt the warmth of relief. At last she knew the truth.

“How did my body die?”

Jani scooted back to the computer.

> The treatment you underwent was experimental. Your parents got you into the trial. But . . . the protocol still needed adjustment.

Stephanie punched her mattress. “Jesus, Mom, you got me into a trial so some crappy nanomed could turn my brain into yoghurt?”

Jani wrote:

> She was doing her best.

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Stephanie tried to swallow away the tightness in her throat. "Thanks. Big consolation."

Jani didn't respond.

"So why keep my mind alive when my body's gone?" Stephanie asked while thumbing moisture from her eyes. "Don't you erase people who don't have bodies to go back to?"

> Normally, yes. But you were the first one ever stranded. It was a huge media case. Everyone knew your name. And by then, Concinnity Corp was so big your mother made Bill Gates look like a toddler in terms of clout. So when the Anti-Singularity movement gathered steam, she went before Congress and spearheaded the compromise that allowed virtual medicine to survive the AS Act. By law, those newly stranded in a neuroprocessor had to be terminated. But you were grandfathered in. Your mother insisted we keep your mind viable for as long as possible.

"But why? It's not like I have anywhere to go."

Jani shrugged and wrote:

> They have your genome on file.

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Stephanie snorted. “Like the technophobes would ever let some scientist clone a new body for me. No, Mom must have had something else in mind.” She paused to think. “You ever heard of Carsonella ruddii?”

The doctor’s eyebrows sank.

> Not since evo bio in college. Something about horizontal evolution.

“My mother never mentioned it when she went before Congress?”

Jani shrugged.

Feeling stronger now, Stephanie stood and tore the ID bracelet from her wrist. With a satisfying flick, she sent it—and the data file it represented—into the garbage.

“Mom, you’re killing me,” she grumbled before walking over to Jani and pulling her chair away from the desk. “I’ll program the chair to let you logout in twenty hours. If I’m going to hack out of this hospital, it’ll happen before then.”

End of Excerpt