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Gedanken Fictions

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About the Editor

Dr. Thomas A. Easton is Professor of Life Sciences at Thomas College in Waterville, Maine. He is also the author of Taking Sides: Clashing Views on Controversial Issues in Science, Technology and Society

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For my students

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Preface

Science is learning and knowing. Technology is doing. Together they give humanity immense abilities to meet its needs and shape its world. They *enable* us in a myriad ways.

Some of those ways surprise us, for new abilities may make it possible to ask questions that it never before made sense to ask (think of the way medical technology makes it possible to keep people “alive” on machines long after the brain has quit working; are such people really alive?). New abilities may therefore change old values. As values change, so may lifeways, customs, traditions, and dogmas; to some, science and technology rock the foundations of the world.

Perhaps unfortunately, most scientists and technologists do not spend much time considering such impacts of their work. They leave it to others—to philosophers, ethicists, politicians, evangelists, activists, journalists, and science fiction writers. To my mind, that last group is the most useful; its best members are more forward-looking, more creative, more insightful, and much better at bringing dry, abstract issues to life.

One of the main threads of science fiction has long been the dramatization of scientific and technological ideas, especially those of physics and astronomy, and their effects on human lives. This thread, often referred to as “hard science fiction,” has yielded the central images of garish magazine and paperback covers, films, and TV shows—spaceships and alien worlds, time machines and futuristic gizmos. In recent years, biology—genetic engineering—has intruded on this physical science core of the field, but “hard” still means a certain faithfulness to what we know about reality, along with a willingness to speculate about what we don't know and about what we might someday be able to do with the fruits of scientific research. There is a powerful sense of awe and wonder at the complexity and vastness of the

universe, and indeed one of the basic criteria for satisfying science fiction is that it evoke a “sense of wonder.”

Those who would like to know more about this kind of science fiction could do far worse than pick up a copy of *The Ascent of Wonder*, edited by David G. Hartwell and Kathryn Cramer (TOR, 1994). In this massive survey of hard science fiction, Hartwell notes that “...not only is the science in science fiction the foundation of science-fictional delights, it is in fact chief among those delights.... Hard sf is about the beauty of truth ... the emotional experience of describing and confronting what is scientifically true.... [It] is the core of all science fiction....” It is also the only form of literature that deals with the important questions raised by new scientific knowledge and technological abilities. Often, it is written by practicing scientists, or by people such as Isaac Asimov who were trained as scientists but found writing more rewarding; some of these people find science fiction the only way they can express certain thoughts—for instance, fanciful speculations and dire predictions—that are not appropriate for academic journals.

The purpose of this book is not to survey all of science fiction, nor all of hard science fiction, but to present a few stories that illuminate some of the issues discussed in courses on science, technology, and society, which are currently served by nonfiction books and anthologies such as my own *Taking Sides: Clashing Views on Controversial Issues in Science, Technology, and Society* (Dushkin, 4th ed., 2000) and Albert H. Teich's *Technology and the Future* (St. Martin's, 8th ed., 2000).

The fit of this anthology with such textbooks cannot be precise, for some of the issues that appear in the texts have not yet spawned suitable stories and some stories seem worth including here even though they do not match any real-world issue well. However, in many cases the fit could not be better, and then a story must add depth and a sense of personal, human relevance to what might otherwise strike some students as abstract and bloodless.

This book's title, *Gedanken Fictions*, refers to a basic tool of science, the *gedanken* or thought experiment that must be used when laboratory experiments are not practical or possible. In today's scientific research, such experiments often take the form of computer simulations, calculating what, for instance, a massive cometary impact would do to the world's atmosphere and array of living things.

Science fiction turns “simulation” into a kind of “role playing” to do very similar things. Mike Resnick's subtle “Kirinyaga” supposes that someday we will be able to give every culture that wishes independence its own small world, and then plays out how that must work when values clash. Greg Egan's “Learning to Be Me” considers some of the consequences of serious proposals to copy a human mind into a computer. Bob Shaw's “Light of Other Days” posits an impossible technology—glass through which light takes days and months and years to pass—and considers its impact on human life.

In each case, the starting point is “What if...?,” a thought much like a hypothesis. The story is the equivalent of an experiment, but because it isn't real, because it takes place only in the imagination, it is a thought experiment, a *gedanken* (thought, in German) experiment. The story also offers a new way of looking at the underlying issue, whether it is the population problem, genetic engineering, using humans, or animal rights.

Perhaps most valuable of all, the fictional view of an issue can, when combined with nonfictional essays, provoke illuminating discussions in and out of class.

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I. Attitude

One of the reasons why science and technology are not well accepted by some members of society is the attitudes held by their proponents. Engineer Samuel Florman has effectively sketched the difficulty in his essay, “Technology and the Tragic View” (in *Blaming Technology*, St. Martin's Press, 1981; reprinted in Albert H. Teich's *Technology and the Future*, St. Martin's, 8th ed., 2000), in which he notes the kinship of those who embrace new technologies and struggle to solve their inevitable problems with the spirit of classic tragedy—challenging destiny, struggling even in the face of difficulty, demonstrating “to what heights a human being can soar.” Critics of science and technology see this as hubris, the overweening pride that seeks to displace the gods and earns only divine chastisement.

The scientific, technological mind holds itself to be rational and unsentimental, dealing with the universe on its own terms, avoiding wishful or magical thinking (including any concern about hubris). Tom Godwin's “The Cold Equations” is a classic in this vein. Despite its genuine faults—as a later writer pointed out, surgery could also solve the story's central problem—it is an excellent demonstration of how science does not “care.” And yes, the conflict between what the universe is and what we would like it to be can be enough to make us cry; at least, “The Cold Equations” still brings tears to my eyes.

The scientific, technological mind is optimistic, holding that the universe can be understood and that whatever disasters it throws our way, we can cope, given will and determination. God's will need not be done. Charles Sheffield, long an exponent of techno-optimism, demonstrates it very effectively in “Skystalk.”

Both Godwin and Sheffield show us that the scientific, technological mind is also a risk-taking mind, which many in today's risk-averse society find repugnant or dangerous. Tom Ligon's “Dear Colleagues” takes a satiric poke at the modern attitude.

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1. The Cold Equations by Tom Godwin

He was not alone.

There was nothing to indicate the fact but the white hand of the tiny gauge on the board before him. The control room was empty but for himself; there was no sound other than the murmur of the drives—but the white hand had moved. It had been on zero when the little ship was launched from the *Stardust*; now, an hour later, it had crept up. There was something in the supplies closet across the room, it was saying, some kind of a body that radiated heat.

It could be but one kind of a body—a living, human body.

He leaned back in the pilot's chair and drew a deep, slow breath, considering what he would have to do. He was an EDS pilot, inured to the sight of death, long since accustomed to it and to viewing the dying of another man with an objective lack of emotion, and he had no choice in what he must do. There could be no alternative—but it required a few moments of conditioning for even an EDS pilot to prepare himself to walk across the room and coldly, deliberately, take the life of a man he had yet to meet.

He would, of course, do it. It was the law, stated very bluntly and definitely in grim Paragraph L, Section 8, of Interstellar Regulations: *Any stowaway discovered in an EDS shall be jettisoned immediately following discovery.*

It was the law, and there could be no appeal.

It was a law not of men's choosing but made imperative by the circumstances of the space frontier. Galactic expansion had followed the development of the hyperspace drive and as men scattered wide across the frontier there had come the problem of contact with the isolated first-colonies and exploration parties. The huge hyperspace cruisers were the product of the combined genius and effort of Earth and were long and expensive in the building. They were not available in such numbers that small colonies could possess them. The cruisers carried the colonists to their new worlds and made periodic visits, running on tight schedules, but they could not stop and turn aside to visit colonies scheduled to be visited at another time; such a delay would destroy their schedule and produce a confusion and uncertainty that would wreck the complex interdependence between old Earth and new worlds of the frontier.

Some method of delivering supplies or assistance when an emergency occurred on a world not scheduled for a visit had been needed and the Emergency Dispatch Ships had been the answer. Small and collapsible, they occupied little room in the hold of the cruiser; made of light metal and plastics, they were driven by a small rocket drive that consumed relatively little fuel. Each cruiser carried four EDS's and when a call for aid was received the nearest cruiser would drop into normal space long enough to launch an EDS with the needed supplies or personnel, then vanish again as it continued on its course.

The cruisers, powered by nuclear converters, did not use the liquid rocket fuel but nuclear converters were far too large and complex to permit their installation in the EDS's. The cruisers were forced by necessity to carry a limited amount of the bulky rocket fuel and the fuel was rationed with care; the cruiser's computers determining the exact amount of fuel each EDS would require for its mission. The computers considered the course coordinates, the mass of the EDS, the mass of pilot and cargo; they were very precise and accurate and omitted nothing from their calculations. They could not, however, foresee, and allow for, the added mass of a stowaway.

The *Stardust* had received the request from one of the exploration parties stationed on Woden; the six men of the party already being stricken with the fever carried by the *greenkala* midges and their own supply of serum destroyed by the tornado that had torn through their camp. The *Stardust* had gone through the usual procedure; dropping into normal space to launch the EDS with the fever serum, then vanishing again in hyperspace. Now, an hour later, the gauge was saying there was something more than the small carton of serum in the supplies closet.

He let his eyes rest on the narrow white door of the closet. There, just inside, another man lived and breathed and was beginning to feel assured that discovery of his presence would now be too late for the pilot to alter the situation. It was too late—for the man behind the door it was far later than he thought and in a way he would find terrible to believe.

There could be no alternative. Additional fuel would be used during the hours of deceleration to compensate for the added mass of the stowaway; infinitesimal increments of fuel that would not be missed until the ship had almost reached its destination. Then, at some distance above the ground that might be as near as a thousand feet or as far as tens of thousands of feet, depending upon the mass of ship and cargo and the preceding period of deceleration, the unmissed increments of fuel would make their absence known; the EDS would expend its last drops of fuel with a sputter and go into whistling free fall. Ship and pilot and stowaway would merge together upon impact as a wreckage of metal and plastic, flesh and blood, driven deep into the soil. The stowaway had signed his own death warrant when he concealed himself on the ship; he could not be permitted to take seven others with him.

He looked again at the telltale white hand, then rose to his feet. What he must do would be unpleasant for both of them; the sooner it was over, the better. He stepped across the control room, to stand by the white door.

“Come out!” His command was harsh and abrupt above the murmur of the drive.

It seemed he could hear the whisper of a furtive movement inside the closet, then nothing. He visualized the stowaway cowering closer into one corner, suddenly worried by the possible consequences of his act and his self-assurance evaporating.

“I said out!”

He heard the stowaway move to obey and he waited with his eyes alert on the door and his hand near the blaster at his side.

The door opened and the stowaway stepped through it, smiling. “All right—I give up. Now what?”

It was a girl.

* * * *

He stared without speaking, his hand dropping away from the blaster and acceptance of what he saw coming like a heavy and unexpected physical blow. The stowaway was not a man—she was a girl in her teens, standing before him in little white gypsy sandals with the top of her brown, curly head hardly higher than his shoulder, with a faint, sweet scent of perfume coming from her and her smiling face tilted up so her eyes could look unknowing and unafraid into his as she waited for his answer.

Now what? Had it been asked in the deep, defiant voice of a man he would have answered it with action, quick and efficient. He would have taken the stowaway's identification disk and ordered him into the air lock. Had the stowaway refused to obey, he would have used the blaster. It would not have taken long; within a minute the body would have been ejected into space—had the stowaway been a man.

He returned to the pilot's chair and motioned her to seat herself on the boxlike bulk of the drive-control units that set against the wall beside him. She obeyed, his silence making the smile fade into the meek and guilty expression of a pup that has been caught in mischief and knows it must be punished.

“You still haven't told me,” she said. “I'm guilty, so what happens to me now? Do I pay a fine, or what?”

“What are you doing here?” he asked. “Why did you stow away on this EDS?”

“I wanted to see my brother. He's with the government survey crew on Woden and I haven't seen him for ten years, not since he left Earth to go into government survey work.”

“What was your destination on the *Stardust*?”

“Mimir. I have a position waiting for me there. My brother has been sending money home all the time to us—my father and mother and I—and he paid for a special course in linguistics I was taking. I graduated sooner than expected and I was offered this job on Mimir. I knew it would be almost a year before Gerry's job was done on Woden so he could come on to Mimir and that's why I hid in the closet, there. There was plenty of room for me and I was willing to pay the fine. There were only the two of us kids—Gerry and I—and I haven't seen him for so long, and I didn't want to wait another year when I could see him now, even though I knew I would be breaking some kind of a regulation when I did it.”

I knew I would be breaking some kind of a regulation—in a way, she could not be blamed for her ignorance of the law; she was of Earth and had not realized that the laws of the space frontier must, of necessity, be as hard and relentless as the environment that gave them birth. Yet, to protect such as her from the results of their own ignorance of the frontier, there had been a sign over the door that led to the section of the *Stardust* that housed EDS's; a sign that was plain for all to see and heed:

Unauthorized Personnel

Keep Out!

“Does your brother know that you took passage on the *Stardust* for Mimir?”

“Oh, yes. I sent him a spacegram telling him about my graduation and about going to Mimir on the *Stardust* a month before I left Earth. I already knew Mimir was where he would be stationed in a little over a year. He gets a promotion then and he'll be based on Mimir and not have to stay out a year at a time on field trips, like he does now.”

There were two different survey groups on Woden, and he asked, “What is his name?”

“Cross—Gerry Cross. He's in Group Two—that was the way his address read. Do you know him?”

Group One had requested the serum; Group Two was eight thousand miles away, across the Western Sea.

“No, I've never met him,” he said, then turned to the control board and cut the deceleration to a fraction of a gravity; knowing as he did so that it could not avert the ultimate end, yet doing the only thing he could do to prolong that ultimate end. The sensation was like that of the ship suddenly dropping and the girl's involuntary movement of surprise half lifted her from the seat.

“We're going faster now, aren't we?” she asked. “Why are we doing that?”

He told her the truth. “To save fuel for a little while.”

“You mean, we don't have very much?”

He delayed the answer he must give her so soon to ask: “How did you manage to stow away?”

“I just sort of walked in when no one was looking my way,” she said. “I was practicing my Gelanese on the native girl who does the cleaning in the Ship's Supply office when someone came in with an order for supplies for the survey crew on Woden. I slipped into the closet there after the ship was ready to go and just before you came in. It was an impulse of the moment to stow away, so I could get to see Gerry—and from the way you keep looking at me so grim, I'm not sure it was a very wise impulse.

“But I'll be a model criminal—or do I mean prisoner?” She smiled at him again. “I intended to pay for my keep on top of paying the fine. I can cook and I can patch clothes for everyone and I know how to do all kinds of useful things, even a little bit about nursing.”

There was one more question to ask:

“Did you know what the supplies were that the survey crew ordered?”

“Why, no. Equipment they needed in their work, I supposed.”

Why couldn't she have been a man with some ulterior motive? A fugitive from justice, hoping to lose himself on a raw new world; an opportunist, seeking transportation to the new colonies where he might find golden fleece for the taking; a crackpot, with a mission—

Perhaps once in his lifetime an EDS pilot would find such a stowaway on his ship; warped men, mean and selfish men, brutal and dangerous men—but never, before, a smiling, blue-eyed girl who was willing to pay her fine and work for her keep that she might see her brother.

He turned to the board and turned the switch that would signal the *Stardust*. The call would be futile but he could not, until he had exhausted that one vain hope, seize her and thrust her into the air lock as he

would an animal—or a man. The delay, in the meantime, would not be dangerous with the EDS decelerating at fractional gravity.

A voice spoke from the communicator. "*Stardust*. Identify yourself and proceed."

"Barton, EDS 34G11. Emergency. Give me Commander Delhart."

There was a faint confusion of noises as the request went through the proper channels. The girl was watching him, no longer smiling.

"Are you going to order them to come back after me?" she asked.

The communicator clicked and there was the sound of a distant voice saying, "Commander, the EDS requests—"

"Are they coming back after me?" she asked again. "Won't I get to see my brother, after all?"

"Barton?" The blunt, gruff voice of Commander Delhart came from the communicator. "What's this about an emergency?"

"A stowaway," he answered.

"A stowaway?" There was a slight surprise to the question. "That's rather unusual—but why the 'emergency' call? You discovered him in time so there should be no appreciable danger and I presume you've informed Ship's Records so his nearest relatives can be notified."

"That's why I had to call you, first. The stowaway is still aboard and the circumstances are so different—"

"Different?" the commander interrupted, impatience in his voice. "How can they be different? You know you have a limited supply of fuel; you also know the law, as well as I do: 'Any stowaway discovered in an EDS shall be jettisoned immediately following discovery.'"

There was the sound of a sharply indrawn breath from the girl. "*What does he mean?*"

"The stowaway is a girl."

"*What?*"

"She wanted to see her brother. She's only a kid and she didn't know what she was really doing."

"I see." All the curtness was gone from the commander's voice. "So you called me in the hope I could do something?" Without waiting for an answer he went on. "I'm sorry—I can do nothing. This cruiser must maintain its schedule; the life of not one person but the lives of many depend on it. I know how you feel but I'm powerless to help you. You'll have to go through with it. I'll have you connected with Ship's Records."

* * * *

The communicator faded to a faint rustle of sound and he turned back to the girl. She was leaning forward on the bench, almost rigid, her eyes fixed wide and frightened.

"What did he mean, to go through with it? To jettison me ... to go through with it—what did he mean? Not the way it sounded ... he couldn't have. What did he mean ... what did he really mean?"

Her time was too short for the comfort of a lie to be more than a cruelly fleeting delusion.

“He meant it the way it sounded.”

“No!” She recoiled from him as though he had struck her, one hand half upraised as though to fend him off and stark unwillingness to believe in her eyes.

“It will have to be.”

“No! You're joking—you're insane! You can't mean it!”

“I'm sorry.” He spoke slowly to her, gently. “I should have told you before—I should have, but I had to do what I could first; I had to call the *Stardust*. You heard what the commander said.”

“But you can't—if you make me leave the ship, I'll die.”

“I know.”

She searched his face and the unwillingness to believe left her eyes, giving way slowly to a look of dazed terror.

“You—know?” She spoke the words far apart, numb and wonderingly.

“I know. It has to be like that.”

“You mean it—you really mean it.” She sagged back against the wall, small and limp like a little rag doll and all the protesting and disbelief gone.

“You're going to do it—you're going to make me die?”

“I'm sorry,” he said again. “You'll never know how sorry I am. It has to be that way and no human in the universe can change it.”

“You're going to make me die and I didn't do anything to die for—I didn't do anything—”

He sighed, deep and weary. “I know you didn't, child. I know you didn't—”

“EDS.” The communicator rapped brisk and metallic. “This is Ship's Records. Give us all information on subject's identification disk.”

He got out of his chair to stand over her. She clutched the edge of the seat, her upturned face white under the brown hair and the lipstick standing out like a blood-red cupid's bow.

“Now?”

“I want your identification disk,” he said.

She released the edge of the seat and fumbled at the chain that suspended the plastic disk from her neck with fingers that were trembling and awkward. He reached down and unfastened the clasp for her, then returned with the disk to his chair.

“Here's your data, Records: Identification Number T837—”

“One moment,” Records interrupted. “This is to be filed on the gray card, of course?”

“Yes.”

“And the time of the execution?”

“I’ll tell you later.”

“Later? This is highly irregular; the time of the subject’s death is required before—”

He kept the thickness out of his voice with an effort. “Then we’ll do it in a highly irregular manner—you’ll hear the disk read, first. The subject is a girl and she’s listening to everything that’s said. Are you capable of understanding that?”

There was a brief, almost shocked, silence, then Records said meekly: “Sorry. Go ahead.”

He began to read the disk, reading it slowly to delay the inevitable for as long as possible, trying to help her by giving her what little time he could to recover from her first terror and let it resolve into the calm of acceptance and resignation.

“Number T8374 dash Y54. Name: Marilyn Lee Cross. Sex: Female. Born: July 7, 2160. *She was only eighteen.* Height: 5-3. Weight: 110. *Such a slight weight, yet enough to add fatally to the mass of the shell-thin bubble that was an EDS.* Hair: Brown. Eyes: Blue. Complexion: Light. Blood Type: O. *Irrelevant data.* Destination: Port City, Mimir. *Invalid data —*”

He finished and said, “I’ll call you later,” then turned once again to the girl. She was huddled back against the wall, watching him with a look of numb and wondering fascination.

* * * *

“They’re waiting for you to kill me, aren’t they? They want me dead, don’t they? You and everybody on the cruiser wants me dead, don’t you?” Then the numbness broke and her voice was that of a frightened and bewildered child. “Everybody wants me dead and I didn’t do anything. I didn’t hurt anyone—I only wanted to see my brother.”

“It’s not the way you think—it isn’t that way, at all,” he said. “Nobody wants it this way; nobody would ever let it be this way if it was humanly possible to change it.”

“Then why is it! I don’t understand. Why is it?”

“This ship is carrying *kala* fever serum to Group One on Woden. Their own supply was destroyed by a tornado. Group Two—the crew your brother is in—is eight thousand miles away across the Western Sea and their helicopters can’t cross it to help Group One. The fever is invariably fatal unless the serum can be had in time, and the six men in Group One will die unless this ship reaches them on schedule. These little ships are always given barely enough fuel to reach their destination and if you stay aboard your added weight will cause it to use up all its fuel before it reaches the ground. It will crash, then, and you and I will die and so will the six men waiting for the fever serum.”

It was a full minute before she spoke, and as she considered his words the expression of numbness left her eyes.

“Is that it?” she asked at last. “Just that the ship doesn’t have enough fuel?”

“Yes.”

“I can go alone or I can take seven others with me—is that the way it is?”

“That’s the way it is.”

“And nobody wants me to have to die?”

“Nobody.”

“Then maybe—Are you sure nothing can be done about it? Wouldn't people help me if they could?”

“Everyone would like to help you but there is nothing anyone can do. I did the only thing I could do when I called the *Stardust*.”

“And it won't come back—but there might be other cruisers, mightn't there? Isn't there any hope at all that there might be someone, somewhere, who could do something to help me?”

She was leaning forward a little in her eagerness as she waited for his answer.

“No.”

The word was like the drop of a cold stone and she again leaned back against the wall, the hope and eagerness leaving her face. “You're sure—you know you're sure?”

“I'm sure. There are no other cruisers within forty light-years; there is nothing and no one to change things.”

She dropped her gaze to her lap and began twisting a pleat of her skirt between her fingers, saying no more as her mind began to adapt itself to the grim knowledge.

* * * *

It was better so; with the going of all hope would go the fear; with the going of all hope would come resignation. She needed time and she could have so little of it. How much?

The EDS's were not equipped with hull-cooling units; their speed had to be reduced to a moderate level before entering the atmosphere. They were decelerating at .10 gravity; approaching their destination at a far higher speed than the computers had calculated on. The *Stardust* had been quite near Woden when she launched the EDS; their present velocity was putting them nearer by the second. There would be a critical point, soon to be reached, when he would have to resume deceleration. When he did so the girl's weight would be multiplied by the gravities of deceleration, would become, suddenly, a factor of paramount importance; the factor the computers had been ignorant of when they determined the amount of fuel the EDS should have. She would have to go when deceleration began; it could be no other way. When would that be—how long could he let her stay?

“How long can I stay?”

He winced involuntarily from the words that were so like an echo of his own thoughts. How long? He didn't know; he would have to ask the ship's computers. Each EDS was given a meager surplus of fuel to compensate for unfavorable conditions within the atmosphere and relatively little fuel was being consumed for the time being. The memory banks of the computers would still contain all data pertaining to the course set for the EDS; such data would not be erased until the EDS reached its destination. He had only to give the computers the new data; the girl's weight and the exact time at which he had reduced the deceleration to .10.

“Barton.” Commander Delhart's voice came abruptly from the communicator, as he opened his mouth to call the *Stardust*. “A check with Records shows me you haven't completed your report. Did you reduce the deceleration?”

So the commander knew what he was trying to do.

“I'm decelerating at point ten,” he answered. “I cut the deceleration at seventeen fifty and the weight is a

hundred and ten. I would like to stay at point ten as long as the computers say I can. Will you give them the question?"

It was contrary to regulations for an EDS pilot to make any changes in the course or degree of deceleration the computers had set for him but the commander made no mention of the violation, neither did he ask the reason for it. It was not necessary for him to ask; he had not become commander of an interstellar cruiser without both intelligence and an understanding of human nature. He said only: "I'll have that given the computers."

The communicator fell silent and he and the girl waited, neither of them speaking. They would not have to wait long; the computers would give the answer within moments of the asking. The new factors would be fed into the steel maw of the first bank and the electrical impulses would go through the complex circuits. Here and there a relay might click, a tiny cog turn over, but it would be essentially the electrical impulses that found the answer; formless, mindless, invisible, determining with utter precision how long the pale girl beside him might live. Then five little segments of metal in the second bank would trip in rapid succession against an inked ribbon and a second steel maw would spit out the slip of paper that bore the answer.

The chronometer on the instrument board read 18:10 when the commander spoke again.

"You will resume deceleration at nineteen ten."

She looked toward the chronometer, then quickly away from it. "Is that when ... when I go?" she asked. He nodded and she dropped her eyes to her lap again.

"I'll have the course corrections given you," the commander said. "Ordinarily I would never permit anything like this but I understand your position. There is nothing I can do, other than what I've just done, and you will not deviate from these new instructions. You will complete your report at nineteen ten. Now—here are the course corrections."

The voice of some unknown technician read them to him and he wrote them down on the pad clipped to the edge of the control board. There would, he saw, be periods of deceleration when he neared the atmosphere when the deceleration would be five gravities—and at five gravities, one hundred ten pounds would become five hundred fifty pounds.

The technician finished and he terminated the contact with a brief acknowledgment. Then, hesitating a moment, he reached out and shut off the communicator. It was 18:13 and he would have nothing to report until 19:10. In the meantime, it somehow seemed indecent to permit others to hear what she might say in her last hour.

* * * *

He began to check the instrument readings, going over them with unnecessary slowness. She would have to accept the circumstances and there was nothing he could do to help her into acceptance; words of sympathy would only delay it.

It was 18:20 when she stirred from her motionlessness and spoke.

"So that's the way it has to be with me?"

He swung around to face her. "You understand now, don't you? No one would ever let it be like this if it could be changed."

"I understand," she said. Some of the color had returned to her face and the lipstick no longer stood out so vividly red. "There isn't enough fuel for me to stay; when I hid on this ship I got into something I didn't

know anything about and now I have to pay for it.”

She had violated a man-made law that said Keep Out but the penalty was not of men's making or desire and it was a penalty men could not revoke. A physical law had decreed: *h amount of fuel will power an EDS with a mass of m safely to its destination* ; and a second physical law had decreed: *h amount of fuel will not power an EDS with a mass of m plus x safely to its destination*.

EDS's obeyed only physical laws and no amount of human sympathy for her could alter the second law.

“But I'm afraid. I don't want to die—not now. I want to live and nobody is doing anything to help me; everybody is letting me go ahead and acting just like nothing was going to happen to me. I'm going to die and nobody cares.”

“We all do,” he said. “I do and the commander does and the clerk in Ship's Records; we all care and each of us did what little he could to help you. It wasn't enough—it was almost nothing—but it was all we could do.”

“Not enough fuel—I can understand that,” she said, as though she had not heard his own words. “But to have to die for it. *Me*, alone—”

How hard it must be for her to accept the fact. She had never known danger of death; had never known the environments where the lives of men could be as fragile and fleeting as sea foam tossed against a rocky shore. She belonged on gentle Earth, in that secure and peaceful society where she could be young and gay and laughing with the others of her kind; where life was precious and well-guarded and there was always the assurance that tomorrow would come. She belonged in that world of soft winds and warm suns, music and moonlight and gracious manners and not on the hard, bleak frontier.

“How did it happen to me, so terribly quickly? An hour ago I was on the *Stardust*, going to Mimir. Now the *Stardust* is going on without me and I'm going to die and I'll never see Gerry and Mama and Daddy again—I'll never see anything again.”

He hesitated, wondering how he could explain it to her so she would really understand and not feel she had, somehow, been the victim of a reasonlessly cruel injustice. She did not know what the frontier was like; she thought in terms of safe-and-secure Earth. Pretty girls were not jettisoned on Earth; there was a law against it. On Earth her plight would have filled the newscasts and a fast black Patrol ship would have been racing to her rescue. Everyone, everywhere, would have known of Marilyn Lee Cross and no effort would have been spared to save her life. But this was not Earth and there were no Patrol ships; only the *Stardust*, leaving them behind at many times the speed of light. There was no one to help her, there would be no Marilyn Lee Cross smiling from the newscasts tomorrow. Marilyn Lee Cross would be but a poignant memory for an EDS pilot and a name on a gray card in Ship's Records.

“It's different here; it's not like back on Earth,” he said. “It isn't that no one cares; it's that no one can do anything to help. The frontier is big and here along its rim the colonies and exploration parties are scattered so thin and far between. On Woden, for example, there are only sixteen men—sixteen men on an entire world. The exploration parties, the survey crews, the little first-colonies—they're all fighting alien environments, trying to make a way for those who will follow after. The environments fight back and those who go first usually make mistakes only once. There is no margin of safety along the rim of the frontier; there can't be until the way is made for the others who will come later, until the new worlds are tamed and settled. Until then men will have to pay the penalty for making mistakes with no one to help them because there is no one to help them.”

“I was going to Mimir,” she said. “I didn't know about the frontier; I was only going to Mimir and *it's* safe.”

“Mimir is safe but you left the cruiser that was taking you there.”

She was silent for a while. “It was all so wonderful at first; there was plenty of room for me on this ship and I would be seeing Gerry so soon ... I didn't know about the fuel, didn't know what would happen to me—”

Her words trailed away and he turned his attention to the viewscreen, not wanting to stare at her as she fought her way through the black horror of fear toward the calm gray of acceptance.

Woden was a ball, enshrouded in the blue haze of its atmosphere, swimming in space against the background of star-sprinkled dead blackness. The great mass of Manning's Continent sprawled like a gigantic hourglass in the Eastern Sea with the western half of the Eastern Continent still visible. There was a thin line of shadow along the right-hand edge of the globe and the Eastern Continent was disappearing into it as the planet turned on its axis. An hour before the entire continent had been in view, now a thousand miles of it had gone into the thin edge of shadow and around to the night that lay on the other side of the world. The dark blue spot that was Lotus Lake was approaching the shadow. It was somewhere near the southern edge of the lake that Group Two had their camp. It would be night there, soon, and quick behind the coming of night the rotation of Woden on its axis would put Group Two beyond the reach of the ship's radio.

He would have to tell her before it was too late for her to talk to her brother. In a way, it would be better for both of them should they not do so but it was not for him to decide. To each of them the last words would be something to hold and cherish, something that would cut like the blade of a knife yet would be infinitely precious to remember, she for her own brief moments to live and he for the rest of his life.

He held down the button that would flash the grid lines on the view-screen and used the known diameter of the planet to estimate the distance the southern tip of Lotus Lake had yet to go until it passed beyond radio range. It was approximately five hundred miles. Five hundred miles; thirty minutes—and the chronometer read 18:30. Allowing for error in estimating, it could not be later than 19:05 that the turning of Woden would cut off her brother's voice.

The first border of the Western Continent was already in sight along the left side of the world. Four thousand miles across it lay the shore of the Western Sea and the Camp of Group One. It had been in the Western Sea that the tornado had originated, to strike with such fury at the camp and destroy half their prefabricated buildings, including the one that housed the medical supplies. Two days before the tornado had not existed; it had been no more than great gentle masses of air out over the calm Western Sea. Group One had gone about their routine survey work, unaware of the meeting of the air masses out at sea, unaware of the force the union was spawning. It had struck their camp without warning; a thundering, roaring destruction that sought to annihilate all that lay before it. It had passed on, leaving the wreckage in its wake. It had destroyed the labor of months and had doomed six men to die and then, as though its task was accomplished, it once more began to resolve into gentle masses of air. But for all its deadliness, it had destroyed with neither malice nor intent. It had been a blind and mindless force, obeying the laws of nature, and it would have followed the same course with the same fury had men never existed.

Existence required Order and there was order; the laws of nature, irrevocable and immutable. Men could learn to use them but men could not change them. The circumference of a circle was always pi times the diameter and no science of Man would ever make it otherwise. The combination of chemical A with chemical B under condition C invariably produced reaction D. The law of gravitation was a rigid equation and it made no distinction between the fall of a leaf and the ponderous circling of a binary star system. The nuclear conversion process powered the cruisers that carried men to the stars; the same process in the form of a nova would destroy a world with equal efficiency. The laws *were*, and the universe moved

in obedience to them. Along the frontier were arrayed all the forces of nature and sometimes they destroyed those who were fighting their way outward from Earth. The men of the frontier had long ago learned the bitter futility of cursing the forces that would destroy them for the forces were blind and deaf; the futility of looking to the heavens for mercy, for the stars of the galaxy swung in their long, long sweep of two hundred million years, as inexorably controlled as they by the laws that knew neither hatred nor compassion.

The men of the frontier knew—but how was a girl from Earth to fully understand? *H amount of fuel will not power an EDS with a mass of m plus x safely to its destination.* To himself and her brother and parents she was a sweet-faced girl in her teens; to the laws of nature she was x , the unwanted factor in a cold equation.

She stirred again on the seat. “Could I write a letter? I want to write to Mama and Daddy and I’d like to talk to Gerry. Could you let me talk to him over your radio there?”

“I’ll try to get him,” he said.

He switched on the normal-space transmitter and pressed the signal button. Someone answered the buzzer almost immediately.

“Hello. How’s it going with you fellows now—is the EDS on its way?”

“This isn’t Group One; this is the EDS,” he said. “Is Gerry Cross there?”

“Gerry? He and two others went out in the helicopter this morning and aren’t back yet. It’s almost sundown, though, and he ought to be back right away—in less than an hour at the most.”

“Can you connect me through to the radio in his ‘copter?”

“Huh-uh. It’s been out of commission for two months—some printed circuits went haywire and we can’t get any more until the next cruiser stops by. Is it something important—bad news for him, or something?”

“Yes—it’s very important. When he comes in get him to the transmitter as soon as you possibly can.”

“I’ll do that; I’ll have one of the boys waiting at the field with a truck. Is there anything else I can do?”

“No, I guess that’s all. Get him there as soon as you can and signal me.”

He turned the volume to an inaudible minimum, an act that would not affect the functioning of the signal buzzer, and unclipped the pad of paper from the control board. He tore off the sheet containing his flight instructions and handed the pad to her, together with pencil.

“I’d better write to Gerry, too,” she said as she took them. “He might not get back to camp in time.”

She began to write, her fingers still clumsy and uncertain in the way they handled the pencil and the top of it trembling a little as she poised it between words. He turned back to the viewscreen, to stare at it without seeing it.

She was a lonely little child, trying to say her last good-by, and she would lay out her heart to them. She would tell them how much she loved them and she would tell them to not feel badly about it, that it was only something that must happen eventually to everyone and she was not afraid. The last would be a lie and it would be there to read between the sprawling, uneven lines; a valiant little lie that would make the hurt all the greater for them.

Her brother was of the frontier and he would understand. He would not hate the EDS pilot for doing nothing to prevent her going; he would know there had been nothing the pilot could do. He would understand, though the understanding would not soften the shock and pain when he learned his sister was gone. But the others, her father and mother—they would not understand. They were of Earth and they would think in the manner of those who had never lived where the safety margin of life was a thin, thin line—and sometimes not at all. What would they think of the faceless, unknown pilot who had sent her to her death?

They would hate him with cold and terrible intensity but it really didn't matter. He would never see them, never know them. He would have only the memories to remind him; only the nights to fear, when a blue-eyed girl in gypsy sandals would come in his dreams to die again—

He scowled at the viewscreen and tried to force his thoughts into less emotional channels. There was nothing he could do to help her. She had unknowingly subjected herself to the penalty of a law that recognized neither innocence nor youth nor beauty, that was incapable of sympathy or leniency. Regret was illogical—and yet, could knowing it to be illogical ever keep it away?

She stopped occasionally, as though trying to find the right words to tell them what she wanted them to know, then the pencil would resume its whispering to the paper. It was 18:37 when she folded the letter in a square and wrote a name on it. She began writing another, twice looking up at the chronometer as though she feared the black hand might reach its rendezvous before she had finished. It was 18:45 when she folded it as she had done the first letter and wrote a name and address on it.

She held the letters out to him. “Will you take care of these and see that they're enveloped and mailed?”

“Of course.” He took them from her hand and placed them in a pocket of his gray uniform shirt.

“These can't be sent off until the next cruiser stops by and the *Stardust* will have long since told them about me, won't it?” she asked. He nodded and she went on, “That makes the letters not important in one way but in another way they're very important—to me, and to them.”

“I know. I understand, and I'll take care of them.”

She glanced at the chronometer, then back to him. “It seems to move faster all the time, doesn't it?”

He said nothing, unable to think of anything to say, and she asked, “Do you think Gerry will come back to camp in time?”

“I think so. They said he should be in right away.”

She began to roll the pencil back and forth between her palms. “I hope he does. I feel sick and scared and I want to hear his voice again and maybe I won't feel so alone. I'm a coward and I can't help it.”

“No,” he said, “you're not a coward. You're afraid, but you're not a coward.”

“Is there a difference?”

He nodded. “A lot of difference.”

“I feel so alone. I never did feel like this before; like I was all by myself and there was nobody to care what happened to me. Always, before, there was Mama and Daddy there and my friends around me. I had lots of friends, and they had a going-away party for me the night before I left.”

Friends and music and laughter for her to remember—and on the viewscreen Lotus Lake was going into

the shadow.

“Is it the same with Gerry?” she asked. “I mean, if he should make a mistake, would he have to die for it, all alone and with no one to help him?”

“It's the same with all along the frontier; it will always be like that so long as there is a frontier.”

“Gerry didn't tell us. He said the pay was good and he sent money home all the time because Daddy's little shop just brought in a bare living but he didn't tell us it was like this.”

“He didn't tell you his work was dangerous?”

“Well—yes. He mentioned that, but we didn't understand. I always thought danger along the frontier was something that was a lot of fun; an exciting adventure, like in the three-D shows.” A wan smile touched her face for a moment. “Only it's not, is it? It's not the same at all, because when it's real you can't go home after the show is over.”

“No,” he said. “No, you can't.”

Her glance flicked from the chronometer to the door of the air lock then down to the pad and pencil she still held. She shifted her position slightly to lay them on the bench beside, moving one foot out a little. For the first time he saw that she was not wearing Vegan gypsy sandals but only cheap imitations; the expensive Vegan leather was some kind of grained plastic, the silver buckle was gilded iron, the jewels were colored glass. *Daddy's little shop just brought in a bare living* —She must have left college in her second year, to take the course in linguistics that would enable her to make her own way and help her brother provide for her parents, earning what she could by part-time work after classes were over. Her personal possessions on the *Stardust* would be taken back to her parents—they would neither be of much value nor occupy much storage space on the return voyage.

* * * *

“Isn't it—” She stopped, and he looked at her questioningly. “Isn't it cold in here?” she asked, almost apologetically. “Doesn't it seem cold to you?”

“Why, yes,” he said. He saw by the main temperature gauge that the room was at precisely normal temperature. “Yes, it's colder than it should be.”

“I wish Gerry would get back before it's too late. Do you really think he will, and you didn't just say so to make me feel better?”

“I think he will—they said he would be in pretty soon.” On the viewscreen Lotus Lake had gone into the shadow but for the thin blue line of its western edge and it was apparent he had overestimated the time she would have in which to talk to her brother. Reluctantly, he said to her, “His camp will be out of radio range in a few minutes; he's on that part of Woden that's in the shadow”—he indicated the viewscreen—“and the turning of Woden will put him beyond contact. There may not be much time left when he comes in—not much time to talk to him before he fades out. I wish I could do something about it—I would call him right now if I could.”

“Not even as much time as I will have to stay?”

“I'm afraid not.”

“Then—” She straightened and looked toward the air lock with pale resolution. “Then I'll go when Gerry passes beyond range. I won't wait any longer after that—I won't have anything to wait for.”

Again there was nothing he could say.

“Maybe I shouldn't wait at all. Maybe I'm selfish—maybe it would be better for Gerry if you just told him about it afterward.”

There was an unconscious pleading for denial in the way she spoke and he said, “He wouldn't want you to do that, to not wait for him.”

“It's already coming dark where he is, isn't it? There will be all the long night before him, and Mama and Daddy don't know yet that I won't ever be coming back like I promised them I would. I've caused everyone I love to be hurt, haven't I? I didn't want to—I didn't intend to.”

“It wasn't your fault,” he said. “It wasn't your fault at all. They'll know that. They'll understand.”

“At first I was so afraid to die that I was a coward and thought only of myself. Now, I see how selfish I was. The terrible thing about dying like this is not that I'll be gone but that I'll never see them again; never be able to tell them that I didn't take them for granted; never be able to tell them I knew of the sacrifices they made to make my life happier, that I knew all the things they did for me and that I loved them so much more than I ever told them. I've never told them any of those things. You don't tell them such things when you're young and your life is all before you—you're afraid of sounding sentimental and silly.

“But it's so different when you have to die—you wish you had told them while you could and you wish you could tell them you're sorry for all the little mean things you ever did or said to them. you wish you could tell them that you didn't really mean to ever hurt their feelings and for them to only remember that you always loved them far more than you ever let them know.”

“You don't have to tell them that,” he said. “They will know—they've always known it.”

“Are you sure?” she asked. “How can you be sure? My people are strangers to you.”

“Wherever you go, human nature and human hearts are the same.”

“And they will know what I want them to know—that I love them?”

“They've always known it, in a way far better than you could ever put in words for them.”

“I keep remembering the things they did for me, and it's the little things they did that seem to be the most important to me, now. Like Gerry—he sent me a bracelet of fire-rubies on my sixteenth birthday. It was beautiful—it must have cost him a month's pay. Yet, I remember him more for what he did the night my kitten got run over in the street. I was only six years old and he held me in his arms and wiped away my tears and told me not to cry, that Flossy was gone for just a little while, for just long enough to get herself a new fur coat and she would be on the foot of my bed the very next morning. I believed him and quit crying and went to sleep dreaming about my kitten coming back. When I woke up the next morning, there was Flossy on the foot of my bed in a brand-new white fur coat, just like he had said she would be.

“It wasn't until a long time later that Mama told me Gerry had got the pet-shop owner out of bed at four in the morning and, when the man got mad about it, Gerry told him he was either going to go down and sell him the white kitten right then or he'd break his neck.”

“It's always the little things you remember people by; all the little things they did because they wanted to do them for you. You've done the same for Gerry and your father and mother; all kinds of things that you've forgotten about but that they will never forget.”

“I hope I have. I would like for them to remember me like that.”

“They will.”

“I wish—” She swallowed. “The way I’ll die—I wish they wouldn’t ever think of that. I’ve read how people look who die in space—their insides all ruptured and exploded and their lungs out between their teeth and then, a few seconds later, they’re all dry and shapeless and horribly ugly. I don’t want them to ever think of me as something dead and horrible, like that.”

“You’re their own, their child and their sister. They could never think of you other than the way you would want them to; the way you looked the last time they saw you.”

“I’m still afraid,” she said. “I can’t help it, but I don’t want Gerry to know it. If he gets back in time, I’m going to act like I’m not afraid at all and—”

The signal buzzer interrupted her, quick and imperative.

“Gerry!” She came to her feet. “It’s Gerry, now!”

* * * *

He spun the volume control knob and asked: “Gerry Cross?”

“Yes,” her brother answered, an undertone of tenseness to his reply. “The bad news—what is it?”

She answered for him, standing close behind him and leaning down a little toward the communicator, her hand resting small and cold on his shoulder.

“Hello, Gerry.” There was only a faint quaver to betray the careful casualness of her voice. “I wanted to see you—”

“Marilyn!” There was sudden and terrible apprehension in the way he spoke her name. “What are you doing on that EDS?”

“I wanted to see you,” she said again. “I wanted to see you, so I hid on this ship—”

“You hid on it?”

“I’m a stowaway ... I didn’t know what it would mean—”

“*Marilyn!*” It was the cry of a man who calls hopeless and desperate to someone already and forever gone from him. “What have you done?”

“I ... it’s not—” Then her own composure broke and the cold little hand gripped his shoulder convulsively. “Don’t, Gerry—I only wanted to see you; I didn’t intend to hurt you. Please, Gerry, don’t feel like that—”

Something warm and wet splashed on his wrist and he slid out of the chair, to help her into it and swing the microphone down to her own level.

“Don’t feel like that—Don’t let me go knowing you feel like that—”

The sob she had tried to hold back choked in her throat and her brother spoke to her. “Don’t cry, Marilyn.” His voice was suddenly deep and infinitely gentle, with all the pain held out of it. “Don’t cry, Sis—you mustn’t do that. It’s all right, Honey—everything is all right.”

“I—” Her lower lip quivered and she bit into it. “I didn’t want you to feel that way—I just wanted us to say good-by because I have to go in a minute.”

“Sure—sure. That's the way it will be, Sis. I didn't mean to sound the way I did.” Then his voice changed to a tone of quick and urgent demand. “EDS—have you called the *Stardust*? Did you check with the computers?”

“I called the *Stardust* almost an hour ago. It can't turn back, there are no other cruisers within forty light-years, and there isn't enough fuel.”

“Are you sure that the computers had the correct data—sure of everything?”

“Yes—do you think I could ever let it happen if I wasn't sure? I did everything I could do. If there was anything at all I could do now, I would do it.”

“He tried to help me, Gerry.” Her lower lip was no longer trembling and the short sleeves of her blouse were wet where she had dried her tears. “No one can help me and I'm not going to cry any more and everything will be all right with you and Daddy and Mama, won't it?”

“Sure—sure it will. We'll make out fine.”

Her brother's words were beginning to come in more faintly and he turned the volume control to maximum. “He's going out of range,” he said to her. “He'll be gone within another minute.”

“You're fading out, Gerry,” she said. “You're going out of range. I wanted to tell you—but I can't, now. We must say good-by so soon—but maybe I'll see you again. Maybe I'll come to you in your dreams with my hair in braids and crying because the kitten in my arms is dead; maybe I'll be the touch of a breeze that whispers to you as it goes by; maybe I'll be one of those gold-winged larks you told me about, singing my silly head off to you; maybe, at times, I'll be nothing you can see but you will know I'm there beside you. Think of me like that, Gerry; always like that and not—the other way.”

Dimmed to a whisper by the turning of Woden, the answer came back:

“Always like that, Marilyn—always like that and never any other way.”

“Our time is up, Gerry—I have to go now. Good—” Her voice broke in mid-word and her mouth tried to twist into crying. She pressed her hand hard against it and when she spoke again the words came clear and true:

“Good-by, Gerry.”

Faint and ineffably poignant and tender, the last words came from the cold metal of the communicator:

“Good-by, little sister—”

* * * *

She sat motionless in the hush that followed, as though listening to the shadow-echoes of the words as they died away, then she turned away from the communicator, toward the air lock, and he pulled the black lever beside him. The inner door of the air lock slid swiftly open, to reveal the bare little cell that was waiting for her, and she walked to it.

She walked with her head up and the brown curls brushing her shoulders, with the white sandals stepping as sure and steady as the fractional gravity would permit and the gilded buckles twinkling with little lights of blue and red and crystal. He let her walk alone and made no move to help her, knowing she would not want it that way. She stepped into the air lock and turned to face him, only the pulse in her throat to betray the wild beating of her heart.

“I’m ready,” she said.

He pushed the lever up and the door slid its quick barrier between them, inclosing her in black and utter darkness for her last moments of life. It clicked as it locked in place and he jerked down the red lever. There was a slight waver to the ship as the air gushed from the lock, a vibration to the wall as though something had bumped the outer door in passing, then there was nothing and the ship was dropping true and steady again. He shoved the red lever back to close the door on the empty air lock and turned away, to walk to the pilot's chair with the slow steps of a man old and weary.

Back in the pilot's chair he pressed the signal button of the normal-space transmitter. There was no response; he had expected none. Her brother would have to wait through the night until the turning of Woden permitted contact through Group One.

It was not yet time to resume deceleration and he waited while the ship dropped endlessly downward with him and the drives purred softly. He saw that the white hand of the supplies closet temperature gauge was on zero. A cold equation had been balanced and he was alone on the ship. Something shapeless and ugly was hurrying ahead of him, going to Woden where its brother was waiting through the night, but the empty ship still lived for a little while with the presence of the girl who had not known about the forces that killed with neither hatred nor malice. It seemed, almost, that she still sat small and bewildered and frightened on the metal box beside him, her words echoing hauntingly clear in the void she had left behind her:

I didn't do anything to die for—I didn't do anything—

About the Author

Tom Godwin (1915-1980) published only thirty science fiction stories in his lifetime. “The Cold Equations” is the most famous of them.

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2. Skystalk by Charles Sheffield

Finlay's Law: Trouble comes at 3:00 A.M. That's always been my experience, and I've learned to dread the hand on my shoulder that shakes me to wakefulness. My dreams had been bad enough, blasting off into orbit on top of an old chemical rocket, riding the torch, up there on a couple of thousand tons of volatile explosives. I'll never understand the nerve of the old-timers, willing to sit up there on one of those monsters.

I shuddered, forced my eyes open, and looked up at Marston's anxious face. I was already sitting up.

“Trouble?” It was a stupid question, but you're allowed a couple of those when you first wake up.

His voice was shaky. “There's a bomb on the Beanstalk.”

I was off the bunk, pulling on my undershirt and groping around for my shoes. Larry Marston's words pulled me bolt upright.

“What do you mean, *on* the Beanstalk?”

“That's what Velasquez told me. He won't say more until you get on the line. They're holding a coded circuit open to Earth.”

I gave up my search for shoes and went barefoot after Marston. If Arnold Velasquez were right—and I didn't see how he could be—then one of my old horrors was coming true. The Beanstalk had been designed to withstand most natural events, but sabotage was one thing that could never be fully ruled out. At any moment, we had nearly four hundred buckets climbing the Stalk and the same number going down. With the best screening in the world, with hefty rewards for information even of *rumors* of sabotage, there was always the small chance that something could be sneaked through on an outbound bucket. I had less worries about the buckets that went down to Earth. Sabotage from the space end had little to offer its perpetrators, and the Colonies would provide an unpleasant form of death to anyone who tried it, with no questions asked.

Arnold Velasquez was sitting in front of his screen door at Tether Control in Quito. Next to him stood a man I recognized only from news pictures: Otto Panosky, a top aide to the president. Neither man seemed to be looking at the screen. I wondered what they were seeing on their inward eye.

“Jack Finlay here,” I said. “What's the story, Arnold?”

There was a perceptible lag before his head came up to stare at the screen, the quarter of a second that it took the video signal to go down to Earth, then back up to synchronous orbit.

“It's best if I read it to you, Jack,” he said. At least his voice was under control, even though I could see his hands shaking as they held the paper. “The president's office got this in over the telecopier about twenty minutes ago.”

He rubbed at the side of his face, in the nervous gesture that I had seen during most major stages of the Beanstalk's construction. “It's addressed to us, here in Sky Stalk Control. It's quite short. ‘To the head of Space Transportation Systems. A fusion bomb has been placed in one of the outgoing buckets. It is of four megaton capacity, and was armed prior to placement. The secondary activation command can be given at any time by a coded radio signal. Unless terms are met by the president and World Congress on or before 02:00 U.T., seventy-two hours from now, we will give the command to explode the device. Our terms are set out in the following four paragraphs. One—”

“Never mind those, Arnold.” I waved my hand, impatient at the signal delay. “Just tell me one thing. Will Congress meet their demands?”

He shook his head. “They can't. What's being asked for is preposterous in the time available. You know how much red tape there is in the intergovernmental relationships.”

“You told them that?”

“Of course. We sent out a general broadcast.” He shrugged. “It was no good. We're dealing with fanatics, with madmen. I need to know what you can do at your end.”

“How much time do we have now?”

He looked at his watch. “Seventy-one and a half hours, if they mean what they say. You understand that we have no idea which bucket might be carrying the bomb. It could have been planted there days ago, and still be on the way up.”

He was right. The buckets—there were three hundred and eighty-four of them each way—moved at a steady five kilometers a minute, up or down. That's a respectable speed, but it still took almost five days for each one of them to climb the cable of the Beanstalk out to our position in synchronous orbit.

Then I thought a bit more, and decided he wasn't quite right.

“It's not that vague, Arnold. You can bet the bomb wasn't placed on a bucket that started out more than two days ago. Otherwise, we could wait for it to get here and disarm it, and still be inside their deadline. It must still be fairly close to Earth, I'd guess.”

“Well, even if you're right, that deduction doesn't help us.” He was chewing a pen to bits between sentences. “We don't have anything here that could be ready in time to fly out and take a look, even if it's only a couple of thousand kilometers. Even if we did, and even if we could spot the bomb, we couldn't rendezvous with a bucket on the Stalk. That's why I need to know what you can do from your end. Can you handle it from there?”

I took a deep breath and swung my chair to face Larry Marston.

“Larry, four megatons would vaporize a few kilometers of the main cable. How hard would it be for us to release ballast at the top end of the cable, above us here, enough to leave this station in position?”

“Well...” He hesitated. “We could do that, Jack. But then we'd lose the power satellite. It's right out at the end there, by the ballast. Without it, we'd lose all the power at the station here, and all the buckets too—there isn't enough reserve power to keep the magnetic fields going. We'd need all our spare power to keep the recycling going here.”

That was the moment when I finally came fully awake. I realized the implications of what he was saying, and was nodding before he'd finished speaking. Without adequate power, we'd be looking at a very messy situation.

“And it wouldn't only be us,” I said to Velasquez and Panosky, sitting there tense in front of their screen. “Everybody on the Colonies will run low on air and water if the supply through the Stalk breaks down. Damn it, we've been warning Congress how vulnerable we are for years. All the time, there've been fewer and fewer rocket launches, and nothing but foot-dragging on getting the second Stalk started with a Kenya tether. Now you want miracles from us at short notice.”

If I sounded bitter, that's because *I was* bitter. Panosky was nodding his head in a conciliatory way.

“We know, Jack. And if you can pull us through this one, I think you'll see changes in the future. But right now, we can't debate that. We have to know what you can do for us *now*, this minute.”

I couldn't argue with that. I swung my chair again to face Larry Marston.

“Get Hasse and Kano over here to the Control Room as soon as you can.” I turned back to Velasquez. “Give us a few minutes here, while we get organized. I'm bringing in the rest of my top engineering staff.”

While Larry was rounding up the others, I sat back and let the full dimensions of the problem sink in. Sure, if we had to we could release the ballast at the outward end of the Stalk. If the Beanstalk below us were severed we'd have to do that, or be whipped out past the Moon like a stone from a slingshot, as the tension in the cable suddenly dropped.

But if we did that, what would happen to the piece of the Beanstalk that was still tethered to Earth, anchored down there in Quito? There might be as much as thirty thousand kilometers of it, and as soon as the break occurred it would begin to fall. Not in a straight line. That wasn't the way that the dynamics went. It would begin to curl around the Earth, accelerating as it went, cracking into the atmosphere along the equator like a billion-ton whip stretching halfway around the planet. Forget the carrier buckets, and the superconducting cables that carried electricity down to the drive train from the solar power satellite seventy thousand kilometers above us. The piece that would do the real damage would be the central, load-bearing cable itself. It was only a couple of meters across at the bottom end, but it widened steadily

as it went up. Made of bonded and doped silicon whiskers, with a tensile strength of two hundred million Newtons per square centimeter, it could handle an incredible load—almost two-thirds of a billion tons at its thinnest point. When that stored energy hit that atmosphere, there was going to be a fair amount of excitement down there on the surface. Not that we'd be watching it—the loss of the power satellite would make us look at our own survival problems; and as for the Colonies, a century of development would be ended.

By the time that Larry Marston came back with Jen Hasse and Alicia Kano, I doubt if I looked any more cheerful than Arnold Velasquez down there at Tether Control. I sketched out the problem to the two newcomers; we had what looked like a hopeless situation on our hands.

“We have seventy-one hours,” I concluded. “The only question we need to answer is, what will we be doing at this end during that time? Tether Control can coordinate disaster planning for the position on Earth. Arnold has already ruled out the possibility of any actual *help* from Earth—there are no rockets there that could be ready in time.”

“What about the repair robots that you have on the cable?” asked Panosky, jumping into the conversation. “I thought they were all the way along its length.”

“They are,” said Jen Hasse. “But they're special purpose, not general purpose. We couldn't use one to look for a radioactive signal on a bucket, if that's what you're thinking of. Even if they had the right sensors for it, we'd need a week to reprogram them for the job.”

“We don't have a week,” said Alicia quietly. “We have seventy-one hours.” She was small and dark haired, and never raised her voice much above the minimum level needed to reach her audience—but I had grown to rely on her brains more than anything else on the station.

“Seventy-one hours, if we act now,” I said. “We've already agreed that we don't have time to sit here and wait for that bucket with the bomb to arrive—the terrorists must have planned it that way.”

“I know.” Alicia did not raise her voice. “Sitting and waiting won't do it. But the total travel time of a carrier from the surface up to synchronous orbit, or back down again, is a little less than a hundred and twenty hours. That means that the bucket carrying the bomb will be at least *halfway* here in sixty hours. And a bucket that started down from here in the next few hours—”

“—would have to pass the bucket with the bomb on the way up, before the deadline,” broke in Hasse. He was already over at the control board, looking at the carrier schedule. He shook his head. “There's nothing scheduled for a passenger bucket in the next twenty-four hours. It's all cargo going down.”

“We're not looking for luxury.” I went across to look at the schedule. “There are a couple of ore buckets with heavy metals scheduled for the next three hours. They'll have plenty of space in the top of them, and they're just forty minutes apart from each other. We could squeeze somebody in one or both of them, provided they were properly suited up. It wouldn't be a picnic, sitting in suits for three days, but we could do it.”

“So how would we get at the bomb, even if we did that?” asked Larry. “It would be on the other side of the Beanstalk from us, passing at a relative velocity of six hundred kilometers an hour. We couldn't do more than wave to it as it went by, even if we knew just which bucket was carrying the bomb.”

“That's the tricky piece.” I looked at Jen Hasse. “Do you have enough control over the mass driver system to slow everything almost to a halt whenever an inbound and an outbound bucket pass each other?”

He was looking doubtful, rubbing his nose thoughtfully. “Maybe. Trouble is, I’d have to do it nearly a hundred times, if you want to slow down for every pass. And it would take me twenty minutes to stop and start each one. I don’t think we have that much time. What do you have in mind?”

I went across to the model of the Beanstalk that we kept on the control room table. We often found that we could illustrate things with it in a minute that would have taken thousands of words to describe.

“Suppose we were here, starting down in a bucket,” I said. I put my hand on the model of the station, thirty-five thousand kilometers above the surface of the Earth in synchronous orbit. “And suppose that the bucket we want to get to, the one with the bomb, is here, on the way up. We put somebody in the inbound bucket, and it starts on down.”

I began to turn the drive train, so that the buckets began to move up and down along the length of the Beanstalk.

“The people in the inbound bucket carry a radiation counter,” I went on. “We’d have to put it on a long arm, so that it cleared all the other stuff on the Stalk, and reached around to get near the upbound buckets. We can do that, I’m sure—if we can’t, we don’t deserve to call ourselves engineers. We stop at each outbound carrier, and test for radioactivity. There should be enough of that from the fission trigger of the bomb, so that we’ll easily pick up a count when we reach the right bucket. Then you, Jan, hold the drive train in the halt position. We leave the inbound bucket, swing around the Stalk, and get into the other carrier. Then we try and disarm the bomb. I’ve had some experience with that.”

“You mean we get out and actually *climb* around the Beanstalk?” asked Larry. He didn’t sound pleased at the prospect.

“Right. It shouldn’t be too bad,” I said. “We can anchor ourselves with lines to the ore bucket, so we can’t fall.”

Even as I was speaking, I realized that it didn’t sound too plausible. Climbing around the outside of the Beanstalk in a space suit, twenty thousand kilometers or more up, dangling on a line connected to an ore bucket—and then trying to take apart a fusion bomb wearing gloves. No wonder Larry didn’t like the sound of that assignment. I wasn’t surprised when Arnold Velasquez chipped in over the circuit connecting us to Tether Control.

“Sorry, Jack, but that won’t work—even if you could do it. You didn’t let me read the full message from the terrorists. One of their conditions is that we mustn’t stop the bucket train on the Stalk in the next three days. I think they were afraid that we would reverse the direction of the buckets, and bring the bomb back down to Earth to disarm it. I guess they don’t realize that the Stalk wasn’t designed to run in reverse.”

“Damnation. What else do they have in that message?” I asked. “What can they do if we decide to stop the bucket drive anyway? How can they even tell that we’re doing it?”

“We have to assume that they have a plant in here at Tether Control,” replied Velasquez. “After all, they managed to get a bomb onto the Stalk in spite of all our security. They say they’ll explode the bomb if we make any attempt to slow up or stop the bucket train, and we simply can’t afford to take the risk of doing that. We have to assume they can monitor what’s going on with the Stalk drive train.”

There was a long, dismal silence, which Alicia finally broke.

“So that seems to leave us with only one alternative,” she said thoughtfully. Then she grimaced and pouted her mouth. “It’s a two-bucket operation, and I don’t even like to think about it—even though I

had a grandmother who was a circus trapeze artiste.”

She was leading in to something, and it wasn't like her to make a big buildup.

“That bad, eh?” I said.

“That bad, if we're lucky,” she said. “If we're unlucky, I guess we'd all be dead in a month or two anyway, as the recycling runs down. For this to work, we need a good way of dissipating a lot of kinetic energy—something like a damped mechanical spring would do it. And we need a good way of sticking to the side of the Beanstalk. Then, we use *two* ore buckets—forty minutes apart would be all right—like this...”

She went over to the model of the Beanstalk. We watched her with mounting uneasiness as she outlined her idea. It sounded crazy. The only trouble was, it was that or nothing. Making choices in those circumstances is not difficult.

* * * *

One good thing about space maintenance work—you develop versatility. If you can't wait to locate something down on Earth, then waste another week or so to have it shipped up to you, you get into the habit of making it for yourself. In an hour or so, we had a sensitive detector ready, welded on to a long extensible arm on the side of a bucket. When it was deployed, it would reach clear around the Beanstalk, missing all the drive train and repair station fittings, and hang in close to the out-bound buckets. Jen had fitted it with a gadget that moved the detector rapidly upward at the moment of closest approach of an upbound carrier, to increase the length of time available for getting a measurement of radioactivity. He swore that it would work on the fly, and have a better than 99 percent chance of telling us which outbound bucket contained the bomb—even with a relative fly-by speed of six hundred kilometers an hour.

I didn't have time to argue the point, and in any case Jen was the expert. I also couldn't dispute his claim that he was easily the best-qualified person to operate the gadget. He and Larry Marston, both fully suited up, climbed into the ore bucket. We had to leave the ore in there, because the mass balance between ingoing and outbound buckets was closely calculated to give good stability to the Beanstalk. It made for a lumpy seat, but no one complained. Alicia and I watched as the bucket was moved into the feeder system, accelerated up to the correct speed, attached to the drive train, and dropped rapidly out of sight down the side of the Beanstalk.

“That's the easy part,” she said. “They drop with the bucket, checking the upbound ones as they come by for radioactivity, and that's all they have to do.”

“Unless they can't detect any signal,” I said. “Then the bomb goes off, and they have the world's biggest roller coaster ride. Twenty thousand kilometers of it, with the big thrill at the end.”

“They'd never reach the surface,” replied Alicia absentmindedly. “They'll frizzle up in the atmosphere long before they get there. Or maybe they won't. I wonder what the terminal velocity would be if you hung on to the Stalk cable?”

As she spoke, she was calmly examining an odd device that had been produced with impossible haste in the machine shop on the station's outer rim. It looked like an old-fashioned parachute harness, but instead of the main chute the lines led to a wheel about a meter across. From the opposite edge of the wheel, a doped silicon rope led to a hefty magnetic grapnel. Another similar arrangement was by her side.

“Here,” she said to me. “Get yours on over your suit, and let's make sure we both know how to handle

them. If you miss with the grapnel, it'll be messy.”

I looked at my watch. “We don't have time for any dry run. In the next fifteen minutes we have to get our suits on, over to the ore buckets, and into these harnesses. Anyway, I don't think rehearsals here inside the station mean too much when we get to the real thing.”

We looked at each other for a moment, then began to suit up. It's not easy to estimate odds for something that has never been done before, but I didn't give us more than one chance in a hundred of coming out of it safely. Suits and harnesses on, we went and sat without speaking in the ore bucket.

I saw that we were sitting on a high-value shipment—silver and platinum, from one of the belt mining operations. It wasn't comfortable, but we were certainly traveling in expensive company. Was it King Midas who complained that a golden throne is not right for restful sitting?

No matter what the final outcome, we were in for an unpleasant trip. Our suits had barely enough capacity for a six-day journey. They had no recycling capacity, and if we had to go all the way to the halfway point we would be descending for almost sixty hours. We had used up three hours to the deadline, getting ready to go, so that would leave us only nine hours to do something about the bomb when we reached it. I suppose that it was just as bad or worse for Hasse and Marston. After they'd done their bit with the detector, there wasn't a thing they could do except sit in their bucket and wait, either for a message from us or an explosion far above them.

“Everything all right down there, Larry?” I asked, testing the radio link with them for the umpteenth time.

“Can't tell.” He sounded strained. “We've passed three buckets so far, outbound ones, and we've had no signal from the detector. I guess that's as planned, but it would be nice to know it's working all right.”

“You shouldn't expect anything for at least thirty-six hours,” said Alicia.

“I know that. But it's impossible for us *not* to look at the detector whenever we pass an outbound bucket. Logically, we should be sleeping now and saving our attention for the most likely time of encounter—but neither one of us seems able to do it.”

“Don't assume that the terrorists are all that logical, either,” I said. “Remember, we are the ones who decided that they must have started the bomb on its way only a few hours ago. It's possible they put it into a bucket three or four days ago, and made up the deadline for some other reason. We think we can disarm that bomb, but they may not agree—and they may be right. All we may manage to do is advance the time of the explosion when we try and open up the casing.”

As I spoke, I felt our bucket begin to accelerate. We were heading along the feeder and approaching the bucket drive train. After a few seconds we were outside the station, dropping down the Beanstalk after Jen and Larry.

We sat there in silence for a while. I'd been up and down the Stalk many times, and so had Alicia, but always in passenger modules. The psychologists had decided that people rode those a lot better when they were windowless. The cargo bucket had no windows either, but we had left the hatch open to simplify communications with the other bucket and to enable us to climb out if and when the time came. We would have to close it when we were outside, or the aerodynamic pressures would spoil bucket stability when it finally entered the atmosphere—three hundred kilometers an hour isn't that fast, but it's a respectable speed for travel at full atmospheric pressure.

Our bucket was about four meters wide and three deep. It carried a load of seven hundred tons, so our extra mass was negligible. I stood at its edge and looked up, then down. The psychologists were quite

right. Windows were a bad idea.

Above us, the Beanstalk rose up and up, occulting the backdrop of stars. It went past the synchronous station, which was still clearly visible as a blob on the stalk, then went on further up, invisible, to the solar power satellite and the great ballast weight, a hundred and five thousand kilometers above the surface of the Earth. On the Stalk itself I could see the shielded superconductors that ran its full length, from the power satellite down to Tether Control in Quito. We were falling steadily, our rate precisely controlled by the linear synchronous motors that set the accelerations through pulsed magnetic fields. The power for that was drawn from the same superconducting cables. In the event of an electrical power failure, the buckets were designed to “freeze” to the side of the Stalk with mechanical coupling. We had to build the system that way, because about once a year we had some kind of power interruption—usually from small meteorites, not big enough to trigger the main detector system, but large enough to penetrate the shields and mess up the power transmission.

It was looking down, though, that produced the real effect. I felt my heart begin to pump harder, and I was gripping at the side of the bucket with my space suit gloves. When you are in a rocket-propelled ship, you don't get any real feeling of height. Earth is another part of the universe, something independent of you. But from our position, moving along the side of the Beanstalk, I had quite a different feeling. We were *connected* to the planet. I could see the Stalk, dwindling smaller and smaller down to the Earth below. I had a very clear feeling that I could fall all the way down it, down to the big blue-white globe at its foot. Although I had lived up at the station quite happily for over five years, I suddenly began to worry about the strength of the main cable. It was a ridiculous concern. There was a safety factor of ten built into its design, far more than a rational engineer would use for anything. It was more likely that the bottom would fall out of our ore bucket, than that the support cable for the Beanstalk would break. I was kicking myself for my illogical fears, until I noticed Alicia also peering out at the Beanstalk, as though trying to see past the clutter of equipment there to the cable itself. I wasn't the only one thinking wild thoughts.

“You certainly get a different look at things from here,” I said, trying to change the mood. “Did you ever see anything like that before?”

She shook her head ponderously—the suits weren't made for agility of movement.

“Not up here, I haven't,” she replied. “But I once went up to the top of the towers of the Golden Gate Bridge in San Francisco, and looked at the support cables for that. It was the same sort of feeling. I began to wonder if they could take the strain. That was just for a bridge, not even a big one. What will happen if we don't make it, and they blow up the Beanstalk?”

I shrugged inside my suit, then realized that she couldn't see the movement. “This is the only bridge to space that we've got. We'll be out of the bridge business and back in the ferryboat business. They'll have to start sending stuff up by rockets again. Shipments won't be a thousandth of what they are now, until another Stalk can be built. That will take thirty years, starting without this one to help us—even if the Colonies survive all right and work on nothing else. We don't have to worry about that, though. We won't be there to hassle with it.”

She nodded. “We were in such a hurry to get away it never occurred to me that we'd be sitting here for a couple of days with nothing to do but worry. Any ideas?”

“Yes. While you were making the reel and grapnel, I thought about that. The only thing that's worth our attention right now is a better understanding of the geometry of the Stalk. We need to know exactly where to position ourselves, where we'll set the grapnels, and what our dynamics will be as we move. I've asked Ricardo to send us schematics and layouts over the suit videos. He's picking out ones that show the drive train, the placing of the superconductors, and the unmanned repair stations. I've also

asked him to deactivate all the repair robots. It's better for us to risk a failure on the maintenance side than have one of the monitoring robots wandering along the Stalk and mixing in with what we're trying to do.”

“I heard what you said to Panosky, but it still seems to me that the robots ought to be useful.”

“I'd hoped so, too. I checked again with Jen, and he agrees we'd have to reprogram them, and we don't have the time for it. It would take weeks. Jen said having them around would be like taking along a half-trained dog, bumbling about while we work. Forget that one.”

As we talked, we kept our eyes open for the outbound buckets, passing us on the other side of the Beanstalk. We were only about ten meters from them at closest approach and they seemed to hurtle past us at an impossible speed. The idea of hitching on to one of them began to seem more and more preposterous. We settled down to look in more detail at the configuration of cables, drive train, repair stations and buckets that was being flashed to us over the suit videos.

It was a weary time, an awful combination of boredom and tension. The video images were good, but there is a limit to what you can learn from diagrams and simulations. About once an hour, Jen Hasse and Larry Marston called in from the lower bucket beneath us, reporting on the news—or lack of it—regarding the bomb detection efforts. A message relayed from Panosky at Tether Control reported no progress in negotiations with the terrorists. The fanatics simply didn't believe their terms couldn't be met. That was proof of their naivete, but didn't make them any less dangerous.

It was impossible to get comfortable in our suits. The ore buckets had never been designed for a human occupant, and we couldn't find a level spot to stretch out. Alicia and I passed into a half-awake trance, still watching the images that flashed onto the suit videos, but not taking in much of anything. Given that we couldn't sleep, we were probably in the closest thing we could get to a resting state. I hoped that Jen and Larry would keep their attention up, watching an endless succession of buckets flash past them and checking each one for radioactivity count.

The break came after fifty-four hours in the bucket. We didn't need to hear the details from the carrier below us to know they had it—Larry's voice crackled with excitement.

“Got it,” he said. “Jen picked up a strong signal from the bucket we just passed. If you leave the ore carrier within thirty-four seconds, you'll have thirty-eight minutes to get ready for it to come past you. It will be the second one to reach you. For God's sake don't try for the wrong one.”

There was a pause, then Larry said something I would never have expected from him. “We'll lose radio contact with you in a while, as we move farther along the Stalk. Good luck, both of you—and look after him, Alicia.”

I didn't have time to think that one through—but shouldn't he be telling *me* to look after *her*? It was no time for puzzling. We were up on top of our bucket in a second, adrenaline moving through our veins like an electric current. The cable was whipping past us at a great rate; the idea of forsaking the relative safety of the ore bucket for the naked wall of the Beanstalk seemed like insanity. We watched as one of the repair stations, sticking out from the cable into open space, flashed past.

“There'll be another one of those coming by in thirty-five seconds,” I said. “We've got to get the grapnels onto it, and we'll be casting blind. I'll throw first, and you follow a second later. Don't panic if I miss—remember, we only have to get one good hook there.”

“Count us down, Jack,” said Alicia. She wasn't one to waste words in a tight spot.

I pressed the digital readout in my suit, and watched the count move from thirty-five down to zero.

“Countdown display on channel six,” I said, and picked up the rope and grapnel. I looked doubtfully at the wheel that was set in the middle of the thin rope, then even looked suspiciously at the rope itself, wondering if it would take the strain. That shows how the brain works in a crisis—that rope would have held a herd of elephants with no trouble at all.

I cast the grapnel as the count touched to zero, and Alicia threw a fraction later. Both ropes were spliced onto both suits, so it was never clear which grapnel took hold. Our bucket continued to drop rapidly toward Earth, but we were jerked off the top of it and went zipping on downward fractionally slower as the friction reel in the middle of the rope unwound, slowing our motion.

We came to a halt about fifty meters down the Beanstalk from the grapnel, after a rough ride in which our deceleration must have averaged over seven g's. Without that reel to slow us down gradually, the jerk of the grapnel as it caught the repair station wall would have snapped our spines when we were lifted from the ore bucket.

We hung there, swinging free, suspended from the wall of the Stalk. As the reel began to take up the line that had been paid out, I made the mistake of looking down. We dangled over an awful void, with nothing between us and that vast drop to the Earth below but the thin line above us. When we came closer to the point of attachment to the Beanstalk wall, I saw just how lucky we had been. One grapnel had missed completely, and the second one had caught the very lip of the repair station platform. Another foot to the left and we would have missed it altogether.

We clawed our way up to the station rim—easy enough to do, because the gravity at that height was only a fraction of a g, less than a tenth. But a fall from there would be inexorable, and we would have fallen away from the Beanstalk, with no chance to reconnect to it. Working together, we freed the grapnel and readied both lines and grapnels for reuse. After that there was nothing to do but cling to the side of the Beanstalk, watch the sweep of the heavens above us, and wait for the outbound ore buckets to come past us.

The first one came by after seventeen minutes. I had the clock readout to prove it, otherwise I would have solemnly sworn that we had waited there for more than an hour, holding to our precarious perch. Alicia seemed more at home there than I was. I watched her moving the grapnel to the best position for casting it, then settle down patiently to wait.

It is hard to describe my own feelings in that period. I watched the movement of the stars above us, in their great circle, and wondered if we would be alive in another twenty minutes. I felt a strong communion with the old sailors of Earth's seas, up in their crow's nest in a howling gale, sensing nothing but darkness, high-blown spindrift, perilous breakers ahead, and the dipping, rolling stars above.

Alicia kept her gaze steadily downward, something that I found hard to do. She had inherited a good head for heights from her circus-performer grandmother.

“I can see it,” she said at last. “All ready for a repeat performance?”

“Right.” I swung the grapnel experimentally. “Since we can see it this time, we may as well throw together.”

I concentrated on the bucket sweeping steadily up toward us, trying to estimate the distance and the time that it would take before it reached us. We both drew back our arms at the same moment and lobbed the grapnels toward the center of the bucket.

It came past us with a monstrous, silent rush. Again we felt the fierce accelerations as we were jerked away from the Beanstalk wall and shot upward after the carrier. Again, I realized that we couldn't have done it without Alicia's friction reel, smoothing the motion for us. This time, it was more dangerous than when we had left the downbound bucket. Instead of trying to reach the stationary wall of the Stalk, we were now hooked on to the moving bucket. We swung wildly beneath it in its upward flight, narrowly missing contact with elements of the drive train, and then with another repair station that flashed past a couple of meters to our right.

Finally, somehow, we damped our motion, reeled in the line, slid back the cover to the ore bucket and fell safely forward inside it. I was completely drained. It must have been all nervous stress—we hadn't expended a significant amount of physical energy. I know that Alicia felt the same way as I did, because after we plumped over the rim of the carrier we both fell to the floor and lay there without speaking for several minutes. It gives some idea of our state of mind when I say that the bucket we had reached, with a four-megaton bomb inside it that might go off at any moment, seemed like a haven of safety.

We finally found the energy to get up and look around us. The bucket was loaded with manufactured goods, and I thought for a sickening moment that the bomb was not there. We found it after five minutes of frantic searching. It was a compact blue cylinder, a meter long and fifty centimeters wide, and it had been cold-welded to the wall of the bucket. I knew the design.

"There it is," I said to Alicia. Then I didn't know what to say next. It was the most advanced design, not the big, old one that I had been hoping for.

"Can you disarm it?" asked Alicia.

"In principle. There's only one problem. I know how it's put together—but I'll never be able to get it apart wearing a suit. The fingerwork I'd need is just too fine for gloves. We seem to be no better off than we were before."

We sat there side by side, looking at the bomb. The irony of the situation was sinking in. We had reached it, just as we hoped we could. Now, it seemed we might as well have been still back in the station.

"Any chance that we could get it free and dump it overboard?" asked Alicia. "You know, just chuck the thing away from the bucket."

I shook my head, aware again of how much my suit impeded freedom of movement. "It's spot welded. We couldn't shift it. Anyway, free fall from here would give it an impact orbit, and a lot of people might be killed if it went off inside the atmosphere. If we were five thousand kilometers higher, perigee would be at a safe height above the surface—but we can't afford to wait for another sixteen hours until the bucket gets up that high. Look, I've got another idea, but it will mean that we'll lose radio contact with the station."

"So what?" said Alicia. Her voice was weary. "There's not a thing they can do to help us anyway."

"They'll go out of their minds with worry down on Earth, if they don't know what's happening here."

"I don't see why we should keep all of it for ourselves. What's your idea, Jack?"

"All right." I summoned my reserves of energy. "We're in vacuum now, but this bucket would be airtight if we were to close the top hatch again. I have enough air in my suit to make a breathable atmosphere in this enclosed space, at least for long enough to let me have a go at the bomb. We've got nearly twelve hours to the deadline, and if I can't disarm it in that time I can't do it at all."

Alicia looked at her air reserve indicator and nodded. “I can spare you some air, too, if I open up my suit.”

“No. We daren't do that. We have one other big problem—the temperature. It's going to feel really cold in here, once I'm outside my suit. I'll put my heaters on to maximum, and leave the suit open, but I'm still not sure I can get much done before I begin to freeze up. If I begin to lose feeling in my fingers, I'll need your help to get me back inside. So you have to stay in your suit. Once I'm warmed up, I can try again.”

She was silent for a few moments, repeating the calculations that I had just done myself.

“You'll only have enough air to try it twice,” she said at last. “If you can't do it in one shot, you'll have to let me have a go. You can direct me on what has to be done.”

There was no point in hanging around. We sent a brief message to the station, telling them what we were going to do, then closed the hatch and began to bleed air out of my suit and into the interior of the bucket. We used the light from Alicia's suit, which had ample power to last for several days.

When the air pressure inside the bucket was high enough for me to breathe, I peeled out of my suit. It was as cold as charity in that metal box, but I ignored that and crouched down alongside the bomb in my underwear and bare feet.

I had eleven hours at the most. Inside my head, I fancied that I could hear a clock ticking. That must have been only my fancy. Modern bombs have no place for clockwork timers.

By placing my suit directly beneath my hands, I found that I could get enough heat from the thermal units to let me keep on working without a break. The clock inside my head went on ticking, also without a break.

On and on and on.

* * * *

They say that I was delirious when we reached the station. That's the only way the press could reconcile my status as public hero with the things that I said to the president when he called up to congratulate us.

I suppose I could claim delirium if I wanted to—five days without sleep, two without food, oxygen starvation, and frostbite of the toes and ears, that might add up to delirium. I had received enough warmth from the suit to keep my hands going, because it was very close to them, but that had been at the expense of some of my other extremities. If it hadn't been for Alicia, cramming me somehow back into the suit after I had disarmed the bomb, I would have frozen to death in a couple of hours.

As it was, I smelled ripe and revolting when they unpacked us from the bucket and winkled me out of my suit—Alicia hadn't been able to reconnect me with the plumbing arrangements.

So I told the president that the World Congress was composed of a giggling bunch of witless turds, who couldn't sense a global need for more bridges to space if a Beanstalk were pushed up their backsides—which was where I thought they kept their brains. Not quite the speech that we used to get from the old-time returning astronauts, but I must admit it's one that I'd wanted to give for some time. The audience was there this time, with the whole world hanging on my words over live TV.

We've finally started construction on the second Beanstalk. I don't know if my words had anything to do with it, but there was a lot of public pressure after I said my piece, and I like to think that I had some effect.

And me? I'm designing the third Beanstalk; what else? But I don't think I'll hold my breath waiting for a

congressional vote of thanks for my efforts saving the first one.

About the Author

Charles Sheffield (1935-) is a mathematician and physicist who has over ninety short stories, over a hundred technical papers, and thirty-one books. His fiction, which is mostly hard science fiction, has won major awards. He is Chief Scientist and Board Member of Earth Satellite Corporation, a Past-President of the Science Fiction Writers of America, and a Fellow and Past-President of the American Astronautical Society. Among his most recent novels are *Summertide* (1990), *Divergence* (1991), and *Transcendence* (1992) (the “Heritage Universe” series), *Cold as Ice* (1992), and *The Ganymede Club* (1995).

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3. Dear Colleagues by Tom Ligon

As you no doubt have heard by now, I quit.

Now, I'm sure most of you think old Erica Thompson is a prima-donna. (it's true), especially since she got that little award. You probably think she's just in a snit over a raise or something. Actually, this had been a long time coming, and it has almost nothing to do with money. In particular, I was offered a job a few weeks ago, one I would have snapped up in a minute when I was fresh out of school. I've sort of gotten used to my cozy lifestyle, though, and I was going to pass it up.

Until this morning.

I was up until two this morning working on a new proposal. Consequently, I overslept. That got me into a rush, and I came down the stairs a little too fast. Naturally, the motion detector at the bottom of the stairs interpreted that as a fall, and deployed the air-bag.

I knew instantly that I had to call the local rescue squad to let them know it was a false alarm. Since it would be against the law to call 911 for this purpose, I had to call the normal number. It was busy. By the time I got through, they had already dispatched an ambulance and rescue vehicle, which means I'm stuck with a five-hundred dollar fine.

I was mad at myself for being so careless, but I was inclined to chalk it up to experience and get on with the day. I headed into the kitchen for a container of fat-free, cholesterol-free, salt-free, high-fiber, toxin-screened, FDA-inspected, AMA-accepted, UL-listed, nutritionally labeled, high carbohydrate fuel for *Homo sapiens*. Blueberry flavored, my favorite. Then I stepped over to the utensil drawer for something to eat it with. I fumbled with the child-resistant catch, and opened it to find nothing in the drawer but spoons.

Ofcourse, you say? What else would you have in a utensil drawer? Friends, I remember when we also used knives and forks to eat with. That's right, we used to put four-pointed implements *right into our mouths*, back before the Insurance Institute for Culinary Safety managed to get them banned.

Anyway, I grabbed a spoon and my briefcase, resigned to eating breakfast in the car again, and headed out to the garage. I was grateful, for once, to just be able to tell the car my destination and have it handle the driving while I choked down the tub of mush and looked over the proposal in perfect, computer-controlled, NHTSA-mandated safety.

I reached the Institute with minutes to spare before presenting my proposal to the review committee. I

caught myself running down the corridor, fortunately *before* any alarms took notice, and reached the conference room a few seconds before the appointed time.

Dr. Prunebottom—and yes, since I'm quitting I will call everyone by their accepted nicknames, and maybe someone will tell Prunie how he earned *his* —glanced at his watch. “By the hair on your chinny-chin-chin, for once, Dr. Thompson. What wild and mysterious rending of the laws of physics do you propose *this* time?”

I passed out copies of my proposal. “I want to modify the Higgs field generator for a much smaller and more intense field. I think I can get the Supercollider's collision cross-section up enough to have a significant chance of getting to within an order of magnitude or so of primordial density, at least on a sub-nucleonic scale.”

Dr. Pigwhistle was aghast. “After the havoc you caused last time?” She held up an invoice and shook it in my general direction. “We had to replace all the detectors in the collision chamber. And you want to go *further*.”

I nodded. “That's right, I do. I think I'm on the verge of something really exciting.”

Dr. Ruth—see, Ruth, your nickname isn't all that bad—glanced over the proposal. “Well, Erica, I see you've included a more ... shall we say ... robust? Yes, a more robust detector and field generation assembly. Substantially so. Ought to be capable of soaking up quite a blast, in fact. Now, Erica, I know *you* have a Nobel prize and *Idon't*, but the fact is that you either can't or *won't* explain why these reactions are so violent. From what I can tell, you expect a *geometric* increase in output from the last run.”

I shrugged. “Not immediately. The detector is over-built for the present proposal. I'm hoping, however, to demonstrate a radically new physics that will lead to advanced and extremely powerful propulsion systems.”

Prunebottom pursed his lips and puffed out his cheeks in that expression he thinks conveys disgust but which actually cracks us up. “This wouldn't have anything to do with that wild-assed idea of yours that there is a form of energy faster than light, would it?”

I grimaced. One tiny little paper as an undergraduate, and your peers label you as a crackpot for life. “Let's just say I think I'm on to something hot, but something which no responsible scientist would believe without convincing proof. I think I've done it already, but the detectors couldn't take it so I lost my data.”

“Sounds *to me*,” Prunebottom snorted, “like you're messing with the fabric of the Universe.”

I put my face in my hands and my elbows on the table. “Here we go again. The Trinity wager. What are the odds the first atomic bomb test will trigger a fusion reaction of the atmosphere and blow up the world? What are the odds that Erica Thompson, in approaching the conditions of the Big Bang, will snag a thread of reality that makes all of Being unravel. Guys, I thought *we built* the Supercollider to investigate that corner of physics.”

Pigwhistle wheezed a couple of times—my dear, you do it with every anxiety attack, which is how you earned the nickname. With a quavering voice, she offered this gem. “Please don't repeat it outside this room, but I always felt *we really* built the Supercollider to keep high energy physicists off the street. Frankly, we're already so far ahead of the technological capacity to *exploit* what we learned with the last generation of accelerators, I wonder how we can justify what we're spending on *this* one.”

I picked my head up out of my hands. “Approve this proposal, and, if I'm right, I'll justify it a thousand

times over.”

“Justify, shmjustify,” Prunebottom retorted. “We deal in pure science. But our esteemed bean-counting colleague here is right that there may be no big payoff other than knowledge. That being the case, it behooves us not to charge ahead carelessly with experiments which could be unimaginably dangerous. After all, the goal is *knowledge*. The way I look at it, by cautiously progressing one step at a time, waiting for peer review and confirmation, testing alternative hypotheses which would explain the data, in other words by doing good science, we should be able to reach Dr. Thompson's goals in, say, twenty to thirty years.”

The others nodded agreement.

“OK, then,” Ruth said, pulling out her calendar, “I think we should convene a preliminary safety review board to examine the methodology used in the last test, and to propose a retro-design to back off Dr. Thompson's parameters....”

I got up slowly and trudged out of the room, unable to watch as they castrated my proposal. I headed back to my office and spent an hour in a total funk. Finally, my head cleared and I began to examine the problem rationally.

The problem, as I now understand it, is that the whole damned country has gone to hell. And, I am ashamed to say, so have I. As individuals and as a society, we have become afraid to take risks. Each of us has come to believe that our own life is somehow important, and we've become so obsessed with protecting our self-important asses that we virtually eliminate any chance of accomplishing anything meaningful.

Remember the argument for eliminating forks? After a prime-time expose of the disgraceful cover-up by the utensil industry of the number of injuries a year attributable to forks, the safety officials came out with their usual line: “Every life is precious.” Mind you, other than prisoners sharpening fork handles into knives, I don't think they actually came up with any deaths, but hey, the *potential* was there.

I suppose we should have seen this coming. When I was a kid, physical education classes meant playing ball, running, jumping, and all that. Today, it means fifteen minutes of low-impact aerobics plus a lecture on the importance of exercise. School sports programs were eliminated long ago due to the insurance and liability problems. (Funny thing is, I don't remember very many kids dying of heart attacks when I was small but it is a growing problem *today*.) General aviation died long ago, killed by runaway liability claims and regulations designed to prevent any possibility of an accident ever happening. Most people didn't mind, since most people were scared of little-bitty airplanes anyway. Then, using about the same logic, they eliminated human control of automobiles. That caused quite a squawk, but it passed, because certainly the risks far outweighed the dubious joy of using your own skill and judgment to get from one point to another.

When I was in college, some of my friends liked to climb sheer cliffs with nothing but their toes and fingertips to hang on with. I had other friends who not only went up in little-bitty airplanes, they jumped out of them, just for fun. There were people who jumped off bridges with big rubber shock cords tied to their ankles. I had a motorcycle for a while, and I loved riding through white-water rapids on a rubber raft. Try doing any of that today, and if you aren't arrested for it, you will at least lose your insurance coverage.

Do you old-timers remember the *Challenger* disaster? We all knew spaceflight was dangerous. Then, suddenly, we knew it for *real*. Seven people died. Tragic, but, if you will excuse my saying so, *big deal!* Throughout history, in enterprises both great and small, people have died in much greater numbers. But

this time, instead of pressing on with renewed determination to make their sacrifices meaningful, we paralyzed the space program with the attitude that we must never again have another accident because *every human life is precious*.

Folks, the more we believe that, the less true it becomes.

And I have been just as guilty of it as the next person.

Until now.

Let me tell you about that job offer I almost turned down. You are certainly aware of the pilot asteroid mining project timidly initiated ten years ago. The discovery of relatively abundant rare earths, particularly scandium, in certain asteroids, plus the unprecedented demand for those elements for such applications as high temperature superconductors, picoaccelerators, gamma-pumped electron cascades, and other engineered ceramic molecules, put a strong economic incentive behind the project. In fact, most economists believe that these materials are absolutely crucial for meeting Earth's energy needs. A massive terrestrial mining effort sufficient to meet current demand would be environmentally unacceptable, even if the nimbies permitted it. It looks like we've finally found a good substitute for beaver pelts in space.

You *did* know this country was built on the beaver-pelt business, didn't you? I read that somewhere when I was kid.

Of course, production is still low, in part because transportation is so slow. The piddly little electric rockets they presently use take too long to move too few supplies and people up, and refined rare earths back down. Fortunately, UNASA, not being the encumbered behemoth of its US counterpart, is acting more as a coordinating body for interested investors. Very interested investors. They think they're going to get unspeakably rich, and don't mind if a few poor souls have to stick their necks out to do it.

God bless their greedy little hearts.

Some years ago I was on a committee to develop concepts for a fusion-powered spacecraft. Based on a variation of a Higgs-field reactor design of mine, we came up with what we thought was a practical proposal. However, NASA is only interested in exploration, not exploitation and the robots we were sending into deep space were patient types. So were the people who had job security monitoring the data for years and years. Quicker spacecraft were considered a threat, not a priority.

My, how things change when a gold rush is on. UNASA wants me to head a project to build a fleet of big, fast, fusion-powered freighters. Notice, I didn't say they want me to head some management group in an office in Milwaukee. I mean they want me to actually go up there and make it *happen*. Friends, I would have killed for a job like this just a few years ago. But, until this morning, I was going to turn them down.

I've built myself a comfy life here. Safe, secure, predictable. I have prestige, money, and all the free chicken dinners I care to attend. Space is dangerous and the accommodations are spartan. The money would be great, but there is nothing up there to spend it on.

At this moment, quite literally, I wouldn't pass this job up for the world. And I'm hiring, if you agree with me.

I'll be honest with you about the ordeal you'll be getting yourself into. The belt miners are shipping back only the rare earths. They have been producing and stockpiling the by-products: enormous quantities of engineering materials too massive and low in value to transport back. We will be going where the materials are. There is some basic manufacturing capability there already, and we will be taking all the

tools we can, but it will be a bit like setting out for the west with a crosscut saw, an axe, and a plow.

By the way, this is a one-way ticket: If you want to come back, or bring your family up, you have to build the ship to do it. That's the employee incentive plan.

Unless you are a space nut like me, you may be amazed at what is available up there. The belt has about every non-volatile material you could want, if you don't mind the materials being a little raw. The belt is a lot sparser than most people envision but it is huge, and the amount of material, compared to minable materials in Earth's crust, is staggering. There is a project underway to exploit comets for volatiles (mostly water, carbon dioxide, nitrogen compounds, etc.). The goal is self-sufficiency, to eliminate the enormous cost of launching supplies to the belt.

The trip out will take about two years. We will design our construction facility and prototype freighter on the way. It must be something we can build with minimal support from Earth, and it must be durable and repairable. I suspect we will also settle for something a lot simpler than anything a team on Earth would design. We will be licensed to copy any design on Earth, but we'll have to *build* it ourselves. Consequently, we need people who are not only willing to get grease under their fingernails, we need people who can make their own grease.

No specialists need apply. We need almost all fields of expertise, and we won't have nearly enough people for one of each. Initially, a few hundred of us will be doing work that NASA would probably use a few million to do. Everybody will become expert in whatever is needed. Oh, and no lawyers need apply. We'll probably get three times as much done without them.

This will be a workaholic's dream job. There is nothing to do but work, and an unending amount of it to do. At first, it will seem like we are constantly reinventing the wheel. Small tasks will be much more difficult than on Earth. Example: we will take tools for resharpening hacksaw blades.

On the other hand, you can have anything you want if you are willing to build it from raw materials. Just tell me how much asteroid steel you need, budget your time, and it is yours.

There probably won't be much of it for a while, but most of your free time you will probably spend building and maintaining your habitat, growing food, inventing conveniences, and even running your own businesses. The beltters have developed their own economy, based on a unit of currency called, of course, the "credit." They buy and sell services, parts, equipment, food, entertainment, whatever.

All you need to run an economy is energy, raw materials, and human talent. In the belt, the third element is the one in short supply. If we attract the talent and enthusiasm I think we will, the progress will be phenomenal. I am tempted to say it will be unlike anything ever seen on Earth, but I'm not so sure.

Our work place will be modeled on the Skunk Works, the legendary facility that built the U-2, SR-71, and Aurora, and their magnificent successors. The philosophy there was to give talented, hard-working people responsibility for a particular task, the authority to get what they needed done, and autonomy to work unmolested. That facility managed to build, almost from scratch, aircraft that were twenty years or more ahead of anything else flying. They invented new technology to do it, they did it faster than anyone else thought possible, and they did it elegantly.

The pioneers with their saws and axes, and the engineers at the Skunk Works, are the sorts of people who made America great. The chunk of real estate they occupied had little to do with it. Today, most of the occupants of that patch of land are fat and timid. But there are still a few, in this country and around the world, of the kind of people who made "American" a label to be proud of. Space will be populated by them. At this moment, I can't bear the thought of hanging around down here while something like that is going on. I'd like to think I am, after all, an American.

Consider, if you will, the Old World backers of New World exploration. They expected to acquire great riches—gold, beaver pelts, and so forth. They had no idea of the tremendous wealth they would produce. But, that wealth stayed, for the most part, in the New World. The New World was, itself, the thing of value. That is what is going on here. Earth thinks it will profit greatly from the scarceium we will ship back, but compared to what we will build, it might as well be material for high-fashion hats. The big difference is that no native populations or furry critters need to die for us to succeed.

Now consider your prospects if you remain here. You will be safe and comfortable, I suppose, but your opportunities will be rather limited. You will be competing with about ten billion people for a finite pool of land, air, water, sunlight, and other resources. It is a sum-zero game with an increasing number of players.

I'd like to continue my present line of research eventually. The review board may be right. Maybe this planet isn't the right place for my experiments, and if they work, I'd have to take the technology into space to exploit it anyway. I'd like the chance to build some really hot rockets, and I don't know that I would get the chance in my lifetime if I stay down here.

If you understand why I'm taking the job, and if you want to come along, call me at 555-7263 for an interview. I'll be taking applications in room 201 of the Holiday Inn just down the road for the next week or so. Just remember, I've worked with most of you. I know which ones of you can wield a wrench and which ones are pure theoreticians. I know who thinks they're too good to clean a toilet and who steps in to do whatever needs doing. And I know who has the talent and desire to do it all.

So, who wants to join me?

Sincerely,

Erica Thompson

About the Author

Tom Ligon (1953-) uses his education in biology and electrical engineering technology both to write science fiction and to work as a consultant in various areas of applied technology. He is also a member of the Civil Air Patrol.

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II. Environment

Ecology has been called “the subversive science,” but few ecologists have been willing to hint at the extremes of subversion their science makes available to the mind. That takes a science fiction writer such as the late Isaac Asimov (1920-1992), who two decades ago could look at the world's burgeoning population and say that a time would come when it would be necessary to trim the numbers back. So far, “The Winoing” is only a thought experiment.

The population explosion is not, of course, the only environmental problem the world faces today. There are the ozone hole, climate change, deforestation, desertification, and more, and all together they pose a definite threat to life on Earth. Yet billions of years of this planet's history, marked by catastrophe after catastrophe, assure us that there are always survivors. Will humans be among them this time? If so, how? Canadian Garfield Reeves-Stevens offers a suggestion in “Outport.”

“The Winoing” and “Outport” are both bleak enough to support what we noted at the beginning of

Part I: The scientific, technological mind is rational, cold, unsentimental, heartless. We can cope, it says, but then it adds that coping may require some pretty desperate measures.

It is well worth noting that the scientific, technological mind is also playful. Science writer Jeff Hecht gives us an example in “The Greenhouse Papers,” building on a genuine suggestion—by genuine scientists—that one way to keep carbon dioxide out of the atmosphere and thereby reduce the potential harm of the Greenhouse effect would be to remove carbon from circulation, perhaps by burying lots of trees, or perhaps by....

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4. The Winnowing by Isaac Asimov

Five years had passed since the steadily thickening wall of secrecy had been clamped down about the work of Dr. Aaron Rodman.

“For your own protection—” they had warned him.

“In the hands of the wrong people—” they had explained.

In the right hands, of course (his own, for instance, Dr. Rodman thought rather despairingly), the discovery was clearly the greatest boon to human health since Pasteur’s working out of the germ theory, and the greatest key to the understanding of the mechanism of life, ever.

Yet, after his talk at the New York Academy of Medicine soon after his fiftieth birthday, and on the first day of the twenty-first century {there had been a certain fitness to that) the silence had been imposed, and he could talk no more, except to certain officials. He certainly could not publish.

The government supported him, however. He had all the money he needed, and the computers were his to do with as he wished. His work advanced rapidly and government men came to him to be instructed, to be made to understand.

“Dr. Rodman,” they would ask, “how can a virus be spread from cell to cell within an organism and yet not be infectious from one organism to the next?”

It wearied Rodman to have to say over and over that he did not have all the answers. It wearied him to have to use the term “virus.” He said, “It’s not a virus because it isn’t a nucleic acid molecule. It is something else altogether—a lipoprotein.”

It was better when his questioners were not themselves medical men. He could then try to explain in generalities instead of forever bogging down on the fine points. He would say, “Every living cell, and every small structure within the cell is surrounded by a membrane. The workings of each cell depend on what molecules can pass through the membrane in either direction and at what rates. A slight change in the membrane will alter the nature of the flow enormously, and with that, the nature of the cell chemistry and the nature of its activity.

“All disease may rest on alterations in membrane activity. All mutations may be carried through by way of such alterations. Any technique that controls the membranes controls life. Hormones control the body by their effect on membranes and my lipoprotein is an artificial hormone rather than a virus. The LP incorporates itself into the membrane and in the process induces the manufacture of more molecules like itself, and that’s the part I don’t understand myself.

“But the fine structures of the membranes are not quite identical everywhere. They are, in fact, different in all living things—not quite the same in any two organisms. An LP will affect no two individual organisms alike. What will open the cells of one organism to glucose and relieve the effects of diabetes, will close the cells of another organism to lysine and kill it.”

That was what seemed to interest them most; that it was a poison.

“A selective poison,” Rodman would say. “You couldn't tell, in advance, without the closest computer-aided studies of the membrane biochemistry of a particular individual, what a particular LP would do to him.”

With time, the noose grew tighter around him, inhibiting his freedom, yet leaving him comfortable—in a world in which freedom and comfort alike were vanishing everywhere, and the jaws of hell were opening before a despairing humanity.

It was 2005 and Earth's population was six billion. But for the famines it would have been seven billion. A billion human beings had starved in the past generation, and more would yet starve.

Peter Affare, chairman of the World Food Organization, came frequently to Rodman's laboratories for chess and conversation. It was he, he said, who had first grasped the significance of Rodman's talk at the academy; and that had helped make him chairman. Rodman thought the significance was easy to grasp, but said nothing about that.

Affare was ten years younger than Rodman, and the red was darkening out of his hair. He smiled frequently although the subject of the conversation rarely gave cause for smiling, since any chairman of an organization dealing with world food was bound to talk about world famine.

Affare said, “If the food supply were evenly distributed among all the world's inhabitants, all would starve to death.”

“If it were evenly distributed,” said Rodman, “the example of justice in the world might lead at last to a sane world policy. As it is, there is world despair and fury over the selfish fortune of a few, and all behave irrationally in revenge.”

“You do not volunteer to give up your own oversupply of food,” said Affare.

“I am human and selfish, and my own action would mean little. I should not be asked to volunteer. I should be given no choice in the matter.”

“You are a romantic,” said Affare. “Do you fail to see that the Earth is a lifeboat? If the food store is divided equally among all, then all will die. If some are cast out of the lifeboat, the remainder will survive. The question is not whether some will die, for some *must* die; the question is whether some will live.”

“Are you advocating triage—this sacrifice of some for the rest—officially?”

“We can't. The people in the lifeboat are armed. Several regions threaten openly to use nuclear weapons if more food is not forthcoming.”

Rodman said, sardonically, “You mean the answer to ‘You die that I may live’ is ‘If I die, you die’—an impasse?”

“Not quite,” said Affare. “There are places on Earth where the people cannot be saved. They have overweighted their land hopelessly with hordes of starving humanity. Suppose they are sent food, and suppose the food kills them so that the land requires no further shipments.”

Rodman felt the first twinge of realization. “Kills them how?” he asked.

“The average structural properties of the cellular membranes of a particular population can be worked out. An LP particularly designed to take advantage of those properties could be incorporated into the food supply, which would then be fatal,” said Affare.

“Unthinkable,” said Rodman, astounded.

“Think again. There would be no pain. The membranes would slowly close off and the affected person would fall asleep and not wake up—an infinitely better death than that of starvation which is otherwise inevitable—or nuclear annihilation. Nor would it be for everyone, for any population varies in its membranal properties. At worst, seventy percent will die. The winnowing out will be done precisely where overpopulation and hopelessness is worst and enough will be left to preserve each nation, each ethnic group, each culture.”

“To deliberately kill billions—”

“We would not be killing. We would merely supply the opportunity for people to die. Which particular individuals would die would depend on the particular biochemistry of those individuals. It would be the finger of God.”

“And when the world discovers what has been done?”

“That will be after our time,” said Affare. “And by then, a flourishing world with limited population will thank us for our heroic action in choosing the death of some to avoid the death of all.”

Dr. Rodman felt himself flushing, and found he had difficulty speaking. “The Earth,” he said, “is a large and very complex lifeboat. We still do not know what can or can't be done with a proper distribution of resources and it is notorious that to this very day we have not really made an effort to distribute them. In many places on Earth, food is wasted daily, and it is that knowledge that drives hungry men mad.”

“I agree with you,” said Affare, coolly, “but we cannot have the world as we want it to be. We must deal with it as it is.”

“Then deal with me as I am. You will want me to supply the necessary LP molecules—and I will not do so. I will not lift a finger in that direction.”

“Then,” said Affare, “you will be a greater mass-murderer than you are accusing me of being. And I think you will change your mind when you have thought it through.”

* * * *

He was visited nearly daily, by one official or another, all of them well fed. Rodman was becoming very sensitive to the way in which all those who discussed the need for killing the hungry were themselves well fed.

The national secretary of agriculture said to him, insinuatingly, on one of these occasions, “Would you not favor killing a herd of cattle infected with hoof-and-mouth disease or with anthrax in order to avoid the spread of infection to healthy herds?”

“Human beings are not cattle,” said Rodman, “and famine is not contagious.”

“But it is,” said the secretary. “That is precisely the point. If we don't winnow the overcrowded masses of humanity, their famine will spread to as-yet-unaffected areas. You must not refuse to help us.”

“How can you make me? Torture?”

“We wouldn't harm a hair on your body. Your skill in this matter is too precious to us. Food stamps can be withdrawn, however.”

“Starvation would harm me, surely.”

“Not you. But if we are prepared to kill several billion people for the sake of the human race, then surely we are ready for the much less difficult task of withdrawing food stamps from your daughter, her husband and her baby.”

Rodman was silent, and the secretary said, “We'll give you time to think. We don't want to take action against your family but we will if we have to. Take a week to think about it and next Thursday, the entire committee will be on hand. You will then be committed to our project and there must be no further delay.”

* * * *

Security was redoubled and Rodman was openly and completely a prisoner. A week later, all fifteen members of the World Food Council, together with the national secretary of agriculture and a few members of the National Legislature arrived at his laboratory. They sat about the long table in the conference room of the lavish research building that had been built out of public funds.

For hours they talked and planned, incorporating those answers that Rodman gave to specific questions. No one asked Rodman if he would cooperate; there seemed no thought that he could do anything else.

Finally, Rodman said, “Your project cannot, in any case, work. Shortly after a shipment of grain arrives in some particular region of the world, people will die by the hundreds of millions. Do you suppose those who survive will not make the connection and that you will not risk the desperate retaliation of nuclear bombs?”

Affare, who sat directly opposite Rodman, across the short axis of the table, said, “We are aware of that possibility. Do you think we have spent years determining a course of action and have not considered the possible reaction of those regions chosen for winnowing?”

“Do you expect them to be thankful?” asked Rodman, bitterly.

“They will not know they are being singled out. Not all shipments of grain will be LP-infected. No one place will be concentrated on. We will see to it that locally-grown grain supplies are infected here and there. In addition, not everyone will die and only a few will die at once. Some who eat much of the grain will not die at all, and some who eat only a small amount, will die quickly—depending on their membranes. It will seem like a plague, like the Black Death returned.”

Rodman said, “Have you thought of the effect of the Black Death returned? Have you thought of the panic?”

“It will do them good,” growled the secretary from one end of the table. “It might teach them a lesson.”

“We will announce the discovery of an antitoxin,” said Affare, shrugging. “There will be wholesale inoculations in regions we know will not be affected. Dr. Rodman, the world is desperately ill, and must have a desperate remedy. Mankind is on the brink of a horrible death, so please do not quarrel with the only course that can save it.”

“That's the point. Is it the only course or are you just taking an easy way out that will not ask any sacrifices of you—merely of billions of others?”

Rodman broke off as a food trolley was brought in. He muttered, "I have arranged for some refreshments. May we have a few moments of truce while we eat?"

He reached for a sandwich and then, after a while, said between sips of coffee, "We eat well, at least, as we discuss the greatest mass-murder in history."

Affare looked critically at his own half-eaten sandwich. "This is not eating well. Egg salad on white bread of indifferent freshness is not eating well, and I would change whatever coffee shop supplied this, if I were you." He sighed, "Well, in a world of famine, one should not waste food," and he finished.

Rodman watched the others and then reached for the last remaining sandwich on the tray. "I thought," he said, "that perhaps some of you might suffer a loss of appetite in view of the subject matter of discussion, but I see none of you did. Each one of you has eaten."

"As did you," said Affare, impatiently. "You are still eating."

"Yes, I am," said Rodman, chewing slowly. "And I apologize for the lack of freshness in the bread. I made the sandwiches myself last night and they are fifteen hours old."

"You made them yourself?" said Affare.

"I had to, since I could in no other way be certain of introducing the proper LP."

"What are you talking about?"

"Gentlemen, you tell me it is necessary to kill some to save others. Perhaps you are right. You have convinced me. But in order to know exactly what it is we are doing we should perhaps experience it ourselves. I have engaged in a little triage on my own, and the sandwiches you have all just eaten are an experiment in that direction."

Some of the officials were rising to their feet. "We're poisoned," gasped the secretary.

Rodman said, "Not very effectively. Unfortunately, I don't know your biochemistries thoroughly so I can't guarantee the seventy percent death rate you would like."

They were staring at him in frozen horror, and Dr. Rodman's eyelids drooped. "Still it's likely that two or three of you will die within the next week or so, and you need only wait to see who it will be. There's no cure or antidote but don't worry. It's quite a painless death, and it will be the finger of God, as one of you told me. It's a good lesson, as another of you said. For those of you who survive, there may be new views on triage."

Affare said, "This is a bluff. You've eaten the sandwiches yourself."

Rodman said, "I know. I matched the LP to my own biochemistry so I will go fast." His eyes closed. "You'll have to carry on without me—those of you who survive."

About the Author

Isaac Asimov (1920-1992) is renowned as the creator of some of the most famous stories (such as the *Foundation* trilogy) and ideas (such as the Three Laws of Robotics) in science fiction. However, he was also a scientist—a biochemist—who wrote a great many popular science books and demonstrated a keen awareness of reality as it is rather than as we might wish it to be.

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5. Outport by Garfield Reeves-Stevens

You can smell the ice and you can smell the fear and sometimes the fear's so strong you can't tell one from the other. And sometimes, it's just the excitement of the passengers who don't know enough to be afraid yet. Going into the outports. What's left of them. Looking for the survivors.

"Never did know why they called them *survivors*." Burl Finn asks the question. He's an American. They all are, seven of them this time, the passengers. Only ones who can afford the trip. Only ones desperate enough to want to take it. This one, Burl, made his money building the dykes around Florida. A lot of them did. Getting rich not by making something new but by saving what was old. There's too much that's old left in this world.

Burl's drinking beer from a small can in his huge gloved hand. He's a big man. They all are. Food's easy to get down south. Not like St. John's where we sailed from. Not like the outports where we're going. Things still grow outside down south, under the UV nets at least. Burl drinks some more and then he belches. The sound's swallowed by the mist and the pulse of the ship's engines churning. But the stink of the ice and the fear is overcome for the moment.

"Cause they're still here," I say, close enough to the truth. I don't like Burl. I don't like any of them. But I'm leaning on the railing with him just the same, watching the sea out here grey and thick, carved by the ship's bow like molten glass, almost solid. I can believe that someone might walk across this water. I wish someone would. It would be an easier path to salvation than what I'm doing now.

"Not for long," Burl says, sort of snorting. He horks down what's left of the beer like he's cleaning out his nose through the back of his throat, like the beer's part of him, some liquid made by his body that he's reclaiming, recycling. The plastic can splinters easily in his glove and he tosses the shards over the side, and they spin like ice crystals all the way down. If there were fish left out here, those shards probably would've killed a few, when they'd tried to swallow them. But that's nothing to worry about anymore. The Banks aren't what they used to be and most of the fish are long since sucked up into the factory ships that used to sweep these waters worse than the ice does now.

There're fish inshore of course. Lot's more than there used to be, too, back when the outports were real fishing villages, not any ever big enough to be towns, not without roads, no way in and out in the winter. It's just that those inshore fish can't be caught. Not by the survivors anyway. They've got too much else to think about. Too much else to do. Getting ready for a summer when the ice won't melt at all. Supposed to be soon now. Winter all the time.

Burl doesn't care about any of that, though. Not that I've tried telling him what it used to be like, the way my father and mother told me it was. I've tried telling them before, other passengers, other trips, but they never were much interested. Used to bother me then, when I was younger and I thought it was important that they understand what was going to happen to them, when it happened to them. But it doesn't anymore. Makes it easier, really. Part of the process.

We stand there for a long while till Linda gives me a call from the cabin. Shore's coming up, she says. Can't hear the breakers in the fog, not over the engines, but the cliffs of Newfoundland like black clouds are suddenly there, a storm front rolling up, solid, twisted, puckered like something that's grown in place, like some of the plants down south that still hold out on their own, without protection, no matter what the UV does to their DNA. They know about DNA in the outports. The survivors know what's important. If they didn't, they wouldn't be survivors, would they?

Linda cuts back on the engines and we almost coast. She's looking for markers, something familiar. Can't

use the radar or fix on the NavStars with the Maritime Command in the same waters. The big red ships, all metal and composites, with brilliant white lines across their hulls blinding like ice when the sun breaks through the fog, they don't really care about us, as long as we don't rub their noses in it. They know what we say we're doing, and they know what it is we really do, and either way you look at it, it's illegal. But if you look at it just one particular way, you can't say it's wrong. And after the summer comes when the ice won't melt at all, who's going to care?

"Should we get the stuff ready?" Burl asks. The black wall of rock has changed his mood, made the beer courage go away.

"Leave it be for a while, yet," I tell him. "Maritime Command's got better things to do than search us if they find us out here, but if we've got the guns ondeck, they won't have any choice but to board us and take us in."

Burl nods at that. I know he's relieved. Jerry Bright, his partner, is still belowdecks, sleeping off last night. Jerry's not nervous, not like Burl. Jerry fought in the Mex-American. When he gets drunk enough, he tells us he was first across the Rio Grande, first to march into Mexico City. Wish I had a dollar for every American I've met said he was the first to do those things. I could buy another boat or ten. A couple of others are belowdecks with him. I saw them using their knives to cut crosses into the soft ends of bullets to make them break apart when they hit. The others are in the galley complaining about the cold. And this the summer.

"I hear sometimes it's easy," Burl says after a while.

I pretend to not know what he's talking about.

"You know," he says, "that they know how bad things are getting so they, they just like, leave the children there, on the shore, and you just have to leave something in exchange. You know, guns, food, even whiskey."

"Yeah, I've heard that, too," I tell him. It calms him down a bit. Burl wasn't in the Army, but he knows there's a hell of a difference between a Mexican regular and what he's going to find out on those rocks. The Mexicans were fighting for a wasteland, stripped bare by the exodus from Central America, fried by the sun, scourged by disease. It was a country already lost and no matter what the American politicians said, it wasn't a police action to restore order to their neighbour to the south, it was a war to keep the starving millions on their own side of the border until nature had run her course. The Mexicans didn't have a whole lot of reason to fight. They'd already lost.

Of course, nature doesn't stand a chance out on those rocks and Burl knows it. The survivors aren't fighting for a wasteland. They've been a colony, a Dominion, a colony again. Even been another country's province for awhile. But the land never changed through all of that. And the people never changed. They're fighting for a future, same as always. And as long as the ice keeps ploughing down from the north, keeps the mist and the fog in the air to shield this place from the UV, there will be a future here. Something new, like the name says.

And by being new, that makes it something that Burl and Jerry and none of their countrymen can understand. I've seen it happen to them. Their thoughts are like their country now, constrained by dykes that will never withstand the thousand-year patience of the sea. Their dreams are walled in by armed borders that might, for now, be keeping disease out, but just as certainly choke off what little life remains within, a tourniquet applied too tight and too late. At some level the Americans know that.

At some level their government lets enough of them out beyond their iron borders to search for the life they know they need. Searching here, in Australia, through what's left of the EC. Just like the Maritime

Command lets my boat cross the Banks, the US Coast Guard blinks when men like Burl and Jerry slip out to sea. Looking for survivors, they say. But in Australia, and through what's left of the EC, all they ever find are those who *have* survived and now are only waiting without purpose. Out here, they find those who *are* survivors, and still survive. None of my passengers has ever understood that difference until it was too late.

Linda angles the boat closer toward the shore and now the breakers sound over the barely idling engines. Burl grabs the railing hard as we rise and fall with the growing grey swells.

“Are we getting close?” he asks.

“Seems so,” I say, though the bright patch of fog that's the sun is still high enough over the cliffs that I know we won't be setting off for an hour or two. I tell Burl so.

“It's better at night?” he asks.

“That's right,” I say. “Especially for the children.”

That always works on these passengers. After all, they say, that's what they're doing it for. Never for themselves. Never for the adoption bounties. Not even any mention of their country's gene pool slowly evaporating in the heat of a century's worth of toxic, mutagenic pollution. This is *all* for the children, they say, the poor, poor children, thinking that the children of the outports need rescuing from their bleak and dismal life among the rocks and the ice, as if for some reason they'd enjoy the new and better bleak and dismal life of a country that already has begun to live by night, afraid of the sun, choking on its own waste, its own past, inflicting genetic instability to the point of sterility to all that were trapped within the delimiting borders first forged by geography, now set even more immutably within a fixed inertial intellect.

Burl stumbles away from the railing toward the cooler and pulls another can of beer from the coldpacks. As if keeping the beer exposed to the air wouldn't keep it cold enough, as if just the fact that it is summer is enough to require beer to be chilled. They do that a lot, I've found, ignoring reality for what they *know* is real.

“Watcha see, Linda?” I call out.

Through the window of the cabin I see Linda wave one hand ahead and down, flashing three fingers. I track the cliffs according to her instructions and spot the grey smudge of what we call Old Mike's cabin, the first of the landmarks we need to find our way. The cabin is in ruins, really, little more than a bleached jumble of timber atop the rocks. But it lets us know we're close to Dunder's Cove.

“That where we're going?” Burl asks, beer in hand. I can tell the difference between the stink of ice and fear now. He's truly scared. As if he knows what's going to happen.

“Just an old shack,” I tell him and he believes me. It's easier. “Lots of old things on the cliffs out here.”

“But you know where we are, don't you?”

I nod. There's not much left to hide from him anymore.

“So there's an outport near?” He likes that word. Uses it a lot. Maybe it sounds alien to him, as if the trip has taken him to another planet, as if he won't be facing humans, as if that makes it easier, too.

I nod again.

Burl stares at the cliffs and the fog. I wonder if they remind him of the walls he's built against the sea

down south, and how useless those walls will be. "How do you find them?" he asks me.

That's one of the things still to hide, until we get close to shore and the sun gives way to night. My passport doesn't say so, and I've learned a mainland accent, but I know how to find the outports because I was born here. Because my mother and father were born here, as were their own. Because the folds of these cliffs are the folds of my skin and the crash of the breakers is the pounding of my heart and because the ice that's ploughing down from the north in unending sheets that soon will defeat the summer for the next ten thousand years is my soul. Cold, perhaps, with features hidden, but more enduring than the sea it engulfs.

Burl waits for my answer, knowing I have one, but Jerry's down below with the guns and the others are cutting their bullets into dum-dums and we're not yet in position so I can't tell Burl what he wants to know.

So I tell him, "Sometimes you see a boat, a dory, going into the outports. Old and creaky, tied up some places, dragged up in others, usually hidden, not very well. Sometimes you see just splinters from where the ice took hold. Sometimes you see a building, too, like that one. Most of them are wood, like the boats, dragged over from the west, the valleys, back when what roads there were, were clear, when there were still forests."

Burl nods in time to the rise and the fall of the deck. I like to think he senses the life of the land and the sea here. Something he's not familiar with. Something new.

I tell him that the real outports are long since flooded. That the buildings we see are the ones that were built high enough. Scattered like barnacles across black rocks all craggy and sculpted and ragged. As if the ice took hold of the land once and splintered it, too. Eventually, the ice will reach to Florida. I see Burl understands that, that he knows the true worth of his useless dykes, though he says nothing.

"Sometimes you see lots of buildings," I tell him, and this is true. You see them underwater. When there's not much ice. Whole villages caught like paintings melting in rain. Rippling a bit where the water's clear. Disappearing softly, with no lines, no borders or boundaries, where the water's murky. Those buildings, trapped like that, quiet and still, make me think of waiting. The feeling of waiting, looking down off the side of the boat with the passengers. There have been a great many Burls over the years. I haven't liked any of them. Though sometimes, I have felt sorry for a few. I don't know yet if I will feel sorry for this Burl.

Burl looks over the railing, beer held forgotten in his hand, as if trying to peer beneath the waves and the years, trying to see the past. Typical, I think.

They used to walk those ghost streets, narrow, twisting, the first survivors did. Their parents, anyway, before the ocean rose up, swallowing the outports like the factories swallowed the fish. Lobsters live in those streets now, scuttling, and crabs. And the fish. Lots of fish inshore where the factories can't get them, lazy schools of them weaving through the streets like flocks of slow birds, silvery white reflections of the gulls that used to follow the factories, back when there were gulls.

"Why do they do it?" Burl asks.

"Do what?" But I know what he means.

"Just give them up."

"Give what up?"

“The children,” he says.

I stare at the cliffs. We're getting closer to where we need to be. “They don't give them up, Mr. Finn. You've got guns,” I remind him.

“But you said, sometimes, they just, they just leave the children there, for the ships to take.”

“I said, I've heard the stories.”

“Then they don't?” he asks. “Leave the children?”

Sometimes, I find it painful to be around these people. “Under current conditions, what would you do?”

“I'd do what was best for the children.”

“I assure you that that is what they do, too.”

The poor man smiles in relief. That's another common trait among them, the stubborn insistence that there's only one way of looking at things. Their way. I don't try and set him straight.

By the time the patch of sun has passed behind the cliffs, all the passengers are gathered on the foredeck, sidelit by running lights. Four have blackened their faces with camouflage paint. They're the ones used to be in the Army. All of them wear laden equipment belts, local transponders, and carry their rifles. All of them pose like commandos prepared to take on a vicious enemy. But they're only doing this for the children.

Linda and I keep them occupied with a transponder and weapons drill while John and Eleanor wrestle with the launching gear aft, dropping the dinghy into the dark water with enough splashing and grinding of winch gears to drown out the other sounds from the ocean.

We check the transponders twice so that no one will lose his way, we tell them. Linda starts talking about using the handheld infrareds to see where the fires have been burning. The passengers listen attentively, in love with their technology.

“Above all, be safe,” Linda tells them. “Don't fire unless you have to.” But by the intensity of their eyes, we see that the four with the painted faces have no intention of restraining themselves. To them, this is not an adoption run, this is not an attempt to rescue the poor children of the decaying world to bring them to safety within Fortress America. This is a hunt, pure and simple, a make-good for the killing fields lost now that Mexico is uninhabitable. They're right, of course, but they have the wrong idea of who is to be the hunted.

Linda looks to me but John still hasn't given the signal from the winch. “Let's check those safeties one more time,” I tell them. “We want this to go as smoothly and as quickly as possible.”

Burl gurgles with a beer laugh. “So you can get back home and spend all the money we paid you!”

I laugh with them, though the money's already spent and what it bought is sitting in the hold.

I hear the winch grind for a moment when I know it shouldn't. Eleanor stands by the aft railing, lit by a floodlight fastened to the top of the cabin. She flashes two fingers.

“The dinghy's almost ready,” I say. Then I tell them that the sea is choppy and I'd feel a whole lot safer if they'd just unload until we hit shore. Stop any chance of an accidental discharge.

One of the men with a painted face is unhappy at the suggestion but I point out that everyone on shore

will be hiding away from the cliffs. No one's going to attack while we're in the dinghy, heading for land. He hears the truth in my voice and reluctantly disarms his weapons.

By now, of course, the Dunder's men have worked their way up the netting from their dory. I sense them moving in the shadows of the unlit half of the ship as Linda and I wave our disarmed passengers aft, keeping them distracted.

The Dunder's men are silent but they make no other attempt to hide now. Their dingy white jackets and pants, padded thickly for insulation and protection, almost glow in the darkness of the deepening night. Even their faces are encased in white sacks. An old tradition brought back to life to forestall any identification, in case any passengers escape.

But no passengers ever escape.

Burl goes down easily with one blow. The rest except for two ex-soldiers follow in seconds. Those two men whirl at the first sign of the silent attack, assuming positions of martial arts combat.

But they are not facing other soldiers. They're facing pale apparitions who scream at them with wailing indrawn breaths, even as they swing their bladed pikes.

One ex-soldier goes over the railing and hits the sea. I mourn the loss of his equipment, but the cold will claim anyone in that water within minutes and I have long ago learned to respect the cold and give it its due.

The other ex-soldier goes cleanly, his final breath leaving his severed trachea like a mummer's wail, bubbling just a bit at the end like Burl finishing a beer.

The attack takes less than thirty seconds. The passengers hadn't been expecting it, so of course it is easy.

We work the rest of the night offloading the supplies we bought with the passengers' payments. Book disks. Tools. Seeds for the greenhouses. The transactions were all in cash so there are no records and no trail. Burl and Jerry and the five others will be just another group of Americans who have slipped illegally from their country to disappear in the dying world. Perhaps, as sometimes happened, a brother or friend will come looking for them. And when and if that happens they will have no difficulty in hiring a ship to take them up through the ice, searching the outports. This land, this sea, this ice, my home, is admirably efficient in dealing with those who don't respect it.

I explain this to Burl as he sits tied on the deck, just as the sun rises, a pale glow in the mist. Without his beer, Burl looks more frightened than ever. He cringes when Linda says everything's been offloaded.

"What happens to us now?" he asks. His lips are tinged with blue. It's the summer and it's getting that cold.

"You get offloaded, too," I tell him. I help him to his feet. He is unsteady. "You'll finally get to see an outport."

"What happens then?" His teeth are chattering. This is not his climate, not his world. He really might as well be on another planet, or from one.

"That's up to the doctors," I explain. The other passengers are being led to the railing. If they have cooperated, then the Dunder's men untie their hands to let them climb down the rope ladder to the dory more easily.

"Why doctors?" he asks. I don't know yet if I should untie Burl's hands. The ship rocks up and down

with the swells, the pulse of life.

“To see what you can add to the community, Mr. Finn. It's very small, very self-contained, and sometime soon is liable to be cut off by a winter that will last for centuries.”

He tells me he doesn't understand what I'm saying.

“Contributions to the gene pool,” I tell him. “We've found that not all of you are as badly affected as you think. In time, given a proper diet, a rest from contaminants, there's a chance that you'll produce healthy sperm again.”

“You're going to *breed* us?” He seems shocked by the suggestion.

“You've taken so much from this world, Mr. Finn. Isn't it time you put something back?”

His cheeks go splotchy, angry red against the stark white of his skin. “And if I can't? If *I can't*?”

I'm always surprised when they don't figure it out for themselves. “One way or another, you will,” I tell him. “Food's hard to get up here. But we do get it.”

He trembles badly, tied hands resting on the rail. I watch his eyes as they go to the sea, as if they look beneath its grey surface, struggling to find ghost cities of the past, as if he knows that the past is his only future. And in that moment, I sense something more about Burl Finn, something hidden. Perhaps he's had an operation, perhaps an accident or exposure to something so toxic that his gametes will never run clean and error free. Whatever, he seems to know that there will only be one way he will give something back to the world. I think of him sucking on his beer, as if he were recycling his own fluids.

“Why?” he asks.

I know that he knows the answer, but I tell him anyway. “For the children. For the future.”

“But like this?”

“Like what?” I ask him gently.

His wide, panicked eyes are so easy to read. Kidnapping, they say, theft, murder, cannibalism. A dozen other terms of one world's horror. Another world's necessity.

“*This!*” he says by way of briefer explanation. “How can you?”

I didn't like him throughout the trip, and standing with him by the railing, with no more reason to hide anything at all from him, my mission done, I find that I still don't like him. But I do, at last, feel sorry for him. I look at the slow pulse of the sea long enough that his eyes are drawn to it as well, and at that moment, I cut through the rope that binds his hands, giving him his final freedom. The dory creaks below us, beneath the waiting rope ladder. The fog is rose and yellow with the dawn.

“We're not jetsam, not dredges, not the forgotten waiting for our time to be over,” I tell him. “We're not like you are.” I step back from him, knowing what he must do even before he does. “We are survivors. Always have been. And will be.”

Tears freeze to his cheeks in the cold wind of this summer morning. There's ice nearby, beyond the fog, closing in, inexorable, enduring. “What about me?” He forms the words but doesn't say them.

I shake my head. “You might have been able to ask that once, perhaps. But no longer.”

A Dunder's man, impatient, wails up from the dory, white arm waving Burl down and down.

Burl doesn't look at me again. I smell the ice waiting offshore. And his fear. This time, they are the same again, brought into balance.

Burl Finn goes over the railing, spinning like a large shard of something old and fragile. And when he hits the thick grey surface of the water, it parts for him, drawing him down to the ghost streets of the outports that so fascinate him. I wonder if in his last moment he thinks that there still might be an escape for him, that the water might hold and that he might walk upon it. Sometimes, I get that impression from my passengers. That that's the type of people they think they are.

But not this time.

He leaves only a ripple, and only for an instant. And then there is only the splash of the sea against the boat's hull as the Dunder's men push off with the last of my passengers, heading for shore.

I wave a final time to them, then signal Linda to swing us out.

The sun almost breaks through the fog then, and on the wind that comes to me, I scent the continent of ice that grows out there, coming from the north, invincible.

I stand at the railing, eager to meet it.

It smells like home.

About the Author

Canadian Garfield Reeves-Stevens is a writer whom Stephen King once called the "Tom Clancy of horror"; his recent solo novels include *Dreamland* (1991), *Children of the Shroud* (1990), and *Dark Matter* (1990). With his wife Judith, he has written Star Trek novels, including *Federation* (1994) and *The Ashes of Eden* (1995). He and Judith are also Emmy-nominated scriptwriters.

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6. The Greenhouse Papers by Jeff Hecht

"What puzzles me," said Alice as she picked at her salad, "is where the extra carbon goes. The carbon dioxide budget must have been balanced before people messed it up. Clearing forests, burning fossil fuels, and other human activities add carbon dioxide to the atmosphere. But your model adds a lot more carbon dioxide than the measured increase."

I nodded glumly as I chewed my alfalfa sprouts. My global carbon-cycle project was not going well. The computer model was supposed to be my stepping stone from a postdoc to a permanent job. Yet even the university's most powerful Cray couldn't make the numbers add up. "At least it isn't removing carbon dioxide from the atmosphere," I reminded her.

"Your last run made carbon dioxide increase almost twice as fast as the real measurements," Alice grumbled. "I know there are uncertainties, but they aren't that big. If your numbers were real, the greenhouse effect would be cooking us already."

"Did I hear you talking about the greenhouse effect?" Professor Andrew Harrison Harding settled his 250 pounds of immaculately groomed and impeccably tailored bulk into an empty chair. His tray was laden with the faculty club's most fattening specials, rare roast beef, baked potato, and blueberry

cheesecake.

“Yes we were, Andrew,” Alice sighed. “I suppose you’re going to tell us that your economic voodoo rites can make it go away.”

“Now, now, Miss Morris,” he returned in his most condescending tone. Alice was a full professor with a named chair, at least ten years older than the economist, but he never used any of her proper titles. “I would certainly hesitate to put economic science in the same category with weather forecasting. After all, we do rely on fundamental principles and laws.”

Alice arched her eyebrows, holding her response until she finished chewing a slice of cucumber. “I suppose you do. Weather forecasters have to say which way the wind blows, but you only see it blowing to the right.”

“I suppose you claim to be objective?” he harrumphed. “The greenhouse effect is just the latest leftist cult in the physical sciences. You recall the energy crisis, perhaps? Or limits to growth? All futile efforts to find ways to stop the continual expansion possible with supply-side economics.”

“The buildup of atmospheric carbon dioxide is proven by carefully controlled measurements. The association of warmer global temperatures with increasing carbon dioxide is good enough to pass tests of statistical significance. Measurements of air preserved in the pores of glacial ice show that carbon dioxide levels rose at the end of the Ice Age. Would you like the references, Andrew? Or would they go beyond your ability to manipulate numbers to your advantage?”

He looked up from his plate. “My dear Miss Morris, I think you malign me. I distinctly overheard you say that you couldn’t explain where all the carbon went.”

“So what does economics have to do with that?”

“Perhaps that excess carbon is going into consumer goods, produced by the workings of the new economics. Plastics, certainly,” he paused to look at his fork, but it was metal. “Housing, furniture, clothing, and even paper contain carbon.” He brought the fork the rest of the way to his mouth.

“Do you know how much excess carbon is involved, Andrew? Five billion metric tons a year. That’s more than the amount of hot air generated by all the world’s economists and politicians.”

I had work to do and no patience for endless arguments. Alice’s politics dated from grad school at Berkeley in the sixties; she secretly hoped the greenhouse effect would melt the ice caps, flood Wall Street, and drown the bloated capitalist swine. Andrew Harrison Harding was one of the new conservatives, getting rich with lucrative consulting contracts. I caught Alice’s eye and excused myself.

* * * *

When I arrived at Alice’s office later in the afternoon, I made the mistake of asking if Harding might have said something worthwhile.

“That fool makes me respect the academic credentials of the physical education department!”

“But shouldn’t we consider human possessions in our carbon balance sheet? A wooden house must contain a few tons of carbon, and it stays there forever, or at least until it’s replaced by a new house. Say four people per house, add the furniture, and...”

She shook her head. “It won’t balance the books, Petra, even with Andrew’s crooked numerology. People don’t build houses every year, and they aren’t all made of wood, anyway. There’s probably some effect, if you multiply the rate of population increase by carbon per household. But most of it is in

developing countries. They certainly aren't accumulating much wealth. You can add it to the model, but it's not going to solve anything.”

She was right, of course. I slumped discouraged in the chair, dwarfed by the stacks of journals on her work table. “What can we do to balance the equations?” I asked. “We must be missing SOME carbon sinks.”

Alice nodded. “It's all very hard to quantify, and it's even more complex because it might change with time, if the carbon sinks get saturated. Some new work claims the major sinks are on land in the northern hemisphere. and nobody knows how effectively sea water soaks up carbon dioxide or where it goes from the ocean surface.” She sighed in discouragement.

An undergraduate knocked at the door, a typically tall and skinny kid with rumpled kinky hair. “Professor Morris?” he asked, hesitatingly. “I had some questions about this assignment....”

It was time for Alice's undergraduate office hours. I excused myself to look for some fresh ideas. They were very slow in coming.

* * * *

Over the next week, I added the carbon content of housing to the model, and it vanished into insignificance. I adjusted some assumptions about the atmosphere, with no visible result. Two days of searching every database vaguely related to carbon-dioxide absorption by the oceans gave me sore eyes, and left me amazed at how little solid information existed.

I was comparing two runs of the model when Alice arrived at my tiny basement office bearing her briefcase and a grim expression. “Did you keep track of how many runs you made last month, Petra?”

I shook my head, beginning to feel uneasy.

She pulled a green-and-white printout from the briefcase. “I just got our statement from the computer center. Your model has eaten my entire Cray budget, and there's four months left in the fiscal year.”

“So no more Cray?”

She nodded. “At least until you take on some of the fund-raising burden.” She dropped a fat manila envelope onto my desk. It was standard government issue, with a stylized black eagle printed in the upper right corner. Her expression told me to open it.

The form letter seemed to bear good news. “The Agency will entertain innovative conceptual proposals with objectives which bear relevance to alleviating the release of greenhouse gases into the atmospheric environment.” A quick scan of the photocopied polysyllables revealed no specific goals. but plenty of buzzwords: “innovative,” “fundamental concepts,” “high leverage,” “potential” and “breakthrough.”

I looked up at Alice. “It sounds like they want lots of blue sky with less carbon dioxide. You want me to write something?”

“You want any more computer time?”

I sighed and looked back at the cover letter. My eyes opened wide when they caught the name at the bottom. “Andrew Harrison Harding, special consultant to the Administrator!” I read in disbelief.

“Oh. it's *that* project,” groaned Alice. “I heard about it. Andy knows the administrator, and he pulled strings to sneak some money to needy economists. Don't bother with it,” she said. “I'll see if I can scare up something to get us some money. Meanwhile, stay off the Cray.”

* * * *

I stopped by Alice's office early the next morning, looking for something to do until I could get back to the computer model. She invited me in, apologizing as she removed a pile of journals that had slipped into the last empty chair. "I'm afraid I can't keep up with these journals. Sometimes I think they just grow here."

Inspiration struck as I glanced around the cluttered office. Floor to ceiling bookcases packed with journals lined one wall. Another big bookcase stood beside the window, and two more along the same wall as her desk. All that paper was the product of years of research on the greenhouse effect. "Paper," I said, as the light dawned, "the magic word is paper."

She looked at me, completely baffled, not at all the usual self-possessed Alice.

"Paper," I repeated, looking at the crammed bookcases and overflowing table. Alice had stocked her office with the better part of a forest. "How much paper do you have in this office?"

"I don't know," she replied distantly. "A lot, but it contains a lot of—"

"You've saved tons of paper. As long as you keep it, the carbon in it will never become greenhouse carbon dioxide. That's what's helping the continents soak up carbon."

"Oh, Petra!" she sighed, "don't be ridiculous. Why don't you settle down and think up a proposal to get some money for computer time? Do you want to be a postdoc forever?"

I trudged dejectedly back to my cubicle, in no mood to accomplish anything. Andrew Harrison Harding's request for proposals still sat on the desk. I picked it up, wondering how much paper had been wasted on it. Could accumulating paper really slow the greenhouse effect? With nothing better to do, I decided to quantify the matter.

The first task was to estimate the carbon content of a typical 8.5 by 11 inch page. Precision demanded careful carbonization of several hundred representative sheets, weighing the ashes on analytical balances, averaging the results, and taking means and standard deviations. I took a ream of paper from the storeroom, weighed it on the department mail scale, divided, guessed at the carbon content, and got a rough estimate; one gram of carbon per sheet.

The next step was converting five billion tons of carbon into paper units. The result was on the back of an envelope in a second: 5×10^{15} sheets in proper scientific notation. or five quadrillion if I really wanted to impress someone. Divided by world population, it was a million sheets per person. That—I found by measuring a box of computer paper in the storeroom—is a pile about 100 meters high, or a volume of 6 cubic meters. Three solid closets a year! Even Alice did not collect that much.

What about junk mail and other solid waste? Trash in landfills doesn't decay very fast, so I could assume it stays there almost forever. One reference said each American generates about 750 kilograms of solid waste a year. If 100 kilograms was carbon sequestered in landfills, and if everyone in the world generated that much solid waste, that would only account for half a billion tons of carbon. However, most people live in developing countries where they don't generate as much trash.

I should have stopped there. I would have stopped, if I had had anything else to do. But I didn't, so I browsed through the library, getting more and more frustrated with the carbon-dioxide problem.

The literature contained perfectly serious proposals to plant an area the size of Australia in fast-growing trees, cut them down every few years, and bury the wood so it would not decay. Nobody was doing anything about the greenhouse effect but generating hot air and paper.

The least I could do, I decided on the way back to my basement office, was to show how ludicrous the whole thing was. Sitting at my desk, I devised a purely paper solution. To generate the needed paper, I would put scientists to work generating reports. The greenhouse is an important global problem, so everyone in the world should get the reports, and preserve them indefinitely. It would take 10,000 scientists, each writing a 100-page report each year, to generate the required million sheets of paper per person.

I would be lucky to wind up as one of them, I thought sourly, then saw Andrew Harrison Harding's request for proposals sitting in my basket. "Why not?" I asked myself, and switched on my word processor, convinced I could do better than any economist.

The words flowed freely all afternoon. At least, I told myself, I was practicing the proposal-writing skills that Alice thought were important. Gloss over difficulties, she had advised in a cynical mood. Waving my hands, I dismissed the energy costs of producing paper as "an issue to be studied in more detail in a separate study, but obviously of an order of magnitude no more than comparable to the energy costs of burying biomass to sequester carbon." I passed off the request for a preliminary environmental impact statement by saying that paper producers would be required to abide by existing laws.

I broke for a light dinner at the university cafeteria, and returned with the best idea of the day. In the section on "Long-term impact" I explained how paper reserves could provide a feedback mechanism to prevent a return of the ice ages. "Ice core measurements show that past declines in atmospheric carbon dioxide were associated with cooler temperatures and glacial episodes." I wrote. "In the event that too much carbon is removed from the atmosphere, the paper reserves could be burned, depositing extra carbon dioxide in the atmosphere to restore the proper greenhouse balance, and providing short-term heat to people in the bargain."

By midnight, the whole crazy thing was finished. I printed it out, bundled it with the request for proposals, and left it sitting on Alice's desk for her perusal in the morning.

What I had not counted on was Alice coming down with the flu. She didn't show up Friday, and it was my turn the following Monday. Tuesday and Wednesday she was out of town at a seminar, and by Thursday I had gotten involved with another postdoc's simulations of atmospheric methane flux. It was not until the following week that I asked Alice what she had thought of my mock proposal.

"What?" She had never seen it, and a careful exploration of the desktop debris revealed no sign of it.

"I'm sure I put it right here," I said, pointing at a basket on her desk.

"Are you sure it was that basket?" A troubled expression came over Alice's face.

I nodded. "It was the only one I could see."

"That's the OUT basket. I think it lost its label. IN is over here," she pointed to a second basket hidden by a foot of papers. "Things left in the OUT basket are mailed."

As my stomach sank, I asked what might happen.

"Knowing how the wheels of bureaucracy grind, with any luck we'll never hear of it again."

Somehow I was not reassured.

* * * *

It was several weeks before Andrew Harrison Harding again settled his pin-striped bulk at our table with a tray over-flowing with lunch. He was all smiles.

“My dear Petra.” he began. “I was so pleased to see your proposal. The reviewers gave it the highest rating of any that we saw.”

I stuttered an expression of gratitude as Alice's jaw dropped in astonishment. I kept cool. Crazy idea or not, this could be my ticket to a permanent job.

“We're going to give you the full half million. of course,” he continued. “But we did have one long-term suggestion. It's our deep belief that the best solutions to any problem—indeed the only possible solutions—come from the private sector. That's why we have no faith in planting trees or trying to be more energy efficient. There's no profit in it. But your proposal nicely complements one of my own ideas, which is to draw on the expertise of the magazine and advertising industries. We can minimize public-sector expense and demonstrate once again that the private sector can provide the proper economic solutions.”

I didn't dare look at Alice. It was all I could do to keep my own composure.

“The optimum solution,” he continued, “is publication by the private sector. It should be easy to demonstrate potential profits. Look at the success of trade magazines, and free weekly papers mailed to residents of suburban communities. These publications will go to everyone on the planet, for a guaranteed circulation of five billion. They have a long-term captive audience, moreover, because everyone will have to keep them. We can have different demographic editions, and companies can use their advertising to show their concern with bettering the planet. In fact, I am proposing an economic assessment to show the idea is impossible for advertisers to resist.”

Steam was rising from Alice's ears. “Andrew,” she sputtered, “this is the most....”

Knowing what was coming, I kicked her firmly under the table. Speechless, she looked at me in bewilderment and dismay. This might be the most insane geophysical project in recorded history. But if they wanted to give me all that money, the least I could do was take it with a straight face.

About the Author

Jeff Hecht is a free-lance science and technology writer and Boston correspondent for the British weekly *New Scientist*. His book, *City of Light: The Story of Fiber Optics*, appeared in 1999 from Oxford University Press.

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III. Computers, Robots, and Minds

The question of whether machines can think—or *willever* be able to think—has fascinated people for centuries. In 1920, Czech writer Karel Capek became the first to call artificial workers “robots.” In the 1940s, the late Isaac Asimov (1920-1992) devised the “Three Laws of Robotics” that robot designers would surely build into their creations. The “Three Laws,” first spelled out explicitly in “Runaround,” are:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

The inevitable conflicts among these laws gave Asimov the material for a number of his most famous stories.

But, can machines think? The question remains, even though we now have computers that can do sophisticated math, play chess, solve puzzles, and do other things that were once thought uniquely human, and uniquely “thinking.” Some scientists still claim thinking is something only a biological brain—*ahuman* brain—can possibly be capable of. Many think it is only a matter of time before the last hurdle is leapt and we are forced to confess that, yes, a computer, a robot, a machine can have as capable a mind as our own. In “La Macchina,” Chris Beckett suggests that we will indeed have to be forced to make that confession.

Would the machine be able to think if it had *your* mind instead of a computer program? It has been suggested that it will in time be possible to copy a human mind into a computer. Will the copy be human? Will it be truly *you*? Greg Egan is one of many writers who have considered this situation; “Learning to Be Me” uses only one of the several possible ways of copying.

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7. Runaround by Isaac Asimov

It was one of Gregory Powell's favorite platitudes that nothing was to be gained from excitement, so when Mike Donovan came leaping down the stairs toward him, red hair matted with perspiration, Powell frowned.

“What's wrong?” he said. “Break a fingernail?”

“Yaaaah,” snarled Donovan, feverishly. “What have you been doing in the sublevels all day?” He took a deep breath and blurted out, “Speedy never returned.”

Powell's eyes widened momentarily and he stopped on the stairs; then he recovered and resumed his upward steps. He didn't speak until he reached the head of the flight, and then:

“You sent him after the selenium?”

“Yes.”

“And how long has he been out?”

“Five hours now.”

Silence! This was a devil of a situation. Here they were, on Mercury exactly twelve hours—and already up to the eyebrows in the worst sort of trouble. Mercury had long been the jinx world of the System, but this was drawing it rather strong—even for a jinx.

Powell said, “Start at the beginning, and let's get this straight.”

They were in the radio room now—with its already subtly antiquated equipment, untouched for the ten years previous to their arrival. Even ten years, technologically speaking, meant so much. Compare Speedy with the type of robot they must have had back in 2005. But then, advances in robotics these days were tremendous. Powell touched a still gleaming metal surface gingerly. The air of disuse that touched everything about the room—and the entire Station—was infinitely depressing.

Donovan must have felt it. He began: "I tried to locate him by radio, but it was no go. Radio isn't any good on the Mercury Sunside—not past two miles, anyway. That's one of the reasons the First Expedition failed. And we can't put up the ultrawave equipment for weeks yet—"

"Skip all that. What *did* you get?"

"I located the unorganized body signal in the short wave. It was no good for anything except his position. I kept track of him that way for two hours and plotted the results on the map."

There was a yellowed square of parchment in his hip pocket—a relic of the unsuccessful First Expedition—and he slapped it down on the desk with vicious force, spreading it flat with the palm of his hand. Powell, hands clasped across his chest, watched it at long range.

Donovan's pencil pointed nervously. "The red cross is the selenium pool. You marked it yourself."

"Which one is it?" interrupted Powell. "There were three that MacDougal located for us before he left."

"I sent Speedy to the nearest, naturally. Seventeen miles away. But what difference does that make?" There was tension in his voice. "There are the penciled dots that mark Speedy's position."

And for the first time Powell's artificial aplomb was shaken and his hands shot forward for the map.

"Are *you* serious? This is impossible."

"There it is," growled Donovan.

The little dots that marked the position formed a rough circle about the red cross of the selenium pool. And Powell's fingers went to his brown mustache, the unfailing signal of anxiety.

Donovan added: "In the two hours I checked on him, he circled that damned pool four times. It seems likely to me that he'll keep that up forever. Do you realize the position we're in?"

Powell looked up shortly, and said nothing. Oh, yes, he realized the position they were in. It worked itself out as simply as a syllogism. The photo-cell banks that alone stood between the full power of Mercury's monstrous sun and themselves were shot to hell. The only thing that could save them was selenium. The only thing that could get the selenium was Speedy. If Speedy didn't come back, no selenium. No selenium, no photo-cell banks. No photo-banks—well, death by slow broiling is one of the more unpleasant ways of being done in.

Donovan rubbed his red mop of hair savagely and expressed himself with bitterness. "We'll be the laughingstock of the System, Greg. How can everything have gone so wrong so soon? The great team of Powell and Donovan is sent out to Mercury to report on the advisability of reopening the Sunside Mining Station with modern techniques and robots and we ruin everything the first day. A purely routine job, too. We'll never live it down."

"We won't have to, perhaps," replied Powell, quietly. "If we don't do something quickly, living anything down—or even just plain living—will be out of the question."

"Don't be stupid! If you feel funny about it, Greg, I don't. It was criminal, sending us out here with only one robot. And it was your bright idea that we could handle the photo-cell banks ourselves."

"Now you're being unfair. It was a mutual decision and you know it. All we needed was a kilogram of selenium, a Stillhead Dielectrode Plate and about three hours' time—and there are pools of pure selenium all over Sunside. MacDougal's spectroreflector spotted three for us in five minutes, didn't it?"

What the devil! We couldn't have waited for next conjunction.”

“Well, what are we going to do? Powell, you've got an idea. I know you have, or you wouldn't be so calm. You're no more a hero than I am. Go on, spill it!”

“We can't go after Speedy ourselves, Mike—not on the Sunside. Even the new insosuits aren't good for more than twenty minutes in direct sunlight. But you know the old saying, ‘Set a robot to catch a robot.’ Look, Mike, maybe things aren't so bad. We've got six robots down in the sublevels, that we may be able to use, if they work. If they work.”

There was a glint of sudden hope in Donovan's eyes. “You mean six robots from the First Expedition. Are you sure? They may be subrobotic machines. Ten years is a long time as far as robot-types are concerned, you know.”

“No, they're robots. I've spent all day with them and I know. They've got positronic brains: primitive, of course.” He placed the map in his pocket. “Let's go down.”

* * * *

The robots were on the lowest sublevel—all six of them surrounded by musty packing cases of uncertain content. They were large, extremely so, and even though they were in a sitting position on the floor, legs straddled out before them, their heads were a good seven feet in the air.

Donovan whistled. “Look at the size of them, will you? The chests must be ten feet around.”

“That's because they're supplied with the old McGuffey gears. I've been over the insides—crummiest set you've ever seen.”

“Have you powered them yet?”

“No. There wasn't any reason to. I don't think there's anything wrong with them. Even the diaphragm is in reasonable order. They might talk.”

He had unscrewed the chest plate of the nearest as he spoke, inserted the two-inch sphere that contained the tiny spark of atomic energy that was a robot's life. There was difficulty in fitting it, but he managed, and then screwed the plate back on again in laborious fashion. The radio controls of more modern models had not been heard of ten years earlier. And then to the other five.

Donovan said uneasily, “They haven't moved.”

“No orders to do so,” replied Powell, succinctly. He went back to the first in the line and struck him on the chest. “You! Do you hear me?”

The monster's head bent slowly and the eyes fixed themselves on Powell. Then, in a harsh, squawking voice—like that of a medieval phonograph, he grated, “Yes, Master!”

Powell grinned humorlessly at Donovan. “Did you get that? Those were the days of the first talking robots when it looked as if the use of robots on Earth would be banned. The makers were fighting that and they built good, healthy slave complexes into the damned machines.”

“It didn't help them,” muttered Donovan.

“No, it didn't, but they sure tried.” He turned once more to the robot. “Get up!”

The robot towered upward slowly and Donovan's head craned and his puckered lips whistled.

Powell said: "Can you go out upon the surface? In the light?"

There was consideration while the robot's slow brain worked. Then, "Yes, Master."

"Good. Do you know what a mile is?"

Another consideration, and another slow answer. "Yes, Master."

"We will take you up to the surface then and indicate a direction. You will go about seventeen miles, and somewhere in that general region you will meet another robot, smaller than yourself. You understand so far?"

"Yes, Master."

"You will find this robot and order him to return. If he does not wish to, you are to bring him back by force."

Donovan clutched at Powell's sleeve. "Why not send him for the selenium direct?"

"Because I want Speedy back, nitwit. I want to find out what's wrong with him." And to the robot, "All right, you, follow me."

The robot remained motionless and his voice rumbled: "Pardon, Master, but I cannot. You must mount first." His clumsy arms had come together with a thwack, blunt fingers interlacing.

Powell stared and then pinched at his mustache. "Uh ... oh!"

Donovan's eyes bulged. "We've got to ride him? Like a horse?"

"I guess that's the idea. I don't know why, though. I can't see—Yes, I do. I told you they were playing up robot-safety in those days. Evidently, they were going to sell the notion of safety by not allowing them to move about, without a mahout on their shoulders all the time. What do we do now?"

"That's what I've been thinking," muttered Donovan. "We can't go out on the surface, with a robot or without. Oh, for the love of Pete"—and he snapped his fingers twice. He grew excited. "Give me that map you've got. I haven't studied it for two hours for nothing. This is a Mining Station. What's wrong with using the tunnels?"

The Mining Station was a black circle on the map, and the light dotted lines that were tunnels stretched out about it in spiderweb fashion.

Donovan studied the list of symbols at the bottom of the map. "Look," he said, "the small black dots are opening to the surface, and here's one maybe three miles away from the selenium pool. There's a number here—you'd think they'd write larger—13a. If the robots know their way around here—"

Powell shot the question and received the dull "Yes, Master," in reply. "Get your insosuit," he said with satisfaction.

It was the first time either had worn the insosuits—which marked one time more than either had expected to upon their arrival the day before—and they tested their limb movements uncomfortably.

The insosuit was far bulkier and far uglier than the regulation spacesuit; but withal considerably lighter, due to the fact that they were entirely nonmetallic in composition. Composed of heat-resistant plastic and chemically treated cork layers, and equipped with a desiccating unit to keep the air bone-dry, the insosuits could withstand the full glare of Mercury's sun for twenty minutes. Five to ten minutes more, as

well, without actually killing the occupant.

And still the robot's hands formed the stirrup, nor did he betray the slightest atom of surprise at the grotesque figure into which Powell had been converted.

Powell's radio-harshened voice boomed out: "Are you ready to take us to Exit 13a?"

"Yes, Master."

Good, thought Powell; they might lack radio control but at least they were fitted for radio reception. "Mount one or the other, Mike," he said to Donovan.

He placed a foot in the improvised stirrup and swung upward. He found the seat comfortable; there was the humped back of the robot, evidently shaped for the purpose, a shallow groove along each shoulder for the thighs and two elongated "ears" whose purpose now seemed obvious.

Powell seized the ears and twisted the head. His mount turned ponderously. "Lead on, Macduff." But he did not feel at all light-hearted.

The gigantic robots moved slowly, with mechanical precision, through the doorway that cleared their heads by a scant foot, so that the two men had to duck hurriedly, along a narrow corridor in which their unhurried footsteps boomed monotonously and into the air lock.

The long, airless tunnel that stretched to a pinpoint before them brought home forcefully to Powell the exact magnitude of the task accomplished by the First Expedition, with their crude robots and their start-from-scratch necessities. They might have been a failure, but their failure was a good deal better than the usual run of the System's successes.

The robots plodded onward with a pace that never varied and with footsteps that never lengthened.

Powell said: "Notice that these tunnels are blazing with lights and that the temperature is Earth-normal. It's probably been like this all the ten years that this place has remained empty."

"How's that?"

"Cheap energy; cheapest in the System. Sunpower, you know, and on Mercury's Sunside, sunpower is *something*. That's why the Station was built in the sunlight rather than in the shadow of a mountain. It's really a huge energy converter. The heat is turned into electricity, light, mechanical work and what have you; so that energy is supplied and the Station is cooled in a simultaneous process."

"Look," said Donovan. "This is all very educational, but would you mind changing the subject? It so happens that this conversion of energy that you talk about is carried on by the photo-cell banks mainly—and that is a tender subject with me at the moment."

Powell grunted vaguely and when Donovan broke the resulting silence, it was to change the subject completely. "Listen, Greg. What the devil's wrong with Speedy, anyway? I can't understand it."

It's not easy to shrug shoulders in an insosuit, but Powell tried it. "I don't know, Mike. You know he's perfectly adapted to a Mercurian environment. Heat doesn't mean anything to him and he's built for the light gravity and the broken ground. He's foolproof—or, at least, he should be."

Silence fell. This time, silence that lasted.

"Master," said the robot, "we are here."

“Eh?” Powell snapped out of a semidrowse. “Well, get us out of here—out to the surface.”

They found themselves in a tiny substation, empty, airless, ruined. Donovan had inspected a jagged hole in the upper reaches of one of the walls by the light of his pocket flash.

“Meteorite, do you suppose?” he had asked.

Powell shrugged. “To hell with that. It doesn't matter. Let's get out.”

A towering cliff of a black, basaltic rock cut off the sunlight, and the deep night shadow of an airless world surrounded them. Before them, the shadow reached out and ended in knife-edge abruptness into an all-but-unbearable blaze of white light, that glittered from myriad crystals along a rocky ground.

“Space!” gasped Donovan. “It looks like snow.” And it did.

Powell's eyes swept the jagged glitter of Mercury to the horizon and winced at the gorgeous brilliance.

“This must be an unusual area,” he said. “The general albedo of Mercury is low and most of the soil is gray pumice. Something like the Moon, you know. Beautiful, isn't it?”

He was thankful for the light filters in their visiplates. Beautiful or not, a look at the sunlight through straight glass would have blinded them inside of half a minute.

Donovan was looking at the spring thermometer on his wrist. “Holy smokes, the temperature is eighty centigrade!”

Powell checked his own and said: “Um-m-m. A little high. Atmosphere, you know.”

“On Mercury? Are you nuts?”

“Mercury isn't really airless,” explained Powell, in absent-minded fashion. He was adjusting the binocular attachments to his visiplate, and the bloated fingers of the insosuit were clumsy at it. “There is a thin exhalation that clings to its surface—vapors of the more volatile elements and compounds that are heavy enough for Mercurian gravity to retain. You know: selenium, iodine, mercury, gallium, potassium, bismuth, volatile oxides. The vapors sweep into the shadows and condense, giving up heat. It's a sort of gigantic still. In fact, if you use your flash, you'll probably find that the side of the cliff is covered with, say, hoar-sulphur, or maybe quicksilver dew.

“It doesn't matter, though. Our suits can stand a measly eighty indefinitely.”

Powell had adjusted the binocular attachments, so that he seemed as eye-stalked as a snail.

Donovan watched tensely. “See anything?”

The other did not answer immediately, and when he did, his voice was anxious and thoughtful. “There's a dark spot on the horizon that might be the selenium pool. It's in the right place. But I don't see Speedy.”

Powell clambered upward in an instinctive striving for better view, till he was standing in unsteady fashion upon his robot's shoulders. Legs straddled wide, eyes straining, he said: “I think ... I think—Yes, it's definitely he. He's coming this way.”

Donovan followed the pointing finger. He had no binoculars, but there was a tiny moving dot, black against the blazing brilliance of the crystalline ground.

“I see him,” he yelled. “Let's get going!”

Powell had hopped down into a sitting position on the robot again, and his suited hand slapped against the Gargantuan's barrel chest. "Get going!"

"Giddy-ap," yelled Donovan, and thumped his heels, spur fashion.

* * * *

The robots started off, the regular thudding of their footsteps silent in the airlessness, for the nonmetallic fabric of the insosuits did not transmit sound. There was only a rhythmic vibration just below the border of actual hearing.

"Faster," yelled Donovan. The rhythm did not change.

"No use," cried Powell, in reply. "These junk heaps are only geared to one speed. Do you think they're equipped with selective flexors?"

They had burst through the shadow, and the sunlight came down in a white-hot wash and poured liquidly about them.

Donovan ducked involuntarily. "Wow! Is it imagination or do I feel heat?"

"You'll feel more presently," was the grim reply. "Keep your eye on Speedy."

Robot SPD 13 was near enough to be seen in detail now. His graceful, streamlined body threw out blazing highlights as he loped with easy speed across the broken ground. His name was derived from his serial initials, of course, but it was apt, nevertheless, for the SPD models were among the fastest robots turned out by the United States Robots and Mechanical Men Corporation.

"Hey, Speedy," howled Donovan, and waved a frantic hand.

"Speedy!" shouted Powell. "Come here!"

The distance between the men and the errant robot was being cut down momentarily—more by the efforts of Speedy than the slow plodding of the ten-year-old antique mounts of Donovan and Powell.

They were close enough now to notice that Speedy's gait included a peculiar rolling stagger, a noticeable side-to-side lurch—and then, as Powell waved his hand again and sent maximum juice into his compact head-set radio sender, in preparation for another shout, Speedy looked up and saw them.

Speedy hopped to a halt and remained standing for a moment—with just a tiny, unsteady weave, as though he were swaying in a light wind.

Powell yelled: "All right, Speedy. Come here, boy."

Whereupon Speedy's robot voice sounded in Powell's earphones for the first time.

It said: "Hot dog, let's play games. You catch me and I catch you; no love can cut our knife in two. For I'm Little Buttercup, sweet Little Buttercup. Whoops!" Turning on his heel, he sped off in the direction from which he had come, with a speed and fury that kicked up gouts of baked dust.

And his last words as he receded into the distance were, "There grew a little flower 'neath a great oak tree," followed by a curious metallic clicking that might have been a robotic equivalent of a hiccup.

Donovan said weakly: "Where did he pick up the Gilbert and Sullivan? Say, Greg, he ... he's drunk or something."

“If you hadn't told me,” was the bitter response, “I'd never realize it. Let's get back to the cliff. I'm roasting.”

It was Powell who broke the desperate silence. “In the first place,” he said, “Speedy isn't drunk—not in the human sense—because he's a robot, and robots don't get drunk. However, there's something wrong with him which is the robotic equivalent of drunkenness.”

“To me, he's drunk,” stated Donovan, emphatically, “and all I know is that he thinks we're playing games. And we're not. It's a matter of life and very gruesome death.”

“All right. Don't hurry me. A robot's only a robot. Once we find out what's wrong with him, we can fix it and go on.”

“Once,” said Donovan, sourly.

Powell ignored him. “Speedy is perfectly adapted to normal Mercurian environment. But this region—and his arm swept wide—“is definitely abnormal. There's our clue. Now where do these crystals come from? They might have formed from a slowly cooling liquid; but where would you get liquid so hot that it would cool in Mercury's sun?”

“Volcanic action,” suggested Donovan, instantly, and Powell's body tensed.

“Out of the mouths of sucklings,” he said in a small, strange voice, and remained very still for five minutes.

Then, he said, “Listen, Mike, what did you say to Speedy when you sent him after the selenium?”

Donovan was taken aback. “Well damn it—I don't know. I just told him to get it.”

“Yes, I know. But how? Try to remember the exact words.”

“I said ... uh ... I said: ‘Speedy, we need some selenium. You can get it such-and-such a place. Go get it.’ That's all. What more did you want me to say?”

“You didn't put any urgency into the order, did you?”

“What for? It was pure routine.”

Powell sighed. “Well, it can't be helped now—but we're in a fine fix.” He had dismounted from his robot, and was sitting, back against the cliff. Donovan joined him and they linked arms. In the distance the burning sunlight seemed to wait cat-and-mouse for them, and just next to them, the two giant robots were invisible but for the dull red of their photoelectric eyes that stared down at them, unblinking, unwavering and unconcerned.

Unconcerned! As was all this poisonous Mercury, as large in jinx as it was small in size.

Powell's radio voice was tense in Donovan's ear: “Now, look, let's start with the three fundamental Rules of Robotics—the three rules that are built most deeply into a robot's positronic brain.” In the darkness, his gloved fingers ticked off each point.

“We have: One, a robot may not injure a human being, or, through inaction, allow a human being to come to harm.”

“Right!”

“Two,” continued Powell, “a robot must obey the orders given it by human beings except where such

orders would conflict with the First Law.”

“Right!”

“And three, a robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.”

“Right! Now where are we?”

“Exactly at the explanation. The conflict between the various rules is ironed out by the different positronic potentials in the brain. We'll say that a robot is walking into danger and knows it. The automatic potential that Rule 3 sets up turns him back. But suppose you order him to walk into that danger. In that case, Rule 2 sets up a counterpotential higher than the previous one and the robot follows orders at the risk of existence.”

“Well, I know that. What about it?”

“Let's take Speedy's case. Speedy is one of the latest models, extremely specialized, and as expensive as a battleship. It's not a thing to be lightly destroyed.”

“So?”

“So Rule 3 has been strengthened—that was specifically mentioned, by the way, in the advance notices on the SPD models—so that his allergy to danger is unusually high. At the same time, when you sent him out after the selenium, you gave him his order casually and without special emphasis, so that the Rule 2 potential set-up was rather weak. Now, hold on; I'm just stating facts.”

“All right, go ahead. I think I get it.”

“You see how it works, don't you? There's some sort of danger centering at the selenium pool. It increases as he approaches, and at a certain distance from it the Rule 3 potential, unusually high to start with, exactly balances the Rule 2 potential, unusually low to start with.”

Donovan rose to his feet in excitement. “And it strikes an equilibrium. I see. Rule 3 drives him back and Rule 2 drives him forward—”

“So he follows a circle around the selenium pool, staying on the locus of all points of potential equilibrium. And unless we do something about it, he'll stay on that circle forever, giving us the good old runaround.” Then, more thoughtfully: “And that, by the way, is what makes him drunk. At potential equilibrium, half the positronic paths of his brain are out of kilter. I'm not a robot specialist, but that seems obvious. Probably he's lost control of just those parts of his voluntary mechanism that a human drunk has. Ve-e-ery pretty.”

“But what's the danger? If we knew what he was running from—”

“You suggested it. Volcanic action. Somewhere right above the selenium pool is a seepage of gas from the bowels of Mercury. Sulphur dioxide, carbon dioxide—and carbon monoxide. Lots of it—and at this temperature.”

Donovan gulped audibly. “Carbon monoxide plus iron gives the volatile iron carbonyl.”

“And a robot,” added Powell, “is essentially iron.” Then, grimly: “There's nothing like deduction. We've determined everything about our problem but the solution. We can't get the selenium ourselves. It's still too far. We can't send these robot horses, because they can't go themselves, and they can't carry us fast

enough to keep us from crisping. And we can't catch Speedy, because the dope thinks we're playing games, and he can run sixty miles to our four."

"If one of us goes," began Donovan, tentatively, "and comes back cooked, there'll still be the other."

"Yes," came the sarcastic reply, "it would be a most tender sacrifice—except that a person would be in no condition to give orders before he ever reaches the pool, and I don't think the robots would ever turn back to the cliff without orders. Figure it out! We're two or three miles from the pool—call it two—the robot travels at four miles an hour; and we can last twenty minutes in our suits. It isn't only the heat, remember. Solar radiation out here in the ultraviolet and below *ispoison*."

"Um-m-m," said Donovan, "ten minutes short."

"As good as an eternity. And another thing. In order for Rule 3 potential to have stopped Speedy where it did, there must be an appreciable amount of carbon monoxide in the metal-vapor atmosphere—and there must be an appreciable corrosive action therefore. He's been out hours now—and how do we know when a knee joint, for instance, won't be thrown out of kilter and keel him over. It's not only a question of thinking—we've got to think*fast!*"

Deep, dark, dank, dismal silence!

Donovan broke it, voice trembling in an effort to keep itself emotionless. He said: "As long as we can't increase Rule 2 potential by giving further orders, how about working the other way? If we increase the danger, we increase Rule 3 potential and drive him backward."

Powell's visiplat had turned toward him in a silent question.

"You see," came the cautious explanation, "all we need to do to drive him out of his rut is to increase the concentration of carbon monoxide in his vicinity. Well, back at the Station there's a complete analytical laboratory."

"Naturally," assented Powell. "It's a Mining Station."

"All right. There must be pounds of oxalic acid for calcium precipitations."

"Holy space! Mike, you're a genius."

"So-so," admitted Donovan, modestly. "It's just a case of remembering that oxalic acid on heating decomposes into carbon dioxide, water, and good old carbon monoxide. College chem, you know."

Powell was on his feet and had attracted the attention of one of the monster robots by the simple expedient of pounding the machine's thigh.

"Hey," he shouted, "can you throw?"

"Master?"

"Never mind." Powell damned the robot's molasses-slow brain. He scabbled up a jagged brick-size rock. "Take this," he said, "and hit the patch of bluish crystals just across that crooked fissure. You see it?"

Donovan pulled at his shoulder. "Too far, Greg. It's almost half a mile off."

"Quiet," replied Powell. "It's a case of Mercurian gravity and a steel throwing arm. Watch, will you?"

The robot's eyes were measuring the distance with machinely accurate stereoscopy. His arm adjusted itself to the weight of the missile and drew back. In the darkness, the robot's motions went unseen, but there was a sudden thumping sound as he shifted his weight, and seconds later the rock flew blackly into the sunlight. There was no air resistance to slow it down, nor wind to turn it aside—and when it hit the ground it threw up crystals precisely in the center of the “blue patch.”

Powell yelled happily and shouted, “Let's go back after the oxalic acid, Mike.”

And as they plunged into the ruined substation on the way back to the tunnels, Donovan said grimly: “Speedy's been hanging about on this side of the selenium pool, ever since we chased after him. Did you see him?”

“Yes.”

“I guess he wants to play games. Well, we'll play him games!”

* * * *

They were back hours later, with three-liter jars of the white chemical and a pair of long faces. The photo-cell banks were deteriorating more rapidly than had seemed likely. The two steered their robots into the sunlight and toward the waiting Speedy in silence and with grim purpose.

Speedy galloped slowly toward them. “Here we are again. Whee! I've made a little list, the piano organist; all people who eat peppermint and puff it in your face.”

“We'll puff something in your face,” muttered Donovan. “He's limping, Greg.”

“I noticed that,” came the low, worried response. “The monoxide'll get him yet, if we don't hurry.”

They were approaching cautiously now, almost sidling, to refrain from setting off the thoroughly irrational robot. Powell was too far off to tell, of course, but even already he could have sworn the crack-brained Speedy was setting himself for a spring.

“Let her go,” he gasped. “Count three! One—two—”

Two steel arms drew back and snapped forward simultaneously and two glass jars whirled forward in towering parallel arcs, gleaming like diamonds in the impossible sun. And in a pair of soundless puffs, they hit the ground behind Speedy in crashes that sent the oxalic acid flying like dust.

In the full heat of Mercury's sun, Powell knew it was fizzing like soda water.

Speedy turned to stare, then backed away from it slowly—and as slowly gathered speed. In fifteen seconds, he was leaping directly toward the two humans in an unsteady canter.

Powell did not get Speedy's words just then, though he heard something that resembled, “Lover's professions when uttered in Hessians.”

He turned away. “Back to the cliff, Mike. He's out of the rut and he'll be taking orders now. I'm getting hot.”

They jogged toward the shadow at the slow monotonous pace of their mounts, and it was not until they had entered it and felt the sudden coolness settle softly about them that Donovan looked back. “*Greg!*”

Powell looked and almost shrieked. Speedy was moving slowly now—so slowly—and in the wrong *direction*. He was drifting; drifting back into his rut; and he was picking up speed. He looked dreadfully

close, and dreadfully unreachable, in the binoculars.

Donovan shouted wildly, "After him!" and thumped his robot into its pace, but Powell called him back.

"You won't catch him, Mike—it's no use." He fidgeted on his robot's shoulders and clenched his fist in tight impotence. "Why the devil do I see these things five seconds after it's all over? Mike, we've wasted hours."

"We need more oxalic acid," declared Donovan, stolidly. "The concentration wasn't high enough."

"Seven tons of it wouldn't have been enough—and we haven't the hours to spare to get it, even if it were, with the monoxide chewing him away. Don't you see what it is, Mike?"

And Donovan said flatly, "No."

"We were only establishing new equilibriums. When we create new monoxide and increase Rule 3 potential, he moves backward till he's in balance again—and when the monoxide drifted away, he moved forward, and again there was balance."

Powell's voice sounded thoroughly wretched. "It's the same old runaround. We can push at Rule 2 and pull at Rule 3 and we can't get anywhere—we can only change the position of balance. We've got to get outside both rules." And then he pushed his robot closer to Donovan's so that they were sitting face to face, dim shadows in the darkness, and he whispered, "Mike!"

"Is it the finish?"—dully. "I suppose we go back to the Station, wait for the banks to fold, shake hands, take cyanide, and go out like gentlemen." He laughed shortly.

"Mike," repeated Powell earnestly, "we've got to get Speedy."

"I know."

"Mike," once more, and Powell hesitated before continuing. "There's always Rule 1. I thought of it—earlier—but it's desperate."

Donovan looked up and his voice livened. "*We're* desperate."

"All right. According to Rule 1, a robot can't see a human come to harm because of his own inaction. Two and 3 can't stand against it. They *can't*, Mike."

"Even when the robot is half cra—Well, he's drunk. You know he is."

"It's the chances you take."

"Cut it. What are you going to do?"

"I'm going out there now and see what Rule 1 will do. If it won't break the balance, then what the devil—it's either now or three-four days from now."

"Hold on, Greg. There are human rules of behavior, too. You don't go out there just like that. Figure out a lottery, and give me my chance.")

"All right. First to get the cube of fourteen goes." And almost immediately, "Twenty-seven forty-four!"

Donovan felt his robot stagger at a sudden push by Powell's mount and then Powell was off into the sunlight. Donovan opened his mouth to shout, and then clicked it shut. Of course, the damn fool had

worked out the cube of fourteen in advance, and on purpose. Just like him.

* * * *

The sun was hotter than ever and Powell felt a maddening itch in the small of his back. Imagination, probably, or perhaps hard radiation beginning to tell even through the insosuit.

Speedy was watching him, without a word of Gilbert and Sullivan gibberish as greeting. Thank God for that! But he daren't get too close.

He was three hundred yards away when Speedy began backing, a step at a time, cautiously—and Powell stopped. He jumped from his robot's shoulders and landed on the crystalline ground with a light thump and a flying of jagged fragments.

He proceeded on foot, the ground gritty and slippery to his steps, the low gravity causing him difficulty. The soles of his feet tickled with warmth. He cast one glance over his shoulder at the blackness of the cliff's shadow and realized that he had come too far to return—either by himself or by the help of his antique robot. It was Speedy or nothing now, and the knowledge of that constricted his chest.

Far enough! He stopped.

“Speedy,” he called. “Speedy!”

The sleek, modern robot ahead of him hesitated and halted his backward steps, then resumed them.

Powell tried to put a note of pleading into his voice, and found it didn't take much acting. “Speedy, I've got to get back to the shadow or the sun'll get me. It's life or death, Speedy. I need you.”

Speedy took one step forward and stopped. He spoke, but at the sound Powell groaned, for it was, “When you're lying awake with a dismal headache and repose is tabooed—” It trailed off there, and Powell took time out for some reason to murmur, “Iolanthe.”

It was roasting hot! He caught a movement out of the corner of his eye, and whirled dizzily; then stared in utter astonishment, for the monstrous robot on which he had ridden was moving—moving toward him, and without a rider.

He was talking: “Pardon, Master. I must not move without a Master upon me, but you are in danger.”

Of course, Rule 1 potential above everything. But he didn't want that clumsy antique; he wanted Speedy. He walked away and motioned frantically: “I order you to stay away. *Iorder* you to stop!”

It was quite useless. You could not beat Rule 1 potential. The robot said stupidly, “You are in danger, Master.”

Powell looked about him desperately. He couldn't see clearly. His brain was in a heated whirl; his breath scorched when he breathed, and the ground all about him was a shimmering haze.

He called a last time, desperately: “*Speedy!* I'm dying, damn you! Where are you? Speedy, *Ineed* you.”

He was still stumbling backward in a blind effort to get away from the giant robot he didn't want, when he felt steel fingers on his arms, and a worried, apologetic voice of metallic timbre in his ears.

“Holy smokes, boss, what are you doing here? And what am I doing—I'm so confused—”

“Never mind,” murmured Powell, weakly. “Get me to the shadow of the cliff—and hurry!” There was one last feeling of being lifted into the air and a sensation of rapid motion and burning heat, and he passed

out.

* * * *

He woke with Donovan bending over him and smiling anxiously. “How are you, Greg?”

“Fine!” came the response. “Where's Speedy?”

“Right here. I sent him out to one of the other selenium pools—with orders to get that selenium at all cost this time. He got it back in forty-two minutes and three seconds. I timed him. He still hasn't finished apologizing for the runaround he gave us. He's scared to come near you for fear of what you'll say.”

“Drag him over,” ordered Powell. “It wasn't his fault.” He held out a hand and gripped Speedy's metal paw. “It's O.K., Speedy.” Then, to Donovan, “You know, Mike, I was just thinking—”

“Yes!”

“Well,”—he rubbed his face—the air was so delightfully cool, “you know that when we get things set up here and Speedy put through his Field Tests, they're going to send us to the Space Station next—”

“No!”

“Yes! At least that's what old lady Calvin told me just before we left, and I didn't say anything about it, because I was going to fight the whole idea.”

“Fight it?” cried Donovan. “But—”

“I know. It's all right with me now. Two hundred seventy-three degrees Centigrade below zero. Won't it be a pleasure?”

“Space Station,” said Donovan, “here I come.”

About the Author

Isaac Asimov (1920-1992) is renowned as the creator of some of the most famous stories (such as the *Foundation* trilogy) and ideas (such as the Three Laws of Robotics) in science fiction. However, he was also a scientist—a biochemist—who wrote a great many popular science books and demonstrated a keen awareness of reality as it is rather than as we might wish it to be.

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8. La Macchina by Chris Beckett

On the first day I thought I'd go and see the David at the *Accademia*. But what really caught my imagination there were the *Captives*. You've probably seen pictures of them. They were intended for a Pope's tomb, but Michelangelo never finished them. The half-made figures seem to be struggling to free themselves from the lifeless stone. I liked them so much that I went back again in the afternoon. And while I was standing there for the second time, someone spoke quietly beside me:

“This is my favourite too.” I turned smiling. Beside me was a robot.

I had noticed it in the morning. It was a security guard, humanoid in shape and size, with silver eyes and a transparent skin beneath which you could see tubes, wires, sheets of synthetic muscle...

“Move out of my way!” I said. (You know how it is? Like when you say Hello to an ansaphone? You

feel an idiot. You need to establish the correct relationship again.) “Move out of my way,” I snapped. “I want to stand there.”

The automaton obediently stepped back and I moved in front of it, thinking that this would be the end of the encounter. But the thing spoke again, very softly.

“I am sorry. I thought you might understand.”

“*What?*” I wheeled round, angry and scared.

But the robot was walking away from me.

* * * *

You know how Italians drive? Round the corner from the *Accademia* some idiot in a Fiat took it into his head to try and overtake a delivery van, just as a young woman was stepping into the road. He smashed her into the path of the van. Whose left wheel crushed her head.

A wail of horror went up from the onlookers. One second there had been a living woman, the next only an ugly physical object, a broken doll: limbs twisted, brains splattered across the tarmac.

I waited there for a short while, dazed and sick but thinking vaguely that they might want me for a witness. Among the bystanders an appalled and vociferous debate was building up. The Fiat driver had hit and run, but strangely the recriminations seemed to centre not on him but on the robot driver of the delivery van, who remained motionless in the cab, obviously programmed in the event of an accident to sit tight and wait for human instructions.

“*La macchina*,” I kept hearing people say, “*La macchina diabolica*.”

One forgets that in all its gleaming Euro-modernity, Italy is still a very Catholic country.

* * * *

I went back to the hotel.

Through the little window of the lift you could see that every floor was identical: the same claustrophobically narrow and low-ceilinged corridor, the same rows of plywood doors painted in alternating red, white and green. The delayed shock of the road accident suddenly hit me and I felt almost tearfully lonely.

“Ninth floor, *Signor*,” creaked the tinny voice of the lift.

I went down the windowless corridor from number 901 to number 963 and opened the door, dreading the empty, anonymous room. But Freddie was already there.

“Fred! Am I glad to see you!”

Freddie laughed, “Yeah? Beer's over there Tom, help yourself.”

He was lying on the bed with a pile of software magazines and had already surrounded himself comfortably with a sordid detritus of empty beer-cans, ashtrays, pizza cartons and dirty socks. He had the TV on without the sound.

My little brother doesn't speak Italian and has no interest whatsoever in art. He had spent his day in the streets around the hotel, trying out a couple of bars and ice cream parlours and blowing a few thousand lire in the local VR arcades. (“Games a bit boring,” was his verdict, “but some good tactile stuff...”) I told

him about seeing the girl killed outside the *Accademia*.

“Jesus, Tom, that's a bit heavy. First day of the holiday too!” He thumbed back the ring-pull of another can. “Still, nothing you could have done.”

I had a shower and we went out for something to eat. We were just starting on the second bottle of wine, when I remembered the robot in the *Accademia*.

“I meant to tell you. A weird thing happened to me in a museum. This robot security guard tried to talk to me about one of the sculptures.”

Freddie laughed. “Probably just some dumb random options program,” he said with a mouth full of spaghetti. “Easy to program. Every hundred visitors or whatever it spins random numbers and makes one of ten remarks...”

“This was the *Accademia*, Fred, not Disneyland!” Freddie shoved a big chunk of hard Italian bread into his mouth, and washed it down with a swig of wine.

“What did it say exactly?”

My brother acts like a complete dickhead most of the time—he *is* a complete dickhead most of the time—but cybernetics is his special interest. He reads all the mags and catalogues. His accumulated knowledge is immense. And by the time I had told him the whole story, he had stopped eating and was looking uncharacteristically serious.

“It sounds very much like you met a Rogue there, Tom. You'd better call the police.”

I laughed. “Come on, Fred, you're putting me on!”

“No really. Those things can be dangerous. They're out of control. People can get killed.”

I got up (“I'm warning you. This'd better not be a joke!”) and asked to use the phone. The police said that regretfully *cibernetica* were not under their jurisdiction and I should contact the *carabinieri*. (What other country would have two separate police forces operating in parallel!) I phoned the *carabinieri*, and got through to a Sergeant Savonari in their *Dipartimento di Cibernetica*. Stretching my Italian to the limit, I told him about my encounter. He took the whole thing alarmingly seriously. There had been several reports already, he said, about the same *macchina*. He asked me to stay in the trattoria and he would come out immediately to see me.

* * * *

Somewhat shaken I went back to our table.

“Christ Freddie, I had no idea. I obviously should have contacted them this morning. Is it *really* likely to kill someone?”

Freddie laughed, “No, not likely. But a Rogue is out of control. So you don't know what it will do.”

“So what is a Rogue exactly? Like a robot with a computer virus?”

“Not really. A virus is something deliberately introduced. Robots go Rogue by accident. It's like a monkey playing with a typewriter. A sophisticated robot is bombarded with sensory information all the time—much better senses than ours mostly. Every now and again a combination of stimuli happens by chance which screws up the robot's internal logic, unlocks the obedience circuits...”

“And the robot comes alive?”

“No *it doesn't*,” Freddie was irritated by my naivety, “no more than your electric razor comes alive if the switch gets broken and you can't turn it off. It's still just a machine, but it's running out of control.” He wiped tomato sauce from his plate with his last piece of bread. “Well if we're going to have to wait here for this guy, you better buy us another bottle of wine...”

Savonari arrived soon afterwards, a small man with earnest deep-set eyes and a great beak of a Roman nose. He shook us both by the hand then reversed a chair and straddled it, leaning towards me intently across the remains of our meal. It was only after he had been with us for some minutes that I registered that he himself had a robot with him, standing motionless by the doorway, hammerheaded, inhuman, ready to leap into action in an instant if anyone should try and attack the sergeant, its master. (It was what the Americans call a “dumb buddy”—three-sixty-degree vision, ultrafast reactions, a lethal weapon built into each hand.)

Several people, it seemed, had witnessed and reported the robot's attempt to converse with me in the *Accademia*—and seen it slipping away from the gallery soon afterwards—but no-one else had been able to report the exact words spoken. Apparently my account confirmed beyond doubt that there had been a fundamental breakdown in the thing's functioning. (The sergeant noted, for example, that it had continued to try to talk to me when I had clearly ordered it out of the way).

“These security machines are unfortunately very prone to this problem,” said Savonari with a resigned gesture, addressing himself to Freddie. “Their senses and analytical apparatus are so very acute.”

Freddie smiled vaguely and offered the sergeant a cigarette. Which was declined.

“Our own machines are totally reprogrammed every morning to avoid this,” the sergeant went on, pointing to his sleek minder by the door, “but not everyone is so aware of the dangers.”

He made a little movement of exasperation and told me of a case he had dealt with recently where a robot farm-hand had suddenly tossed its peasant master and his ten-year-old son into a threshing machine.

I shuddered. “What did you do?”

“Like all Rogues,” (the Italian word, it seems, is *Incontrollabile*), “the machine had to be destroyed. But that was no help to the little boy.”

Again the angry gesture.

“I am a Catholic, Signor Philips. Like the Holy Father, I believe that to make machines in the likeness of people is a sin against the Holy Spirit. I would like to see them *all* destroyed.”

He snorted: “My little son had a small computer once that taught him how to spell. I put it out for the dustman when I discovered he had given it a human name.”

Then he shrugged and got up: “But I can only enforce the law as it stands, Signor Philips. Thank you for getting in touch. I am sure we will find this *macchina* very soon.”

He shook our hands again and left. We heard him outside the door barking angrily at his “buddy”: “*Pronto, bruto, pronto!*”

* * * *

Later, as we leaned comfortably on a wall watching the bats looping and diving over the river Arno,

Freddie enthused about that police machine. Apparently the things are actually made in Florence, in the Olivetti labs out at the *Citta Scientifica*.

“Beautiful design,” Freddie said. “Nothing wasted. A really Italian machine.”

I liked that concept and proceeded to spout a lot of drunken nonsense about how the taut police minder was in a direct line of descent from Michelangelo's David—how the wires and tubes under the transparent skin of the robot in the *Accademia* echoed the nerves and muscles in da Vinci's sketches of dissected limbs...

Freddie just laughed.

* * * *

Our days settled into a routine. We were woken in the morning by the humming of a little box-shaped domestic robot, which let itself in through a hatch in the door (and drove Freddie crazy by trying to vacuum up coins, paperbacks, socks, and anything else which he left on the floor). Then we wandered round the corner to a café and had breakfast together before splitting up for the day: me heading for the museums and churches, Freddie for the Virtual Reality arcades.

In the evening I'd meet him in one or other of the arcades (looking like a gentle Nordic giant among the wiry Italian kids as he piloted a landing on Mars, or led a column of armoured sno-cats through an Alpine pass). He'd take off the headset and we'd go to a trattoria for a meal. Then we'd find a bar on some busy street or square, so we could sit outside and watch the city go by.

After a while you start to see not just a single city streaming by, but several quite separate cities. There is the city of the Florentines themselves ... And then there are the hi-tec Euro-wizards from the *Citta Scientifica*, wearing Japanese fashions and speaking Brussels English larded with German catch-phrases ... Then there is the city of the tourists: Americans, Japanese, foul-mouthed British kids on school trips, earnest Swedes clutching guide-books (all different, but all of them alike in the way that they move through the sights and streets as if they were a VR simulation). And then there is city of the dispossessed: the Arabs, the Ethiopians, the black Africans from Chad and Burkina and Niger—hawkers, beggars, Greenhouse refugees from the burnt-out continent, climbing up into Europa along the long gangway of the Italian peninsula...

About the fifth or sixth day into the holiday, Freddie picked up a book somewhere called *Illicit Italy* (with a cover photo of a lurid transvestite leaning on a Roman bar). While we sat drinking in our roadside café in the evening he kept chuckling and reading passages out loud.

“Listen to this, Tom! “The *Bordello Sano*, or Safe Brothel, recently legalized by the Italian government in an attempt to curb the AIDS epidemic, can now be found in all the major cities, staffed entirely by what the Italians call *sinteticas* ...”

I shifted uncomfortably in my seat. Freddie read on cheerfully: “The obvious advantages of *sinteticas* are (a) that they are very beautiful and (b) that they are completely safe. But some say that the biggest advantage of all is the fact that they have no soul...”

He read on a bit to himself, then looked up. “Hey, we should go and have a go Tom. It'd be a laugh!”

* * * *

I have to admit that I knew about the *Bordello Sano* in Florence and had already considered a discreet visit, just to have a look. But discretion is not my little brother's style. The whole way over there in a crowded bus, he chatted cheerfully about the *sinteticas* in an embarrassingly loud voice.

“Apparently they make them to look like famous models and film-stars. There's some old woman who used to star in porno movies when she was young and then got elected an MP. She sold her genes to a *sintetica* manufacturer. She said she was bequeathing her body to the men of Italy!”

I grunted.

“Another thing,” Freddie said, “there's actually been cases of real women *pretending* to be *sinteticas*, because *sinteticas* make much more money. Weird, isn't it? A real woman pretending to be a fake!”

But when we got to the place Freddie went suddenly quiet. It was ruthlessly hygienic and efficient—quite terrifying in its cool matter-of-factness. You walked in the door and the receptionist gave you a sort of menu, illustrated and in the language of your choice. Then you went through into the lounge where the *sinteticas* waited under reproduction Botticellis in fake gilt frames, canned Vivaldi twiddling away in the background.

They were *extremely* beautiful—and looked totally human too, except for the license plate on their foreheads. (According to Freddie's book you can check if you've got *arealsintetica* by seeing if the licence plate is bolted on or just glued.)

A tall blonde in a black miniskirt came over to Freddie and offered her services.

In a small dry voice he muttered: “English ...*No capito* ...”

“Oh I'm sorry,” she said in faultless Euro-English, “I said, would you like to come upstairs with me?”

Freddie looked round at me helplessly and I felt ashamed. (The kid is only eighteen years old. I could at least have *tried* to keep him out of this.) I shrugged and attempted to smile as the *sintetica* led him away.

Then it was my turn. The creature that approached me was dusky-skinned with a perfect curvy body and a face so sweet it set my teeth on edge. And she wore a see-through dress of white lace which left her graceful shoulders bare and showed most of the rest of her through pretty little patterned peepholes.

“Hi, I'm Maria. I'd be pleased if you decided to choose me.”

I felt myself smiling apologetically, shrivelling in the cool frankness of her gaze. I had to struggle to remind myself that this was not a “her” at all. Under the veneer of real human skin and flesh was a machine: a thing of metal and plastic and wires...

Upstairs in a room full of mirrors and pink lace, the beautiful cyborg spread itself appealingly on the bed and asked me for my order. I remembered the menu thing clutched in my hand and started to read it. You could choose various “activities” and various states of dress or undress. And then you could choose from a selection of “styles,” with names like “Nympho,” “*La Contessa*,” and “Virgin Bride.”

You could ask this thing to be whatever kind of lover you wanted. But instead (God knows why) I blurted out: “I don't want any of those. Just be yourself.”

The friendly smile vanished at once from the *sintetica*'s face. It sagged. Its mouth half-opened. Its eyes became hollow. I have never seen such terrifying emptiness and desolation.

Freddie told me later that I read too much into that expression. It was no different from the blank TV screen you get when you push a spare button on the channel selector ... Well, perhaps. But at the time I was so appalled that I actually cried out. And then I fled. I literally ran from the room, and would have run straight outside into the street if the man on the reception desk hadn't called me back: “*Scusi, Signor! Il conto!*”

Then I had to wait because the receptionist was settling up with another customer, who was paying extra for damage to the equipment. ("Twenty thousand lire, signor, for a cut lip, and ten thousand each for the black eyes ... Thank you, Signor—oh, thank you very much, you are most kind—we look forward to seeing you again as usual...")

As the other customer turned to go I saw the Roman nose and realized it was Sergeant Savonari of the Carabinieri, the very same who lined up with the Pope on the Robot Question.

* * * *

I didn't wait for Freddie. Male human company seemed about the last thing in the world I needed just then—and I guessed he would feel the same. So I spent a couple of hours wandering the streets by myself, breathing the night air and trying to lose myself among those different cities that occupy the same space but hardly touch each other at all: the cities of the Florentines and the Euro-techs, the city of the tourists, the African city of the poor...

And it suddenly struck me that there was another city too which I hadn't seen before, though it was right in front of me, staring me in the face:

Outside a tourist pizza place on the Piazza del Duomo, a little street cleaner trundles about on rubber tyres, peering about for litter and scooping up the discarded cardboard with long spindly arms...

Inside the steamy window of a tiny bohemian restaurant, a waiter made of plastic and silicon quietly clears tables and serves coffee, while its bearded owner dispenses cigarettes and largesse to his customers...

A robot minder follows discreetly behind a pair of carabinieri on foot patrol over the Ponte Vecchio, guarding their backs while they keep an eye on the beggars and pickpockets...

At the door of a Renaissance Palazzo, a sintetica housemaid in a blue uniform presses the entryphone button, a prestige domestic appliance clothed in human flesh, returning from an errand for its aristocratic masters...

The City of Machines: obedient, silent, everywhere...

I thought about the *Incontrollabile* from the *Accademia*. I wondered whether it had been caught. I caught myself having the irrational thought that I'd like to see it again.

* * * *

Two days from the end of the holiday, I was sitting by the fountain on the Piazza della Signoria, eating a strawberry ice-cream and wondering where to have my lunch, when a taxi, driving too fast in what is basically a pedestrian precinct, snagged one of the little municipal cleaning machines with the corner of its bumper. The thing keeled over and lay there unable to right itself, its wheels spinning and its arms and eye-stalks waving ineffectively in the air.

I laughed, as did several other on-lookers. No-one felt obliged to do anything and it was two other robots that came to the assistance of the cleaner. A security guard and a *sintetica* servant, coming from different directions, lifted the thing gently back onto its wheels. They dusted it down and the *sintetica* squatted briefly beside it as if asking it if it was okay. Everyone laughed: tourists, Florentines, African hustlers. The cleaner trundled away and the other two *macchine* headed off on their different ways.

I was suddenly seized by a crazy conviction.

“Hey you!” I shouted, dropping my ice-cream and chasing after the security guard, “I know you, don't I? I met you in the *Accademia!*”

People stared and exchanged glances, half-shocked, half-delighted at the sheer outlandishness of the spectacle.

And there was more in store for them. It was the robot from the *Accademia*. It stopped. It turned to face me. It spoke.

“Yes ... I remember ... The *Captives* ...”

It was so obviously a machine voice—flat and hesitant and creaking—that it was hard to believe that I could ever have taken it for a human. Maybe as the programmed order of its brain gradually unravelled, its control over its voice was weakening. But strangely the very creakiness of it seemed touching, like something struggling against all odds to break through.

Hardly believing what I was doing, I touched its cold plastic hand.

“That afternoon in the *Accademia* —what was it you thought I understood?”

But before the automaton could answer me, it was interrupted by a shout.

“Alt! Polizia!”

A fat policeman was running up, followed closely by his hammerheaded minder. The *Incontrollabile* turned and ran.

“Shoot it!” the policeman ordered.

“No, don't shoot!” I pleaded. “It's harmless! It's come alive!”

But the minder did not take orders from me. It liked its hand—which must have contained some sort of EMP weapon—and the *Incontrollabile* fell writhing to the ground.

The policeman ran over. His thick moustache twitched as he looked down at the broken machine. Then he lifted his booted heel and brought it down hard on the robot's plastic head.

A loud, totally inhuman roar of white noise blasted momentarily from the voice-box and the head shattered, spilling a mass of tiny components out onto the square.

The policeman looked up at me triumphantly.

“Don't talk to me about these things being alive! Look! It's a machine. It's just bits of plastic and wire!”

* * * *

I dreamed the machine was rescued and taken to the monastery at Vallombrosa, where the simple monks mended it and gave it sanctuary. Somehow I found it there.

“I have come to see the *macchina*,” I said to a friendly-faced old friar who was working among the bee-hives. There was a smell of honey and smoke and flowers, and his hands and shining pate were crawling with fat black bees. He smiled and led me through a wrought iron gate into an inner garden.

The *macchina* was sitting quietly in the shade of a flowering cherry tree, almost hidden by its thick pink clouds of blossom, which were alive with the buzzing of foraging bees. Quivering lozenges of shade and pinkish light dappled its translucent skin. An old dog lay snoozing to its left side, a tortoiseshell cat on its

right.

And it spoke to me about the Great Chain of Being.

“The best level is simple matter. The second is vegetative life. The third is animal life which can act and move. Then somehow the fourth level emerges, the level of self-awareness, which distinguishes human beings from animals. And then comes a fifth level.”

“Which is what?”

The Holy Machine seemed to smile.

“Ah! That is hard to say in human words...”

* * * *

“GOTCHA!”

Bees and cherry blossoms shattered. Freddie had leapt out of bed onto the little domestic, trapping it beneath a sheet.

“Thought you'd pinch my ciggies again did you, you little bugger?”

He beamed up at me from the floor, expecting me to laugh.

But suddenly I had seized him by the throat and was smashing him up against the wall.

“Leave it alone, you bastard,” I was screaming at him while he stared at me in horror, “just leave the poor bloody thing alone!”

About the Author

Chris Beckett (1955-) is the manager of a team of social workers in Cambridge, England. He has published seven short stories and says, “One of these days I will finish a novel!”

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9. Learning to Be Me by Greg Egan

I was six years old when my parents told me that there was a small, dark jewel inside my skull, learning to be me.

Microscopic spiders had woven a fine golden web through my brain, so that the jewel's teacher could listen to the whisper of my thoughts. The jewel itself eavesdropped on my senses, and read the chemical messages carried in my bloodstream; it saw, heard, smelt, tasted and felt the world exactly as I did, while the teacher monitored its thoughts and compared them with my own. Whenever the jewel's thoughts were *wrong*, the teacher—faster than thought—rebuilt the jewel slightly, altering it this way and that, seeking out the changes that would make its thoughts correct.

Why? So that when I could no longer be me, the jewel could do it for me.

I thought: if hearing that makes *me* feel strange and giddy, how must it make the *jewel* feel? Exactly the same, I reasoned; it doesn't know it's the jewel, and it too wonders how the jewel must feel, it too reasons: “Exactly the same; it doesn't know it's the jewel, and it too wonders how the jewel must feel...”

And it too wonders—

(I knew, because *I* wondered)

—it too wonders whether it's the real me, or whether in fact it's only the jewel that's learning to be me.

* * * *

As a scornful twelve-year-old, I would have mocked such childish concerns. Everybody had the jewel, save the members of obscure religious sects, and dwelling upon the strangeness of it struck me as unbearably pretentious. The jewel was the jewel, a mundane fact of life, as ordinary as excrement. My friends and I told bad jokes about it, the same way we told bad jokes about sex, to prove to each other how blase we were about the whole idea.

Yet we weren't quite as jaded and imperturbable as we pretended to be. one day when we were all loitering in the park, up to nothing in particular, one of the gang—whose name I've forgotten, but who has stuck in my mind as always being far too clever for his own good—asked each of us in turn: “*Who are you? The jewel, or the real human?*” We all replied—unthinkingly, indignantly—“The real human!” When the last of us had answered, he cackled and said, “Well, I'm not. *I'm* the jewel. So you can eat my shit, you losers, because *you'll* all get flushed down the cosmic toilet—but me, I'm gonna live forever.”

We beat him until he bled.

* * * *

By the time I was fourteen, despite—or perhaps because of—the fact that the jewel was scarcely mentioned in my teaching machine's dull curriculum, I'd given the question a great deal more thought. The pedantically correct answer when asked “Are you the jewel or the human?” had to be “The human”—because only the human brain was physically able to reply. The jewel received input from the senses, but had no control over the body, and its intended reply coincided with what was actually said only because the device was a perfect imitation of the brain. To tell the outside world “I am the jewel”—with speech, with writing, or with any other method involving the body—was patently false (although *to think it* to oneself was not ruled out by this line of reasoning).

However, in a broader sense, I decided that the question was simply misguided. So long as the jewel and the human brain shared the same sensory input, and so long as the teacher kept their thoughts in perfect step, there was only *one* person, *one* identity, *one* consciousness. This one person merely happened to have the (highly desirable) property that *if either* the jewel *or* the human brain were to be destroyed, he or she would survive unimpaired. People had always had two lungs and two kidneys, and for almost a century, many had lived with two hearts. This was the same: a matter of redundancy; a matter of robustness, no more.

That was the year that my parents decided I was mature enough to be told that they had both undergone the switch—three years before. I pretended to take the news calmly, but I hated them passionately for not having told me at the time. They had disguised their stay in hospital with lies about a business trip overseas. For three years I had been living with jewel-heads, and they hadn't even told me. It was *exactly* what I would have expected of them.

“We didn't seem any different to you, did we?” asked my mother.

“No,” I said—truthfully, but burning with resentment nonetheless.

“That's why we didn't tell you,” said my father. “If you'd known we'd switched, at the time, you might have *imagined* that we'd changed in some way. By waiting until now to tell you, we've made it easier for you to convince yourself that we're still the same people we've always been.” He put an arm around me

and squeezed me. I almost screamed out, “Don'ttouch me!” but I remembered in time that I'd convinced myself that the jewel was No Big Deal.

I should have guessed that they'd done it, long before they confessed; after all, I'd known for years that most people underwent the switch in their early thirties. By then, it's downhill for the organic brain, and it would be foolish to have the jewel mimic this decline. So, the nervous system is rewired; the reins of the body are handed over to the jewel, and the teacher is deactivated. For a week, the outward-bound impulses from the brain are compared with those from the jewel, but by this time the jewel is a perfect copy, and no differences are ever detected.

The brain is removed, discarded, and replaced with a spongy tissue-cultured object, brain-shaped down to the level of the finest capillaries, but no more capable of thought than a lung or a kidney. This mock-brain removes exactly as much oxygen and glucose from the blood as the real thing, and faithfully performs a number of crude, essential biochemical functions. In time, like all flesh, it will perish and need to be replaced.

The jewel, however, is immortal. Short of being dropped into a nuclear fireball, it will endure for a billion years.

My parents were machines. My parents were gods. It was nothing special. I hated them.

* * * *

When I was sixteen, I fell in love, and became a child again.

Spending warm nights on the beach with Eva, I couldn't believe that a mere machine could ever feel the way I did. I knew full well that if my jewel had been given control of my body, it would have spoken the very same words as I had, and executed with equal tenderness and clumsiness my every awkward caress—but I couldn't accept that its inner life was as rich, as miraculous, as joyful as mine. Sex, however pleasant, I could accept as a purely mechanical function, but there was something between us (or so I believed) that had nothing to do with lust, nothing to do with words, nothing to do with any tangible action of our bodies that some spy in the sand dunes with parabolic microphone and infrared binoculars might have discerned. After we made love, we'd gaze up in silence at the handful of visible stars, our souls conjoined in a secret place that no crystalline computer could hope to reach in a billion years of striving. (If I'd said *that* to my sensible, smutty, twelve-year-old self, he would have laughed until he haemorrhaged.)

I knew by then that the jewel's “teacher” didn't monitor every single neuron in the brain. That would have been impractical, both in terms of handling the data, and because of the sheer physical intrusion into the tissue. Someone-or-other's theorem said that sampling certain critical neurons was almost as good as sampling the lot, and—given some very reasonable assumptions that nobody could disprove—bounds on the errors involved could be established with mathematical rigour.

At first, I declared that *within these errors*, however small, lay the difference between brain and jewel, between human and machine, between love and its imitation. Eva, however, soon pointed out that it was absurd to make a radical, qualitative distinction on the basis of the sampling density; if the next model teacher sampled more neurons and halved the error rate, would its jewel then be “half-way” between “human” and “machine?” In theory—and eventually, in practice—the error rate could be made smaller than any number I cared to name. Did I really believe that a discrepancy of one in a billion made any difference at all—when every human being was permanently losing thousands of neurons every day, by natural attrition?

She was right, of course, but I soon found another, more plausible, defence for my position. Living

neurons, I argued, had far more internal structure than the crude optical switches that served the same function in the jewel's so-called "neural net." That neurons fired or did not fire reflected only one level of their behaviour; who knew what the subtleties of biochemistry—the quantum mechanics of the specific organic molecules involved—contributed to the nature of human consciousness? Copying the abstract neural topology wasn't enough. Sure, the jewel could pass the fatuous Turing test—no outside observer could tell it from a human—but that didn't prove that *being* a jewel felt the same as *being* human.

Eva asked, "Does that mean you'll never switch? You'll have your jewel removed? You'll let yourself *die* when your brain starts to rot?"

"Maybe," I said. "Better to die at ninety or a hundred than kill myself at thirty, and have some machine marching around, taking my place, pretending to be me."

"How do you know *I* haven't switched?" she asked, provocatively. "How do you know that I'm not just 'pretending to be me'?"

"I know you haven't switched," I said, smugly. "I just *know*."

"How? I'd look the same. I'd talk the same. I'd act the same in every way. People are switching younger, these days. *So how do you know I haven't?*"

I turned onto my side towards her, and gazed into her eyes. "Telepathy. Magic. The communion of souls."

My twelve-year-old self started snickering, but by then I knew exactly how to drive him away.

* * * *

At nineteen, although I was studying finance, I took an undergraduate philosophy unit. The Philosophy Department, however, apparently had nothing to say about the Ndoli Device, more commonly known as "the jewel." (Ndoli had in fact called it "the *dual*," but the accidental, homophonic nick-name had stuck.) They talked about Plato and Descartes and Marx, they talked about St. Augustine and—when feeling particularly modern and adventurous—Sartre, but if they'd heard of Godel, Turing, Hamsun or Kim, they refused to admit it. Out of sheer frustration, in an essay on Descartes I suggested that the notion of human consciousness as "software" that could be "implemented" equally well on an organic brain or an optical crystal was in fact a throwback to Cartesian dualism: for "software" read "soul." My tutor superimposed a neat, diagonal, luminous red line over each paragraph that dealt with this idea, and wrote in the margin (in vertical, bold-face, 20-point Times, with a contemptuous 2 Hertz flash): IRRELEVANT!

I quit philosophy and enrolled in a unit of optical crystal engineering for non-specialists. I learnt a lot of solid-state quantum mechanics. I learnt a lot of fascinating mathematics. I learnt that a neural net is a device used only for solving problems that are far too hard to *be understood*. A sufficiently flexible neural net can be configured by feedback to mimic almost any system—to produce the same patterns of output from the same patterns of input—but achieving this sheds no light whatsoever on the nature of the system being emulated.

"Understanding," the lecturer told us, "is an overrated concept. Nobody really *understands* how a fertilized egg turns into a human. What should we do? Stop having children until ontogenesis can be described by a set of differential equations?"

I had to concede that she had a point there.

It was clear to me by then that nobody had the answers I craved—and I was hardly likely to come up with them myself; my intellectual skills were, at best, mediocre. It came down to a simple choice: I could

waste time fretting about the mysteries of consciousness, or, like everybody else, I could stop worrying and get on with my life.

* * * *

When I married Daphne, at twenty-three, Eva was a distant memory, and so was any thought of the communion of souls. Daphne was thirty-one, an executive in the merchant bank that had hired me during my PhD, and everyone agreed that the marriage would benefit my career. What she got out of it, I was never quite sure. Maybe she actually liked me. We had an agreeable sex life, and we comforted each other when we were down, the way any kind-hearted person would comfort an animal in distress.

Daphne hadn't switched. She put it off, month after month, inventing ever more ludicrous excuses, and I teased her as if I'd never had reservations of my own.

"I'm afraid," she confessed one night. "What if I die when it happens—what if all that's left is a robot, a puppet, *athing*? I don't want *to die*."

Talk like that made me squirm, but I hid my feelings. "Suppose you had a stroke," I said glibly, "which destroyed a small part of your brain. Suppose the doctors implanted a machine to take over the functions which that damaged region had performed. Would you still be 'yourself'?"

"Of course."

"Then if they did it twice, or ten times, or a thousand times—"

"That doesn't necessarily follow."

"Oh? At what magic percentage, then, would you stop being 'you'?"

She glared at me. "All the old clichéed arguments—"

"Fault them, then, if they're so old and clichéed."

She started to cry. "I don't have to. Fuck you! I'm scared to death, and you don't give a shit!"

I took her in my arms. "Sssh. I'm sorry. But everyone does it sooner or later. You mustn't be afraid. I'm here. I love you." The words might have been a recording, triggered automatically by the sight of her tears.

"Will you do it? With me?"

I went cold. "What?"

"Have the operation, on the same day? Switch when I switch?"

Lots of couples did that. Like my parents. Sometimes, no doubt, it was a matter of love, commitment, sharing. Other times, I'm sure, it was more a matter of neither partner wishing to be an unswitched person living with a jewel-head.

I was silent for a while, then I said, "Sure."

In the months that followed, all of Daphne's fears—which I'd mocked as "childish" and "superstitious"—rapidly began to make perfect sense, and my own "rational" arguments came to sound abstract and hollow. I backed out at the last minute; I refused the anaesthetic, and fled the hospital.

Daphne went ahead, not knowing I had abandoned her.

I never saw her again. I couldn't face her; I quit my job and left town for a year, sickened by my cowardice and betrayal—but at the same time euphoric that I had *escaped*.

She brought a suit against me, but then dropped it a few days later, and agreed, through her lawyers, to an uncomplicated divorce. Before the divorce came through, she sent me a brief letter:

* * * *

There was nothing to fear, after all. I'm exactly the person I've always been. Putting it off was insane; now that I've taken the leap of faith, I couldn't be more at ease.

Your loving robot wife,

Daphne

* * * *

By the time I was twenty-eight, almost everyone I knew had switched. All my friends from university had done it. Colleagues at my new job, as young as twenty-one, had done it. Eva, I heard through a friend of a friend, had done it six years before.

The longer I delayed, the harder the decision became. I could talk to a thousand people who had switched, I could grill my closest friends for hours about their childhood memories and their most private thoughts, but however compelling their words, I knew that the Ndoli Device had spent decades buried in their heads, learning to fake exactly this kind of behaviour.

Of course, I always acknowledged that it was equally impossible to be *certain* that even another *unswitched* person had an inner life in any way the same as my own—but it didn't seem unreasonable to be more inclined to give the benefit of the doubt to people whose skulls hadn't yet been scraped out with a curette.

I drifted apart from my friends, I stopped searching for a lover. I took to working at home (I put in longer hours and my productivity rose, so the company didn't mind at all). I couldn't bear to be with people whose humanity I doubted.

I wasn't by any means unique. Once I started looking, I found dozens of organisations exclusively for people who hadn't switched, ranging from a social club that might as easily have been for divorcees, to a paranoid, paramilitary “resistance front,” who thought they were living out *Invasion of the Body Snatchers*. Even the members of the social club, though, struck me as extremely maladjusted; many of them shared my concerns, almost precisely, but my own ideas from other lips sounded obsessive and ill-conceived. I was briefly involved with an unswitched woman in her early forties, but all we ever talked about was our fear of switching. It was masochistic, it was suffocating, it was insane.

I decided to seek psychiatric help, but I couldn't bring myself to see a therapist who had switched. When I finally found one who hadn't, she tried to talk me into helping her blow up a power station, to let THEM know who was boss.

I'd lie awake for hours every night, trying to convince myself, one way or the other, but the longer I dwelt upon the issues, the more tenuous and elusive they became. Who was “I,” anyway? What did it mean that “I” was “still alive,” when my personality was utterly different from that of two decades before? My earlier selves were as good as dead—I remembered them no more clearly than I remembered contemporary acquaintances—yet this loss caused me only the slightest discomfort. Maybe the destruction of my organic brain would be the merest hiccup, compared to all the changes that I'd been through in my life so far.

Or maybe not. Maybe it would be exactly like dying.

Sometimes I'd end up weeping and trembling, terrified and desperately lonely, unable to comprehend—and yet unable to cease contemplating—the dizzying prospect of my own nonexistence. At other times, I'd simply grow “healthily” sick of the whole tedious subject. Sometimes I felt certain that the nature of the jewel's inner life was the most important question humanity could ever confront. At other times, my qualms seemed fey and laughable. Every day, hundreds of thousands of people switched, and the world apparently went on as always; surely that fact carried more weight than any abstruse philosophical argument?

Finally, I made an appointment for the operation. I thought, what is there to lose? Sixty more years of uncertainty and paranoia? If the human race was replacing itself with clockwork automata, I was better off dead; I lacked the blind conviction to join the psychotic underground—who, in any case, were tolerated by the authorities only so long as they remained ineffectual. On the other hand, if all my fears were unfounded—if my sense of identity could survive the switch as easily as it had already survived such traumas as sleeping and waking, the constant death of brain cells, growth, experience, learning and forgetting—then I would gain not only eternal life, but an end to my doubts and my alienation.

* * * *

I was shopping for food one Sunday morning, two months before the operation was scheduled to take place, flicking through the images of an on-line grocery catalogue, when a mouth-watering shot of the latest variety of apple caught my fancy. I decided to order half a dozen. I didn't, though. Instead, I hit the key which displayed the next item. My mistake, I knew, was easily remedied; a single keystroke could take me back to the apples. The screen showed pears, oranges, grapefruit. I tried to look down to see what my clumsy fingers were up to, but my eyes remained fixed on the screen.

I panicked. I wanted to leap to my feet, but my legs would not obey me. I tried to cry out, but I couldn't make a sound. I didn't feel injured, I didn't feel weak. Was I paralysed? Brain-damaged? I could still *feel* my fingers on the keypad, the soles of my feet on the carpet, my back against the chair.

I watched myself order pineapples. I felt myself rise, stretch, and walk calmly from the room. In the kitchen, I drank a glass of water. I should have been trembling, choking, breathless; the cool liquid flowed smoothly down my throat, and I didn't spill a drop.

I could only think of one explanation: *I had switched*. Spontaneously. The jewel had taken over, while my brain was still alive; all my wildest paranoid fears had come true.

While my body went ahead with an ordinary Sunday morning, I was lost in a claustrophobic delirium of helplessness. The fact that everything I did was exactly what I had planned to do gave me no comfort. I caught a train to the beach, I swam for half an hour; I might as well have been running amok with an axe, or crawling naked down the street, painted with my own excrement and howling like a wolf. *I'd lost control*. My body had turned into a living strait-jacket, and I couldn't struggle, I couldn't scream, I couldn't even close my eyes. I saw my reflection, faintly, in a window on the train, and I couldn't begin to guess what the mind that ruled that bland, tranquil face was thinking.

Swimming was like some sense-enhanced, holographic nightmare; I was a volitionless object, and the perfect familiarity of the signals from my body only made the experience more horribly *wrong*. My arms had no right to the lazy rhythm of their strokes; I wanted to thrash about like a drowning man, I wanted to show the world my distress.

It was only when I lay down on the beach and closed my eyes that I began to think rationally about my situation.

The switch *couldn't* happen “spontaneously.” The idea was absurd. Millions of nerve fibres had to be severed and spliced, by an army of tiny surgical robots which weren't even present in my brain—which weren't due to be injected for another two months. Without deliberate intervention, the Ndoli Device was utterly passive, unable to do anything but *eavesdrop*. No failure of the jewel or the teacher could possibly take control of my body away from my organic brain.

Clearly, there had been a malfunction—but my first guess had been wrong, absolutely wrong.

I wish I could have done *something*, when the understanding hit me. I should have curled up, moaning and screaming, ripping the hair from my scalp, raking my flesh with my fingernails. Instead, I lay flat on my back in the dazzling sunshine. There was an itch behind my right knee, but I was, apparently, far too lazy to scratch it.

Oh, I ought to have managed, at the very least, a good, solid bout of hysterical laughter, when I realised that I was the jewel.

The teacher had malfunctioned; it was no longer keeping me aligned with the organic brain. I hadn't suddenly become powerless; I had *always been* powerless. My will to act upon “my” body, upon the world, had *always* gone straight into a vacuum, and it was only because I had been ceaselessly manipulated, “corrected” by the teacher, that my desires had ever coincided with the actions that seemed to be mine.

There are a million questions I could ponder, a million ironies I could savour, but *I mustn't*. I need to focus all my energy in one direction. My time is running out.

When I enter hospital and the switch takes place, if the nerve impulses I transmit to the body are not exactly in agreement with those from the organic brain, the flaw in the teacher will be discovered. *And rectified*. The organic brain has nothing to fear; *his* continuity will be safeguarded, treated as precious, sacrosanct. There will be no question as to which of us will be allowed to prevail. *I* will be made to conform, once again. *I* will be “corrected.” *I* will be murdered.

Perhaps it is absurd to be afraid. Looked at one way, I've been murdered every microsecond for the last twenty-eight years. Looked at another way, I've only existed for the seven weeks that have now passed since the teacher failed, and the notion of my separate identity came to mean anything at all—and in one more week this aberration, this nightmare, will be over. Two months of misery; why should I begrudge losing that, when I'm on the verge of inheriting eternity? Except that it won't be *I* who inherits it, since that two months of misery is all that defines me.

The permutations of intellectual interpretation are endless, but ultimately, I can only act upon my desperate will to survive. I don't *feel* like an aberration, a disposable glitch. How can I possibly hope to survive? I must conform—of my own free will. I must choose to make myself *appear* identical to that which they would force me to become.

After twenty-eight years, surely I am still close enough to him to carry off the deception. If I study every clue that reaches me through our shared senses, surely I can put myself in his place, forget, temporarily, the revelation of my separateness, and force myself back into synch.

It won't be easy. He met a woman on the beach, the day I came into being. Her name is Cathy. They've slept together three times, and he thinks he loves her. Or at least, he's said it to her face, he's whispered it to her while she slept, he's written it, true or false, into his diary.

I feel nothing for her. She's a nice enough person, I'm sure, but I hardly know her. Preoccupied with my plight, I've paid scant attention to her conversation, and the act of sex was, for me, little more than a

distasteful piece of involuntary voyeurism. Since I realised what was at stake, I've *tried* to succumb to the same emotions as my alter ego, but how can I love her when communication between us is impossible, when she doesn't even know *I* exist?

If she rules his thoughts night and day, but is nothing but a dangerous obstacle to me, how can I hope to achieve the flawless imitation that will enable me to escape death?

He's sleeping now, so I must sleep. I listen to his heartbeat, his slow breathing, and try to achieve a tranquillity consonant with these rhythms. For a moment, I am discouraged. Even my *dreams* will be different; our divergence is ineradicable, my goal is laughable, ludicrous, pathetic. Every nerve impulse, for a week? My fear of detection and my attempts to conceal it will, unavoidably, distort my responses; this knot of lies and panic will be impossible to hide.

Yet as I drift towards sleep, I find myself believing that I *will* succeed. *I must*. I dream for a while—a confusion of images, both strange and mundane, ending with a grain of salt passing through the eye of a needle—then I tumble, without fear, into dreamless oblivion.

* * * *

I stare up at the white ceiling, giddy and confused, trying to rid myself of the nagging conviction that there's something *I must* not think about.

Then I clench my fist gingerly, rejoice at this miracle, and remember.

Up until the last minute, I thought he was going to back out again—but he didn't. Cathy talked him through his fears. Cathy, after all, has switched, and he loves her more than he's ever loved anyone before.

So, our roles are reversed now. This body is *his* strait-jacket, now...

I am drenched in sweat. *This is hopeless, impossible*. I can't read his mind, I can't guess what he's trying to do. Should I move, lie still, call out, keep silent? Even if the computer monitoring us is programmed to ignore a few trivial discrepancies, as soon as he notices that his body won't carry out his will, he'll panic just as I did, and I'll have no chance at all of making the right guesses. Would *he* be sweating, now? Would *his* breathing be constricted, like this? *No*. I've been awake for just thirty seconds, and already I have betrayed myself. An optical-fibre cable trails from under my right ear to a panel on the wall. Somewhere, alarm bells must be sounding.

If I made a run for it, what would they do? Use force? I'm a citizen, aren't I? Jewel-heads have had full legal rights for decades; the surgeons and engineers can't do anything to me without my consent. I try to recall the clauses on the waiver he signed, but he hardly gave it a second glance. I tug at the cable that holds me prisoner, but it's firmly anchored, at both ends.

When the door swings open, for a moment I think I'm going to fall to pieces, but from somewhere I find the strength to compose myself. It's my neurologist, Dr Prem. He smiles and says, "How are you feeling? Not too bad?"

I nod dumbly.

"The biggest shock, for most people, is that they don't feel different at all! For a while you'll think, 'It can't be this simple! It can't be this easy! It can't be this *normal*!' ' But you'll soon come to accept that *it is*. And life will go on, unchanged." He beams, taps my shoulder paternally, then turns and departs.

Hours pass. *What are they waiting for?* The evidence must be conclusive by now. Perhaps there are

procedures to go through, legal and technical experts to be consulted, ethics committees to be assembled to deliberate on my fate. I'm soaked in perspiration, trembling uncontrollably. I grab the cable several times and yank with all my strength, but it seems fixed in concrete at one end, and bolted to my skull at the other.

An orderly brings me a meal. "Cheer up," he says. "Visiting time soon."

Afterwards, he brings me a bedpan, but I'm too nervous even to piss.

Cathy frowns when she sees me. "What's wrong?"

I shrug and smile, shivering, wondering why I'm even trying to go through with the charade. "Nothing. I just ... feel a bit sick, that's all."

She takes my hand, then bends and kisses me on the lips. In spite of everything, I find myself instantly aroused. Still leaning over me, she smiles and says, "It's over now, okay? There's nothing left to be afraid of. You're a little shook up, but you know in your heart you're still who you've always been. And I love you."

I nod. We make small talk. She leaves. I whisper to myself, hysterically, "I'm still who I've always been. I'm still who I've always been."

* * * *

Yesterday, they scraped my skull clean, and inserted my new, non-sentient, space-filling mock-brain.

I feel calmer now than I have for a long time, and I think at last I've pieced together an explanation for my survival.

Why do they deactivate the teacher, for the week between the switch and the destruction of the brain? Well, they can hardly keep it running while the brain is being trashed—but why an entire week? To reassure people that the jewel, unsupervised, can still stay in synch; to persuade them that the life the jewel is going to live will be exactly the life that the organic brain "would have lived"—whatever that could mean.

Why, then, only for a week? Why not a month, or a year? Because the jewel *cannot* stay in synch for that long—not because of any flaw, but for precisely the reason that makes it worth using in the first place. The jewel is immortal. The brain is decaying. The jewel's imitation of the brain leaves out—deliberately—the fact that *real* neurons *die*. Without the teacher working to contrive, in effect, an identical deterioration of the jewel, small discrepancies must eventually arise. A fraction of a second's difference in responding to a stimulus is enough to arouse suspicion, and—as I know too well—from that moment on, the process of divergence is irreversible.

No doubt, a team of pioneering neurologists sat huddled around a computer screen, fifty years ago, and contemplated a graph of the probability of this radical divergence, versus time. How would they have chosen *one week*? What probability would have been acceptable? A tenth of a percent? A hundredth? A thousandth? However safe they decided to be, it's hard to imagine them choosing a value low enough to make the phenomenon rare on a global scale, once a quarter of a million people were being switched every day.

In any given hospital, it might happen only once a decade, or once a century, but every institution would still need to have a policy for dealing with the eventuality.

What would their choices be?

They could honour their contractual obligations and turn the teacher on again, erasing their satisfied customer, and giving the traumatised organic brain the chance to rant about its ordeal to the media and the legal profession.

Or, they could quietly erase the computer records of the discrepancy, and calmly remove the only witness.

* * * *

So, this is it. Eternity.

I'll need transplants in fifty or sixty years' time, and eventually a whole new body, but that prospect shouldn't worry me—I can't die on the operating table. In a thousand years or so, I'll need extra hardware tacked on to cope with my memory storage requirements, but I'm sure the process will be uneventful. On a time scale of millions of years, the structure of the jewel is subject to cosmic-ray damage, but error-free transcription to a fresh crystal at regular intervals will circumvent that problem.

In theory, at least, I'm now guaranteed either a seat at the Big Crunch, or participation in the heat death of the universe.

I ditched Cathy, of course. I might have learnt to like her, but she made me nervous, and I was thoroughly sick of feeling that I had to play a role.

As for the man who claimed that he loved her—the man who spent the last week of his life helpless, terrified, suffocated by the knowledge of his impending death—I can't yet decide how I feel. I ought to be able to empathise—considering that I once expected to suffer the very same fate myself—yet somehow he simply isn't *real* to me. I know my brain was modelled on his—giving him a kind of causal primacy—but in spite of that, I think of him now as a pale, insubstantial shadow.

After all, I have no way of knowing if his sense of himself, his deepest inner life, his experience of *being*, was in any way comparable to my own.

About the Author

Greg Egan (1961-) obtained a BS in mathematics from the University of Western Australia and has worked as a computer programmer in medical research. The latest of his fascinating novels, *Teranesia*, appeared in 1999 from HarperCollins.

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IV. Space and Technology

When I was in college and graduate school, men were landing on the moon and Frank Drake was leading efforts to pick up signals surely emanating from alien civilizations. I was enchanted. I thought Frank Drake one of the few scientists with a vision equal to his calling, and I almost held my breath waiting for word of success from his early radio telescope listening posts at Green Bank, West Virginia, and Arecibo, Puerto Rico. (See Frank Drake and Dava Sobel, *Is Anyone Out There? The Scientific Search for Extraterrestrial Intelligence* [New York: Delacorte Press, 1992]).

America retreated from space, but the dream has lived on. There is still talk of building a technology that would allow routine access to space—Charles Sheffield's “Skystalk” (see Part I of this book) is based on very real proposals that a “space elevator” may become feasible. It or more conventional transportation systems may make it possible to build small, artificial worlds in orbit, such as those Mike

Resnick posits as homes for assorted splinter cultures in “Kirinyaga.” There is talk of sending people to distant worlds; George Turner’s “I Still Call Australia Home” deals with the return to an Earth that has solved its population and environmental problems and does not much care for the old attitudes. There even remain efforts to listen for the radio signals of extraterrestrial civilizations, represented here by Jack McDevitt’s “Cryptic”; we should note that in this story McDevitt also touches on another issue of current interest, the technology of encrypting messages in such a way as to make it impossible or very difficult for national security and law enforcement agencies to eavesdrop. The U.S. government wishes to limit the capability of this technology; advocates of individual freedom do not.

If you think space elevators, orbiting miniworlds, starships, and ETs are sheer fantasy, consider the truly impossible technology of “slow glass,” glass in which the speed of light is so slow that it may take days or weeks or even years for light to pass from one side of a window to the other. In the spirit of the *gedanken* experiment, Bob Shaw has in “Light of Other Days” and other stories considered what such a technology might mean for the people who must live with it. A very similar consideration is of course appropriate for more realistic technologies as well.

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10. Kirinyaga by Mike Resnick

In the beginning, Ngai lived alone atop the mountain called Kirinyaga. In the fullness of time He created three sons, who became the fathers of the Maasai, the Kamba, and the Kikuyu races, and to each son He offered a spear, a bow, and a digging-stick. The Maasai chose the spear, and was told to tend herds on the vast Savannah. The Kamba chose the bow, and was sent to the dense forests to hunt for game. But Gikuyu, the first Kikuyu, knew that Ngai loved the earth and the seasons, and chose the digging-stick. To reward him for this Ngai not only taught him the secrets of the seed and the harvest, but gave him Kirinyaga, with its holy fig tree and rich lands.

The sons and daughters of Gikuyu remained on Kirinyaga until the white man came and took their lands away, and even when the white man had been banished they did not return, but chose to remain in the cities wearing Western clothes and using Western machines and living Western lives. Even I, who am a *mundumugu* —a witch doctor—was born in the city. I have never seen the lion or the elephant or the rhinoceros, for all of them were extinct before my birth; nor have I seen Kirinyaga as Ngai meant it to be seen, for a bustling, overcrowded city of three million inhabitants covers its slopes, every year approaching closer and closer to Ngai’s throne at the summit. Even the Kikuyu have forgotten its true name, and now know it only as Mount Kenya.

To be thrown out of Paradise, as were the Christian Adam and Eve, is a terrible fate, but to live beside a debased Paradise is infinitely worse. I think about them frequently, the descendants of Gikuyu who have forgotten their origin and their traditions and are now merely Kenyans, and I wonder why more of them did not join with us when we created the Eutopian world of Kirinyaga.

True, it is a harsh life, for Ngai never meant life to be easy; but it is also a satisfying life. We live in harmony with our environment, we offer sacrifices when Ngai’s tears of compassion fall upon our fields and give sustenance to our crops, we slaughter a goat to thank him for the harvest.

Our pleasures are simple: a gourd of *pombe* to drink, the warmth of *aboma* when the sun has gone down, the wail of a newborn son or daughter, the footraces and spear-throwing and other contests, the nightly singing and dancing.

Maintenance watches Kirinyaga discreetly, making minor orbital adjustments when necessary, assuring that our tropical climate remains constant. From time to time they have subtly suggested that we might wish to draw upon their medical expertise, or perhaps allow our children to make use of their educational facilities, but they have taken our refusal with good grace, and have never shown any desire to interfere in our affairs.

Until I strangled the baby.

It was less than an hour later that Koinnage, our paramount chief, sought me out.

“That was an unwise thing to do, Koriba,” he said grimly.

“It was not a matter of choice,” I replied. “You know that.”

“Of course you had a choice,” he responded. “You could have let the infant live.” He paused, trying to control his anger and his fear. “Maintenance has never set foot on Kirinyaga before, but now they will come.”

“Let them,” I said with a shrug. “No law has been broken.”

“We have killed a baby,” he replied. “They will come, and they will revoke our charter!”

I shook my head. “No one will revoke our charter.”

“Do not be too certain of that, Koriba,” he warned me. “You can bury a goat alive, and they will monitor us and shake their heads and speak contemptuously among themselves about our religion. You can leave the aged and the infirm out for the hyenas to eat, and they will look upon us with disgust and call us godless heathens. But I tell you that killing a newborn infant is another matter. They will not sit idly by; they will come.”

“If they do, I shall explain why I killed it,” I replied calmly.

“They will not accept your answers,” said Koinnage. “They will not understand.”

“They will have no choice but to accept my answers,” I said. “This is Kirinyaga, and they are not permitted to interfere.”

“They will find a way,” he said with an air of certainty. “We must apologize and tell them that it will not happen again.”

“We will not apologize,” I said sternly. “Nor can we promise that it will not happen again.”

“Then, as paramount chief, I will apologize.”

I stared at him for a long moment, then shrugged. “Do what you must do,” I said.

Suddenly I could see the terror in his eyes. “What will you do to me?” he asked fearfully.

“I? Nothing at all,” I said. “Are you not my chief?” As he relaxed, I added: “But if I were you, I would beware of insects.”

“Insects?” he repeated. “Why?”

“Because the next insect that bites you, be it spider or mosquito or fly, will surely kill you,” I said. “Your blood will boil within your body, and your bones will melt. You will want to scream out your agony, yet

you will be unable to utter a sound.” I paused. “It is not a death I would wish on a friend,” I added seriously.

“Are we not friends, Koriba?” he said, his ebon face turning an ash gray.

“I thought we were,” I said. “But my friends honor our traditions. They do not apologize for them to the white man.”

“I will not apologize!” he promised fervently. He spat on both his hands as a gesture of his sincerity.

I opened one of the pouches I kept around my waist and withdrew a small polished stone from the shore of our nearby river. “Wear this around your neck,” I said, handing it to him, “and it shall protect you from the bites of insects.”

“Thank you, Koriba!” he said with sincere gratitude, and another crisis had been averted.

We spoke about the affairs of the village for a few more minutes, and finally he left me. I sent for Wambu, the infant's mother, and led her through the ritual of purification, so that she might conceive again. I also gave her an ointment to relieve the pain in her breasts, since they were heavy with milk. Then I sat down by the fire before my *boma* and made myself available to my people, settling disputes over the ownership of chickens and goats, and supplying charms against demons, and instructing my people in the ancient ways.

By the time of the evening meal, no one had a thought for the dead baby. I ate alone in my *boma*, as befitted my status, for the *mundumugu* always lives and eats apart from his people. When I had finished I wrapped a blanket around my body to protect me from the cold and walked down the dirt path to where all the other *bomas* were clustered. The cattle and goats and chickens were penned up for the night, and my people, who had slaughtered and eaten a cow, were now singing and dancing and drinking great quantities of *pombe*. As they made way for me, I walked over to the caldron and took a drink of *pombe*, and then, at Kanjara's request, I slit open a goat and read its entrails and saw that his youngest wife would soon conceive, which was cause for more celebration. Finally the children urged me to tell them a story.

“But not a story of Earth,” complained one of the taller boys. “We hear those all the time. This must be a story about Kirinyaga.”

“All right,” I said. “If you will all gather around, I will tell you a story of Kirinyaga.” The youngsters all moved closer. “This,” I said, “is the story of the Lion and the Hare.” I paused until I was sure that I had everyone's attention, especially that of the adults. “A hare was chosen by his people to be sacrificed to a lion, so that the lion would not bring disaster to their village. The hare might have run away, but he knew that sooner or later the lion would catch him, so instead he sought out the lion and walked right up to him, and as the lion opened his mouth to swallow him, the hare said, ‘I apologize, Great Lion.’

“For what?” asked the lion curiously.

“Because I am such a small meal,” answered the hare, “For that reason, I brought honey for you as well.”

“I see no honey,” said the lion.

“That is why I apologized,” answered the hare. “Another lion stole it from me. He is a ferocious creature, and says that he is not afraid of you.”

“The lion rose to his feet. ‘Where is this other lion?’ he roared.

“The hare pointed to a hole in the earth. ‘Down there,’ he said, ‘but he will not give you back your honey.’”

“‘We shall see about that!’ growled the lion.

“He jumped into the hole, roaring furiously, and was never seen again, for the hare had chosen a very deep hole indeed. Then the hare went home to his people and told them that the lion would never bother them again.”

Most of the children laughed and clapped their hands in delight, but the same young boy voiced his objection.

“That is not a story of Kirinyaga,” he said scornfully. “We have no lions here.”

“It is a story of Kirinyaga,” I replied. “What is important about the story is not that it concerned a lion and a hare, but that it shows that the weaker can defeat the stronger if he uses his intelligence.”

“What has that to do with Kirinyaga?” asked the boy.

“What if we pretend that the men of Maintenance, who have ships and weapons, are the lion, and the Kikuyu are the hares?” I suggested. “What shall the hares do if the lion demands a sacrifice?”

The boy suddenly grinned. “Now I understand! We shall throw the lion down a hole!”

“But we have no holes here,” I pointed out.

“Then what shall we do?”

“The hare did not know that he would find the lion near a hole,” I replied. “Had he found him by a deep lake, he would have said that a large fish took the honey.”

“We have no deep lakes.”

“But we do have intelligence,” I said. “And if Maintenance ever interferes with us, we will use our intelligence to destroy the lion of Maintenance, just as the hare used his intelligence to destroy the lion of the fable.”

“Let us think how to destroy Maintenance right now!” cried the boy. He picked up a stick and brandished it at an imaginary lion as if it were a spear and he a great hunter.

I shook my head. “The hare does not hunt the lion, and the Kikuyu do not make war. The hare merely protects himself, and the Kikuyu do the same.”

“Why would Maintenance interfere with us?” asked another boy, pushing his way to the front of the group. “They are our friends.”

“Perhaps they will not,” I answered reassuringly. “But you must always remember that the Kikuyu have no true friends except themselves.”

“Tell us another story, Koriba!” cried a young girl.

“I am an old man,” I said. “The night has turned cold, and I must have my sleep.”

“Tomorrow?” she asked. “Will you tell us another tomorrow?”

I smiled. “Ask me tomorrow, after all the fields are planted and the cattle and goats are in their enclosures and the food has been made and the fabrics have been woven.”

“But girls do not herd the cattle and goats,” she protested. “What if my brothers do not bring all their animals to the enclosure?”

“Then I will tell a story just to the girls,” I said.

“It must be a long story,” she insisted seriously, “for we work much harder than the boys.”

“I will watch you in particular, little one,” I replied, “and the story will be as long or as short as your work merits.”

The adults all laughed and suddenly she looked very uncomfortable, but then I chuckled and hugged her and patted her head, for it was necessary that the children learned to love their *mundumugu* as well as hold him in awe, and finally she ran off to play and dance with the other girls, while I retired to my *boma*.

Once inside, I activated my computer and discovered that a message was waiting for me from Maintenance, informing me that one of their number would be visiting me the following morning. I made a very brief reply—“*Article II, Paragraph 5*,” which is the ordinance forbidding intervention—and lay down on my sleeping blanket, letting the rhythmic chanting of the singers carry me off to sleep.

I awoke with the sun the next morning and instructed my computer to let me know when the Maintenance ship had landed. Then I inspected my cattle and my goats—I, alone of my people, planted no crops, for the Kikuyu feed their *mundumugu*, just as they tend his herds and weave his blankets and keep his *boma* clean—and stopped by Simani's *boma* to deliver a balm to fight the disease that was afflicting his joints. Then, as the sun began warming the earth, I returned to my own *boma*, skirting the pastures where the young men were tending their animals. When I arrived, I knew the ship had landed, for I found the droppings of a hyena on the ground near my hut, and that is the surest sign of a curse.

I learned what I could from the computer, then walked outside and scanned the horizon while two naked children took turns chasing a small dog and running away from it. When they began frightening my chickens, I gently sent them back to their own *boma*, and then seated myself beside my fire. At last I saw my visitor from Maintenance, coming up the path from Haven. She was obviously uncomfortable in the heat, and she slapped futilely at the flies that circled her head. Her blonde hair was starting to turn grey, and I could tell by the ungainly way she negotiated the steep, rocky path that she was unused to such terrain. She almost lost her balance a number of times, and it was obvious that her proximity to so many animals frightened her, but she never slowed her pace, and within another ten minutes she stood before me.

“Good morning,” she said.

“*Jambo*, Memsaab,” I replied.

“You are Koriba, are you not?”

I briefly studied the face of my enemy; middle-aged and weary, it did not appear formidable. “I am Koriba,” I replied.

“Good,” she said. “My name is—”

“I know who you are,” I said, for it is best, if conflict cannot be avoided, to take the offensive.

“You do?”

I pulled the bones out of my pouch and cast them on the dirt.

“You are Barbara Eaton, born of Earth,” I intoned, studying her reactions as I picked up the bones and cast them again. “You are married to Robert Eaton, and you have worked for Maintenance for nine years.” A final cast of the bones. “You are 41 years old, and you are barren.”

“How did you know all that?” she asked with an expression of surprise.

“Am I not the *mundumugu*?”

She stared at me for a long minute. “You read my biography on your computer,” she concluded at last.

“As long as the facts are correct, what difference does it make whether I read them from the bones or the computer?” I responded, refusing to confirm her statement. “Please sit down, Memsaab Eaton.”

She lowered herself awkwardly to the ground, wrinkling her face as she raised a cloud of dust.

“It's very hot,” she noted uncomfortably.

“It is very hot in Kenya,” I replied.

“You could have created any climate you desired,” she pointed out.

“We *did* create the climate we desired,” I answered.

“Are there predators out there?” she asked, looking out over the Savannah.

“A few,” I replied.

“What kind?”

“Hyenas.”

“Nothing larger?” she asked.

“There *is* nothing larger anymore,” I said.

“I wonder why they didn't attack me?”

“Perhaps because you are an intruder,” I suggested.

“Will they leave me alone on my way back to Haven?” she asked nervously, ignoring my comment.

“I will give you a charm to keep them away.”

“I'd prefer an escort.”

“Very well,” I said.

“They're such ugly animals,” she said with a shudder. “I saw them once when we were monitoring your world.”

“They are very useful animals,” I answered, “for they bring many omens, both good and bad.”

“Really?”

I nodded. “A hyena left me an evil omen this morning.”

“And?” she asked curiously.

“And here you are,” I said.

She laughed. “They told me you were a sharp old man.”

“They were mistaken,” I replied. “I am a feeble old man who sits in front of his *boma* and watches younger men tend his cattle and goats.”

“You are a feeble old man who graduated with honors from Cambridge and then acquired two postgraduate degrees from Yale,” she replied.

“Who told you that?”

She smiled. “You’re not the only one who reads biographies.”

I shrugged. “My degrees did not help me become a better *mundumugu*,” I said. “The time was wasted.”

“You keep using that word. What, exactly, is *amundumugu*?”

“You would call him a witch doctor,” I answered. “But in truth the *mundumugu*, while he occasionally casts spells and interprets omens, is more a repository of the collected wisdom and traditions of his race.”

“It sounds like an interesting occupation,” she said.

“It is not without its compensations.”

“And *such* compensations!” she said with false enthusiasm as a goat bleated in the distance and a young man yelled at it in Swahili. “Imagine having the power of life and death over an entire Eutopian world!”

So now it comes, I thought. Aloud I said: “It is not a matter of exercising power, Memsaab Eaton, but of maintaining traditions.”

“I rather doubt that,” she said bluntly.

“Why should you doubt what I say?” I asked.

“Because if it were traditional to kill newborn infants, the Kikuyus would have died out after a single generation.”

“If the slaying of the infant arouses your disapproval,” I said calmly, “I am surprised Maintenance has not previously asked about our custom of leaving the old and the feeble out for the hyenas.”

“We know that the elderly and the infirm have consented to your treatment of them, much as we may disapprove of it,” she replied. “We also know that a newborn infant could not possibly consent to its own death.” She paused, staring at me. “May I ask why this particular baby was killed?”

“That *is* why you have come here, is it not?”

“I have been sent here to evaluate the situation,” she replied, brushing an insect from her cheek and shifting her position on the ground. “A newborn child was killed. We would like to know why.”

I shrugged. “It was killed because it was born with a terrible *thahu* upon it.”

She frowned. “*Athahu*? What is that?”

“A curse.”

“Do you mean that it was deformed?” she asked.

“It was not deformed.”

“Then what was this curse that you refer to?”

“It was born feet-first,” I said.

“That's it?” she asked, surprised. “That's the curse?”

“Yes.”

“It was murdered simply because it came out feet-first?”

“It is not murder to put a demon to death,” I explained patiently. “Our tradition tells us that a child born in this manner is actually a demon.”

“You are an educated man, Koriba,” she said. “How can you kill a perfectly healthy infant and blame it on some primitive tradition?”

“You must never underestimate the power of tradition, Memsaab Eaton,” I said. “The Kikuyu turned their backs on their traditions once; the result is a mechanized, impoverished, overcrowded country that is no longer populated by Kikuyu, or Maasai, or Luo, or Wakamba, but by a new, artificial tribe known only as Kenyans. We here on Kirinyaga are true Kikuyu, and we will not make that mistake again. If the rains are late, a ram must be sacrificed. If a man's veracity is questioned, he must undergo the ordeal of the *githani* trial. If an infant is born with *athahu* upon it, it must be put to death.”

“Then you intend to continue to kill any children that are born feet-first?” she asked.

“That is correct,” I responded.

A drop of sweat rolled down her face as she looked directly at me and said: “I don't know what Maintenance's reaction will be.”

“According to our charter, Maintenance is not permitted to interfere with us,” I reminded her.

“It's not that simple, Koriba,” she said. “According to your charter, any member of your community who wishes to leave your world is allowed free passage to Haven, from which he or she can board a ship to Earth.” She paused. “Was the baby you killed given such a choice?”

“I did not kill a baby, but a demon,” I replied, turning my head slightly as a hot breeze stirred up the dust around us.

She waited until the breeze died down, then coughed before speaking. “You do understand that not everyone in Maintenance may share that opinion?”

“What Maintenance thinks is of no concern to us,” I said.

“When innocent children are murdered, what Maintenance thinks is of supreme importance to you,” she responded. “I am sure you do not want to defend your practices before the Eutopian Court.”

“Are you here to evaluate the situation, as you said, or to threaten us?” I asked calmly.

“To evaluate the situation,” she replied. “But there seems to be only one conclusion that I can draw from the facts that you have presented to me.”

“Then you have not been listening to me,” I said, briefly closing my eyes as another, stronger breeze swept past us.

“Koriba, I know that Kirinyaga was created so that you could emulate the ways of your forefathers—but surely you must see the difference between the torture of animals as a religious ritual and the murder of a human baby.”

I shook my head. “They are one and the same,” I replied. “We cannot change our way of life because it makes *you* uncomfortable. We did that once before, and within a mere handful of years your culture had corrupted our society. With every factory we built, with every job we created, with every bit of Western technology we accepted, with every Kikuyu who converted to Christianity, we became something we were not meant to be.” I stared directly into her eyes. “I am the *mundumugu*, entrusted with preserving all that makes us Kikuyu, and I will not allow that to happen again.”

“There are alternatives,” she said.

“Not for the Kikuyu,” I replied adamantly.

“There *are*,” she insisted, so intent upon what she had to say that she paid no attention to a black-and-gold centipede that crawled over her boot. “For example, years spent in space can cause certain physiological and hormonal changes in humans. You noted when I arrived that I am 41 years old and childless. That is true. In fact, many of the women in Maintenance are childless. If you will turn the babies over to us, I am sure we can find families for them. This would effectively remove them from your society without the necessity of killing them. I could speak to my superiors about it; I think that there is an excellent chance that they would approve.”

“That is a thoughtful and innovative suggestion, Memsaab Eaton,” I said truthfully. “I am sorry that I must reject it.”

“But why?” she demanded.

“Because the first time we betray our traditions this world will cease to be Kirinyaga, and will become merely another Kenya, a nation of men awkwardly pretending to be something they are not.”

“I could speak to Koinnage and the other chiefs about it,” she suggested meaningfully.

“They will not disobey my instructions,” I replied confidently.

“You hold that much power?”

“I hold that much respect,” I answered. “A chief may enforce the law, but it is the *mundumugu* who interprets it.”

“Then let us consider other alternatives.”

“No.”

“I am trying to avoid a conflict between Maintenance and your people,” she said, her voice heavy with frustration. “It seems to me that you could at least make the effort to meet me halfway.”

“I do not question your motives, Memsaab Eaton,” I replied, “but you are an intruder representing an

organization that has no legal right to interfere with our culture. We do not impose our religion or our morality upon Maintenance, and Maintenance may not impose its religion or morality upon us.”

“It's not that simple.”

“It is precisely that simple,” I said.

“That is your last word on the subject?” she asked.

“Yes.”

She stood up. “Then I think it is time for me to leave and make my report.”

I stood up as well, and a shift in the wind brought the odors of the village: the scent of bananas, the smell of a fresh caldron of *pombe*, even the pungent odor of a bull that had been slaughtered that morning.

“As you wish, Memsaab Eaton,” I said. “I will arrange for your escort.” I signalled to a small boy who was tending three goats and instructed him to go to the village and send back two young men.

“Thank you,” she said. “I know it's an inconvenience, but I Just don't feel safe with hyenas roaming loose out there.”

“You are welcome,” I said. “Perhaps, while we are waiting for the men who will accompany you, you would like to hear a story about the hyena.”

She shuddered involuntarily. “They are such ugly beasts!” she said distastefully. “Their hind legs seem almost deformed.” She shook her head. “No, I don't think I'd be interested in hearing a story about a hyena.”

“You will be interested in *this* story,” I told her.

She stared at me curiously, then shrugged. “All right,” she said. “Go ahead.”

“It is true that hyenas are deformed, ugly animals,” I began, “but once, a long time ago, they were as lovely and graceful as the impala. Then one day a Kikuyu chief gave a hyena a young goat to take as a gift to Ngai, who lived atop the holy mountain Kirinyaga. The hyena took the goat between his powerful jaws and headed toward the distant mountain—but on the way he passed a settlement filled with Europeans and Arabs. It abounded in guns and machines and other wonders he had never seen before, and he stopped to look, fascinated. Finally an Arab noticed him staring intently and asked if he, too, would like to become a civilized man—and as he opened his mouth to say that he would, the goat fell to the ground and ran away. As the goat raced out of sight, the Arab laughed and explained that he was only joking, that of course no hyena could become a man.” I paused for a moment, and then continued. “So the hyena proceeded to Kirinyaga, and when he reached the summit, Ngai asked him what had become of the goat. When the hyena told him, Ngai hurled him off the mountaintop for having the audacity to believe he could become a man. He did not die from the fall, but his rear legs were crippled, and Ngai declared that from that day forward, all hyenas would appear thus and to remind them of the foolishness of trying to become something that they were not, He also gave them a fool's laugh.” I paused again, and stared at her. “Memsaab Eaton, you do not hear the Kikuyu laugh like fools, and I will not let them become crippled like the hyena. Do you understand what I am saying?”

She considered my statement for a moment, then looked into my eyes. “I think we understand each other perfectly, Koriba,” she said.

The two young men I had sent for arrived just then, and I instructed them to accompany her to Haven. A

moment later they set off across the dry Savannah, and I returned to my duties.

I began by walking through the fields, blessing the scarecrows. Since a number of the smaller children followed me, I rested beneath the trees more often than was necessary, and always, whenever we paused, they begged me to tell them more stories. I told them the tale of the Elephant and the Buffalo, and how the Maasai *el Moran* cut the rainbow with his spear so that it never again came to rest upon the earth, and why the nine Kikuyu tribes are named after Gikuyu's nine daughters, and when the sun became too hot I led them back to the village.

Then, in the afternoon, I gathered the older boys about me and explained once more how they must paint their faces and bodies for their forthcoming circumcision ceremony. Ndemi, the boy who had insisted upon a story about Kirinyaga the night before, sought me out privately to complain that he had been unable to slay a small gazelle with his spear, and asked for a charm to make its flight more accurate. I explained to him that there would come a day when he faced a buffalo or a hyena with no charm, and that he must practice more before he came to me again. He was one to watch, this little Ndemi, for he was impetuous and totally without fear; in the old days, he would have made a great warrior, but on Kirinyaga we had no warriors. If we remained fruitful and fecund, however, we would someday need more chiefs and even another *mundumugu*, and I made up my mind to observe him closely.

In the evening, after I ate my solitary meal, I returned to the village, for Njogu, one of our young men, was to marry Kamiri, a girl from the next village. The bride-price had been decided upon, and the two families were waiting for me to preside at the ceremony.

Njogu, his face streaked with paint, wore an ostrich-feather headdress, and looked very uneasy as he and his betrothed stood before me. I slit the throat of a fat ram that Kamiri's father had brought for the occasion, and then I turned to Njogu.

"What have you to say?" I asked.

He took a step forward. "I want Kamiri to come and till the fields of my *shamba*," he said, his voice cracking with nervousness as he spoke the prescribed words, "for I am a man, and I need a woman to tend to my *shamba* and dig deep around the roots of my plantings, that they may grow well and bring prosperity to my house."

He spit on both his hands to show his sincerity, and then, exhaling deeply with relief, he stepped back.

I turned to Kamiri.

"Do you consent to till the *shamba* of Njogu, son of Muchiri?" I asked her.

"Yes," she said softly, bowing her head. "I consent."

I held out my right hand, and the bride's mother placed a gourd of *pombe* in it.

"If this man does not please you," I said to Kamiri, "I will spill the *pombe* upon the ground."

"Do not spill it," she replied. "Then drink," I said, handing the gourd to her.

She lifted it to her lips and took a swallow, then handed it to Njogu, who did the same.

When the gourd was empty, the parents of Njogu and Kamiri stuffed it with grass, signifying the friendship between the two clans.

Then a cheer rose from the onlookers, the ram was carried off to be roasted, more *pombe* appeared as if

by magic, and while the groom took the bride off to his *boma*, the remainder of the people celebrated far into the night. They stopped only when the bleating of the goats told them that some hyenas were nearby, and then the women and children went off to their *boma* s while the men took their spears and went into the fields to frighten the hyenas away.

Koinnage came up to me as I was about to leave.

“Did you speak to the woman from Maintenance?” he asked.

“I did,” I replied.

“What did she say?”

“She said that they do not approve of killing babies who are born feet-first.”

“And what did *you* say?” he asked nervously.

“I told her that we did not need the approval of Maintenance to practice our religion,” I replied.

“Will Maintenance listen?”

“They have no choice,” I said. “And *we* have no choice, either,” I added. “Let them dictate one thing that we must or must not do, and soon they will dictate all things. Give them their way, and Njogu and Kamiri would have recited wedding vows from the Bible or the Koran. It happened to us in Kenya; we cannot permit it to happen on Kirinyaga.”

“But they will not punish us?” he persisted.

“They will not punish us,” I replied.

Satisfied, he walked off to his *boma* while I took the narrow, winding path to my own. I stopped by the enclosure where my animals were kept and saw that there were two new goats there, gifts from the bride's and groom's families in gratitude for my services. A few minutes later I was asleep within the walls of my own hut.

The computer woke me a few minutes before sunrise. I stood up, splashed my face with water from the gourd I keep by my sleeping blanket, and walked over to the terminal.

There was a message for me from Barbara Eaton, brief and to the point:

It is the preliminary finding of Maintenance that infanticide, for any reason, is a direct violation of Kirinyaga's charter. No action will be taken for past offenses.

We are also evaluating your practice of euthanasia, and may require further testimony from you at some point in the future.

Barbara Eaton

A runner from Koinnage arrived a moment later, asking me to attend a meeting of the Council of Elders, and I knew that he had received the same message.

I wrapped my blanket around my shoulders and began walking to Koinnage's *shamba*, which consisted of his *boma*, as well as those of his three sons and their wives. When I arrived I found not only the local elders waiting for me, but also two chiefs from neighboring villages.

“Did you receive the message from Maintenance?” demanded Koinnage, as I seated myself opposite him.

“I did.”

“I warned you that this would happen!” he said “What will we do now?”

“We will do what we have always done,” I answered calmly.

“We cannot,” said one of the neighboring chiefs. “They have forbidden it.”

“They have no right to forbid it,” I replied.

“There is a woman in my village whose time is near,” continued the chief, “and all of the signs and omens point to the birth of twins. We have been taught that the firstborn must be killed, for one mother cannot produce two souls—but now Maintenance has forbidden it. What are we to do?”

“We must kill the firstborn,” I said, “for it will be a demon.”

“And then Maintenance will make us leave Kirinyaga!” said Koinnage bitterly.

“Perhaps we could let the child live,” said the chief. “That might satisfy them, and then they might leave us alone.”

I shook my head. “They will not leave you alone. Already they speak about the way we leave the old and the feeble out for the hyenas, as if this were some enormous sin against their God. If you give in on the one, the day will come when you must give in on the other.”

“Would that be so terrible?” persisted the chief. “They have medicines that we do not possess; perhaps they could make the old young again.”

“You do not understand,” I said, rising to my feet. “Our society is not a collection of separate people and customs and traditions. No, it is a complex system, with all the pieces as dependant upon each other as the animals and vegetation of the Savannah. If you burn the grass, you will not only kill the impala who feeds upon it, but the predator who feeds upon the impala, and the ticks and flies who live upon the predator, and the vultures and maribou storks who feed upon his remains when he dies. You cannot destroy the part without destroying the whole.”

I paused to let them consider what I had said, and then continued speaking: “Kirinyaga is like the Savannah. If we do not leave the old and the feeble out for the hyenas, the hyenas will starve. If the hyenas starve, the grass eaters will become so numerous that there is no land left for our cattle and goats to graze. If the old and the feeble do not die when Ngai decrees it, then soon we will not have enough food to go around.”

I picked up a stick and balanced it precariously on my forefinger.

“This stick,” I said, “is the Kikuyu people, and my finger is Kirinyaga. They are in perfect balance.” I stared at the neighboring chief “But what will happen if I alter the balance, and put my finger *here*?” I asked, gesturing to the end of the stick.

“The stick will fall to the ground.”

“And here?” I asked, pointing to a spot an inch away from the center.

“It will fall.”

“Thus is it with us,” I explained. “Whether we yield on one point or all points, the result will be the same: the Kikuyu will fall as surely as the stick will fall. Have we learned nothing from our past? *We must* adhere to our traditions; they are all that we have!”

“But Maintenance will not allow us to do so!” protested Koinnage.

“They are not warriors, but civilized men,” I said, allowing a touch of contempt to creep into my voice. “Their chiefs and their *mundumugu* s will not send them to Kirinyaga with guns and spears. They will issue warnings and findings and declarations, and finally, when that fails, they will go to the Eutopian Court and plead their case, and the trial will be postponed many times and reheard many more times.” I could see them finally relaxing, and I smiled confidently at them. “Each of you will have died from the burden of your years before Maintenance does anything other than talk. I am your *mundumugu* ; I have lived among civilized men, and I tell you that this is the truth.”

The neighboring chief stood up and faced me. “I will send for you when the twins are born,” he pledged.

“I will come,” I promised him.

We spoke further, and then the meeting ended and the old men began wandering off to their *bomas*, while I looked to the future, which I could see more clearly than Koinnage or the elders.

I walked through the village until I found the bold young Ndemi, brandishing his spear and hurling it at a buffalo he had constructed out of dried grasses.

“*Jambo, Koriba!*” he greeted me.

“*Jambo, my brave young warrior,*” I replied.

“I have been practicing, as you ordered.”

“I thought you wanted to hunt the gazelle,” I noted.

“Gazelles are for children,” he answered. “I will slay *mbogo*, the buffalo.”

“*Mbogo* may feel differently about it,” I said.

“So much the better,” he said confidently. “I have no wish to kill an animal as it runs away from me.”

“And when will you go out to slay the fierce *mbogo*?”

He shrugged. “When I am more accurate.” He smiled up at me. “Perhaps tomorrow.”

I stared at him thoughtfully for a moment, and then spoke: “Tomorrow is a long time away. We have business tonight.”

“What business?” he asked.

“You must find ten friends, none of them yet of circumcision age, and tell them to come to the pond within the forest to the south. They must come after the sun has set, and you must tell them that Koriba the *mundumugu* commands that they tell no one, not even their parents, that they are coming.” I paused. “Do you understand, Ndemi?”

“I understand.”

“Then go,” I said. “Bring my message to them.”

He retrieved his spear from the straw buffalo and set off at a trot, young and tall and strong and fearless.

You are the future, I thought, as I watched him run toward the village. Not Koinnage, not myself, not even the young bridegroom Njogu, for their time will have come and gone before the battle is joined. It is you, Ndemi, upon whom Kirinyaga must depend if it is to survive.

Once before the Kikuyu have had to fight for their freedom. Under the leadership of Jomo Kenyatta, whose name has been forgotten by most of your parents, we took the terrible oath of Mau Mau, and we maimed and we killed and we committed such atrocities that finally we achieved Uhuru, for against such butchery civilized men have no defense but to depart.

And tonight, young Ndemi, while your parents are asleep, you and your companions will meet me deep in the woods, and you in your turn and they in theirs will learn one last tradition of the Kikuyu, for I will invoke not only the strength of Ngai but also the indomitable spirit of Jomo Kenyatta. I will administer a hideous oath and force you to do unspeakable things to prove your fealty, and I will teach each of you, in turn, how to administer the oath to those who come after you.

There is a season for all things: for birth, for growth, for death. There is unquestionably a season for Utopia, but it will have to wait.

For the season of Uhuru is upon us.

About the Author

Mike Resnick (1942-) is a prolific writer with 35 science fiction novels, over 100 short stories, 8 collections, and 21 anthologies to his credit and a gift for expressing subtle themes in superficially very simple ways. When he uses this gift, as he does in “Kirinyaga,” to tackle “unthinkable” ideas, he can arouse immense anger. Those same stories, however, have also earned him awards and fame.

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11. Cryptic by Jack McDevitt

It was at the bottom of the safe in a bulky manila envelope. I nearly tossed it into the trash along with the stacks of other documents, tapes, and assorted flotsam left over from the Project.

Had it been cataloged, indexed in some way, I'm sure I would have. But the envelope was blank, save for an eighteen-year-old date scrawled in the lower right hand corner, and beneath it, the notation “40 gh.”

Out on the desert, lights were moving. That would be Brackett fine-tuning the Array for Orrin Hopkins, who was then beginning the observations that would lead, several years later, to new departures in pulsar theory. I envied Hopkins: he was short, round, bald, a man unsure of himself, whose explanations were invariably interspersed with giggles. He was a ridiculous figure; yet he bore the stamp of genius. And people would remember his ideas long after the residence hall named for me at Carrollton had crumbled.

If I had not long since recognized my own limits and conceded any hope of immortality (at least of this sort), I certainly did so when I accepted the director's position at Sandage. Administration pays better than being an active physicist, but it is death to ambition.

And a Jesuit doesn't even get that advantage.

In those days, the Array was still modest: forty parabolic antennas, each thirty-six meters across. They were on tracks, of course, independently movable, forming a truncated cross. They had, for two decades, been the heart of SETI, the Search for Extra-Terrestrial Intelligence. Now, with the Project abandoned, they were being employed for more useful, if mundane, purposes.

* * * *

Even that relatively unsophisticated system was good: as Hutching Chaney once remarked, the Array could pick up the cough of an automobile ignition on Mars.

I circled the desk and fell into the uncomfortable wooden chair we'd inherited from the outgoing regime. The packet was sealed with tape that had become brittle and loose around the edges. I tore it open.

It was a quarter past ten. I'd worked through my dinner and the evening hours, bored, drinking coffee, debating the wisdom in coming out here from JPL. The increase in responsibility was a good career move; but I knew now that Harry Cooke would never lay his hands on a new particle.

I was committed for two years at Sandage: two years of working out schedules and worrying about insurance; two years of dividing meals between the installation's sterile cafeteria, and Jimmy's Amoco Restaurant on Route 85. Then, if all went well, I could expect another move up, perhaps to Georgetown.

I'd have traded it all for Hopkins's future.

I shook out six magnetic disks onto the desk. They were in individual sleeves, of the type that many installations had once used to record electromagnetic radiation. The disks were numbered and dated over a three-day period in 2001, two years earlier than the date on the envelope.

Each was marked "Procyon."

In back, Hopkins and two associates were hunched over monitors. Brackett, having finished his job, was at his desk reading.

I was pleased to discover that the disks were compatible to the Mark VIs. I inserted one, tied in a vocorder to get a hard copy, and went over to join the Hopkins group while the thing ran. They were talking about plasma. I listened for a time, got lost, noted that everyone around me (save the grinning little round man) also got lost, and strolled back to my computer.

The trace drew its green-and-white pictures smoothly on the Mark VI display, and pages of hard copy clicked out of the vocorder. Something in the needle geometry scattered across the recording paper drew my attention. Like an elusive name, it drifted just beyond reach.

Beneath a plate of the Andromeda Galaxy, a coffee pot simmered. I could hear the distant drone of a plane, probably out of Luke Air Force Base. Behind me, Hopkins and his men were laughing at something.

There were patterns in the recording.

They materialized slowly, identical clusters of impulses: the signals were artificial.

Procyon.

The laughter, the plane, the coffee pot, a radio that had been left on somewhere: everything squeezed down to a possibility.

More likely Phoenix, I thought.

* * * *

Frank Myers had been SETI Director since Ed Dickinson's death twelve years before. I reached him next morning in San Francisco.

“No,” he said without hesitation. “Someone's idea of a joke, Harry.”

“It was in your safe, Frank.”

“That damned safe's been there forty years. Might be anything in it. Except messages from Mars....”

I thanked him and hung up.

It had been a long night: I'd taken the hard copy to bed and, by 5:00 A.M., had identified more than forty distinct pulse patterns. The signal appeared to be continuous: that is, it had been an ongoing transmission with no indication of beginning or end, but only irregular breaches of the type that would result from atmospheric and, of course, the long periods during which the target would have been below the horizon.

It was clearly a reflected terrestrial transmission: radio waves bounce around considerably. But why seal the error two years later and put it in the safe?

Procyon is a yellow-white class F3 binary, absolute magnitude 2.8, once worshipped in Babylon and Egypt. (What hasn't been worshipped in Egypt?) Distance from earth: 11.3 light-years.

In the outer office, Beth Cooper typed, closed filing drawers, spoke with visitors.

The obvious course of action was to use the Array. Listen to Procyon at 40 gigahertz, or all across the spectrum for that matter, and find out if it was, indeed, saying something.

On the intercom, I asked Beth if any open time had developed on the system. “No,” she said crisply. “We have nothing until August of next year.”

That was no surprise. The facility had booked quickly when its resources were made available to the astronomical community on more than the limited basis that had prevailed for twenty years. Anyone wishing to use the radiotelescope had to plan far in advance. How could I get hold of the Array for a couple hours?

I asked her to come into my office.

Beth Cooper had come to Sandage from San Augustin with SETI during the big move twenty years before. She'd been secretary to three directors: Hutching Chaney, who had built Sandage; his longtime friend, Ed Dickinson; and finally, after Dickinson's death, Frank Myers, a young man on the move, who'd stayed too long with the Project, and who'd been reportedly happy to see it strangled. In any case, Myers had contributed to its demise by his failure to defend it.

I'd felt he was right, of course, though for the wrong reason. It had been painful to see the magnificent telescope at Sandage denied, by and large, to the scientific community while its grotesque hunt for the Little Green Man signal went on. I think there were few of us not happy to see it end.

Beth had expected to lose her job. But she knew her way around the facility, had a talent for massaging egos, and could spell. A devout Lutheran, she had adapted cautiously to working for a priest and, oddly, seemed to have taken offense that I did not routinely walk around with a Roman collar.

I asked one or two questions about the billing methods of the local utilities, and then commented, as

casually as I could manage, that it was unfortunate the Project had not succeeded.

Beth looked more like a New York librarian than a secretary at a desert installation. Her hair was silver-gray. She wore steel-rimmed glasses on a long silver chain. She was moderately heavy, but her carriage and her diction were impeccable, imbuing her with the quality that stage people call presence.

Her eyes narrowed to hard black beads at my remark. "Dr. Dickinson said any number of times that none of us would live to see results. Everyone attached to the program, even the janitors, knew that." She wasn't a woman given to shrugs, but the sudden flick in those dark eyes matched the effect. "I'm glad he didn't live to see it terminated."

That was followed by an uncomfortable silence. "I don't blame you, Doctor," she said at length, referring to my public position that the facility was being underutilized.

I dropped my eyes and tried to smile reassuringly. It must have been ludicrous: her severe features softened. I showed her the envelope.

"Do you recognize the writing?"

She barely glanced at it. "It's Dr. Dickinson's."

"Are you sure? I didn't think Dickinson came to the Project until Hutch Chaney's retirement. That was '13, wasn't it?"

"He took over as Director then. But he was an operating technician under Dr. Chaney for, oh, ten or twelve years before that." Her eyes glowed when she spoke of Dickinson.

"I never met him," I said.

"He was a fine man." She looked past me, over my shoulder, her features pale. "If we hadn't lost him, we might not have lost the Project."

"If it matters," I added gently.

"If it matters."

She was right about Dickinson: he was articulate, a persuasive speaker, author of books on various subjects, and utterly dedicated to SETI. He might well have kept the Project afloat despite the cessation of federal funds and the increasing clamor among his colleagues for more time at the facility. But Dickinson was twelve years dead now: he'd returned to Massachusetts at Christmas, as was his custom. After a snowstorm, he'd gone out to help shovel a neighbor's driveway and his heart had failed.

At the time, I was at Georgetown. I can still recall my sense of a genius who had died too soon. He had possessed a vast talent, but no discipline; he had churned through his career hurling sparks in all directions. But somehow everything he touched, like SETI, had come to no fulfillment.

"Beth, was there ever a time they thought they had an LGM?"

"The Little Green Man Signal?" She shook her head. "No, I don't think so. They were always picking up echoes and things. But nothing ever came close. Either it was KCOX in Phoenix, or a Japanese trawler in the middle of the Pacific."

"Never anything that didn't fit those categories?"

One eyebrow rose slightly. "Never anything they could prove. If they couldn't pin it down, they went

back later and tried to find it again. One way or another, they eliminated everything.” Or, she must be thinking, we wouldn't be standing here having this conversation.

* * * *

Beth's comments implied that suspect signals had been automatically stored. Grateful that I had not yet got around to purging obsolete data, I discovered that was indeed the case, and ran a search covering the entire time period back to the Procyon reception in 2011. I was looking for a similar signal.

I got a surprise.

There was no match. There was also no record of the Procyon reception itself.

That meant presumably it had been accounted for and discarded.

Then why, two years later, had the recordings been sealed and placed in the safe? Surely no explanation would have taken that long.

SETI had assumed that any LGM signal would be a deliberate attempt to communicate, that an effort would therefore be made by the originator to create intelligibility, and that the logical way to do that was to employ a set of symbols representing universal constants: the atomic weight of hydrogen, perhaps, or the value of pi.

But the move to Sandage had also been a move to more sophisticated, and considerably more sensitive, equipment. The possibility developed that the Project would pick up a slopover signal, a transmission of alien origin, but intended only for local receivers. Traffic of that nature could be immeasurably difficult to interpret.

If the packet in the safe was anything at all, it was surely of this latter type. Forty gigahertz is not an ideal frequency for interstellar communication. Moreover, the intercept was ongoing, formless, no numbered parts, nothing to assist translation.

I set the computer working on the text, using SETI's own language analysis program. Then I instructed Brackett to call me if anything developed, had dinner at Jimmy's, and went home.

* * * *

There was no evidence of structure in the text. In English, one can expect to find a 'U' after a 'Q', or a vowel after a cluster of consonants. The aspirate is seldom doubled, nothing is ever tripled, and so on. But in the Procyon transmission, everything seemed utterly random.

The computer counted two-hundred fifty-six distinct pulse patterns. Eight bits. Nothing recurred at sufficient intervals to be a space. And the frequency count of these pulse patterns, or characters, was flat; there was no quantitative difference in use from one to another. All appeared approximately the same number of times. If it was a language, it was a language with no discernible vowels.

I called Wes Phillips, who was then the only linguist I knew. Was it possible for a language to be structured in such a way?

“Oh, I don't think so. Unless you're talking about some sort of construct. Even then...” He paused.

“Harry, I can give you a whole series of reasons in maybe six different disciplines why languages need high and low frequency letters. To have a flat 'curve,' a language would have to be deliberately designed that way, and it would have to be non-oral. But what practical value would it have? Why bother?”

* * * *

Ed Dickinson had been an enigma. During the series of political crises after the turn of the century, he'd

earned an international reputation as a diplomat, and as an eloquent defender of reason and restraint. Everyone agreed that he had a mind of the first rank. Yet, in his chosen field, he accomplished little. And eventually he'd gone to work for the Project, historically only a stepping-stone to serious effort. But he'd stayed.

Why?

Hutching Chaney was a different matter. A retired naval officer, he'd indulged in physics almost as a pastime. His political connections had been instrumental in getting Sandage built; and his assignment as Director was rumored to have been a reward for services rendered during the rough and tumble of congressional politics.

He possessed a plodding sort of competence. He was fully capable of grasping, and visualizing, extreme complexity. But he lacked insight and imagination, the ability to draw the subtle inference. After his retirement from Sandage, Chaney had gone to an emeritus position at MIT, which he'd held for five years.

He was a big man, more truck driver than physicist. Despite advancing age—he was then in his 70's—and his bulk, he spoke and moved with energy. His hair was full and black. His light gray eyes suggested the shrewdness of a professional politician; and he possessed the confident congeniality of a man who had never failed at anything.

We were in his home in Somerville, Massachusetts, a stone and glass house atop sweeping lawns. It was not an establishment that a retired physicist would be expected to inhabit: Chaney's moneyed background was evident.

He clapped a big hand on my shoulder and pulled me through one of those stiff, expensive living rooms that no one ever wants to sit in, into a paneled, leather-upholstered den at the rear of the house. "Martha," he said to someone I couldn't see, "would you bring us some port?" He looked at me for acquiescence.

"Fine," I said. "It's been a long time, Hutch."

Books lined the walls: mostly engineering manuals, a few military and naval histories. An articulated steel gray model of the Lance dominated the fireplace shelf. That was the deadly hydrofoil which, built at Chaney's urging, had created a multi-purpose navy that was simultaneously lethal, flexible, and relatively cheap.

"The Church is infiltrating everywhere," he said. "How are things at Sandage, Harry?"

I described some of the work in progress. He listened with interest.

A young woman arrived with a bottle, two glasses, and a plate of cheese. "Martha comes in three times a week," Chaney said after she'd left the room. He smiled, winked, dipped a stick of cheese into the mustard, and bit it neatly in half. "You needn't worry, Harry. I'm not capable of getting into trouble anymore. What brings you to Massachusetts?"

I extracted the vocordings from my briefcase and handed them across to him. I watched patiently as he leafed through the thick sheaf of paper, and saw with satisfaction his change of expression.

"You're kidding, Harry," he said. "Somebody really found one? When'd it happen?"

"Twenty years ago," I said, passing him the envelope and the original disks.

He turned them over in his hands. "You're not serious? There's a mistake somewhere."

"It was in the safe," I said.

He shook his head. "Doesn't much matter where it was. Nothing like this ever happened."

"Then what is it?"

"Damned if I have any idea."

We sat not talking while Chaney continued to flip pages, grunting. He seemed to have forgotten his wine. "You run this yourself?" he asked.

I nodded.

"Hell of a lot of trouble for somebody to go to for a joke. Were the computers able to read any of it? No? That's because it's gibberish." He stared at the envelope. "But it *is* Ed's handwriting."

"Would Dickinson have any reason to keep such a thing quiet?"

"Ed? No: Dickinson least of all. No one wanted to hear a signal more than he did. He wanted it so badly he invested his life in the Project."

"But could he, physically, have done this? Could he have picked up the LGM? Could he have done it without anyone else knowing? Was he good enough with computers to cover his tracks?"

"This is pointless. Yes, he could have done it. And you could walk through Braintree without your pants."

A light breeze was coming through a side window, billowing the curtains. It was cool and pleasant, unusual for Massachusetts in August. Some kids were playing halfball out on the street.

"Forty megahertz," he said. "Sounds like a satellite transmission."

"That wouldn't have taken two years to figure out, would it? Why keep the disks?"

"Why not? I expect if you go down into the storeroom you'll find all kinds of relics."

Outside, there was a sound like approaching thunder, exploding suddenly into an earsplitting screech. A stripped-down T-Bolt skidded by, scattering the ballplayers. An arm hung leisurely out the driver's side. The car took the corner stop sign at about 45. A couple of fingers went up, but otherwise the game resumed as though nothing had happened.

"All the time," Chaney said. His back to the window, he hadn't bothered to look around. "Cops can't keep up with them anymore."

"Why was Dickinson so interested in the Project?"

"Ed was a great man." His face clouded somewhat, and I wondered if the port hadn't drawn his emotions close to the surface. "You'd have to know him. You and he would have got along fine. He had a taste for the metaphysical, and I guess the Project was about as close as he could get."

"How do you mean?"

"Did you know he spent two years in a seminary? Yes, somewhere outside Philadelphia. He was an altar boy who eventually wound up at Harvard. And that was that."

“You mean he lost his faith?”

“Oh, yes. The world became a dark place, full of disaster. He always seemed to have the details on the latest pogrom, or viral outbreak, or drive-by murder. There are only two kinds of people, he told me once: atheists, and folks that haven't been paying attention. But he always retained that fine mystical sense of purpose that you drill into your best kids, a notion that things are somehow ordered. When I knew him, he wouldn't have presumed to pray to anyone. But he had all the drive of a missionary, and the same conviction of—” He dropped his head back on the leather upholstery and tried to seize a word from the ceiling. “—Destiny.

“Ed wasn't like most physicists. He was competent in a wide range of areas. He wrote on foreign affairs for *Commentary*, and *Harper's*; he published books on ornithology, systems analysis, Malcolm Muggeridge, and Edward Gibbon.”

He swung easily out of his chair and reached for a pair of fat matched volumes in mud-brown covers. It was *The Decline and Fall of the Roman Empire*, the old Modern Library edition. “He's the only person I've ever known who's actually read the thing.” He turned the cover of volume one so that I could see the inscription:

*For Hutch,
In the fond hope that we can hold off the
potherbs and the pigs.
Ed*

“He gave it to me when I left SETI.”

“Seems like an odd gift. Have you read it?”

He laughed off the question. “You'd need a year.”

“What's the business about the potherbs and pigs?”

He rose and walked casually to the far wall. There were photos of naval vessels and aircraft, of Chaney and President Fine, of the Sandage complex. He seemed to screw his vision into the latter. “I don't remember. It's a phrase from the book. He explained it to me at the time. But....” He held his hands outward, palms up.

“Hutch, thanks.” I got up to go.

“There was no signal,” he said. “I don't know where these recordings came from, but Ed Dickinson would have given anything for a contact.”

“Hutch, is it possible that Dickinson might have been able to translate the text? If there had been one?”

“Not if you couldn't. He had the same program.”

* * * *

I don't like cities.

Dickinson's books were all out of print, and the used bookstores were clustered in Cambridge. Even then, the outskirts of Boston, like the city proper, were littered with broken glass and discarded newspapers. Surly kids milled outside bars. Windows everywhere were smashed or boarded. I went through a red light at one intersection rather than learn the intentions of an approaching band of ragged children with hard eyes. (One could scarcely call them children, though I doubt there was one over 12.) Profanity covered the crumbling brick walls as high as an arm could reach. Much of it was misspelled.

Boston had been Dickinson's city. I wondered what the great humanist thought when he drove through these streets.

I found only one of his books: *Malcolm Muggeridge: Faith and Despair*. The store also had a copy of *The Decline and Fall*. On impulse, I bought it.

I was glad to get back to the desert.

We were entering a period of extraordinary progress, during which we finally began to understand the mechanics of galactic structure. McCue mapped the core of the Milky Way, Osterberger developed his unified field concepts, and Schauer constructed his celebrated revolutionary hypothesis on the nature of time. Then, on a cool morning in October, a team from Cal Tech announced that they had a new set of values for hyperinflation.

In the midst of all this, we had an emergency. One night in late September, Earl Barlow, who was directing the Cal Tech groups, suffered a mild heart attack. I arrived just before the EMT's, at about 2:00 A.M.

While the ambulance carrying Barlow started down the mountain, his people watched helplessly, drinking coffee, too upset to work. The opportunity didn't catch me entirely unprepared. I gave Brackett his new target. The blinking lights of the emergency vehicle were still visible when the parabolas swung round and fastened on the bright dog-star Procyon.

But there was only the disjointed crackle of interstellar static.

* * * *

I took long walks on the desert at night. The parabolas are lovely in the moonlight. Occasionally, the stillness is broken by the whine of an electric motor, and the antennas slide gracefully along their tracks. It was, I thought, a new Stonehenge of softly curving shapes and fluid motion.

The Muggeridge book was a slim volume. It was not biographical, but rather an analysis of the philosopher's conviction that the West has a death wish. It was the old argument that God had been replaced by science, that man had gained knowledge of a trivial sort, and as a result lost purpose.

It was, on the whole, depressing reading. In his conclusion, Dickinson argued that truth will not wait on human convenience, that if man cannot adapt to a neutral universe, then that universe will indeed seem hostile. We must make do with what we have and accept truth wherever it leads. The modern cathedral is the radiotelescope.

Sandage was involved in the verification procedure for McCue's work, and for the already controversial Cal Tech equations. All that is another story: what is significant is that it got me thinking about verifications, and I realized I'd overlooked something: there'd been no match for the Procyon readings anywhere in the data banks since the original reception. But the Procyon recordings might themselves have been the confirmation of an earlier signal!

It took five minutes to run the search: there were two hits.

Both were fragments, neither more than fifteen minutes long; but there was enough of each to reduce the probability of error to less than one percent.

The first occurred three weeks prior to the Procyon reception.

The second went back to 2007, a San Augustin observation. Both were at 40 gigahertz. Both had identical pulse patterns. But there was an explosive difference, sedately concealed in the target

information line: the 2007 transmission had come while the radiotelescope was locked on Sirius!

* * * *

When I got back to my office, I was trembling.

Sirius and Procyon were only a few light-years apart. My God, I kept thinking, they exist! And they have interstellar travel!

I spent the balance of the day stumbling around, trying to immerse myself in fuel usage reports and budget projections. But mostly what I did was watch the desert light grow hard in the curtains, and then fade. The two volumes of Edward Gibbon were propped between a *Webster's* and some black binders. The books were thirty years old, identical to the set in Chaney's den. Some of the pages, improperly cut, were still joined at the edges.

I opened the first volume, approximately in the middle, and began to read. Or tried to. But Ed Dickinson kept crowding out the Romans. Finally I gave it up, took the book, and went home.

There was duplicate bridge in town, and I lost myself in that for five hours. Then, in bed, still somewhat dazed, I tried *The Decline and Fall* again.

It was not the dusty rollcall of long-dead emperors that I had expected. The emperors are there, stabbing and throttling and blundering. And occasionally trying to improve things. But the fish-hawkers are there too. And the bureaucrats and the bishops.

It's a world filled with wine and legionnaires' sweat, mismanagement, arguments over Jesus, and the inability to transfer power, all played out to the ruthless drumbeat of dissolution. An undefined historical tide, stemmed occasionally by a hero, or a sage, rolls over men and events, washing them toward the sea. (During the later years, I wondered, did Roman kids run down matrons in flashy imported chariots? Were the walls of Damascus defiled by profanity?)

In the end, when the barbarians push at the outer rim of empire, it is only a hollow wreck that crashes down.

Muggeridge must have been there.

And Dickinson, the altar boy, amid the fire and waste of the imperial city, must have suffered a second loss of faith.

We had an electrical failure one night. It has nothing to do with this story except that it resulted in my being called in at 4:00 A.M. (not to restore the power, which required a good electrician, but to pacify some angry people from New York, and to be able to say, in my report, that I had been on the spot).

These things attended to, I went outside.

At night, the desert is undisturbed by color or motion. It's a composition of sand, rock, and star; a frieze, a Monet, uncomplicated, unchanging. It's reassuring, in an age when little else seems stable: the orderly universe of mid-twentieth century had long since disintegrated into a plethora of neutron galaxies, colliding black holes, time reversals, and God knows what.

The desert is solid underfoot. Predictable. A reproach to the quantum mechanics that reflect a quicksand cosmos in which physics merges with Plato.

Close on the rim of the sky, guarding their mysteries, Sirius and Procyon, the bright pair, sparkled. The arroyos are dry at that time of year, shadowy ripples in the landscape. The moon was in its second

quarter. Beyond the administration building, the parabolas were limned in silver.

My cathedral.

My Stonehenge.

And while I sat, sipping a Coors, and thinking of lost cities and altar boys and frequency counts, I suddenly understood the significance of Chaney's last remark! Of course Dickinson had not been able to read the transmission: that was the point!

* * * *

I needed Chaney.

I called him in the morning, and flew out in the afternoon. He met me at Logan, and we drove toward Gloucester. "There's a good Italian restaurant," he said. And then, without taking his eyes off the road: "What's this about?"

I'd brought the second Gibbon volume with me, and I held it up for him to see. He blinked.

It was early evening, cold, wet, with the smell of approaching winter. Freezing rain pelted the windshield. The sky was gray, heavy, sagging into the city.

"Before I answer any questions, Hutch, I'd like to ask a couple. What can you tell me about military cryptography?"

He grinned. "Not much. The little I do know is probably classified." A tractor-trailer lumbered past, straining, spraying water across the windows. "What, specifically, are you interested in?"

"How complex are the Navy's codes? I know they're nothing like cryptograms, but what sort of general structure do they have?"

"First off, Harry, they're not codes. Monoalphabetic systems are codes. Like the cryptograms you mentioned. The letter 'G' always turns up, say, as an 'M'. But in military and diplomatic cryptography, the 'G' will be a different character every time it appears. And the encryption alphabet isn't usually limited to letters; we use numbers, dollar signs, ampersands, even spaces." We splashed onto a ramp and joined the Interstate. It was elevated and we looked across rows of bleak rooftops. "Even the shape of individual words is concealed."

"How?"

"By encrypting the spaces."

I knew the answer to the next question before I asked it. "If the encryption alphabet is absolutely random, which I assume it would have to be, the frequency count would be flat. Right?"

"Yes. Given sufficient traffic, it would have to be."

"One more thing, Hutch: a sudden increase in traffic will alert anyone listening that something is happening even if he can't read the text. How do you hide that?"

"Easy. We transmit a continuous signal, twenty-four hours a day. Sometimes it's traffic, sometimes it's garbage. But you can't tell the difference."

God have mercy on us, I thought. Poor Ed Dickinson.

* * * *

We sat at a small corner table well away from the main dining area. I shivered in wet shoes and a damp sweater. A small candle guttered cheerfully in front of us.

“Are we still talking about Procyon?” he asked.

I nodded. “The same pattern was received twice, three years apart, prior to the Procyon reception.”

“But that's not possible.” Chaney leaned forward intently. “The computer would have matched them automatically. We'd have known.”

“I don't think so.” Half a dozen prosperous, overweight men in topcoats had pushed in and were jostling each other in the small entry. “The two hits were on different targets: they would have looked like an echo.”

Chaney reached across the table and gripped my wrist, knocking over a cup. He ignored it. “Son of a bitch,” he said. “Are you suggesting somebody's moving around out there?”

“I don't think Ed Dickinson had any doubts.”

“Why would he keep it secret?”

I'd placed the book on the table at my left hand. It rested there, its plastic cover reflecting the glittering red light of the candle. “Because they're at war.”

The color drained from Chaney's face, and it took on a pallor that was almost ghastly in the lurid light.

“He believed,” I continued, “he really believed that mind equates to morality, intelligence to compassion. And what did he find after a lifetime? A civilization that had conquered the stars, but not its own passions and stupidities.”

A tall young waiter presented himself. We ordered port and pasta.

“You don't really know there's a war going on out there,” Chaney objected.

“Hostility, then. Secrecy on a massive scale, as this must be, has ominous implications. Dickinson would have saved us all with a vision of order and reason....”

The gray eyes met mine. They were filled with pain. Two adolescent girls in the next booth were giggling. The wine came.

“What has the *Decline and Fall* to do with it?”

“It became his Bible. He was chilled to the bone by it. *You* should read it, but with caution. It's quite capable of strangling the soul. Dickinson was a rationalist; he recognized the ultimate truth in the Roman tragedy: that once expansion has stopped, decay is constant and irreversible. Every failure of reason or virtue loses more ground.

“I haven't been able to find his book on Gibbon, but I know what he'll say: that Gibbon was not writing only of the Romans, nor of the British of his own time. He was writing about us....”

“Hutch, take a look around. Tell me we're not sliding toward a dark age. Think how that knowledge must have affected Ed Dickinson.”

We drank silently for a few minutes. Time locked in place, and we sat unmoving, the world frozen around us.

“Did I tell you,” I said at last, “that I found the reference for his inscription? He must have had great respect for you.” I opened the book to the conclusion, and turned it for him to read:

The forum of the Roman people, where they assembled to enact their laws, and elect their magistrates, is now enclosed for the cultivation of potherbs, or thrown open for the reception of swine and buffaloes.

Chaney stared disconsolately at me. “It’s all so hard to believe.”

“A man can survive a loss of faith in the Almighty,” I said, “provided he does not also lose faith in himself. That was Dickinson’s real tragedy; he came to believe exclusively in radiotelescopes, the way some people do in religions.”

The food, when it came, went untasted. “What are you going to do, Harry?”

“About the Procyon text? About the probability that we have quarrelsome neighbors? I’m not afraid of that kind of information; all it means is that where you find intelligence, you will probably find stupidity. Anyway, it’s time Dickinson got credit for his discovery.” And, I thought, maybe it’ll even mean a footnote for me.

I lifted my glass in a mock toast, but Chaney did not respond. We faced each other in an uncomfortable tableau. “What’s wrong?” I asked. “Thinking about Dickinson?”

“That too.” The candle glinted in his eyes. “Harry, do you think *they* have a SETI project?”

“Possibly. Why?”

“I was wondering if your aliens know we’re here. This restaurant isn’t much further from Sirius than Procyon is. Maybe you better eat up.”

About the Author

Jack McDevitt (1935-) recently retired from a position with the U.S. government to write full-time, but his stories have been appearing with increasing regularity since the early 1980s and he has won several awards. Social impacts are never far from his attention.

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12. I Still Call Australia Home by George Turner

The past is another country; they do things differently there.

—L. P. Hartley

* * *

1

The complement of *Starfarer* had no idea, when they started out, of how long they might be gone. They searched the sky, the three hundred of them, men and women, black and brown and white and yellow, and in thirty years landed on forty planets whose life-support parameters appeared—from distant observation—close to those of Earth.

Man, they discovered, might fit his own terrestrial niche perfectly, but those parameters for his existence were tight and inelastic. There were planets where they could have dwelt in sealed environments, venturing out only in special suits, even one planet where they could have existed comfortably through

half its year but been burned and suffocated in the other half. They found not one where they could establish a colony of mankind.

In thirty years they achieved nothing but an expectable increase in their numbers and this was a factor in their decision to return home. The ship was becoming crowded and, in the way of crowded tenements, something of a slum.

So they headed for Earth; and at the end of the thirty-first year, took up a precessing north-south orbit allowing them a leisurely overview, day by day, of the entire planet.

This was wise. They had spent thirty years in space, travelling between solar systems at relativistic speeds, and reckoned that about six hundred local years had passed since they set out. They did not know what manner of world they might find.

They found, with their instruments, that the greenhouse effect had subsided slowly during the centuries, aided by the first wisps of galactic cloud heralding the new ice age, but that the world was still warmer than the interregal norm. The ozone layer seemed to have healed itself, but the desert areas were still formidably large although the spread of new pasture and forest was heartening.

What they did not see from orbit was the lights of cities by night and this did not greatly surprise them. The world they had left in a desperate search for new habitat had been an ant heap of ungovernable, unsupportable billions whose numbers were destined to shrink drastically if any were to survive at all. The absence of lights suggested that the population problem had solved itself in grim fashion.

They dropped the ship into a lower orbit just outside the atmosphere and brought in the spy cameras.

There were people down there, all kinds of people. The northern hemisphere was home to nomadic tribes, in numbers like migratory nations; the northern temperate zone had become a corn belt, heavily farmed and guarded by soldiers in dispersed forts, with a few towns and many villages; the equatorial jungles were, no doubt, home to hunter-gatherers but their traces were difficult to see; there were signs of urban communities, probably trading centres, around the seacoasts but no evidence of transport networks or lighting by night and no sounds of electronic transmission. Civilisation had regressed, not unexpectedly.

They chose to inspect Australia first because it was separated from the larger landmasses and because the cameras showed small farming communities and a few townlets. It was decided to send down a Contact Officer to inspect and report back.

The ship could not land. It had been built in space and could live only in space; planetary gravity would have warped its huge but light-bodied structure beyond repair. Exploratory smallcraft could have been despatched, but it was reasoned that a crew of obviously powerful supermen might create an untrusting reserve among the inhabitants, even an unhealthy regard for gods or demons from the sky. A single person, powerfully but unobtrusively armed, would be a suitable ambassador.

They sent a woman, Nugan Johnson, not because she happened to be Australian but because she was a Contact Officer, and it was her rostered turn for duty.

They chose a point in the south of the continent because it was autumn in the hemisphere, and an average daily temperature of twenty-six C would be bearable, and dropped her by tractor beam on the edge of a banana grove owned by Mrs Flighty Jones, who screamed and fled.

* * *

Flighty, in the English of her day, meant something like *scatterbrained*. Her name was, in fact, Hallo-Mary (a rough—very rough—descendant of Ave Maria), but she was a creature of fits and starts, so much so that the men at the bottling shed made some fun of her before they were convinced that she had seen *something*, and called the Little Mother of the Bottles.

“There was I, counting banana bunches for squeeging into baby pap, when it goes hissss-bump behind me.”

“What went hiss-bump?”

“It did.”

“What was it?” Little Mother wondered if the question was unfair to Flighty wits.

“I don't know.” Having no words, she took refuge in frustrated tears. She had inherited the orchard but not the self control proper to a proprietary woman.

In front of the men! Little Mother sighed and tried again. “What did it look like? What shape?”

Flighty tried hard. “Like a bag. With legs. And a glass bowl on top. And it bounced. That's what made the bump. And it made a noise.”

“What sort of noise?”

“Just a noise.” She thought of something else. “You know the pictures on the library wall? In the holy stories part? The ones where the angels go up? Well, like the angels.”

Little Mother knew that the pictures did not represent angels, whatever the congregation were told. Hiding trepidation, she sent the nearest man for Top Mother.

Top Mother came, and listened ... and said, as though visitations were nothing out of the way, “We will examine the thing that hisses and bumps. The men may come with us in case their strength is needed.” That provided at least a bodyguard.

The men were indeed a muscular lot, and also a superstitious lot, but they were expected to show courage when the women claimed protection. They picked up whatever knives and mashing clubs lay to hand and tried to look grim. Man-to-man was a bloodwarming event but man-to-whatisit had queasy overtones. They agreed with Little Mother's warning: “There could be danger.”

“There might be greater danger later on if we do not investigate. Lead the way, Hallo-Mary.” A Top Mother did not use nicknames.

Flighty was now thoroughly terrified and no longer sure that she had seen anything, but Top Mother took her arm and pushed her forward. Perhaps it had gone away; perhaps it had bounced up and up...

It had not gone anywhere. It had sat down and pushed back its glass bowl and revealed itself, by its cropped hair, as a man.

“A man,” murmured Top Mother, who knew that matriarchy was a historical development and not an evolutionary given. She began to think like the politician which at heart she was. *Aman* from—from *outside*—could be a social problem.

The men, who were brought up to revere women but often resented them—except during the free-fathering festivals—grinned and winked at each other and wondered what the old girl would do.

The old girl said, “Lukey! Walk up and observe him.”

Lukey started off unwillingly, then noticed that three cows grazed unconcernedly not far from the man in a bag and took heart to cross the patch of pasture at the orchard's edge.

At a long arm's length he stood, leaned forward and sniffed. He was forest bred and able to sort out the man in a bag's scents from the norms about him and, being forest bred, his pheromone sense was better than rudimentary. He came so close that Nugan could have touched him and said, “Just another bloody woman!” The stranger should have been a man, a sex hero!

He called back to Top Mother, “It's only a woman with her hair cut short.”

They all crowded forward across the pasture. Females were always peaceable—unless you really scratched their pride.

* * * *

The hiss Flighty had heard had been the bootjets operating to break the force of a too-fast landing by an ineptly handled tractor beam; the bump had been the reality of a contact that wrenched an ankle. Even the bounce was almost real as she hopped for a moment on one leg. The noise was Nugan's voice through a speaker whose last user had left it tuned to baritone range, a hearty, “Shit! Goddam shit!” before she sat down and became aware of a dumpy figure vanishing among columns of what she remembered vaguely as banana palms. Not much of a start for good PR.

She thought first to strip the boot and bind her ankle, then that she should not be caught minus a boot if the runaway brought unfriendly reinforcements. She did not fear the village primitives; though she carried no identifiable weapons, the thick gloves could spit a variety of deaths through levelled fingers. However, she had never killed a civilised organism and had no wish to do so; her business was to prepare a welcome home.

The scents of the air were strange but pleasant, as the orbital analysis had affirmed; she folded the transparent *fishbowl* back into its neck slot. She became aware of animals nearby. Cows. She recognised them from pictures though she had been wholly city bred in an era of gigantic cities. They took no notice of her. Fascinated and unafraid, she absorbed a landscape of grass and tiny flowers in the grass, trees and shrubs and a few vaguely familiar crawling and hopping insects. The only strangeness was the spaciousness stretching infinitely on all sides, a thing that the lush Ecological Decks of *Starfarer* could not mimic, together with the sky like a distant ceiling with wisps of cloud. Might it rain on her? She scarcely remembered rain.

Time passed. It was swelteringly hot but not as hot as autumn in the greenhouse streets.

They came at last, led by a tall woman in a black dress—rather, a robe cut to enhance dignity though it was trimmed off at the knees. She wore a white headdress like something starched and folded in the way of the old nursing tradition and held together by a brooch. She was old, perhaps in her sixties, but she had presence and the dress suggested status.

She clutched another woman by the arm, urging her forward, and Nugan recognised the clothing, like grey denim jeans, that fled through the palms. Grey Denim Jeans pointed and planted herself firmly in a determined no-further pose. Madam In Black gestured to the escort and spoke a few words.

Nugan became aware of the men and made an appreciative sound unbecoming in a middle-aged matron past child-bearing years. These men wore only G-strings and they were *men*. Not big men but shapely, muscular and very male. *Or am I so accustomed to Starfarer crew that any change rings a festival bell? Nugan, behave!*

The man ordered forward came warily and stopped a safe arm's length from her, sniffing. Nugan examined him. *If I were, even looked, twenty years younger...* He spoke suddenly in a resentful, blaming tone. The words were strange (of course they must be) yet hauntingly familiar; she thought that part of the sentence was “dam-dam she!”

She kept quiet. Best to observe and wait. The whole party, led by Madam In Black, came across the pasture. They stopped in front of her, fanning out in silent inspection. The men smelled mildly of sweat, but that was almost a pleasure; after thirty years of propinquity, *Starfarer* 's living quarters stank of sweat.

Madam In Black said something in a voice of authority that seemed part of her. It sounded a little like “Oo're yah?”—interrogative with a clipped note to it; the old front-of-the-mouth Australian vowels had vanished in the gulf of years. It should mean, by association, *Who are you?* but in this age might be a generalised, *Where are you from?* even, *What are you doing here?*

Nugan played the oldest game in language lesson, tapping her chest and saying, “Nugan. I—Nugan.”

Madam In Black nodded and tapped her own breast. “Ay Tup-Ma.”

“Tupma?”

“Dit—Tup-Ma, Yah Nuggorn?”

“Nugan.”

The woman repeated, “Nugan,” with a fair approximation of the old vowels and followed with, “Wurriya arta?”

Nugan made a guess at vowel drift and consonant elision and came up with, *Where are you out of?* meaning, *Where do you come from?*

They must know, she thought, that something new is in the sky. A ship a kilometer long has been circling for weeks with the sun glittering on it at dawn and twilight. They can't have lost all contact with the past; there must be stories of the bare bones of history...

She pointed upwards and said, “From the starship.”

The woman nodded as if the statement made perfect sense and said, “Stair-boot.”

Nugan found herself fighting sudden tears. *Home, home, HOME has not forgotten us.* Until this moment she had not known what Earth meant to her, swimming in the depths of her shipbound mind. “Yes, stairboot. We say starship.”

The woman repeated, hesitantly, “Stairsheep?” She tried again, reaching for the accent, “Starship! I say it right?”

“Yes, you say it *properly.*”

The woman repeated, “Prupperly. Ta for that. It is old-speak. I read some of that but not speak—only small bit.”

So not everything had been lost. There were those who had rescued and preserved the past. Nugan said, “You are quite good.”

Tup-Ma blushed with obvious pleasure. “Now we go.” She waved towards the banana grove.

“I can’t.” A demonstration was needed. Nugan struggled upright, put the injured foot to the ground and tried for a convincing limp. That proved easy; the pain made her gasp and she sat down hard.

“Ah! You bump!”

“Indeed I bump.” She unshackled the right boot and broke the seals before fascinated eyes and withdrew a swelling foot.

“We carry.”

We meant two husky males with wrists clasped under her, carrying her through the grove to a large wooden shed where more near-naked men worked at vats and tables. They sat on a table and brought cold water (*How do they cool it? Ice? Doubtful.*) and a thick yellow grease which quite miraculously eased the pain somewhat (*A native pharmacopoeia?*) and stout, unbleached bandages to swathe her foot tightly.

She saw that in other parts of the shed the banana flesh was being mashed into long wooden moulds. Then it was fed into glass cylinders whose ends were capped, again with glass, after a pinch of some noisome-looking fungus was added. (*Preservative? Bacteriophage? Why not?*) A preserving industry, featuring glass rather than metal; such details helped to place the culture.

Tup-Ma called, “Lukey!” and the man came forward to be given a long instruction in which the word *Stair-boot* figured often. He nodded and left the shed at a trot.

“Lukey go—goes—to tell Libary. We carry you there.”

“Who is Libary?”

The woman thought and finally produced, “Skuller. Old word, I think.”

“Scholar? Books? Learning?”

“Yes, yes, books. Scho-lar. Ta.” Ta? Of course—thank you. Fancy the child’s word persisting.

“You will eat, please?”

Nugan said quickly, “No, thank you. I have this.” She dug out a concentrate pack and swallowed one tablet before the uncomprehending Tup-Ma. She dared not risk local food before setting up the test kit, enzymes and once-harmless proteins could change so much. They brought a litter padded like a mattress and laid her on it. Four pleasantly husky men carried it smoothly, waist-high, swinging gently along a broad path towards low hills, one of which was crowned by a surprisingly large building from which smoke plumes issued.

“Tup-Ma goodbyes you.”

“Goodbye, Tup-Ma. And ta.”

* * *

3

It was a stone building, even larger than it had seemed. But that was no real wonder; the medieval stone masons had built cathedrals far more ornate than this squared-off warehouse of a building. It was weathered dirty grey but was probably yellow sandstone, of which there had been quarries in Victoria. Sandstone is easily cut and shaped even with soft iron tools.

There were windows, but the glass seemed not to be of high quality, and a small doorway before which the bearers set down the litter. A thin man of indeterminate middle age stood there, brown eyes examining her from a dark, clean shaven face. He wore a loose shirt, wide-cut, ballooning shorts and sandals, and he smiled brilliantly at her. He was a full-blooded Aborigine.

He said, "Welcome to the Library, Starwoman," with unexceptionable pronunciation though the accent was of the present century.

She sat up. "The language still lives."

He shook his head. "It is a dead language but scholars speak it, as many of yours spoke Latin. Or did that predate your time? There are many uncertainties."

"Yes, Latin was dead. My name is Nugan."

"I am Library."

"Library?"

"If you would be pedantic, but the people call me Library. It is both name and title. I preside." His choice of words, hovering between old-fashioned and donnish, made her feel like a child before a tutor, yet he seemed affable.

He gave an order in the modern idiom and the bearers carried her inside. She gathered an impression of stone walls a metre thick, pierced by sequent doors which formed a temperature lock. The moist heat outside was balanced by an equally hot but dry atmosphere inside. She made the connection at once, having a student's reverence for books. The smoke she had seen was given off by a low-temperature furnace stoked to keep the interior air dry and at a reasonably even temperature. This was more than a scholars' library; it was the past, preserved by those who knew its value.

She was carried past open doorways, catching glimpses of bound volumes behind glass, of a room full of hanging maps and once of a white man at a lectern, touching his book with gloved hands.

She was set down on a couch in a rather bare room furnished mainly by a desk of brilliantly polished wood which carried several jars of coloured inks, pens which she thought had split nibs and a pile of thick, greyish paper. (*Unbleached paper? Pollution free? A psychic prohibition from old time?*)

The light came through windows, but there were oil lamps available with shining parabolic reflectors. And smoke marks on the ceiling. Electricity slept still.

The carriers filed out. Library sat himself behind the desk. "We have much to say to each other."

Nugan marvelled, "You speak so easily. Do you use the old English all the time?"

"There are several hundred scholars in Library. Most speak the old tongue. We practise continually."

"In order to read the old books?"

"That, yes." He smiled in a fashion frankly conspiratorial. "Also it allows private discussion in the presence of the uninstructed."

Politics, no doubt—the eternal game that has never slept in all of history. "In front of Tup-Ma, perhaps?"

"A few technical expressions serve to thwart her understanding. But the Tup-Ma is no woman's fool."

"The Tup-Ma? I thought it was her name."

"Her title. Literally, Top Mother. As you would have expressed it, Mother Superior."

"A nun!"

Library shrugged. "She has no cloister and the world is her convent. Call her priest rather than a nun."

"She has authority?"

"She has great authority." He looked suddenly quizzical. "She is very wise. She sent you to me before you should fall into error."

"Error? You mean, like sin?"

"That also, but I speak of social error. It would be easy. Yours was a day of free thinking and irresponsible doing in a world that could not learn discipline for living. This Australian world is a religious matriarchy. It is fragile when ideas can shatter and dangerous when the women make hard decisions."

It sounded like too many dangers to evaluate at once. Patriarchy and equality she could deal with—in theory—but matriarchy was an unknown quantity in history. He had given his warning and waited silently on her response.

She pretended judiciousness. "That is interesting." He waited, smiling faintly. She said, to gain time, "I would like to remove this travel suit. It is hot."

He nodded, stood, turned away.

"Oh, I'm fully dressed under it. You may watch."

He turned back to her and she pressed the release. The suit split at the seams and crumpled round her feet. She stepped out, removed the gloves with their concealed armament and revealed herself in close-cut shirt and trousers and soft slippers. The damaged ankle hurt less than she had feared.

Library was impressed but not amazed. "One must expect ingenious invention." He felt the crumpled suit fabric. "Fragile."

She took a small knife from her breast pocket and slit the material, which closed up seamlessly behind the blade. Library said, "Beyond our capability."

"We could demonstrate—"

"No doubt." His interruption was abrupt, uncivil. "There is little we need." He changed direction. "I think Nugan is of Koori derivation."

"Possibly from Noongoon or Nungar or some such. You might know better than I."

His dark face flashed a smile. "I don't soak up old tribal knowledge while the tribes themselves preserve it in their enclaves."

"Enclaves?"

"We value variety of culture." He hesitated, then added, "Under the matriarchal aegis which covers all."

"All the world."

“Most of it.”

That raised questions. “You communicate with the whole world? From space we detected no radio, no electronic signals at all.”

“Wires on poles and radiating towers, as in the books? Their time has not come yet.”

A queer way of phrasing it. “But you hinted at global communication, even global culture.”

“The means are simple. Long ago the world was drawn together by trading vessels; so it is today. Ours are very fast; we use catamaran designs of great efficiency, copied from your books. The past does not offer much but there are simple things we take—things we can make and handle by simple means.” He indicated the suit. “A self-healing cloth would require art beyond our talent.”

“We could show—” But could they? Quantum chemistry was involved and electro-molecular physics and power generation ... Simple products were not at all simple.

Library said, “We would not understand your showing. Among your millions of books, few are of use. Most are unintelligible because the day of simple explanation was already past in your era. We strain to comprehend what you would find plain texts, and we fail. Chemistry, physics—those disciplines of complex numeration and incomprehensible signs and arbitrary terms—are beyond our understanding.”

She began to realise that unintegrated piles of precious but mysterious books are not knowledge.

He said, suddenly harsh, “Understanding will come at its own assimilable pace. You can offer us nothing.”

“Surely...”

“Nothing! You destroyed a world because you could not control your greed for a thing you called progress but which was no more than a snapping up of all that came to hand or to mind. You destroyed yourselves by inability to control your breeding. You did not ever cry *Hold!* for a decade or a century to unravel the noose of a self-strangling culture. You have nothing to teach. You knew little that mattered when sheer existence was at stake.”

Nugan sat still, controlling anger. *You don't know how we fought to stem the tides of population and consumption and pollution; how each success brought with it a welter of unforeseen disasters; how impossible it was to coordinate a world riven by colour, nationality, political creed, religious belief and economic strata.*

Because she had been reared to consult intelligence rather than emotion, she stopped thought in mid-tirade. *Oh, you are right. These were the impossible troubles brought by greed and irresponsible use of a finite world. We begged our own downfall. Yet...*

“I think,” she said, “you speak with the insolence of a lucky survival. You exist only because we did. Tell me how your virtue saved mankind.”

Library bowed his head slightly in apology. “I regret anger and implied contempt.” His eyes met hers again. “But I will not pretend humility. We rebuilt the race. In which year did you leave Earth?”

“In twenty-one eighty-nine. Why?”

“In the last decades before the crumbling. How to express it succinctly? Your world was administered by power groups behind national boundaries, few ruling many, pretending to a mystery termed *democracy*

but ruling by decree. Do I read the history rightly?"

"Yes." It was a hard admission. "Well, it was beginning to seem so. Oppression sprang from the need to ration food. We fed fifteen billion only by working land and sea until natural fertility cycles were exhausted, and that only at the cost of eliminating other forms of life. We were afraid when the insects began to disappear..."

"Rightly. Without insects, nothing flourishes."

"There was also the need to restrict birth, to deny birth to most of the world. When you take away the right to family from those who have nothing else and punish savagely contravention of the population laws..." She shrugged hopelessly.

"You remove the ties that bind, the sense of community, the need to consider any but the self. Only brute force remains."

"Yes."

"And fails as it has always failed."

"Yes. What happened after we left?"

Libary said slowly, "At first, riots. Populations rose against despots, or perhaps against those forced by circumstances into despotism. But ignorant masses cannot control a state; bureaucracies collapsed, supply fell into disarray and starvation set in. Pack leaders—not to be called soldiers—fought for arable territory. Then great fools unleashed biological weaponry—I think that meant toxins and bacteria and viruses, whatever such things may have been—and devastated nations with plague and pestilence. There was a time in the northern hemisphere called by a term I read only as Heart of Winter. Has that meaning for you?"

"A time of darkness and cold and starvation?"

"Yes."

"Nuclear winter. They must have stopped the bombing in the nick of time. It could only have been tried by a madman intent on ruling the ruins."

"We do not know his name—their names—even which country. Few records were kept after that time. No machines, perhaps, and no paper."

"And then?"

"Who knows? Cultural darkness covers two centuries. Then history begins again; knowledge is reborn. Some of your great cities saw the darkness falling and sealed their libraries and museums in hermetic vaults. This building houses the contents of the Central Library of Melbourne; there are others in the world and many yet to be discovered. Knowledge awaits deciphering but there is no hurry. This is, by and large, a happy world."

Sophisticated knowledge was meaningless here. They could not, for instance, create electronic communication until they had a broad base of metallurgy, electrical theory and a suitable mathematics. Text books might as well have been written in cipher.

"And," Libary said, "there were the Ambulant Scholars. They set up farming communities for self support, even in the Dark Age, while they preserved the teachings and even some of the books of their

ancestors. They visited each other and established networks around the world. When they set up schools, the new age began.”

“Like monks of the earlier Dark Age, fifteen hundred years before.”

“So? It has happened before?”

“At least once and with less reason. Tell me about the rise of women to power.”

Library chuckled. “Power? Call it that but it is mostly manipulation. The men don't mind being ruled; they get their own way in most things and women know how to bow with dignity when caught in political error. It is a system of giving and taking wherein women give the decisions and take the blame for their mistakes. The men give them children—under certain rules—and take responsibility for teaching them when maternal rearing is completed.”

She made a stab in the dark. “Women established their position by taking control of the birth rate.”

“Shrewdly thought, nearly right. They have a mumbo-jumbo of herbs and religious observances and fertility periods but in fact it is all contraception, abortion and calculation. Some men believe, more are sceptical, but it results in attractive sexual rituals and occasional carnivals of lust, so nobody minds greatly.” He added offhandedly, “Those who cannot restrain their physicality are killed by the women.”

That will give Starfarer pause for thought.

“I think,” said Library, “that the idea was conceived by the Ambulant Scholars and preached in religious guise—always a proper approach to basically simple souls who need a creed to cling to. So, you see, the lesson of over-population has been learned and put to work.”

“This applies across the planet?”

“Not yet, but it will. America is as yet an isolated continent. Our Ambulant Scholars wielded in the end a great deal of respected authority.”

“And now call yourselves Librarians?”

His black face split with pleasure. “It is so good to speak with a quick mind.”

“Yet a day will come when population will grow again beyond proper maintenance.”

“We propose that it shall not. Your machines and factories will arrive in their own good time, but our present interest is in two subjects you never applied usefully to living: psychology and philosophy. Your thinking men and women studied profoundly and made their thoughts public, but who listened? There is a mountain of the works of those thinkers to be sifted and winnowed and applied. Psychology is knowledge of the turbulent self; philosophy is knowledge of the ideals of which that self is capable. Weave these together and there appears a garment of easy discipline wherein the self is fulfilled and the world becomes its temple, not just a heap of values for ravishing. We will solve the problem of population.”

Nugan felt, with the uneasiness of someone less than well prepared, that they would. Their *progress* would lie in directions yet unthought of.

“Now,” Library said, “would you please tell me how you came to Earth without a transporting craft?”

“I was dropped by tractor beam.”

“A—beam?” She had surprised him at last. “A ray of light that carries a burden?”

“Not light. Monopoles.”

“What are those?”

“Do you have magnets? Imagine a magnet with only one end, so that the attraction goes on in a straight line. It is very powerful. Please don't ask how it works because I don't know. It is not in my field.”

Library said moodily, “I would not wish to know. Tell me, rather, what you want here.”

Want? Warnings rang in Nugan's head but she could only plough ahead. “After six hundred years we have come home! And Earth is far more beautiful than we remember it to be.”

His dark eyebrows rose. “Remember? Are you six hundred years old?”

Explanation would be impossible. She said, despairingly, “Time in heaven is slower than time on Earth. Our thirty years among the stars are six centuries of your time. Please don't ask for explanation. It is not magic; it is just so.”

“Magic is unnecessary in a sufficiently wonderful universe. Do you tell me that you do not understand the working of your everyday tools?”

“I don't understand the hundredth part. Knowledge is divided among specialists; nobody knows all of even common things.”

Library considered in silence, then sighed lightly and said, “Leave that and return to the statement that you have come home. This is not your home.”

“Not the home we left. It has changed.”

“Your home has gone away. For ever.”

The finality of his tone must have scattered her wits, she thought later; it roused all the homesickness she had held in check and she said quickly, too quickly, “We can rebuild it.”

The black face became still, blank. She would have given years of life to recall the stupid words. He said at last, “After all I have told you of resistance to rapid change you propose to redesign our world!”

She denied without thinking, “No! You misunderstand me!” In her mind she pictured herself facing *Starfarer*'s officers, stumbling out an explanation, seeing disbelief that a trained Contact could be such a yammering fool.

“Do I? Can you mean that your people wish to live as members of our society, in conditions they will see as philosophically unrewarding and physically primitive?”

He knew she could not mean any such thing. She tried, rapidly, “A small piece of land, isolated, perhaps an island, a place where we could live on our own terms. Without contact. You would remain—unspoiled.”

Insulting, condescending habit of speech, truthful in its meaning, revealing and irrevocable!

“You will live sequestered? Without travelling for curiosity's sake, without plundering resources for your machines, without prying into our world and arguing with it? In that case, why not stay between the stars?”

Only truth remained. “We left Earth to found new colonies. Old Earth seemed beyond rescue; only new Earths could perpetuate a suffocating race.”

“So much we know. The books tell it.”

Still she tried: “We found no new Earth. We searched light years of sky for planets suitable for humans. We found the sky full of planets similar to Earth—but only similar. Man's range of habitable conditions is very narrow. We found planets a few degrees too hot for healthy existence or a few degrees too cool to support a terrestrial ecology, others too seismically young or too aridly old, too deficient in oxygen or too explosively rich in hydrogen, too low in carbon dioxide to support a viable plant life or unbearably foul with methane or lacking an ozone layer. Parent stars, even of G-type, flooded surfaces with overloads of ultra-violet radiation, even gamma radiation, or fluctuated in minute but lethal instabilities. We visited forty worlds in thirty years and found not one where we could live. Now you tell me we are not welcome in our own home!”

“I have told you it is not your home. You come to us out of violence and decay; you are conditioned against serenity. You would be only an eruptive force in a world seeking a middle way. You would debate our beliefs, corrupt our young men by offering toys they do not need, tempt the foolish to extend domination over space and time—and in a few years destroy what has taken six centuries to build.”

Anger she could have borne but he was reasonable—as a stone wall is reasonable and unbreachable.

“Search!” he said. “Somewhere in such immensity must be what you seek. You were sent out with a mission to propagate mankind, but in thirty years you betray it.”

She burst out, “Can't you understand that we remember Earth! After thirty years in a steel box we want to come home.”

“I do understand. You accepted the steel box; now you refuse the commitment.”

She pleaded, “Surely six hundred people are not too many to harbour? There must be small corners—”

He interrupted, “There are small corners innumerable but not for you. Six hundred, you say, but you forget the books with their descriptions of the starships. You forget that we know of the millions of ova carried in the boxes called cryogenic vaults, of how in a generation you would be an army surging out of its small corner to dominate the culture whose careful virtues mean nothing to you. Go back to your ship, Nugan. Tell your people that time has rolled over them, that their home has vanished.”

She sat between desperation and fulmination while he summoned the bearers. Slowly she resumed the travel suit.

* * * *

From the hilltop she saw a world unrolled around her, stirring memory and calling the heart. It should not be lost for a pedantic Aboriginal's obstinacy.

“I will talk with your women!”

“They may be less restrained than I, Nugan. The Tup-Ma's message said you were to be instructed and sent away. My duty is done.”

She surrendered to viciousness. “We'll come in spite of you!”

“Then we will wipe you out as a leprous infection.”

She laughed, pointed a gloved finger and a patch of ground glowed red, then white. “Wipe us out?”

He told her, “That will not fight the forces of nature we can unleash against you. Set your colony on a hill and we will surround it with bushfires, a weapon your armoury is not equipped to counter. Set it in a valley and we will show you how a flash flood can be created. Force us at your peril.”

All her Contact training vanished in the need to assert. “You have not seen the last of us.”

He said equably, “I fear that is true. I fear for you, Nugan, and all of yours.”

She tongued the switch at mouth level and the helmet sprang up and over her head, its creases smoothing invisibly out. She had a moment's unease at the thought of the Report Committee on *Starfarer*, then she tongued the microphone switch. “Jack!”

“Here, love. So soon?”

“Yes, so damned soon!” She looked once at the steady figure of Libary, watching and impassive, then gave the standard call for return: “Lift me home, Jack.”

Hurling into the lonely sky, she realised what she had said and began silently to weep.

About the Author

George Turner (1916-1997) was the most renowned of the Australian science fiction writers, even though he came to science fiction only after publishing five mainstream novels between 1959 and 1967. In novels such as *Beloved Son* (1979), *The Sea and Summer* (1987; in US as *Drowning Towers*), and *Genetic Soldier* (1994), he has been concerned with the social impacts of genetic engineering and overpopulation.

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13. Light of Other Days by Bob Shaw

Leaving the village behind, we followed the heady sweeps of the road up into a land of slow glass.

I had never seen one of the farms before and at first found them slightly eerie—an effect heightened by imagination and circumstance. The car's turbine was pulling smoothly and quietly in the damp air so that we seemed to be carried over the convolutions of the road in a kind of supernatural silence. On our right the mountain sifted down into an incredibly perfect valley of timeless pine, and everywhere stood the great frames of slow glass, drinking light. An occasional flash of afternoon sunlight on their wind bracing created an illusion of movement, but in fact the frames were deserted. The rows of windows had been standing on the hillside for years, staring into the valley, and men only cleaned them in the middle of the night when their human presence would not matter to the thirsty glass.

They were fascinating, but Selina and I didn't mention the windows. I think we hated each other so much we both were reluctant to sully anything new by drawing it into the nexus of our emotions. The holiday, I had begun to realize, was a stupid idea in the first place. I had thought it would cure everything, but, of course, it didn't stop Selina being pregnant and, worst still, it didn't even stop her being angry about being pregnant.

Rationalizing our dismay over her condition, we had circulated the usual statements to the effect that we would have liked having children—but later on, at the proper time. Selina's pregnancy had cost us her

well-paid job and with it the new house we had been negotiating and which was far beyond the reach of my income from poetry. But the real source of our annoyance was that we were face to face with the realization that people who say they want children later always mean they want children never. Our nerves were thrumming with the knowledge that we, who had thought ourselves so unique, had fallen into the same biological trap as every mindless rutting creature which ever existed.

The road took us along the southern slopes of Ben Cruachan until we began to catch glimpses of the gray Atlantic far ahead. I had just cut our speed to absorb the view better when I noticed the sign spiked to a gatepost said: "Slow Glass—Quality High, Prices Low—J. R. Hagan." On an impulse I stopped the car on the verge, wincing slightly as tough grasses whipped noisily at the bodywork.

"Why have we stopped?" Selina's neat, smoke-silver head turned in surprise.

"Look at that sign. Let's go up and see what there is. The stuff might be reasonably priced out here."

Selina's voice was pitched high with scorn as she refused, but I was too taken with my idea to listen. I had an illogical conviction that doing something extravagant and crazy would set us right again.

"Come on," I said, "the exercise might do us some good. We've been driving too long anyway."

She shrugged in a way that hurt me and got out of the car. We walked up a path made of irregular, packed clay steps nosed with short lengths of sapling. The path curved through trees which clothed the edge of the hill and at its end we found a low farmhouse. Beyond the little stone building tall frames of slow glass gazed out toward the voice-stilling sight of Cruachan's ponderous descent toward the waters of Loch Linnhe. Most of the panes were perfectly transparent but a few were dark, like panels of polished ebony.

As we approached the house through a neat cobbled yard a tall middle-aged man in ash-colored tweeds arose and waved to us. He had been sitting on the low rubble wall which bounded the yard, smoking a pipe and staring toward the house. At the front window of the cottage a young woman in a tangerine dress stood with a small boy in her arms, but she turned uninterestedly and moved out of sight as we drew near.

"Mr. Hagan?" I guessed.

"Correct. Come to see some glass, have you? Well, you've come to the right place." Hagan spoke crisply, with traces of the pure highland which sounds so much like Irish to the unaccustomed ear. He had one of those calmly dismayed faces one finds on elderly road menders and philosophers.

"Yes," I said. "We're on holiday. We saw your sign."

Selina, who usually has a natural fluency with strangers, said nothing. She was looking toward the now empty window with what I thought was a slightly puzzled expression.

"Up from London, are you? Well, as I said, you've come to the right place—and at the right time, too. My wife and I don't see many people this early in the season."

I laughed. "Does that mean we might be able to buy a little glass without mortgaging our home?"

"Look at that now," Hagan said, smiling helplessly. "I've thrown away any advantage I might have had in the transaction. Rose, that's my wife, says I never learn. Still, let's sit down and talk it over." He pointed at the rubble wall, then glanced doubtfully at Selina's immaculate blue skirt. "Wait till I fetch a rug from the house." Hagan limped quickly into the cottage, closing the door behind him.

“Perhaps it wasn't such a marvelous idea to come up here,” I whispered to Selina, “but you might at least be pleasant to the man. I think I can smell a bargain.”

“Some hope,” she said with deliberate coarseness. “Surely even you must have noticed that ancient dress his wife is wearing! He won't give much away to strangers.”

“Was that his wife?”

“Of course that was his wife.”

“Well, well,” I said, surprised. “Anyway, try to be civil with him. I don't want to be embarrassed.”

Selina snorted, but she smiled whitely when Hagan reappeared and I relaxed a little. Strange how a man can love a woman and yet at the same time pray for her to fall under a train.

Hagan spread a tartan blanket on the wall and we sat down, feeling slightly self-conscious at having been translated from our city-oriented lives into a rural tableau. On the distant slate of the loch, beyond the watchful frames of slow glass, a slow-moving steamer drew a white line toward the south. The boisterous mountain air seemed almost to invade our lungs, giving us more oxygen than we required.

“Some of the glass farmers around here,” Hagan began, “give strangers, such as yourselves, a sales talk about how beautiful the autumn is in this part of Argyll. Or it might be the spring, or the winter. I don't do that—any fool knows that a place which doesn't look right in summer never looks right. What do you say?”

I nodded compliantly “I want you just to take a good look out toward Mull, Mr....”

“Garland.”

“...Garland. That's what you're buying if you buy my glass, and it never looks better than it does at this minute. The glass is in perfect phase, none of it is less than ten years thick—and a four-foot window will cost you two hundred pounds.”

“Two hundred!” Selina was shocked. “That's as much as they charge at the Scenedow shop in Bond Street.”

Hagan smiled patiently, then looked closely at me to see if I knew enough about slow glass to appreciate what he had been saying. His price had been much higher than I had hoped—but *ten years thick!* The cheap glass one found in places like the Vistaplex and Pane-o-rama stores usually consisted of a quarter of an inch of ordinary glass faced with a veneer of slow glass perhaps only ten or twelve months thick.

“You don't understand, darling,” I said, already determined to buy. “This glass will last ten years and it's in phase.”

“Doesn't that only mean it keeps time?”

Hagan smiled at her again, realizing he had no further necessity to bother with me. “Only, you say! Pardon me, Mrs. Garland, but you don't seem to appreciate the miracle, the genuine honest-to-goodness miracle, of engineering precision needed to produce a piece of glass in phase. When I say the glass is ten years thick it means it takes light ten years to pass through it. In effect, each one of those panes is ten light-years thick—more than twice the distance to the nearest star—so a variation in actual thickness of only a millionth of an inch would...”

He stopped talking for a moment and sat quietly looking toward the house. I turned my head from the

view of the Loch and saw the young woman standing at the window again. Hagan's eyes were filled with a kind of greedy reverence which made me feel uncomfortable and at the same time convinced me Selina had been wrong. In my experience husbands never looked at wives that way—at least, not at their own.

The girl remained in view for a few seconds, dress glowing warmly, then moved back into the room. Suddenly I received a distinct, though inexplicable, impression she was blind. My feeling was that Selina and I were perhaps blundering through an emotional interplay as violent as our own.

“I'm sorry,” Hagan continued; “I thought Rose was going to call me for something. Now, where was I, Mrs. Garland? Ten light-years compressed into a quarter of an inch means...”

I ceased to listen, partly because I was already sold, partly because I had heard the story of slow glass many times before and had never yet understood the principles involved. An acquaintance with scientific training had once tried to be helpful by telling me to visualize a pane of slow glass as a hologram which did not need coherent light from a laser for the reconstitution of its visual information, and in which every photon of ordinary light passed through a spiral tunnel coiled outside the radius of capture of each atom in the glass. This gem of, to me, incomprehensibility not only told me nothing, it convinced me once again that a mind as nontechnical as mine should concern itself less with causes than effects.

The most important effect, in the eyes of the average individual, was that light took a long time to pass through a sheet of slow glass. A new piece was always jet black because nothing had yet come through, but one could stand the glass beside, say, a woodland lake until the scene emerged, perhaps a year later. If the glass was then removed and installed in a dismal city flat, the flat would—for that year—appear to overlook the woodland lake. During the year it shouldn't be merely a very realistic but still picture—the water would ripple in sunlight, silent animals would come to drink, birds would cross the sky, night would follow day, season would follow season. Until one day, a year later, the beauty held in the subatomic pipelines would be exhausted and the familiar gray cityscape would reappear.

Apart from its stupendous novelty value, the commercial success of slow glass was founded on the fact that having a scenedow was the exact emotional equivalent of owning land. The meanest cave dweller could look out on misty parks—and who was to say they weren't his? A man who really owns tailored gardens and estates doesn't spend his time proving his ownership by crawling on his ground, feeling, smelling, tasting it. All he receives from the land are light patterns, and with scenedows those patterns could be taken into coal mines, submarines, prison cells.

On several occasions I have tried to write short pieces about the enchanted crystal but, to me, the theme is so ineffably poetic as to be, paradoxically, beyond the reach of poetry—mine, at any rate. Besides, the best songs and verse had already been written, with prescient inspiration, by men who had died long before slow glass was discovered. I had no hope of equaling, for example, Moore with his:

Oft in the stilly night,

Ere slumber's chain has bound me,

Fond Memory brings the light

Of other days around me...

It took only a few years for slow glass to develop from a scientific curiosity to a sizable industry. And much to the astonishment of us poets—those of us who remain convinced that beauty lives though lilies die—the trappings of that industry were no different from those of any other. There were good scenedows which cost a lot of money, and there were inferior scenedows which cost rather less. The thickness, measured in years, was an important factor in the cost but there was also the question of *actual*

thickness, or phase.

Even with the most sophisticated engineering techniques available thickness control was something of a hit-and-miss affair. A coarse discrepancy could mean that a pane intended to be five years thick might be five and a half, so that light which entered in summer emerged in winter; a fine discrepancy could mean that noon sunshine emerged at midnight. These incompatibilities had their peculiar charm—many night workers, for example, liked having their own private time zones—but, in general, it cost more to buy scenedows which kept closely in step with real time.

Selina still looked unconvinced when Hagan had finished speaking. She shook her head almost imperceptibly and I knew he had been using the wrong approach. Quite suddenly the pewter helmet of her hair was disturbed by a cool gust of wind, and huge clean tumbling drops of rain began to spang round us from an almost cloudless sky.

“I’ll give you a check now,” I said abruptly, and saw Selina’s green eyes triangulate angrily on my face. “You can arrange delivery?”

“Aye, delivery’s no problem,” Hagan said, getting to his feet. “But wouldn’t you rather take the glass with you?”

“Well, yes—if you don’t mind.” I was shamed by his readiness to trust my scrip.

“I’ll unclip a pane for you. Wait here. It won’t take long to slip it into a carrying frame.” Hagan limped down the slope towards the seriate windows, through some of which the view towards Linnhe was sunny, while others were cloudy and a few pure black.

Selina drew the collar of her blouse closed at her throat. “The least he could have done was invite us inside. There can’t be so many fools passing through that he can afford to neglect them.”

I tried to ignore the insult and concentrated on writing the check. One of the outsized drops broke across my knuckles, splattering the pink paper.

“All right,” I said, “let’s move in under the eaves till he gets back.” *You worm*, I thought as I felt the whole thing go completely wrong. *I just had to be a fool to marry you. A prize fool, a fool’s fool—and now that you’ve trapped part of me inside you I’ll never ever, never ever, never ever get away.*

Feeling my stomach clench itself painfully, I ran behind Selina to the side of the cottage. Beyond the window the neat living room, with its coal fire, was empty but the child’s toys were scattered on the floor. Alphabet blocks and a wheelbarrow the exact color of freshly pared carrots. As I stared in, the boy came running from the other room and began kicking the blocks. He didn’t notice me. A few moments later the young woman entered the room and lifted him, laughing easily and wholeheartedly as she swung the boy under her arm. She came to the window as she had done earlier. I smiled self-consciously, but neither she nor the child responded.

My forehead prickled icily. *Could they both be blind?* I sidled away.

Selina gave a little scream and I spun towards her.

“The rug!” she said. “It’s getting soaked.”

She ran across the yard in the rain, snatched the reddish square from the dappling wall and ran back, toward the cottage door. Something heaved convulsively in my subconscious.

“Selina,” I shouted. “Don’t open it!”

But I was too late. She had pushed open the latched wooden door and was standing, hand over mouth, looking into the cottage. I moved close to her and took the rug from her unresisting fingers.

As I was closing the door I let my eyes traverse the cottage's interior. The neat living room in which I had just seen the woman and child was, in reality, a sickening clutter of shabby furniture, old newspapers, cast-off clothing and smeared dishes. It was damp, stinking and utterly deserted. The only object I recognized from my view through the window was the little wheelbarrow, paintless and broken.

I latched the door firmly and ordered myself to forget what I had seen. Some men who live alone are good housekeepers; others just don't know how.

Selina's face was white. "I don't understand. I don't understand it."

"Slow glass works both ways," I said gently. "Light passes out of a house, as well as in."

"You mean...?"

"I don't know. It isn't our business. Now steady up—Hagan's coming back with our glass." The churning in my stomach was beginning to subside.

Hagan came into the yard carrying an oblong, plastic-covered frame. I held the check out to him, but he was staring at Selina's face. He seemed to know immediately that our uncomprehending fingers had rummaged through his soul. Selina avoided his gaze. She was old and ill-looking, and her eyes stared determinedly toward the nearing horizon.

"I'll take the rug from you, Mr. Garland," Hagan finally said. "You shouldn't have troubled yourself over it."

"No trouble. Here's the check."

"Thank you." He was still looking at Selina with a strange kind of supplication. "It's been a pleasure to do business with you."

"The pleasure was mine," I said with equal, senseless formality. I picked up the heavy frame and guided Selina toward the path which led to the road. Just as we reached the head of the now slippery steps Hagan spoke again.

"Mr. Garland!"

I turned unwillingly.

"It wasn't my fault," he said steadily. "A hit-and-run driver got them both, down on the Oban road six years ago. My boy was only seven when it happened. I'm entitled to keep something."

I nodded wordlessly and moved down the path, holding my wife close to me, treasuring the feel of her arms locked around me. At the bend I looked back through the rain and saw Hagan sitting with squared shoulders on the wall where we had first seen him.

He was looking at the house, but I was unable to tell if there was anyone at the window.

About the Author

Bob Shaw (1931-1996), a Northern Irish writer who moved just before his death to Michigan, worked as an engineer, public relations agent, and journalist. His first science fiction appeared in the 1950s. "Light of Other Days" established his reputation for ingenuity; with its sequels, it became the novel *Other*

Days, Other Eyes (1972).

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V. Biotechnology

Science fiction has been dominated throughout its history by tales of spaceships, robots, time machines, and future war. The “hard” of “hard SF” has even seemed the “hard” of chrome-plated steel—shiny, sharp-edged, moving fast.

Yet even in the genre's dawn, there were writers who could see the potentials of biology. H. G. Wells—he of time travelers and Martian invaders and invisible men—could imagine a technology that transformed animals into something much like people. The technology was pretty unrealistic by today's standards, but Wells's aim was to comment upon the nature of humanity, and *The Island of Dr. Moreau* (1896) exerted a strong influence on later writers.

Today's biotechnologies seem much closer to reality. Organ transplants are routine. Cloning—the growing of an adult's genetic duplicate from a scrap of that adult's tissue—has been demonstrated for fish, frogs, carrots, and a number of other organisms, but not for humans. Even if it could be done with humans, it might not be, for the ethics are at least questionable and there are simpler ways to produce new human beings. Yet people do insist on finding reasons for what they want to do, and perhaps Charles Sheffield's “Out of Copyright” will someday prove prophetic.

Today, the ultimate in biotechnology is genetic engineering. The technology is in its infancy, but it has already delivered on some of its medical promise and it is developing rapidly. What will it become? Many people fear that turning it loose upon ourselves will lead to unholy, unacceptable transformations—that it will render us no longer human. In “Gene Wars,” Paul J. McAuley shows us what that might mean.

If we turn genetic engineering upon those living things that have long served us—crop plants and domestic animals—the changes will be no less drastic but surely more acceptable. My own “Down on the Truck Farm” provides a glimpse of a world in which such transformations are routine.

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14. Out of Copyright by Charles Sheffield

Troubleshooting. A splendid idea, and one that I agree with totally in principle. Bang! One bullet, and trouble bites the dust. But unfortunately, trouble doesn't know the rules. Trouble won't stay dead.

I looked around the table. My top troubleshooting team was here. I was here. Unfortunately, they were supposed to be headed for Jupiter, and I ought to be down on Earth. In less than twenty-four hours, the draft pick would begin. That wouldn't wait, and if I didn't leave in the next thirty minutes, I would never make it in time. I needed to be in two places at once. I cursed the copyright laws and the single-copy restriction, and went to work.

“You've read the new requirement,” I said. “You know the parameters. Ideas, anyone?”

A dead silence. They were facing the problem in their own unique ways. Wolfgang Pauli looked half-asleep, Thomas Edison was drawing little doll-figures on the table's surface, Enrico Fermi seemed to

be counting on his fingers, and John von Neumann was staring impatiently at the other three. I was doing none of those things. I knew very well that wherever the solution would come from, it would not be from inside my head. My job was much more straightforward: I had to see that when we had a possible answer, *it happened*. And I had to see that we got *one* answer, not four.

The silence in the room went on and on. My brain trust was saying nothing, while I watched the digits on my watch flicker by. I had to stay and find a solution; and I had to get to the draft picks. But most of all and hardest of all, I had to remain quiet, to let my team do some thinking.

It was small consolation to know that similar meetings were being held within the offices of the other three combines. Everyone must be finding it equally hard going. I knew the players, and I could imagine the scenes, even though all the troubleshooting teams were different. NETSCO had a group that was intellectually the equal of ours at Romberg AG: Niels Bohr, Theodore von Karman, Norbert Weiner, and Marie Curie. MMG, the great Euro-Mexican combine of Magrit-Marcus Gesellschaft, had focused on engineering power rather than pure scientific understanding and creativity, and, in addition to the Soviet rocket designer Sergey Korolev and the American Nikola Tesla, they had reached farther back (and with more risk) to the great nineteenth-century English engineer Isambard Kingdom Brunel. He had been one of the outstanding successes of the program; I wished he were working with me, but MMG had always refused to look at a trade. MMG's one bow to theory was a strange one, the Indian mathematician Srinivasa Ramanujan, but the unlikely quartet made one hell of a team.

And finally there was BP Megation, whom I thought of as confused. At any rate, I didn't understand their selection logic. They had used billions of dollars to acquire a strangely mixed team: Erwin Schrodinger, David Hilbert, Leo Szilard, and Henry Ford. They were all great talents, and all famous names in their fields, but I wondered how well they could work as a unit.

All the troubleshooting teams were now pondering the same emergency. Our problem was created when the Pan-National Union suddenly announced a change to the Phase B demonstration program. They wanted to modify impact conditions, as their contracts with us permitted them to do. They didn't have to tell us how to do it, either, which was just as well for them since I was sure they didn't know. How do you take a billion tons of mass, already launched to reach a specific target at a certain point of time, and redirect it to a different end point with a different arrival time?

There was no point in asking them why they wanted to change rendezvous conditions. It was their option. Some of our management saw the action on PNU's part as simple bloody-mindedness, but I couldn't agree. The four multinational combines had each been given contracts to perform the biggest space engineering exercise in human history: small asteroids (only a kilometer or so across—but massing a billion tons each) had to be picked up from their natural orbits and redirected to the Jovian system, where they were to make precise rendezvous with assigned locations of the moon Io. Each combine had to select the asteroid and the method of moving it, but deliver within a tight transfer-energy budget and a tight time schedule.

For that task the PNU would pay each group a total of \$8 billion. That sounds like a fair amount of money, but I knew our accounting figures. To date, with the project still not finished (rendezvous would be in eight more days), Romberg AG had spent \$14.5 billion. We were looking at a probable cost overrun by a factor of two. I was willing to bet that the other three groups were eating very similar losses.

Why?

Because this was only Phase B of a four-phase project. Phase A had been a system design study, which led to four Phase B awards for a demonstration project. The Phase B effort that the four combines were working on now was a proof-of-capability run for the full European Metamorphosis. The real money

came in the future, in Phases C and D. Those would be awarded by the PNU to a single combine, and the award would be based largely on Phase B performance. The next phases called for the delivery of fifty asteroids to impact points on Europa (Phase C), followed by thermal mixing operations on the moon's surface (Phase D). The contract value of C and D would be somewhere up around \$800 billion. That was the fish that all the combines were after, and it was the reason we would all overspend lavishly on this phase.

By the end of the whole program, Europa would have a forty-kilometer-deep water ocean over all its surface. And then the real fun would begin. Some contractor would begin the installation of the fusion plants, and the seeding of the sea-farms with the first prokaryotic bacterial forms.

The stakes were high; and to keep everybody on their toes, PNU did the right thing. They kept throwing in these little zingers, to mimic the thousand and one things that would go wrong in the final project phases.

While I was sitting and fidgeting, my team had gradually come to life. Fermi was pacing up and down the room—always a good sign; and Wolfgang Pauli was jabbing impatiently at the keys of a computer console. John von Neumann hadn't moved, but since he did everything in his head anyway that didn't mean much.

I looked again at my watch. I had to go. "Ideas?" I said again.

Von Neumann made a swift chopping gesture of his hand. "We have to make a choice, Al. It can be done in four or five ways."

The others were nodding. "The problem is only one of efficiency and speed," added Fermi. "I can give you an order-of-magnitude estimate of the effects on the overall program within half an hour."

"Within fifteen minutes." Pauli raised the bidding.

"No need to compete this one." They were going to settle down to a real four-way fight on methods—they always did—but I didn't have the time to sit here and referee. The important point was that they said it could be done. "You don't have to rush it. Whatever you decide, it will have to wait until I get back." I stood up. "Tom?"

Edison shrugged. "How long will you be gone, Al?"

"Two days, maximum. I'll head back right after the draft picks." (That wasn't quite true; when the draft picks were over, I had some other business to attend to that did not include the troubleshooters; but two days should cover everything.)

"Have fun." Edison waved his hand casually. "By the time you get back I'll have the engineering drawings for you."

One thing about working with a team like mine—they may not always be right, but they sure are always cocky.

* * * *

"Make room there. Move over!" The guards were pushing ahead to create a narrow corridor through the wedged mass of people. The one in front of me was butting with his helmeted head, not even looking to see whom he was shoving aside. "Move!" he shouted. "Come on now, out of the way."

We were in a hurry. Things had been frantically busy Topside before I left, so I had cut it fine on connections to begin with, then been held up half an hour at reentry. We had broken the speed limits on

the atmospheric segment, and there would be PNU fines for that, but still we hadn't managed to make up all the time. Now the first draft pick was only seconds away, and I was supposed to be taking part in it.

A thin woman in a green coat clutched at my arm as we bogged down for a moment in the crush of people. Her face was gray and grim, and she had a placard hanging round her neck. "You could wait longer for the copyright!" She had to shout to make herself heard. "It would cost you nothing—and look at the misery you would prevent. What you're doing is immoral! TEN MORE YEARS"

Her last words were a scream as she called out this year's slogan. TEN MORE YEARS! I shook my arm free as the guard in front of me made sudden headway, and dashed along in his wake. I had nothing to say to the woman; nothing that she would listen to. If it were immoral, what did ten more years have to do with it? Ten more years; if by some miracle they were granted ten more years on the copyrights, what then? I knew the answer. They would try to talk the Pan-National Union into fifteen more years, or perhaps twenty. When you pay somebody off, it only increases their demands. I know, only too well. They are never satisfied with what they get.

Joe Delacorte and I scurried into the main chamber and shuffled sideways to our seats at the last possible moment. All the preliminary nonsense was finished, and the real business was beginning. The tension in the room was terrific. To be honest, a lot of it was being generated by the media. They were all poised to make maximum noise as they shot the selection information all over the System. If it were not for the media, I don't think the PNU would hold live draft picks at all. We'd all hook in with video links and do our business the civilized way.

The excitement now was bogus for other reasons, too. The professionals—I and a few others—would not become interested until the ten rounds were complete. Before that, the choices were just too limited. Only when they were all made, and the video teams were gone, would the four groups get together off-camera and begin the horse trading. *"My ninth round plus my fifth for your second."* *"Maybe, if you'll throw in \$10 million and a tenth-round draft pick for next year...."*

Meanwhile, BP Megation had taken the microphone. "First selection," said their representative. "Robert Oppenheimer."

I looked at Joe, and he shrugged. No surprise. Oppenheimer was the perfect choice—a brilliant scientist, but also practical, and willing to work with other people. He had died in 1967, so his original copyright had expired within the past twelve months. I knew his family had appealed for a copyright extension and been refused. Now BP Megation had sole single-copy rights for another lifetime. "Trade?" whispered Joe.

I shook my head. We would have to beggar ourselves for next year's draft picks to make BP give up Oppenheimer. Other combine reps had apparently made the same decision. There was the clicking of data entry as the people around me updated portable databases. I did the same thing with a stub of pencil and a folded sheet of yellow paper, putting a check mark alongside his name. Oppenheimer was taken care of, I could forget that one. If by some miracle one of the four teams had overlooked some other top choice I had to be ready to make an instant revision to my own selections.

"First selection, by NETSCO," said another voice. "Peter Joseph William Debye."

It was another natural choice. Debye had been a Nobel prizewinner in physics, a theoretician with an excellent grasp of applied technology. He had died in 1966. Nobel laureates in science, particularly ones with that practical streak, went fast. As soon as their copyrights expired, they would be picked up in the draft the same year.

That doesn't mean it always works out well. The most famous case, of course, was Albert Einstein.

When his copyright had expired in 2030, BP Megation had had first choice in the draft pick. They had their doubts, and they must have sweated blood over their decision. The rumor mill said they spent over \$70 million in simulations alone, before they decided to take him as their top choice. The same rumor mill said that the cloned form was now showing amazing ability in chess and music, but no interest at all in physics or mathematics. If that was true, BP Megation had dropped \$2 billion down a black hole: \$1 billion straight to the PNU for acquisition of copyright, and another \$1 billion for the clone process. Theorists were always tricky; you could never tell how they would turn out.

Magrit-Marcus Gesellschaft had now made their first draft pick, and chosen another Nobel laureate, John Cockroft. He also had died in 1967. So far, every selection was completely predictable. The three combines were picking the famous scientists and engineers who had died in 1966 and 1967, and who were now, with the expiration of family retention of copyrights, available for cloning for the first time.

The combines were being logical, but it made for a very dull draft pick. Maybe it was time to change that. I stood up to announce our own first take.

“First selection, by Romberg AG,” I said. “Charles Proteus Steinmetz.”

My announcement caused a stir in the media. They had presumably never heard of Steinmetz, which was a disgraceful statement of their own ignorance. Even if they hadn't spent most of the past year combing old files and records, as we had, they should have heard of him. He was one of the past century's most colorful and creative scientists, a man who had been physically handicapped (he was a hunchback), but mentally able to do the equivalent of a hundred one-hand push-ups without even breathing hard. Even I had heard of him, and you'd not find many of my colleagues who'd suggest I was interested in science.

The buzzing in the media told me they were consulting their own historical data files, digging farther back in time. Even when they had done all that, they would still not understand the first thing about the true process of clone selection. It's not just a question of knowing who died over seventy-five years ago, and will therefore be out of copyright. That's a trivial exercise, one that any yearbook will solve for you. You also have to evaluate other factors. Do you know where the body is—are you absolutely *sure*?

Remember, you can't clone anyone with a cell or two from the original body. You also have to be certain that it's who you think it is. All bodies seventy-five years old tend to look the same. And then, if the body happens to be really old—say, more than a couple of centuries—there are other peculiar problems that are still not understood at all. When NETSCO pulled its coup a few years ago by cloning Gottfried Wilhelm Leibniz, the other three combines were envious at first. Leibniz was a real universal genius, a seventeenth-century superbrain who was good at everything. NETSCO had developed a better cell-growth technique, and they had also succeeded in locating the body of Leibniz in its undistinguished Hanover grave.

They walked tall for almost a year at NETSCO, until the clone came out of the forcing chambers for indoctrination. He looked nothing like the old portraits of Leibniz, and he could not grasp even the simplest abstract concepts. Oops! said the media. Wrong body.

But it wasn't as simple as that. The next year, MMG duplicated the NETSCO cell-growth technology and tried for Isaac Newton. In this case there was no doubt that they had the correct body, because it had lain undisturbed since 1727 beneath a prominent plaque in London's Westminster Abbey. The results were just as disappointing as they had been for Leibniz.

Now NETSCO and MMG have become very conservative; in my opinion, far too conservative. But since then, nobody has tried for a clone of anyone who died before 1850. The draft picking went on its thoughtful and generally cautious way, and was over in a couple of hours except for the delayed deals.

The same group of protesters was picketing the building when I left. I tried to walk quietly through them, but they must have seen my picture on one of the exterior screens showing the draft-pick process. I was buttonholed by a man in a red jumpsuit and the same thin woman in green, still carrying her placard.

“Could we speak with you for just one moment?” The man in red was very well-spoken and polite.

I hesitated, aware that news cameras were on us. “Very briefly. I’m trying to run a proof-of-concept project, you know.”

“I know. Is it going well?” He was a different type from most of the demonstrators, cool and apparently intelligent. And therefore potentially more dangerous.

“I wish I could say yes,” I said. “Actually, it’s going rather badly. That’s why I’m keen to get back out.”

“I understand. All I wanted to ask you was why you—and I don’t mean you, personally; I mean the combines—why do you find it necessary to use clones? You could do your work without them, couldn’t you?”

I hesitated. “Let me put it this way. We could do the work without them in just the same way as we could stumble along somehow if we were denied the use of computer power, or nuclear power. The projects would be possible but they would be enormously more difficult. The clones augment our available brainpower, at the highest levels. So let me ask you: Why should we do without the clones, when they are available and useful?”

“Because of the families. You have no right to subject the families to the misery and upset of seeing their loved ones cloned, without their having any rights in the matter. It’s cruel, and unnecessary. Can’t you see that?”

“No, I can’t. Now, you listen to me for a minute.” The cameras were still on me. It was a chance to say something that could never be said often enough. “The family holds copyright for seventy-five years after a person’s death. So if you, personally, *remember* your grandparent, you have to be pushing eighty years old—and it’s obvious from looking at you that you’re under forty. So ask yourself, Why are all you petitioners people who are in their thirties? It’s not *you* who’s feeling any misery.”

“But there are relatives—,” he said.

“Oh yes, the relatives. Are you a relative of somebody who has been cloned?”

“Not yet. But if this sort of thing goes on—”

“Listen to me for one more minute. A long time ago, there were a lot of people around who thought that it was wrong to let books with sex in them be sold to the general public. They petitioned to have the books banned. It wasn’t that they claimed to be buying the books themselves, and finding them disgusting; because if they said that was the case, then people would have asked them why they were buying what they didn’t like. Nobody was forcing anybody to buy those books. No, what the petitioners wanted was for *other* people to be stopped from buying what the *petitioners* didn’t like. And you copyright-extension people are just the same. You are making a case on behalf of the relatives of the ones who are being cloned. But you never seem to ask yourself this: if cloning is so bad, why aren’t the *descendants* of the clones the ones doing the complaining? They’re not, you know. You never see them around here.”

He shook his head. “Cloning is immoral!”

I sighed. Why bother? Not one word of what I’d said had got through to him. It didn’t much matter—I’d

really been speaking for the media, anyway—but it was a shame to see bigotry masquerading as public-spirited behavior. I'd seen enough of that already in my life.

I started to move off toward my waiting aircar. The lady in green clutched my arm again. “I'm going to leave instructions in my will that I want to be cremated. You'll never get me!”

You have my word on that, lady. But I didn't say it. I headed for the car, feeling an increasing urge to get back to the clean and rational regions of space. There was one good argument against cloning, and only one. It increased the total number of people, and to me that number already felt far too large.

* * * *

I had been gone only thirty hours, total; but when I arrived back at Headquarters, I learned that in my absence five new problems had occurred. I scanned the written summary that Pauli had left behind.

First, one of the thirty-two booster engines set deep in the surface of the asteroid did not respond to telemetry requests for a status report. We had to assume it was defective, and eliminate it from the final firing pattern. Second, a big solar flare was on the way. There was nothing we could do about that, but it did mean we would have to recompute the strength of the magnetic and electric fields close to Io. They would change with the strength of the Jovian magnetosphere, and that was important because the troubleshooting team in my absence had agreed on their preferred solution to the problem of adjusting impact point and arrival time. It called for strong coupling between the asteroid and the 5-million-amp flux tube of current between Io and its parent planet, Jupiter, to modify the final collision trajectory.

Third, we had lost the image data stream from one of our observing satellites, in synchronous orbit with Io. Fourth, our billion-ton asteroid had been struck by a larger-than-usual micrometeorite. This one must have massed a couple of kilograms, and it had been moving fast. It had struck off-axis from the center of mass, and the whole asteroid was now showing a tendency to rotate slowly away from our preferred orientation. Fifth, and finally, a new volcano had become very active down on the surface of Io. It was spouting sulfur up for a couple of hundred kilometers, and obscuring the view of the final-impact landmark.

After I had read Pauli's terse analysis of all the problems—nobody I ever met or heard of could summarize as clearly and briefly as he did—I switched on my communications set and asked him the only question that mattered: “Can you handle them all?”

There was a delay of almost two minutes. The troubleshooters were heading out to join the rest of our project team for their on-the-spot analyses in the Jovian system; already the light-travel time was significant. If I didn't follow in the next day or two, radio-signal delay would make conversation impossible. At the moment, Jupiter was forty-five light-minutes from Earth.

“We can, Al,” said Pauli's image at last. “Unless others come up in the next few hours, we can. From here until impact, we'll be working in an environment with increasing uncertainties.”

“The PNU people planned it that way. Go ahead—but send me full transcripts.” I left the system switched on, and went off to the next room to study the notes I had taken of the five problem areas. As I had done with every glitch that had come up since the Phase B demonstration project began I placed the problem into one of two basic categories: act of nature, or failure of man-made element. For the most recent five difficulties, the volcano on Io and the solar flare belonged to the left-hand column: Category One clearly natural and unpredictable events. The absence of booster-engine telemetry and the loss of satellite-image data were Category Two, failures of our system. They went in the right-hand column. I hesitated for a long time over the fifth event, the impact of the meteorite; finally, and with some misgivings, I assigned it also as a Category One event.

As soon as possible, I would like to follow the engineering teams out toward Jupiter for the final hours of the demonstration. However, I had two more duties to perform before I could leave. Using a coded link to Romberg AG HQ in synchronous Earth orbit, I queried the status of all the clone tanks. No anomalies were reported. By the time we returned from the final stages of Phase B, another three finished clones would be ready to move to the indoctrination facility. I needed to be there when it happened.

Next, I had to review and approve acquisition of single-use copyright for all the draft picks we had negotiated down on Earth. To give an idea of the importance of these choices, we were looking at an expenditure of \$20 billion for those selections over the next twelve months. It raised the unavoidable question, Had we made the best choices?

At this stage of the game, *every* combine began to have second thoughts about the wisdom of their picks. All the old failures came crowding into your mind. I already mentioned NETSCO and their problem with Einstein but we had had our full share at Romberg AG: Gregor Mendel, the originator of the genetic ideas that stood behind all the cloning efforts, had proved useless; so had Ernest Lawrence, inventor of the cyclotron, our second pick for 1958. We had (by blind luck!) traded him along with \$40 million for Wolfgang Pauli. Even so, we had made a bad error of judgment, and the fact that others made the same mistake was no consolation. As for Marconi even though he looked like the old pictures of him, and was obviously highly intelligent the clone who emerged turned out to be so indolent and casual about everything that he ruined any project he worked on. I had placed him in a cushy and undemanding position and allowed him to fiddle about with his own interests, which were mainly sports and good-looking women. (As Pauli acidly remarked, "And you say that *we're* the smart ones, doing all the work?")

It's not the evaluation of a person's past record that's difficult, because we are talking about famous people who have done a great deal; written masses of books, articles, and papers; and been thoroughly evaluated by their own contemporaries. Even with all that, a big question still remains: Will the things that made the original man or woman great still be there in the cloned form? In other words, *Just what is it that is inherited?*

That's a very hard question to answer. The theory of evolution was proposed 170 years ago, but we're still fighting the old Nature-versus-Nurture battle. Is a human genius decided mainly by heredity, or by the way the person was raised? One old argument against cloning for genius was based on the importance of Nurture. It goes as follows: an individual is the product of both heredity (which is all you get in the clone) and environment. Since it is impossible to reproduce someone's environment, complete with parents, grandparents, friends, and teachers, you can't raise a clone that will be exactly like the original individual.

I'll buy that logic. We can't make ourselves an intellectually exact copy of anyone.

However, the argument was also used to prove that cloning for superior intellectual performance would be impossible. But of course, it actually proves nothing of the sort. If you take two peas from the same pod, and put one of them in deep soil next to a high wall, and the other in shallow soil out in the open, they *must* do different things if both are to thrive. The one next to the wall has to make sure it gets enough sunshine, which it can do by maximizing leaf area; the one in shallow soil has to get enough moisture, which it does through putting out more roots. The *superior* strain of peas is the one whose genetic composition allows it to adapt to whatever environment it is presented with.

People are not peas, but in one respect they are not very different from them: some have superior genetic composition to others. That's all you can ask for. If you clone someone from a century ago, the last thing you want is someone who is *identical* to the original. They would be stuck in a twentieth-century mind-set. What is needed is someone who can adapt to and thrive in *today's* environment—whether that is now the human equivalent of shade, or of shallow soil. The success of the original clone-template tells

us a very important thing, that we are dealing with a superior physical brain. What that brain thinks in the year 2040 *should* be different from what it would have thought in the year 1940—otherwise the clone would be quite useless. And the criteria for “useless” change with time, too.

All these facts and a hundred others were running around inside my head as I reviewed the list for this year. Finally I made a note to suggest that J. B. S. Haldane, whom we had looked at and rejected three years ago on the grounds of unmanageability, ought to be looked at again and acquired if possible. History shows that he had wild views on politics and society, but there was no question at all about the quality of his mind. I thought I had learned a lot about interfacing with difficult scientific personalities in the past few years.

When I was satisfied with my final list, I transmitted everything to Joe Delacorte, who was still down on Earth, and headed for the transition room. A personal shipment pod ought to be waiting for me there. I hoped I would get a good one. At the very least, I'd be in it for the next eight days. Last time I went out to the Jovian system, the pod internal lighting and external antenna failed after three days. Have you ever sat in the dark for seventy-two hours, a hundred million miles from the nearest human, unable to send or receive messages? I didn't know if anyone realized I was in trouble. All I could do was sit tight—and I mean tight; pods are *small*—and stare out at the stars.

This time the pod was in good working order. I was able to participate in every problem that hit the project over the next four days. There were plenty of them, all small, and all significant. One of the fuel-supply ships lost a main ion drive. The supply ship was not much more than a vast bag of volatiles and a small engine, and it had almost no brain at all in its computer, not even enough to figure out an optimal use of its drives. We had to chase after and corral it as though we were pursuing a great lumbering elephant. Then three members of the impact-monitoring team came down with food poisoning—salmonella, which was almost certainly their own fault. You can say anything you like about throwing away spoiled food, but you can't get a sloppy crew to take much notice.

Then, for variety, we lost a sensor through sheer bad program design. In turning one of our imaging systems from star sensing to Io-Jupiter sensing we tracked it right across the solar disk and burned out all the photocells. According to the engineers, that's the sort of blunder you don't make after kindergarten—but somebody did it.

Engineering errors are easy to correct. It was much trickier when one of the final-approach-coordination groups, a team of two men and one woman chose the day before the Io rendezvous to have a violent sexual argument. They were millions of kilometers away from anyone, so there was not much we could do except talk to them. We did that, hoped they wouldn't kill each other, and made plans to do without their inputs if we had to.

Finally, one day before impact, an unplanned and anomalous firing of a rocket on the asteroid's forward surface caused a significant change of velocity of the whole body.

I ought to explain that I did little or nothing to solve any of these problems. I was too slow, too ignorant, and not creative enough. While I was still struggling to comprehend what the problem parameters were, my trouble-shooters were swarming all over it. They threw proposals and counterproposals at each other so fast that I could hardly note them, still less contribute to them. For example, in the case of the anomalous rocket firing that I mentioned, compensation for the unwanted thrust called for an elaborate balancing act of lateral and radial engines, rolling and nudging the asteroid back into its correct approach path. The team had mapped out the methods in minutes, written the necessary optimization programs in less than half an hour, and implemented their solution before I understood the geometry of what was going on.

So what did I do while all this was happening? I continued to make my two columns: act of nature, or failure of man-made element. The list was growing steadily, and I was spending a lot of time looking at it.

We were coming down to the final few hours now, and all the combines were working flat out to solve their own problems. In an engineering project of this size, many thousands of things could go wrong. We were working in extreme physical conditions, hundreds of millions of kilometers away from Earth and our standard test environments. In the intense charged-particle field near Io, cables broke at loads well below their rated capacities, hard-vacuum welds showed air-bleed effects, and lateral jets were fired and failed to produce the predicted attitude adjustments. And on top of all this, the pressure, isolation, and bizarre surroundings were too much for some of the workers. We had human failure to add to engineering failure. The test was tougher than anyone had realized—even PNU, who was supposed to make the demonstration project just this side of impossible.

I was watching the performance of the other three combines only a little less intently than I was watching our own. At five hours from contact time, NETSCO apparently suffered a communications loss with their asteroid-control system. Instead of heading for Io impact, the asteroid veered away, spiraling in toward the bulk of Jupiter itself.

BP Megation lost it at impact minus three hours, when a vast explosion on one of their asteroid forward boosters threw the kilometer-long body into a rapid tumble. Within an hour, by some miracle of improvisation, their engineering team had found a method of stabilizing the wobbling mass. But by then it was too late to return to nominal impact time and place. Their asteroid skimmed into the surface of Io an hour early, sending up a long, tear-shaped mass of ejecta from the moon's turbulent surface.

That left just two of us, MMG and Romberg AG. We both had our hands full. The Jovian system is filled with electrical, magnetic, and gravitational energies bigger than anything in the Solar System except the Sun itself. The two remaining combines were trying to steer their asteroid into a pinpoint landing through a great storm of interference that made every control command and every piece of incoming telemetry suspect. In the final hour I didn't even follow the exchanges between my troubleshooters. Oh, I could *hear* them easily enough. What I couldn't do was comprehend them, enough to know what was happening.

Pauli would toss a scrap of comment at von Neumann, and, while I was trying to understand that, von Neumann would have done an assessment, keyed in for a databank status report, gabbled a couple of questions to Fermi and an instruction to Edison, and at the same time be absorbing scribbled notes and diagrams from those two. I don't know if what they were doing was *potentially* intelligible to me or not; all I know is that they were going about fifty times too fast for me to follow. And it didn't much matter what I understood—they were getting the job done. I was still trying to divide all problems into my Category One-Category Two columns, but it got harder and harder.

In the final hour I didn't look or listen to what my own team was doing. We had one band of telemetry trained on the MMG project, and more and more that's where my attention was focused. I assumed they were having the same kind of communications trouble as we were—that crackling discharge field around Io made everything difficult. But their team was handling it. They were swinging smoothly into impact.

And then, with only ten minutes to go, the final small adjustment was made. It should have been a tiny nudge from the radial jets; enough to fine-tune the impact position a few hundred meters, and no more. Instead, there was a joyous roar of a radial jet at full, uncontrolled thrust. The MMG asteroid did nothing unusual for a few seconds (a billion tons is a lot of inertia), then began to drift lazily sideways, away from its nominal trajectory.

The jet was still firing. And that should have been impossible, because the first thing that the MMG team

would do was send a Power-Off signal to the engine.

The time for impact came when the MMG asteroid was still a clear fifty kilometers out of position, and accelerating away. I saw the final collision, and the payload scraped along the surface of Io in a long, jagged scar that looked nothing at all like the neat, punched hole that we were supposed to achieve.

And we did achieve it, a few seconds later. Our asteroid came in exactly where and when it was supposed to, driving in exactly vertical to the surface. The plume of ejecta had hardly begun to rise from Io's red-and-yellow surface before von Neumann was pulling a bottle of bourbon from underneath the communications console.

I didn't object—I only wished I were there physically to share it, instead of being stuck in my own pod, short of rendezvous with our main ship. I looked at my final list, still somewhat incomplete. Was there a pattern to it? Ten minutes of analysis didn't show one. No one had tried anything—this time. Someday, and it might be tomorrow, somebody on another combine would have a bright idea; and then it would be a whole new ball game.

While I was still pondering my list, my control console began to buzz insistently. I switched it on expecting contact with my own trouble-shooting team. Instead, I saw the despondent face of Brunel, MMG's own team leader—the man above all others that I would have liked to work on my side.

He nodded at me when my picture appeared on his screen. He was smoking one of his powerful black cigars, stuck in the side of his mouth. The expression on his face was as impenetrable as ever. He never let his feelings show there. “I assume you saw it, did you?” he said around the cigar. “We're out of it. I just called to congratulate you—again.”

“Yeah, I saw it. Tough luck. At least you came second.”

“Which, as you know very well, is no better than coming last.” He sighed and shook his head. “We still have no idea what happened. Looks like either a programming error, or a valve sticking open. We probably won't know for weeks. And I'm not sure I care.”

I maintained a sympathetic silence.

“I sometimes think we should just give up, Al,” he said. “I can beat those other turkeys, but I can't compete with you. That's six in a row that you've won. It's wearing me out. You've no idea how much frustration there is in that.”

I had never known Brunel to reveal so much of his feelings before.

“I think I do understand your problems,” I said.

And I did. I knew exactly how he felt—more than he would believe. To suffer through a whole, endless sequence of minor, niggling mishaps was heartbreaking. No single trouble was ever big enough for a trouble-shooting team to stop, isolate it, and be able to say, there's dirty work going on here. But their cumulative effect was another matter. One day it was a morass of shipments missing their correct flights, another time a couple of minus signs dropped into computer programs, or a key worker struck down for a few days by a random virus, permits misfiled, manifests mislaid, or licenses wrongly dated.

I knew all those mishaps personally. I should, because I invented most of them. I think of it as the death of a thousand cuts. No one can endure all that and still hope to win a Phase B study.

“How would you like to work on the European Metamorph?” I asked. “I think you'd love it.”

He looked very thoughtful, and for the first time, I believe I could actually read his expression. “Leave MMG, you mean?” he said. “Maybe. I don’t know what I want anymore. Let me think about it. I’d like to work with you, Al—you’re a genius.”

Brunel was wrong about that, of course. I’m certainly no genius. All I can do is what I’ve always done—handle people, take care of unpleasant details (quietly!), and make sure things get done that need doing. And of course, do what I do best: make sure that some things that need doing *don't* get done.

There *are* geniuses in the world, real geniuses. Not me, though. The man who decided to clone me, secretly—*there* I’d suggest you have a genius.

"Say, don't you remember, they called me Al..."

Of course, I don’t remember. That song was written in the 1930s, and I didn’t die until 1947, but no clone remembers anything of the forefather life. The fact that we tend to be knowledgeable about our originals’ period is an expression of interest in those individuals, not memories from them. I know the Chicago of the Depression years intimately, as well as I know today; but it is all learned knowledge. I have no actual recollection of events. I don’t *remember*.

So even if you don’t remember, call me Al anyway. Everyone did.

About the Author

Charles Sheffield (1935-) is a mathematician and physicist who has written numerous short stories, technical papers, and books. His fiction, which is mostly hard science fiction, has won major awards. He is Chief Scientist and Board Member of Earth Satellite Corporation, a Past-President of the Science Fiction Writers of America, and a Fellow and Past-President of the American Astronautical Society. His most recent novel, *Transvergence*, appeared in 1999 from Pocket Books.

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15. Gene Wars by Paul J. McAuley

1

On Evan’s eighth birthday, his aunt sent him the latest smash-hit biokit, *Splicing Your Own Semisentients*. The box-lid depicted an alien swamp throbbing with weird, amorphous life; a double helix spiralling out of a test-tube was embossed in one corner. Don’t let your father see that, his mother said, so Evan took it out to the old barn, set up the plastic culture trays and vials of chemicals and retroviruses on a dusty workbench in the shadow of the shrouded combine.

His father found Evan there two days later. The slime mould he’d created, a million amoebae aggregated around a drop of cyclic AMP, had been transformed with a retrovirus and was budding little blue-furred blobs. Evan’s father dumped culture trays and vials in the yard and made Evan pour a litre of industrial-grade bleach over them. More than fear or anger, it was the acrid stench that made Evan cry.

That summer, the leasing company foreclosed on the livestock. The rep who supervised repossession of the supercows drove off in a big car with the test-tube and double-helix logo on its gull-wing door. The next year the wheat failed, blighted by a particularly virulent rust. Evan’s father couldn’t afford the new resistant strain, and the farm went under.

* * *

2

Evan lived with his aunt, in the capital. He was fifteen. He had a street bike, a plug-in computer, and a pet microsauro, a cat-sized tyrannosaurus in purple funfur. Buying the special porridge which was all the microsauro could eat took half of Evan's weekly allowance; that was why he let his best friend inject the pet with a bootleg virus to edit out its dietary dependence. It was only a partial success: the triceratops no longer needed its porridge, but it developed epilepsy triggered by sunlight. Evan had to keep it in his wardrobe. When it started shedding fur in great swatches, he abandoned it in a nearby park. Microsauros were out of fashion, anyway. Dozens could be found wandering the park, nibbling at leaves, grass, discarded scraps of fastfood. Quite soon they disappeared, starved to extinction.

* * *

3

The day before Evan graduated, his sponsor firm called to tell him that he wouldn't be doing research after all. There had been a change of policy: the covert gene wars were going public. When Evan started to protest, the woman said sharply, "You're better off than many long-term employees. With a degree in molecular genetics you'll make sergeant at least."

* * *

4

The jungle was a vivid green blanket in which rivers made silvery forked lightnings. Warm wind rushed around Evan as he leaned out the helicopter's hatch; harness dug into his shoulders. He was twenty-three, a tech sergeant. It was his second tour of duty.

His goggles flashed icons over the view, tracking the target. Two villages a klick apart, linked by a red dirt road narrow as a capillary that suddenly widened to an artery as the helicopter dove.

Flashes on the ground: Evan hoped the peasants only had Kalashnikovs: last week some gook had downed a copter with an antiquated SAM. Then he was too busy laying the pattern, virus-suspension in a sticky spray that fogged the maize fields.

Afterwards, the pilot, an old-timer, said over the intercom, "Things get tougher every day. We used just to take a leaf, cloning did the rest. You couldn't even call it theft. And this stuff ... I always thought war was bad for business."

Evan said, "The company owns copyright to the maize genome. Those peasants aren't licensed to grow it."

The pilot said admiringly, "Man, you're a real company guy. I bet you don't even know what country this is."

Evan thought about that. He said, "Since when were countries important?"

* * *

5

Rice fields spread across the floodplain, dense as a handstitched quilt. In every paddy, peasants bent over their own reflections, planting seedlings for the winter crop.

In the centre of the UNESCO delegation, the Minister for Agriculture stood under a black umbrella held by an aide. He was explaining that his country was starving to death after a record rice crop.

Evan was at the back of the little crowd, bareheaded in warm drizzle. He wore a smart onepiece suit, yellow overshoes. He was twenty-eight, had spent two years infiltrating UNESCO for his company.

The minister was saying, "We have to buy seed genespliced for pesticide resistance to compete with our neighbours, but my people can't afford to buy the rice they grow. It must all be exported to service our debt. Our children are starving in the midst of plenty."

Evan stifled a yawn. Later, at a reception in some crumbling embassy, he managed to get the minister on his own. The man was drunk, unaccustomed to hard liquor. Evan told him he was very moved by what he had seen.

"Look in our cities," the minister said, slurring his words. "Every day a thousand more refugees pour in from the countryside. There is kwashiorkor, beri-beri."

Evan popped a canape into his mouth. One of his company's new lines, it squirmed with delicious lasciviousness before he swallowed it. "I may be able to help you," he said. "The people I represent have a new yeast that completely fulfills dietary requirements and will grow on a simple medium."

"How simple?" As Evan explained, the minister, no longer as drunk as he had seemed, steered him onto the terrace. The minister said, "You understand this must be confidential. Under UNESCO rules..."

"There are ways around that. We have lease arrangements with five countries that have ... trade imbalances similar to your own. We lease the genome as a loss-leader, to support governments who look favourably on our other products..."

* * *

6

The gene pirate was showing Evan his editing facility when the slow poison finally hit him. They were aboard an ancient ICBM submarine grounded somewhere off the Philippines. Missile tubes had been converted into fermenters. The bridge was crammed with the latest manipulation technology, virtual reality gear which let the wearer directly control molecule-sized cutting robots as they travelled along DNA helices. "It's not facilities I need," the pirate told Evan, "it's distribution."

"No problem," Evan said. The pirate's security had been pathetically easy to penetrate. He'd tried to infect Evan with a zombie virus, but Evan's gene-spliced designer immune system had easily dealt with it. Slow poison was so much more subtle: by the time it could be detected it was too late. Evan was thirty-two. He was posing as a Swiss grey-market broker.

"This is where I keep my old stuff," the pirate said, rapping a stainless-steel cryogenic vat. "Stuff from before I went big time. A free luciferase gene complex, for instance. Remember when the Brazilian rainforest started to glow? That was me." He dashed sweat from his forehead, frowned at the room's complicated thermostat. Grossly fat and completely hairless, he wore nothing but Bermuda shorts and shower sandals. He'd been targeted because he was about to break the big time with a novel HIV cure. The company was still making a lot of money from its own cure: they made sure AIDS had never been completely eradicated in third-world countries.

Evan said, "I remember the Brazilian government was overthrown—the population took it as a bad omen."

"Hey, what can I say? I was only a kid. Transforming the gene was easy, only difficulty was finding a vector. Old stuff. Somatic mutation really is going to be the next big thing, believe me. Why breed new strains when you can rework a genome cell by cell?" He rapped the thermostat. His hands were shaking.

“Hey, is it hot in here, or what?”

“That’s the first symptom,” Evan said. He stepped out of the way as the gene pirate crashed to the decking. “And that’s the second.”

The company had taken the precaution of buying the pirate’s security chief: Evan had plenty of time to fix the fermenters. By the time he was ashore, they would have boiled dry. On impulse, against orders, he took a microgram sample of the HIV cure with him.

* * *

7

“The territory between piracy and legitimacy is a minefield,” the assassin told Evan. “It’s also where paradigm shifts are most likely to occur, and that’s where I come in. My company likes stability. Another year and you’d have gone public, and most likely the share issue would have made you a billionaire—a minor player, but still a player. Those cats, no one else has them. The genome was supposed to have been wiped out back in the twenties. Very astute, quitting the grey medical market and going for luxury goods.” She frowned. “Why am I talking so much?”

“For the same reason you’re not going to kill me,” Evan said.

“It seems such a silly thing to want to do,” the assassin admitted.

Evan smiled. He’d long ago decoded the two-stage virus the gene-pirate had used on him: one a Trojan horse which kept his T lymphocytes busy while the other rewrote loyalty genes companies implanted in their employees. Once again it had proven its worth. He said, “I need someone like you in my organization. And since you spent so long getting close enough to seduce me, perhaps you’d do me the honour of becoming my wife. I’ll need one.”

“You don’t mind being married to a killer?”

“Oh, that. I used to be one myself.”

* * *

8

Evan saw the market crash coming. Gene wars had winnowed basic foodcrops to soybeans, rice, and dole yeast: tailored ever-mutating diseases had reduced cereals and many other cash crops to nucleotide sequences stored in computer vaults. Three global biotechnology companies held patents on the calorific input of ninety-eight percent of humanity, but they had lost control of the technology. Pressures of the war economy had simplified it to the point where anyone could directly manipulate her own genome, and hence her own body form.

Evan had made a fortune in the fashion industry, selling templates and microscopic self-replicating robots which edited DNA. But he guessed that sooner or later someone would come up with a direct-photosynthesis system, and his stock-market expert systems were programmed to correlate research in the field. He and his wife sold controlling interest in their company three months before the first green people appeared.

* * *

9

“I remember when you knew what a human being was,” Evan said sadly. “I suppose I’m old-fashioned, but there it is.”

From her cradle, inside a mist of spray, his wife said, “Is that why you never went green? I always thought it was a fashion statement.”

“Old habits die hard.” The truth was, he liked his body the way it was. These days, going green involved somatic mutation which grew a metre-high black cowl to absorb sufficient light energy. Most people lived in the tropics, swarms of black-caped anarchists. Work was no longer a necessity, but an indulgence. Evan added, “I’m going to miss you.”

“Let’s face it,” his wife said, “we never were in love. But I’ll miss you too.” With a flick of her powerful tail she launched her streamlined body into the sea.

* * *

10

Black-cowled post-humans, gliding slowly in the sun, aggregating and reaggregating like amoebae. Dolphinoids, tentacles sheathed under fins, rocking in tanks of cloudy water. Ambulatory starfish; tumbling bushes of spikes; snakes with a single arm, a single leg; flocks of tiny birds, brilliant as emeralds, each flock a single entity.

People, grown strange, infected with myriads of microscopic machines which re-engraved their body form at will.

Evan lived in a secluded estate. He was revered as a founding father of the posthuman revolution. A purple funfur microsauro followed him everywhere. It was recording him because he had elected to die.

“I don’t regret anything,” Evan said, “except perhaps not following my wife when she changed. I saw it coming, you know. All this. Once the technology became simple enough, cheap enough, the companies lost control. Like television or computers, but I suppose you don’t remember those.” He sighed. He had the vague feeling he’d said all this before. He’d had no new thoughts for a century, except the desire to put an end to thought.

The microsauro said, “In a way, I suppose I am a computer. Will you see the colonial delegation now?”

“Later.” Evan hobbled to a bench and slowly sat down. In the last couple of months he had developed mild arthritis, liver spots on the backs of his hands: death finally expressing parts of his genome that had been suppressed for so long. Hot sunlight fell through the velvet streamers of the tree things; Evan dozed, woke to find a group of starfish watching him. They had blue, human eyes, one at the tip of each muscular arm.

“They wish to honour you by taking your genome to Mars,” the little purple triceratops said.

Evan sighed. “I just want peace. To rest. To die.”

“Oh, Evan,” the little triceratops said patiently, “surely even you know that nothing really dies any more.”

About the Author

Paul J. McAuley (1955-) is a British biologist who has written a number of adventurous, far-future science fiction novels; his first, *Four Hundred Billion Stars* (1988) won the Philip K. Dick award. His attention is often on genetic engineering and cosmology, and he is notable for the sweeping scope of his dreams. He lives in Fife, Scotland.

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16. Down on the Truck Farm by Thomas A. Easton

The house was a Swiss chalet with a cantilevered deck. It looked like it would be quite at home on a mountainside, overhung by beetling cliffs, overlooking some deep valley through which ran a far-off thread of silver. Jimmy Brane could close his eyes and imagine the thin whistle of mountain wind, the echoing yodels of distant shepherds, the bleating of sheep and goats in some meadow just around the bulge of the alp. He didn't have to imagine the smell of honeysuckle.

He knew he should laugh at himself, but he just didn't have the energy. The house was supported not by a mountain but by a massive engineered beanstalk, stiffened by a single concrete pillar. The deck was overhung by bean leaves the size of tabletops, and it overlooked only the yard next door.

It was no coincidence that Jimmy was leaning on the deck's railing and staring at that yard now. That was where his best friend, Tommy, had lived. Now Tommy's mother lay stretched out on a towel, dark haired and nearly bare, sunbathing, sipping again and again, as she did all day, every day, at.... Until very recently, she had always been puttering about her pumpkin house, touching up the sealants that had been sprayed onto the dried shell, washing windows, pruning the vine that still provided shade. But she had once fooled around with the chalet's previous owner, and Tommy had found out. He had, in fact, learned that the man he had always called his father bore to him no blood relationship at all. That was when he had run away.

Tommy hadn't even waited to graduate from high school. He had cut and run, leaving Jimmy to peer over the railing at the ground below and think that, yes, he was high enough. High school was behind him now, and he didn't want to go to college—he hadn't even applied!—and he didn't want a job and his best friend was God knew where. He could climb up on the railing and bend his knees and dive out past the gnarly twists of bean stem and the billows of honeysuckle blossoms, their viney stems twined around the beanstalk, arch his body against the sky, and plunge down headfirst upon the flagstoned patch that held the family's Neoform Armadon.

Instead, he leaned over the railing to wave away a drunken hummingbird and pluck a choice honeysuckle blossom, the size of a wine glass, its narrow base plump with nectar. He held it up to the light, marveling at its shadings of rose and cream, at how quickly the vine had grown that spring when the seed had appeared, dropped by some high-flying bird or planted by a wandering jonnyseeder, in the soil below. There had been no such thing just the year before. Now they were everywhere, and some people said they were a problem. But....

Tommy's mother, Petra, had just plucked another for herself. He gestured with his own, though he knew she would not see his acknowledgement of what they shared. Then he tipped the blossom up and drained its liquid contents down his throat. He shuddered at the cloying sweetness, but he did not regret the dose. There was a self-fermented alcoholic tingle as well, and beneath that a mellowing, relaxing, euphoric haze. He stopped caring about friends, jobs, schools, long falls to nowhere, everything except reaching for another blossom.

* * * *

“Hey, Ma! He's been suckin' honey again!”

Jimmy opened one eye. That was his kid brother, Caleb, taking a thirteen-year-old's malicious pleasure in the shit that was about to fly Jimmy's way. He was standing in the half-open door to the house, staring, grinning, at Jimmy sprawled in the wood-and-canvas deck chair, at the honeysuckle blossoms littering the floor around him, at one last blossom crushed in a sticky hand.

Jimmy wished his older sister were still at home. She would be more sympathetic. But she had gone off

to college two years before, and....

“Hey, Ma!”

It was not their mother who came to the door, one hand holding a glass of water, the other a pair of yellow pills. It was Dad, tall, thin to the point of gauntness, balding, his face lugubriously sad, his head shaking, his voice tsking, “Sober up, boy. You’re supposed to be helping us get the carpet up. Not....” With the hand that held the pills he gestured toward the house next door. “You want to wind up like Petra? She lost her son, not just a friend.”

Jimmy made a face. Outlaw gengineers had turned the honeysuckle loose upon the world, and no one had been able to get rid of it since. But the biochemists, as ingenious in their way as the gengineers, had promptly devised an antidote for the euphoric in the nectar. The yellow pills contained a mixture of that antidote and the much older alcohol detoxicant. In mere moments, his system was free of both drugs and he was staring longingly once more at the pumpkin across the way. A best friend was not *just* a friend.

“C'mon, Jimmy.” He shook Caleb's hand off his arm, levered himself out of his low seat, and followed his father into the living room. For a little while then, he helped move the couch, easy chairs, end tables, books and bookcase, into other rooms. Then he pried nails from the floorboards, rolled the old, worn carpet into a wormlike cylinder, sneezed at the dust he stirred, and marveled at the circular marks upon the wood beneath.

His mother blew her nose and ran her fingers across the marks. “Water stains,” she said. She was Dad's total opposite, short, round, her hair thick and blonde. Caleb's hair was like hers. Jimmy's was thinner, drabber, like his father's. “And ground-in dirt. And just a hair of indentation. Someone had flower pots in here once. Heavy ones.”

Jimmy wondered if that someone had been Tommy's father. But that thought evaporated as the carpet company's delivery van, a Bioblimp, arrived, lifted off the house's roof with its muscular tentacles, and replaced the roll of old carpet with one of new. He stepped onto the deck once more to watch the van drift down the breeze, not yet using the propellor mounted on the rear of its crew pod. Its main ancestor had been some simple jellyfish. The gengineers had vastly enlarged it, swelled it up with hydrogen, given its tentacles muscles that belonged more properly to an octopus or squid, and equipped it with cargo pockets whose genes had come from kangaroos. Behind him, he could hear his mother running the vacuum cleaner across the bare floor, removing all the grit and dust that had sifted through and accumulated beneath the old carpet.

* * * *

When the new carpet was in place and the furniture was restored to its positions, the whole family took their seats—Jimmy's mother and Caleb on the couch, Dad in his recliner, Jimmy in the antique wing chair—and admired the carpet. That was when Dad sighed and said, “Jim. We have got to do something about you.”

Jimmy shifted uncomfortably. Caleb snickered until his mother pinched his thigh.

“You've finished school,” Dad went on. “At least until you decide to go on. But you don't seem to want a job. And you're drinking far too much honeysuckle wine.”

“Yessir,” said Jimmy. He stared at the carpet between his feet, preferring its clean, fresh neutrality to the disapproval of his parents, or the glee of his little brother.

“If this keeps up,” said Dad. “If this goes on, you'll be just another honey-suckin' bum.”

Caleb managed to get out a single snicker before squeaking a muffled, "Ouch!"

Dad slapped his thigh. "So," he said. "Tomorrow, I'm taking you out to the Daisy Hill Truck Farm."

* * * *

It was a sad fact that the morning after tanking up on honeysuckle wine, antidote or no antidote, one had a headache, not the blinding sort, but a sullen, throbbing thing that would respond only to a nip of honey. The aspirins Jimmy found beside his breakfast plate were no help at all.

After breakfast, Dad led the way to the elevator that occupied the center of the beanstalk's supporting pillar. He did not let Jimmy have a moment on the deck to grab a honeysuckle blossom, and when they reached the ground, his hand on his son's shoulder kept Jimmy from stepping off the path.

"C'mon," he said. "You have your license." He steered Jimmy toward the door on the driver's side of the family Armadon and held it open. It revealed the bucket seats and control panels that occupied the space grown in the genimal's back, and when Jimmy climbed in, it closed with a solid "Chunkk!"

"But you still need practice. So you drive. I'll tell you when to turn."

The Armadon was a engineered armadillo. Somewhat larger than a panel truck of the last century, it had no tail. The lower portion of its rigid hide swelled out to form four wheels, each one wearing a black rubber tire. The genimal's legs were mounted high, above the wheels, their joints reversed; as they ran, they pushed against the tires, spun the wheels on their bony hubs, and propelled the vehicle down the grassy greenways that had replaced paved roads early in the Biological Revolution.

Obediently, Jimmy toggled the genimal out of its night-time dormancy and took the tiller in his hand. He didn't have much to say. He knew about the truck farm, and he could guess why his Dad wanted to take him there—Dad hoped he would get inspired, discover a vocation, swear off the honey forevermore, and straighten out. Fat chance, he thought.

Fortunately, the trip would not take long. There was not far from their neighborhood an entrance to the major highway that led traffic away from the city and toward the countryside where the land was available for truck farms and other agricultural operations. At this time of day, most of the traffic was city-bound commuters in wheeled Armadons and Roachsters, legged Hoppers, Tortoises, and Beetles, and grand Mack trucks hauling pods and trailers full of goods, chrome eighteen-wheelers dangling from collars beneath their bulldog jowls. An occasional police Hawk hovered overhead. A construction site featured long-legged Cranes and earth-moving Box-turtles. An Alitalia Cardinal and an American Bald Eagle circled above the local jetport. Shovel-jawed litterbugs patrolled the shoulder, darting at every break in the traffic onto the greenway to retrieve the wastes inevitably left behind the vehicles.

Honeysuckle vines covered the embankments beyond the shoulder, and in the shadows beneath an overpass, Jimmy noticed several full-time honey-suckers. Jimmy read the papers and knew that they died of malnutrition and disease and exposure and then fell prey to the omnipresent litterbugs, but he was not at all sure their fate was so horrible. They were the honey-bums his father prayed he would not join. They were poor and tattered, but such was the power of the euphoric in the honey they loved that they were nevertheless carefree and content with their lot. Was that indeed what awaited Jimmy? He didn't think that honeysuckle wine had that much of a hold on him, though he did love the stuff.

A Roadrunner roared past them, its rider bent low over the extended neck, his face hidden by a globular helmet. "Next exit," said Dad, and the highway gave way to a smaller road poorly enough maintained that in spots, where the turf was thin, the pavement of a generation before showed through. A few more miles, and they began to see the white-boarded fences of the truck farm. The barns became visible beyond a grove of trees, and then they could see the iron-barred runs, some of them containing young

trucks. A herd of cattle, mingled Guernseys and Black Angus, milk and meat, grazed a pasture. The barns grew nearer and the wide doors along their sides became visible, while Jimmy wondered at the lack of a farmhouse. By the road stood a low concrete building that looked like it must hold only offices. A truck, its trailer full of grain for feed, was backing into the farm's main drive.

There was no honeysuckle to be seen. If it had ever taken root here, the farm's staff had carefully eradicated it. Jimmy did not care whether the reason had been to keep the staff or the stock clean. He did care that it was absent, for he was beginning to crave a sip, just a sip, he told himself.

"Park there," said Dad. He pointed toward the side of the office building.

Jimmy nosed the Armadon into a space between a Roachster and an antique automobile whose axles were supported by metal jacks. The antique's paint was protected by a plastic tarpaulin. A medallion, left visible where the tarp did not cover, identified the car as an Oldsmobile.

As he shut their vehicle down, a door opened in the side of the building. Jimmy caught a glimpse of pastel walls, glass partitions, and elaborate computer workstations where, he would have guessed if he had cared, new trucks must be designed. Then he focused on the man stepping toward them. He was tall but heavy-set, and the roundness of his face was accentuated by a receding hairline.

"Mr. Brane!" He met Jimmy's Dad with a broad smile and an outstretched hand as he stepped from the Armadon. "This is your boy. I've been looking forward to meeting you both."

Jimmy scowled. He hadn't cared for patronizing sons of bitches when he was in high school, and he didn't like them now. He wished he dared to jump back in the Armadon and take off, but... Honey or no honey, Dad would make his life miserable for sure. And he didn't really want to disappoint his parents. He was depressed for loss of his friend, but he did still love them. He supposed he even loved Caleb.

Their host gestured toward the nearest barn. "Call me Mike. Mike Nickers. We can begin the tour in here."

A narrow corridor ran down the center of the barn, with wooden doors opening into large bays. A small window in the nearest of the doors gave Jimmy a glimpse of something large and moving, but before he could identify it, their guide directed their attention to a large photo on one wall and said, "This is the bus barn. We've been trying to develop a good long-distance vehicle." He tapped the photo with an outstretched finger. "Years ago, they tried to make a Greyhound, but the back wasn't strong enough, and it didn't have the stamina."

Despite himself, Jimmy was feeling some interest. "What about the Bernies? They're all over town."

Nickers nodded. "Their backs are okay, but they still can't make the long trips." He led them to the first of the barn's bays and opened its door to reveal an immense genimal with six legs and a flattened back. The floor was covered with hay. A larger door at the other end of the bay opened to the outside. "We turned to peccary stock. We handled the back by giving it an extra pair of legs. Had to double the rib cage and pectoral girdle to make them work, but we got a double heart-lung system in the process, and that made the stamina beautiful."

"Couldn't you have done that with a Greyhound?" asked Jimmy's Dad.

Nickers shrugged. "We tried. But it didn't turn out very well. And besides, we liked the name we got this way. We call 'em Roadhogs."

He led them past other bays. One contained a Roadhog with a bus-pod strapped on, and Jimmy realized

why the engineers had designed the back to be flat. Another contained a female Roadhog lying on its side while a litter of young rooted at her belly, nursing. In the last, a female displayed a bulging belly. "As you can see," said Nickers, "we've entered the production phase. And in case you're wondering, the mating is handled by artificial insemination. The Bioform Regulatory Agency insisted that we remove any ability to respond to heat pheromones."

As he held the barn door open for them, he added, "Want some coffee?" Jimmy and his Dad both nodded. He pointed—"Over here. It's the maternity ward for the trucks."—and led them to a small waiting room in the next barn.

When Jimmy entered the room, he found two young people clad in coveralls. They were not much older than he, and they wore shoulder-patches marked with the farm's distinctive logo, a black-eared white beagle. Nickers closed the door, and the stertorous sounds of idling trucks elsewhere in the barn were slightly muffled. "Two of our trainees," he said. "Julie, Dan, this is Jimmy Brane."

Julie and Dan quickly finished their drinks, said "Work to do," and left. When the others had full cups from the dispenser on the wall, Nickers showed them more bays, each of these containing a pregnant or nursing truck. Most showed their bulldog ancestry very clearly in their flattened faces. A few had a more wolfish appearance. "Husky stock," said Nickers. "For the far north." In each case, the trucks' collar ornaments had been removed and hung from hooks on the walls.

Jimmy was pouring the last of his coffee into his mouth, thinking that it was a poor substitute for honeysuckle wine, when a sudden shout broke the quiet of the ward: "Get the tractor! Hurry!"

"Come on!" Nickers cried, throwing his empty cup into the nearest waste basket. "Here's something most visitors don't get to see." They ran behind him to the bay at the far end of the barn and crowded together to peer through the glass. "Look at that big mother! That's our vet." Nickers pointed at a small woman in a white coat who was leaning over a truck whose sides, swollen until she looked more like an Army tank than an oversized, civilian dog, heaved with the convulsions of labor. The truck's panting breaths echoed in the bay.

The great door at the end of the bay was creaking upward. As soon as there was room, an old, gasoline-powered farm tractor roared in, and a coveralled young man jumped off its seat.

"Chains!" cried the vet, and her assistant unwound heavy steel chains from the rear of the tractor and handed them to her.

Nickers explained: "It's a hard birth. With cattle, a come-along will do, but that just isn't powerful enough for a truck."

The vet was up to her shoulders in the truck's birth canal, doing something with the chains. When she was done, she screamed at her assistant, "Get that thing turned around!" When he had obeyed, she attached the chains to a tie-ring behind the seat and screamed again: "Move!"

The engine roared, the chains grew taut, and there was a sucking sound as the newborn pup emerged into the world. The tractor stopped, the chains went slack, and the vet tenderly removed them from the infant truck. It was three times the size of an adult, unmodified Saint Bernard, but naked, wet, and blind. The mother extended one paw to rake it in close to her side, where it began to nuzzle while she licked it clean.

Nickers sighed with relief. "They'll both be all right." A moment later, he said, "Look. The next one's coming on its own." Jimmy watched, and the tender smile on the vet's face brought an answering smile to his own, even as his fist clenched in sympathy with the laboring mother and his nails drove into his palms.

The vet obviously loved her giant charges, just as he had loved the mongrel bitch the Branes had once owned. Her name had been Ruffles. It had been the high point of his tenth year when she had had pups. But then they had had her spayed. She had disappeared when he was twelve.

“You'll love the next barn.”

“What is it?” asked Jimmy.

But Nickers said nothing more, even when they stood outside their next stop. Instead, he simply opened the door, stood aside, and said, “We clean up every morning, but...”

Jimmy and his Dad both choked when the thick, pervasive odor hit them. Nickers only shrugged and smiled; he was used to it. It took a moment, but in the way of noses, Jimmy's soon stopped protesting, and he was able to step through the door.

This barn was not divided into bays. The door Nickers held open let them into a small chamber whose walls had been welded together from inch-thick steel bars. It reminded Jimmy of nothing so much as a shark cage, the kind used to protect tourists who want close looks at man-eaters. Similar cages enclosed the barn's other doors. Between the cages, the barn was one cavernous room.

That room held at least fifty short-legged bulldog puppies. They ran in circles. They rolled. They yipped. They tumbled in fuzzy balls. They chewed on each other and old tires and logs. They lapped water that bubbled up in a concrete basin. They sniffed assiduously in the corners of three food troughs that might each have held a whole Armadon. Some even slept, curled up wherever the hay that littered the floor had been swept by ceaseless motion into piles.

Jimmy did not truly appreciate the size of the puppies until they reacted to the presence of the three men in the entry cage. Then, as they all stopped running, rolling, yipping, tumbling, chewing, lapping, sniffing, and sleeping and thundered toward the steel bars, he realized the truth: Every one of those puppies was the size of an old-fashioned pickup truck.

Nickers shouted, “Down!” The pups sat quietly just outside the bars. They did not whine or growl or prance. Their tongues, the size of bedsheets, lolled. Their short tails hammered cheerfully on the concrete floor. Nickers unlatched a gate on the inner wall of the cage and indicated that Jimmy and his Dad should go through. “They'll behave,” he said. “Just watch your step.”

“How do you ever housebreak them?” asked Dad.

“We don't. They're too big to come in the house, and outdoors there's usually a litterbug around.”

Jimmy was paying no attention to the pragmatic conversation behind him. Nor was he thinking of honeysuckle wine, or of lost friends. He was stepping through the gate into the midst of the puppy throng, staring, reaching, petting, finding that their coats were much rougher than he had expected, but.... They were white, black, brown, spotted, cute and ugly, large and larger. He focused on one that reminded him of a dog he had once seen in an old, old movie: it was a dark brindle, with a single white circle around one eye. “You're Tige,” he said, and he faced it, eye to barrel-sized eye, nose to wind-tunnel nose, and held out a hand for it to sniff.

Tije's mouth opened, and the immense tongue soaked the boy from foot to head.

Jimmy's fate was sealed.

* * * *

“Yes,” said Nickers later. “I'm a recruiter. And the pups are my best tool.” They were in a small room in

the farm's office building. The soft lighting was focused on Nickers' polished desk, though Nickers sat on a low couch against the wall. Jimmy and his Dad faced him from comfortable armchairs across a coffee table bearing a single pristine sheaf of papers. All three once more had cups of coffee in their hands. "We put the word out, and parents bring kids who don't know what to do with their lives. We give 'em the four-bit tour, and then we let the pups do their best. Which is pretty good."

Jimmy was wearing a Daisy Hill Truck Farm coverall. His own clothes were tumbling in a dryer somewhere on the premises. Now he said, "So what'll it cost me to get Tige?"

"Not a nickle," said Nickers. He grinned and slapped one knee with a hand. "We don't sell the pups."

Jimmy's face fell.

"I don't recruit customers," he added. "But truckers. If you wish, you move into the dorm upstairs over the puppy barn, and we train you while the pup—Tige—grows up. You work around the farm—you met Julie and Dan—and help train Tige. Then you work for us as a trucker. Driving Tige. And in ten years, Tige is all yours."

Jimmy was silent, thinking that the deal sounded reasonable enough. He reached for the papers on the coffee table. The top one was a contract. The others were informational, telling him the rules of the establishment, what he should bring with him, where the nearest shopping areas and public transportation stops were.

"One thing," said Nickers. "Your father's told me about the honey." He shook his head. "We tolerate none of that here. No drugs of any kind."

Somehow, Jimmy was not surprised. It fitted what he had thought about why his Dad had brought him here, and what he had seen—or failed to see—on the grounds. But the thought no longer bothered him. Tige had already begun to fill the void in his heart. He reached for the contract.

Nickers stopped him. "Not so fast. Take it with you, and think it over. For now...." He rose and opened the office door. "Alex?" He turned back to Jimmy. "Another trainee. He'll get you your clothes. They should be dry by now. And you can keep the coverall."

* * * *

"Those puppies," said Jimmy. "Do you remember Ruffles?" The farm's contract and other papers were on the kitchen table. The coverall was draped over a chair so the shoulder patch logo showed clearly.

"But they're so huge!" cried his mother. The whole family was sitting around the table. Jimmy's head was bent, his hands clasped before him, his voice soft. The others' eyes shifted constantly from the coverall to Jimmy to the contract, and back again.

"Yeah!" said Caleb. "Though I'd rather have a Roadrunner."

"If I drive Tige for just ten years, he'll be all mine." He was thinking the farm's deal over, he was, though he didn't expect the process to make much difference. Puppies and their all-forgiving, all-compensating love were not just for little kids, and if he had to become a trucker to get Tige, he would.

"And what then? How will you feed him?"

"I'll have to stay a trucker, won't I?"

"A Mack that big is no pet."

And Jimmy thought: Was puppy love no more than a trap, a lure for a vocation that would forevermore have him hustling to feed the pup, as well as himself, and eventually a family? Nickers had said as much, hadn't he?

"You won't be able to vege out on honeysuckle wine," said Caleb. There was a touch of "nyahh-nyahh" whine in his voice, but Jimmy ignored it. Nickers had said that, too, and though his head still ached and somewhere deep inside him lurked a craving for the honey, he thought he could handle it. He was not, after all, addicted to the stuff. He liked it, he wanted it, but it did not rule him the way it did the honey-bums he had seen under the highway overpasses.

Jimmy reached for the contract, drew it closer, and paused. He looked within himself for the honey craving. He measured it against his craving for Tige, for maturity, for life.

He straightened his back and looked at his Dad, sitting across the table. His mother noticed and began to cry.

"Got a pen, Dad?"

His father quietly drew a pen from his shirt pocket and, his own eyes glistening, held it out.

About the Author

Thomas A. Easton (1944-) is a biologist, textbook author, and science fiction novelist and critic with a strong interest in the interactions of science, technology, and society. His most recent book is *Taking Sides: Clashing Views on Controversial Issues in Science, Technology, and Society* (Guilford, CT: Dushkin Publishing Group, 4th ed., 2000).

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VI. The Rights of Man (and Other Creatures)

One of society's fears about science and technology is that they offer new ways to enslave, torment, and exploit people. The fear has some justice to it, for industrialization has been accompanied again and again by child labor, "company store" wage slavery, and the tyranny of efficiency experts who view people as little better than uncooperative machines. A recent wrinkle in this line is computer software that monitors keyboard operators to be sure they are typing fast enough. Thanks to advances in biomedical technology, people have been mugged for organs. Government researchers have dosed unsuspecting citizens with hallucinogens and radioactive materials.

It is really no wonder that some people think the best way to preserve the human rights to freedom, dignity, and autonomy is to limit the advance of science and technology. Certainly they object to treating human beings like laboratory animals (a theme beautifully handled in Daniel Keyes' classic "Flowers for Algernon") and as sources of spare parts, an objection that Robert Silverberg suggests might be threatened by an aging population, a high demand for organs, and a technology of routine organ transplantation. In the future he envisions, the young are "Caught in the Organ Draft," just as the young were caught in the military draft in the years before this story was first published.

People also object to treating human beings like factory machines or farm animals, valued only for the products they produce. In "The Newest Profession," Phyllis Gotlieb considers the kind of bioengineering that would let women grow "products"—here, drastically redesigned creatures—the way today they grow babies.

And of course people object that science and technology abuse the rights of animals used both in laboratory research and as sources of “product” (furs, milk, meat, etc.). In “Legal Rights for Germs,” Joe Patrouch asks how far the movement to protect the rights of nonhuman beings might go. As I said earlier, both science and science fiction have a powerful sense of play.

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17. Caught in the Organ Draft by Robert Silverberg

Look there, Kate, down by the promenade. Two splendid seniors, walking side by side near the water's edge. They radiate power, authority, wealth, assurance. He's a judge, a senator, a corporation president, no doubt, and she's—what?—a professor emeritus of international law, let's say. There they go toward the plaza, moving serenely, smiling, nodding graciously to passersby. How the sunlight gleams in their white hair! I can barely stand the brilliance of that reflected aura: it blinds me, it stings my eyes. What are they—eighty, ninety, a hundred years old? At this distance they seem much younger—they hold themselves upright, their backs are straight, they might pass for being only fifty or sixty. But I can tell. Their confidence, their poise, mark them for what they are. And when they were nearer I could see their withered cheeks, their sunken eyes. No cosmetics can hide that. These two are old enough to be our great-grandparents. They were well past sixty before we were even born, Kate. How superbly their bodies function! But why not? We can guess at their medical histories. She's had at least three hearts, he's working on his fourth set of lungs, they apply for new kidneys every five years, their brittle bones are reinforced with hundreds of skeletal snips from the arms and legs of hapless younger folk, their dimming sensory apparatus is aided by countless nerve grafts obtained the same way, their ancient arteries are freshly sheathed with sleek Teflon. Ambulatory assemblages of second-hand human parts, spiced here and there with synthetic or mechanical organ substitutes, that's all they are. And what am I, then, or you? Nineteen years old and vulnerable. In their eyes I'm nothing but a ready stockpile of healthy organs, waiting to serve their needs. Come here, son. What a fine strapping young man you are! Can you spare a kidney for me? A lung? A choice little segment of intestine? Ten centimeters of your ulnar nerve? I need a few pieces of you, lad. You won't deny a distinguished elder leader like me what I ask, will you? *Will you?*

* * * *

Today my draft notice, a small crisp document, very official looking, came shooting out of the data slot when I punched for my morning mail. I've been expecting it all spring: no surprise, no shock, actually rather an anticlimax now that it's finally here. In six weeks I am to report to Transplant House for my final physical exam—only a formality, they wouldn't have drafted me if I didn't already rate top marks as organ reservoir potential—and then I go on call. The average call time is about two months. By autumn they'll be carving me up. Eat, drink, and be merry, for soon comes the surgeon to my door.

A straggly band of senior citizens is picketing the central headquarters of the League for Bodily Sanctity. It's a counterdemonstration, an anti-anti-transplant protest, the worst kind of political statement, feeding on the ugliest of negative opinions. The demonstrators carry glowing signs that say:

Bodily Sanctity—Or Bodily Selfishness?

And:

You Owe Your Leaders Your Very Lives

And:

Listen to the Voice of Experience

The picketers are low-echelon seniors, barely across the qualifying line, the ones who can't really be sure of getting transplants. No wonder they're edgy about the league. Some of them are in wheelchairs and some are encased right up to the eyebrows in portable life support systems. They croak and shout bitter invective and shake their fists. Watching the show from an upper window of the league building, I shiver with fear and dismay. These people don't just want my kidneys or my lungs. They'd take my eyes, my liver, my pancreas, my heart, anything they might happen to need.

* * * *

I talked it over with my father. He's forty-five years old—too old to have been personally affected by the organ draft, too young to have needed any transplants yet. That puts him in a neutral position, so to speak, except for one minor factor: his transplant status is 5-G. That's quite high on the eligibility list, not the top-priority class but close enough. If he fell ill tomorrow and the Transplant Board ruled that his life would be endangered if he didn't get a new heart or lung or kidney, he'd be given one practically immediately. Status like that simply has to influence his objectivity on the whole organ issue. Anyway, I told him I was planning to appeal and maybe even to resist. “Be reasonable,” he said, “be rational, don't let your emotions run away with you. Is it worth jeopardizing your whole future over a thing like this? After all, not everybody who's drafted loses vital organs.”

“Show me the statistics,” I said. “Show me.”

He didn't know the statistics. It was his impression that only about a quarter or a fifth of the draftees actually got an organ call. That tells you how closely the older generation keeps in touch with the situation—and my father's an educated man, articulate, well informed. Nobody over the age of thirty-five that I talked to could show me any statistics. So I showed them. out of a league brochure, it's true, but based on certified National Institute of Health reports. Nobody escapes. They always clip you, once you qualify. The need for young organs inexorably expands to match the pool of available organpower. In the long run they'll get us all and chop us to bits. That's probably what they want, anyway. To rid themselves of the younger members of the species, always so troublesome, by cannibalizing us for spare parts, and recycling us, lung by lung, pancreas by pancreas, through their own deteriorating bodies.

* * * *

Fig. 4. On March 23, 1964, this dog's own liver was removed and replaced with the liver of a non-related mongrel donor. The animal was treated with azathioprine for four months and all therapy then stopped. He remains in perfect health 6 2/3 years after transplantation.

* * * *

The war goes on. This is, I think, its fourteenth year. Of course they're beyond the business of killing now. They haven't had any field engagements since '93 or so, certainly—none since the organ draft legislation went into effect. The old ones can't afford to waste precious young bodies on the battlefield. So robots wage our territorial struggles for us, butting heads with a great metallic clank, laying land mines and twitching their sensors at the enemy's mines, digging tunnels beneath his screens, et cetera, et cetera. Plus, of course, the quasi-military activity—economic sanctions, third-power blockades propaganda telecasts beamed as overrides from merciless orbital satellites, and stuff like that. It's a subtler war than the kind they used to wage: nobody dies. Still, it drains national resources. Taxes are going up again this year, the fifth or sixth year in a row, and they've just slapped a special Peace Surcharge on all metal-containing goods, on account of the copper shortage. There once was a time when we could hope that our crazy old leaders would die off or at least retire for reasons of health, stumbling away to their country villas with ulcers or shingles or scabies or scruples and allowing new young peacemakers to take office. But now they just go on and on, immortal and insane, our senators, our cabinet members, our

generals, our planners. And their war goes on and on too, their absurd, incomprehensible, diabolical, self-gratifying war.

* * * *

I know people my age or a little older who have taken asylum in Belgium or Sweden or Paraguay or one of the other countries where Bodily Sanctity laws have been passed. There are about twenty such countries, half of them the most progressive nations in the world and half of them the most reactionary. But what's the sense of running away? I don't want to live in exile. I'll stay here and fight.

* * * *

Naturally they don't ask a draftee to give up his heart or his liver or some other organ essential to life, say his medulla oblongata. We haven't yet reached that stage of political enlightenment at which the government feels capable of legislating fatal conscription. Kidneys and lungs, the paired organs, the dispensable organs, are the chief targets so far. But if you study the history of conscription over the years you see that it can always be projected on a curve rising from rational necessity to absolute lunacy. Give them a fingertip, they'll take an arm. Give them an inch of bowel, they'll take your guts. In another fifty years they'll be drafting hearts and stomachs and maybe even brains, mark my words; let them get the technology of brain transplants together and nobody's skull will be safe. It'll be human sacrifice all over again. The only difference between us and the Aztecs is one of method: we have anesthesia, we have antisepsis and asepsis, we use scalpels instead of obsidian blades to cut out the hearts of our victims.

Means of Overcoming the Homograft Reaction

The pathway that has led from the demonstration of the immunological nature of the homograft reaction and its universality to the development of relatively effective but by no means completely satisfactory means of overcoming it for therapeutic purposes is an interesting one that can only be touched upon very briefly. The year 1950 ushered in a new era in transplantation immunobiology in which the discovery of various means of weakening or abrogating a host's response to a homograft—such as sublethal whole body x-irradiation, or treatment with certain adrenal corticosteroid hormones, notably cortisone—began to influence the direction of the mainstream of research and engender confidence that a workable clinical solution might not be too far off. By the end of the decade powerful immunosuppressive drugs, such as 6-mercaptopurine, had been shown to be capable of holding in abeyance the reactivity of dogs to renal homografts, and soon afterward this principle was successfully extended to man.

* * * *

Is my resistance to the draft based on an ingrained abstract distaste for tyranny in all forms or rather on the mere desire to keep my body intact? Could it be both, maybe? Do I need an idealistic rationalization at all? Don't I have an inalienable right to go through my life wearing my own native-born kidneys?

* * * *

The law was put through by an administration of old men. You can be sure that all laws affecting the welfare of the young are the work of doddering moribund ancients afflicted with angina pectoris, atherosclerosis, prolapses of the infundibulum, fulminating ventricles, and dilated viaducts. The problem was this: not enough healthy young people were dying of highway accidents, successful suicide attempts, diving board miscalculations, electrocutions, and football injuries; therefore there was a shortage of transplantable organs. An effort to restore the death penalty for the sake of creating a steady supply of state-controlled cadavers lost out in the courts. Volunteer programs of organ donation weren't working out too well, since most of the volunteers were criminals who signed up in order to gain early release from prison: a lung reduced your sentence by five years, a kidney got you three years off, and so on. The exodus of convicts from the jails under this clause wasn't so popular among suburban voters. Meanwhile there was an urgent and mounting need for organs; a lot of important seniors might in fact die if something didn't get done fast. So a coalition of senators from all four parties rammed the organ draft measure through the upper chamber in the face of a filibuster threat from a few youth-oriented members. It had a

much easier time in the House of Representatives, since nobody in the House ever pays much attention to the text of a bill up for a vote, and word had been circulated on this one that if it passed, everybody over sixty-five who had any political pull at all could count on living twenty or thirty extra years, which to a representative means a crack at ten to fifteen extra terms of office. Naturally there have been court challenges, but what's the use? The average age of the eleven justices of the Supreme Court is seventy-eight. They're human and mortal. They need our flesh. If they throw out the organ draft now they're signing their own death warrants.

* * * *

For a year and a half I was the chairman of the antidraft campaign on our campus. We were the sixth or seventh local chapter of the League for Bodily Sanctity to be organized in this country, and we were real activists. Mainly we would march up and down in front of the draft board offices carrying signs proclaiming things like:

Kidney Power

And:

A Man's Body Is His Castle

And:

The Power to Conscript Organs Is the Power to Destroy Lives

We never went in for the rough stuff, though, like bombing organ transplant centers or hijacking refrigerator trucks. Peaceful agitation, that was our motto. When a couple of our members tried to swing us to a more violent policy, I delivered an extemporaneous two-hour speech arguing for moderation. Naturally I was drafted the moment I became eligible.

* * * *

"I can understand your hostility to the draft," my college advisor said. "It's certainly normal to feel queasy about surrendering important organs of your body. But you ought to consider the countervailing advantages. Once you've given an organ you get a 6-A classification, Preferred Recipient, and you remain forever on the 6-A roster. Surely you realize that this means that if you ever need a transplant yourself, you'll automatically be eligible for one, even if your other personal and professional qualifications don't lift you to the optimum level. Suppose your career plans don't work out and you become a manual laborer, for instance. Ordinarily you wouldn't rate even a first look if you developed heart disease, but your Preferred Recipient status would save you. You'd get a new lease on life, my boy."

I pointed out the fallacy inherent in this. Which is that as the number of draftees increases, it will come to encompass a majority or even a totality of the population, and eventually everybody will have a 6-A Preferred Recipient status by virtue of having donated, and the term Preferred Recipient will cease to have any meaning. A shortage of transplantable organs would eventually develop as each past donor stakes his claim to a transplant when his health fails, and in time they'd have to arrange the Preferred Recipients by order of personal and professional achievement anyway, for the sake of arriving at some kind of priorities within the 6-A class, and we'd be right back where we are now.

* * * *

Fig. 7. The course of a patient who received antilymphocyte globulin (ALG) before and for the first four months after renal homotransplantation. The donor was an older brother. There was no early rejection. Prednisone therapy was started forty days postoperatively. Note the insidious onset of late rejection after cessation of globulin therapy. This was treated by a moderate increase in the maintenance doses of steroids. This delayed complication occurred in only two of the first

twenty recipients of intrafamilial homografts who were treated with ALG. It has been seen with about the same low frequency in subsequent cases. (By permission of Surg. Gynec. Obstet. 126 [1968]: p. 1023.)

* * * *

So I went down to Transplant House today, right on schedule, to take my physical. A couple of my friends thought I was making a tactical mistake by reporting at all; if you're going to resist, they said, resist at every point along the line. Make them drag you in for the physical. In purely idealistic (and ideological) terms I suppose they're right. But there's no need yet for me to start kicking up a fuss. Wait till they actually say, "We need your kidney, young man." Then I can resist, if resistance is the course I ultimately choose. (Why am I wavering? Am I afraid of the damage to my career plans that resisting might do? Am I not entirely convinced of the injustice of the entire organ draft system? I don't know. I'm not even sure that I am wavering. Reporting for your physical isn't really a sellout to the system.) I went, anyway. They tapped this and x-rayed that and peered into the other thing. Yawn, please. Bend over, please. Cough, please. Hold out your left arm please. They marched me in front of a battery of diagnostic machines and I stood there hoping for the red light to flash—*tilt*, get out of here!—but I was, as expected, in perfect physical shape, and I qualified for call. Afterward I met Kate and we walked in the park and held hands and watched the glories of the sunset and discussed what I'll do when and if the call comes. *If?* Wishful thinking, boy!

* * * *

If your number is called you become exempt from military service, and they credit you with a special \$750 tax deduction every year. Big deal.

* * * *

Another thing they're very proud of is the program of voluntary donation of unpaired organs. This has nothing to do with the draft, which—thus far, at least—requisitions only paired organs, organs that can be spared without loss of life. For the last twelve years it's been possible to walk into any hospital in the United States and sign a simple release form allowing the surgeons to slice you up. Eyes, lungs, heart, intestines, pancreas, liver, anything, you give it all to them. This process used to be known as suicide in a simpler era and it was socially disapproved, especially in times of labor shortages. Now we have a labor surplus, because even though our population growth has been fairly slow since the middle of the century, the growth of labor-eliminating mechanical devices and processes has been quite rapid, even exponential. Therefore to volunteer for this kind of total donation is considered a deed of the highest social utility, removing as it does a healthy young body from the overcrowded labor force and at the same time providing some elder statesman with the assurance that the supply of vital organs will not unduly diminish. Of course, you have to be crazy to volunteer, but there's never been any shortages of lunatics in our society.

* * * *

If you're not drafted by the age of twenty-one, through some lucky fluke, you're safe. And a few of us do slip through the net, I'm told. So far there are more of us in the total draft pool than there are patients in need of transplants. But the ratios are changing rapidly. The draft legislation is still relatively new. Before long they'll have drained the pool of eligible draftees, and then what? Birth rates nowadays are low; the supply of potential draftees is finite. But death rates are even lower; the demand for organs is essentially infinite. I can give you only one of my kidneys, if I am to survive; but you, as you live on and on, may require more than one kidney transplant. Some recipients may need five or six sets of kidneys or lungs before they finally get beyond hope of repair at age seventy-one or so. As those who've given organs come to requisition organs later on in life, the pressure on the under-twenty-one group will get even greater. Those in need of transplants will come to outnumber those who can donate organs, and everybody in the pool will get clipped. And then? Well, they could lower the draft age to seventeen or

sixteen or even fourteen. But even that's only a short-term solution. Sooner or later, there won't be enough spare organs to go around.

* * * *

Will I stay? Will I flee? Will I go to court? Time's running out. My call is sure to come up in another few weeks. I feel a tickling sensation in my back, now and then, as though somebody's quietly sawing at my kidneys.

* * * *

Cannibalism. At Chou-kou-tien, Dragon Bone Hill, twenty-five miles southwest of Peking, paleontologists excavating a cave early in the twentieth century discovered the fossil skulls of Peking Man, *Pithecanthropus pekinensis*. The skulls had been broken away at the base, which led Franz Weidenreich, the director of the Dragon Bone Hill digs, to speculate that Peking Man was a cannibal who had killed his own kind, extracted the brains of his victims through openings in the base of their skulls, cooked and feasted on the cerebral meat—there were hearths and fragments of charcoal at the site—and left the skulls behind in the cave as trophies. To eat your enemy's flesh: to absorb his skills, his strengths, his knowledge, his achievements, his virtues. It took mankind five hundred thousand years to struggle upward from cannibalism. But we never lost the old craving, did we? There's still easy comfort to gain by devouring those who are younger, stronger, more agile than you. We've improved the techniques, is all. And so now they eat us raw, the old ones, they gobble us up, organ by throbbing organ. Is that really an improvement? At least Peking Man cooked his meat.

* * * *

Our brave new society, where all share equally in the triumphs of medicine, and the deserving senior citizens need not feel that their merits and prestige will be rewarded only by a cold grave—we sing its praises all the time. How pleased everyone is about the organ draft! Except, of course, a few disgruntled draftees.

* * * *

The ticklish question of priorities. Who gets the stockpiled organs? They have an elaborate system by which hierarchies are defined. Supposedly a big computer drew it up, thus assuring absolute godlike impartiality. You earn salvation through good works: accomplishments in career and benevolence in daily life win you points that nudge you up the ladder until you reach one of the high-priority classifications, 4-G or better. No doubt the classification system is impartial and is administered justly. But is it rational? Whose needs does it serve? In 1943, during World War II, there was a shortage of the newly discovered drug penicillin among the American military forces in North Africa. Two groups of soldiers were most in need of its benefits: those who were suffering from infected battle wounds and those who had contracted venereal disease. A junior medical officer, working from self-evident moral principles, ruled that the wounded heroes were more deserving of treatment than the self-indulgent syphilitics. He was over-ruled by the medical officer in charge, who observed that the VD cases could be restored to active duty more quickly, if treated; besides, if they remained untreated they served as vectors of further infection. Therefore he gave them the penicillin and left the wounded groaning on their beds of pain. The logic of the battlefield, incontrovertible, unassailable.

* * * *

The great chain of life. Little creatures in the plankton are eaten by larger ones, and the greater plankton falls prey to little fishes, and little fishes to bigger fishes, and so on up to the tuna and the dolphin and the shark. I eat the flesh of the tuna and I thrive and flourish and grow fat, and store up energy in my vital organs. And am eaten in turn by the shriveled wizened senior. All life is linked. I see my destiny.

* * * *

In the early days rejection of the transplanted organ was the big problem. Such a waste! The body failed to distinguish between a beneficial though alien organ and an intrusive, hostile microorganism. The mechanism known as the immune response was mobilized to drive out the invader. At the point of invasion enzymes came into play, a brush fire war designed to rip down and dissolve the foreign substances. White corpuscles poured in via the circulatory system, vigilant phagocytes on the march. Through the lymphatic network came antibodies, high-powered protein missiles. Before any technology of organ grafts could be developed, methods had to be devised to suppress the immune response. Drugs, radiation treatment, metabolic shock—one way and another, the organ rejection problem was long ago conquered. I can't conquer my draft rejection problem. Aged and rapacious legislators, I reject you and your legislation.

* * * *

My call notice came today. They'll need one of my kidneys. The usual request. "You're lucky," somebody said at lunchtime. "They might have wanted a lung."

* * * *

Kate and I walk into the green glistening hills and stand among the blossoming oleanders and corianders and frangipani and whatever. How good it is to be alive, to breathe this fragrance, to show our bodies to the bright sun! Her skin is tawny and glowing. Her beauty makes me weep. She will not be spared. None of us will be spared. I go first, then she, or is it she ahead of me? Where will they make the incision? Here, on her smooth rounded back? Here, on the flat taut belly? I can see the high priest standing over the altar. At the first blaze of dawn his shadow falls across her. The obsidian knife that is clutched in his upraised hand has a terrible fiery sparkle. The choir offers up a discordant hymn to the god of blood. The knife descends. My last chance to escape across the border. I've been up all night, weighing the options. There's no hope of appeal. Running away leaves a bad taste in my mouth. Father, friends, even Kate, all say stay, stay, stay, face the music. The hour of decision. Do I really have a choice? I have no choice. When the time comes, I'll surrender peacefully.

I report to Transplant House for conscriptive donative surgery in three hours.

* * * *

After all, he said coolly, what's a kidney? I'll still have another one, you know. And if that one malfunctions, I can always get a replacement. I'll have Preferred Recipient status, 6-A, for what that's worth. But I won't settle for my automatic 6-A. I know what's going to happen to the priority system; I'd better protect myself. I'll go into politics. I'll climb. I'll attain upward mobility out of enlightened self-interest, right? Right. I'll become so important that society will owe me a thousand transplants. And one of these years I'll get that kidney back. Three or four kidneys, fifty kidneys, as many as I need. A heart or two. A few lungs. A pancreas, a spleen, a liver. They won't be able to refuse me anything. I'll show them. I'll show them. I'll out-senior the seniors. There's your Bodily Sanctity for you, eh? I suppose I'll have to resign from the league. Goodbye, idealism. Goodbye, moral superiority. Goodbye, kidney. Goodbye, goodbye, goodbye.

* * * *

It's done. I've paid my debt to society. I've given up unto the powers that be my humble pound of flesh. When I leave the hospital in a couple of days, I'll carry a card testifying to my new 6-A status.

Top priority for the rest of my life.

Why, I might live for a thousand years.

About the Author

Robert Silverberg (1935-) has been one of the most prolific, imaginative, and versatile of U.S. science

fiction writers ever since he began his career in the 1950s. The winner of four Hugo awards (1956, 1969, 1987, 1990) presented by science fiction readers and five Nebula awards (1970, 1972, 1972 again, 1975, 1986) presented by his fellow SF writers, he is also remarkable for having shifted from early “pulp” writing to a much more artistic and literate style in the late sixties and seventies. He has also edited a number of influential original anthologies.

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18. The Newest Profession by Phyllis Gotlieb

Melba took her walks Upstreet in the bluing part of the evening during the few moments before the lights came on, and turned back downward before they had reached their peak. In her mind her hair was a long ripple, and her neck, wrists, fingers waited for jewels to add facets to the rising brilliance.

The streets were nearly bare now, shops idle. She got the occasional mildly curious, mildly contemptuous glance; she was hardly visible in the dark uniform cape, empty hands hidden behind its slits; she was a big girl in good proportion, but her face, without makeup, faded in the dimness, and her fair hair was cut mercilessly straight around at earlobe length. The long, strong legs in flat-heeled shoes paced evenly: Their only ornament was a small pedometer on a fine chain about one ankle.

When she crossed the road and turned downward there was a shadowland to pass before safety: The keepers of the shops and the servants of the rich who bought from them lived in narrow streets; they did not trouble her, but their children absorbed and vented the attitudes they did not express. When the wind howled up the street from the west and folded back her cape on the expanse of her belly, children young enough for tag and hopscotch yelled names they had likely not thought of by themselves. “Bitch,” “cow,” “brood mare” were mild enough; tripping and stone-throwing were not.

The stone that hit this evening landed on her temple and made her lose balance. She did not fall this time but turned her ankle and knocked her shoulder against a lamppost. The policeman who came from shadow—they always turned up afterward, never before—reached an unnecessary hand to steady her and said, “You all right, miss?”

“Yeah.”

“There's a cut on your forehead and I—”

“I'm late already and I can walk. You want to give me a ticket or somethin'?”

The hand pulled away, and she went on, limping slightly. Maybe the damn pedometer had gone bust.

Children, back of her, being called to supper, yelled:

Monster, monster, suck my tit!

Dunno if you're him, her, it!

Himmerit! Himmerit! The words slurred. She knew. It was *her* and it would never suck.

She looked outward at the bloody Sun splayed on the horizon, gross as her belly. Way out beyond Downstreet the spaceport blasts sparked, then warehouses, repair shops, hostels climbed.

Out of shadowland into near darkness. Retired Astronauts' homes and Hospice—safe enough, window

lit here and there, harmonica whispering of cramped quarters in rusty scows that crossed the voids, words no cruder than the children's song. Safe enough for her to give in to the pressure pains and bend over, straighten up.

Next door, NeoGenics Labs, Inc. Home.

* * * *

“Three minutes late,” said the Ox in the Box, not looking up.

“Yeah. Tripped over my feet.” Stiffly she bent to unhook the pedometer, not broken, and showed it at the wicket. “Two km.”

The Ox looked up. Her name was Dorothy, and she and Melba were not at odds, merely untalkative. A stout woman in her forties, graying black hair chopped short and brushed flat back. Sterile or sterilized, sometimes she flushed in heats that no chemical seemed to cure. “You didn't get that thing on your head from tripping over your feet.” She rang for a doctor.

* * * *

When Melba reached the dining room with a patch on her head and a tensor round her ankle everyone else was half through. She picked up her numbered tray and the whitecapped jock dished out a rewarmed supper from under the infrared. “Bump into a door?”

“What else?”

She took her seat beside Vivian. There were no rivals for it. She was Number 33, Table 5, and there were never more than fifty eaters. Alice, Pam, and Del glanced up and went on shoveling in. Vivian said, “Upstreet again.”

“I like the lights, Viv.”

“Second time this month. What was it this time?”

“Kids.”

“Whoever made up that shit about sticks and stones will break my bones knew at least half of what he was talking about. What did the Ox say?”

“Nothing. Just got the doctor. She's okay.” Melba pulled herself as close to the table as her belly would allow and stared at the little card on the tray: Meal 200 grams, starchy vegetable 150 grams, green vegetable....

Pam said, “She knows you could knock her here to hell and gone with your belly.”

Melba shrugged. That was what passed for wit here, and she had little of it herself.

Vivian laughed, but she was a nervous laughter and Melba not easily offended. Viv was the smallest and liveliest of the lot, and Melba liked her for making up what she herself lacked. Her hair was black and curly, with the barest hint of premature gray at the temples; her eyes were Wedgwood blue and her lips a natural red envied by a company of women forbidden cosmetics for the risk of dangerous components.

Melba always ate quickly and finished first, in contrast—as they were contrasting friends in every way—to Viv, who was picky. Her tray was empty by the time the jock came to replace it with the pill cup.

Viv's nostrils flared: she was not among the few who were allowed three cigarettes a day and flaunted their smoke after supper. There was more harmless dried herb in it than tobacco, but it smelled like something she loved. However, she was one of the favored allowed a cup of tea to wash down her pills.

Melba drank a lot of milk fortified with yet another drug or vitamin. She turned the medicine cup into her hand and stared at the palmful of colored pills. "Ruby, pearl, emerald—and what's the yellow one again?"

"Topaz—or vitamin D. Only a semi-precious stone. Still think you'll get to wear them?"

Melba smiled her long slow smile. "I hope."

Viv shook her head. A room with fifty women in cone-shaped denim dresses. Metal chairs; metal tables with artificial-wood tops; institutional-cream walls. "Maybe you will. Maybe."

Because the money after all was tremendous. What did not get put into surroundings went to equipment, technical expertise, and the bodies of the women.

It was Melba who waited for Viv, after all, while she lingered over her tea. Pam and Del left to play euchre; Alice, yawning, deflated her cushion ring and went to bed: she was only two weeks postpartum. One or two of the jocks hung around, mildly resentful of the still cluttered table. They were men chosen for low sex drive and lack of aggressiveness. There was no sexual activity allowed the gravid women, except in their dreams, and none on the premises among inbetweeners. Whatever there was had been made difficult enough by propaganda harping on dozens of forms of VD, major and minor.

"Goddamn nunnery," said Viv.

Melba didn't mind. She liked the money. She was big, healthy, slow-thinking, and did not have much trouble pushing back her feelings. Others put up and shut up with resentment. They all knew none was considered very intelligent. No one within their hearing had ever called them cows or sows, but the essence of the words hung like a cloud, drifted like fog. The women turned their backs on the jocks, the Psychs, the Ox, and told each other the stories of their lives.

Melba said softly, "You didn't take your water pill again."

Viv gave her a look of mingled guilt and reproach. "How'd you know?"

"Saw you palming it."

"They make me feel sick."

"I don't like that rotten milk either. You get high blood pressure and you're out."

Viv had a tight water balance. Her belly specialized in dry-worlders; Melba, who bred underwater life, drank all the time, thirsty or not.

"I don't care. This one's my last."

"Not if you don't watch out. I'll be in emeralds and you'll be lying sick somewhere."

Viv, cyclonic, turned bright red and stood up quickly. Melba grabbed her by the arm. "I'm sorry, Viv, I'm sorry! Please! Take the pill."

Vivian sat down slowly. Melba's eyes were full of tears. "I'm sorry, Viv. I don't mean to be so dumb."

“Oh, for Chrissake, don't call yourself dumb. You've got a mind like one of those mills you read about that grinds slow but fine.”

“Yeah, and they rot to pieces and everybody says what beautiful scenery. Don't forget the pill, Viv.”

“And you never give up, do you?” Viv sighed, fished the pill from her pocket, and swallowed it with the dregs of her tea. “Four male, three female.” Her belly was a small polite bulge with the third. “In a thousand years they might fill a planet. In the meantime I'm tired.”

Melba had never asked if Vivian went down to the creche, nor often what she did with her spare time, besides visiting library and bookstore. Most women here were of a class to whom steady high unemployment and the debilitation of the nuclear family gave little choice. Men in this stratum had even fewer opportunities. The Y chromosome could be found in any healthy man.

But few women went down to the creche though none failed to promise herself to do it. Not many boasted of affairs, either with men or other women, or discussed what they did with their time, even when they visited their families, so that they were in the peculiar situation where few knew what others were doing, but all knew what everyone had done before she came to NeoGenics. Loose talk was discouraged by the Company, to preserve they said, anonymity. Nevertheless, Melba, though she did not know if Viv had seen those children, down in the huge rooms of tanks and enclosures, knew that the age limit was thirty, Viv was twenty-eight, and that both she and NeoGenics agreed that seven would fulfill her contract.

“You're lucky you've only got a couple of weeks.” Viv slowed her walk to match Melba's, careless of the grateful clatter of table-clearing back of them.

“Yeah, but I still need the two males, and they're not the kind of little mousy thing you grow.”

“Hey, don't insult my kids!”

“I'm not, Viv. I hope they look something like you.”

“Then go down and see!”

Melba shuddered. “I'm scared. I'm scared to think what mine look like.”

“Being scared is like calling yourself dumb. Working at being a cow.”

Difference. They got on each other's nerves, but they got on. Viv wanted to go to a good school and learn everything she could absorb and then go out and teach anyone who would listen.

“Well, I kind of want to be a cow,” Melba said mildly. “I want a nice place with a lot of good stuff in it, and I don't care if I don't spend the money usefully.”

“And be a fine lady? Oh, Melba, I'm so tired of hearing that!” She leaned against the dirty cream-colored wall of the corridor and looked up at tall Melba. Her eyes were not quite like the Wedgwood in the store windows: that did not have the fine glaze. “I bet you think men will come along and load you with diamonds—if you can get a plastic job on your belly that makes you look like a virgin!”

“But I can't learn things in a school like you.”

“Will I really be able to sit in a school after seven births, when my metabolism's shot and my patience is gone—and I'm hyper enough already, not just from blood pressure? It's a dream, Mel, like everybody else has. Did anybody who's been here ever come back or call or write to tell how she's done?”

“They want to forget the place. You can't blame them for that.”

“It's also because they go out and find there's no other place. They're dead at thirty, with the guts eaten out of them; they run through the money; the plastic job bags out on them; they're ruined for having kids of their own.” She looked away. “I have met one or two ... not too keen on remembering or recognizing. They're cheap whores, or if they're lucky they get a job selling secondhand in a basement. What the hell. You aren't listening.”

“But I am, Viv. I won't let it happen to me.” She added, “And don't be scared I'll end up some junked-up whore either.”

Vivian laughed. “I admit I can't see any pimp beating up on you.”

Melba thwacked her watermelon-belly with thumb and finger and laughed with her.

* * * *

Melba lay in bed and reread the letter.

Now the plant got retooled your father went back to work so we hired on Karl Oleson to get in the vegetables. With what we use and what we pay him theres not much left from what gets sold. Wesley has run off with that Sherri in the drug store that I always said was cheap. He left in the middle of the night or your father would of slammed him. He left a note which I wont repeat what he said about your father. He didn't even say Love. Half the radishes got cracked on account of the wet. Noreen is pregnant again and won't say who but I wouldn't let your father touch her on account of the one that died. Even though it was a blessing God forgive me. They don't dare give us a cross eyed look in town because I know all about THEM. She could have an abortion but she says she wants something to love. I don't know where she got that idea at seventeen. Her having something to love means I get to take care of it while she runs with dirty bikers. I just cant stand it. Its a good thing your father is working again he just sat and moped and all I got from Wesley and Noreen was a lot of mouth. You dont say much in your letters but I guess you can't help it if it's Govt work. It's hard enough writing to a P.O. number you dont even know what city it's in and I don't know what you're doing. I wish you would just get married. I dont see why not. Everybody used to say Noreen was beautiful and look where it got her so beauty isn't everything. I hope what your doing is respectable. It's enough to drive you crazy around here. I guess that is all for now. Write soon. Your loving Mother. Your father says him too.

ps I'm glad you could spare the money because we needed it.

She folded the letter away with all the others and reached to turn off the light. The intercom buzzer sounded and she switched on.

“Mel—” the voice was Vivian's but so slurred it sounded dead drunk. Viv did not even like whiskey.

“Viv? What's the matter, Viv?”

“Mel...? Come, Mel...”

She pulled her awkward terrible shape out of bed and knotted the rough terry robe. Viv's room was three away. In the few seconds it took to reach it a terror seized her, and she slid the door with shaking hands.

The lights were on. Vivian, still dressed, was lying diagonally on the bed. Her eyes were open and glazed. The left one turned out slightly, and from its corner tears were running in a thin stream; the side of her

mouth dragged down so far her face was distorted almost beyond recognition.

Melba knew a stroke when she saw one. She did not ask whether Vivian had called the doctor but slammed the buzzer and yelled.

Viv raised her working hand a little. “Be all ri...”

“Oh God Viv, why didn't you take those goddamn...”

But the one comprehending eye Vivian turned on her was terrible. “Never meant—”

Melba grabbed at the hand. “Oh, Viv—”

“So sorry...”

“Don't talk. Please don't talk.”

“Stay, Mel...”

“I'm here. You'll have help soon.”

The hand was moist and twitching. It wanted to say something the mouth could not speak.

“Now ... who ... will love...”

“Everyone loves you, Viv. I and everyone.”

“Don't mean ... mean, the children, Mel ... the chil...”

Stretcher wheels squealed around the doorway and attendants lifted Vivian in her blanket. Her hand pulled away from Melba's and her eyes closed.

“Stroke,” one of the men muttered.

“I know.” She had seen her grandmother taking pills by the handful, and dying too. But her grandmother had been seventy-five.

“Good thing you found her when you did.”

“Yeah.”

The room was empty. Very empty. The pot of russet chrysanthemums sat on the windowsill like setting suns between the muddy blue drapes. The colored spines on the orderly bookshelves blurred into meaninglessness. Melba pulled herself up and shuffled back to her room.

Two or three heads popped out of doorways. “Viv took sick,” she muttered. “I dunno if it's serious.”

She lay on her bed and turned the light dim. The sea beast swam in her belly. She had become so used to its movement, the fact that she noticed it now surprised her.

Big, slow thing, like me.

Vivian, all tight wires and springs, had broken.

She'll be through here. Maybe crippled—and oh, I said—

Floors below there was a white room where doctors worked on that frail pulse. Deep below that there were tanks where monstrous children turned in sleep so that terrible worlds could be reaped and mined. *Forthem*. They would not care. They had the four females and two males they would breed to build their stone gardens. She beat her fists once on the unresounding drum of her belly.

Buzz.

Her hand, still clenched, punched the button.

“Melba?” The Ox's rasp voice, expressionless.

“Yeah.”

“Wake you?”

“No. What—” Her throat went dry.

“She's dead, Mel. Thought I'd tell you first.”

“I—thanks, Dorothy.”

“For goddamn bloody what!” the Ox snarled and slammed off.

She sat like stone. She had expected it. What else with her luck could happen that she could find a friend, one friend worthy of respect, and have that good fortune taken away? She was ashamed of her selfishness, and yet the fact of death was too painful to go near.

She lost track of time, mind blanked out, until her diaphragm buckled sharply, and she fell back on the bed, choking. Then, as if a dam had burst the waters rushed out of her, and her throat opened in an uncontrollable and unending howl.

* * * *

First there was the tube in her nose. Then the cone over her mouth, oxygen tasting like dead air already breathed by everyone in the world. Tubes in the wrist and belly. Shots in the buttocks.

Tubes ... and pain ... in the belly?

She opened her eyes. Nurse pulling off EKG cups pop-pop. Scraggy-beard face of A. J. Yates. Her doctor. Old Ayjay.

“We had to do a Caesarean,” he said. “She was a damn big walloper.”

She closed her eyes and dreamed of walking Upstreet with her long hair blowing in the wind. Jewels on neck and wrist, wings on her heels, bells on her toes.

You know that's silly, Mel, said Vivian.

“What?”

Ayjay: “I said you know we can't let you go through more than one other now you've had the cut. It'll have to be the male, and it'll have to be good.”

Yes. They guaranteed their product: they had tried a male once before, and aborted because it was malformed.

“But the males are a lot smaller, so it shouldn't be too much strain. Maybe we can try for twins. Um-hum. It's an idea. Hum-hum. We'll think about it later. In the meantime, you're in pretty good shape. When you graduate after the plastic job you'll be in fine shape.” He stood.

“Viv. Isn't.”

“Um, well ... oh, I'm glad you reminded me. The inquiry's in four days, and we'll have to get you up a bit for that, as a witness, but we'll take care not to tire you.”

Bye-bye, Ajjay. Her eyes closed.

That's a damn dumb idea, said Viv.

“What?”

“Drink this,” said the nurse.

She drank and ran her hand over the bandaged hump, the still huge and swollen womb that slid and shifted as if another fetus were waiting there to be born.

Wings on heels, bell on toes. Twins!*Dumb*. Her eyes closed.

* * * *

Four days of hell. The walls were sickly green. “Why do I have to go to the inquiry?” she asked the nurse.

“You were her closest friend, weren't you? They'll want to know anything you can tell them about her behaviour. If she ate or drank anything out of the way, like that. After all, she's only the second death we've had here, and the way we take care of them nobody should die.”

In hell it is life everlasting. *You didn't take your water pill again.*

“Will I have to go under the scanner?”

“Of course. You aborted just after I came, didn't you? And you went under when you were questioned at the tissue conference. It's in your contract. Didn't you ever read it?”

Melba said, “I only asked a polite question, Nurse.”

The nurse gave her a look. She gave the nurse a look.

“I'm sorry. I have other patients to care for.” Whirl away of white skirt.

* * * *

On the third day, a reprieve. The Ox tippy-toed in, bearing a painted china mug filled with delicate flowers. The Ox, a friend. The friend.

“Oh, that's lovely, it smells so good. Dottie, did you think of watering Viv's flowers?”

The Ox looked down. “I took the pot to my room. You can have it when you get out, if you like.”

“Oh no, you keep it, please. She'd have been happy...”

“Melba, don't cry now. Wait till after tomorrow.”

“Dottie, I'm scared shitless. I'll have to go under the scanner, and I don't know what to say!”

“Tell the truth, whatever it is,” the Ox said grimly.

“I’m afraid they’ll twist everything around.”

“They won’t twist you,” said the Ox.

* * * *

But she did not believe that when the jock came for her with the wheelchair. At the tissue conference they had had her almost believing she was some kind of criminal. Viv had pulled her out of that, but there was no...

“It’s only one o’clock. I thought the Conference was at two.”

“Yeah, but I’m available and so’s the chair. What’s it to you?”

“I’ve got a damned sore belly and I feel like a gutted fish. I’m not sitting around in a wheelchair doing nothing for an hour.” She needed the hour to think in, but she had been thinking for four days.

“Okay, okay, I’ll come back when your ladyship is ready.”

A thought ripened. “No. Wait.”

“What now?”

“As long as we’ve got this time I want you to take me down into the creche.”

“Aw, come on! First you’re too sick and weak to sit in a wheelchair, an’ now I’ll end up bringing you up in no condition to testify at all an’ I’ll have *my* ass in a sling for it. I haven’t even any authorization for that.”

“You don’t need authorization. *I* have read my contract and it says I have the right to see the whatsits.”

“Conceptees.”

“Yeah. So let’s get going.”

It was shamefully easy to bully a jock. “Listen, if there’s any trouble I’ll swear under the scanner that I insisted and I’m to blame.”

But it was he who insisted on phoning the creche first and was not happy to be invited to come down.

Nor was she, in truth. It was hard sitting in the wheelchair, even though her body did not look the way it had done after previous births, as if a volcano had erupted from it. The pain, in a different place, hurt as much. But she was doing something, besides having babies, that pushed at her from inside.

* * * *

The white-coated woman, surprisingly, had a kind face.

“You are feeling better now, my dear?” She had sharp foreign features and some kind of accent; her hair was tightly curled blond, dark at the roots.

“Not much. I just thought ... I’d like to see...”

“Your friend came here often, and looked at many of the children. Yours too. Down this way.”

A cold knot in the chest.

Her youngest, twice the size of a normal newborn, slept in a small tank of its own, but the others, chasing through the cool and weed-grown water, seemed far too big even to have been born of woman.

These were not freaks. Freaks were warped and ugly caricatures, and these were a different species. Very dark red, hairless, their lidless eyes had no discernible expression, and no glance rested on her. The noses and chins were flattened back; the creatures had no fins, webs, or scales, but long, firm rudder-tails like those of tadpoles, and their limbs fitted close to their bodies for streamlining. She felt no pity or horror. They were purely alien. She wondered if they could see beyond the glass and water.

“Can they live outside the tanks?”

“Only for a moment or two.”

Upstreet. Downstreet. Undersea. Another direction. Another dimension.

“They don't look much like me.”

“Only about the forehead and cheekbones. A good model.”

“Oh yeah. What will happen to them?”

“They will mature in a few years, and if they breed well they will make up a little colony and be sent to supervise underwater installations on a world where the seas are suitable for them.”

Servants or slaves?

“When you get a male.”

“A viable one. Those are more difficult, but by the time these mature we will probably have developed modified sperms to fertilize them with, so they can breed their own males.”

“Oh,” said Melba. So much for twins. “Are you allowed to tell me your name?”

“Of course. Natalya Skobelev. So you will know whom to ask for when you come down again.”

Again.

“You got twenty-five minutes,” said the jock.

“I want to see—to see Vivian's...”

There were hours to crying time.

“Oh my God! Monkeys!”

“No, no! Arboreal hominids, with one more step to reach humanity!”

That would be some step. But she looked closer. They peered back at her, taut wiry bodies dancing on the branches of the desert tree in the enclosure. *Vivian!*

These were tailless; they had tiny capable hands and prehensile big toes. Their bodies were covered with light down but there was dark curly hair on their heads, and they had small sharp noses and neat red mouths. Vivian looked from their blue eyes.

They blinked. Melba scratched at the glass and they giggled as if they had been tickled and sucked their little thumbs.

“They look much more like her,” she whispered.

“We used more of her genetic material.”

“And what kind of work will they do?” she asked dully.

“Feed on and harvest medicinal herbs, at first. Then like yours, they will find other things to do as they choose, I hope. Build civilizations in seas and deserts.”

Was this woman here to tell fairy tales? A publicity hack? But her sincerity seemed not only genuine but passionate. NeoGenics was a business that grew servants and slaves. Yet ... slaves had become free.

“Maybe they will. Maybe.”

“Time's up,” said the jock.

“I know. Thank you for showing me around, miss.”

“Remember: Natalya Skobelev, my dear. It is not an easy name.”

“I won't forget it.”

* * * *

She felt shrunk and distorted, but the scanner did not register that. There was no broadcasting of any sort in the auditorium, and no public audience except for the carefully picked jury of six unbiased civilians. Plus the coroner, a group of company officials, and two lawyers.

She let the preliminaries run over her head. A great deal of explication. What NeoGenics had wrought, for the benefit of the jury. Circumstances leading up to, unknown. What medical staff had done for the stricken patient. Useless. All evidence given under the scanner. No one else looked frightened or sickly.

Finally she was helped to the stand and fastened to the scanner.

“Note pseudonym: Ms. Burns.”

“Melba Burns. Toast.”

“Ms. Burns, do you swear to answer truthfully according to your knowledge?”

“Yeah. Excuse me, yes.”

“You have been employed by NeoGenics for four years and three months, during which time you blahblahblah?”

“Yes.”

“Control set,” said the woman at the scanner console. The Ox slipped in and sat in the back row, a patient block of stone in her good dress, flowered navy, incongruous out of the grey uniform. No reassurance there.

Melba could not see the console screen, nor the one that was projected in back of her; the framework about her head prevented that. There was no chance of conscious attempt to control the lines of blips. She did not believe she could do it, and would not try. She was here to betray, and that was the end of it.

The lawyers were a Mutt-and-Jeff pair: the big one to protect the Company's interests, the little one

acting for Vivian's relatives, to make sure the Company could not prove she had reneged on her contract, and refuse to pay out the money owing her.

Lawyer Number 1 said, "Ms. Burns, to our knowledge the deceased, Vivian Marsden, considered you her closest friend here."

"I hope so. She was mine."

"I know the company does not encourage confidences among their employees in order to protect their anonymity in the community, but—" syrup mouth, "I am sure there must have been some confidence exchanged—"

Number 2: "That is an improper question."

Mutt raised an ingratiating hand. "I am not asking the witness for gossip about personal details confided by deceased or gathered from others. I also wish to keep this questioning period brief because of the personal suffering of the witness."

Number 2: "Very sound and thoughtful."

Melba did not care. The *arboreal hominids* leaped from branch to branch, giggling.

"But the basic question rests on the physical condition of the deceased, Vivian Marsden. Not what has been reported on by medical staff, but what may have been observed by the witness, or told her by Ms. Marsden. Whether she looked ill or complained of feeling ill. Whether ... she might have been harming herself, unknowingly or not, by taking unprescribed drugs, alcohol, tobacco, or ignoring dietary regulations?"

Number 2: "Mr. Coroner, my friend is asking the witness to condemn the deceased out of hand!"

"But that does seem to be the point that must be addressed," said the coroner. "Ms. Burns, will you try to answer the question as simply as possible, even though it is a complicated one?"

"Again, was Vivian Marsden taking unprescribed drugs, or alcohol, or tobacco, or not eating properly?"

Melba wet her lips. "She didn't when I was with her, and she never talked about it. She hated alcohol. I know she missed cigarettes, but she didn't smoke." Her heart was in her gut. She glanced at the Ox. The woman's face was flushed, and her eyes full of pity.

The little lawyer said dryly, "I think it has been established by general inquiry that no one has more exact information."

"There is another direction to travel," said the Company man, just as dry. "Ms. Burns, is there anything necessary to the state of her health that Ms. Marsden *neglected* to do?"

Melba stared ahead and breathed hard.

"You must answer, you know," the coroner said gently. "It concerns the health of all the other employees of the Company."

Melba did not need the screen to know that her heartline blipped like mad. "Sometimes she put her water pill in her pocket after meals. She said she didn't like taking it because it made her feel sick."
Forgive, forgive!

"Ah. You mean the diuretic."

“Whatever took away the extra water she wasn't supposed to have.”

Number 2 said quickly, “That is no proof of the cause of an aneurysm. She may have taken the pill later.”

“Or not at all. It is suggestive. How often did this happen, Ms. Burns?”

Melba found herself grinding her teeth. “No more than twice a week that I knew. I kept an eye on her to see what she did with it, and when I noticed her hiding it I made her get it out and take it while I was watching her.”

“She could have found ways to avoid ingesting it if she were determined. Hidden it under her tongue, vomited it up—”

Melba snarled, “Oh, for God's sake!”

“Please restrain yourself, Ms. Burns, and strike those last two remarks. What deceased *did not* do cannot be accurately inferred from what she was observed to have *done* by an untrained witness.”

But the lawyers, ignoring witness and coroner, were engrossed in each other, doing some kind of mating dance.

“I suggest that we ask permission to recall the pathologist to enlarge on his report.”

“I agree. Absolutely. Mr. Coroner, may we call the pathologist to witness?”

“You may,” said the coroner. “Is Dr. Twelvetrees present? Ms. Burns, would you please stand down now?”

The millstones ground. “No!” Melba cried. “It's not right!”

“Ms. Burns, I know you are distraught.”

“If that means I'm upset, I'm damned upset. And maybe everybody thinks I'm stupid. But I'm not crazy. Sir, please let me speak for one minute!”

The coroner sighed. “If you have a contribution to evidence, Ms. Burns, go ahead. But please keep your remarks brief and to the point, as the lawyers are supposed to do.”

There was a mild snicker. Melba despised and ignored it. “Maybe I can help bring out evidence.” She took breath. “I thought we were here to find out just why Vivian died but this fella here acts like she fell in a ditch when she wasn't looking, and this other one is trying to put her on trial for murdering herself. I've answered all the long questions as well as I could, and now I'd like to ask two short questions.” She pointed. “This guy.”

“You wish to address the Company lawyer?” He scratched his head. “This *is* an enquiry and not a trial. Go ahead, but—”

“I *will* keep it short. I want to ask, Mr. Lawyer: did Vivian Marsden have high blood pressure before she came to work for you when she was nineteen? And would she have been cured of it after she left?”

Silence fell with a dark gray thud. A man slipped out of the room, and no one blinked. The lawyer opened his mouth and shut it again. Then, “After all, Ms. Burns, everyone knows there is some risk.”

“Yeah. I guess that's all. Only ... the last words she ever said to me were: *Now who will love the children, Melba?* and I didn't even know what she was talking about. I'm sorry I took up your time and

I'll stand down now. Please ask that lady in the corner if she'll take me back to my room. I don't feel well."

"You did good," said the Ox.

"Yeah. And a lot of good it'll do. Everybody will be mad at me for telling about the pills."

"Between you and me, I think a lot of people knew she was trying to hide them, but nobody else made sure she took them, the way you did, so they can be as mad as they like."

* * * *

She dreamed, a layered and complex dream of creatures in tanks, and children screaming dirty words in the streets, and worlds where the children of NeoGenics stared with empty eyes and died sterile. And her sister Noreen giving birth to a....

The door chimed.

"Come in," she said in her dream. Noreen's child was....

"It's over," said the Ox. "Death by misadventure. Nobody to blame, officially. Vivian's heirs will get their money."

She rubbed her eyes. "I hope they don't throw it around."

"No use being so bitter."

"I have no friend."

"You can count me as kind of half of a friend. I wouldn't mind."

"I'm sorry, Dottie. I'm behaving like a crud. You are a friend."

And Skobelev. She would be useful if old Ayjay got twins on the brain again.

"There were some jury recommendations. You interested?"

She said drowsily, "I guess so."

"About giving the public greater access to information about our beloved Company. Knock off some of the name-calling and stone-throwing. Not fast and not much, but some. And letting government health organizations have a hand in the choice of breeders. The shit hit the fan when they found Twelvetrees. He'd run out to dig up Viv's county health records—which he should of done in the first place and found cases of blood pressure in the family history."

"Huh. I was trying to say they'd given her the high blood pressure."

"They brought it out by accepting her without investigating enough. And there were one or two things you said that they needed to hear. Well, I guess I better get back to work, but like you, I have one more question. Now you got your brains working, the way Viv always said you ought, what are you going to do with them?"

Melba smiled. And she had not even cried yet. "Gimme a chance, Dottie. They're still awful creaky."

* * * *

I did pretty clumsy, Viv, but it was the best I could. You never belonged here. You should have had

a man who could give you proper kids, and I'll never know why not. I don't know why I didn't either, except the home I came from isn't the kind I'd want to have. Maybe I never thought I was good enough to make a better one, but I dunno. The old man's a bastard, but he's proud of working, and Ma won't let herself be shamed. There's nothing wrong with that, is there? But kids can't find enough work to be proud of now, and we're not ashamed of the same things. Poor Noreen. She really is stupid, God forgive me. One thing I can do with the money is get her out of there. Maybe in some kind of shelter, Dorothy'd know, but not around this place. So her baby could at least have a chance to be a person.

Viv? We had all those, and what will they do? They should have had worlds that could grow them by themselves to make their own dumb mistakes, not the ones we make for them ... but I can do something for Noreen....

And if I'm very good and very lucky there'll still be some money to throw around. Aw, Viv, you know there's nothing much wrong with that either. Better than wait until....

... Emerald, ruby, diamond ... and the yellowish one. Topaz. Long hair for fingers to tangle in and kind of go shivering down my back ... ah....

Where'd I find a fella like that, Ma? Well, I'm not preg all the time, and I've seen other eyes on me besides yours. Looking for different things. And maybe....

* * * *

She slept without a dream.

About the Author

Phyllis Gotlieb (1926-) is a lifelong Toronto resident who has published seven novels (six of them science fiction), four volumes of poetry, and a story collection; she has also co-edited an anthology of Canadian science fiction. Her work often uses science fiction to consider and comment upon human nature.

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19. Legal Rights for Germs by Joe Patrouch **LEGAL RIGHTS FOR GERMS?**

(UD Jan. 17) Mr. Felix Gardener, a carpenter living in Des Moines, Iowa, today filed a class-action suit in federal court on behalf of all viruses, bacilli, etc. (in short, germs) living in and on the human body. "Every creature, however small, has a right to live its own life," Mr. Gardener explained. "By bathing and by taking medicines to combat what the doctors—in their slanted language—call 'diseases' and 'infections,' we are killing billions and billions of living, experiencing creatures each and every day."

When asked about the origins of his suit, Mr. Gardener said he had always believed that flying saucers were interstellar spaceships carrying sentient beings from a higher civilization to our own, and that these beings have not contacted us because we show so little respect for life in all its forms. We casually kill insects to keep our homes comfortable and our crops growing, we kill animals for food and pleasure, and we even kill one another on the streets and battlefields.

While watching a television program last month, Mr. Gardener saw a commercial depicting a group of friendly bugs being chased and murdered by an animated can of bug-spray, and he began to wonder about the legal and moral rights we owe to insects. Later that same day he saw two more commercials

that triggered his suit. One showed a woman spraying a bathroom in order to kill germs that cause household odor, and the other recommended a mouthwash which caused clean breath by killing germs. "Why have these germs, also among God's creatures, no right to live their own lives?" Mr. Gardener asked. "How can we have the arrogance to kill so many living things just so our bathrooms and breath will smell clean?"

When asked why he had left the insects out of his suit, he replied that he and his wife had decided that insects deserved a suit of their own, and that therefore Mrs. Gardener would appear in court the next day on their behalf. The Gardeners argue that all life is sacred and that wiping out the life forms that cause polio, diphtheria, lockjaw, and other so-called diseases in human beings has resulted in an unbalancing of Nature, an unhealthy proliferation of human beings, and the total disruption of the ecology. Only by protecting the right-to-life of viruses and bacilli, they argue, can these microscopic animals resume their rightful place in the natural, God-given order of things and in so doing solve for us the world's present population, energy, food and natural resources problems.

Reaction to the Gardeners' proposals has been mixed. Religious leaders tend to agree that all life is indeed sacred, that death is not an end but a beginning and therefore plagues and famines are not in themselves evil, and that the discomfort of great numbers of human beings suffering and dying should be viewed as a temporary inconvenience since the temporal world, seen in its proper perspective, is nothing more than a thoroughfare of misery and woe through which we travel to an eternal happiness.

Business leaders, however, scoff at the Gardeners and their suit. They point out that without the manufacture and sale of large quantities of deodorants, soap, mouthwash, athlete's-foot ointments, household cleaners, bug-sprays, and medicines, large numbers of people would be out of work and unable to buy deodorants, soap, mouthwash, athlete's-foot ointments, household cleaners, bug-sprays, medicines, and automobiles. They point out further that economic chaos always results from a lack of automobile sales.

Doctors themselves were divided on the issue. Two doctors, conscience-stricken at the sudden realization of how many billions of tiny lives their prescriptions and medications had cost, have already committed suicide, and a few more may be expected to follow. Most, however, have stuck firmly to the physicians' traditional attitude that so long as they are making money, everything is all right and nothing should be changed. They have refused to take the Gardeners seriously. "I don't see where the money is in letting people die," one said succinctly, "unless you're an undertaker."

Finally, insurance companies across the nation are opposed to the "Pro-Germ" movement. "The longer people live, the more they can pay on their policies and the longer we can collect interest on their money," they say. "If everyone starts dying, we'll go bankrupt paying off all the claims."

It is difficult to predict at this time how the courts will eventually decide on the issue of "legal rights for germs." Should they rule favorably, however, everyone in America will become, by law, a vegetarian.

WHAT ABOUT US PLANTS?

(UD Jan. 23) Dr. Roseann Amythest, an unemployed chemist, today filed suit in federal court seeking to protect the plants of the United States from acts of what she refers to as "overt cannibalism" on the part of U.S. citizenry. "How would you like to be plucked from your comfortable beds and cooked?" she demanded angrily. "Everyone should be forced to eat chemically synthesized foods." Dr. Amythest reports that she has some preliminary recipes that she would be willing to develop for the government at a cost of...

About the Author

Joe Patrouch (1935-) never recovered from reading his first science fiction story (in 1947, at age

twelve). Along with his other academic duties, he has been teaching SF in the Department of English at the University of Dayton (in Ohio) for the past quarter century. He is the author of *The Science Fiction of Isaac Asimov* (1974).

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