

The background of the cover is a vibrant space scene. In the upper right, a dark, spherical planet or moon is visible against a starry sky. A large, colorful nebula with shades of purple, pink, and blue dominates the right side. In the lower right, a satellite or space station is shown in orbit, featuring a large, glowing spherical component and several solar panels. The overall lighting is dramatic, with bright highlights from the nebula and satellite lights.

ALL NEW
ASTONISHING STORIES
YEAR'S
BEST
SF
6

"Impressive."
Locus

EDITED BY
DAVID G. HARTWELL

YEAR'S BEST SF6

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 HarperCollins e-books

This book is dedicated to Elisabeth Malartre, Robert Sheckley, Bill Johnson, because they have treated me well this year under difficult circumstances.

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Acknowledgments

I would like to acknowledge the continuing value of Mark Kelly's short fiction reviews in *Locus*, and of the various short fiction reviewers of the Tangent website. Also, I wish to thank Kathryn Cramer for invaluable help in preparing this book, and Caitlin Blasdell for extra editorial devotion, and Diana Gill for catching the ball.

Introduction

Last year I said that 1999 was one of the legendary years of the science fiction future, and we have lived through it. So of course was 2000, the turning point, the end of a thousand-year period of growth and change and a significant moment in the Christian Era (AD). Well, the world didn't end, nor did the Second Coming come, nor the aliens in whatever form. Nor was there a socialist civilization in Boston, Massachusetts, as envisioned by Edward Bellamy in *Looking Backward* in the 1880s. And now that that millennium is gone, we live in the Year One CE, and all the SF written about the '80s and '90s is just fiction—now robbed of most of its significant prophetic power—and must stand or fall as fiction, on the merits of its execution and/or historical importance. Even Arthur C. Clarke, whose special year is 2001, will have to wait a while longer for commercial travel to the Moon. It is a sobering thought to consider that fifty years ago 2000 looked like the relatively distant future, a time of wonders and radical difference. Now the year 2000 looks somewhat like the 1950s, plus computers and minus the Cold War. Most of the same buildings are standing in most major cities.

Some things don't change fast enough, other changes leave us breathless or shocked. Fifty years is not so long, less than the career of Jack Williamson for instance, who published in 1929 and this year too, in the course of seven decades of writing SF—and barring unforeseen circumstances, Williamson will be in his eighth decade of writing when you read this. I leave you again with the thought that we should set our SF stories farther ahead in time, lest we become outdated fantasy too soon.

Looking backward from December 2000, I see a past year of tremendous growth for the SF field and many reasons for optimism in the year ahead. Australia is still full of energy and big science-fictional plans a year or two after the 1999 Melbourne world science fiction convention, and Australian writers are continuing to break out worldwide, at least in the English language. Canadian SF is still thriving, and Canada is still introducing new world-class SF and fantasy writers to the world stage each year. The UK may not perhaps be the UK much longer, since Scotland is getting its own Parliament, but either way England, Ireland, and Scotland are a major force in SF, and *Interzone* has grown into one of the three or four leading SF magazines (*Analog*, *Asimov's*, *F&SF* are its peers) in the world. The best new SF magazine of the year is *Spectrum SF*, from Scotland. There are stirrings of energy in France and in French SF, new awards and conferences there, and German SF has recently produced at least one new writer on the world stage, Andreas Eschbach. And the world SF convention is now becoming more global and is likely to be held in Scotland, Australia, Japan, and perhaps elsewhere in the world in the next decade.

Worldwide, the small press is a force of growing strength and importance in the field, in part due to the availability of computers within reach of the average fannish budget and in part due to the new economies of instant print, now prevalent in the USA and soon to reach everywhere. Hardly a day goes by without a new instant print review copy of a small press trade paperback in the NYRSF* mailbox. Many of them are in fact self-published works that do not meet professional standards of writing, it is true, but a few of them are carefully written, well-edited gems. And the books from the more established small presses, from Golden Gryphon, Ministry of Whimsey, Borderlands, and others, continue to impress.

The field lost two fine magazines this year, *Amazing* and *SF Age*, but a perceptible increase in the number and quality of small press magazines helped to cushion the loss, as did the announcement of several high-paying online short fiction markets. Interestingly, none of the highest paying online publishers intend to actually make money selling the fiction, but are supporting it as a promotional expense! I wonder how long that will last. Certainly not many months in the future if the world stock markets continue to lose trillions of dollars (I write at a particularly low point in recent economic times). Still, we are better off right now than in the not-too-distant past, and are all grateful that SF is of promotional value in 2001. I hope to find some excellent science fiction online this year to reprint next year in this series.

As to the quality of the year's fiction, 2000 was a particularly fine year, with grand old names and hot new talents competing for attention. It was a good year to be reading the magazines, both pro and semi-professional. It was a strong year for novellas, with fifteen or twenty of them in consideration for the limited space allowed in this book by length constraints; you'll have to go to the competing *Year's Best* in fat trade paperback to sample more novellas. And there were a hundred shorter stories in consideration, from which this rich selection was chosen. So I repeat, for readers new to this series, my usual disclaimer: this selection of science fiction stories represents the best that was published during the year 2000. I could perhaps have filled two or three more volumes this size and then claimed to have nearly all of the best—though not all the best novellas. I believe that representing the best from year to year, while it is not physically possible to encompass it all in one even very large book, also implies presenting some substantial variety of excellence, and I left some writers out in order to include others in this limited space.

My general principle for selection: this book is full of science fiction—every story in the book is clearly that and not something else. I personally have a high regard for horror, fantasy, speculative fiction, and slipstream, and postmodern literature. This year Kathryn Cramer and I launch the *Year's Best Fantasy* in paperback from Eos as a companion volume to this one—look for it if you enjoy short fantasy fiction too. But here, I chose science fiction. It is the intention of this *Year's Best* series to focus on science fiction, and to provide readers who are looking especially for science fiction an annual home base.

Which is not to say that I chose one kind of science fiction—I try to represent the varieties of tones and voices and attitudes that keep the genre vigorous and responsive to the changing realities of which it emerges, in science and daily life. This is a book about what's going on now in SF. The stories that follow show, and the story notes point out, the strengths of the evolving genre in the year 2000. I hope that this book and its companions are essential reading in SF.

—David G. Hartwell
Pleasantville, NJ

²The *New York Review of Science Fiction* (www.NYRSF.com or c/o Dragon Press, PO Box 78, Pleasantville, NY 10570) is a monthly 24 page journal of essays and reviews on SF and fantasy.

Reef

PAUL J. MCAULEY

Paul McAuley is a British writer who often writes hard SF, one of the group (along with Stephen Baxter, Peter Hamilton, Iain M. Banks, and others) responsible for the hard SF/space opera renaissance of the 1990s. His first novel, 400 Billion Stars, was co-winner of the Philip K. Dick Award in 1988. He has since published a number of SF novels, of which Fairyland (1994) won the Arthur C. Clarke and the John W. Campbell Awards for best novel and Pasquale's Angel (1994) won the Sidewise Award for Alternate History fiction. He has two collections of short fiction, The King of the Hill and Other Stories (1991) and The Invisible Country (1996). A year ago he completed a trilogy of SF novels, The Book of Confluence (Child of the River, 1997; Ancients of Days, 1998; Shrine of Stars, 1999). His Web site is www.omegacom.demon.co.uk.

“Reef” is an excellent hard SF story from the ambitious (and mostly reprint) anthology, SkyLife edited by Gregory Benford and George Zebrowski (about visions of life in space and on other planets which reprints some wonderful SF art too). This story is an instant classic of hard SF. It is dense with wonderful technological and scientific images, but also fast paced and sufficiently rounded in characterization that the unlikely heroine, Margaret Henderson Wu, a scientist to the core, will be remembered by many readers for a long time. It is interesting to compare it to Stephen Baxter's “Sheena 5,” later in this book, in terms of scope and imagery.

Margaret Henderson Wu was riding a proxy by telepresence deep inside Tigris Rift when Dzu Sho summoned her. The others in her crew had given up one by one and only she was left, descending slowly between rosy, smoothly rippled cliffs scarcely a hundred meters apart. These were pavements of the commonest vacuum organism, mosaics made of hundreds of different strains of the same species. Here and there bright red whips stuck out from the pavement; a commensal species which deposited iron sulphate crystals within its integument.

The pavement seemed to stretch endlessly below her. No probe or proxy had yet reached the bottom, still more than thirty kilometers away. Microscopic flecks of sulfur-iron complexes, sloughed cells, and excreted globules of carbon compounds and other volatiles made a kind of smog or snow, and the vacuum organisms deposited nodes and intricate lattices of reduced metals that, by some trick of superconductivity, produced a broad-band electromagnetic resonance that pulsed like a giant's slow heartbeat.

All this futzed the telepresence link between operators and their proxies. One moment Margaret was experiencing the 320-degree panorama of the little proxy's microwave radar, the perpetual tug of vacuum on its mantle, the tang of extreme cold, a mere thirty degrees above absolute zero, the complex taste of the vacuum smog (burnt sugar, hot rubber, tar), the minute squirts of hydrogen from the folds of the proxy's puckered nozzle as it maintained its orientation relative to the cliff face during its descent, with its tentacles retracted in a tight ball around the relay piton. The next, she was back in her cradled body in warm blackness, phosphenes floating in her vision and white noise in her ears while the transmitter searched for a viable waveband, locked on and—*pow*—she was back, falling past rippled pink pavement.

The alarm went off, flashing an array of white stars over the panorama. Her number two, Srin Kerenyi, said in her ear, "You're wanted, boss."

Margaret killed the alarm and the audio feed. She was already a kilometer below the previous bench mark, and she wanted to get as deep as possible before she implanted the telemetry relay. She swiveled the proxy on its long axis, increased the amplitude of the microwave radar. Far below were intimations of swells and bumps jutting from the plane of the cliff face, textured mounds like brain coral, randomly orientated chimneys. And something else, clouds of organic matter perhaps—

The alarm again. Srin had overridden the cutout.

Margaret swore and dove at the cliff, unfurling the proxy's tentacles and jamming the piton into pinkness rough with black papillae, like a giant's tongue quick frozen against the ice. The piton's spikes fired automatically. Recoil sent the little proxy tumbling over its long axis until it reflexively stabilized itself with judicious squirts of gas. The link rastered, came back, cut out completely. Margaret hit the switch that turned the tank into a chair; the mask lifted away from her face.

Srin Kerenyi was standing in front of her. "Dzu Sho wants to talk with you, boss. Right now."

The job had been offered as a sealed contract. Science crews had been informed of the precise nature of their tasks only when the habitat was under way. But it was good basic pay with promises of fat bonuses on completion, and when she had won the survey contract, Margaret Henderson Wu brought with her most of the crew from her previous job, and nursed a small hope that this would be change in her family's luck.

The *Ganapati* was a new habitat founded by an alliance of two of the Commonwealth's oldest patrician families. It was of standard construction, a basaltic asteroid cored by a gigawatt X-ray laser spun up by vented rock vapor to give 0.2 gee on the inner surface of its hollowed interior, factories and big reaction motors dug into the stern. With its AIs rented out for information crunching, and

refineries synthesizing exotic plastics from cane-sugar biomass and genetically engineered oilseed rape precursors, the new habitat had enough income to maintain the interest on its construction loan from the Commonwealth Bourse, but not enough to attract new citizens and workers. It was still not completely fitted out, had less than a third of its optimal population.

Its Star Chamber, young and cocky and eager to win independence from their families, had taken a big gamble. They were chasing a legend.

Eighty years ago, an experiment in accelerated evolution of chemoautotrophic vacuum organisms had been set up on a planetoid in the outer edge of the Kuiper Belt. The experiment had been run by a shell company registered on Ganymede but covertly owned by the Democratic Union of China. In those days, companies and governments of Earth were not allowed to operate in the Kuiper Belt, which had been claimed and ferociously defended by outer-system cartels. That hegemony ended in the Quiet War, but the Quiet War also destroyed all records of the experiment; even the Democratic Union of China disappeared, absorbed into the Pacific Community.

There were over fifty thousand objects with diameters greater than a hundred kilometers in the Kuiper Belt, and a billion more much smaller, the plane of their orbits stretching beyond those of Neptune and Pluto. The experimental planetoid, Enki, named for one of the Babylonian gods of creation, had been lost among them. It became a legend, like the Children's Habitat, or the ghost comet, or the pirate ship crewed by the reanimated dead, or the worker's paradise of Fiddler's Green.

And then, forty-five years after the end of the Quiet War, a data miner recovered enough information to reconstruct Enki's eccentric orbit. She sold it to the *Ganapati*. The habitat bought time on the Uranus deepspace telescopic array and confirmed that the planetoid was where it was supposed to be, currently more than seven thousand million kilometers from the sun.

Nothing more was known. The experiment could have failed almost as soon as it had begun, but if it had worked, the results would win the *Ganapati* platinum-rated credit on the Bourse. Margaret and the rest of the science crews would, of course, receive only their fees and bonuses, less deduction for air and food and water taxes, and anything they bought with scrip in the habitat's stores; the indentured workers would not even get that. Like every habitat in the Commonwealth, the *Ganapati* was structured like an ancient Greek republic, ruled by shareholding citizens, who lived in the landscaped parklands of the inner surface, and run by indentured and contract workers, who were housed in the undercroft of malls and barracks tunneled into the *Ganapati*'s rocky skin.

On the long voyage out, the science crews were on minimal pay, far less than that of the unskilled techs who worked the farms and refineries, or of the servants who maintained the citizens' households. There were food shortages on the *Ganapati* because so much biomass was being used to make exportable biochemicals. Any foodstuffs other than basic rations were expensive, and prices were carefully manipulated by the habitat's Star Chamber. When the *Ganapati* reached Enki and the contracts of the science crews were activated, food prices increased accordingly. Techs and household servants suddenly found themselves unable to afford anything other than dole yeast. Resentment bubbled over into skirmishes and knife fights, and a small riot which the White Mice, the undercroft police, subdued with gas. Margaret had had to take time off to bail out several of her crew, had given them an angry lecture about threatening everyone's bonuses.

"We got to defend our honor," one of the men said.

“Don’t be a fool,” Margaret told him. “The citizens play workers against science crews to keep both sides in their places, and still turn a good profit from increases in food prices. Just be glad you can afford the good stuff now, and keep out of trouble.”

“They were calling you names, boss,” the man said. “On account you’re—”

Margaret stared him down. She was standing on a chair, but even so she was a good head shorter than the gangling outers. She said, “I’ll fight my own fights. I always have. Just think of your bonuses and keep quiet. It will be worth it. I promise you.”

And it was worth it, because of the discovery of the reef.

At some time in the deep past, Enki had suffered an impact that remelted it and split it into two big pieces and thousands of fragments. One lone fragment still orbited Enki, a tiny moonlet where the AI that had controlled the experiment had been installed; the others had been drawn together again by their feeble gravity fields, but cooled before coalescence was completed, leaving a vast deep chasm, Tigris Rift, at the lumpy equator.

Margaret’s crew discovered that the vacuum organisms had proliferated wildly in the deepest part of the Rift, deriving energy by oxidation of elemental sulfur and ferrous iron, converting carbonaceous material into useful organic chemicals. There were crusts and sheets, things like thin scarves folded into fragile vases and chimneys, organ-pipe clusters, whips, delicate fretted laces. Some fed on others, one crust slowly overgrowing and devouring another. Others appeared to be parasites, sending complex veins ramifying through the thalli of their victims. Water-mining organisms recruited sulfur oxidizers, trading precious water for energy and forming warty outgrowths like stromaliths. Some were more than a hundred meters across, surely the largest prokaryotic colonies in the known Solar System.

All this variety, and after only eighty years of accelerated evolution! Wild beauty won from the cold and the dark. The potential to feed billions. The science crews would get their bonuses, all right; the citizens would become billionaires.

Margaret spent all her spare time exploring the reef by proxy, pushing her crew hard to overcome the problems of penetrating the depths of the Rift. Although she would not admit it even to herself, she had fallen in love with the reef. She would even have explored in person if the Star Chamber allowed it, but as in most habitats, the *Ganapati*’s citizens did not like their workers going where they themselves would not.

Clearly, the experiment had far exceeded its parameters, but no one knew why. The AI that had overseen the experiment had shut down thirty years ago. There was still heat in its crude proton-beam fission pile, but it had been overgrown by the very organisms it manipulated.

Its task had been simple. Colonies of a dozen species of slow-growing chemoautotrophs were introduced into a part of the Rift rich with sulfur and ferrous iron. Thousands of random mutations were induced. Most colonies died, and those few which thrived were sampled, mutated, and reintroduced in a cycle repeated every hundred days.

But the AI had selected only for fast growth, not for adaptive radiation, and the science crews

But the AI had selected only for fast growth, not for adaptive radiation, and the science crews held heated seminars about the possible cause of the unexpected richness of the reef. Very few believed that it was simply a result of accelerated evolution. Many terrestrial bacteria divided every twenty minutes in favorable conditions, and certain bacteria were known to have evolved from being resistant to an antibiotic to becoming obligately dependent upon it as a food source in less than five days, or only three hundred and sixty generations. But that was merely a biochemical adaptation. The fastest division rate of the vacuum organisms in the Rift was less than once a day, and while that still meant more than thirty thousand generations since the reef was seeded, half a million years in human terms, the evolutionary radiation in the reef was the equivalent of Neanderthal Man's evolving to fill every mammalian niche from bats to whales.

Margaret's survey crew explored and sampled the reef for more than thirty days. Cluster analysis suggested that they had identified less than ten percent of the species which had formed from the original seed population. And now deep radar suggested that there were changes in the unexplored regions in the deepest part of Tigris Rift, which the proxies had not yet successfully penetrated.

Margaret pointed this out at the last seminar.

"We're making hypotheses on incomplete information. We don't know everything that's out there. Sampling suggests that complexity increases away from the surface. There could be thousands more species in the deep part of the Rift."

At the back of the room, Opie Kindred, the head of the genetics crew, said languidly, "We don't need to know everything. That's not what we're paid for. We've already found several species that perform better than present commercial cultures. The *Ganapati* can make money from them and we'll get full bonuses. Who cares how they got there?"

Arn Nivedta, the chief of the biochemist crew, said, "We're all scientists here. We prove our worth by finding out how things work. Are your mysterious experiments no more than growth tests, Opie? If so, I'm disappointed."

The genetics crew had set up an experimental station on the surface of the *Ganapati*, off limits to everyone else.

Opie smiled. "I'm not answerable to you."

This was greeted with shouts and jeers. The science crews were tired and on edge, and the room was hot and poorly ventilated.

"Information should be free," Margaret said. "We all work toward the same end. Or are you hoping for extra bonuses, Opie?"

There was a murmur in the room. It was a tradition that all bonuses were pooled and shared out between the various science crews at the end of a mission.

Opie Kindred was a clever, successful man, yet somehow soured, as if the world was a continual disappointment. He rode his team hard, was quick to find failure in others. Margaret was a natural target for his scorn, a squat, musclebound, unedited dwarf from Earth who had to take drugs so that she could survive in microgravity, who grew hair in all sorts of unlikely places. He stared at her with

disdain and said, "I'm surprised at the tone of this briefing, Dr. Wu. With speculations built on nothing at all. I have sat here for a hour and heard nothing useful. We are paid to get results, not generate hypotheses. All we hear from your crew is excuses, when what we want are samples. It seems simple enough to me. If something is upsetting your proxies, then you should use robots. Or send people in and handpick samples. I've worked my way through almost all you've obtained. I need more material, especially in light of my latest findings."

"Robots need transmission relays too," Srin Kerenyi pointed out.

Orly Higgins said, "If you ride them, to be sure. But I don't see the need for human control. It is simple enough task to program them to go down, pick up samples, return."

She was the leader of the crew that had unpicked the AI's corrupted code, and was an acolyte of Opie Kindred.

"The proxies failed whether or not they were remotely controlled," Margaret said, "and on their own they are as smart as any robot. I'd love to go down there myself, but the Star Chamber has forbidden it for the usual reasons. They're scared we'll get up to something if we go where they can't watch us."

"Careful, boss," Srin Kerenyi whispered. "The White Mice are bound to be monitoring this."

"I don't care," Margaret said. "I'm through with trying polite requests. We need to get down there, Srin."

"Sure, boss. But getting arrested for sedition isn't the way."

"There's some interesting stuff in the upper levels," Arn Nivedta said. "Commercial stuff, as you pointed out, Opie."

Murmurs of agreement throughout the crowded room. The reef could make the *Ganapati* the richest habitat in the Outer System, where expansion was limited by the availability of fixed carbon. Even a modest-sized comet nucleus, ten kilometers in diameter, say, and salted with only one-hundredth of one percent carbonaceous material, contained fifty million tons of carbon, mostly as methane and carbon monoxide ice, with a surface dusting of tarry long-chain hydrocarbons. And the mass of some planetoids consisted of up to fifty percent methane ice. But most vacuum organisms converted simple carbon compounds into organic matter using the energy of sunlight captured by a variety of photosynthetic pigments, and so could grow only on the surfaces of planetoids. No one had yet developed vacuum organisms that, using other sources of energy, could efficiently mine planetoid interiors. But that was what accelerated evolution appeared to have produced in the reef. It could enable exploitation of the entire volume of objects in the Kuiper Belt, and beyond, in the distant Oort Cloud.

Arn Nivedta waited for silence, and added, "If the reef species test out, of course. What about it, Opie? Are they commercially viable?"

"We have our own ideas about commercialism," Opie Kindred said. "I think you'll find that we hold the key to success here."

Boos and catcalls at this from both the biochemists and the survey crew. The room was polarizing. Margaret saw one of her crew unsheathe a sharpened screwdriver, and she caught the man's hand and squeezed it until he cried out. "Let it ride," she told him. "Remember that we're scientists."

"We hear of indications of more diversity in the depths, but we can't seem to get there. One might suspect," Opie said, his thin upper lip lifting in a supercilious curl, "sabotage."

"The proxies are working in the upper part of the Rift," Margaret said, "and we are working hard to get them operative farther down."

"Let's hope so," Opie Kindred said. He stood, and around him his crew stood, too. "I'm going back to work, and so should all of you. Especially you, Dr. Wu. Perhaps you should be attending to your proxies instead of planning useless expeditions."

And so the seminar broke up in uproar, with nothing productive coming from it and lines of enmity drawn through the community of scientists.

"Opie is scheming to come out of this on top," Arn Nivedta said to Margaret afterward. He was friendly, enthusiastic man, tall even for an outer, and as skinny as a rail. He stooped in Margaret's presence, trying to appear less tall. He said, "He wants desperately to become a citizen, and so he thinks like one."

"Well, my god, we all want to be citizens," Margaret said. "Who wants to live like this?"

She gestured, meaning the crowded bar, its rock walls and low ceiling, harsh lights and the stink of spilled beer and too many people in close proximity. Her parents had been citizens, once upon a time. Before their run of bad luck. It was not that she wanted those palmy days back—she could scarcely remember them—but she wanted more than this.

She said, "The citizens sleep in silk sheets and eat real meat and play their stupid games, and we have to do their work on restricted budgets. The reef is the discovery of the century, Arn, but god forbid that the citizens should begin to exert themselves. We do the work, they fuck in rose petals and get the glory."

Arn laughed at this.

"Well, it's true!"

"It's true we have not been as successful as we might like," Arn said mournfully.

Margaret said reflectively, "Opie's a bastard, but he's smart, too. He picked just the right moment to point the finger at me."

Loss of proxies was soaring exponentially, and the proxy farms of the *Ganapati* were reaching a critical point. Once losses exceeded reproduction, the scale of exploration would have to be drastically curtailed, or the seed stock would have to be pressed into service, a gamble the *Ganapati* could hardly afford.

And then, the day after the disastrous seminar, Margaret was pulled back from her latest survey to account for herself in front of the chairman of the *Ganapati's* Star Chamber.

“We are not happy with the progress of your survey, Dr. Wu,” Dzu Sho said. “You promise much but deliver little.”

Margaret shot a glance at Opie Kindred, and the man smiled. He was immaculately dressed in gold-trimmed white tunic and white leggings. His scalp was oiled and his manicured fingernails were painted with something that split light into rainbows. Margaret, fresh from the tank, wore loose, grubby work grays. There was sticky electrolyte paste on her arms and legs and shaven scalp, the reek of sour sweat under her breasts and in her armpits.

She contained her anger and said, “I have submitted daily reports on the problems we encountered. Progress is slow but sure. I have just established a relay point a full kilometer below the previous datum point.”

Dzu Sho waved this away. Naked, as smoothly fat as a seal, he lounged in a blue gel chair. He had a round, hairless head and pinched features, like a thumbprint on an egg. The habitat's lawyer sat behind him, a young woman neat and anonymous in a gray tunic suit. Margaret, Opie Kindred, and Arn Nivedta sat on low stools, supplicants to Dzu Sho's authority. Behind them, half a dozen servants stood at the edge of the grassy space.

This was in an arbor of figs, ivy, bamboos, and fast-growing banyan at the edge of Sho's estate. Residential parkland curved above, a patchwork of spindly, newly planted woods and meadows and gardens. Flyers were out, triangular rigs in primary colors pirouetting around the weightless axis. Directly above, mammoths the size of large dogs grazed an upside-down emerald-green field. The parkland stretched away to the ring lake and its slosh barrier, three kilometers in diameter, and the huge farms which dominated the inner surface of the habitat. Fields of lentils, wheat, cane fruits, tomatoes, rice, and exotic vegetables for the tables of the citizens, and fields and fields and fields of sugar cane and oilseed rape for the biochemical industry and the yeast tanks.

Dzu Sho said, “Despite the poor progress of the survey crew, we have what we need, thanks to the work of Dr. Kindred. This is what we will discuss.”

Margaret glanced at Arn, who shrugged. Opie Kindred's smile deepened. He said, “My crew has established why there is so much diversity here. The vacuum organisms have invented sex.”

“We know they have sex,” Arn said. “How else could they evolve?”

His own crew had shown that the vacuum organisms could exchange genetic material through pilli, microscopic hollow tubes grown between cells or hyphal strands. It was analogous to the way in which genes for antibiotic resistance spread through populations of terrestrial bacteria.

“I do not mean genetic exchange, but genetic recombination,” Opie Kindred said. “I will explain.”

The glade filled with flat plates of color as the geneticist conjured charts and diagrams and

The grade lined with flat plates of color as the geneticist conjured charts and diagrams and pictures from his slate. Despite her anger, Margaret quickly immersed herself in the flows of data, racing ahead of Opie Kindred's clipped explanations.

It was not normal sexual reproduction. There was no differentiation into male or female, or even into complementary mating strains. Instead, it was mediated by a species that aggressively colonized the thalli of others. Margaret had already seen it many times, but until now she had thought that it was merely a parasite. Instead, as Opie Kindred put it, it was more like a vampire.

A shuffle of pictures, movies patched from hundreds of hours of material collected by roving proxies. Here was a colony of the black crustose species found all through the explored regions of the Rift. Time speeded up. The crustose colony elongated its ragged perimeter in pulsing spurts. As it grew, it exfoliated microscopic particles. Margaret's viewpoint spiraled into a close-up of one of the exfoliations, a few cells wrapped in nutrient-storing strands.

Millions of these little packages floated through the vacuum. If one landed on a host thallus, it injected its genetic pay-load into the host cells. The view dropped inside one such cell. A complex of carbohydrate and protein strands webbing the interior like intricately packed spiderwebs. Part of the striated cell wall drew apart, and a packet of DNA coated in hydrated globulins and enzymes burst inward. The packet contained the genomes of both the parasite and its previous victim. It latched onto protein strands and crept along on ratcheting microtubule claws until it fused with the cell's own circlet of DNA.

The parasite possessed an enzyme that snipped strands of genetic material at random lengths. These recombined, forming chimeric cells that contained genetic information from both sets of victims, with the predator species' genome embedded among the native genes like an interpenetrating text.

The process repeated itself in flurries of coiling and uncoiling DNA strands as the chimeric cell replicated. It was a crude, random process. Most contained incomplete or non-complementary copies of the genomes and were unable to function, or contained so many copies that transcription was halting and imperfect. But a few out of every thousand were viable, and a few of those were more vigorous than either of their parents. They grew from a few cells to a patch, and finally overgrew the parental matrix in which they were embedded. There were pictures which showed every stage of this transformation in a laboratory experiment.

"This is why I have not shared the information until now," Opie Kindred said, as the pictures faded around him. "I had to ensure by experimental testing that my theory was correct. Because the procedure is so inefficient, we had to screen thousands of chimeras until we obtained a strain that overgrew its parent."

"A very odd and extreme form of reproduction," Arn said. "The parasite dies so that the child might live."

Opie Kindred smiled. "It is more interesting than you might suppose."

The next sequence showed the same colony, now clearly infected by the parasitic species—leprous black spots mottled its pinkish surface. Again time speeded up. The spots grew larger, merged a cloud of exfoliations

“Once the chimera overgrows its parent,” Opie Kindred said, “the genes of the parasite, which have been reproduced in every cell of the thallus, are activated. The host cells are transformed. It is rather like an RNA virus, except that the virus does not merely subvert the protein-and RNA-making machinery of its host cell. It takes over the cell itself. Now the cycle is completed, and the parasite sheds exfoliations that will in turn infect new hosts.

“Here is the motor of evolution. In some of the infected hosts, the parasitic genome is prevented from expression, and the host becomes resistant to infection. It is a variation of the Red Queen’s race. There is an evolutionary pressure upon the parasite to evolve new infective forms, and then for the hosts to resist them, and so on. Meanwhile, the host species benefit from new genetic combinations that by selection incrementally improve growth. The process is random but continuous, and takes place on a vast scale. I estimate that millions of recombinant cells are produced each hour, although perhaps only one in ten million are viable, and of those only one in a million are significantly more efficient at growth than their parents. But this is more than sufficient to explain the diversity we have mapped in the reef.”

Arn said, “How long have you known this, Opie?”

“I communicated my findings to the Star Chamber just this morning,” Opie Kindred said. “The work has been very difficult. My crew has to work under very tight restraints, using Class One containment techniques, as with the old immunodeficiency plagues.”

“Yah, of course,” Arn said. “We don’t know how the exfoliations might contaminate the ship.”

“Exactly,” Opie Kindred said. “That is why the reef is dangerous.”

Margaret bridled at this. She said sharply, “Have you tested how long the exfoliations survive?”

“There is a large amount of data about bacterial spore survival. Many survive thousands of years in vacuum close to absolute zero. It hardly seems necessary—”

“You didn’t bother,” Margaret said. “My God, you want to destroy the reef and you have no *evidence*. You didn’t *think*.”

It was the worst of insults in the scientific community. Opie Kindred colored, but before he could reply, Dzu Sho held up a hand, and his employees obediently fell silent.

“The Star Chamber has voted,” Dzu Sho said. “It is clear that we have all we need. The reef is dangerous, and must be destroyed. Dr. Kindred has suggested a course of action that seems appropriate. We will poison the sulfur-oxidizing cycle and kill the reef.”

“But we don’t know—”

“We haven’t found—”

Margaret and Arn had spoken at once. Both fell silent when Dzu Sho held up a hand again. He said, “We have isolated strains which are commercially useful. Obviously, we can’t use the organism we have isolated because they contain the parasite within every cell. But we can synthesize useful

we have isolated because they contain the parasite within every cell. But we can synthesize useful gene sequences and splice them into current commercial strains of vacuum organism to improve quality.”

“I must object,” Margaret said. “This is a unique construct. The chances of it evolving again are minimal. We must study it further. We might be able to discover a cure for the parasite.”

“It is unlikely,” Opie Kindred said. “There is no way to eliminate the parasite from the host cell by gene therapy, because they are hidden within the host chromosome, shuffled in a different pattern in every cell of the trillions of cells that make up the reef. However, it is quite easy to produce a poison that will shut down the sulfur-oxidizing metabolism common to the different kinds of reef organism.”

“Production has been authorized,” Sho said. “It will take, what did you tell me, Dr. Kindred?”

“We require a large quantity, given the large biomass of the reef. Ten days at least. No more than fifteen.”

“We have not studied it properly,” Arn said. “So we cannot yet say what and what is not possible.”

Margaret agreed, but before she could add her objection, her ear-piece trilled, and Srin Kerenyi’s voice said apologetically, “Trouble, boss. You better come at once.”

The survey suite was in chaos, and there was worse chaos in the Rift. Margaret had to switch proxies three times before she found one she could operate. All around her, proxies were fluttering and jinking, as if caught in strong currents instead of floating in vacuum in virtual free fall.

This was at the four-thousand-meter level, where the nitrogen-ice walls of the Rift were sparsely patched with faux yellow and pink marblings that followed veins of sulfur and organic contaminants. The taste of the vacuum smog here was strong, like burnt rubber coating Margaret’s lips and tongue.

As she looked around, a proxy jettied toward her. It overshot and rebounded from a gable of frozen nitrogen, its nozzle jinking back and forth as it tried to stabilize its position.

“Fuck,” its operator, Kim Nieye, said in Margaret’s ear. “Sorry, boss. I’ve been through five of these, and now I’m losing this one.”

On the other side of the cleft, a hundred meters away, two specks tumbled end over end, descending at a fair clip toward the depths. Margaret’s vision color-reversed, went black, came back to normal. She said, “How many?”

“Just about all of them. We’re using proxies that were up in the tablelands, but as soon as we bring them down, they start going screwy too.”

“Herd some up and get them to the sample pickup point. We’ll need to do dissections.”

“No problem boss. Are you okay?”

Margaret's proxy had suddenly upended. She couldn't get its trim back. "I don't think so," she said, and then the proxy's nozzle flared, and with a pulse of gas the proxy shot away into the depths.

It was a wild ride. The proxy expelled all its gas reserves, accelerating as straight as an arrow. Coralline formations blurred past, and then long stretches of sulfur-eating pavement. The proxy caromed off the narrowing walls and began to tumble madly.

Margaret had no control. She was a helpless but exhilarated passenger. She passed the place where she had set the relay and continued to fall. The link started to break up. She lost all sense of proprioception, although given the tumbling fall of the proxy, that was a blessing. Then the microwave radar started to go, with swathes of raster washing across the false-color view. Somehow the proxy managed to stabilize itself, so it was falling headfirst toward the unknown regions at the bottom of the Rift. Margaret glimpsed structures swelling from the walls. And then everything went away, and she was back, sweating and nauseous on the couch.

It was bad. More than ninety-five percent of the proxies had been lost. Most, like Margaret's, had been lost in the depths. A few, badly damaged by collision, had stranded among the reef colonies, but proxies which tried to retrieve them went out of control too, and were lost. It was clear that some kind of infective process had affected them. Margaret had several dead proxies collected by a sample robot and ordered that the survivors should be regrouped and kept above the deep part of the Rift where the vacuum organisms proliferated. And then she went to her suite in the undercroft and waited for the Star Chamber to call her before them.

The Star Chamber took away Margaret's contract, citing failure to perform and possible sedition (that remark in the seminar had been recorded). She was moved from her suite to a utility room in the lower level of the undercroft and put to work in the farms.

She thought of her parents.

She had been here before.

She thought of the reef.

She couldn't let it go.

She would save it if she could.

Srin Kerenyi kept her up-to-date. The survey crew and its proxies were restricted to the upper level of the reef. Manned teams under Opie Kindred's control were exploring the depths—*he* was trusted where Margaret was not—but if they discovered anything, it wasn't communicated to the other science crews.

Margaret was working in the melon fields when Arn Nivedta found her. The plants sprawled from hydroponic tubes laid across gravel beds, beneath blazing lamps hung in the axis of the farmlands. It was very hot, and there was a stink of dilute sewage. Little yellow ants swarmed everywhere. Margaret had washed the ends of her tentacles into the shallow trays of brown sludge she used to grow melons. She

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